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**Yukon River Summer Chum Salmon Stock Status,  
2006; a Report to the Alaska Board of Fisheries**

by

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and

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December 2006

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Divisions of Sport Fish and Commercial Fisheries



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

### Weights and measures (English)

cubic feet per second	ft <sup>3</sup> /s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

### Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

### Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity	pH
(negative log of)	
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

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REPORT TO THE ALASKA BOARD OF FISHERIES**

by

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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 the Yukon River summer chum salmon *Oncorhynchus keta* as a stock of management concern at the September 2000 work session. A “management concern” is defined as, “a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for salmon stocks within the bound of Sustainable Escapement Goal (SEG), Biological Escapement Goal (BEG), Optimal Escapement Goal (OEG), or other specified objectives for the fishery.” An action plan was developed by the Alaska Department of Fish and Game (ADF&G, department) 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, the department 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 OEG of 600,000 fish exceeded annually, and the 2006 run was slightly lower than the 1995 run, which was the largest on record since summer chum salmon runs were first assessed based on Pilot Station sonar counts in 1995. Both the 1995 and 2006 summer chum runs exceeded 4.0 million fish. In general, escapement objectives for summer chum salmon in the Yukon River drainage, as a whole, have been met or exceeded from 2002 through 2006 and a near average surplus yield has been available from 2004 to 2006. The Yukon River summer chum salmon stock no longer meets the requirements for a “stock of concern” as defined in SSFP; thus, the department recommends that this classification be discontinued.

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

## INTRODUCTION

The *Policy for the Management of Sustainable Salmon Fisheries* (SSFP; 5 AAC 39.222, effective 2000, amended 2001) directs the Alaska Department of Fish and Game (ADF&G, department) 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. This report provides ADF&G’s reassessment of the Yukon River summer chum salmon stock, which has been previously classified as a stock of management concern by the BOF in 2000 and 2004.

In response to the guidelines established in the SSFP (5 AAC 39.222(f)(21)), the BOF classified the Yukon River summer chum salmon *Oncorhynchus keta* stock as a management concern at the 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” (5 AAC 39.222(f)(21)). The SSFP further goes on to define chronic inability as “the continuing or anticipated inability to meet escapement objectives over a 4 to 5 year period”. This determination as a management concern was based on documented low escapements during 1998–2000 and the anticipated very low run expected 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 the East Fork Andreafsky River from 1998 through 2003 and in the Anvik River in 1998–2001 and 2003 (Salomone and Bergstrom 2004).

Based on the definition contained in the SSFP, only the most recent 5-year yield and escapement history (2002–2006) and the historical level of yield or harvestable surplus were considered in our current analysis and subsequent recommendations regarding stock of concern status. This

stock has shown marked improvement since 2001. Given the collectively large spawning escapements of the Yukon River summer chum salmon stock over the past 3 years (2004–2006), the stock no longer meets the stock of management concern criteria. Although Yukon River drainage subsistence and commercial harvests from 1999 through 2003 were significantly below the 1989–1998 average, a near average surplus yield available during 2004–2006 has not been taken primarily due to the lack of commercial markets. Therefore, the Yukon River summer chum salmon stock does not meet the criteria for a yield concern either. Based on definitions provided in the SSFP (5 AAC 39.222(f)(21) and (42)), the department recommended discontinuing the Yukon River summer chum salmon stock as a stock of concern at the October 2006 BOF work session.

## **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 run is typically managed as a single stock for which there is currently a drainage-wide OEG of 600,000 summer chum salmon, as identified in the regulatory management plan (5 AAC 05.362, 2001). An approximate estimate of the total run of summer chum salmon in the 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 1997–2006, (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 the East and West Fork of the Andreafsky River. The estimate is approximate because some of the 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 the West Fork Andreafsky is estimated based on the numbers observed in the East Fork (Clark 2001), and some minor stocks of summer chum salmon spawn in tributaries below Pilot Station. However, the Pilot Station counts are so much greater than the total catch and monitored escapement, that the total run estimate is primarily based upon the sonar passage estimates. The total run of Yukon River summer chum salmon estimated in this manner averaged about 1.8 million fish during the 11-year period (1995 and 1997–2006), 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 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 drainage-wide escapement exceeding 1.0 million salmon since 2001, greater than 2.4 million fish in 2005, and approximately 3.9 million in 2006, the largest escapement on record. The drainage-wide OEG of 600,000 summer chum salmon was not met in 2000 and 2001, but has been exceeded annually since that time (Figure 2).

ADF&G has established two BEGs for summer chum salmon in the Yukon River drainage. Currently, the BEG range for the Anvik River is 350,000–700,000 chum salmon and the BEG range for the East Fork Andreafsky River is 65,000–130,000 chum salmon. The BEG for Anvik River has been met or exceeded in 24 of 27 years (89%) since 1980; the 3 years when the BEG was not met were 2000, 2001, and 2003 (Table 1; Figure 3). Assessment of annual escapements has occurred in 18 of 26 years since 1981 in the East Fork Andreafsky River with the BEG met or exceeded in 9 out of 18 years (50%), and last met in 2006 (Table 1; Figure 4).

The Anvik River BEG was met in 2002 and 2004–2006 (Figure 3). A substantial decrease in Anvik River summer chum salmon production began with the 1993 brood year and continued through the 1998 brood year. These escapements produced salmon that returned in 1997 through 2003. 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). However, recent returns from the 2001 brood year indicate that the Anvik River summer chum salmon stock has rebounded, in terms of production, with a R/S greater than 4.0. However, the Anvik River summer chum salmon contribution to the overall Yukon River summer chum salmon stock above Pilot Station sonar has decreased from approximately 46% during the period from 1995–2002, to an average of 24% after 2002. This reduction corresponds with increased production in other chum salmon spawning streams above Pilot Station, such as in the Tanana River drainage where record escapements of over 100,000 summer chum salmon were observed in Salcha River in 2005 and 2006, as well as in the Koyukuk River drainage, where record escapements of 170,000 and 225,000 in the Gisasa River were observed in 2005 and 2006, respectively.

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 only been met once, in 2006, since 2002 (Figure 4). However, the 2004 East Fork Andreafsky escapement was within 2,000 summer chum salmon of the lower range of the BEG of 65,000. It is interesting to note that during this time, no directed summer chum salmon commercial fisheries occurred below the mouth of the 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 water marked, making them less desirable to commercial buyers and fishers. 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 the 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. However, recent production estimates from the poor 2000 and 2001 escapements to the Andreafsky River indicates that even this system is experiencing increased production along with the rest of the Yukon River drainage.

## **HARVEST**

Combined commercial and subsistence harvests show a substantial decrease from the 10-year (1989–1998) average of approximately 665,100 summer chum salmon to the recent 5-year (2002–2006) average of approximately 122,500 (Figure 5). Commercial harvest of summer chum salmon averaged about 394,400 during the 1990s and approximately 27,500 from 2000 through 2006. The recent decline in utilization is largely due to the reductions in commercial harvest. Below average runs from 1998 to 2003 resulted in low available yields. 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. Since 1997, commercial harvest of summer chum salmon has been incidental to directed Chinook salmon fisheries, with the exception of a limited directed harvest in District 6 since 2002, and a single restricted mesh ( $\leq$  6-inch mesh) opening in District 2 in 2006. Additionally, there is a regulatory management plan to allow directed commercial harvest of summer chum salmon in the 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 (ADF&G 2002).

### **EXPLOITATION RATES**

The annual total run estimates can be coupled with total annual inriver utilization to estimate exploitation rates exerted on Yukon River summer chum salmon for the years 1995 and 1997–2006 (Figure 6). Total exploitation rates exerted by Yukon River fisheries on summer chum salmon over 11 years averaged about 11.4%, ranging from as high as about 23.0% in 1995 to as low as about 4.3% in 2006. Note that both these years had run sizes in excess of 4.0 million fish. Exploitation rates on the two lowest runs, approximately 550,000 fish, in 2000 and 2001, were 15.1% and 13.1%, respectively (Figure 6). These harvest rates are low in comparison to exploitation rates exerted on most Alaska salmon populations and primarily reflect the lack of commercial markets.

### **STOCK OF CONCERN RECOMENDATION**

Based on the definitions provided in the Policy for the Management of Sustainable Salmon Fisheries of 5 AAC 39.222(f)(21) and (42), the department recommends discontinuing the stock of concern classification for Yukon River summer chum salmon based on improved production and run strength of Yukon River summer chum salmon stocks over the past 5 years.

Since the poor runs of 2000 and 2001, Yukon River summer chum salmon have rebounded substantially, averaging a total run of approximately 2.0 million fish per year, with the Yukon River drainage-wide OEG of 600,000 fish exceeded each year beginning in 2002. Individual spawning tributary escapement goals were met in the Anvik River in 2002 and 2004 through 2006, and in the East Fork Andreafsky in 2006, and were within 2% of the lower end of the range in 2004. The exploitation rate on Andreafsky River fish is assumed to be lower than that of other spawning stocks since it is located near the Yukon River mouth and subsequently subjected to less fishing pressure. To date, no specific management measures have been taken to manage East Fork Andreafsky River escapement. Failure to meet escapement objectives in some years in the Andreafsky Rivers is believed to be the result of continued poor parent-year production caused by factors beyond the department’s control, such as the recent large runs of pink salmon spawning along with chum salmon in this system. However, production estimates from the poor 2000 and 2001 escapements to the Andreafsky River indicates that even this system is experiencing increased production along with the rest of the Yukon River drainage. Although the Yukon River subsistence and commercial harvests from 1999 through 2003 were significantly below the 1989–1998 average, a near average surplus was available for harvest during 2004–2006, which has not been taken due primarily to the lack of commercial markets.

Given the large spawning escapements of summer chum salmon over the past 3 years 2004–2006, approximately 1.4, 2.4, and 3.9 million fish, respectively, and the drainage-wide OEG of 600,000 summer chum salmon exceeded every year since the poor run in 2001, the Yukon River summer chum salmon stock does not fit the SSFP definition of either a management or yield concern as it has consistently maintained “expected yields, or harvestable surpluses, above escapement needs” (5 AAC 39.222(f)(42)). ADF&G recommends the Yukon River summer chum salmon stock no longer be considered a stock of concern.

## **OUTLOOK**

The preliminary outlook for 2007 is for average abundance, similar to the run size observed in 2004. Information from previous Bering-Aleutian Salmon International Survey (BASIS) studies and the 2006 trawl bycatch information indicate continued high abundance of all salmon species. The run in 2007 will be comprised of returns from the 2002 and 2003 brood years, of which 2002 was one of the poorest escapements on record. However, large runs in 2005 and 2006 have resulted from poor parent escapements. Hence, if the 2007 run is similar to the runs of 2004–2006, the department anticipates that a substantial surplus will be available for a directed commercial summer chum fishery.

## **ALASKA BOARD OF FISHERIES ACTION**

In response to the guidelines established in the Sustainable Salmon Fisheries Policy, the Alaska Board of Fisheries is anticipated to discontinue the stock of concern classification for the Yukon River summer chum salmon stock during the January 31–February 5, 2007 regulatory meeting.

## **REVIEW OF YUKON RIVER SUMMER CHUM MANAGEMENT ACTION PLAN, 2001–2006**

### **CURRENT STOCK STATUS**

In response to the guidelines established in the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), the department recommended the discontinuation of the stock of concern classification for the Yukon River summer chum salmon during the October 2006 BOF work session. After reviewing stock status information and public input during the January 31–February 5, 2007 regulatory meeting, the Alaska Board of Fisheries is anticipated to discontinue the stock of concern classification for the Yukon River summer chum salmon stock. This determination is anticipated to be based on the ability to maintain escapements for Yukon River summer chum salmon within the bounds or in excess of the river-wide OEG and most tributary specific BEGs during the last 5 years and the availability of a near average surplus yield during 2004–2006.

### **YUKON RIVER SUMMER CHUM SALMON ACTION PLAN GOAL**

The goal of the action plan enacted in 2001 was to conservatively manage harvests in order to meet spawning escapement goals, to provide for subsistence levels within the amounts reasonably necessary for subsistence (ANS) range, and to reestablish historic harvest levels by other users. This objective has been met for summer chum salmon with most escapement goals throughout the drainage being met, or exceeded, from 2002–2006, with the exception of the East Fork Andreafsky River. Although harvests the past 5 years remain below historical range, the surplus available for harvest since 2003 was near the historical range. Low salmon harvests were primarily the result of poor commercial markets for summer chum salmon.

### **EXISTING MANAGEMENT PLAN**

5 AAC 05.362. YUKON RIVER SUMMER CHUM SALMON MANAGEMENT PLAN.

5 AAC 01.210. FISHING SEASONS AND PERIODS.

## Customary and Traditional Use Finding and the Amount Necessary for Subsistence Uses

In 1993, the Alaska Board of Fisheries made a positive finding for Customary and Traditional Use for all salmon in the Yukon-Northern Area. In 2001, the department recommended that the BOF amend 5 AAC 01.236 to include revised findings regarding the amounts reasonably necessary for subsistence (ANS) for the Yukon-Northern Area using updated subsistence harvest data. After a thorough review of various options (ADF&G 2000), the BOF made a finding of ANS for the Yukon Area by species.

### ANS range for the Yukon River drainage by species

Chinook salmon	45,500–66,704
Summer chum salmon	83,500–142,192
Fall chum salmon	89,500–167,900
Coho salmon	20,500–51,980

During the most recent 5-year period that subsistence harvest data are available, 2001–2005, harvests were within the ANS range in 2 years, 2002 and 2005 (Table 2). However, the failure to achieve ANS is not only because of salmon availability but probably due to a number of factors, including the lack of a summer chum salmon roe market and changing subsistence harvest patterns. Low abundance during the period 1998–2001 (Figure 2) accounts for a portion of the reduction in subsistence harvest during these years. Additionally, changes in summer chum salmon harvest amounts are also related to the lack of a commercial roe fishery in the middle Yukon area since 1997. Fish wheels were the dominant gear type used to harvest summer chum salmon in the District 4 commercial fishery. In 1997, subsistence fishers reported harvests taken from 41 fish wheels, whereas only 4 to 7 fish wheels were operated annually from 2001 through 2005 in District 4. Although a harvestable surplus has been identified in every year since 2001, and, in 2005 and 2006, over 2.0 million surplus summer chum salmon were available, very few fish wheels were operated. The loss of a market and changes in subsistence fishing patterns have made it difficult to remain at historic levels even though salmon runs have rebounded.

## Regulation Changes Adopted in January 2001

In January 2001, after review of the management action plan options addressing this stock of concern, the BOF modified the YUKON RIVER SUMMER CHUM SALMON MANAGEMENT PLAN 5 AAC 05.361.

The BOF added wording to the Yukon River Summer Chum Salmon Management Plan regarding management objectives and data used to manage summer chum salmon fisheries. The BOF established guidelines for managing summer chum salmon fisheries based on projected run size inseason as follows:

1. When the run size is projected to be less than 600,000 fish, directed summer chum salmon commercial, sport, personal use, and subsistence fishing will be closed.
2. When projected run size is between 600,000 to 700,000 fish, directed commercial, sport, and personal use fishing will be closed and subsistence fishing will be managed to so that the drainage wide escapement shall be no less than 600,000 summer chum salmon. However, if a district, subdistrict or tributary is projected to meet its escapement goal the commissioner may open a less restrictive subsistence summer chum salmon fishery in that district, subdistrict, or portion of a district or subdistrict.

3. When the projected run size is 700,000 to 1,000,000 summer chum salmon, then the commissioner may open subsistence fishing schedule according to the management plan. However, if a district, subdistrict or tributary is projected to meet its escapement goal the department may open a directed commercial, sport, or personal use summer chum salmon fishery in that district, subdistrict, or portion of a district or subdistrict.
4. When the projected run size is greater than 1,000,000 fish, directed summer chum salmon commercial fishing may open to harvest the available surplus.
5. All salmon caught by CFEC permit holders during commercial fishing periods in which salmon roe is sold shall be reported in numbers on fish tickets. Previously this was only required in Subdistrict 4-A.
6. Additionally, when the projected commercial harvest range is 0–400,000 summer chum salmon, the BOF provided the percentage of harvest allocated by district or subdistrict based on the low end of the established guideline harvest ranges:

Districts 1 and 2:	62.9%
District 3:	1.6%
Subdistrict 4-A:	28.2%
Subdistricts 4-B and 4-C:	3.9%
Districts 5:	0.4%
District 6:	0.9%

The BOF adopted a fishing schedule for subsistence salmon fisheries. The schedule will be implemented chronologically, consistent with migratory timing as the run progresses upstream. This schedule may be altered by emergency order if pre-season or in-season indicators suggest this is necessary.

<b>Yukon Area Subsistence Fishing Schedule</b>	
Coastal District; Koyukuk River drainage; Subdistrict 5-D: 7 days/week	
Districts 1–3: two 36-hour periods/week	
District 4; Subdistricts 5-B and C: two 48-hour periods/week	
Subdistrict 5-A; District 6: two 42-hour periods/week	
Old Minto Area: 5 days/week	

### **Regulation Changes Adopted in January 2004**

In January 2004, after review of the management action plan options addressing this stock of concern, the BOF modified the following regulations.

1. The BOF adopted a proposal to include Subdistrict 5-A in the subsistence fishing schedule for Subdistricts 5-B and 5-C, two 48-hour periods/week, rather than being included with the District 6 schedule.
2. The BOF adopted a proposal to allow the department to schedule subsistence fishing periods in Districts 3 and 4 to occur on weekends. The BOF opted not to place the mandated weekend fishing periods in regulation by allowing the department to establish the subsistence fishing schedule, by emergency order.

3. The BOF determined that when conservation of chum salmon is necessary the commercial fish wheel season maybe closed, by emergency order, and immediately afterwards, open the season during which set gillnet gear may be used instead of a fish wheel. This regulation was designed to protect a weak summer chum salmon run while allowing the harvest of surplus king salmon.
4. Increased the area where a subsistence salmon fishing permit was required to include all of Subdistrict 5-C.

### **Management Review 2001–2006**

Conservative management strategies based on the action plan adopted by the BOF in 2001 contributed to success in increasing escapement. The Yukon River summer chum salmon management plan established guidelines to provide a sustainable fishery through escapement goals, providing for the subsistence fishing priority, and allowing for other uses. Beginning in 2001, the subsistence salmon fishing schedule adopted by the BOF was implemented progressively upriver consistent with migratory timing. The migratory timing of summer chum salmon is such that the schedule is usually in place when the fish arrive in the river. The subsistence fishing schedule assisted in spreading opportunity among users. Based on an outlook for a very poor run in 2001, no commercial, sport, or personal use fishing for summer chum salmon occurred. Inseason management actions were taken near the middle of the Chinook salmon *Oncorhynchus tshawytscha* run to reduce subsistence fishing time to less than that provided by the regulatory schedule. Subsequently, the Chinook salmon run was judged to be large enough to provide for escapement and subsistence needs. However, in order to conserve summer chum salmon, subsistence gillnets were restricted to 8-inch or larger mesh size.

In 2002 when the inseason projection indicated that the 1,000,000 fish threshold to allow commercial fishing would be exceeded, the department began to inform fishers and processors of the potential for a directed summer chum salmon fishery. Unfortunately, in the time elapsed since the last commercial fishing opportunity in the middle Yukon River area, fish wheels had become dilapidated, permits lapsed, and considerable effort was needed to restore markets and the processing infrastructure. In 2003, the preseason management strategy was to compare the summer chum salmon run to the 2002 run and, if the run was similar, to approach management with the view that a small surplus for a directed commercial fishery would be available. ADF&G spent considerable time preseason attempting to inform fishers and processors of the potential for a directed summer chum salmon commercial fishery. These efforts to renew interest in a directed commercial summer chum fishery were unsuccessful due to poor market conditions.

After directed commercial Chinook salmon fishing was allowed in 2002, an issue arose regarding whether the subsistence fishing schedule should remain in effect or if previous subsistence fishing regulations were to be utilized after a surplus above escapement and subsistence needs was identified. Maintaining the subsistence fishing schedule in Districts 1, 2, and 3, and Subdistrict 4-A is problematic and inflexible for managers when subsistence and commercial fishing times are separated under regulations. In March 2003, the Alaska Board of Fisheries addressed two agenda change requests regarding the subsistence fishing schedule, specifically whether the schedule can be terminated inseason based on run abundance and, if so, how that would be done based on the current regulations. The BOF adopted a change to allow the subsistence fishing schedule to revert to the pre-2001 subsistence fishing regulations when a sufficient abundance above escapement needs and subsistence uses was identified.

Since 2002, Yukon River summer chum salmon commercial harvest has been taken incidentally to the harvest of Chinook salmon, with the exception of a limited directed summer chum salmon commercial fishery in District 6 and a short restricted mesh size (6-inch mesh or less) period in District 1 in 2006. The decline in commercial harvest over the last 3 years, when compared to historical averages, is a function of low market demand for summer chum salmon and not overall abundance. This is evidenced by estimates from Pilot Station sonar of over 1.0 million summer chum each year after 2001, with 3.7 million in 2006 being the highest passage estimate on record (Figure 3).

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

In summary, poor summer chum salmon runs from 1998 to 2002 produced large summer chum returns, with 2006 the largest summer chum run on record. Large escapements in 1994–1996 were followed by poor returns in 1998–2002. Summer chum salmon fisheries management has been conservative since 1997, and escapements have generally been met since 2002. However, most of the available surplus of summer chum salmon has gone unharvested from 2002 to 2006 due to poor market conditions.

## **2007 ALASKA BOARD OF FISHERIES REGULATORY PROPOSALS AFFECTING YUKON RIVER SUMMER CHUM SALMON**

### **SUMMER CHUM SALMON**

- Subsistence fishing schedule and fishing periods – proposal numbers: 159,160,161, and 162.
- Subsistence and commercial fishing gillnet gear – proposal number: 163.
- Commercial gear specifications – proposal numbers: 164.
- District boundaries – proposal number: 172.

Proposals before the BOF that may affect summer chum salmon are actually directed at the Chinook salmon fishery. Prohibiting gillnets greater than 6-inch mesh in the commercial and/or subsistence fishery would greatly increase the harvest of summer chum salmon.

### **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 the Division of Commercial Fisheries to manage the Alaskan Yukon River salmon fisheries. Pre-season forecasts are based upon the 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 fishing, (2) sonar counts of fish passage, (3) various escapement assessment projects in tributary systems, (4) commercial and subsistence catch data, and (5) catch per effort data from monitored 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, data on resident species, and information from the recovery of tagged fish in coordination with various mark-recapture and radiotelemetry projects.

### **MAIN RIVER SONAR**

This main river sonar project located near Pilot Station estimates summer chum salmon passage. 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.

### **TRIBUTARY SONAR**

The Anvik River is a major producer of summer chum salmon on the Yukon River accounting for as much as 50% of the entire summer chum salmon run in a given year. Summer chum salmon have been monitored in the Anvik River since 1978.

### **WEIRS AND COUNTING TOWERS**

Weirs or counting towers are currently operated on Henshaw Creek, and the Gisasa, Tozitna, Chena, and Salcha rivers. In 2006, high water was a problem that affected several of the weir and tower projects, as well as the Anvik River sonar project, by limiting the ability of the projects to enumerate salmon and resulting in reduced estimates of summer chum salmon escapement. Nonetheless in 2006, a record 225,000 summer chum salmon were enumerated in the Gisasa River and over 100,000 in the Salcha River.

### **FISH WHEELS**

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

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## **TABLES AND FIGURES**

**Table 1.**—Yukon River summer chum salmon historical escapements 1980–2006, and Pilot Station sonar passage 1995 and 1997–2006.

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)
Number of Fish							
1980		147,312 <sup>a</sup>	492,676				
1981		181,352 <sup>a</sup>	1,486,182				
1982		110,608 <sup>a</sup>	444,581				
1983		70,125 <sup>a</sup>	362,912				
1984		118,193 <sup>a</sup>	891,028				
1985		167,614 <sup>b</sup>	1,080,243				
1986		45,221 <sup>b</sup>	1,189,602				
1987		68,937 <sup>b</sup>	455,876				
1988			1,125,449				
1989			636,906				
1990			403,627				
1991		56,976	847,772				
1992			775,626				
1993			517,409				
1994		200,981 <sup>c,d</sup>	1,124,689	47,295	148,762 <sup>d</sup>	51,116 <sup>d</sup>	
1995	3,556,445	172,148 <sup>c</sup>	1,339,418	77,193	236,890	136,886	116,735
1996	<sup>e</sup>	108,450 <sup>c</sup>	933,240	51,269	129,694	157,589	100,912
1997	1,415,641	51,139 <sup>c</sup>	609,118	48,018	157,975	31,800	76,454
1998	826,385	67,591 <sup>c</sup>	471,865	8,113	49,140	18,228	212 <sup>d</sup>
1999	973,708	32,229 <sup>c</sup>	437,631	5,300	30,076	9,920	11,283 <sup>c</sup>
2000	456,271	23,500 <sup>c</sup>	196,349	6,727	24,308	14,410	19,376
2001	441,450		224,058	<sup>d</sup>	<sup>d</sup>	17,936 <sup>d</sup>	3,674
2002	1,088,463	44,191 <sup>c</sup>	462,101	13,583	72,232	32,943	13,150
2003	1,168,518	22,603 <sup>c</sup>	251,358	3,056 <sup>d</sup>	17,814 <sup>d</sup>	24,379	5,230
2004	1,357,826	62,878 <sup>c</sup>	365,691	5,247		37,851	15,661
2005	2,439,616	20,127 <sup>c</sup>	525,391	22,093		172,259	26,420
2006	3,767,044	101,465 <sup>c</sup>	599,146 <sup>d</sup>			224,509	
2001–2005 avg.	1,299,175	37,450	365,720	10,995	45,023	57,074	12,827
BEG		65000–130,000	350,000–700,000	n/a	n/a	n/a	n/a

*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.

<sup>a</sup> Sonar counts used.

<sup>b</sup> Tower counts used.

<sup>c</sup> Weir counts used.

<sup>d</sup> Incomplete count caused by late installation and/or early removal of project, or high water.

<sup>e</sup> Pilot Station sonar operated in training mode only and no estimates were generated.

**Table 2.**–Yukon River total summer chum salmon utilization, 1970–2006.

<b>Year</b>	<b>Subsistence<sup>a</sup></b>	<b>Commercial Commercial</b>	<b>Commercial Related</b>	<b>Personal Use</b>	<b>Test Fish<sup>b</sup></b>	<b>Sport Fish<sup>c</sup></b>	<b>Total</b>
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	272,398	928,609	139,106			483	1,340,596
1981	208,284	1,006,938	272,763	0		612	1,488,597
1982	260,969	461,403	255,610	0		780	978,762
1983	240,386	744,879	250,590	0		998	1,236,853
1984	230,747	588,597	277,443	0		585	1,097,372
1985	264,828	516,997	417,016	0		1,267	1,200,108
1986	290,825	721,469	467,381	0		895	1,480,570
1987	300,042	442,238	180,303	4,262		846	927,691
1988	229,838	1,148,650	468,032	2,225	3,587	1,037	1,853,369
1989	169,496	955,806	496,934	1,891	10,605	2,132	1,636,864
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	142,192	332,313	211,264	0	1,967	1,308	689,044
1993	125,574	96,522	43,594	674	1,869	564	268,797
1994	124,807	80,284	178,457	0	3,212	350	387,110
1995	136,083	259,774	558,640	780	6,073	1,174	962,524
1996	124,738	147,127	535,106	905	7,309	1,854	817,039
1997	112,820	95,242	133,010	391	2,590	475	344,528
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	72,301	0	0	146	0	82	72,529
2002	87,056	13,558	19	175	218	384	101,410
2003	82,272	10,685	0	148	119	1,603	94,827
2004	77,934	26,410	0	231	217	203	104,995
2005	93,259	41,264	0	152	134	435	135,244
2006 <sup>d</sup>	82,564	92,209	0	170	502	541	175,987
<hr/>							
2001–2005							
Average	82,564	18,383	4	170	138	541	101,801
1996–2005							
Average	89,960	39,891	66,835	264	1,509	617	199,077

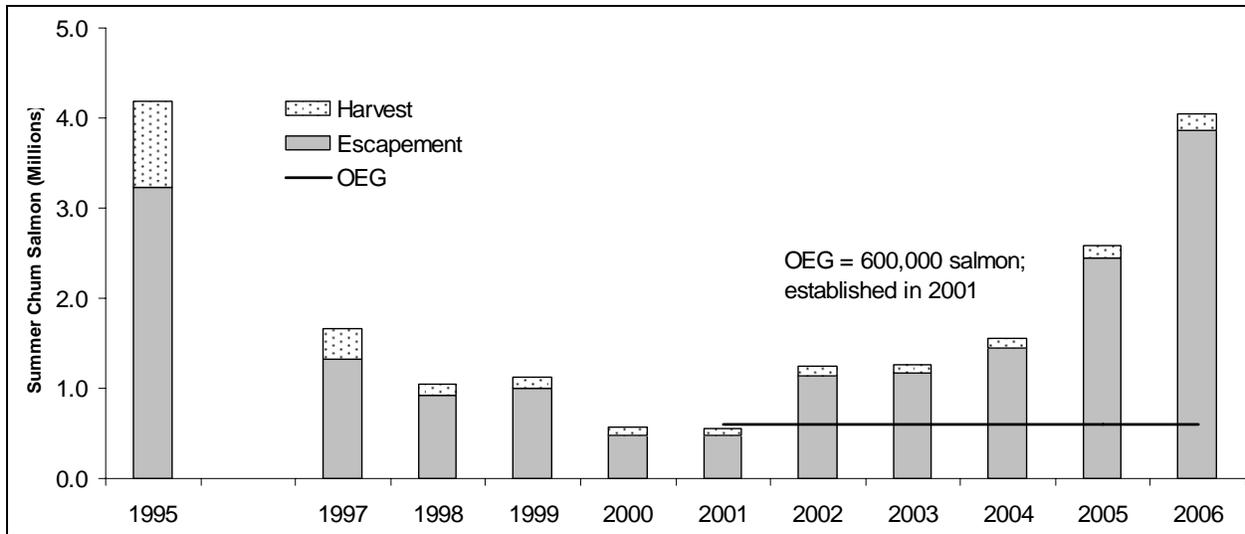
<sup>a</sup> Includes harvest from the Coastal District and test fish harvest that were utilized for subsistence.

<sup>b</sup> Includes only test fish that were sold commercially.

<sup>c</sup> Sport fish harvest is assumed to be primarily summer chum salmon caught incidental to directed Chinook fishing.

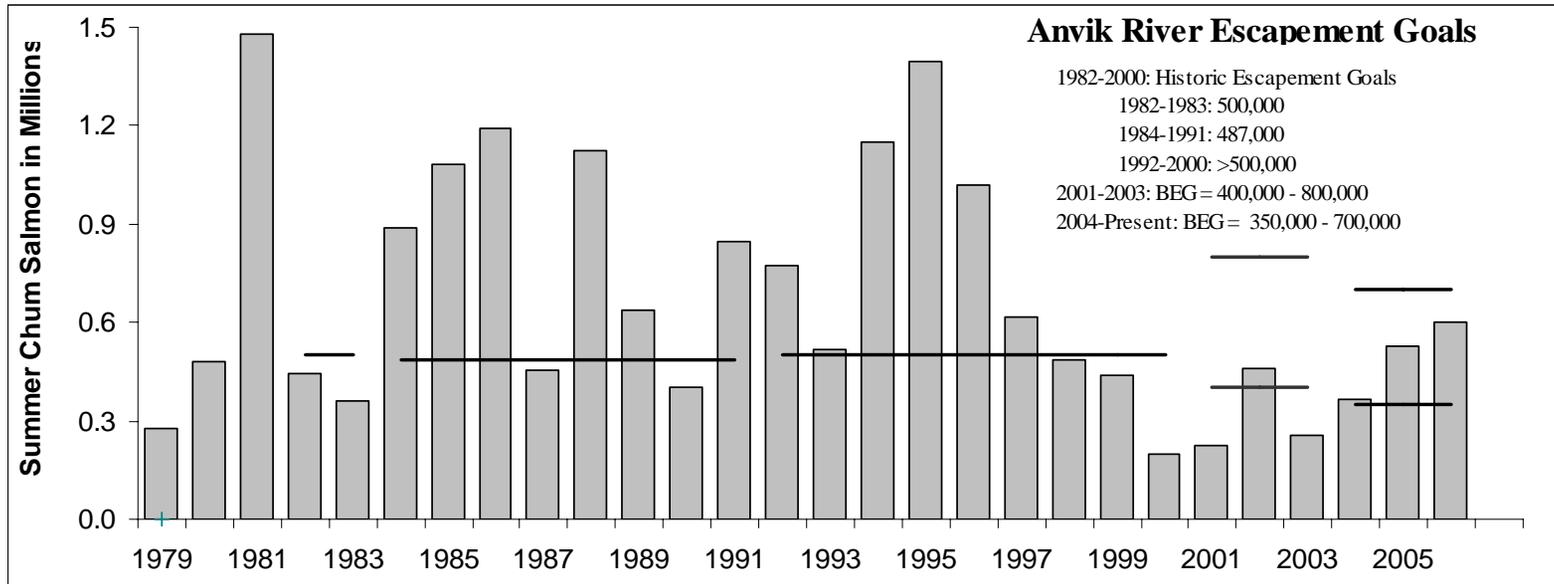
<sup>d</sup> Data is preliminary. Subsistence and sport fish are represented by the recent 5 year average.



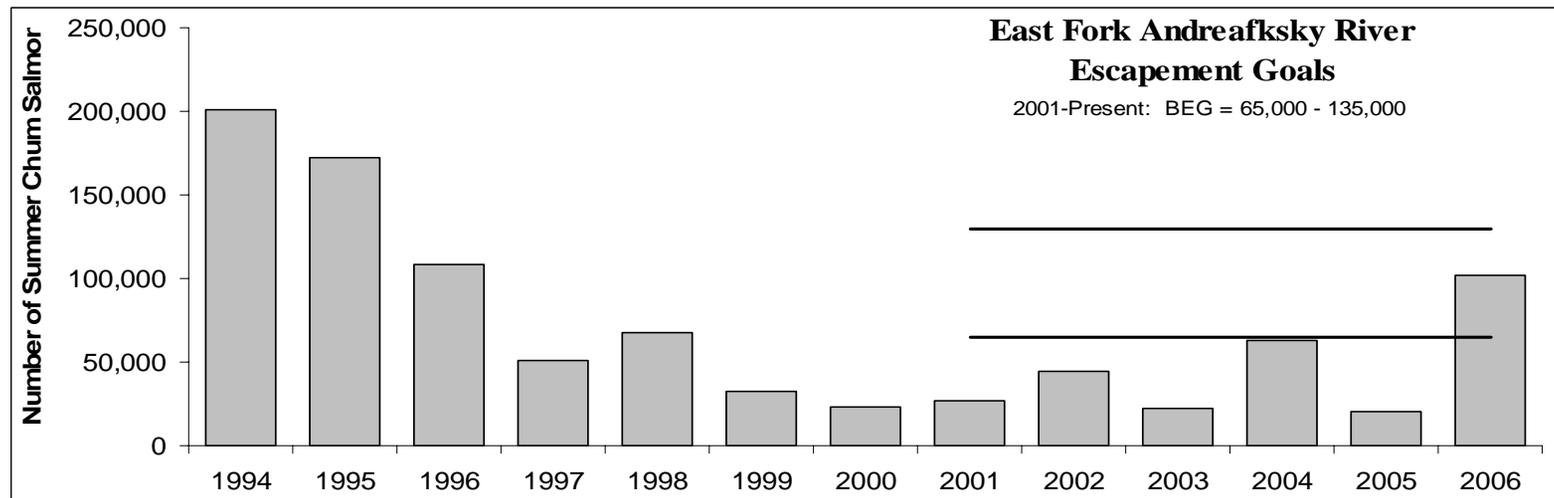


Note: Sonar passage data are unavailable for 1996. The 2006 harvest data includes preliminary subsistence harvest information.

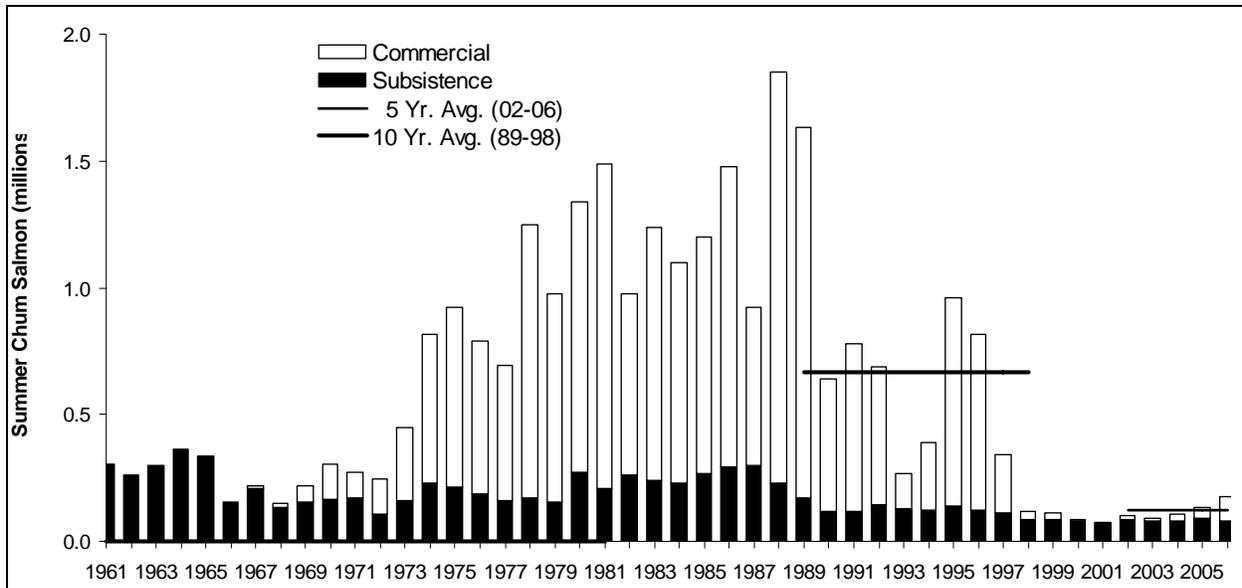
**Figure 2.**—Approximate total run size of Yukon River summer chum salmon, by harvest, and escapement, with escapement compared to the drainage-wide OEG, 1995 and 1997–2006.



**Figure 3.**—Summer chum salmon escapement estimates and escapement goals for the Anvik River, 1979–2006.

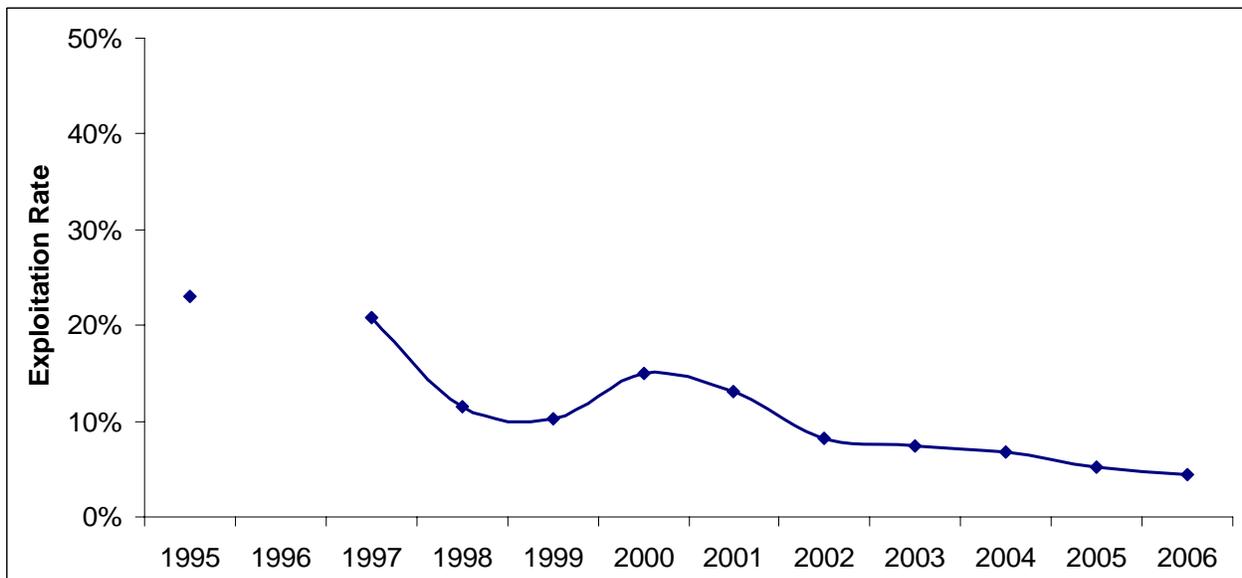


**Figure 4.**—Summer chum salmon escapement estimates and escapement goals for the East Fork Andreafksy weir 1994–2006.



Note: Subsistence harvest data for 2006 are preliminary.

**Figure 5.**—Yukon River summer chum salmon subsistence and commercial harvests from 1961 to 2006, compared to the 1989–1998 average (approximately 665,100 fish) and the 2002–2006 average (approximately 122,500 fish).



Note: Data are unavailable for 1996. Exploitation rate for 2006 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 1997–2006.