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**Kuskokwim River Chinook and Chum Salmon Stock  
Status and Kuskokwim Area Fisheries; a Report to the  
Alaska Board of Fisheries**

by

**John C. Linderman Jr.**

and

**Daniel J. Bergstrom**

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December 2006

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



## Symbols and Abbreviations

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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	e.g.	degree (angular)	°
		(for example)		degrees of freedom	df
		Federal Information	FIC	expected value	<i>E</i>
		Code		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
				probability of a type II error	
				(acceptance of the null	
				hypothesis when false)	β
				second (angular)	"
				standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var

### 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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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) designated Kuskokwim River Chinook salmon *Oncorhynchus tshawytscha* and chum salmon *O. keta* stocks as yield concerns at the September 2000 work session. Action plans were subsequently developed by the Alaska Department of Fish and Game (ADF&G) and acted upon by the BOF in January 2001. Based on definitions provided in SSFP 5 AAC 39.222(f)(42), ADF&G recommended continuation of the stock of concern classification for the Kuskokwim River Chinook and chum salmon stocks as yield concerns at the September 2003 BOF work session. Since the stock of concern designations in 2001, Kuskokwim River Chinook and chum salmon runs have been improving. The 2002 through 2006 Chinook and chum salmon runs provided the opportunity for all Kuskokwim River subsistence fishers to achieve amounts necessary for subsistence. Additionally, escapements were above average in 2002 and 2003 and have been well above average to record since 2004. ADF&G believes additional Chinook and chum salmon were available for harvest from 2002 through 2006, but lack of a market for a directed chum salmon commercial fishery precluded harvest in 2002 and 2003 and resulted in a limited number of commercial openings in late June and early July from 2004 through 2006. Review of escapement information indicates Chinook salmon escapements from 1998 through 2000 were below average and escapements since 2001 have ranged from average to the highest on record. Kuskokwim River Chinook and chum salmon Sustainable Escapement Goals have been achieved or exceeded since 2002. Kuskokwim Area salmon stocks are biologically healthy with recent year runs resulting in several of the highest escapements in the last 30 years. Additional harvestable surpluses of Chinook, sockeye, and chum salmon have received low levels of exploitation in recent years because of continued poor commercial market conditions, low price, and a lack of adequate local processing capacity and interest. Commercial harvests and value have increased slightly over the lows seen from 1999 through 2003, but harvest, value, and effort remain well below historical highs.

Key words: Kuskokwim Area, Chinook salmon, *Oncorhynchus tshawytscha*, chum salmon, *O. keta*, stock of concern, subsistence, 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) 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 regular BOF meetings. This report provides ADF&G's reassessment of Kuskokwim River Chinook and chum salmon stock of concern designations and also provides current assessment of Kuskokwim Area salmon stocks and their use.

In response to the guidelines established in the SSFP (5 AAC 39.222(f)(42)), the BOF classified the Kuskokwim River Chinook and chum salmon as yield concerns at the September 2000 work session. A stock of yield concern is defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern" (5 AAC 39.222(f)(42)). The determination as yield concerns was based on low harvest levels for the previous 5-year period (1996–2000). Action plans were subsequently developed by ADF&G and acted upon by the BOF in January 2001 (Burkey et al. 2000a, b). The classification as yield concerns was continued at the January 2004 BOF meeting (Bergstrom and Whitmore 2004). Based on definitions provided in SSFP (5 AAC 39.222(f)(5, 42)), only the most recent 5-year yield and escapement history (2002–2006) and the historical level of yield or harvestable surpluses were considered in our current analysis and subsequent recommendations regarding stock of concern status. For purposes of this report and the recommendation regarding the yield stock of concern classification, harvests during the 10-year period, from 1989 through 1998, were considered the historical base of comparison for Kuskokwim River Chinook and

chum salmon harvests. Accordingly, ADF&G recommended discontinuing the stock of yield concern designations for Kuskokwim River Chinook and chum salmon at the October 2006 BOF work session. From 2002 to 2006, Kuskokwim River Chinook and chum salmon stocks have provided for yields at or above the long term average.

Overall, abundance of Kuskokwim area salmon stocks have been increasing since the poor runs during the years of 1998 through 2000 with larger runs in more recent years. Chinook, chum, and sockeye salmon stocks have achieved above average to record escapements since 2004. Although abundance of coho salmon stocks has been decreasing in recent years, they achieved a record run in 2003 and it is believed the current low abundance trend is attributable to natural fluctuations. Although overall salmon abundance has been increasing in recent years, utilization has remained below historical averages. Amounts Necessary for Subsistence (ANS) has been achieved each year since 2001, except for sockeye salmon in 2002. However, commercial harvest has remained well below average. This is primarily attributed to continued poor salmon markets and low commercial fishing effort.

## **STOCK ASSESSMENT BACKGROUND**

The Kuskokwim Management Area is approximately 50,000 square miles in size including the Kuskokwim River drainage and all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, plus Nunivak and St. Matthew Islands (Figure 1). There are four commercial salmon fishing districts within the Kuskokwim Area. Districts 1 and 2 are within the Kuskokwim River and Districts 4 and 5 are Kuskokwim Bay fisheries targeting salmon bound for the Kanektok and Goodnews rivers, respectively.

### **Chinook Salmon**

#### **Escapement**

Chinook salmon escapements are evaluated by aerial survey during most years in portions of at least 13 drainages of the Kuskokwim River and by weirs on six tributary streams (Table 1; Figure 2) (Costello et al. 2006a; b; Roettiger et al. 2005; Sheldon et al. 2005; Stewart et al. 2006; Zabkar et al. 2005). A radiotelemetry mark-recapture program has been conducted the last 5 seasons (Table 2; Pawluk et al. 2006; Stuby et al. 2006). The program estimates total Chinook salmon passage upstream of the Aniak River. Review of escapement information indicates Chinook salmon escapements from 1998 through 2000 were generally below established goals. Weather conditions precluded aerial survey evaluation of Chinook salmon escapements in many streams during 1998 and 1999. In 1999 and 2000, Chinook salmon escapements at the Kogrukluk River weir were poor. The escapement of 5,600 Chinook salmon in 1999 was just above the lower end of the SEG range of 5,300 to 14,000 fish and the escapement of 3,200 fish in 2000 was the lowest on record since 1976 and below the SEG range. Chinook salmon escapement at the Kogrukluk River weir from 2001 to 2003 were at approximately the middle of the SEG range and escapement from 2004 through 2006 exceeded the SEG range with a record escapement of 22,000 fish in 2005. The Chinook salmon escapement index, which is based primarily on aerial surveys of 13 index streams, follows a similar trend with poor escapements from 1998 through 2000, average to above average escapements from 2001 through 2003, and above average to record escapement from 2004 through 2006 (Figure 2). It is notable that the high escapements documented from 2004 through 2006 were produced from the low parent year escapements of 1999 through 2001. From 2002 through 2005, Chinook salmon radiotelemetry mark-recapture estimates upstream of the Aniak River are in general agreement with

escapements elsewhere in the drainage in these same years (Table 2). The mark–recapture estimates have also been used in combination with weir escapement estimates to reconstruct the 2002 through 2005 Chinook salmon runs. Total run estimates indicate low exploitation rates on Chinook salmon in these years ranging from a high of 32% in 2002 to a low of 24% in 2005 (Table 3; Molyneaux and Brannian 2006).

## **Yield**

Kuskokwim River Chinook salmon are harvested primarily for subsistence use (Table 4; Figure 3). Directed Chinook salmon commercial fishing in the Kuskokwim River was discontinued in 1987 by regulation. Chinook salmon are harvested incidentally in the commercial chum and sockeye salmon fisheries during late June and July. Total utilization of Chinook salmon (all harvests combined) in the Kuskokwim River drainage ranged from 25,000 to 140,400 fish since 1960. The recent 5-year (2002–2006) average total utilization was 74,600 fish; harvest ranged from 67,500 to approximately 84,300 fish. The prior 10-year (1989–1998) average harvest was 112,600 fish; harvest ranged from 87,200 to 140,400 fish. Total utilization declined 38,000 fish from the recent 5-year (2002–2006) average compared to the previous 10-year (1989–1998) average. The recent 5-year average subsistence harvest of 71,280 fish also reflects a decline from the historical 10-year average harvest (1989–1998) of 83,560 fish. During the last 5 years (2002–2006), commercial harvest decreased an average of 25,200 fish from the previous 10-year average (1989–1998).

Parent-year escapements during 1992–1995 that produce the poor runs of 1998 through 2000 were not over harvested. Those poor runs were from parent-year escapements that were at average to above average levels. It is likely that the poor runs of 1998 to 2000 were the result of poor ocean environments. Poor wild stock runs occurred throughout Western Alaska in 1998–2000.

## **Chum Salmon**

### **Escapement**

Chum salmon escapements are evaluated through enumeration at weirs on six tributary streams, sonar in the Aniak River, and by a mainstem mark–recapture project in 2002 and 2003 (Tables 2 and 5) (Costello et al. 2006a; b; McEwen 2005; Pawluk et al. 2006; Roettiger et al. 2005; Sheldon et al. 2005; Stewart et al. 2006; Zabkar et al. 2005). Review of escapement information indicates chum salmon escapements from 1999 through 2000 were generally below established goals. The Kogruklu River weir chum salmon escapements of 13,800 in 1999 and 11,500 in 2000 were both below the lower end of the SEG range of 15,000 to 49,000 fish. Chum salmon escapement at the Kogruklu River weir in 2001, 2003, and 2004 were at approximately the middle of the SEG range and escapement in 2005 exceeded the SEG range. Kogruklu River weir chum salmon escapement of 197,700 fish in 2005 and 180,510 fish in 2006 represented two consecutive record escapements that were approximately three times higher than previous record escapements dating back to 1976. Similar trends in chum salmon escapement were observed at weir and sonar escapement monitoring projects elsewhere in the Kuskokwim River drainage. Aniak River sonar counts were below the SEG range in 1999 and 2000, followed by sonar counts within or above the SEG range from 2001 through 2004, and sonar counts in 2005 and 2006 were among the highest on record. Similar to Chinook salmon, it is notable that the high escapements seen in 2005 came from the comparatively low parent year escapements of 2001.

## **Yield**

Kuskokwim River chum salmon, though an important subsistence species, have been the primary salmon species targeted in June and July for commercial use (Table 6; Figure 4). During 1999 and 2000 very low numbers of fish were available for harvest. Only one commercial opening was allowed each year in 1999 and 2000. Declining salmon markets increase the difficulty of evaluating yield of chum salmon. Although a harvestable surplus existed each year beginning in 2001, no market existed for chum salmon in the Kuskokwim River fishery from 2001 through 2003 and only modest commercial fisheries were prosecuted from 2004 through 2006. Chum salmon market and local processing capacity limitations have resulted in fewer commercial openings and reduced fisher participation in June and July compared to historical levels. The potential harvests during the 2002 and 2003 seasons have not been estimated and harvest from 2004 through 2006 were well below recent and historical averages. Given adequate market interest, processor capacity, and fisher participation, the potential harvests from the 2005 and 2006 commercial fisheries may have been among the highest on record given the record high escapements seen in those years.

Total utilization of chum salmon in the Kuskokwim River drainage since 1960 has ranged from 47,864 to 1,538,784 fish (Table 6). Recent 5-year average total utilization (2002–2006) was 83,823 fish and ranged from 47,864 to 120,242 fish. The previous 10-year total utilization average harvest (1989–1998) was 425,704 fish; harvest ranged from 57,889 to 892,959 fish. Total utilization declined approximately 341,900 fish during the recent 5-year (2002–2006) average compared to the previous 10-year (1989–1998) average.

## **STOCK OF CONCERN RECOMMENDATION**

Based on the definitions provided in the *Policy for the Management of Sustainable Salmon Fisheries* of 5 AAC 39.222(f)(42), ADF&G recommends discontinuation of the stock of concern status for the Kuskokwim River Chinook and chum salmon stocks as yield concerns. The 2002 through 2006 Chinook and chum salmon runs provided the opportunity for all Kuskokwim River subsistence fishers to achieve amounts necessary for subsistence. Additionally, escapements were above average to the highest on record. ADF&G believes additional Chinook and chum salmon were available for harvest from 2002 through 2006, but lack of market for a directed commercial chum fishery precluded harvest in 2002 and 2003 and resulted in limited harvest from 2004 through 2006. Although there was no identified surplus of Chinook salmon and there were very low numbers of chum salmon available for commercial harvest from 1999 to 2001, harvestable surpluses of Chinook and chum salmon at or above the historical average have been available for commercial harvest since 2002.

## **OUTLOOK**

The preliminary outlook for 2007 is for similar or increased abundance from that observed in 2006. The Chinook salmon returns of 5- and 6-year-olds are expected to be above average based on above average returns of 4- and 5-year-olds observed in 2006. The 2007 chum salmon run is expected to be above average based on an above average return of 3-, 4-, and 5-year-old chum salmon observed in 2006. Information from previous Bering Sea studies (BASIS) and trawl bycatch information indicates above average abundance of all salmon species compared to historical years. Depending on the origination of these salmon, 2007 salmon runs are expected to be above average. Given this outlook, the potential yield in 2007 is expected to be at or above the long-term average.

## **ALASKA BOARD OF FISHERIES ACTION**

In response to the guidelines established in the Policy for the Management of Sustainable Salmon Fisheries, it is anticipated that the BOF, during the January 31–February 5, 2007 regulatory meeting, will discontinue the stock of concern classification for the Kuskokwim River Chinook and Kuskokwim River chum salmon stocks as yield concerns.

### **REVIEW OF KUSKOKWIM RIVER CHINOOK AND 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), during the October 2006 BOF work session, ADF&G recommended discontinuing the stock of concern classification for the Kuskokwim River Chinook and chum salmon as stocks of yield concern. After reviewing stock status information and public input during the February 2007 regulatory meeting, the BOF is anticipated to discontinue the stock of concern classification for Kuskokwim River Chinook and chum salmon as stocks of yield concern. This determination is anticipated to be based on the availability of a near historical average harvestable surplus of Chinook and chum salmon since 2002.

#### **KUSKOKWIM RIVER CHINOOK AND CHUM SALMON ACTION PLAN GOAL**

The goal of the action plan was to conservatively manage harvests in order to meet spawning escapement goals, to provide for subsistence levels within the ANS range, and to reestablish historic range of harvest levels by other users. This goal has been achieved with all Chinook and chum salmon escapement goals being met or exceeded from 2002–2006. Additionally, although harvests the past 5 years remain below historical range, the surplus available for harvest since 2002 was near or above the historical range. Low salmon harvests in June and July were primarily the result of poor commercial markets for chum salmon and resulted in low harvests of chum, Chinook, and sockeye salmon. Although additional surpluses of Chinook and sockeye were available, the unwanted harvest of chum salmon precluded additional commercial harvests.

#### **REVIEW OF MANAGEMENT ACTION PLAN**

##### **Existing Management Plan**

5 AAC 07.365 KUSKOKWIM RIVER SALMON REBUILDING MANAGEMENT PLAN

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

In 1993, the BOF of Fisheries made a positive finding for customary and traditional use for all salmon in the entire Kuskokwim Area. In 2001, ADF&G recommended that the BOF amend 5 AAC 01.286 to include a revised finding of ANS for the Kuskokwim Area using updated subsistence harvest data from 1990 to 1999. After a thorough review of various options, the BOF made a finding of the amounts reasonably necessary for subsistence for the Kuskokwim River by species and for the remainder of the Kuskokwim Area by all species combined (Burkey et al. 2000a).

ANS range for the Kuskokwim River drainage by species

Chinook salmon	64,500–83,000
Chum salmon	39,500–75,500
Sockeye salmon	27,500–39,500
Coho salmon	24,500–35,000
ANS range for the remainder of Kuskokwim Area	
All salmon	7,500–13,500

ADF&G recommends no change to current ANS finding. Subsistence harvests during 1999–2000 were impacted by lower run sizes. Beginning in 2001, subsistence harvests have remained relatively low, but within the ANS range except for sockeye salmon in 2002. It appears subsistence harvests are not substantially affected by run size. Subsistence harvests may be more affected by the lack of commercial fishing opportunity during the months of June and July, which may have changed historical subsistence fishing patterns. However, note that subsistence salmon harvests have decreased during the most recent 5-year period (2002–2006) from the 1989–1998 base period by approximately 13,000 Chinook and 32,000 chum salmon.

### **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 KUSKOKWIM RIVER SALMON REBUILDING MANAGEMENT PLAN 5 AAC 07.365.

The plan was re-titled as a rebuilding management plan and was modified to provide guidelines for management of the subsistence, commercial and sport fisheries for Kuskokwim River salmon. The main changes in this rebuilding plan were:

1. The primary objectives in management of Kuskokwim River salmon fisheries in June and July will be to provide for escapement and subsistence needs. Salmon fisheries management will be very conservative and the BOF intent is that the commercial fishery remains closed in June and July unless Chinook and chum salmon run strength is clearly adequate to provide for escapement and subsistence needs and allow for other uses.
2. Established a subsistence fishing schedule in the Kuskokwim River and all salmon tributaries. During June and July, subsistence fishing will be open for 4 consecutive days per week and closed for 3 consecutive days per week. The days of the week open to fishing was selected through a public process. Historically, subsistence fishing was open 7 days per week if no commercial fishing periods were allowed. During subsistence fishing closures, all nets greater than 4-inch mesh must be removed from the water and fish wheels must be stopped.

The subsistence fishing schedule will be implemented in a step-wise manner upriver consistent with run timing. The subsistence schedule will not apply to non-salmon bearing tributaries. Subsistence users will be able to use gillnets of 4-inch or less mesh and hook and line (rod and reel) at any time.

3. ADF&G was given the authority to limit gear in the subsistence fishery to gillnets of 6-inch or less mesh in order to conserve Chinook salmon if it becomes necessary inseason.
4. If necessary to further conserve Chinook or chum salmon, ADF&G was given the authority to close some areas to subsistence fishing and set daily limits on the number of salmon that can be harvested using subsistence hook and line gear.
5. The BOF clarified that there will be no directed commercial fishery for Chinook and sockeye salmon in the Kuskokwim River. Further, if inseason indicators of run strength suggest sufficient harvest abundance to allow a directed chum salmon commercial fishery, subsistence fishing (schedule) shall revert to the fishing periods as specified in 5 AAC 01.260.
6. The BOF directed ADF&G to manage the commercial coho fishery conservatively to insure that chum salmon escapement and subsistence needs are met.

As part of this rebuilding plan, the northern boundary of District 4 (Quinhagak) was moved 3 miles south to Oyak Creek to lower the potential harvest of Kuskokwim River salmon in the District 4 commercial fishery.

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

1. Provided explicit instructions for relaxing the subsistence fishing windows when salmon abundance assures that drainage-wide escapement goals and upriver subsistence needs will be met.
2. Maintained established subsistence schedule windows throughout the Kuskokwim River drainage.
3. Modified subsistence salmon fishing gillnet regulations providing more subsistence fishing opportunity around commercial fishing periods.
4. Provided a guideline harvest level of 0–50,000 sockeye salmon for the Kuskokwim River.
5. Provided emergency order authority to increase gillnet length to 100 fathoms in W-4 and W-5 salmon fishing districts provided adequate run strength.
6. Increased the commercial fishing area for salmon in W-4 and W-5. The northern boundary of District W-4 was returned to the pre-2001 boundary at Weelung Creek. The western boundary of District W-5 was moved from a line between the northernmost and southernmost tips of the north and south spits to outside of Goodnews Bay approximately 2 miles along the western edge of the north and south spits.

#### **Management Review 2001–2006**

Management of the Kuskokwim River salmon fishery is complex due to the overlapping multi-species salmon runs, generally high efficiency of existing fisheries, and the large size of the drainage.

The Kuskokwim River Salmon Rebuilding Management Plan was adopted by the BOF during the January 2001 meeting to address Chinook and chum salmon yield concerns. The purpose of

the Kuskokwim River Salmon Rebuilding Management Plan is to provide guidelines for the rebuilding and management of the Kuskokwim River salmon fishery that will result in the sustained yield of salmon stocks large enough to meet escapement goals, the amount necessary for subsistence, and harvests for fisheries other than subsistence.

Conservative fisheries management, including the subsistence fishing schedule, adopted by the BOF is the centerpiece of the plan. The subsistence-fishing schedule was implemented by emergency order. The schedule was consistent with the progression of the run upriver becoming effective downstream of Bogus Creek during the first week, downstream of Chuathbaluk during the second week, and throughout the entire drainage as of the third week. The intent of the 4 consecutive days per-week fishing schedule from Wednesday through Saturday was to allow escapement of salmon throughout the run, provide reasonable opportunity, and spread subsistence harvest out, thereby allowing a higher proportion of larger fish to reach the spawning grounds. This was expected to give those fishers in the upper river greater opportunity to meet their subsistence needs. The days of the week open to subsistence fishing was selected through a public process.

The fishing schedule remained in effect from June through July during the 2001 season, through June 29 during the 2002 season, and through July 6 during the 2003 season. The schedule was in effect through June 20 during the 2004 season, through June 19 during the 2005 season, and through June 18 during the 2006 season. The subsistence fishing schedule was discontinued during 2002 through 2006 seasons based on the determination of a surplus of Chinook and chum salmon above that necessary to provide for escapement and subsistence uses 5 AAC 07.365. (d)(3). Since the 2004 season, additional subsistence opportunity was provided through a reduction of the periods closed to subsistence fishing before and after commercial fishing openings. From 2004 through 2006, the period closed to subsistence fishing was established at 6 hours before, during, and 3 hours after commercial openings, compared to 12 hours before, during, and 6 hours after prior to 2004. A directed commercial fishery for chum salmon would have been allowed in 2002 and 2003, except there were no buyers interested in chum salmon. The extremely poor market for chum salmon and local processing limitations were the primary factors that limited the 2004 through 2006 June and July commercial fisheries. These limitations are not expected to change significantly in the near future.

The Kuskokwim River Salmon Management Working Group (Working Group) met frequently during the 2001 through 2006 seasons. Fishery management information discussed and reviewed at each meeting included reports from members, state and federal staff, native organizations, fishery partners, and people to be heard. Information discussed included subsistence harvest reports by species, test fish project summaries, and as fish began reaching clear water tributaries, reports from weir, sonar, and aerial survey programs.

Beginning with the 2001 season, Chinook and chum salmon run size has been increasing and have resulted in above average to record escapements in the most recent 2 to 3 years (Table 1; Figure 2). During the 2001 season, in response to poor Chinook and chum runs to the George River, that drainage was closed to subsistence fishing through July 31. The 2002 runs of Chinook and chum salmon were a marked improvement from the lower runs of 1998–2000. From the beginning of the 2003 season there was a good showing of all species of fish and they returned in greater numbers than projected. The 2004 and 2005 Chinook salmon runs began strong and resulted in above average to record escapements throughout the drainage. Although the 2006 Chinook salmon run was not as strong as 2004 and 2005, escapements were still above

average and escapement goals were achieved or exceeded throughout the drainage. The 2004 chum salmon run was average to above average and the 2005 and 2006 chum salmon runs resulted in 2 consecutive years of well above average to record chum salmon escapements throughout the drainage (Table 5).

The northern boundary of District 4 was moved 3 miles south to Oyak Creek during the January 2001 BOF meeting to lower the potential harvest of Kuskokwim River salmon in the District 4 commercial fishery. In review of this conservation measure for Kuskokwim River Chinook and chum salmon during the 2001 through 2003 seasons, it was not possible to quantify any reduction in harvest of Kuskokwim River salmon. In fact, because of declining salmon markets and prices paid for salmon, the harvest in District 4 declined through 2003 because of lower fishing effort and processing capacity. In response to this, the northern boundary of District W-4 was expanded to Weelung Creek at the January 2004 BOF meeting. Although harvest has increased in District 4 since 2004, this increase is attributed to above average to record Chinook, chum, and sockeye salmon runs over the last 3 years. District 4 saw modest increases in price and effort since 2004, but both of these factors remained below historical averages.

During the January 2004 BOF meeting, the western boundary of District 5 was moved outside of Goodnews Bay approximately 2 miles along the western edge of the north and south spits to increase commercial harvest opportunity for District 5 fishers. Reports from local fishers and aerial surveys show the increased area of the district was utilized each year since the 2004 season, but did not appear to increase harvest or effort. Districts 5 also saw a modest increase in price since 2004, but price, effort, and harvest remained well below historical averages.

In general, recreational harvests by sport anglers in the Kuskokwim Area are very small when compared to commercial and subsistence harvests. By regulation within the Kuskokwim Area sport fishing for Chinook salmon begins on May 1. Prior to the Federal Subsistence Special Action in the Kuskokwim in 2001, a sport fishing emergency order was issued to reduce the possession and bag limit to one Chinook or one chum salmon in the entire Kuskokwim River drainage. In 2002 and 2003 similar sport fishing emergency orders were issued prohibiting the retention of Chinook and chum salmon from May 1 through June 15 and after June 15 the possession and bag limits were established at one fish a day for either Chinook or chum salmon.

### **2007 ALASKA BOARD OF FISHERIES REGULATORY PROPOSALS AFFECTING KUSKOKWIM RIVER SALMON**

- Allow 8-inch mesh size gillnets in the District 1 commercial fishery – proposal number: 155.
- Allow additional fishing time for Subdistrict 1-B commercial openings – proposal number: 156.
- Recommend to the Legislature a designation of Fisheries Reserve for the Holitna River drainage – proposal number: 157.
- Increase the bag and possession limit in the Aniak River subsistence fishery – proposal number: 254.

Based upon the recommendation to no longer consider the Kuskokwim River chum salmon stock as a stock of concern, ADF&G would like the BOF to consider a Board generated proposal to address the sport fishing regulation prohibiting possession or retention of chum salmon in the Aniak River drainage.

Amend this regulation as follows:

5 AAC 70.017 (c)(3) in the Aniak River drainage,

(B) the bag and possession limit for pink, sockeye, **chum**, and coho salmon is three fish, with no size limit; however, the aggregate daily bag and possession limit of all salmon species may not exceed three salmon, of which no more than two fish may be king salmon;

[(C) chum salmon may not be possessed or retained; any chum salmon caught must be immediately released;]

This modification would re-establish the sport limit for Kuskokwim River chum salmon that was in place prior to its listing as a stock of concern.

## **KUSKOKWIM RIVER FISHERIES AND SOCKEYE AND COHO SALMON STOCK STATUS**

### **KUSKOKWIM RIVER SOCKEYE AND COHO SALMON STOCK STATUS**

Sockeye salmon escapements are monitored at each of the six tributary weir projects; however, sockeye are not a prominent species in many of these systems (Table 7) (Costello et al. 2006a; b; Roettiger et al. 2005; Shelden et al. 2005; Stewart et al. 2006; Zabkar et al. 2005). Among these locations, Kogrukluk and Kwethluk Rivers receive the largest sockeye escapements. Prior to 2004, Kogrukluk River weir sockeye salmon escapements have ranged from 1,176 to 29,358 fish with a median escapement of 6,700. Kogrukluk River weir sockeye salmon escapement of 37,960 fish in 2005 and 60,787 fish in 2006 represented 2 consecutive years of record escapements dating back to 1976. Although the data set is much shorter, Kwethluk River sockeye salmon escapement indicates a similar trend with a record escapement in 2006. In recent years, small numbers of sockeye salmon have also been returning to other Kuskokwim River tributaries where they had not been observed previously, for example the Takotna and Tatlawiksuk Rivers. It is unclear whether this is evidence of pioneering populations of sockeye salmon or the result of straying from the abundant runs in recent years. A recent sockeye salmon radiotelemetry program initiated in 2005 has also added new insight into Kuskokwim River sockeye salmon populations. Preliminary radiotelemetry results have indicated the Holitna River is a more important sockeye salmon spawning tributary than previously thought with approximately 70% of radio-tagged fish returning to the Holitna River drainage (S. Gilk, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication). Other important sockeye salmon spawning tributaries identified by the project are the Stony River drainage, which drains Telaquana Lake, and the Aniak River drainage. Data from the radiotelemetry project is still being analyzed and the project is expected to continue and be expanded upon over the next several seasons. Expanded objectives include estimating escapement by tributary and for the entire Kuskokwim River drainage.

Coho salmon escapements are monitored at weirs on six tributary streams, by radiotelemetry on the Holitna River in 2001 and 2002, and by a mark-recapture program on the mainstem Kuskokwim River from 2002 through 2005 (Tables 2 and 8) (Costello et al. 2006a; b; Pawluk et al. 2006; Roettiger et al. 2005; Shelden et al. 2005; Stewart et al. 2006; Zabkar et al. 2005). Review of escapement information indicates coho salmon have followed a pattern of increasing and decreasing escapements over time with a trend towards higher abundance that peaked in 2003 and has since decreased through 2006. The Kogrukluk River weir coho salmon

escapement of 74,754 in 2003 exceeded the upper end of the SEG range as the highest on record since 1976 and record escapements were observed at all other monitored locations in 2003 (Table 8). From 2002 through 2005, coho salmon mark-recapture estimates upstream of the Aniak River are in general agreement with escapements elsewhere in the drainage in the same years (Table 2). Although coho salmon escapements have decreased since the record year of 2003, the Kogrukluk River SEG has been achieved each year since then. The available data indicates coho salmon abundance trends are consistent among monitored locations; however, the majority of monitoring projects span a relatively short time series, with the notable exception of the Kogrukluk River weir.

## **KUSKOKWIM RIVER (DISTRICT 1 AND 2)**

A directed commercial fishery for chum and sockeye salmon was prosecuted from 2004 through 2006, but harvest and duration was limited by poor market conditions for chum salmon, limited processing capacity, and low effort. In District 1, four subdistrict commercial openings occurred in late June and early July during 2004 and 2005, and two subdistrict commercial openings occurred in late June during 2006. Chum salmon harvest ranged from 20,429 to 69,139 fish, sockeye salmon harvest ranged from 9,748 to 27,645 fish, and incidental Chinook salmon harvest ranged from 2,300 to 4,784 fish (Table 9). There was no interest from buyers to purchase fish in District 2 because of market conditions. A coho salmon directed fishery occurred in August each year with harvests ranging from 142,319 fish to 433,809 fish (Table 9). Commercial harvest and fishing effort from 2004 through 2006 improved modestly over the historic low levels seen from 2001 through 2003, but remained well below historic highs (Figure 5).

Division of District 1 into two subdistricts and registration of fishers to a subdistrict (5 AAC 07.370, 2001) allowed for fishing periods to be of shorter length, which kept harvest within processor capacity (Figure 6). When fish abundance and market interest allowed, a twice weekly subdistrict period schedule was implemented in District 1. Many Subdistrict 1-B registered fishermen requested additional fishing time because they felt Subdistrict 1-B fishers had a harvest disadvantage, especially in Statistical Area 335-11, compared to Subdistrict 1-A fishers. Historically, harvest in those statistical areas comprising Subdistrict 1-B (335-11 and 335-12) had higher harvest and effort compared to statistical areas comprising Subdistrict 1-A (335-12 and 335-13). However, catch per unit effort (CPUE) in Subdistrict 1-B has been consistently lower because of the wider and deeper channel and greater tidal influence in this portion of District 1 (Figure 7). Although Subdistrict 1-B fishers have lower catch rates compared to Subdistrict 1-A, requests for additional time was not granted because of current processing capacity limitations, concerns that fishers would primarily register in Subdistrict 1-B to take advantage of additional fishing time, the potential for allocating a harvest advantage to one group of users over another, and the heightened management complexity of allowing unequal fishing times between subdistricts.

Given the scale of record Chinook, chum, and sockeye salmon escapements observed from 2004 through 2006 in the Kuskokwim River, large surpluses of these species were available for commercial harvest. These surpluses were underexploited and contributed, in part, to the record escapements in these years. Given the poor market conditions which have persisted in the Kuskokwim Area for almost a decade, it is doubtful that such large commercially harvestable surpluses could have been fully exploited. Along with harvest, the average number of permit holders participating in the fishery has declined significantly to approximately 1/5 of historical

highs (Figure 5). Even if effort had been at or near historical highs, market interest in such large harvests from the Kuskokwim Area does not currently exist, especially for chum salmon. It is not realistic to expect harvest, effort, and value to approach historical highs in the Kuskokwim Area; however, Kuskokwim Area salmon fisheries do have the potential for modest revitalization compared to their current status. Kuskokwim River sockeye and Chinook salmon have much higher market interest compared to chum salmon and their relative abundance is small enough to accommodate current processing capacity limitations. Chum salmon do have some small market interest as well, but not in light of the yield that can be expected from recent runs.

The Kuskokwim River commercial Chinook salmon fishery has been closed to directed harvest since 1987 with the primary strategy to delay commercial fishing until late June and July to reduce incidental Chinook salmon harvest and target later running sockeye and chum salmon. This closure was put into effect just after a gillnet mesh size restriction of 6 inches or less went into effect in 1985. These regulations were put in place as conservation measures to improve escapements of Chinook salmon, to provide for the subsistence priority for Chinook salmon, and to allow for a directed commercial fishery on more abundant chum salmon in June and July. The Chinook salmon run has improved since the low run years of 1998–2000 and harvestable surpluses for uses other than subsistence have been identified in all years since 2001.

The Kuskokwim River subsistence salmon fishery is one of the largest in the state and Chinook salmon is the most utilized subsistence salmon species on the Kuskokwim River (Figures 8 and 9). Gillnet mesh size is unrestricted in Kuskokwim Area subsistence fisheries and Kuskokwim River subsistence fishers primarily utilize large mesh gillnets when targeting Chinook salmon. Age, sex, and length studies indicate a disproportionate number of older and larger Chinook salmon are harvested from the subsistence fishery (Figure 10; Molyneaux et al. 2005). With the reported improvements in Chinook salmon runs beginning in 2001, a harvestable surplus in excess of escapement requirements and subsistence needs now exists, especially for younger age classes. Additionally, subsistence catch calendars report an average of 76% of the harvest is taken from the first half of the run, leaving the second half of the run subject to lower exploitation. However, allowing 8 inch mesh gear in the commercial fishery would further increase exploitation of older and larger Chinook salmon. Presently, it is unclear whether older and larger Chinook salmon can sustain additional directed exploitation. A restricted mesh size commercial fishery allows for harvest of more abundant sockeye and chum salmon stocks and allows for harvest of all ages, sex, and size classes of Chinook salmon. Because of the current poor market conditions, reduced commercial fishing effort compared to historical levels, and current processing capacity limitations, commercial fishing earlier during the second half of June is still a conservative management approach at this time.

The Holitna River is located in the middle Kuskokwim River drainage and comprises one of the largest and most productive tributaries of the Kuskokwim River drainage (Figure 1). It encompasses several sub-basins and tributaries including the Hoholitna River drainage and the Kogrukluuk and Chukowan rivers. The Holitna River is one of the largest contributors to Kuskokwim River salmon populations and is believed to account for one-third to one-half of overall Kuskokwim River salmon production. Recent radiotelemetry studies both within the Holitna drainage and on the mainstem Kuskokwim River have estimated the Holitna River contributed from 27% to 33% to overall Kuskokwim River Chinook salmon escapement between 2002 and 2005 (Table 3). Preliminary results from the 2006 sockeye salmon radiotelemetry program have indicated approximately 70% of the 2006 Kuskokwim River sockeye salmon run

returned to the Holitna River (S. Gilk, Commercial Fisheries Biologist, ADF&G, Anchorage; personal communication). The Holitna River drainage is clearly an important area that contributes substantially to Kuskokwim River fish production and provides for a high level of human consumptive use, both locally and throughout the lower half of the Kuskokwim River drainage.

Proposal 157 seeks to apply some as yet unknown level of protection to Holitna River drainage fisheries resources to elevate their protection and use over all other uses that have the potential to harm fish and game resources. This proposal was developed and submitted to the BOF and the Board of Game (BOG). The proposal was submitted under a Game Reserve designation to the BOG in March of 2006 and was carried.

## **KUSKOKWIM BAY FISHERIES AND SALMON STOCK STATUS**

### **QUINHAGAK (DISTRICT 4)**

The objective of the District 4 Management Plan (5 AAC 07.367, 2004) is to maintain a level of sustained yield which will provide for subsistence needs, the economic long-term health of the commercial and sport fishing industries, and recreational fishing opportunities. The management plan further provides direction to open the commercial fishery prior to June 16, open commercial periods by emergency order, and to provide at least one period per week unless a severe conservation problem exists. Commercial fishing periods are typically 12 hours in duration. Commercial fishing period frequency is based on catch rates compared to prior year catch rates in association with inseason escapement information from the Kanektok River weir and aerial surveys. Typically a fishing schedule of two-12 hour periods is established during June targeting Chinook salmon, with three 12-hour periods per week scheduled during July targeting sockeye salmon. During the 2001 through 2005 seasons, the single registered buyer ceased operation during the last week to 10 days of July when there is declining abundance of sockeye salmon. In early August, the fishery was reopened on a schedule of three-12 hour periods per week targeting coho salmon. In 2006, the local buyer continued purchasing fish throughout July and into the August coho salmon directed fishery. Fishing periods were cancelled when catch rates were below average, or when no processor or tender was available. During the 2005 and 2006 seasons, the processor put fishers on catch limits during several periods in response to a high abundance of sockeye salmon to assure those fish harvested could be processed. From 2004 through 2006, the commercial salmon harvest ranged from 158,252 to 191,474 fish (Table 9). Exvessel value ranged from \$405,000 to \$570,385 during these same years. Sockeye salmon comprised the majority of the harvest at 41% followed by coho salmon at 31%, chum salmon at 15%, and Chinook salmon at 13%.

Aerial surveys of salmon escapements to the Kanektok River were conducted from 2004 through 2006 for Chinook and sockeye salmon (Table 10). The Chinook salmon SEG range of 3,500 to 8,000 fish was exceeded each year, including a record aerial survey count of 28,375 fish in 2004. The sockeye salmon SEG range of 14,000 to 34,000 fish was also exceeded each year including 2 consecutive years of record aerial survey counts of 110,730 fish in 2005 and 382,800 fish in 2006. The record 2006 sockeye salmon aerial survey count was eleven times higher than the upper end of the SEG range. A weir was operated on the Kanektok River at River Mile 45 in 2004 and 2005 (Jones and Linderman 2006a). The weir was not operated in 2006 because it could not be removed from the river in 2005 and was extensively damaged from remaining in the river over the winter of 2005–2006. Weir escapement counts were 19,406 Chinook, 102,443

sockeye, 46,194 chum, and 87,827 coho salmon in 2004 and 12,721 Chinook, 160,702 sockeye, 50,881 chum, and 13,690 coho salmon in 2005 (Table 11). However, a significant number of salmon spawn downstream of the weir.

Total Kanektok River escapement was estimated in 2004 and 2005 using the proportion of aerial survey counts upstream and downstream of the weir and applying them to the weir escapement counts (Jones and Linderman 2006a). In 2004, Chinook salmon total escapement was estimated to be 42,908 fish for a total run size of 72,561 fish and exploitation rate of 41% and in 2005 Chinook salmon total escapement was estimated to be 33,110 fish for a total run size of 61,420 fish and exploitation rate of 46%. Sockeye salmon total escapement in 2004 was estimated to be 131,873 fish for a total run size of 168,215 fish and exploitation rate of 22% and in 2005 sockeye salmon total escapement was estimated to be 278,386 fish for a total run size of 361,000 and exploitation rate of 19%. The moderate to low exploitation rates estimated in 2004 and 2005 indicate the District 4 salmon stocks are unlikely to be overexploited under the current management strategy and would likely be sustained at higher levels of exploitation.

### **GOODNEWS BAY (DISTRICT 5)**

There is no management plan that directs the District 5 commercial fishery, however, the primary fishery strategy since 1990 has been to delay the commercial opening until late June to increase Chinook salmon escapements into the Goodnews River drainage and assure amounts necessary for subsistence will be achieved. The fishery typically opens the last week of June and commercial fishing periods are typically 12 hours in duration. Commercial fishing period frequency is based on catch rates compared to prior year catch rates in association with prior year and inseason escapement levels.

Typically the fishing schedule begins the last week of June with three 12-hour periods scheduled per week. During the 2001 through 2005 seasons the single registered buyer ceased operation during the last week to 10 days of July when there is declining abundance of sockeye salmon. In early August, the fishery was reopened on a schedule of three-12 hour periods per week targeting coho salmon. In 2006, the local buyer continued purchasing fish throughout July and into the August coho salmon directed fishery. Fishing periods were cancelled when catch rates were below average, or when no processor or tender was available. During the 2005 and 2006 seasons, the processor put fishers on catch limits during several periods in response to a high abundance of sockeye salmon to assure those fish harvested could be processed. From 2004 to 2006, commercial salmon harvests ranged from 40,271 to 56,753 (Table 9). Exvessel value of the fishery ranged from \$135,169 to \$ 141,235 during these same years. Sockeye salmon comprised the majority of the harvest at 51% followed by coho salmon at 32%, chum salmon at 13%, and Chinook salmon at 5%.

Complete aerial surveys of salmon escapements to the Goodnews River were conducted during 2004 for Chinook and sockeye salmon (Table 10). Aerial surveys were not conducted in 2005 and only the North Fork Goodnews River was surveyed in 2006. The North Fork Goodnews River Chinook salmon SEG range of 640 to 3,300 fish was exceeded in 2004 and 2006 and the North Fork Goodnews River sockeye salmon SEG range of 5,500 to 19,500 fish was also exceeded in 2004 and 2006. The 2006 sockeye salmon aerial survey count of 78,100 fish was a new record eclipsing the 1980 count of 75,639. A weir was operated at River Mile 15 on the Middle Fork Goodnews River during 2004 to 2006 (Jones and Linderman 2006b). The Chinook salmon SEG range of 2,000 to 4,500 was achieved in 2004 and exceeded in 2005 and 2006

(Table 11). The sockeye salmon SEG range of 23,000 to 50,000 fish was exceeded each year since 2004 with two consecutive record escapements in 2005 and 2006. The chum salmon SEG threshold of 12,000 fish was achieved each year since 2004, and the coho salmon SEG threshold of 12,000 fish was achieved in each of these years. However, the weir only accounts for salmon escapements to the Middle Fork of the Goodnews River and a significant number of fish also return to the North Fork of the Goodnews River drainage.

Goodnews River drainage escapement was estimated in 2004 and 2005 using the proportion of aerial survey counts between the Middle Fork and North Fork of the Goodnews River and applying them to the weir escapement counts (Jones and Linderman 2006b). In 2004, Chinook salmon total escapement was estimated to be 16,901 fish for a total run size of 20,369 fish and exploitation rate of 17% and in 2005 Chinook salmon total escapement was estimated to be 11,032 fish for a total run size of 13,971 fish and exploitation rate of 21%. Sockeye salmon total escapement in 2004 was estimated to be 108,572 fish for a total return of 130,153 fish and exploitation rate of 17% while in 2005 sockeye salmon total escapement was estimated to be 204,644 fish for a total run size of 229,233 and exploitation rate of 11%. The low exploitation rates estimated in 2004 and 2005 and historically indicate District 5 salmon stocks are unlikely to be overexploited under the current management strategy and would likely be sustained at higher levels of exploitation.

## **SUMMARY**

Kuskokwim Area salmon stocks are biologically healthy with recent year runs resulting in several of the highest escapements in the last 30 years. Escapement goals are being met or exceeded the majority of the time and amounts necessary for subsistence are being achieved annually. Additional harvestable surpluses of Chinook, sockeye, and chum salmon have received low levels of exploitation in recent years because of continued poor commercial market conditions, low price, and a lack of adequate local processing capacity and interest. Commercial harvests and value have increased slightly over the lows seen from 1999 through 2003, but harvest, value, and effort remain well below historical highs.

## **KUSKOKWIM AREA ESCAPEMENT GOAL RECOMMENDATIONS**

ADF&G has undertaken a review of escapement goals for several Kuskokwim River salmon stocks where long-term escapement data exist that enable the development of SEGs based on analysis consistent with the escapement goal policy. A separate report details the escapement goal review for the AYK Region (Brannian et al. 2006).

The SEGs are based on aerial surveys and weir projects information reviewed using the Cook Inlet Algorithm methodology and we also conducted additional evaluation using the Parken habitat based methodology (Bue and Hasbrouck *Unpublished*; Parken et al. 2004). This analysis resulted in recommending revision to three existing escapement goals, discontinuing two existing escapement goals, and establishing three escapement goals.

Although there are many new and recently established escapement projects within the Kuskokwim drainage, there are few with sufficient historical data available concerning Chinook and chum salmon stocks.

## **AYK SUSTAINABLE SALMON INITIATIVE RESEARCH PLAN**

The AYK Sustainable Salmon Initiative (AYK SSI) emerged as a collaborative response to recent sharp declines of Chinook and chum salmon runs in the Yukon River, Kuskokwim River, and rivers draining into Norton Sound. Through this initiative, native regional organizations have joined with state and federal agencies to form an innovative partnership to cooperatively address salmon research and restoration needs. This partnership includes the Association of Village Council Presidents (AVCP), the Tanana Chiefs Conference (TCC), Kawerak, Inc., Bering Sea Fishermen's Association (BSFA), ADF&G, National Marine Fisheries Service (NMFS), US Fish & Wildlife Service (USFWS), plus additional native, governmental and nongovernmental ex-officio partner institutions.

In addition to funding high quality salmon research projects, the AYK SSI is undertaking the development of a comprehensive Research and Restoration Plan for AYK. This long range, strategic science plan was published in 2005 and identified major research themes, significant knowledge gaps and research questions, and established research priorities for the region. To date, the current Kuskokwim River Chinook and sockeye salmon radiotelemetry projects, and Kuskokwim River Chinook and chum salmon historical run reconstruction projects have been funded through AYK SSI. Additional proposals for continuing and new area research programs addressing goals outlined in the Research and Restoration plan are planned for submission to AKY SSI in coming years.

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## **TABLES AND FIGURES**

**Table 1.**—Chinook salmon aerial survey and weir escapement counts in Kuskokwim River spawning tributaries, 1980 through 2006.

Year	Kipchuk Salmon																	Salmon (Pitka)		
	Eek Aerial	Kwethluk Aerial	Weir	Kisaralik Aerial	Tuluksak Aerial	Weir	Aniak Aerial	(Aniak) Aerial	(Aniak) Aerial	Holokuk Aerial	Oskawalik Aerial	George Weir	Holitna Aerial	Kogrukuk Weir	Gagarayah Aerial	Cheeneetnuk Aerial	Tatlawiksuk Weir		Takotna Weir	
1975							202	94												
1976		997											2,571	5,579	663					
1977		1,116			439				60					1,385	897	1,407			1,940	
1978		1,722		2,417	403					322			2,766	13,667	504				1,100	
1979									45					11,338					682	
1980	2,378				1,035					1,186									1,450	
1981		2,034		672			9,074							16,655					1,439	
1982		471		81								42	521	10,993					413	
1983	188				202		1,909		231	33			1,069	3,009					572	
1984														4,928		1,177			545	
1985	1,118	51		63	142					135				4,619		1,002			620	
1986							424		336	100			650	5,038		317				
1987	1,739							193	516	210	193					205				
1988	2,255			869	188		954		244		80			8,505					473	
1989	1,042	610		152			2,109	994	631					11,940					452	
1990				631	200		1,255	537	596	157	113			10,218						
1991	1,312			217	358	697	1,564	885	583					7,850						
1992			9,675			1,083	2,284	670	335	64	91		2,022	6,755	328	1,050			2,536	
1993						2,218	2,687	1,248	1,082	114	103		1,573	12,332	419	678			1,010	
1994				1,243		2,917	1,520	1,218						15,227	807	1,206			1,010	
1995				1,243			3,171	1,215	1,446	181	326		1,887	20,630	1,193	1,565			1,911	
1996			7,415						985	85		7,716		14,199				422		
1997			10,395				2,187	855	980	165	1,470	7,823	2,093	13,286		345		1,161		
1998	522	126		457			1,930	443	557					12,107						
1999										18	98	3,548		5,570				1,490		
2000			3,547				714	182	238	42		2,960	301	3,310			817	345	362	
2001						997			598		186	3,309	1,130	9,298	143		2,010	721	1,033	
2002		1,795	8,502	1,727		1,346		1,615	1,236	186	295	2,444	1,578	10,104	452			2,237	316	1,255
2003	1,236	2,628	14,474	654	94	1,064	3,514	1,493	1,242	528	844	4,693		11,771	1,095	810	1,683	378	1,391	
2004	4,653	6,801	28,605	6,913	1,196	1,475	5,569	1,868	2,177	539	293	5,207	4,842	19,503	670	918	2,833	461	1,138	
2005		5,059		4,112	672	2,653		1,944	4,097	510	582	3,845	2,795	21,993	788	1,155	2,918	499	1,809	
2006 <sup>a</sup>			14,220	4,734		992	5,639	1,618		705	386	4,358	3,924	19,414	531	1,015	1,702	540	928	
SEG <sup>b</sup>		580-1,800		400-1,200			1,200-2,300		330-1,200				970-2,100	5,300-14,000	300-830	340-1,300			470-1,600	
Median <sup>c</sup>	1,312	989	9,089	680	166	1,083	1,909	855	614	107	120	3,548	1,344	10,059	504	810	1,683	400	1,021	

Note: Estimates are from "peak" aerial surveys conducted between 20 and 31 July with fair or good overall rankings.

<sup>a</sup> 2006 weir escapements are preliminary and subject to minor revision.

<sup>b</sup> Formally established SEG (ADF&G 2004).

<sup>c</sup> Median of years 1975 through 2003.

**Table 2.**—Kuskokwim River salmon tagging programs and abundance estimates, 2001 through 2006.

Kuskokwim River fish wheel mark and recapture abundance estimates upstream of the community of Kalskag <sup>a</sup>				
Year	Operational Period	Sockeye	Chum	Coho
2001	07/22 to 09/10	b	b	b
2002	06/14 to 09/11	b	675,659	316,068
2003	06/06 to 09/10	90,449	507,772	849,494
2004	06/07 to 09/10	b	b	386,743
2005	06/01 to 09/09	b	b	640,736
2006	06/01 to 08/16	b	b	b

Kuskokwim River radiotelemetry mark and recapture abundance estimates upstream of the Aniak River <sup>a</sup>			
Year	Chinook	SE	
2002	100,733	24,267	
2003	103,161	18,720	
2004	146,839	21,980	
2005	145,373	15,528	
2006	n/a	n/a	

Holitna River radiotelemetry mark and recapture abundance estimates							
Year	Operational Period	Chinook	SE	Chum	SE	Coho	SE
2001	06/16 to 09/10	25,405	6,207	n/a <sup>c</sup>	n/a <sup>c</sup>	63,442	10,063
2002		42,902	6,334	542,172	285,925	157,277	56,624
2003		42,013	4,981	n/a <sup>c</sup>	n/a <sup>c</sup>	d	d
2004		81,961	13,150	d	d	d	d
2005		72,690	8,510	d	d	d	d
2006		n/a	n/a	d	d	d	d

<sup>a</sup> Reported numbers do not account for upstream harvest.

<sup>b</sup> Field operations were incomplete and annual abundance was not estimated.

<sup>c</sup> Valid estimates could not be determined for chum salmon in 2001 or 2003.

<sup>d</sup> These species were not sampled in these years.

**Table 3.**—Kuskokwim River Chinook salmon run reconstruction and exploitation, 2002 through 2005.

Run Component	Enumeration				
	Method	2002	2003	2004	2005
<b>Harvest</b>					
Subsistence		66,807	67,788	80,065	68,213
Commercial		72	158	2,300	4,825
Sport		300	401	330	330
<b>Total Harvest</b>		67,179	68,347	82,695	73,368
<b>Escapement</b>					
Kwethluk River	Weir	8,502	14,474	28,605	22,217 <sup>a</sup>
Kisaralik River	<i>Estimate<sup>b</sup></i>	8,500	14,500	28,600	22,200
Tuluksak River	Weir	1,346	1,064	1,479	2,653
Aniak River	<i>Estimate<sup>c</sup></i>	21,451	21,007	40,981	41,492
Holitna River	Radiotelemetry	42,902	42,013	81,961	72,690
Mainstem Upstream of Aniak River <sup>d</sup>	Radiotelemetry	100,733	103,161	146,839	145,373
<b>Total Escapement</b>		140,532	154,206	246,504	233,935
<b>Holitna River Contribution (%)</b>		31%	27%	33%	31%
<b>Total Abundance Statistics</b>					
Total Abundance		207,711	222,553	329,199	307,304
Annual Exploitation (Maximum)		32%	31%	25%	24%

<sup>a</sup> Kwethluk River escapement in 2005 was estimated as an expanded aerial survey count.

<sup>b</sup> Chinook salmon escapement into the Kisaralik is estimated to be equal to the Kwethluk River weir count.

<sup>c</sup> Chinook escapement into the Aniak is estimated as 50% of the radiotelemetry estimate for the Holitna River based on subjective judgment.

<sup>d</sup> Estimate is inclusive of Holitna River escapement and does not account for harvest upstream of the Aniak River.

**Table 4.**—Utilization of Chinook salmon in the Kuskokwim River, 1960 through 2006.

Year	Commercial Harvest <sup>a</sup>		Subsistence Harvest <sup>b</sup>		Test Fish Harvest	Sport Fish Harvest	Total Utilization	10-Year Average
	Annual	10-yr Ave	Annual	10-yr Ave				
1960	5,969		18,887				24,856	
1961	18,918		28,934				47,852	
1962	15,341		13,582				28,923	
1963	12,016		34,482				46,498	
1964	17,149		29,017				46,166	
1965	21,989		24,697				46,686	
1966	25,545		49,325		285		75,155	
1967	29,986		59,913		766		90,665	
1968	34,278		32,942		608		67,828	
1969	43,997	22,519	40,617	33,240	833		85,447	56,008
1970	39,290	25,851	69,612	38,312	857		109,759	64,498
1971	40,274	27,987	43,242	39,743	756		84,272	68,140
1972	39,454	30,398	40,396	42,424	756		80,606	73,308
1973	32,838	32,480	39,093	42,885	577		72,508	75,909
1974	18,664	32,632	27,139	42,698	1,236		47,039	75,997
1975	22,135	32,646	48,448	45,073	704		71,287	78,457
1976	30,735	33,165	58,606	46,001	1,206		90,547	79,996
1977	35,830	33,750	56,580	45,668	1,264	33	93,707	80,300
1978	45,641	34,886	36,270	46,000	1,445	116	83,472	81,864
1979	38,966	34,383	56,283	47,567	979	74	96,302	82,950
1980	35,881	34,042	59,892	46,595	1,033	162	96,968	81,671
1981	47,663	34,781	61,329	48,404	1,218	189	110,399	84,284
1982	48,234	35,659	58,018	50,166	542	207	107,001	86,923
1983	33,174	35,692	47,412	50,998	1,139	420	82,145	87,887
1984	31,742	37,000	56,930	53,977	231	273	89,176	92,100
1985	37,889	38,576	43,874	53,519	79	85	81,927	93,164
1986	19,414	37,443	51,019	52,761	130	49	70,612	91,171
1987	36,179	37,478	67,325	53,835	384	355	104,243	92,225
1988	55,716	38,486	70,943 <sup>c</sup>	57,303	576	528	127,763	96,654
1989	43,217	38,911	81,175	59,792	543	1,218	126,153	99,639
1990	53,504	40,673	85,976	62,400	512	394	140,386	103,981
1991	37,778	39,685	85,556	64,823	117	401	123,852	105,326
1992	46,872	39,549	64,794	65,500	1,380	367	113,413	105,967
1993	8,735	37,105	87,513	69,511	2,483	587	99,318	107,684
1994	16,211	35,552	93,243	73,142	1,937	1,139	112,530	110,020
1995	30,846	34,847	96,435	78,398	1,421	541	129,243	114,751
1996	7,419	33,648	78,062	81,102	247	1,432	87,160	116,406
1997	10,441	31,074	81,577	82,527	332	1,227	93,577	115,340
1998	17,359	27,238	81,264	83,560	210	1,434	100,267	112,590
1999	4,705	23,387	73,194	82,761	98	252	78,249	107,800
2000	444	18,081	64,893	80,653	64	105	65,506	100,312
2001	90	14,312	73,610	79,459	86	290	74,076	95,334
2002	72	9,632	66,807	79,660	288	319	67,486	90,741
2003	158	8,775	67,788	77,687	409	734	69,089	87,718
2004	2,300	7,383	80,065	76,370	691	1,197	84,253	84,891
2005	4,784	4,777	68,213	73,547	608	1,092	74,697	79,436
2006 <sup>d</sup>	2,777	4,313	73,547	73,096	352	808	77,485	78,468
5 Yr Avg								
(2002–2006)	2,018		71,284		470	830	74,602	
10 Yr Avg								
(1989–1998)	27,238		83,560	71,297	918	874	112,590	

<sup>a</sup> Districts 1 and 2; also includes harvests in District 3 from 1960 to 1965.<sup>b</sup> Estimated subsistence harvest expanded from villages surveyed.<sup>c</sup> Beginning in 1988, estimates based on a new formula. Data since 1988 not comparable with previous years.<sup>d</sup> 2006 subsistence and sport harvest based on recent 10 year average.

**Table 5.**—Kuskokwim River chum salmon escapement estimates, 1976 through 2006.

Year	Kwethluk Weir	Tuluksak Weir	Aniak Sonar <sup>a</sup>	Kogrukluks Weir	George Weir	Tatlawiksuk Weir	Takotna Weir
1976				8,177			
1977				19,443			
1978				48,125			
1979				18,198			
1980			1,600,032	<sup>b</sup>			
1981			649,849	57,365			
1982			529,758	64,063			
1983			166,452	9,407			
1984			317,688	41,484			
1985			273,306	15,005			
1986			219,770	14,693			
1987			204,834	<sup>b</sup>			
1988			485,077	39,540			
1989			295,993	39,549			
1990			246,813	26,765			
1991		7,675	366,687	24,188			
1992	30,595	11,183	87,467	34,105			
1993		13,804	15,278	31,899			
1994		15,724	474,356	46,635			
1995			<sup>b</sup>	31,265			<sup>b</sup>
1996	26,049		402,195	48,495	19,393		2,872
1997	10,659		289,654	7,958	5,907		1,779
1998	<sup>b</sup>		351,792	36,442	<sup>b</sup>	<sup>b</sup>	<sup>b</sup>
1999	<sup>b</sup>		214,429	13,820	11,552	9,599	<sup>b</sup>
2000	11,691		177,384	11,491	3,492	7,044	1,254
2001	<sup>b</sup>	19,321	408,830	30,569	11,601	23,718	5,414
2002	35,854	9,958	472,346	51,570	6,543	24,542	4,377
2003	41,812	11,724	477,544	23,413	33,666	<sup>b</sup>	3,393
2004	38,646	11,796	672,931	24,201	14,409	21,245	1,630
2005	<sup>b</sup>	35,696	1,151,505	197,723	14,828	55,720	6,467
2006 <sup>c</sup>	42,328	23,818	1,042,132	180,510	41,450	32,204	12,608
SEG			220,000-480,000 <sup>d</sup>	15,000-49,000			
Median							
1976-2003	28,322	11,724	317,688	30,917	11,552	16,658	3,132

<sup>a</sup> Unapportioned sonar counts considered to be primarily chum salmon.

<sup>b</sup> Field operations incomplete; annual escapement was not determined.

<sup>c</sup> 2006 weir escapement estimates and sonar counts are preliminary and subject to minor revisions.

<sup>d</sup> Revised SEG being recommended to account for DIDSON sonar methodology (Brannian et al. 2006).

**Table 6.**—Utilization of chum salmon in the Kuskokwim River, 1960–2006.

Year	Commercial Harvest <sup>a</sup>		Subsistence Harvest <sup>b</sup>		Test Fish Harvest	Sport Fish Harvest	Total Utilization	10-Year Average
	Annual	10-yr Ave	Annual	10-yr Ave				
1960	0		301,753 <sup>c</sup>				301,753	
1961	0		179,529 <sup>c</sup>				179,529	
1962	0		161,849 <sup>c</sup>				161,849	
1963	0		137,649 <sup>c</sup>				137,649	
1964	0		190,191 <sup>c</sup>				190,191	
1965	0		250,878 <sup>c</sup>				250,878	
1966	0		175,735 <sup>c</sup>		502 <sup>d</sup>		176,237	
1967	148		208,445 <sup>c</sup>		338		208,931	
1968	187		275,008 <sup>c</sup>		562		275,757	
1969	7,165	750	204,105 <sup>c</sup>		384		211,654	209,443
1970	1,664	916	246,810 <sup>c</sup>	203,020	1,139 <sup>d</sup>		249,613	204,229
1971	68,914	7,808	116,391 <sup>c</sup>	196,706	254		185,559	204,832
1972	78,619	15,670	120,316 <sup>c</sup>	192,553	486		199,421	208,589
1973	148,746	30,544	179,259 <sup>c</sup>	196,714	675		328,680	227,692
1974	171,887	47,733	277,170 <sup>c</sup>	205,412	2,021		451,078	253,781
1975	184,171	66,150	176,389 <sup>c</sup>	197,963	1,062		361,622	264,855
1976	177,864	83,937	223,792 <sup>c</sup>	202,769	2,101		403,757	287,607
1977	248,721	108,794	198,355 <sup>c</sup>	201,760	576	129	447,781	311,492
1978	248,656	133,641	118,809 <sup>c</sup>	186,140	2,153	555	370,173	320,934
1979	261,874	159,112	161,239 <sup>c</sup>	181,853	412	259	423,784	342,147
1980	483,751	207,320	165,172 <sup>c</sup>	173,689	2,058	324	651,305	382,316
1981	418,677	242,297	157,306 <sup>c</sup>	177,781	1,793	598	578,374	421,598
1982	278,306	262,265	190,011 <sup>c</sup>	184,750	504	1125	469,946	448,650
1983	276,698	275,061	146,876 <sup>c</sup>	181,512	1,069	922	425,565	458,339
1984	423,718	300,244	142,542 <sup>c</sup>	168,049	1,186	520	567,966	470,027
1985	199,478	301,774	94,750	159,885	616	150	294,994	463,365
1986	309,213	314,909	141,931 <sup>c</sup>	151,699	1,693	245	453,082	468,297
1987	574,336	347,471	70,709	138,935	2,302	566	647,913	488,310
1988	1,381,674	460,773	151,967 <sup>e</sup>	142,250	4,379	764	1,538,784	605,171
1989	749,182	509,503	139,672	140,094	2,082	2,023	892,959	652,089
1990	461,624	507,291	126,509	136,227	2,107	533	590,773	646,036
1991	431,802	508,603	93,077	129,804	931	378	526,188	640,817
1992	344,603	515,233	96,491	120,452	15,330	608	457,032	639,526
1993	43,337	491,897	59,394	111,704	8,451	359	111,541	608,123
1994	271,115	476,636	72,022	104,652	11,998	1,280	356,415	586,968
1995	605,918	517,280	67,861	101,963	17,473	226	691,478	626,617
1996	207,877	507,147	88,966	96,667	2,864	280	299,987	611,307
1997	17,026	451,416	39,987	93,595	790	86	57,889	552,305
1998	207,809	334,029	63,537	84,752	1,140	291	272,777	425,704
1999	23,006	261,412	43,601	75,145	562	180	67,349	343,143
2000	11,570	216,406	51,696	67,663	1,038	26	64,330	290,499
2001	1,272	173,353	49,874	63,343	1,743	112	53,001	243,180
2002	1,900	139,083	69,019	60,596	2,666	53	73,638	204,841
2003	2,764	135,026	43,320	58,988	1,713	67	47,864	198,473
2004	20,429	109,957	52,374	57,024	1,810	117	74,730	170,304
2005	69,139	56,279	46,036	54,841	4,459	608	120,242	113,181
2006 <sup>f</sup>	44,070	39,899	54,841	51,429	3,547	182	102,640	93,446
5 Yr Avg (2002–2006)	27,660		53,118		2,839	205	83,823	
10 Yr Avg (1989–1998)	334,029		84,752		6,317	606	425,704	

<sup>a</sup> Districts 1 and 2 only; no chum harvests were reported in District 3.<sup>b</sup> Estimated subsistence harvest expanded from villages surveyed.<sup>c</sup> Includes small numbers of small Chinook, sockeye and coho salmon.<sup>d</sup> Includes small numbers of sockeye.<sup>e</sup> Beginning in 1988, estimates based on a new formula. Data since 1988 not comparable with previous years.<sup>f</sup> 2006 subsistence and sport harvest based on recent 10 year average.

**Table 7.**—Kuskokwim River sockeye salmon escapement estimates, 1976 through 2006.

Year	Kwethluk Weir	Tuluksak Weir	George Weir	Kogrukluk Weir	Tatlawiksuk Weir	Takotna Weir
1976				2,326		
1977				1,637		
1978				1,670		
1979				2,628		
1980				<sup>a</sup>		
1981				18,066		
1982				17,297		
1983				1,176		
1984				4,133		
1985				4,359		
1986				4,244		
1987				<sup>a</sup>		
1988				4,397		
1989				5,811		
1990				8,406		
1991		697		16,455		
1992	1,316	1,083		7,540		
1993		2,218		29,358		
1994		2,917		14,192		
1995				10,996		<sup>a</sup>
1996	1,801	<sup>a</sup>	<sup>a</sup>	15,385		0
1997	1,374		445	13,078		0
1998	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	16,773	<sup>a</sup>	<sup>a</sup>
1999	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	5,864	6	
2000	358		22	2,867	0	4
2001	<sup>a</sup>	997	24	8,773	3	1
2002	272	1,346	17	4,050	1	1
2003	2,928	1,064	11	9,138	<sup>a</sup>	3
2004	3,302	1,479	174	6,671	10	18
2005	<sup>a</sup>	2,663	270	37,960	77	35
2006 <sup>b</sup>	7,000	992	164	60,787	37	61
Median						
1976–2003	1,345	1,083	22	6,671	2	1

<sup>a</sup> Field operations incomplete; annual escapement was not determined.

<sup>b</sup> 2006 weir escapement estimates are preliminary and subject to minor revisions.

**Table 8.**—Kuskokwim River coho salmon escapement estimates, 1981 through 2006.

Year	Kwethluk Weir	Tuluksak Weir	George Weir	Kogrukluk Weir	Tatlawiksuk Weir	Takotna Weir
1981				11,455		
1982				37,796		
1983				8,538		
1984				27,595		
1985				16,441		
1986				22,506		
1987				22,821		
1988				13,512		
1989				<sup>a</sup>		
1990				6,132		
1991		4,651		9,964		
1992	45,605	7,501		26,057		
1993		8,328		20,517		
1994		7,952		34,695		
1995				27,861		<sup>a</sup>
1996	<sup>a</sup>		<sup>a</sup>	50,555		<sup>a</sup>
1997	<sup>a</sup>		9,210	12,237		<sup>a</sup>
1998	<sup>a</sup>		<sup>a</sup>	24,348	<sup>a</sup>	<sup>a</sup>
1999	<sup>a</sup>		8,914	12,609	3,455	<sup>a</sup>
2000	25,610		11,262	33,135	<sup>a</sup>	3,957
2001	22,904	23,768	14,398	19,387	10,539	2,606
2002	23,298	11,487	6,759	14,516	11,345	3,984
2003	107,789	39,627	31,925	74,754	<sup>a</sup>	7,171
2004	64,143	20,336	12,522	26,993	16,408	3,207
2005	<sup>a</sup>	11,324	8,187	24,113	6,729	2,216
2006 <sup>b</sup>	20,188	<sup>a</sup>	10,771	17,014	<sup>a</sup>	5,594
SEG				13,000–28,000		
Median						
1981–2003	25,610	8,328	10,236	21,512	10,539	3,971

<sup>a</sup> Field operations incomplete; annual escapement was not determined.

<sup>b</sup> 2006 weir escapement estimates are preliminary and subject to minor revisions.

**Table 9.**—Kuskokwim Area commercial salmon harvests by district, 1975 through 2006.

Year	Districts W-1 and W-2 (Kuskokwim River)				District W-4 (Quinhagak)				District W-5 (Goodnews Bay)			
	Chinook	Sockeye	Coho	Chum	Chinook	Sockeye	Coho	Chum	Chinook	Sockeye	Coho	Chum
1975	22,135	23	81,945	184,171	3,928	8,584	10,742	35,233	2,156	9,098	17,889	5,904
1976	30,735	2,971	88,501	177,864	14,110	6,090	13,777	43,659	4,417	5,575	9,852	10,354
1977	35,830	9,379	241,364	248,721	19,090	5,519	9,028	43,707	3,336	3,723	13,335	6,531
1978	45,641	733	213,393	248,656	12,335	7,589	20,114	24,798	5,218	5,412	13,764	8,590
1979	38,966	1,054	219,060	261,874	11,144	18,828	47,525	25,995	3,204	19,581	42,098	9,298
1980	35,881	360	222,012	483,751	10,387	13,221	62,610	65,984	2,331	28,632	43,256	11,748
1981	47,663	48,375	211,251	418,677	24,524	17,292	47,551	53,334	7,190	40,273	19,749	13,642
1982	48,234	33,154	447,117	278,306	22,106	25,685	73,652	34,346	9,476	38,877	46,683	13,829
1983	33,174	68,855	196,287	276,698	46,385	10,263	32,442	23,090	14,117	11,716	19,660	6,766
1984	31,742	48,575	623,447	423,718	33,633	17,255	132,151	50,422	8,612	15,474	71,176	14,340
1985	37,889	106,647	335,606	199,478	30,401	7,876	29,992	20,418	5,793	6,698	16,498	4,784
1986	19,414	95,433	659,988	309,213	22,835	21,484	57,544	29,700	2,723	25,112	19,378	10,355
1987	36,179	136,602	399,467	574,336	26,022	6,489	50,070	8,557	3,357	27,758	29,057	20,381
1988	55,716	92,025	524,296	1,381,674	13,883	21,556	68,605	29,220	4,964	36,368	30,832	33,059
1989	43,217	42,747	479,856	749,182	20,820	20,582	44,607	39,395	2,966	19,299	31,849	13,622
1990	53,504	84,870	410,332	461,624	27,644	83,681	26,926	47,717	3,303	35,823	7,804	13,194
1991	37,778	108,946	500,935	431,802	9,480	53,657	42,571	54,493	912	39,838	13,312	15,892
1992	46,872	92,218	666,170	344,603	17,197	60,929	86,404	73,383	3,528	39,194	19,875	18,520
1993	8,735	27,008	610,739	43,337	15,784	80,934	55,817	40,943	2,117	59,293	20,014	10,657
1994	16,211	49,365	724,689	271,115	8,564	72,314	83,912	61,301	2,570	69,490	47,499	28,477
1995	30,846	92,500	471,461	605,918	38,584	68,194	66,203	81,462	2,922	37,351	17,875	19,832
1996	7,419	33,878	937,299	207,877	14,165	57,665	118,718	83,005	1,375	30,717	43,836	11,093
1997	10,441	21,989	130,803	17,026	35,510	69,562	32,862	38,445	2,039	31,451	2,983	11,729
1998	17,359	60,906	210,481	207,809	23,158	41,382	80,183	45,095	3,675	27,161	21,246	14,155
1999	4,705	16,976	23,593	23,006	18,426	41,315	6,184	38,091	1,888	22,910	2,474	11,562
2000	444	4,130	261,379	11,570	21,229	68,557	30,529	30,553	4,442	37,252	15,531	7,450
2001	90	84	192,998	1,272	12,775	33,807	18,531	17,209	1,519	25,654	9,275	3,412
2002	72	84	83,463	1,900	11,480	17,802	26,695	29,252	979	6,304	3,041	3,799
2003	158	282	284,064	2,764	14,444	33,941	49,833	27,868	1,412	29,423	12,658	5,593
2004	2,300	9,748	433,809	20,429	25,465	34,627	82,398	25,820	2,565	20,922	23,690	6,014
2005	4,784	27,645	142,319	69,139	24,195	68,801	51,708	13,529	2,035	23,933	11,735	2,568
2006	2,777	12,618	185,598	44,070	19,184	106,308	26,831	39,151	2,892	29,857	12,436	11,568
5 Yr Avg (2002–2006)	2,018	10,075	225,851	27,660	18,954	52,296	47,493	27,124	1,977	22,088	12,712	5,908
10 Yr Avg (1989–1998)	27,238	61,443	514,277	334,029	21,091	60,890	63,820	56,524	2,541	38,962	22,629	15,717

**Table 10.**—Peak aerial survey counts from Kuskokwim Bay spawning tributaries, 1961 through 2006.

Year	Kanektok River				Middle Fork Goodnews River				North Fork Goodnews River			
	Chinook	Sockeye	Chum	Coho	Chinook	Sockeye	Chum	Coho	Chinook	Sockeye	Chum	Coho
1961												
1962												
1963												
1964												
1965												
1966	3,718		28,800									
1967												
1968	4,170	8,000	14,000									
1969												
1970	3,112	11,375										
1971												
1972												
1973	814											
1974												
1975		6,018										
1976		22,936	8,697									
1977	5,787	7,244	32,157									
1978	19,180	44,215	229,290									
1979												
1980				69,325	1,164	18,926	3,782		1,228	75,639	1,975	
1981												
1982	15,900	49,175	71,840		1,546	2,327	6,300		1,990	19,160	9,700	
1983	8,142	55,940			2,500	5,900			2,600	9,650		
1984	8,890	2,340	9,360	46,830	1,930	12,897	9,172		3,245	9,240	17,250	43,925
1985	12,182	30,840	53,060		2,050	5,470	3,593		3,535	2,843	4,415	
1986	13,465	16,270	14,385		1,249	16,990	7,645		1,068	8,960	11,850	
1987	3,643	14,940	16,790	20,056	2,222	34,585	9,696		2,234	19,786	12,103	11,122
1988	4,223	51,753	9,420		1,024	5,831	5,814		637	5,820	3,846	
1989	11,180	30,440	20,583		1,277	8,044	2,922		651	3,605		
1990	7,914	14,735	6,270						626	27,689		
1991			2,475	4,330								
1992	2,100	44,436	19,052		1,012	7,200	3,270		875	10,397	1,950	
1993	3,856	14,955	25,675									
1994	4,670	23,128	1,285									
1995	7,386	30,090	10,000	2,900					3,314			
1996				23,656								
1997				4,892	1,447	19,843			3,611	12,610		
1998	6,107	22,020	7,040		731	11,632	3,619		578	3,497	2,743	
1999				5,192								
2000	1,118	11,670	10,000	10,120								
2001	6,483	38,610	11,440		3,561	29,340	7,330		2,799	12,383	6,945	
2002					1,470	3,475	3,075		1,195	2,626	1,208	
2003	6,206	21,335	2,700		1,210	21,760	2,310		2,015	27,380	3,370	
2004	28,375	78,380			2,617	33,670			7,462	31,695		
2005	14,202	110,730										
2006	8,433	382,800							4,159	78,100		
	3,500–	14,000–		7,700–					640–	5,500–		
SEG <sup>a</sup>	8,000	34,000	>5,200	36,000					3,300	19,500		

Note: Estimates are from "peak" aerial surveys conducted under fair, good, or excellent viewing conditions.

<sup>a</sup> Formally established Sustainable Escapement Goal (ADF&G 2004).

**Table 11.**—Salmon escapements, Middle Fork Goodnews and Kanektok Rivers, 1981 through 2006.

Year	Operating Period <sup>a</sup>	Chinook	Sockeye	Chum	Pink	Coho
<b>Middle Fork Goodnews River</b>						
SEG:		2,000–4,500	23,000–50,000	>12,000		>12,000
Counting Tower						
1981	06/13 to 08/15	3,688	49,108	21,827	1,327 <sup>b</sup>	356 <sup>b</sup>
1982	06/23 to 08/03	1,395	56,255	6,767	13,855 <sup>b</sup>	91 <sup>b</sup>
1983	06/11 to 07/28	6,022	25,813	15,548	34 <sup>b</sup>	0 <sup>b</sup>
1984	06/15 to 07/31	3,260	32,053	19,003	13,744 <sup>b</sup>	249 <sup>b</sup>
1985	06/27 to 07/31	2,831	24,131	10,367	144 <sup>b</sup>	282 <sup>b</sup>
1986	06/16 to 07/24	2,092	51,069	14,764	8,133 <sup>b</sup>	163 <sup>b</sup>
1987	06/22 to 07/30	2,272	28,871	17,517	62 <sup>b</sup>	62 <sup>b</sup>
1988	06/23 to 07/30	2,712	15,799	20,799	6,781 <sup>b</sup>	6 <sup>b</sup>
1989	06/29 to 07/31	1,915	21,186	10,380	24 <sup>b</sup>	1,212 <sup>b</sup>
1990	06/19 to 07/24	3,636	31,679	6,410	3,378 <sup>b</sup>	0 <sup>b</sup>
Weir						
1991	06/29 to 08/24	1,952	47,397	27,525	1,694 <sup>b</sup>	1,978 <sup>b</sup>
1992	06/29 to 08/25	1,903	27,268	22,023	23,030 <sup>b</sup>	150 <sup>b</sup>
1993	06/22 to 08/18	2,317	26,044	14,472	253 <sup>b</sup>	1,374 <sup>b</sup>
1994	06/23 to 08/08	3,856	55,751	34,849	38,705 <sup>b</sup>	309 <sup>b</sup>
1995	06/19 to 08/28	4,836	39,009	33,699	330 <sup>b</sup>	5,415 <sup>b</sup>
1996	06/19 to 08/23	2,930	58,264	40,450	14,509 <sup>b</sup>	9,699 <sup>b</sup>
1997	06/11 to 09/17	2,937	35,530	17,296	940	9,619
1998	07/04 to 09/13	4,584	47,951	28,905	10,367	35,441
1999	06/26 to 09/26	3,221	48,205	19,533	914	11,545
2000	07/02 to 09/22	3,295	42,197	14,720	2,530	19,676
2001	06/26 to 09/30	5,398	22,487	26,829	1,323	19,630
2002	06/25 to 09/18	3,076	22,019	30,233	1,328	27,364
2003	06/18 to 09/18	2,389	44,390	21,637	1,917	52,810
2004	06/21 to 09/20	4,266	52,772	29,992	20,610	49,611
2005	06/26 to 09/12	4,529	111,458	26,428	5,925	13,938 <sup>c</sup>
2006 <sup>d</sup>	06/26 to 09/07	4,595	124,256	54,422	18,427	13,050
Year	Operating Period <sup>a</sup>	Chinook	Sockeye	Chum	Pink	Coho
<b>Kanektok River</b>						
Counting Tower						
1996	7/2–7/13; 7/20–7/25	6,827 <sup>b</sup>	71,637 <sup>b</sup>	70,617 <sup>b</sup>		
1997	06/11 to 08/21	16,731	96,348	51,180	7,872 <sup>b</sup>	23,172 <sup>b</sup>
1998	Not Operational					
1999	Not Operational					
Weir						
2000	Not Operational					
2001	08/10 to 10/03	132 <sup>b</sup>	733 <sup>b</sup>	1,058 <sup>b</sup>	21 <sup>b</sup>	36,440
2002	07/01 to 09/20	5,343 <sup>b</sup>	58,367 <sup>b</sup>	42,014 <sup>b</sup>	87,036	24,883
2003	06/24 to 09/18	8,231	127,471	40,066	2,443	72,448
2004	06/29 to 09/20	19,406	102,443	46,194	98,060	87,827
2005	07/08 to 09/08	12,721 <sup>c</sup>	160,702 <sup>c</sup>	50,881 <sup>c</sup>	3,530 <sup>c</sup>	13,690 <sup>c</sup>
2006	Not Operational					

<sup>a</sup> The operational period is inclusive of days when passage was estimated; unless noted otherwise, less than 10% of the total annual escapement is estimated.

<sup>b</sup> Field operations were incomplete and total annual escapement was not estimated.

<sup>c</sup> Total annual escapement is believed to be higher given the late project start date and/or premature project stop date.

<sup>d</sup> Escapement estimates are preliminary and subject to revisions.

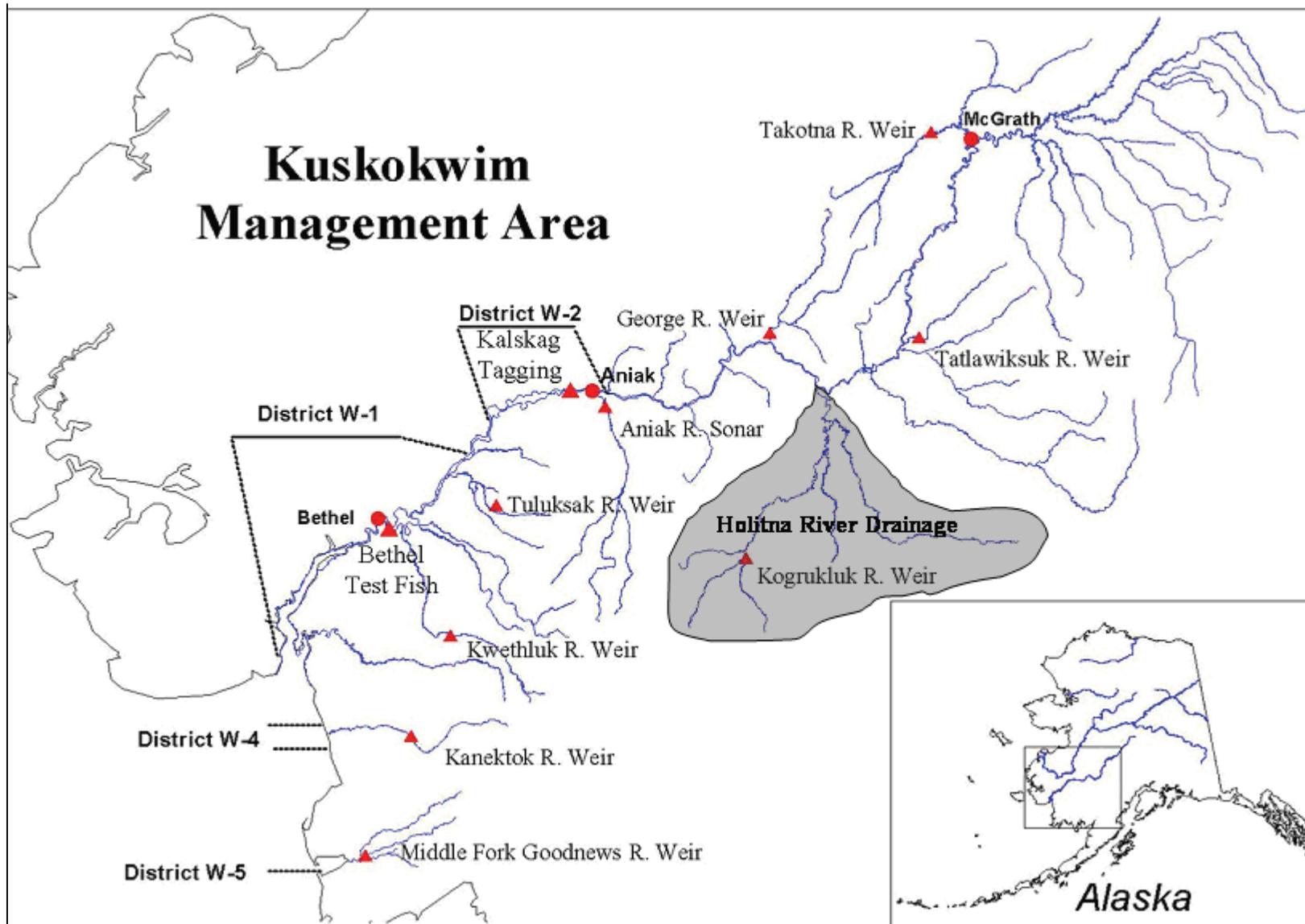
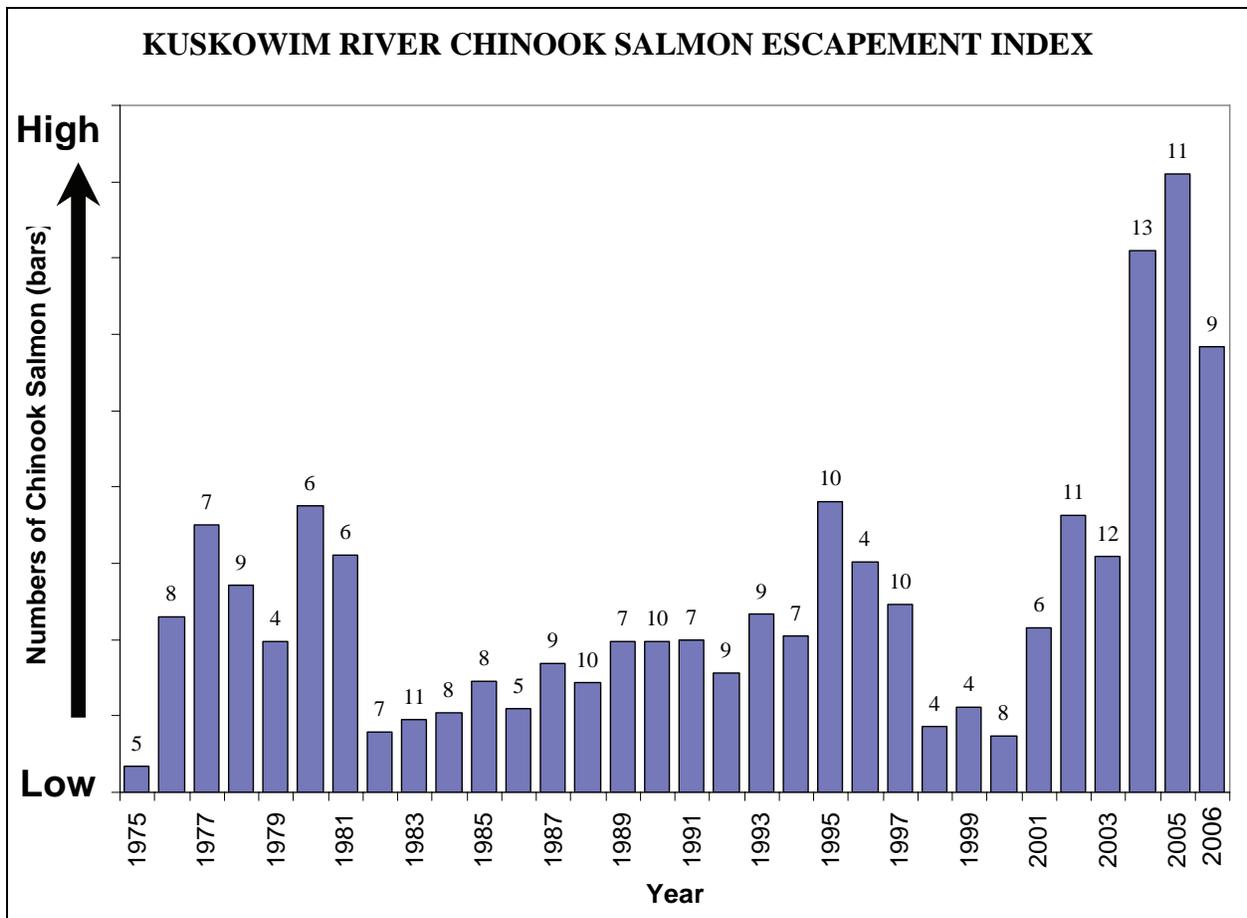
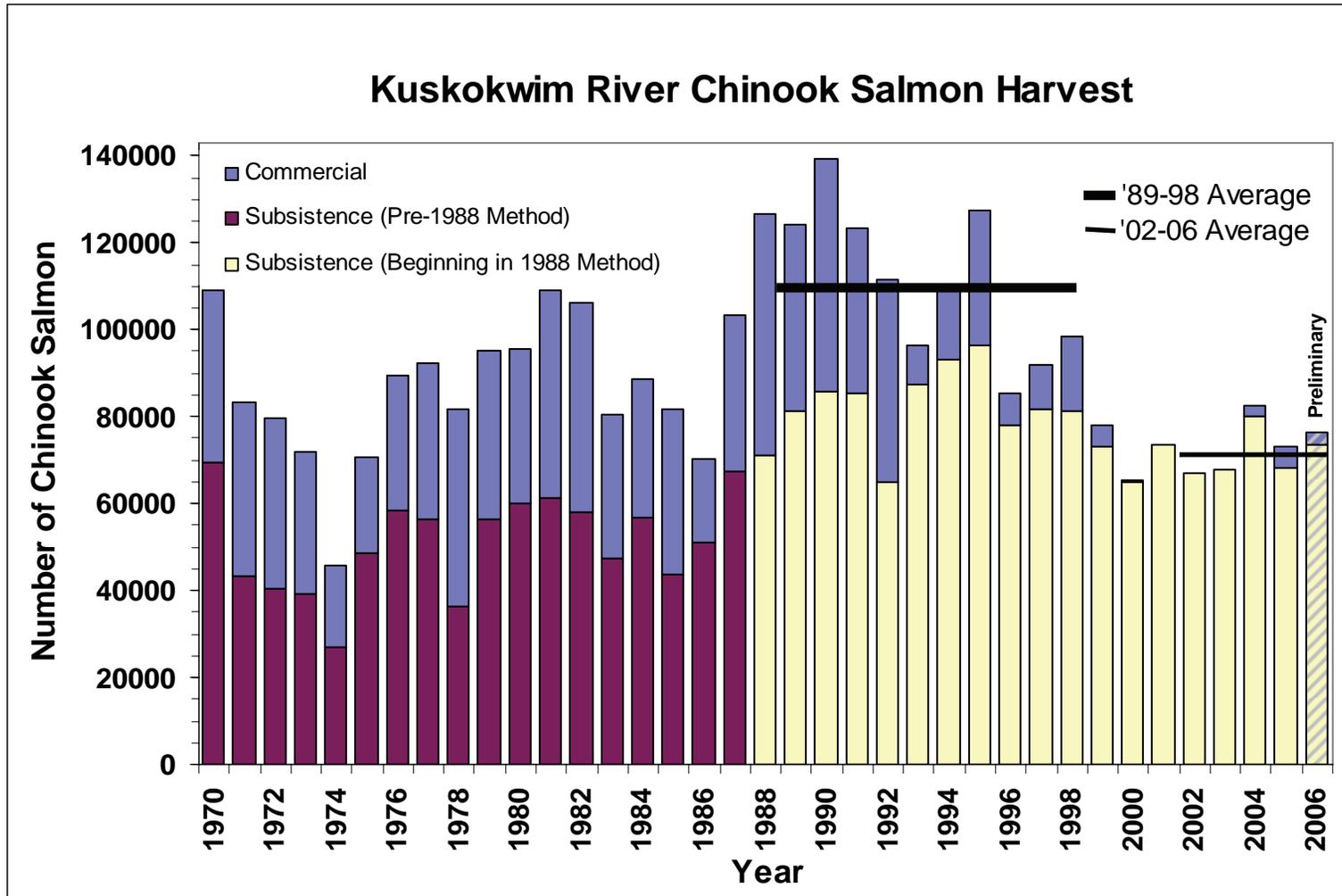


Figure 1.—Kuskokwim Management Area and salmon monitoring project locations.



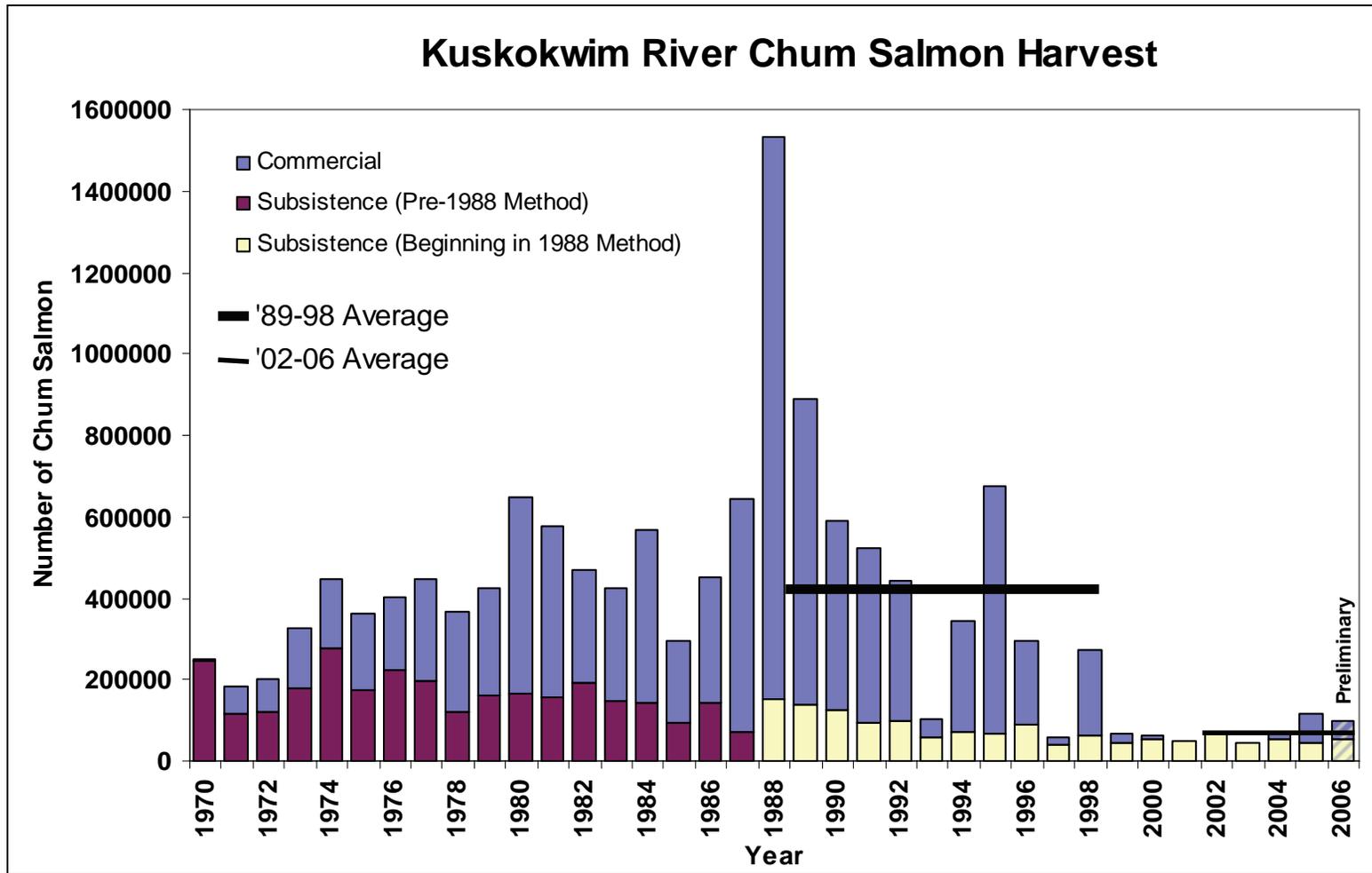
*Note:* The number on the top of each bar represents the number of streams where escapement was successfully evaluated in that year.

**Figure 2.**—The Kuskokwim River Chinook salmon escapement index is a composite of median historical escapements for 13 possible index streams throughout the Kuskokwim River drainage. The index is solely designed to show trends in Chinook salmon escapement in the Kuskokwim River drainage since 1975.



*Note:* The 2006 subsistence harvest is a preliminary estimate based on the previous 5-year average subsistence harvest.

**Figure 3.**—Kuskokwim River Chinook salmon subsistence and commercial harvests compared to the 1989–1998 average (112,600 fish) and the 2002–2006 average (74,600 fish).



*Note:* The 2006 subsistence harvest is a preliminary estimate based on the previous 5-year average subsistence harvest.

**Figure 4.**—Kuskokwim River coho salmon subsistence and commercial harvests compared to the 1989–1998 average (418,800 fish) and the 1999–2003 average (67,400 fish).

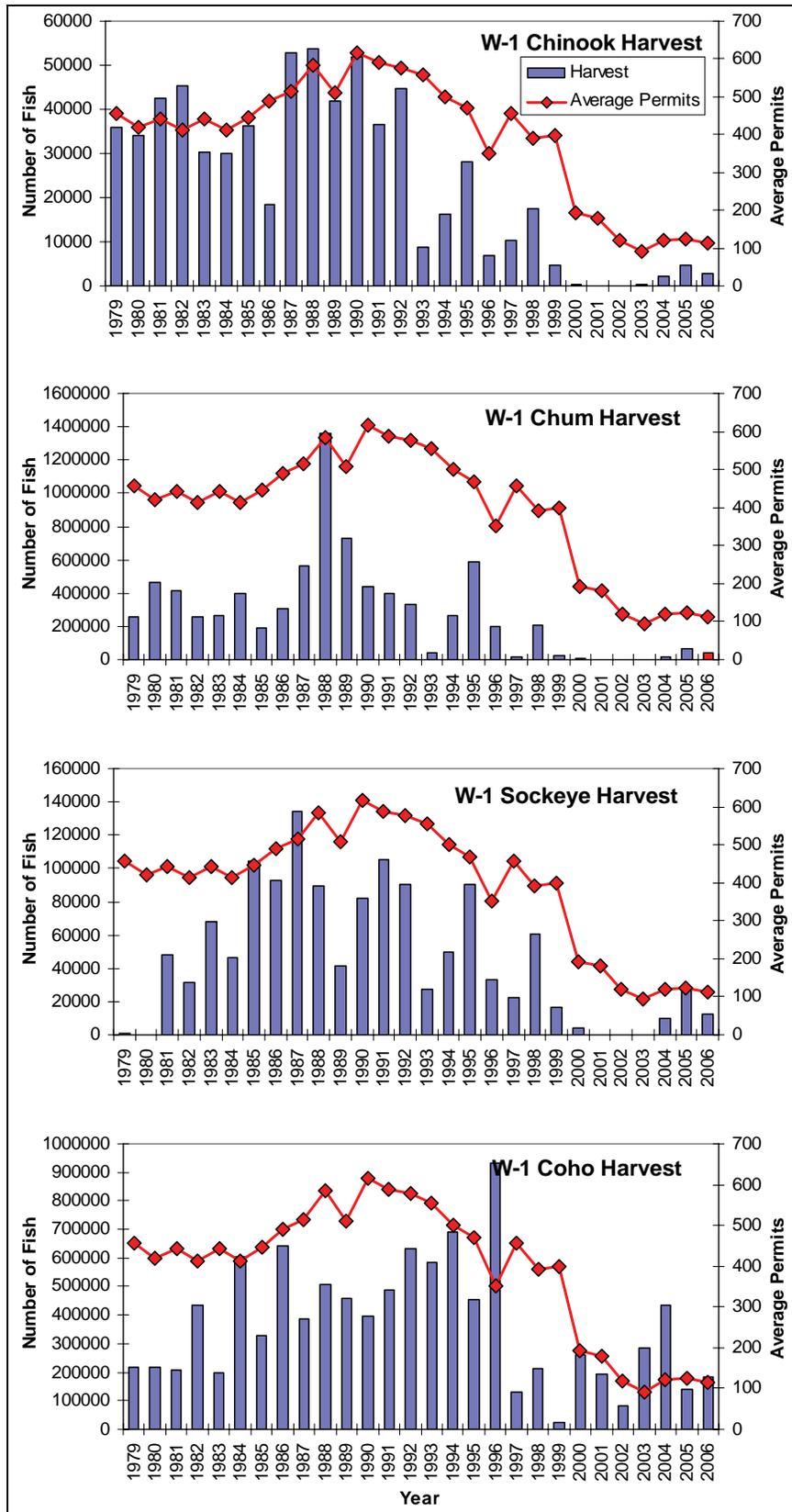


Figure 5.—District W-1 commercial harvests and average permits participating, 1979 through 2006.

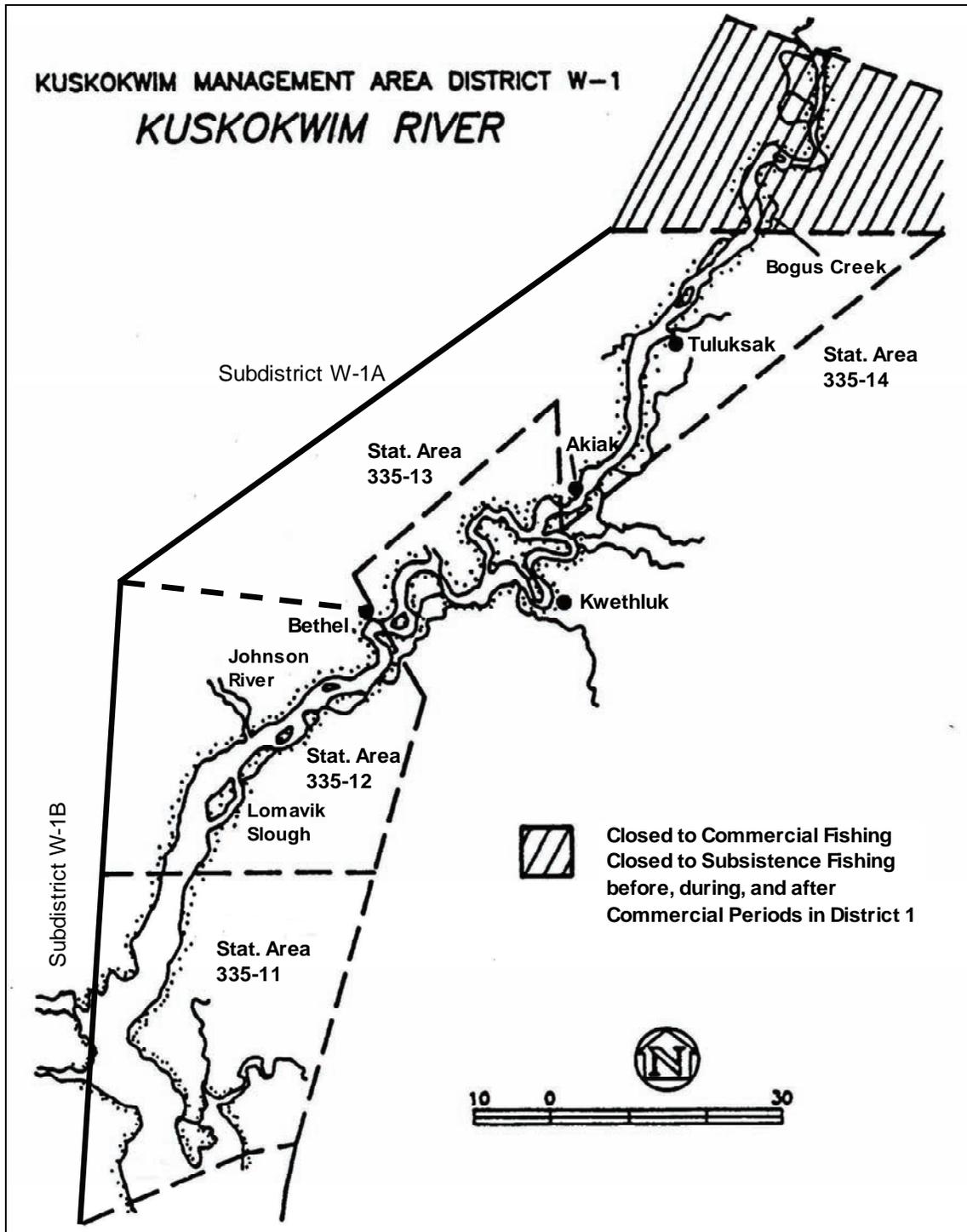
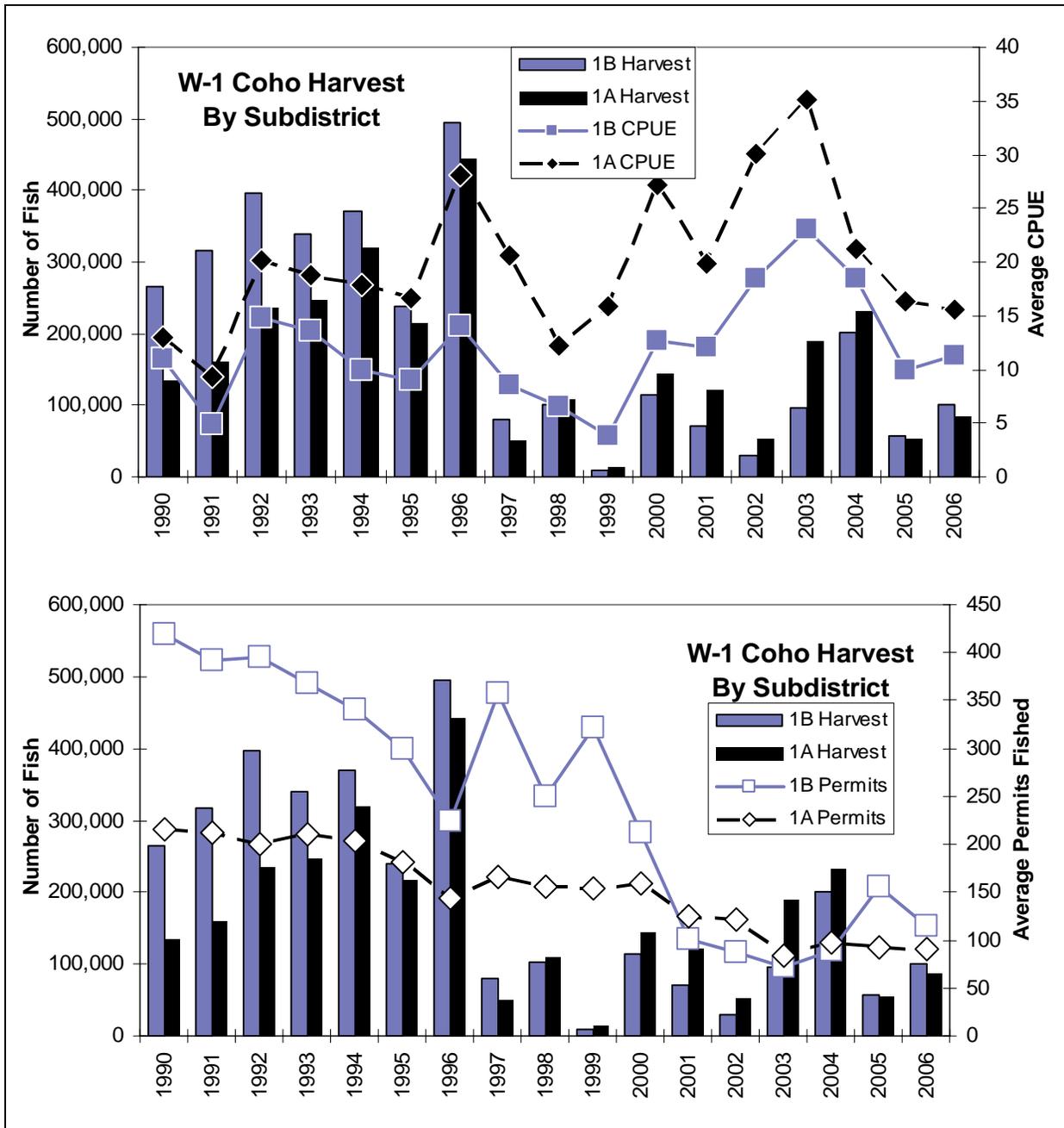
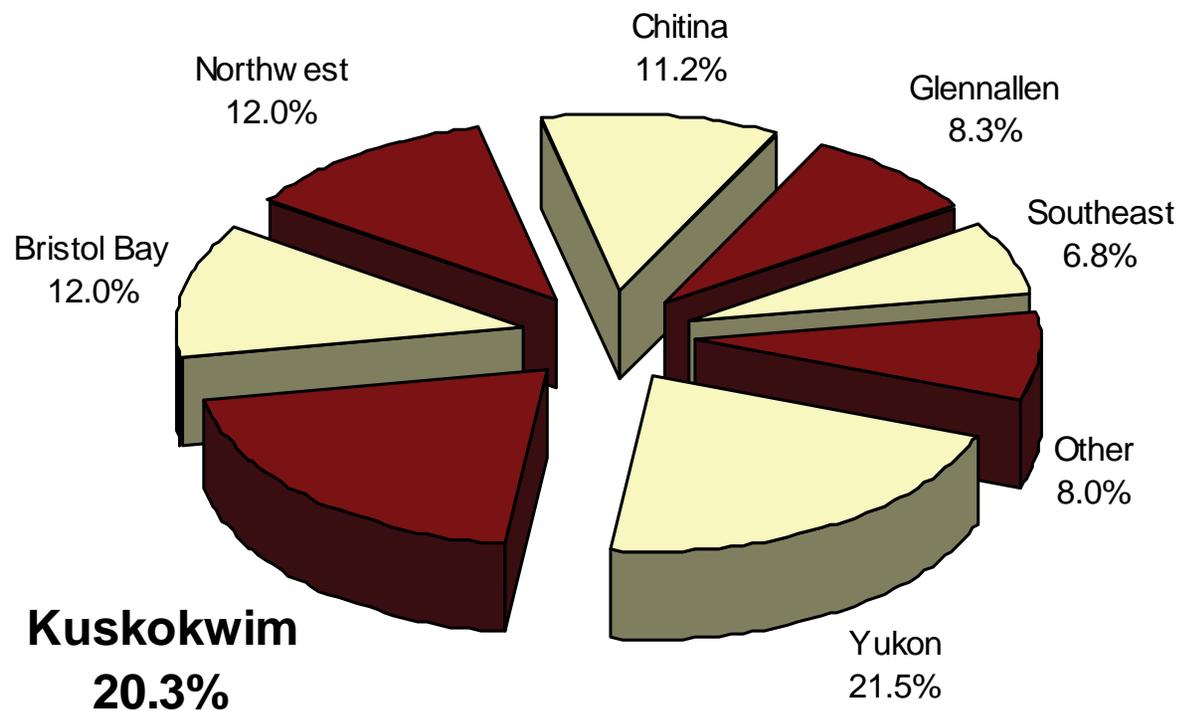


Figure 6.—Kuskokwim Management Area, District W-1.



**Figure 7.**—District W-1 commercial harvest, average CPUE (above) and average permits fished (below) by subdistrict, 1990 through 2006.

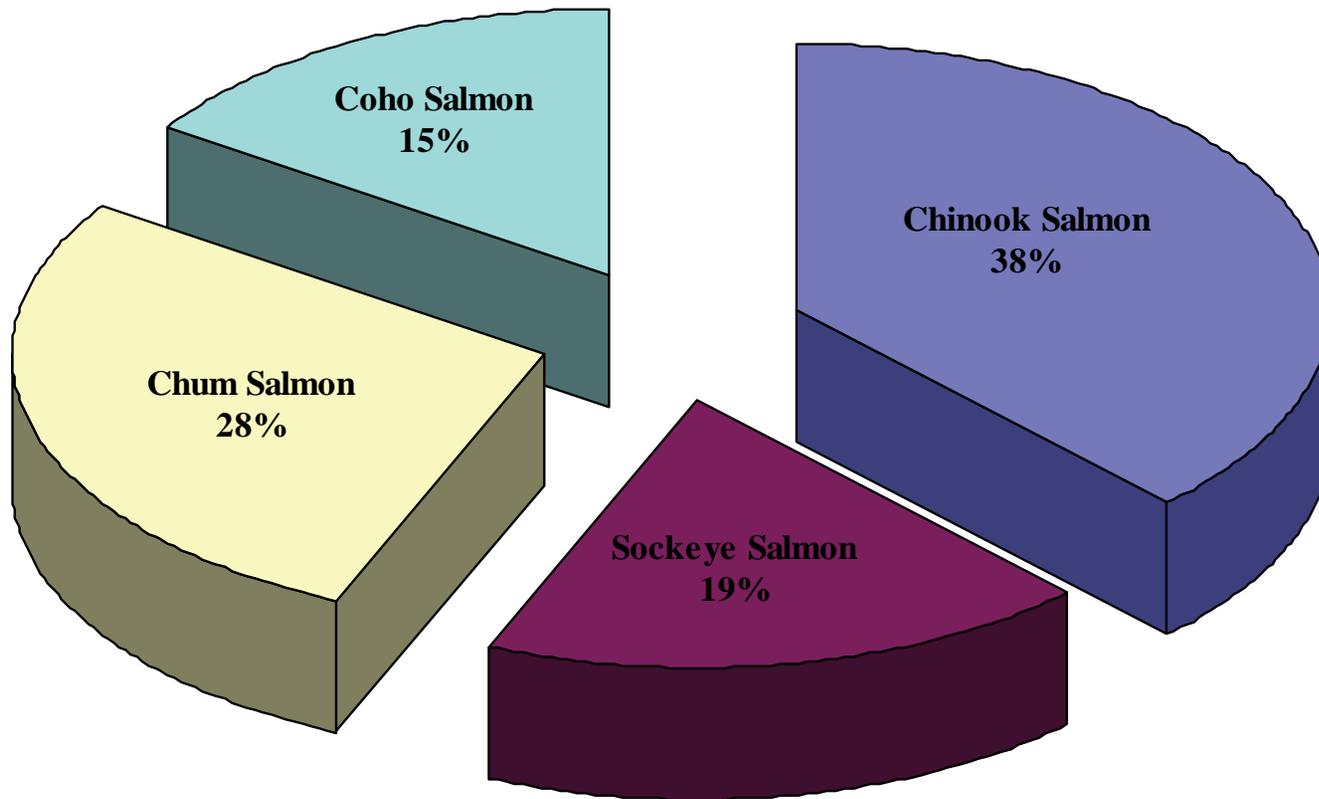
## Alaska Subsistence Salmon Harvest by Area, 2004



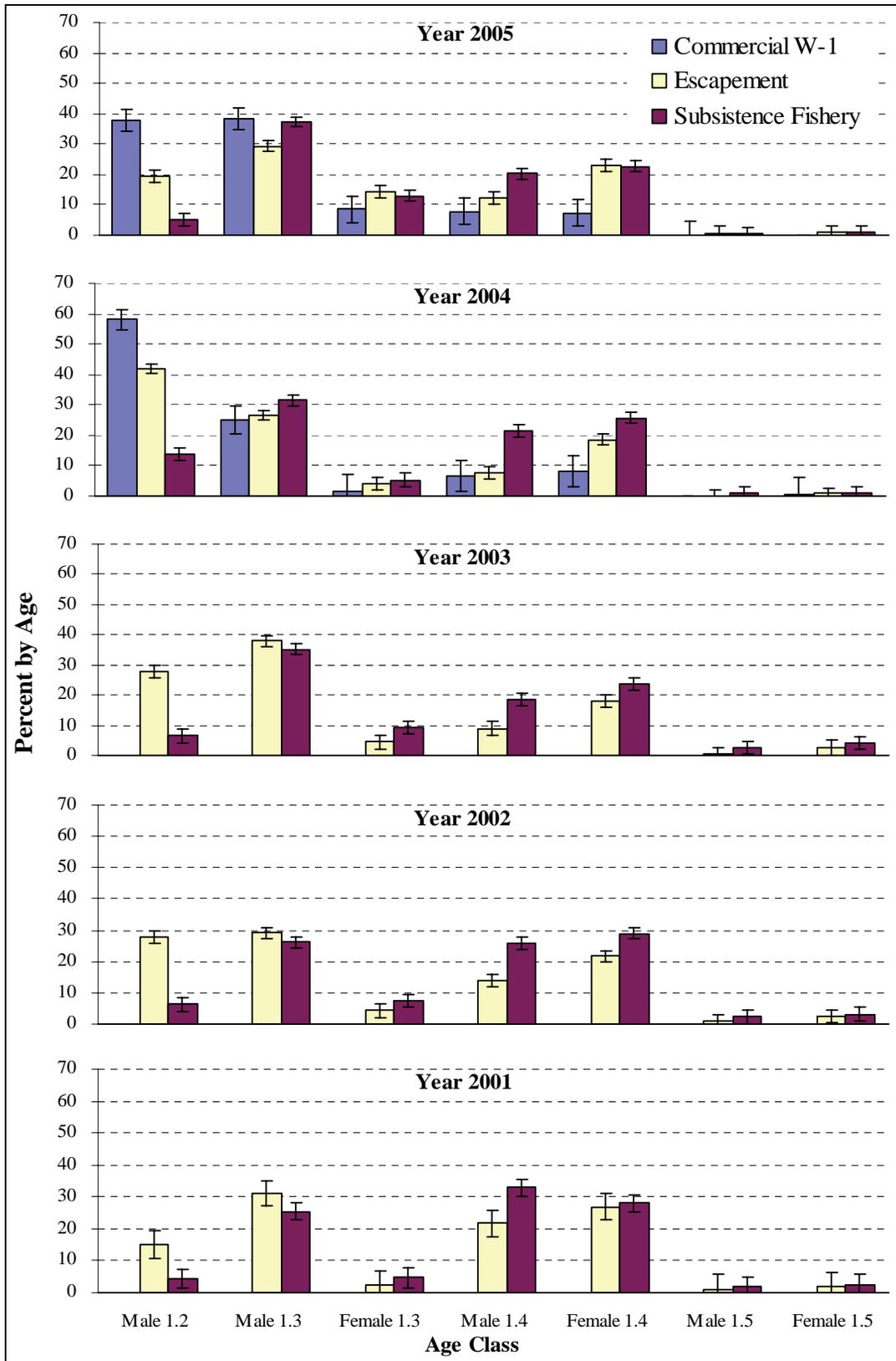
Total salmon = 1,057,071

Figure 8.—Percentage of subsistence salmon harvest by Area or Region, State of Alaska, 2004.

**Average Kuskokwim River Subsistence Salmon Utilization  
1996 through 2005**



**Figure 9.**—Kuskokwim River salmon utilization as percentage by species, 10 year average 1996 through 2005.



**Figure 10.**—Age and sex composition from 2001 to 2005 of Kuskokwim River Chinook salmon commercial harvest, subsistence harvest, and escapement (+/-SE top of each bar).