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**Yukon River Summer Chum Salmon Stock Status,
2009; a Report to the Alaska Board of Fisheries**

by

Daniel J. Bergstrom

Danielle F. Evenson

and

Eric J. Newland

December 2009

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mideye to fork	MEF
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	mideye to tail fork	METF
hectare	ha	at	@	standard length	SL
kilogram	kg	compass directions:		total length	TL
kilometer	km	east	E		
liter	L	north	N	Mathematics, statistics	
meter	m	south	S	<i>all standard mathematical signs, symbols and abbreviations</i>	
milliliter	mL	west	W	alternate hypothesis	H _A
millimeter	mm	copyright	©	base of natural logarithm	<i>e</i>
		corporate suffixes:		catch per unit effort	CPUE
Weights and measures (English)		Company	Co.	coefficient of variation	CV
cubic feet per second	ft ³ /s	Corporation	Corp.	common test statistics	(F, t, χ^2 , etc.)
foot	ft	Incorporated	Inc.	confidence interval	CI
gallon	gal	Limited	Ltd.	correlation coefficient (multiple)	R
inch	in	District of Columbia	D.C.	correlation coefficient (simple)	r
mile	mi	et alii (and others)	et al.	covariance	cov
nautical mile	nmi	et cetera (and so forth)	etc.	degree (angular)	°
ounce	oz	exempli gratia		degrees of freedom	df
pound	lb	(for example)	e.g.	expected value	<i>E</i>
quart	qt	Federal Information Code	FIC	greater than	>
yard	yd	id est (that is)	i.e.	greater than or equal to	≥
		latitude or longitude	lat. or long.	harvest per unit effort	HPUE
Time and temperature		monetary symbols		less than	<
day	d	(U.S.)	\$, ¢	less than or equal to	≤
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	logarithm (natural)	ln
degrees Fahrenheit	°F	registered trademark	®	logarithm (base 10)	log
degrees kelvin	K	trademark	™	logarithm (specify base)	log ₂ , etc.
hour	h	United States (adjective)	U.S.	minute (angular)	'
minute	min	United States of America (noun)	USA	not significant	NS
second	s	U.S.C.	United States Code	null hypothesis	H ₀
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	percent	%
Physics and chemistry				probability	P
all atomic symbols				probability of a type I error (rejection of the null hypothesis when true)	α
alternating current	AC			probability of a type II error (acceptance of the null hypothesis when false)	β
ampere	A			second (angular)	"
calorie	cal			standard deviation	SD
direct current	DC			standard error	SE
hertz	Hz			variance	
horsepower	hp			population	Var
hydrogen ion activity (negative log of)	pH			sample	var
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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Daniel J. Bergstrom, Danielle F. Evenson, and Eric J. Newland
Division of Commercial Fisheries, Anchorage

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

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*Daniel J. Bergstrom, Danielle F. Evenson, and Eric J. Newland
Alaska Department of Fish and Game, Division of Commercial Fisheries,
333 Raspberry Road, Anchorage, AK 99518, USA*

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ABSTRACT

In response to the guidelines established in the *Policy for the Management of Sustainable Salmon Fisheries* (SSFP; 5 AAC 39.222), the Alaska Board of Fisheries (BOF) classified Yukon River summer chum salmon *Oncorhynchus keta* as a stock of management concern at its September 2000 work session. An action plan was developed by Alaska Department of Fish and Game (ADF&G) and acted upon by the BOF in January 2001. The SSFP directs ADF&G to assess salmon stocks in areas addressed during the BOF regulatory cycle to identify stocks of concern, and in the case of Yukon River summer chum salmon, to reassess the stock of concern status. In 2003, ADF&G recommended continuation of this classification as a stock of management concern, which was supported by the BOF at its January 2004 meeting. Beginning in 2002, Yukon River summer chum salmon have shown marked improvement in abundance with the drainage-wide optimum escapement goal (OEG) of 600,000 fish exceeded annually, and the 2006 run was the second largest on record since summer chum salmon runs were first assessed based on Pilot Station sonar counts in 1995. This improved abundance led to the stock of concern designation for summer chum salmon being discontinued by the BOF in January 2007. Since then, run abundance has shifted to near average levels, but is still sufficient for allowing subsistence harvests within amounts necessary for subsistence (ANS) and a near average available yield for commercial harvests.

Key words: Yukon River, chum salmon, *Oncorhynchus keta*, stock of concern, commercial, subsistence, fishing, ADF&G, sustainable salmon fisheries policy, Alaska Board of Fisheries.

INTRODUCTION

The Yukon Area includes all waters of Alaska within the Yukon River drainage and coastal waters from Naskonat Peninsula to Point Romanof, northeast of the village of Kotlik. For management purposes, the Yukon Area is divided into 7 districts and 10 subdistricts (Figure 1). Commercial fishing may be allowed along the entire 1,224 miles of Yukon River in Alaska and along the lower 225 miles of Tanana River. Coastal District includes the majority of coastal marine waters within the Yukon Area and is only open to subsistence fishing. Lower Yukon Area (Districts 1, 2, and 3) includes coastal waters of the Yukon River delta and that portion of the Yukon River drainage downstream of Old Paradise Village (river mile 301). Upper Yukon Area (Districts 4, 5, and 6) is the Alaskan portion of the Yukon River drainage upstream of Old Paradise Village.

Chinook *Oncorhynchus tshawytscha*, chum *O. keta*, and coho *O. kisutch* salmon are harvested in Yukon River commercial, subsistence, personal use, and sport fisheries. Subsistence fishing in portions of the Yukon Area is under dual regulatory authority of Alaska Department of Fish and Game (ADF&G) and U.S. Fish and Wildlife Service (USFWS). Yukon River chum salmon consists of an earlier and typically more abundant summer chum salmon run, and a later fall chum salmon run. No directed commercial fishing has occurred for pink *O. gorbuscha* salmon, which overlap in run timing with summer chum salmon. However, sporadic sales of incidental harvests of pink salmon have been documented.

The *Policy for the Management of Sustainable Salmon Fisheries* (SSFP; 5 AAC 39.222, 2001) directs ADF&G to provide the Alaska Board of Fisheries (BOF) with reports on the status of salmon stocks and identify any salmon stocks that present a concern related to yield, management, or conservation during the BOF regulatory cycle.

In response to the guidelines established in the SSFP (5 AAC 39.222(f)(21)), the BOF classified Yukon River summer chum salmon stock as a management concern at its September 2000 work session. A stock of management concern is defined as “a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the sustainable escapement goal (SEG), biological escapement goal

(BEG), optimum escapement goal (OEG), or other specified management objectives for the fishery”. The SSFP further defines chronic inability as “the continuing or anticipated inability to meet escapement objectives over a 4 to 5 year period.” This determination of a management concern was based on documented low escapements during 1998–2000 and an anticipated low run in 2001. An action plan was subsequently developed by the department (ADF&G 2000) and enacted by the BOF in January 2001. The classification as a management concern was continued at the January 2004 BOF meeting due to established escapement goals not being achieved in East Fork Andreafsky River from 1998–2003 and in Anvik River in 1998–2001 and 2003 (Salomone and Bergstrom 2004).

Given the collectively large spawning escapements of the Yukon River summer chum salmon stock over the 3 years preceding the January 2007 BOF meeting (2004–2006), including a near record run in 2006, the stock no longer met stock of management concern criteria (Clark et al. 2006). Although Yukon River drainage subsistence and commercial harvests from 1999–2003 were significantly below the 1989–1998 historic baseline average, a near average surplus yield available during 2004–2006 was not taken, primarily due to the lack of commercial markets. Based on definitions provided in the SSFP (5 AAC 39.222(f)(21) and (42)), the BOF discontinued the classification as a stock of concern in January 2007. This report focuses on the recent 5-year period prior to the January 2010 BOF cycle meeting.

STOCK ASSESSMENT BACKGROUND

ESCAPEMENT

Most summer chum salmon spawn in the Yukon River drainage downstream of and within the Tanana River drainage (Figure 1). The Yukon River summer chum salmon run is typically managed as a single stock for which there is currently a drainagewide OEG of 600,000, measured at Pilot Station sonar, as identified in the regulatory management plan, 5 AAC 05.362. *Yukon River Summer Chum Salmon Management Plan*. An approximate estimate of total run of summer chum salmon in Yukon River can be obtained by summing: (1) the sonar based estimates of summer chum salmon passage at Pilot Station, which successfully estimated summer chum salmon passage in the years 1995 and 1997–2009, (2) total harvest of summer chum salmon in District 1 and that portion of District 2 below the Pilot Station sonar site, and (3) summer chum salmon escapement estimates in East and West forks of Andreafsky River. The estimate is approximate because some commercial and subsistence harvest in District 2 may not be accurately reported by location in relation to the Pilot Station sonar site, the escapement to West Fork Andreafsky is estimated based on the numbers observed in East Fork (Clark 2001), and some minor stocks of summer chum salmon spawn in tributaries below Pilot Station. However, Pilot Station sonar counts are so much greater than total catch and monitored escapement, that the total run estimate is primarily based upon sonar passage estimates. The total run of Yukon River summer chum salmon estimated in this manner averaged about 1.8 million fish during the 14-year period (1995 and 1997–2009), ranging from a low of about 550,000 fish in 2000 and 2001 to over 4.0 million fish in 1995 and 2006, about an 8-fold level of variation (Figure 2). Summer chum salmon run strength was poor to below average from 1998 through 2003 with 2000 and 2001 being the weakest runs on record. More recently, summer chum salmon runs have shown marked improvement with estimated drainagewide escapement exceeding 1.0 million salmon annually since 2001, with approximately 3.9 million in 2006, the

largest escapement on record. The drainagewide OEG of 600,000 summer chum salmon was not met in 2000 and 2001, but has been exceeded annually since that time (Figure 2).

Currently, there is not an established drainagewide escapement goal for summer chum salmon because of a lack of long-term accurate spawner and recruitment data. However, the comprehensive management plan identifies summer chum salmon runs above a projected run size of 1 million fish as surplus available for commercial harvest (Table 2). Thus, in effect, there is an escapement threshold of 1 million minus the annual subsistence harvest, which equates to a riverwide escapement greater than approximately 900,000 fish. Escapement goal analysis of fall chum salmon indicates that there is a wide range of escapement that will provide similar yield and this would likely be the case for summer chum salmon. Of note is that the near record abundance in 2006 was from some of the lowest parent year escapements on record (2001 and 2002).

Presently, there are 2 established BEGs for summer chum salmon in the Yukon River drainage. The BEG range for Anvik River is 350,000–700,000 chum salmon and the BEG range for East Fork Andreafsky River is 65,000–130,000 chum salmon. The BEG for Anvik River has been met or exceeded in 26 of 30 years (86%) since 1980; the 4 years when the BEG was not met were 2000, 2001, 2003, and 2009 (Table 1; Figure 3). Assessment of annual escapements has occurred in 22 of 29 years since 1981 in East Fork Andreafsky River with the BEG met or exceeded in 12 out of 22 years (54%), and last met in 2007 (Table 1; Figure 4).

The Anvik River BEG was met in 2004–2008 (Figure 3). A substantial decrease in Anvik River summer chum salmon production began with the 1993 brood year and has continued through the 2004 brood year. These escapements produced salmon that returned in 1997 through 2009. Escapements during this time period included large escapements in 1994, 1995, and 1996 (Figure 3) that failed to replace themselves (recruits per spawner (R/S) <1.0; Clark and Sandone 2001).

Stock composition of Yukon River summer chum runs has been in flux over the last decade. Anvik River, the largest producer of summer chum salmon, contribution to the overall Yukon River stock production above Pilot Station sonar has decreased from approximately 46% during the period from 1995 through 2002 to an average of 24% after 2002. This reduction corresponds with a shift to increased production in other chum salmon spawning streams such as in the Koyukuk River drainage, where record escapements of 170,000 and 225,000 in Gisasa River were observed in 2005 and 2006, respectively. However, runs in the Tanana River drainage are also exhibiting instability with record escapements of over 100,000 summer chum salmon observed in Salcha River in 2005 and 2006, yet less than 15,000 observed in 2007. These fluctuations have been observed elsewhere in the Yukon River drainage. The disparate strength of individual stocks within and among years seems to signal a shift in summer chum production, and exploratory aerial surveys were conducted in 2009 to better assess primary locations of summer chum salmon escapement in lower and middle Yukon River tributaries.

Although the Yukon River summer chum salmon stock appears to have recovered as a whole, the BEG for East Fork Andreafsky summer chum salmon has been met twice, in 2006 and 2007, since 2002 (Figure 4). However, the 2004 East Fork Andreafsky River escapement was within 2,000 summer chum salmon of the lower range of the BEG of 65,000. It is interesting to note that from 2002 through 2006, no directed summer chum salmon commercial fisheries occurred below the mouth of Andreafsky River, with the exception of a 3-hour commercial period in

2006, and the subsistence exploitation rate is relatively low. It is thought that Andreafsky River fish enter the Yukon River delta late in the run and are watermarked, making them less desirable to commercial buyers and fishermen. Further, it is believed that Andreafsky River fish are not readily susceptible to harvest because most, if not all, subsistence harvest has been completed by the time Andreafsky River summer chum salmon enter lower Yukon River. Regardless, under current management practices, Andreafsky River summer chum salmon are managed incidental to the overall Yukon River summer chum salmon run, and no management actions have been taken specifically for this tributary stock.

HARVEST AND MANAGEMENT REVIEW

In 1993, the BOF made a positive finding for Customary and Traditional Use for all salmon in Yukon-Northern Area. In 2001, the BOF made a finding of amounts necessary for subsistence (ANS) for Yukon River summer chum salmon of 83,500–142,192. The *Yukon River Summer Chum Salmon Management Plan* (5 AAC 05.362) established management guidelines to provide a sustainable fishery through providing for spawning escapement, a subsistence fishing priority, and for other uses (Table 2). Given recent concerns for poor Chinook salmon runs, and poor market conditions prior to 2007, ADF&G has not managed the commercial fishery strictly toward the 1 million fish level within the management plan.

Combined commercial and subsistence harvests show a substantial decrease from the 1980s and 1990s compared to the recent 5-year (2005–2009) average of approximately 226,994 (Table 3; Figure 5). The recent decline in utilization is largely due to reductions in commercial harvest. Commercial harvest of summer chum salmon averaged about 394,400 during the 1990s and 130,611 from 2005 through 2009 (Table 3). Below average runs from 1998 through 2003 resulted in low available yields of summer chum salmon. In 2004, a modest surplus was identified, whereas in 2005 and 2006, substantial surpluses were available for commercial harvest. However, there was little exploitation of these available surpluses due to poor commercial market conditions for summer chum salmon. From 1997 through 2006, the commercial harvest of summer chum salmon was primarily incidental to directed Chinook salmon fisheries, with the exception of a limited directed harvest in District 6 since 2002, and a single restricted mesh (≤ 6 -inch mesh) opening in District 2 in 2006. Because of the near demise of the District 4 commercial fishery, subsistence harvests have declined overall during the recent 5-years (2005–2009) compared to the 1990s (Busher et al 2007). With no commercial fishery in District 4 targeting summer chum salmon from 1997 through 2007, fewer fishermen are using fish wheels which target summer chum salmon and fewer fishermen have used their fish camps (Hayes et al. 2008). Thus, subsistence use of summer chum salmon has decreased in this area.

However, since 2007 there has been renewed market interest for summer chum salmon in Districts 1 and 2, and since 2008, in Subdistrict 4-A. Directed summer chum salmon commercial opportunity has been provided in 2007 through 2009. Unfortunately, despite harvestable surpluses available in these years, redevelopment of this fishery has been largely hindered by management strategies taken in response to poor Chinook salmon runs which co-migrate with summer chum salmon. Management actions taken to reduce Chinook salmon harvest, including incidental harvest in summer chum salmon-directed fisheries, have negatively affected the summer chum salmon fishery. In 2007, because of the uncertainty about Chinook salmon run strength, summer chum salmon-directed commercial periods were scheduled to occur when Chinook salmon abundance was expected to be low, reducing potential for incidental harvest. Ideally, these chum

salmon-directed periods would have been scheduled when summer chum salmon harvest could be maximized. Similarly, in response to another poor run of Chinook salmon in 2008, chum salmon-directed commercial opportunity was delayed until more than 85% of the Chinook salmon run and nearly half of the summer chum salmon run had passed through the lower river fishery.

Anticipating another poor Chinook salmon run in 2009, ADF&G collaborated with Yukon River Drainage Fisheries Association (YRDFA) to facilitate a series of regional teleconferences and an in-person meeting to provide managers, fishermen, tribal council representatives, and other stakeholders the opportunity to share information, provide input, and discuss management options. Based on input from these meetings, a preseason management plan was developed for the subsistence fishery. Furthermore, recognizing the economic effect of delaying summer chum salmon commercial fishing to the redeveloping market, ADF&G spent considerable effort working with buyers preseason to identify options to provide opportunity as early in the summer chum salmon run as possible. A key strategy was to reduce the incentive to fishermen to target economically more valuable Chinook salmon during these periods by not allowing sales of Chinook salmon. However, ADF&G did not have the regulatory tools to do so.

When the 2009 Chinook salmon run was assessed to be poor as anticipated, ADF&G worked with buyers to get an agreement to not purchase Chinook salmon during the first summer chum salmon directed opening in Districts 1 and 2. Subsequently, ADF&G sought an emergency regulation from the BOF specifying that during the commercial summer chum season in Districts 1–5, Chinook salmon taken could be retained, but not sold. The BOF adopted an emergency regulation July 1. With this regulation in effect, fishermen could release live Chinook salmon or use them for subsistence purposes. Chinook salmon caught, but not sold, were to be reported on fish tickets. The emergency regulation allowed summer chum salmon commercial periods to continue during a poor Chinook salmon run. Otherwise, the poor Chinook salmon run would have prevented summer chum salmon-directed commercial fishing, but implementing restrictions on sale of Chinook salmon during the summer chum salmon fishery allowed for Chinook salmon protection without foregoing the available surplus of summer chum salmon. This emergency regulation was discontinued, effective July 16, by emergency order since the majority of the Chinook salmon run had passed lower river districts. A total of 157,906 summer chum salmon were sold, compared to 131 Chinook salmon in Districts 1 and 2 (Table 5). Commercial fishermen reported a harvest of 3,540 Chinook salmon caught, but not sold, in Districts 1 and 2. Since the buyer in Subdistrict 4-A had a market for summer chum salmon roe, no sales of Chinook salmon occurred there and the buyer in District 6 decided preseason not to buy Chinook salmon.

Additionally, there is a regulatory management plan to allow directed commercial harvest of summer chum salmon in Anvik River if inseason run assessment projections indicate that 500,000 or greater summer chum salmon will be available for escapement in that specific system. Summer chum salmon were harvested in this terminal area only during the years 1994–1997 (Hayes et al. 2008).

In general, sport fish salmon harvests in Yukon Area are minor compared to commercial and subsistence harvests (Table 3). The Tanana River drainage is the exception because it supports a popular salmon sport fishery. However, most fishermen in this area target Chinook salmon.

EXPLOITATION RATES

Annual total run estimates can be coupled with total inriver utilization to estimate exploitation rates exerted on Yukon River summer chum salmon for the years 1995 and 1997–2009 (Figure 6). Total exploitation rates exerted by Yukon River fisheries on summer chum salmon over 14 years averaged about 12.2%, ranging from as high as 23.0% in 1995 to as low as 4.3% in 2006. Note that both these years had run sizes in excess of 4.0 million fish. Exploitation rates on the 2 lowest runs, approximately 550,000 fish, in 2000 and 2001, were 15.1% and 13.1%, respectively (Figure 6). Exploitation rates have been increasing slightly since 2007 owing to increased market interest; however, these harvest rates are low in comparison to exploitation rates exerted on most Alaska salmon populations and primarily reflect the lack of commercial markets.

ESCAPEMENT GOAL RECOMMENDATIONS

ADF&G has undertaken a review of escapement goals for several Yukon Area summer chum salmon stocks where sufficient long-term escapement, catch, and age composition data exist that enable the development of SEGs based on analysis of production consistent with the *Policy for statewide salmon escapement goals* (5 AAC 39.223) (Volk et al. *In prep*). The escapement goal team evaluated the type, quality, and amount of data for each stock to determine the appropriate type of escapement goal as defined in these policies.

A lower bound SEG is recommended to replace the current BEG range for the East Fork Andreafsky River stock, primarily because it would be difficult or undesirable to hold escapements below the upper bound of a range through inseason management actions (Fleischman and Evenson *In prep*). Andreafsky River is low in the drainage and its chum salmon are of relatively low quality, reducing the incentive to single them out for harvest, for instance, by fishing in or near the mouth of the river. Elsewhere in District 1 and part of District 2, Andreafsky River chum salmon are mixed with other chum salmon stocks, as well as with Chinook salmon. These other stocks are subject to higher harvest rates because they are vulnerable for a longer period as they travel upriver, and thus they must be managed more carefully in the lower river. Therefore, it is unlikely sufficient fishing power could be generated in a timely manner to prevent escapement to Andreafsky River from exceeding an upper limit, and a lower-bound SEG is most appropriate for this stock.

Andreafsky River summer chum salmon abundance is probably largely controlled by density-independent factors, such as fluctuating conditions in the freshwater, marine, and estuarine environments. Information garnered from run reconstruction and spawner-recruit analyses suggests that the current escapement goal could safely be changed to a lower bound SEG of 40,000. The new goal would improve yield potential and reduce disruptions to the lower Yukon River summer chum salmon fishery.

ADF&G recommends changing the goal to a lower-bound SEG of 40,000 summer chum salmon enumerated at East Fork Andreafsky River weir. Escapements of 40,000 have a high probability of achieving near optimal yields, with an 84% probability of achieving 0.7 maximum sustained yield (MSY), a 70% probability of achieving 0.8 MSY, and 47% probability of achieving 0.9 MSY on average. No additional goals or changes to the existing Anvik River BEG are recommended.

Current and proposed BEG and SEGs for Yukon River Chinook salmon are as follows:

Stream (Project Type)	Current Goal	Recommended Range	Type of Goal
East Fork Andreafsky River (Weir)	65,000–130,000	>40,000	SEG
Anvik River Index (Sonar)	350,000–700,000	No Revision	BEG

OUTLOOK

The preliminary informal outlook for 2010 is for chum salmon abundance to be near average and similar to levels observed in 2009. Age data collected in 2009 are still being processed, but as of yet, nothing extraordinary has been observed in age compositions to suggest large changes in abundance from what occurred in 2009, nor have there been any extraordinary environmental conditions that may have resulted in unusual ocean or freshwater survival. The run in 2010 will be comprised of returns from the 2005 and 2006 brood years, of which 2006 was one of the highest escapements on record. However, it is worth noting that some poor runs have resulted from large escapements. The 2010 run is projected to be sufficient to provide for amounts necessary for subsistence (ANS) and a surplus available for a directed commercial summer chum fishery.

2010 ALASKA BOARD OF FISHERIES REGULATORY PROPOSALS AFFECTING YUKON RIVER SUMMER CHUM SALMON

There are several proposals before the BOF that may affect summer chum salmon management, including some proposals that address Chinook salmon management and have summer chum salmon management implications.

Subsistence and Commercial Proposals

Proposal 88 – Prohibit drift gillnet gear for subsistence and commercial fishing

Proposal 90 – Prohibit subsistence and commercial gillnets over 6-inch mesh size

Proposal 193 – Revise management triggers in 5 AAC 05.362. Yukon River Summer Chum Salmon Management Plan.

Commercial Proposals

Proposal 91 – Limit commercial Chinook salmon harvest during chum salmon-directed fisheries

Proposal 92 – Prohibit sale of Chinook salmon during non- Chinook salmon-directed fisheries

Proposal 93 – Prohibit retention of Chinook salmon during chum salmon-directed mainstem fisheries

Proposal 96 – Reallocate commercial summer chum salmon harvest

Proposal 88 prohibits use of drift gillnets and would affect many subsistence fishermen from Subdistrict 4-A downstream and reduce harvest efficiency of commercial fishermen in Districts 1-3. Proposal 90 prohibits gillnets greater than 6-inch mesh in commercial and subsistence fisheries, which would greatly increase the harvest of summer chum salmon. Proposal 193 would allow commercial fishing for summer chum salmon at lower run sizes than currently allowed.

Proposals 91–93 relate to management of incidental Chinook salmon harvest during directed summer chum salmon commercial fisheries. Incidental harvests of Chinook salmon in chum salmon-directed fisheries using 6-inch maximum mesh size in Districts 1 and 2 have been as high as 39,469 (1988), but more recently 9,121 (2007) and 4,348 (2008) (Table 5). Proposal 96 would reallocate commercial harvest from Lower Yukon Area to Upper Yukon Area. The majority of the commercial summer chum salmon harvest has been in Districts 1 and 2 and Subdistrict 4-A, and most of the fishing effort has been in Districts 1 and 2 historically (Tables 6 and 7).

RESEARCH

Long-term stock assessment information is needed to assess how various summer chum salmon stocks in the Yukon River drainage can support sustained fisheries. Little stock assessment information is available for Yukon River salmon prior to statehood. Additionally, most stock assessment information collected during the 1960s and 1970s consisted of aerial surveys conducted on a periodic basis, which provided crude indices of spawning abundance. Long-term and accurate estimates of abundance and stock composition are needed, along with harvest estimates from various fisheries in the Yukon River drainage. Progress toward these objectives has been made since the late 1980s, particularly over the last decade. However, the time series for many data sets is relatively short and obtaining such information in the Yukon River drainage is difficult and expensive due to the remoteness of the area.

ADF&G, several federal agencies, non-governmental organizations, and various organized groups of fishermen operate salmon stock assessment projects throughout the Yukon River drainage, which is used by ADF&G Division of Commercial Fisheries to manage Alaskan Yukon River salmon fisheries. Preseason forecasts are based upon historic performance of parent spawning and are generally expressed as below average, average, or above average. Inseason run assessment tools include: (1) abundance indices from test fisheries, (2) sonar counts of fish passage, (3) various escapement assessment projects in tributary systems, (4) commercial and subsistence catch data, (5) catch per effort data from monitored fisheries, and (6) inseason genetic mixed stock analysis (MSA) from lower river test fisheries.

CURRENT PROGRAMS

Main river sonar, tributary sonar, weir, and counting tower projects are used to monitor spawning populations or major segments of those populations. Other information collected at ground-based assessment projects may include, but is not limited to, sex and length composition, scales for age determination, samples for genetic stock identification, and data on resident species. Additionally, an annual study is conducted to estimate the subsistence and personal use salmon harvest within the Alaskan portion of the Yukon Area drainage.

MAIN RIVER SONAR

This main river sonar project located near Pilot Station (river mile 123) estimates fish passage and uses a drift gillnet test fishery to apportion fish passage estimates to species. *The Yukon River Summer Chum Salmon Management Plan* is based on projected passage estimates at Pilot Station, with varying levels of management actions dependent on projected inseason passage estimates for summer chum salmon.

GENETIC STOCK COMPOSITION ESTIMATES

USFWS Conservation Genetics Laboratory has used genetic mixed-stock analysis (MSA) to derive stock composition estimates for Yukon River summer chum salmon with samples collected in the Pilot Station sonar test fishery since 2008. Knowledge of the origin of chum salmon as they enter the river assists in managing fisheries to achieve adequate escapement and may allow for increased fishing opportunities by identifying harvestable surpluses, particularly with respect to the independent Tanana River terminal fisheries. In addition, a breakdown between summer chum and fall chum salmon stocks is provided for overlap in run timing during July. Estimates of stock compositions for major Yukon River summer chum salmon stock groups have been provided inseason to facilitate management. From the beginning of the spawning run, genetic samples were collected from the Pilot Station test fishery and analyzed on a weekly basis using Bayesian mixture modeling as implemented in the computer program BAYES (Pella and Masuda 2001).

TRIBUTARY SONAR

Anvik River is a major producer of summer chum salmon on Yukon River, accounting for as much as 50% of the overall summer chum salmon run during the period from 1995–2002 and decreased more recently to an average of 24% after 2002. This reduction corresponds with increased production in other chum salmon spawning streams. Summer chum salmon have been monitored in Anvik River since 1978.

WEIRS AND COUNTING TOWERS

Weirs or counting towers are currently operated on Henshaw Creek, and East Fork Andreafsky, Gisasa, Tozitna, Chena, and Salcha rivers. Typically, Chena and Salcha rivers escapement projects are terminated prior to the end of the summer chum migration because of high water events.

FISH WHEELS

There are 3 fish wheel projects currently associated with the assessment of summer chum salmon. One is located in the mainstem Yukon River near the mouth of Tanana River (Subdistrict 5-A), another is located upstream near Rapids (Subdistrict 5-B), and the third is located in the Tanana River drainage downstream from Nenana (District 6). All 3 fish wheels provide indices of summer chum salmon abundance through catch per unit effort (CPUE) information.

SUBSISTENCE HARVEST SURVEYS

Most Yukon Area communities have no regulatory requirements to report their subsistence salmon harvest. For these communities, ADF&G operates a voluntary survey program. Harvest information is collected through postseason household interviews, follow-up telephone interviews and postal questionnaires, and harvest calendars. In select areas, fishermen must document their harvest on a subsistence or personal use permit. Subsistence harvest information is necessary to determine if sufficient salmon are returning to the Yukon Area for escapement and subsistence requirements, and if adequate fishing opportunity is provided to meet subsistence uses. Subsistence harvest information is critical for run reconstruction analysis and forecasting.

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TABLES AND FIGURES

Table 1.—Yukon River summer chum salmon historical escapements 1980–2009, and Pilot Station sonar passage 1995 and 1997–2009.

Year	Pilot Station Sonar	East Fork Andreafsky River	Anvik River Sonar	Kaltag Creek Tower	Nulato River Tower	Gisasa River Weir	Clear Creek (tower or weir)	Henshaw Creek Weir
Number of Fish								
1980			492,676					
1981		147,312 ^a	1,486,182					
1982		181,352 ^a	444,581					
1983		110,608 ^a	362,912					
1984		70,125 ^a	891,028					
1985		^b	1,080,243					
1986		167,614 ^c	1,189,602					
1987		45,221 ^c	455,876					
1988		68,937 ^c	1,125,449					
1989			636,906					
1990			403,627					
1991			847,772					
1992			775,626					
1993			517,409					
1994		200,981 ^{b,d}	1,124,689	47,295	148,762 ^b	51,116 ^b		
1995	3,556,445	172,148 ^d	1,339,418	77,193	236,890	136,886	116,735	
1996	^e	108,450 ^d	933,240	51,269	129,694	157,589	100,912	
1997	1,415,641	51,139 ^d	609,118	48,018	157,975	31,800	76,454	
1998	826,385	67,591 ^d	471,865	8,113	49,140	18,228	212 ^b	
1999	973,708	32,229 ^d	437,631	5,300	30,076	9,920	11,283 ^b	^b
2000	456,271	22,918 ^d	196,349	6,727	24,308	14,410	19,376	27,271
2001	441,450	^{b,d}	224,058	^b	^b	17,936 ^b	3,674	35,031
2002	1,088,463	45,019 ^d	462,101	13,583	72,232	32,943	13,150	25,249
2003	1,168,518	22,603 ^d	251,358	3,056 ^b	17,814 ^b	24,379	5,230	22,556
2004	1,357,826	62,730 ^d	365,691	5,247	^f	37,851	15,661	85,966
2005	2,439,616	20,127 ^d	525,391	22,093	^f	172,259	26,420	237,481
2006	3,767,044	102,260 ^d	992,378 ^g	^f	^f	225,225	29,166 ^h	^b
2007	1,726,885	69,642 ^d	459,038	^f	^f	46,257	^f	31,442
2008	1,665,667	57,259 ^d	374,929	^f	^f	36,758	^f	97,281
2009	1,283,206 ⁱ	8,770 ^{d,i}	182,988 ⁱ	^f	^f	25,893 ⁱ	^f	156,201 ⁱ
2005-2009 avg.	2,176,484	51,612	506,945	n/a	n/a	101,278	n/a	130,601
BEG		65,000-130,000	350,000-700,000	n/a	n/a	n/a	n/a	n/a

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Note: Years with no data are years in which the project was not operated or was inoperable for a large portion of the season due to water conditions.

- ^a Sonar counts used.
- ^b Incomplete count caused by late installation and/or early removal of project or high water.
- ^c Tower counts used.
- ^d Weir counts used.
- ^e Pilot Station sonar operated in training mode only and no estimates were generated.
- ^f Project did not operate.
- ^g HTI and DIDSON sonar equipment were both used in 2006, and the estimate reported is DIDSON-derived.
- ^h Videography count used.
- ⁱ Data are preliminary.

Table 2.–Yukon River summer chum salmon management plan overview, 2009.

Projected Run Size ^a	Required Management Actions Summer Chum Salmon-Directed Fisheries			
	Commercial	Personal Use	Sport	Subsistence
600,000 or Less	Closure	Closure	Closure	Closure ^b
600,000 to 700,000	Closure	Closure	Closure	Possible Restrictions ^c
700,001 to 1,000,000	Restrictions ^d	Restrictions ^e	Restrictions ^e	Normal Fishing Schedules
Greater Than 1,000,000	Open ^f	Open	Open	Normal Fishing Schedules

^a ADF&G will use the best available data, including pre-season projections, mainstem river sonar passage estimates, test fisheries indices, subsistence and commercial fishing reports, and passage estimates from escapement monitoring projects to assess the run size.

^b ADF&G may, by emergency order, open chum salmon-directed subsistence fisheries where indicators show that escapement goal(s) in that area will be achieved.

^c ADF&G shall manage the fishery to achieve drainagewide escapement of no less than 600,000 summer chum salmon, except that the department may, by emergency order, open a less restrictive directed subsistence summer chum fishery in areas that indicator(s) show that the escapement goal(s) in that area will be achieved.

^d ADF&G may, by emergency order, open commercial fishing in areas that show escapement goal(s) in that area will be achieved.

^e ADF&G may, by emergency order, open personal use and sport fishing in areas that indicator(s) show escapement goal(s) in that area will be achieved.

^f ADF&G may open a drainagewide commercial fishery with harvestable surplus distributed by district or subdistrict in proportion to guideline harvest levels established in 5 AAC 05.362.(f) and (g).

Table 3.–Yukon River total summer chum salmon utilization, 1970–2009.

Year	Subsistence ^a	Commercial		Personal	Test	Sport	Total
		Commercial	Related ^b	Use	Fish Sales ^c	Fish ^d	
1970	166,504	137,006	0				303,510
1971	171,487	100,090	0				271,577
1972	108,006	135,668	0				243,674
1973	161,012	285,509	0				446,521
1974	227,811	589,892	0				817,703
1975	211,888	710,295	0				922,183
1976	186,872	600,894	0				787,766
1977	159,502	534,875	0			316	694,693
1978	171,383	1,052,226	25,761			451	1,249,821
1979	155,970	779,316	40,217			328	975,831
1980	167,705	928,609	139,106			483	1,235,903
1981	117,629	1,006,938	272,763	0		612	1,397,942
1982	117,413	461,403	255,610	0		780	835,206
1983	149,180	744,879	250,590	0		998	1,145,647
1984	166,630	588,597	277,443	0		585	1,033,255
1985	157,744	516,997	417,016	0		1,267	1,093,024
1986	182,337	721,469	467,381	0		895	1,372,082
1987	170,678	442,238	180,303	4,262		846	798,327
1988	196,599	1,148,650	468,032	2,225	3,587	1,037	1,820,130
1989	167,155	955,806	496,934	1,891	10,605	2,132	1,634,523
1990	115,609	302,625	214,552	1,827	8,263	472	643,348
1991	118,540	349,113	308,989	0	3,934	1,037	781,613
1992	125,497	332,313	211,264	0	1,967	1,308	672,349
1993	104,776	96,522	43,594	674	1,869	564	247,999
1994	109,904	80,284	178,457	0	3,212	350	372,207
1995	118,723	259,774	558,640	780	6,073	1,174	945,164
1996	102,503	147,127	535,106	905	7,309	1,854	794,804
1997	97,109	95,242	133,010	391	2,590	475	328,817
1998	87,366	28,611	187	84	3,019	421	119,688
1999	83,784	29,389	24	382	836	555	114,970
2000	78,072	6,624	0	30	648	161	85,535
2001 ^e	72,155	0	0	146	0	82	72,383
2002	87,056	13,558	19	175	218	384	101,410
2003	82,272	10,685	0	148	119	1,638	94,862
2004	77,934	26,410	0	231	217	203	104,995
2005	93,259	41,264	0	152	134	435	135,244
2006	115,093	92,116	0	262	502	583	208,556
2007	92,891	198,201	0	184	10	245	291,531
2008	86,514	151,201	0	138	80	371	238,304
2009 ^f	93,138 ^g	170,272	0	193 ^g	0	367 ^g	263,971
Average							
2005-2009	96,179	130,611	0	186	145	400	227,521
2000-2009 ^h	87,838	71,033	2	166	193	447	159,679
ANS ⁱ	83,500-142,192						

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Table 3.–Page 2 of 2.

- ^a Includes harvest from Coastal District communities of Scammon Bay and Hooper Bay, and from test fishery harvest and commercial retained fish (not sold) that were utilized for subsistence.
- ^b Includes salmon harvested for subsistence and an estimate of the number of salmon harvested for commercial production of salmon roe and carcasses used for subsistence. These data are only available since 1990.
- ^c Includes only the portion of the test fishery harvest that was sold commercially.
- ^d Sport fish harvest is assumed to be primarily summer chum salmon caught incidental to directed Chinook fishing.
- ^e No commercial fishery was conducted.
- ^f Subsistence and personal use data are preliminary.
- ^g Data are unavailable at this time, estimated based on previous 5-year average.
- ^h Average does not include data from 2001 due to no commercial fishery being conducted.
- ⁱ The amount reasonably necessary for subsistence (ANS) as determined by Alaska Board of Fisheries.

Table 4.—Summer chum salmon subsistence harvest by district and community of residence, as estimated from postseason survey, returned permits, and test fishery projects, Yukon Area, 1998–2008.

Community	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1998-2002 Average	2003-2007 Average
Hooper Bay	261	10,146	9,301	12,593	9,780	10,658	3,242	9,771	19,468	12,234	12,007	8,416	11,075
Scammon Bay	1,101	3,315	3,876	1,323	5,016	3,310	5,020	4,586	4,703	3,887	6,113	2,926	4,301
Coastal District Total	1,362	13,461	13,177	13,916	14,796	13,968	8,262	14,357	24,171	16,121	18,120	11,342	15,376
Nunam Iqua	1,872	1,343	3,309	1,942	1,897	2,561	2,698	2,794	2,903	2,325	1,949	2,073	2,656
Alakanuk	5,643	3,808	6,259	5,992	7,637	5,287	6,555	5,687	7,790	7,611	6,881	5,868	6,586
Emmonak	9,558	10,310	8,338	8,242	8,458	7,644	8,618	12,594	11,899	9,256	9,646	8,981	10,002
Kotlik	9,815	4,708	6,173	6,595	6,115	4,209	2,749	6,620	5,289	5,017	4,291	6,681	4,777
District 1 Subtotal	26,888	20,169	24,079	22,771	24,107	19,701	20,620	27,695	27,881	24,209	22,767	23,603	24,021
Mountain Village	9,596	10,059	7,074	8,484	6,657	6,497	10,676	8,861	13,119	8,104	7,559	8,374	9,451
Pitkas Point	1,302	849	1,728	862	639	800	717	1,023	680	515	1,246	1,076	747
St. Marys	9,047	6,752	8,094	10,026	7,284	4,521	6,994	6,877	7,394	8,107	6,451	8,241	6,779
Pilot Station	5,042	5,265	5,223	5,329	6,490	4,163	5,779	4,333	6,070	3,711	6,012	5,470	4,811
Marshall	1,293	1,212	3,212	1,602	2,484	792	1,765	3,183	4,392	3,070	3,023	1,961	2,640
District 2 Subtotal	26,280	24,137	25,331	26,303	23,554	16,773	25,931	24,277	31,655	23,507	24,291	25,121	24,429
Russian Mission	702	616	1,318	165	395	171	884	925	1,328	759	2,400	639	813
Holy Cross	269	264	569	460	155	214	276	760	825	320	441	343	479
Shageluk	5,501	4,868	1,800	684	1,956	5,473	1,798	4,081	1,381	977	130	2,962	2,742
District 3 Subtotal	6,472	5,748	3,687	1,309	2,506	5,858	2,958	5,766	3,534	2,056	2,971	3,944	4,034
Lower Yukon River Total	59,640	50,054	53,097	50,383	50,167	42,332	49,509	57,738	63,070	49,772	50,029	52,668	52,484
Anvik	2,139	848	425	94	1,089	844	248	529	387	5,250	340	919	1,452
Grayling	4,032	4,126	474	92	1,311	1,072	1,129	783	644	641	660	2,007	854
Kaltag	175	625	169	10	234	1,028	213	680	159	109	916	243	438
Nulato	3,518	1,945	377	208	269	180	198	634	838	356	468	1,263	441
Koyukuk	1,819	197	204	118	426	1,339	329	537	394	995	1,104	553	719
Galena	2,333	1,688	820	53	712	289	782	1,013	1,205	571	758	1,121	772
Ruby/Kokrines	2,251	1,697	1,233	1,025	1,406	876	2,010	967	1,714	416	655	1,522	1,197
District 4 Subtotal (Excluding Koyukuk River)	16,267	11,126	3,702	1,600	5,447	5,628	4,909	5,143	5,341	8,338	4,901	7,628	5,872

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Table 4.–Page 2 of 3.

Community	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	1998-2002 Average	2003-2007 Average
Huslia	449	1,192	745	833	3,178	6,187	3,844	2,433	1,122	3,243	4,377	1,279	3,366
Hughes	334	577	1,079	551	1,089	1,265	3,823	2,230	3,254	1,213	944	726	2,357
Allakaket	901	2,245	1,520	1,604	6,242	4,383	2,367	2,535	5,170	3,451	3,229	2,502	3,581
Alatna	13	99	0	0	15	50	16	5	110	11	66	25	38
Bettles	82	100	0	0	0	0	0	4	0	0	0	36	1
Koyukuk River Subtotal	1,779	4,213	3,344	2,988	10,524	11,885	10,050	7,207	9,656	7,918	8,616	4,570	9,343
District 4 Total	18,046	15,339	7,046	4,588	15,971	17,513	14,959	12,350	14,997	16,256	13,517	12,198	15,215
Tanana	1,966	1,214	2,848	1,407	3,321	3,075	1,490	4,832	5,474	5,229	2,877	2,151	4,020
Rampart ^a	19	60	47	0	14	9	103	315	135	25	27	28	117
Fairbanks ^b	57	346	275	165	295	89	280	780	1,341	529	119	228	604
Stevens Village	171	26	50	0	12	0	108	442	972	254	163	52	355
Beaver	15	91	7	328	77	7	2	68	117	41	27	104	47
Fort Yukon ^c	30	0	0	289	1,832	2,176	1,187	67	2,165	2,365	230	430	1,592
Circle	1	60	109	6	5	85	52	3	58	200	5	36	80
Central	1	0	1	0	0	0	0	5	2	0	0	0	1
Eagle	52	271	121	555	24	104	171	235	989	15	14	205	303
Other ^d	2	42	51	0	17	0	3	53	117	81	25	22	51
District 5 Subtotal	2,314	2,110	3,509	2,750	5,597	5,545	3,396	6,800	11,370	8,739	3,487	3,256	7,170
(Excluding Chandalar and Black rivers)													
Venetie	0	166	0	106	13	0	15	0	475	107	50	57	119
Chalkyitsik	0	0	132	0	0	0	0	0	0	0	0	26	0
Chandalar/Black River Subtotal	0	166	132	106	13	0	15	0	475	107	50	83	119
District 5 Total	2,314	2,276	3,641	2,856	5,610	5,545	3,411	6,800	11,845	8,846	3,537	3,339	7,289
Manley	211	272	240	338	93	65	296	163	89	140	144	231	151
Minto	148	173	3	19	10	625	7	21	460	82	9	71	239
Nenana	5,041	1,894	775	19	360	2,193	1,171	1,771	388	1,419	753	1,618	1,388
Fairbanks ^e	604	315	90	36	47	31	308	45	73	255	94	218	142
Other ^f	0	0	3	0	2	0	11	14	0	0	311	1	5
District 6 Tanana R. Total	6,004	2,654	1,111	412	512	2,914	1,793	2,014	1,010	1,896	1,311	2,139	1,925
Upper Yukon River Total	26,364	20,269	11,798	7,856	22,093	25,972	20,163	21,164	27,852	26,998	18,365	17,676	24,430
Alaska, Yukon River Total ^g	86,004	70,323	64,895	58,239	72,260	68,304	69,672	78,902	90,922	76,770	68,394	70,344	76,914
Alaska, Yukon Area Total	87,366	83,784	78,072	72,155	87,056	82,272	77,934	93,259	115,093	92,891	86,514	81,687	92,290

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- ^a Rampart area harvest as reported from subsistence survey information prior to 2004 and from fishing permits since 2004 as established by Alaska Board of Fisheries (BOF).
- ^b Fairbanks North Star Borough residents who subsistence fished in District 5 Rampart and Yukon River bridge permit areas.
- ^c Includes Birch Creek harvest of one summer chum salmon in 1997.
- ^d Other permit holders who fished in District 5, but did not reside in the communities listed.
- ^e Fairbanks North Star Borough residents who subsistence fished in Tanana River. Does not include harvest by personal use permit holders.
- ^f Other permit holders who fished in District 6, but did not reside in ,communities listed.
- ^g Does not include Coastal District.

Table 5.—Commercial catches of Chinook and summer chum salmon by mesh size, Districts 1 and 2, Lower Yukon area, 1970–2009.

Year	Unrestricted Mesh Size ^a			6-inch Maximum Mesh Size ^b		
	Chinook		Total	Summer Chum Districts 1 and 2	Chinook Districts 1 and 2	Summer Chum Districts 1 and 2
	District 1	District 2				
1970	56,469	17,141	73,610	104,705	57	16,623
1971	84,397	19,226	103,623	42,189	1,176	57,851
1972	68,059	17,317	85,376	78,698	1,991	37,881
1973 ^c	52,790	12,479	65,269	89,841	5,168	196,540
1974	69,457	17,464	86,921	349,758	1,631	227,507
1975	41,550	9,064	50,614	148,919	4,162	345,472
1976	56,392	15,296	71,688	267,075	7,631	128,431
1977	65,745	15,328	81,073	157,909	4,720	205,634
1978	53,198	28,872	82,070	275,512	7,737	354,603
1979	61,790	33,347	95,137	136,973	22,136	434,188
1980	78,157	42,755	120,912	95,876	19,474	605,679
1981	88,038	37,660	125,698	163,979	18,648	758,767
1982	70,743	35,656	106,399	225,106	6,887	217,563
1983	76,280	30,798	107,078	121,927	31,002	590,329
1984	65,101	29,355	94,456	242,076	16,394	287,531
1985 ^d	76,106	38,194	114,300	170,345	22,445	265,240
1986	42,922	36,603	79,525	231,372	15,307	438,182
1987	62,147	40,127	102,274	128,017	21,827	269,757
1988	32,792	20,009	52,801	225,049	39,469	848,321
1989 ^e	32,180	21,494	53,674	126,360	38,548	765,233
1990 ^e	42,092	24,000	66,092	99,588	18,147	281,418
1991 ^e	52,074	36,290	88,364	108,986	4,145	205,610
1992 ^e	54,569	28,679	83,248	81,458	27,678	242,878
1993	47,084	37,293	84,377	47,488	2,202	45,503
1994 ^f	61,633	41,692	103,325	39,832	608	15,369
1995	74,827	39,607	114,434	113,860	3,098	112,223

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Table 5.–Page 2 of 2.

Year	Unrestricted Mesh Size ^a			6-inch Maximum Mesh Size ^b		
	Chinook		Total	Summer Chum Districts 1 and 2	Chinook Districts 1 and 2	Summer Chum Districts 1 and 2
	District 1	District 2				
1996	56,642	30,209	86,851	123,233	0	0
1997	63,062	39,052	102,114	49,953	3,611	28,204
1998	24,202	16,806	41,008	20,314	1,211	7,804
1999	37,145	27,119	64,264	27,883	0	0
2000	4,735	3,783	8,518	6,624	0	0
2001 ^g	0	0	0	0	0	0
2002	11,087	11,434	22,521	10,354	0	0
2003	22,709	14,220	36,929	6,162	0	0
2004	28,403	24,145	52,548	20,652	0	0
2005	16,619	13,413	30,032	32,278	0	0
2006	23,728	19,356	43,084	35,574	478	11,785
2007	13,558	9,238	22,796	11,311	9,121	164,911
2008 ^h	0	0	0	0	4,348	125,598
2009 ^{h,i}	0	0	0	0	131	157,906
10 Year Average						
1986-1995	50,232	32,579	82,811	120,201	17,103	322,449
10 Year Average						
1996-2005	26,460	18,018	44,479	29,745	482	3,601

Note: ADF&G test fishery sales are included for years 1970–1990. ADF&G test fishery sales are not included for years 1991–2009. Chinook salmon caught during the fall season fishery are not included.

- ^a Primarily 8- to 8.5-inch mesh size used during early June to early July.
- ^b Summer season harvest through July 15-20.
- ^c 6-inch maximum mesh size regulation beginning late June to early July became effective in 1973.
- ^d 6-inch maximum mesh size regulation by emergency order during commercial fishing season became effective in 1985.
- ^e Only includes information from fish ticket database; does not include salmon purchased illegally.
- ^f 8-inch or greater mesh size restriction was in effect until June 27 and fishermen were requested to take chum salmon home for subsistence use until June 22 in order to reduce the harvest of chum salmon.
- ^g No commercial fishery in 2001.
- ^h Due to conservation concern for Chinook salmon, no unrestricted commercial periods were authorized.
- ⁱ This harvest does not include 3,540 fish caught, but not sold, per an Alaska Board of Fisheries emergency regulation prohibiting the sale of Chinook salmon during the chum salmon-directed fishery.

Table 6.—Commercial summer chum salmon sales and estimated harvest by area and district Yukon River drainage in Alaska, 1982–2009.

Year	Lower Yukon					Upper Yukon Estimated Harvest ^a			
	District 1 ^b	District 2 ^b	Combined	District 3	Subtotal	Subdistrict 4A	Subdistricts 4B and 4C	District 5	District 6
1982	249,516	182,344	431,860	4,086	435,946	234,431	23,288	234	23,114
1983	451,164	248,092	699,256	14,600	713,856	224,160	31,228	1,898	24,327
1984	292,676	236,931	529,607	1,087	530,694	247,532	30,538	692	56,584
1985	247,486	188,099	435,585	1,792	437,377	384,341	43,142	700	68,453
1986	381,127	288,427	669,554	442	669,996	409,078	56,457	690	52,629
1987	222,898	174,876	397,774	3,501	401,275	191,670	18,130	406	11,060
1988	645,322	424,461	1,069,783	13,965	1,083,748	443,382	46,692	1,085	41,775
1989	544,373 ^c	343,032	887,405	7,578	894,983	486,102	24,142	527	46,986
1990	146,725	131,755	278,480	643	279,123	197,621	24,929	671	14,833
1991	140,470 ^d	175,149	315,619	8,912	324,531	290,255	19,389	35	23,892
1992	^e 177,329	147,129	324,458	65	324,523	184,171	27,225	430	7,228
1993	73,659	19,332	92,991	463	93,454	38,196	4,761	0	3,705
1994	42,332	12,869	55,201	35	55,236	131,794	17,239	464	31,434
1995	142,266	83,817	226,083	0	226,083	419,688	80,155	316	37,428
1996	92,506	30,727	123,233	1,534 ^f	123,233	356,938	68,639	336	46,890
1997	59,915	18,242	78,157	0	78,157	100,389	12,796	137	25,287
1998	21,270	6,848	28,118	0	28,118	0	0	110	570
1999	16,181	11,702	27,883	0	27,883	0	1,267	115	148
2000	^g 3,315	3,309	6,624	0	6,624	0	0	0	0
2001	^h 0	0	0	0	0	0	0	0	0
2002	6,327	4,027	10,354	0	10,354	0	0	6	3,218
2003	3,579	2,583	6,162	0	6,162	0	62	0	4,461
2004	13,993	5,782	19,775	0	19,775	0	0	25	6,610
2005	23,965	8,313	32,278	0	32,278	0	0	0	8,986

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Table 6.–Page 2 of 2.

Year	Lower Yukon					Upper Yukon Estimated Harvest ^a			
	District 1 ^b	District 2 ^b	Combined	District 3	Subtotal	Subdistrict 4A	Subdistricts 4B and 4C	District 5	District 6
2006	21,816	25,543	47,359	116	47,475	0	0	20	44,621
2007	106,790	69,432	176,222	1	176,223	7,304	0	0	14,674
2008	67,459	58,139	125,598	0	125,598	24,346	0	0	1,842
2009	71,335	86,571	157,906	0	157,906	4,589	0	0	7,777
1999-2008									
Average	26,343	18,883	45,226	12	45,237	3,165	133	17	8,456
2004-2008									
Average	46,805	33,442	80,246	23	80,270	6,330	0	9	15,347

^a Estimated harvest is fish sold in the round, plus estimated number of females caught to produce the roe sold. In addition, estimated harvest for District 4 includes the estimated number of unsold males harvested.

^b All sales are fish in the round in Districts 1, 2, and 3. Includes department test fish sales prior to 1988.

^c Includes illegal sales of 150 summer chum salmon in District 1.

^d Includes illegal sales of 1,023 summer chum salmon.

^e Includes illegal sales of 31 summer chum salmon in District 1, and 91 summer chum salmon in District 2.

^f Estimated harvest from 935 pounds of roe sold. Estimated harvest includes the number of females caught to produce the roe sold and estimated number of unsold males.

^g No commercial fishing periods in Districts 3,4,5, and 6.

^h No commercial fishing periods in Districts 1 through 6.

Table 7.—Number of commercial salmon fishing gear permit holders who delivered fish, listed by district and season, Yukon Area, 1971–2009.

Year	Chinook and Summer Chum Salmon Season								Total
	Lower Yukon Area				Upper Yukon Area				
	District 1	District 2	District 3	Subtotal ^a	District 4	District 5	District 6	Subtotal	
1971	405	154	33	592	-	-	-	-	592
1972	426	153	35	614	-	-	-	-	614
1973	438	167	38	643	-	-	-	-	643
1974	396	154	42	592	27	31	20	78	670
1975	441	149	37	627	93	52	36	181	808
1976	453	189	42	684	80	46	29	155	839
1977	392	188	46	626	87	41	18	146	772
1978	429	204	22	655	80	45	35	160	815
1979	425	210	22	657	87	34	30	151	808
1980	407	229	21	657	79	35	33	147	804
1981	448	225	23	696	80	43	26	149	845
1982	450	225	21	696	74	44	20	138	834
1983	455	225	20	700	77	34	25	136	836
1984	444	217	20	613	54	31	27	112	725
1985	425	223	18	666	74	32	27	133	799
1986	441	239	7	672	75	21	27	123	795
1987	440	239	13	659	87	30	24	141	800
1988	456	250	22	678	95	28	33	156	834
1989	445	243	16	687	98	32	29	159	846
1990	453	242	15	679	92	27	23	142	821
1991	489	253	27	678	85	32	22	139	817
1992	438	263	19	679	90	28	19	137	816
1993	448	238	6	682	75	30	18	123	805
1994	414	250	7	659	55	28	20	103	762
1995	439	233	0	661	87	28	21	136	797
1996	448	189	9	627	87	23	15	125	752
1997	457	188	0	639	39	29	15	83	722
1998	434	231	0	643	0	18	10	28	671
1999	412	217	5	631	5	26	6	37	668
2000	350	214	-	562	-	-	-	-	562
2001 ^b	-	-	-	-	-	-	-	-	-
2002	323	223	^c	540	^c	14	6	20	560
2003	352	217	^c	556	3	16	7	26	582
2004	396	213	^c	550	^c	14	6	20	570
2005	370	228	^c	578	^c	12	5	17	595

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Table 7.–Page 2 of 2.

Year	Chinook and Summer Chum Salmon Season								
	Lower Yukon Area				Upper Yukon Area				Total
	District 1	District 2	District 3	Subtotal ^a	District 4	District 5	District 6	Subtotal	
2006	379	214	6	569	^c	15	10	25	594
2007	359	220	3	564	5	12	10	27	591
2008	266	181	^c	444	8	^c	5	13	457
2009	213	166	^c	376	6	^c	5	11	387
1999-2008 Avg.	356	214	5	555	5	16	7	23	575
2009 vs. Avg.	-40.2%	-22.5%		-32.2%	14.3%		-27.3%	-52.4%	-32.7%

^a Since 1984, the subtotal for Lower Yukon Area was the unique number of permits fished. Prior to 1984, subtotals are additive for Districts 1, 2, and 3. Some individual fishermen in Lower Yukon Area may have operated in more than one district during the season.

^b No commercial fishing occurred in 2001.

^c No commercial fishing periods in portions or all of Districts 3, 4, and 5.

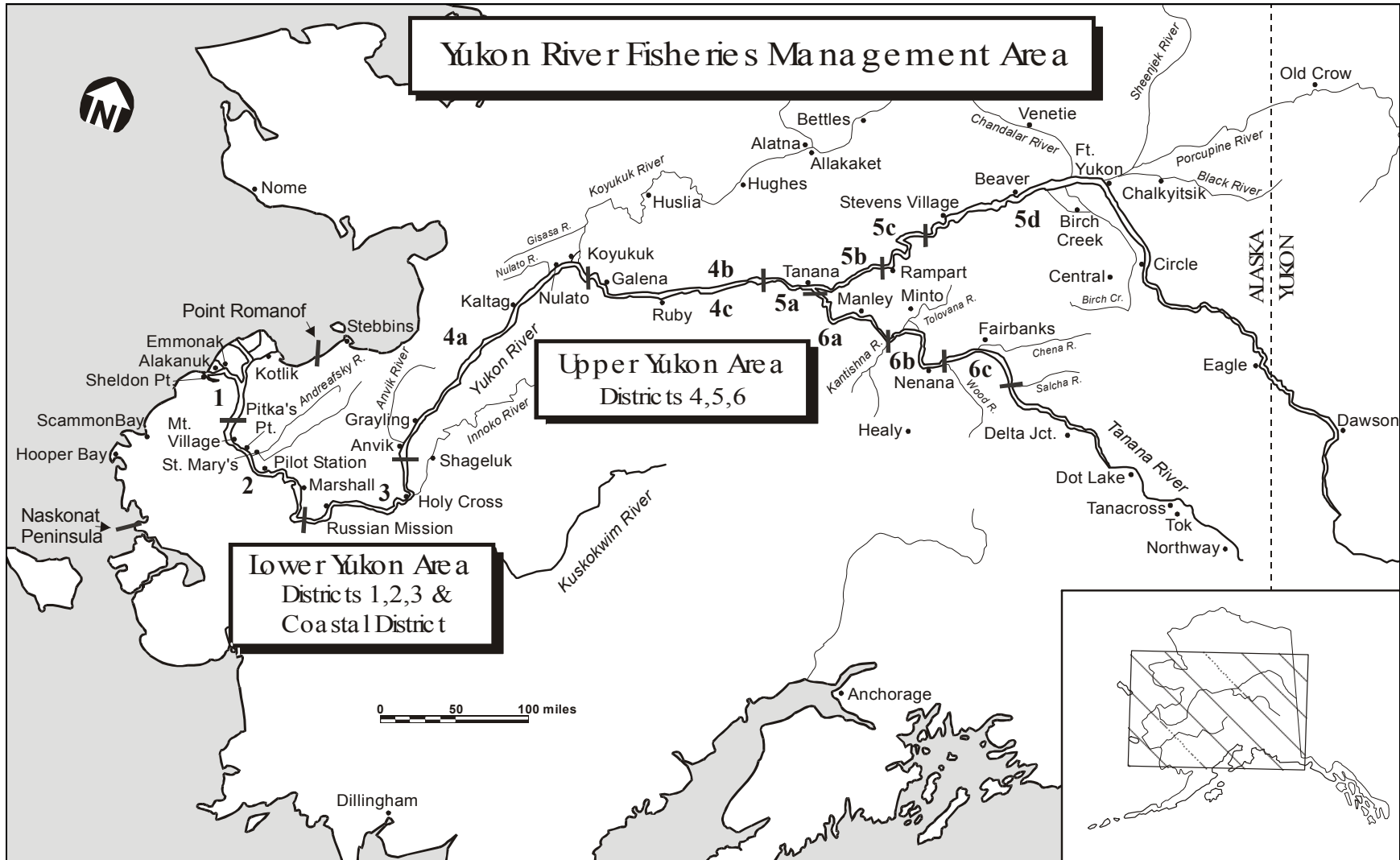
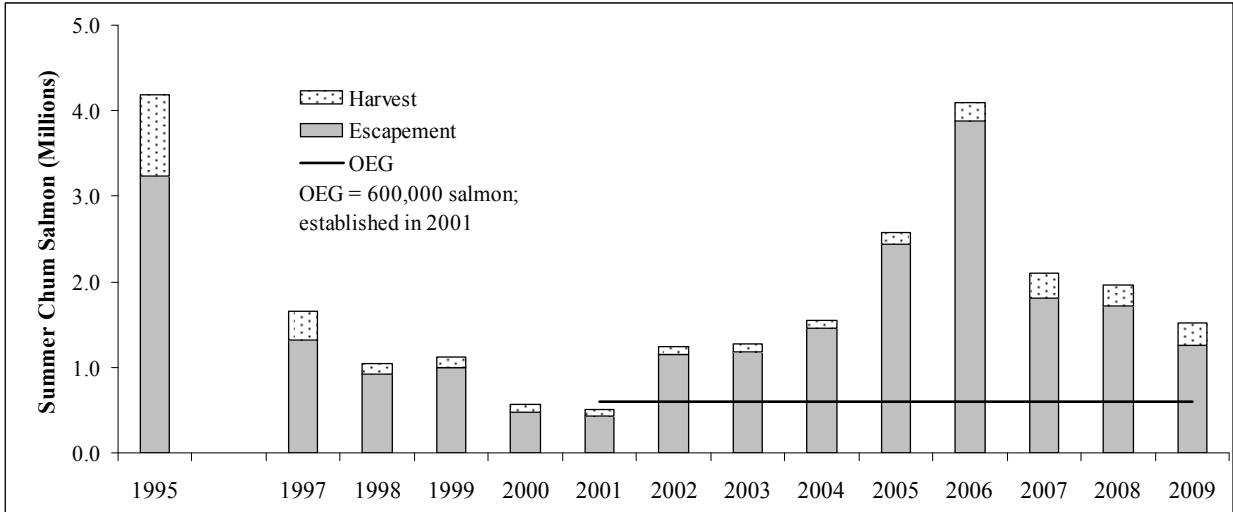


Figure 1.—Alaska portion of the Yukon River drainage showing communities and fishing districts.



Note: Sonar passage data are unavailable for 1996. The 2009 harvest data includes preliminary subsistence harvest information.

Figure 2.—Approximate total run size of Yukon River summer chum salmon, by harvest, and escapement, with escapement compared to the drainagewide OEG, 1995 and 1997–2009.

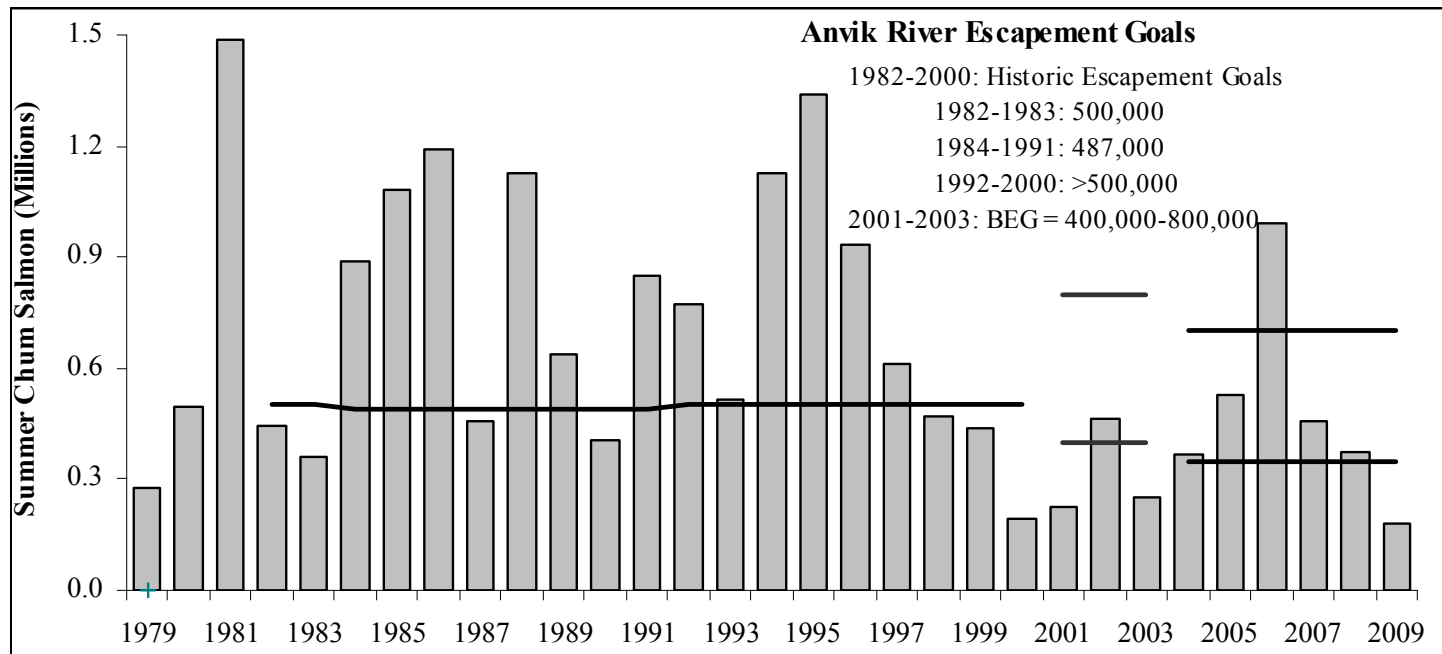


Figure 3.—Summer chum salmon escapement estimates and escapement goals for Anvik River, 1979–2009.

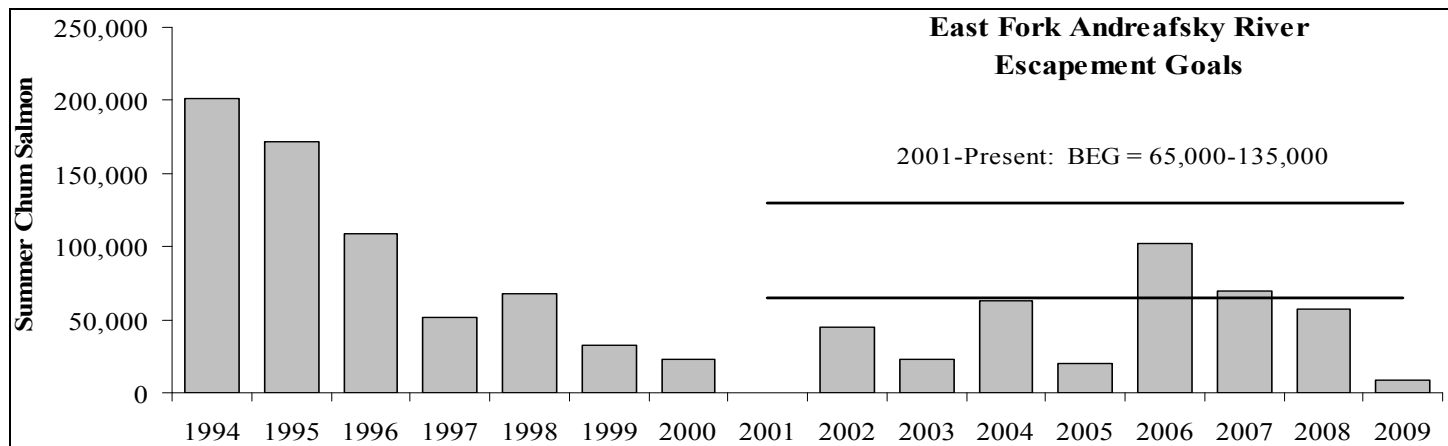
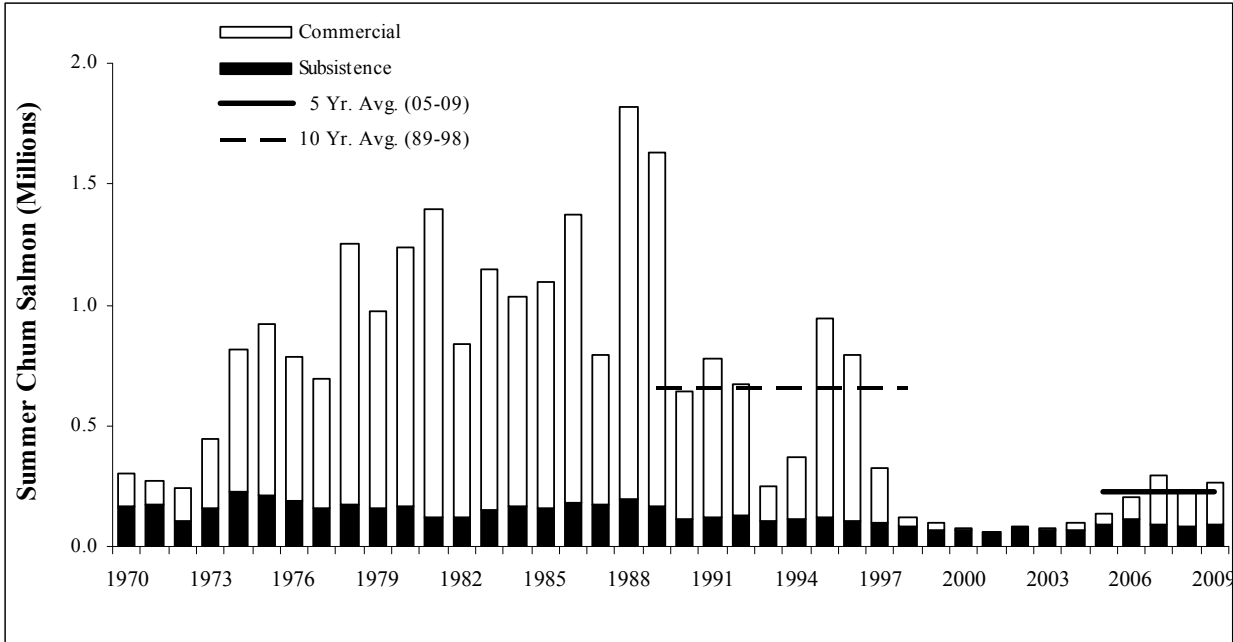
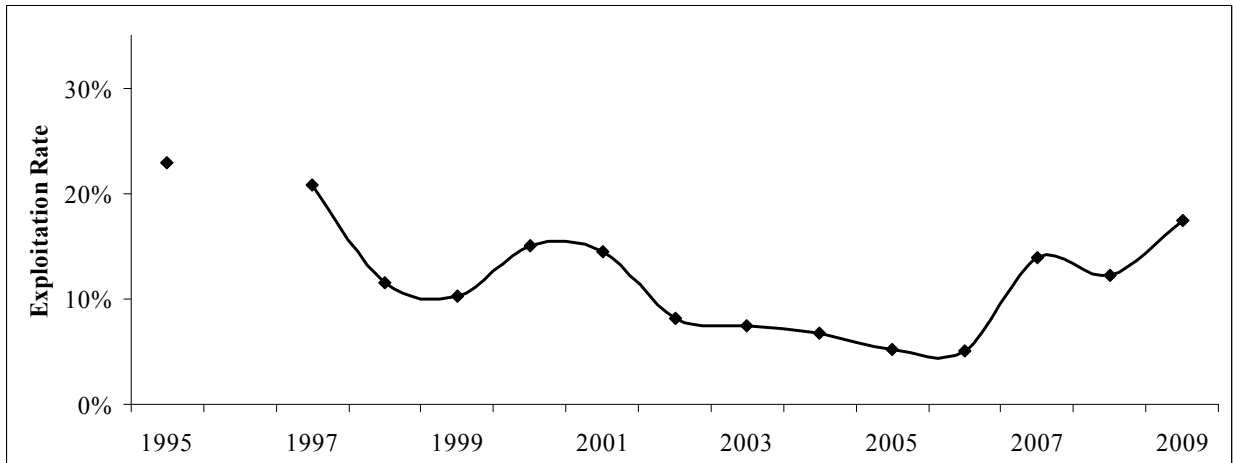


Figure 4.—Summer chum salmon escapement estimates and escapement goals for East Fork Andreafsky weir 1994–2009.



Note: Subsistence harvest data for 2009 are preliminary.

Figure 5.—Yukon River summer chum salmon subsistence and commercial harvests from 1970 to 2009, compared to the 1989–1998 average (approximately 665,100 fish) and the 2005–2009 average (226,994 fish).



Note: Data are unavailable for 1996. Exploitation rate for 2009 is partially based on preliminary subsistence and sport fish harvest data.

Figure 6.—Approximate exploitation rates on Yukon River summer chum salmon stocks, 1995 and 1997–2009.