

Special Publication No. 06-29

**Report to the Alaska Board of Fisheries for the
Recreational Fisheries of Bristol Bay, 2004, 2005, and
2006**

by

Jason E. Dye,

Craig J. Schwanke

and

Troy A. Jaecks

November 2006

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)		General		Measures (fisheries)	
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	@	Mathematics, statistics	
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 _A
		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, χ^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 ₂ , etc.
		registered trademark	®	minute (angular)	'
		trademark	™	not significant	NS
		United States		null hypothesis	H ₀
		(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 ³ /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
nautical mile	nmi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				

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

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

SPECIAL PUBLICATION NO. 06-29

**REPORT TO THE ALASKA BOARD OF FISHERIES FOR THE
RECREATIONAL FISHERIES OF BRISTOL BAY, 2004, 2005, AND 2006**

by

Jason E. Dye,
Craig J. Schwanke
and

Troy A. Jaecks

Alaska Department of Fish and Game, Division of Sport Fish, Dillingham

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

November 2006

The Division of Sport Fish Special Publications series was established in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and other documents that do not fit in another publication series of the Division of Sport Fish. Since 2004, the Division of Commercial Fisheries has also used the same Special Publication series. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library and on the Internet: <http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm>. This publication has undergone editorial and peer review.

*Jason E. Dye,
Craig J. Schwanke,
and
Troy A. Jaecks*

*Alaska Department of Fish and Game, Division of Sport Fish
P.O. Box 230, Dillingham, AK 99576-0230, USA*

This document should be cited as:

Dye, J. E., C. J. Schwanke and T.A. Jaecks. 2006. Report to the Alaska Board of Fisheries for the recreational fisheries of Bristol Bay, 2004, 2005, and 2006. Alaska Department of Fish and Game, Special Publication No. 06-29, Anchorage.

The Alaska Department of Fish and Game (ADF&G) administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act (ADA) of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility please write:

ADF&G ADA Coordinator, P.O. Box 115526, Juneau AK 99811-5526

U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington VA 22203

Office of Equal Opportunity, U.S. Department of the Interior, Washington DC 20240

The department's ADA Coordinator can be reached via phone at the following numbers:

(VOICE) 907-465-6077, (Statewide Telecommunication Device for the Deaf) 1-800-478-3648, (Juneau TDD) 907-465-3646, or (FAX) 907-465-6078

For information on alternative formats and questions on this publication, please contact:

ADF&G, Sport Fish Division, Research and Technical Services, 333 Raspberry Road, Anchorage AK 99518 (907)267-2375.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	iii
LIST OF FIGURES.....	iii
ABSTRACT.....	1
MANAGEMENT AREA OVERVIEW.....	1
Management Area Description.....	1
Information Sources for Management.....	2
Sport Effort and Harvest.....	3
Management Plans and Policies.....	7
Nushagak-Mulchatna Chinook Salmon Management Plan.....	7
Kvichak River Drainage Sockeye Salmon Management Plan.....	7
Southwest Alaska Rainbow Trout Management Plan.....	7
Sustainable Salmon Fisheries Policy for Alaska.....	9
Statewide Policy and Plan for Management of Sustainable Wild Rainbow Trout Fisheries.....	9
Emergency Orders Issued in 2004-2006.....	9
Emergency Order No.: 2-RS-5-02-06.....	10
Emergency Order No.: 2-RS-5-24-06.....	10
CHINOOK SALMON FISHERIES.....	10
Area-wide Fishery Description.....	10
Area-wide Fishery Management and Objectives.....	11
Alagnak River.....	14
Fishery Description.....	14
Fishery Management and Objectives.....	15
2006 Season.....	15
Nushagak and Mulchatna Rivers.....	17
Fishery Description.....	17
Fishery Management and Objectives.....	22
2006 Season.....	23
SOCKEYE SALMON FISHERIES.....	23
Area-wide Fishery Description.....	23
Area-wide Harvest.....	23
Area-wide Management.....	24
Kvichak River.....	24
Fishery Description.....	24
Harvest and Effort.....	28
Fishery Management and Objectives.....	30
2006 Season.....	30

TABLE OF CONTENTS (Continued)

RAINBOW TROUT FISHERIES	33
Area-wide Fishery Description.....	33
Southwest Alaska Rainbow Trout Management Plan	33
Philosophy of the Plan	38
Plan Implementation.....	38
Bristol Bay Rainbow Trout Studies.....	39
Lower Talarik Creek.....	39
Fishery Description.....	39
Harvest and Effort.....	43
Fishery Management and Objectives.....	43
Upper Nushagak River	45
Fishery Description.....	45
Fishery Management and Objectives.....	45
OTHER SPECIES FISHERIES.....	46
Northern Pike.....	46
Chulitna River Drainage	46
Lake Kulik	46
ACKNOWLEDGEMENTS.....	50
REFERENCES CITED	50

LIST OF TABLES

Table		Page
1.	Sport fishing effort (angler-days), by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.....	4
2.	Sport harvest by species, Bristol Bay Sport Fish Management Area, 1977-2005.....	8
3.	Sport harvest of Chinook salmon, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.....	13
4.	Aerial Index counts of escapement, and sport effort, catch, and harvest of Chinook salmon, Alagnak River, 1970-2006.....	16
5.	Commercial, subsistence, and sport harvests, inriver return, and escapement of Chinook salmon, Nushagak River drainage, 1986-2006.....	18
6.	Historical aerial escapement counts of Chinook salmon in selected streams in the drainages of the Wood, Nushagak and Mulchatna rivers, 1967 to 2006.....	20
7.	Sport harvest of sockeye salmon, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.....	27
8.	Commercial and subsistence harvests and escapements of sockeye salmon for the Kvichak River drainage, and sport harvests of sockeye salmon from the Kvichak River, 1974-2006.....	29
9.	Expected total returns (forecasts) of Bristol Bay sockeye salmon, 2004, 2005 and 2006.....	31
10.	Sport harvest of rainbow trout, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.....	36
11.	Sport catch of rainbow trout, by fishery, in the Bristol Bay Sport Fish Management Area, 1991-2005.....	37
12.	Angler effort, catch, retention rate, and catch/angler-hour for rainbow trout, Lower Talarik Creek, 1970-1976, 1986-1987, 1990-1991, 1993-2005.....	44
13.	Sport catch of northern pike, by fishery, in the Bristol Bay Sport Fish Management Area, 1991-2005.....	47
14.	Sport harvest of northern pike, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.....	49

LIST OF FIGURES

Figure		Page
1.	Bristol Bay Sport Fish Management Area, showing the Eastern, Central, and Western sections.....	2
2.	Sport fishing effort in angler-days for the Bristol Bay Sport Fish Management Area, 1977-2005.....	5
3.	Percentage of sport fishing effort expended in the Eastern, Central, and Western sections of Bristol Bay, 1994-2004 average and 2005.....	6
4.	Popular Chinook salmon sport fisheries in the Bristol Bay Sport Fish Management Area.....	11
5.	Sport harvest of Chinook salmon, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.....	12
6.	Popular sockeye salmon sport fisheries in the Bristol Bay Sport Fish Management Area.....	25
7.	Sport harvest of sockeye salmon, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.....	26
8.	Popular rainbow trout sport fisheries in the Bristol Bay Sport Fish Management Area.....	34
9.	Sport harvest of rainbow trout, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.....	35
10.	Catch-and-release special management areas for rainbow trout.....	40
11.	Fly-only/catch-and-release special management areas for rainbow trout.....	41
12.	Unbaited single-hook artificial lure special management areas for rainbow trout.....	42

ABSTRACT

This report summarizes sport fisheries addressed in Bristol Bay proposals to the Alaska Board of Fisheries during 2006. Fisheries include Alagnak and Nushagak/Mulchatna Chinook salmon *Oncorhynchus tshawytscha*, Kvichak sockeye salmon *O. nerka*, lower Talarik Creek and upper Nushagak River rainbow trout *O. mykiss*, and northern pike *Esox lucius*. The sport fisheries are described, and estimates of sport effort, catch, and harvest, and escapement are provided. Overviews of management for each fishery are provided, such as pertinent sport fishing regulations and management plans, including the Nushagak-Mulchatna Chinook Salmon Management Plan, the Kvichak River Drainage Sockeye Salmon Management Plan, and the Southwest Alaska Rainbow Trout Management Plan.

Key words: Bristol Bay Sport Fish Management Area, Alaska Board of Fisheries, management plan, Alagnak River, Nushagak River, Mulchatna River, Chinook salmon, *Oncorhynchus tshawytscha*, Kvichak River, sockeye salmon, *Oncorhynchus nerka*, Talarik Creek, Nushagak River, rainbow trout, *Oncorhynchus mykiss*, northern pike, *Esox lucius*.

MANAGEMENT AREA OVERVIEW

MANAGEMENT AREA DESCRIPTION

The purpose of this report is to summarize sport fisheries addressed in Bristol Bay proposals to the Alaska Board of Fisheries (BOF) during 2006. The Bristol Bay Sport Fish Management Area (BBMA) is part of Sport Fish Division's Southcentral Region (Region II) and includes all waters and drainages flowing into Bristol Bay between Cape Newenham on the northwest to Cape Menshikof on the southeast (Figure 1).

The sport fisheries of this large region are more easily discussed by dividing the management area into three geographic sections: Eastern, Central, and Western (Figure 1). The sections are based on general habitat types and are somewhat arbitrary. However, for some species, particularly rainbow trout, the sections represent distinct differences in the character of the fisheries or biology of local stocks.

The Eastern Section includes all drainages from the Kvichak River to the area's southern boundary at Cape Menshikof (Figure 1). Major federal jurisdictions in the Eastern Section include the Lake Clark National Park and Preserve, Katmai National Park and Preserve, and the Becharof National Wildlife Refuge. The Central Section is composed of the drainages entering Nushagak Bay, and is dominated by the Nushagak and Wood River systems. The Wood-Tikchik State Park falls within the Central Section boundaries. The Western Section includes all drainages from Cape Constantine on the Nushagak Peninsula west to Cape Newenham and contains portions of the Togiak National Wildlife Refuge. The Togiak River is the major drainage within the section.

Major communities located within the area include Iliamna, Dillingham, King Salmon, Naknek, Togiak, Egegik and Pilot Point. The management area is not linked to the state's highway system, although local roads provide sport fishermen with limited access near the major communities. Float-equipped aircraft, and to a lesser extent boats, are commonly used to access the area's many remote fisheries.

Although the Alaska Department of Fish and Game (ADF&G) has management jurisdiction for fisheries in the BBMA, the U. S. Fish and Wildlife Service, National Park Service, and U.S. Geological Survey manage federal public lands and conduct research in the area.

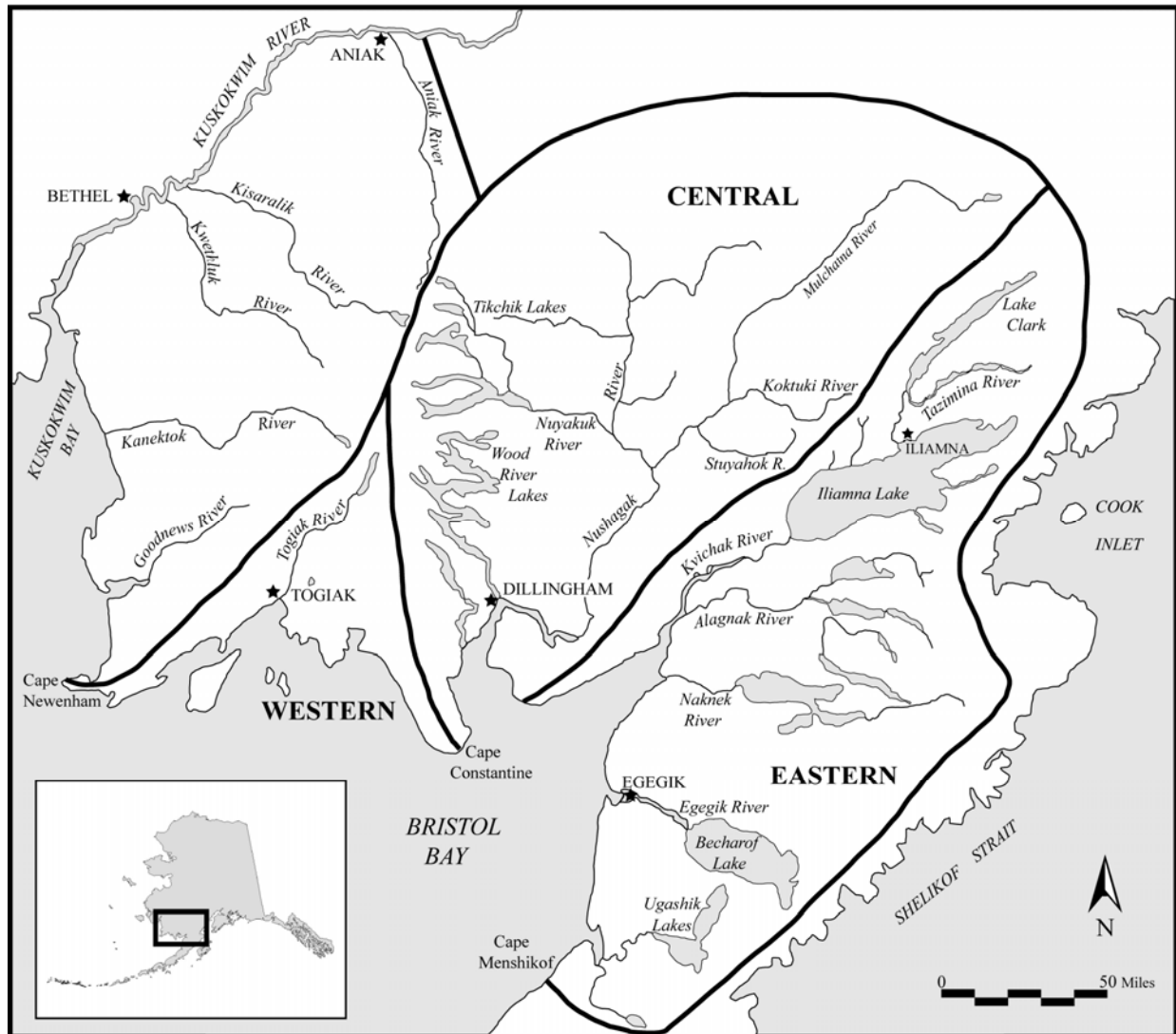


Figure 1.-Bristol Bay Sport Fish Management Area, showing the Eastern, Central, and Western sections.

INFORMATION SOURCES FOR MANAGEMENT

ADF&G utilizes several sources of information to manage fisheries in the BBMA. One of the primary means for monitoring sport fishing effort, catch and harvest is the Statewide Harvest Survey (SWHS), a mail survey (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b). This survey, begun in 1977, estimates the number of angler-days of sport fishing effort expended by anglers in Alaskan waters (residents as well as non-residents), and harvest by species. The survey provides estimates of effort and harvest on a site-by-site basis but is not designed to provide estimates of effort directed toward a single species. Beginning in 1990, the survey was modified to include estimates of catch (release plus harvest) on a site-by-site basis. The BBMA includes portions of three areas defined in the SWHS: a portion of the Naknek River Drainage-Alaska Peninsula

Area (Area R) excluding the saltwater fisheries and freshwater fisheries of Cold Bay and the Aleutian Islands, the Kvichak area (Area S), and the Nushagak area (Area T).

Creel surveys have been selectively used to ground-truth the SWHS for fisheries of interest or for fisheries that require more detailed information or inseason management. These include the Alagnak River (Brookover 1989; Dunaway 1990, 1994; Naughton and Gryska 2000; Collins and Dye 2003), the Kvichak River in 1995 (Dunaway and Fleischman 1996), and lower Talarik Creek (Russell 1977; Minard 1990; Minard et al. 1992; and unpublished data¹).

Sport Fish Division also conducts stock assessment projects. For example, on the Nushagak and Mulchatna rivers significant monitoring and stock assessment projects have been conducted intermittently since 1986 (Minard 1987; Minard and Brookover 1988; Dunaway et al. 1991; Dunaway and Bingham 1992; Dunaway and Fleischman 1995; Minard et al. 1998; Dye 2005; Cappiello and Dye *In Prep.*) and on lower Talarik Creek (Russell 1977; Minard 1990; Minard et al. 1992; and unpublished data¹).

Commercial and subsistence harvests of salmon are monitored and reported by the Commercial Fisheries Division (Westing et al. 2006). For larger fisheries, forecasts of each season's return are provided by the Commercial Fisheries Division and are reported in a statewide salmon forecast summary (Westing et al. 2005, 2006, *In prep.*).

Escapements of some salmon stocks are monitored. At the Kvichak River, escapement is estimated by counts made from towers as the salmon migrate upriver (Westing et al. 2005, 2006, *In prep.*). In 2005 and 2006, aerial index surveys of Chinook salmon in the Nushagak, Togiak, Alagnak and Naknek River drainages were conducted.

SPORT EFFORT AND HARVEST

The BBMA contains some of the most productive Pacific salmon *Oncorhynchus sp.*, rainbow trout *O. mykiss*, Arctic grayling *Thymallus arcticus*, Arctic char *Salvelinus alpinus*, and Dolly Varden *S. malma* waters in the world. The area has been acclaimed for its sport fisheries since the 1930s.

Sport effort in the BBMA increased from about 25,000 angler days in 1977 to a peak of more than 116,000 angler days in 1995 (Table 1). From 2000-2004, effort averaged nearly 96,000 angler-days annually (Figure 2). Effort during 2005 was 98,038 angler days. Sport effort is expected to stabilize or slowly increase during the foreseeable future.

Historically, more than 60% of the effort occurred in the waters of the Eastern Section of the BBMA (Table 1). Although the Eastern Section effort still dominates, the percentage has declined slightly with the growth of fisheries in the Central Section (Table 1, Figure 3). The Eastern Section accounted for 59% of the total effort from 1994 through 2004. The Central Section typically accounts for the second largest proportion of effort, followed by the Western Section. Distribution of effort among sections during 2005 was similar to other recent seasons (Figure 3).

¹ Memos summarizing the Lower Talarik Creek rainbow trout projects; located at Alaska Department of Fish and Game, Division of Sport Fish, Dillingham. 1997 data from J. Dye, dated October 15, 1997, Dillingham; 1998 data from C. Schwanke, dated December 1, 1998; 1999 data from J. Dye to Bob Clark, dated November 15, 2000; 2000 data from J. Dye and M. Cavin to Bob Clark, dated November 15, 2000; 2001 data from J. Dye to Bob Clark, dated January 2002; 2003 data from C. Collins to James Hasbrouck, dated August 12, 2004; 2004 data from T. Jaecks to James Hasbrouck, dated January 23, 2005.

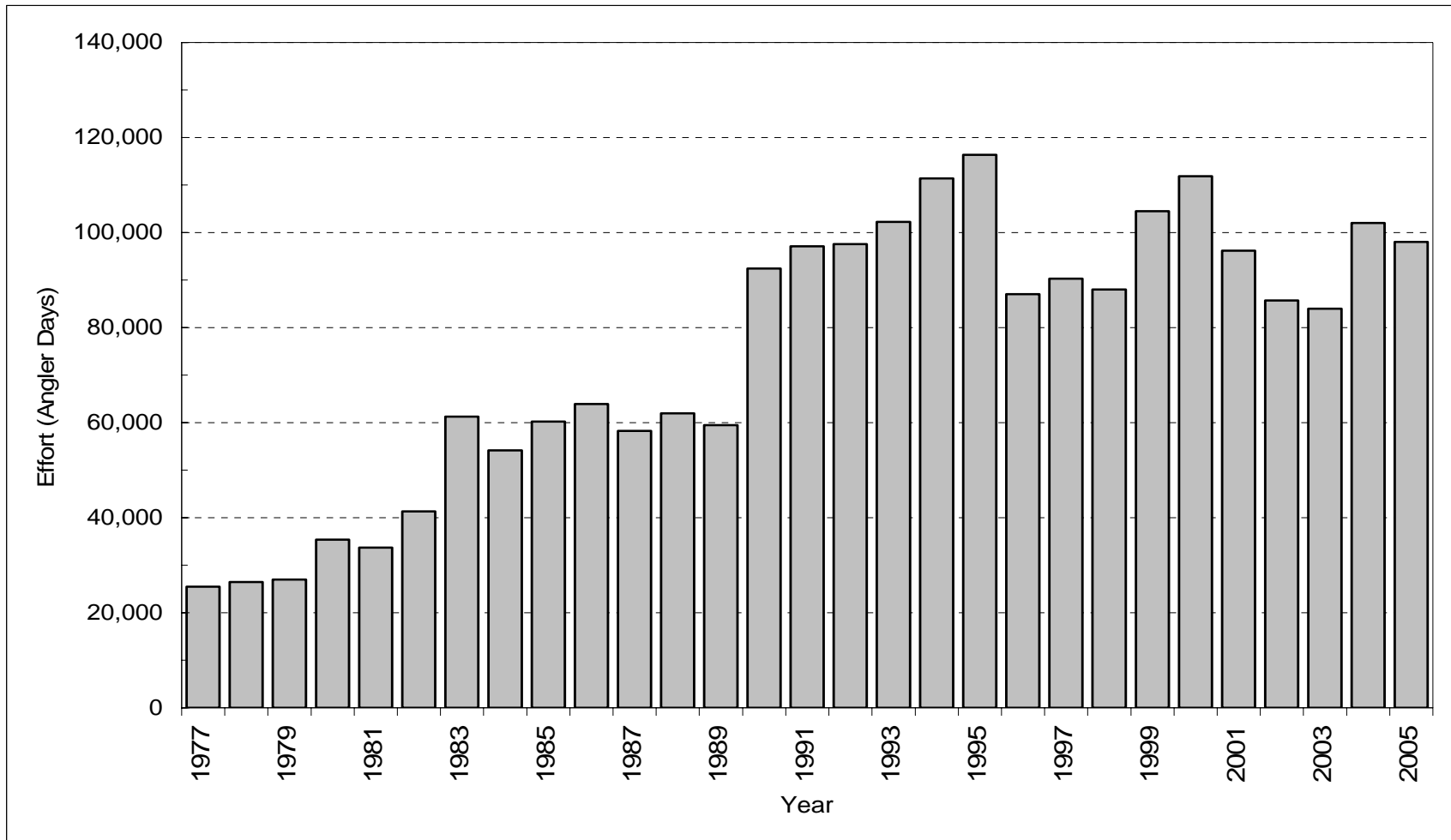
Table 1.-Sport fishing effort (angler-days), by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.	12,794	12,005	16,738	11,971	13,673	13,988	21,189	22,529	12,401	21,020	13,398	16,956	17,261	12,699
Brooks R.	3,029	4,566	4,047	3,784	3,971	2,916	1,418	3,227	3,226	3,381	2,027	3,317	3,036	1,945
Kvichak R.	2,697	5,796	5,411	4,484	3,947	3,339	5,095	7,365	4,763	5,313	5,380	4,219	5,408	5,463
Copper R.	1,395	4,324	2,820	1,558	2,782	2,191	3,359	2,194	2,134	2,485	2,271	1,349	2,087	1,082
Alagnak R.	4,863	10,949	13,232	8,121	11,062	7,715	6,411	7,589	8,576	10,614	9,956	9,028	9,153	11,228
Newhalen R.	4,198	5,790	6,392	3,037	3,773	3,506	5,178	3,063	3,337	1,556	1,959	1,842	2,351	1,273
Lake Clark	2,567	3,084	4,148	1,003	3,132	1,462	2,331	1,429	4,328	1,985	1,472	2,886	2,420	1,244
Other	<u>5,839</u>	<u>21,322</u>	<u>20,991</u>	<u>15,849</u>	<u>17,771</u>	<u>16,872</u>	<u>22,917</u>	<u>20,930</u>	<u>15,137</u>	<u>4,160</u>	<u>7,289</u>	<u>17,216</u>	<u>12,946</u>	<u>14,083</u>
Subtotal ^a	40,914	67,836	73,779	49,807	60,111	51,989	67,898	68,326	53,902	50,514	43,752	56,813	54,661	49,017
Central														
Nushagak	5,116	15,460	16,410	15,034	8,866	15,933	15,028	16,150	14,040	13,396	16,834	18,869	15,858	17,841
Mulchatna	3,003	4,708	4,484	3,806	2,356	3,145	2,642	2,306	3,761	2,807	3,706	2,218	2,960	3,071
Agulowak					1,389	1,434	2,028	2,469	2,311	2,712	2,012	2,712	2,443	4,094
Agulukpak					1,384	923	1,102	1,402	1,437	1,225	688	1,473	1,245	1,406
Wood River L. ^b	4,678	12,144	9,022	7,366	4,918	3,653	5,678	8,885	6,685	6,988	8,866	8,884	8,062	10,547
Tikchik/Nuyakuk	1,980	3,306	2,804	2,341	2,380	1,722	1,899	1,826	2,619	2,433	2,433	2,899	2,442	2,001
Other	<u>2,106</u>	<u>5,151</u>	<u>4,811</u>	<u>4,916</u>	<u>5,908</u>	<u>3,886</u>	<u>4,043</u>	<u>5,637</u>	<u>6,297</u>	<u>1,193</u>	<u>1,215</u>	<u>3,693</u>	<u>3,607</u>	<u>3,789</u>
Subtotal ^a	16,292	40,769	37,531	33,463	27,201	30,696	32,420	38,675	37,150	30,754	35,754	38,774	36,221	42,749
Western														
Togiak	1,351	2,361	3,384	3,535	2,943	5,206	4,059	4,700	4,931	4,340	4,380	6,249	4,920	6,235
Other	<u>375</u>	<u>449</u>	<u>1,689</u>	<u>223</u>	<u>59</u>	<u>162</u>	<u>153</u>	<u>137</u>	<u>187</u>	<u>108</u>	<u>108</u>	<u>160</u>	<u>140</u>	<u>37</u>
Subtotal ^a	1,726	2,810	5,073	3,758	3,002	5,368	4,212	4,837	5,118	4,448	4,488	6,409	5,060	6,272
Total	58,932	111,415	116,383	87,028	90,314	88,053	104,530	111,838	96,170	85,716	83,994	101,996	95,943	98,038

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

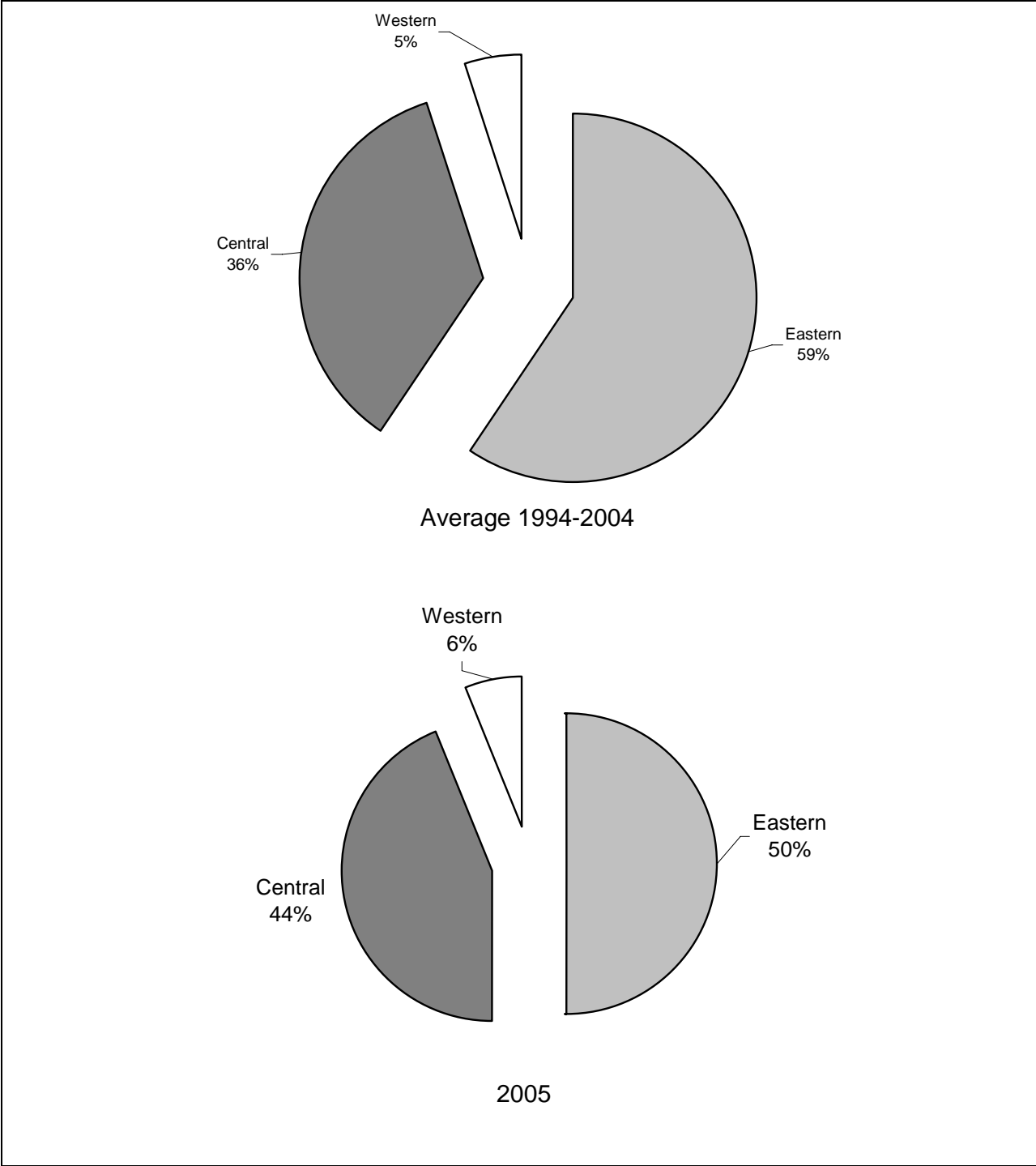
^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.



Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

Figure 2.-Sport fishing effort in angler-days for the Bristol Bay Sport Fish Management Area, 1977-2005.



Source: Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

Figure 3.-Percentage of sport fishing effort expended in the Eastern, Central, and Western sections of Bristol Bay, 1994-2004 average and 2005.

Sockeye *O. nerka*, Chinook *O. tshawytscha* and coho *O. kisutch* salmon are the most popular species harvested in the BBMA, with fewer Dolly Varden/Arctic char, Arctic grayling, and rainbow trout being taken annually (Table 2). The apparent decline in harvests of non-salmon species is likely due in part to the increasingly accepted catch-and-release ethic among sport anglers as well as bag limit reductions for Dolly Varden/Arctic char, northern pike *Esox lucius*, and Arctic grayling adopted by the BOF in 1997 and 2001.

MANAGEMENT PLANS AND POLICIES

The following section is a list of the various management plans adopted or implemented by the BOF that guide the department's management of Bristol Bay sport fisheries. For those plans specifically adopted as a regulation, the Alaska Administrative Code (AAC) is provided. Additional information is provided later in the pertinent fishery sections. There are other management plans that address commercial salmon fisheries that do not directly address sport fisheries management, but may affect sport fisheries to some extent. These plans are more fully discussed under the specific sport fishery where such plans may be a factor.

Nushagak-Mulchatna Chinook Salmon Management Plan

Management of the subsistence, commercial, and sport fisheries for Nushagak Chinook salmon stocks is governed by the Nushagak-Mulchatna Chinook Salmon Management Plan (5 AAC 06.361). The plan was first adopted by the BOF in January 1992 and most recently modified during the December 2003 meeting.

Kvichak River Drainage Sockeye Salmon Management Plan

To ensure biological spawning escapement requirements of sockeye salmon into the Kvichak River drainage, the BOF adopted the Kvichak River Drainage Sockeye Salmon Management Plan (5 AAC 67.025) during the January 2001 meeting. The impetus for this plan was the poor sockeye salmon returns of 1999 and 2000. This is an inriver plan that addresses sport and subsistence fisheries only.

Southwest Alaska Rainbow Trout Management Plan

In February 1990, the BOF overhauled nearly all regulations for rainbow trout fisheries in the two management areas now known as the Bristol Bay Management Area and Kuskokwim-Goodnews Sport Fish Management Area. The new regulations essentially implemented the Southwest Alaska Rainbow Trout Management Plan without adopting the plan's language into regulation. However, the BOF recognized the plan as a guiding policy to achieve and maintain a more orderly and comprehensive mix of rainbow trout angling opportunities throughout the two areas. The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management (ADF&G 1990). In 1998 the BOF adopted Criteria for Establishing Special Management Areas for Trout (5 AAC 75.013; subsequently amended as 5 AAC 75.210). This regulation embodies most of the criteria that originated and are still used in the Southwest Alaska Rainbow Trout Management Plan.

Table 2.-Sport harvest by species, Bristol Bay Sport Fish Management Area, 1977-2005.

Species	1977-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Sockeye Salmon	10,572	20,413	20,250	12,752	16,690	24,477	19,048	18,975	11,887	8,153	10,375	12,048	12,288	11,771
Chinook Salmon	9,008	19,333	12,687	13,043	14,196	16,029	9,031	9,903	10,427	6,826	10,077	13,102	10,067	13,076
Coho Salmon	6,738	10,608	8,229	19,797	14,151	10,606	10,534	11,946	11,590	12,445	14,098	17,977	13,611	12,447
Dolly Varden / Arctic Char	6,044	5,970	5,065	7,966	10,069	5,075	3,893	4,373	3,868	3,016	3,548	6,268	4,215	2,177
Rainbow Trout	5,088	3,122	2,702	3,760	4,385	2,484	2,792	1,977	1,383	1,384	1,455	1,932	1,626	1,902
Arctic Grayling	4,831	5,971	3,775	4,508	6,879	4,686	3,085	2,352	2,815	2,173	1,955	3,010	2,461	839
Pink Salmon	1,335	669	310	1,887	351	1,367	248	804	633	2,046	469	3,138	1,418	550
Lake Trout	1,393	2,075	936	1,314	1,709	662	1,232	677	691	708	1,094	1,289	892	1,309
Chum Salmon	1,421	2,934	1,917	2,844	1,973	3,039	3,380	3,273	2,047	1,544	1,828	1,848	2,108	2,703
Northern Pike	1,290	2,427	1,803	2,733	1,136	1,815	1,391	1,009	1,315	1,067	1,456	1,751	1,320	1,626
Total	47,719	73,522	57,674	70,604	71,539	70,240	54,634	55,289	46,656	39,362	46,355	62,363	50,005	48,400

∞

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

Sustainable Salmon Fisheries Policy for Alaska

In March 2000, the BOF adopted the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), that became an integral part of the BOF's yearly review of the state's salmon fisheries. The policy contains five fundamental principles for sustainable salmon management, each with criteria that are to be used by the department and the BOF to evaluate the health of the state's salmon fisheries and address any conservation issues and problems as they arise. The five fundamental principles of the policy are:

- Wild salmon populations and their habitats must be protected to maintain resource productivity;
- Fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning;
- Effective salmon management systems should be established and applied to regulate human activities that affect salmon;
- Public support and involvement for sustained use and protection of salmon resources must be maintained;
- In the face of uncertainty, salmon stocks, fisheries, artificial propagation and essential habitats must be managed conservatively.

The policy requires that the department describe the extent to which salmon fisheries and their habitats conform to explicit principles and criteria. In response to these reports the BOF must review fishery management plans or create new ones. If a salmon stock concern is identified in the course of this review, the management plan will contain measures to address the concern, including needed research, habitat improvements, or new regulations.

Statewide Policy and Plan for Management of Sustainable Wild Rainbow Trout Fisheries

The BOF adopted the Policy for the Management of Sustainable Wild Trout Fisheries (5 AAC 75.222), and Statewide Management Standards for Wild Trout (5 AAC 75.220) in March 2003. The policy provides principles and criteria to ensure conservation, sustainability, and optimal sustained yield and benefits for wild trout, and provides direction to the BOF and the department as to how those principles and criteria are to be applied in the regulatory process. The plan ensures conservative management of wild trout fisheries while recognizing existing plans and policies that guide management of wild trout on a regional basis.

In most areas of the state, conservative management for wild rainbow trout, cutthroat trout, and steelhead trout, in combination, means a bag and possession limit of two fish, of which only one may be 20 inches or greater in length, with an annual limit of two fish 20 inches or greater in length. The plan recognizes existing plans and policies that guide management of wild trout on a regional basis, and allows the Board to adopt regulations that deviate from the plan as necessary to address sustainability or optimal sustained yield issues, establish special management areas, or liberalize harvest opportunities in specific water bodies under other criteria.

EMERGENCY ORDERS ISSUED IN 2004-2006

There were no emergency orders issued in 2004 or 2005. In 2006, two emergency orders were issued.

Emergency Order No.: 2-RS-5-02-06

Issued March 7, 2006

Effective Date 12:01 a.m., Wednesday, March 8, 2006

Expiration Date 11:59 p.m., Sunday, December 31, 2006

Unless superseded by subsequent Emergency Order

This emergency order reduced the daily bag and possession limit sockeye salmon from five fish per day to two fish per day in all waters of the Kvichak River drainage upstream of its confluence with the Alagnak River (Branch River). In addition, this emergency order closed sport fishing for sockeye salmon in four areas of the Kvichak River drainage to eliminate the potential for conflict between sport and subsistence fisheries.

Emergency Order No.: 2-RS-5-24-06

Issued September 5, 2002

Effective Date 12:01 AM Tuesday July 11, 2006

Expiration Date 11:59 PM Sunday, December 31, 2006

Unless superseded by subsequent Emergency Order

This emergency order rescinded Emergency Order No. **2-RS-5-02-06** that reduced the daily bag and possession limit sockeye salmon from five fish per day to two fish per day in all waters of the Kvichak River drainage upstream of its confluence with the Alagnak River (Branch River). In addition, this emergency order reopened sport fishing for sockeye salmon in four areas of the Kvichak River drainage that were closed to eliminate the potential for conflict between sport and subsistence fisheries.

CHINOOK SALMON FISHERIES

AREA-WIDE FISHERY DESCRIPTION

Bristol Bay is home to several world-class Chinook salmon sport fisheries. The peak of the sport Chinook salmon fishery occurs from mid-June to mid-July in the lower reaches of the Alagnak, Nushagak, Naknek, and Togiak rivers, as well as several smaller rivers (Figure 4). Chinook salmon stocks throughout the management area significantly increased in abundance from the late 1970s through the early 1980s. From about 1984 through the 1990s, Chinook salmon abundance in Bristol Bay returned to previous levels.

The Chinook salmon sport fisheries of the area, like the sport fisheries for most species, are fished primarily by guided anglers. With few exceptions, the guided to unguided angler ratio is about 3 to 1. Anglers usually keep less than 50% of the fish they catch, especially since the adoption of area-wide annual bag limits (see management section below).

Sport fishing harvests of Chinook salmon have loosely followed the trends in abundance, reaching peaks of 17,404 fish in 1987 and 17,544 fish in 1994 (Figure 5). Chinook salmon typically account for approximately 20-30% of the sport salmon harvest in Bristol Bay. The 2000 through 2004 sport harvest estimate averaged slightly more than 10,000 Chinook salmon (Table 3). The 2005 sport harvest for the whole Bristol Bay area was 13,076 fish. The 2005 commercial harvest was 75,569 fish and the subsistence harvest was 15,628 fish (Westing et al.

2006). The 2005 sport harvest was about 11% of the total Bristol Bay Chinook salmon harvest, which is similar to the 1995 through 2004 average.

AREA-WIDE FISHERY MANAGEMENT AND OBJECTIVES

Since 1960, bag limits for Chinook salmon in Bristol Bay, and across Alaska, have become increasingly conservative and complex. The most conservative and sweeping regulatory changes to the area's Chinook salmon fisheries were adopted during the November and December 1997 BOF meetings. A Bristol Bay-wide annual limit of five Chinook salmon was adopted, and in the Nushagak River drainage, anglers were further restricted to an annual limit of four Chinook salmon. The daily bag limits in several other major fisheries were reduced slightly. Season closures of July 25 or 31 were adopted for all Bristol Bay waters to protect spawning Chinook salmon.

In 2001, a statewide regulation (5 AAC 67.010 (b)) created a daily bag and possession limit for Chinook salmon under 20 inches of 10 per day in all fresh waters open to Chinook salmon sport fishing, except for the Nushagak River drainage. The limit is in addition to the daily limits for

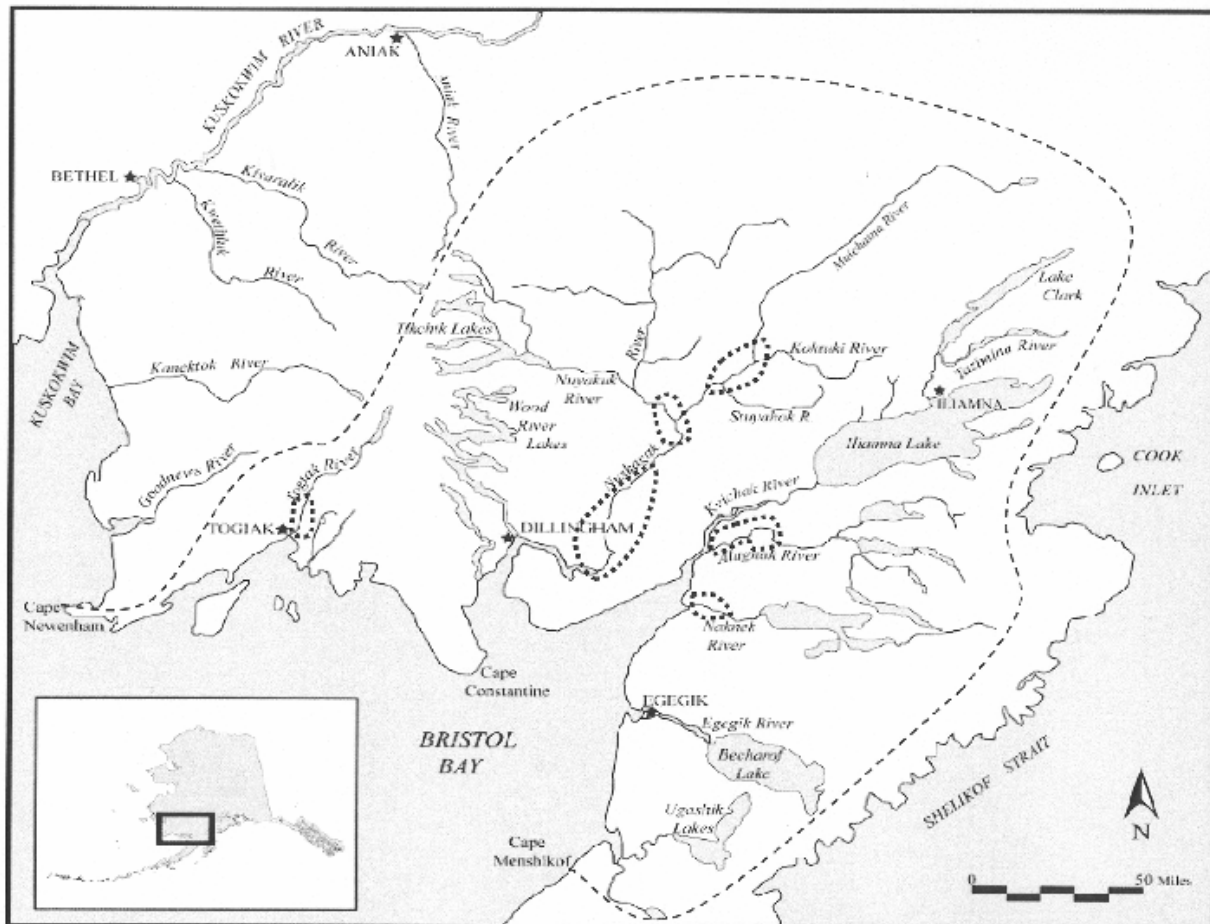
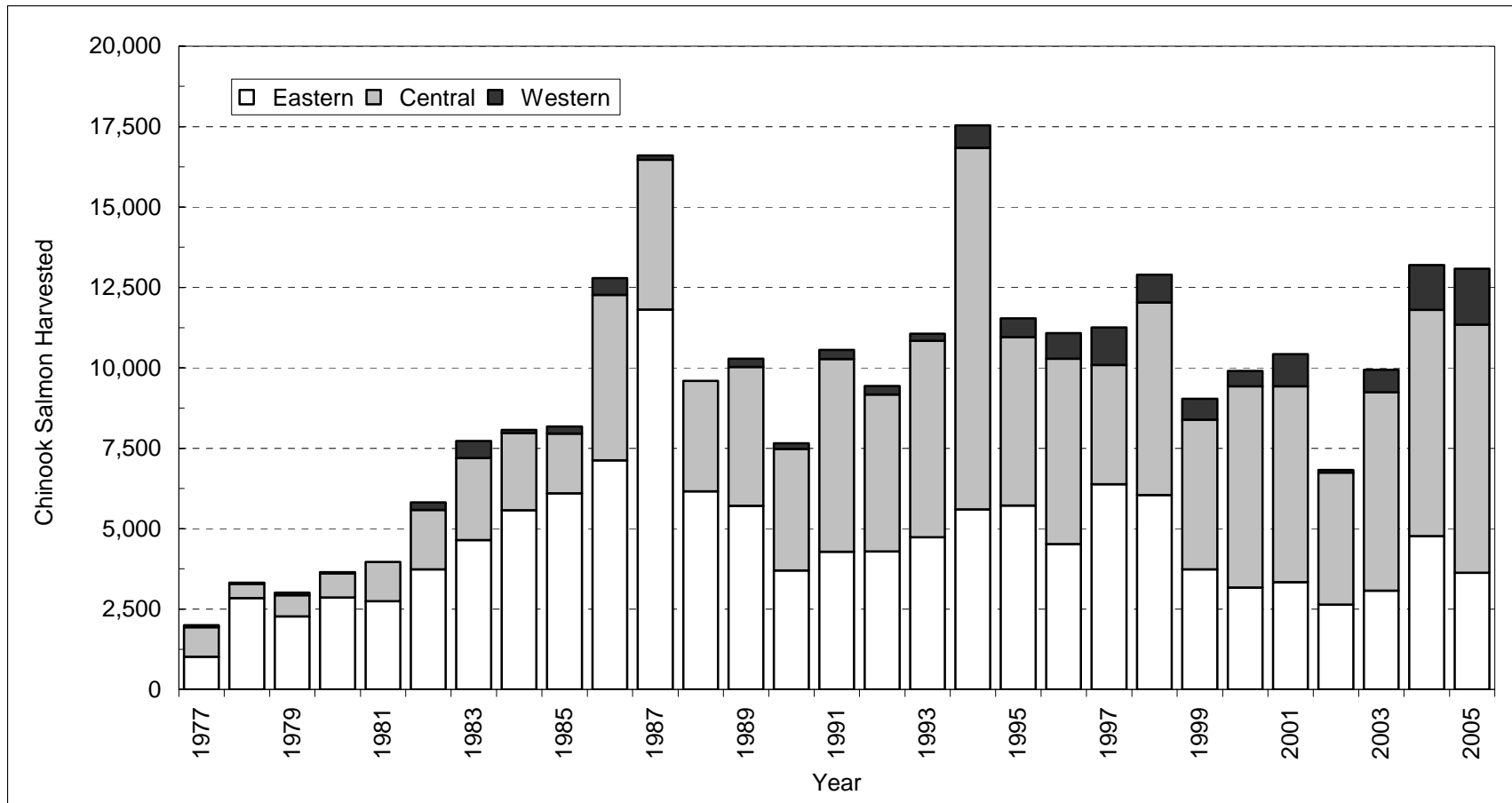


Figure 4.-Popular Chinook salmon sport fisheries in the Bristol Bay Sport Fish Management Area.



Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

Figure 5.-Sport harvest of Chinook salmon, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.

Table 3.-Sport harvest of Chinook salmon, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.	3,462	3,692	4,153	2,984	4,231	3,443	2,697	2,105	2,656	2,170	2,412	3,004	2,469	2,140
Brooks R.	10	0	19	0	12	0	0	0	0	0	0	0	0	0
Kvichak R.	146	90	175	107	47	239	0	167	61	18	183	27	91	217
Copper R.	19	0	9	43	0	17	22	20	0	0	0	27	9	0
Alagnak R.	665	1,048	891	931	982	1,531	592	501	508	305	334	1,146	559	1,008
Newhalen R.	3	30	9	0	0	0	0	0	0	0	0	13	3	0
Lake Clark	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	<u>241</u>	<u>739</u>	<u>461</u>	<u>459</u>	<u>1,110</u>	<u>813</u>	<u>423</u>	<u>379</u>	<u>109</u>	<u>140</u>	<u>144</u>	<u>557</u>	<u>266</u>	<u>267</u>
Subtotal ^a	4,423	5,599	5,717	4,524	6,382	6,043	3,734	3,172	3,334	2,633	3,073	4,774	3,397	3,632
Central														
Nushagak	1,761	8,871	4,476	4,691	3,343	5,350	3,894	5,785	5,623	3,693	5,590	6,773	5,493	7,399
Mulchatna	863	1,675	402	644	154	265	262	200	221	191	317	40	194	134
Agulowak					0	0	30	0	0	0	0	0	0	0
Agulukpak					0	30	25	0	0	0	0	0	0	0
Wood River L. ^b	70	435	93	85	23	57	58	0	208	104	186	87	117	15
Tikchik/Nuyakuk	33	60	73	11	0	170	12	0	25	58	48	93	45	61
Other	<u>175</u>	<u>201</u>	<u>193</u>	<u>332</u>	<u>186</u>	<u>120</u>	<u>372</u>	<u>268</u>	<u>12</u>	<u>68</u>	<u>21</u>	<u>40</u>	<u>82</u>	<u>101</u>
Subtotal ^a	2,862	11,242	5,237	5,763	3,706	5,992	4,653	6,253	6,089	4,114	6,162	7,033	5,930	7,710
Western														
Togiak drainage	175	663	581	790	1,165	763	644	478	1,004	76	706	1,388	730	1,734
Other	<u>4</u>	<u>40</u>	<u>9</u>	<u>0</u>	<u>0</u>	<u>130</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal ^a	177	703	590	790	1,165	893	644	478	1,004	76	706	1,388	730	1,734
Total		17,544	11,544	11,077	11,253	12,928	9,031	9,903	10,427	6,823	9,941	13,195	10,058	13,076

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Chinook salmon 20 inches or longer. Chinook under 20 inches do not count toward the annual limit of four and are in addition to the daily bag limit for Chinook salmon 20 inches or longer. The sole exception is the Nushagak River which has a daily bag and possession limit of five Chinook salmon under 20 inches per day.

In the drainages of the Alagnak, Egegik, Kvichak, Igushik, Naknek, Snake, and Ugashik rivers, the daily bag and possession limits for Chinook salmon are uniform at three per day, one of which may exceed 28 inches in length (5 AAC 67.020. (1)). Additionally, recent changes were made to Chinook salmon fisheries regulations including the Nushagak-Mulchatna Chinook Salmon Management Plan, harvest limits in the Wood River drainage, and waters open to fishing in Big Creek in the Naknek River drainage.

Anglers are prohibited from removing a Chinook salmon from the water before releasing the fish in all fresh waters of Bristol Bay. Any Chinook salmon removed from the water must be kept and becomes part of an angler’s daily bag limit. The goal of this regulation is to improve the potential survival of released Chinook salmon and to encourage anglers to be more careful with the fish they release.

The following is a chronology of the bag limit regulatory changes affecting Chinook salmon sport fisheries in all drainages of Bristol Bay.

Effective Year	Regulation
1965	10 salmon (all species combined) per day, no size limit
1972	5 Chinook per day, only 2 may be over 26 inches
1976	5 Chinook per day, only 2 may be over 28 inches
1988	3 Chinook per day, only 2 may be over 28 inches
1998	Daily bag and possession limits on several waters reduced to 3 per day, only 2 over 28 inches. Annual limit of 5 Chinook salmon. Spawning closures for all waters.
2001	Daily bag and possession limits on most Eastern and most Central section waters (except Nushagak and Wood River drainages) reduced to 3 per day, <u>only 1</u> over 28 inches. All waters except Nushagak drainage allow harvest of 10/day under 20 inches. All fish released must remain in the water from Cape Menshikof to Cape Constantine.
2003	All fish released must remain in the water from Cape Menshikof to Cape Pierce. Harvest of 5/day under 20 inches allowed in the Nushagak drainage.

ALAGNAK RIVER

Fishery Description

The Alagnak River, known locally as the Branch River, is located in the Kvichak River drainage approximately 40 miles north of the community of King Salmon. The Alagnak’s proximity to the community of King Salmon makes it an attractive alternative to fishing the more crowded Naknek River. In addition, it is the closest Chinook fishery for many of the lodges based at Iliamna Lake, which has few spawning Chinook. The Chinook salmon fishery in the Alagnak River occurs mainly in the lower 15 miles of the river and peaks in mid to late July, roughly 2 weeks later than other Chinook salmon fisheries in the area (Dunaway 1994). Effort is primarily guided (80%), with nonresidents comprising the majority of anglers (more than 90%) (Dunaway 1990, 1994; Naughton and Gryska 2000; Collins and Dye 2003). Most anglers fly in with float-

equipped aircraft for 1-day trips, or base out of one of the four lodges located along the lower half of the river. Anglers keep only about 20% of the Chinook salmon they catch.

The largest estimated annual harvest of sport caught Chinook salmon from the Alagnak River was 1,969 fish in 1987 (Mills 1988; Table 4). The 2001-2004 average harvest was 559 fish, and harvest in 2005 was 1,008 fish.

Fishery Management and Objectives

A minimum sustainable escapement goal (SEG) of 2,700 was recommended by the Bristol Bay escapement goal committee in 2003, with a desire to maintain an average escapement index of 5,000 fish (Fair et al. 2004). Aerial survey escapement index counts averaged 5,281 fish from 2000 through 2004. Aerial survey escapement index counts were 5,084 in 2005 and 4,278 in 2006 (Table 4).

Terminal tackle in this river system was restricted to single-hook artificial lures only by the BOF in 1990 to protect rainbow trout.

Commercial and subsistence harvests are monitored by the Commercial Fisheries Division and are reported in their Annual Management Report series (Westing et al. 2006). Commercial harvests are generally reported for the Naknek/Kvichak district, which is a mixed-stock fishery composed of Kvichak, Naknek, and Alagnak River stocks. During the winter of 2005 the BOF created the Alagnak River Special Harvest Area (ARSHA), which allowed commercial set net fishing in the lower Alagnak River. In 2006 the BOF expanded the fishery to include drift gear. These actions were in response to unusually large sockeye salmon escapements in the drainage, and restricted commercial fishing in the Naknek/Kvichak district due to low escapements to the Kvichak River. It is not possible to separate the commercial harvests by river of origin for fishing that occurs in the districts, however numbers are available for the ARSHA. In 2005 and 2006, the reported harvest was 209 and 68 Chinook salmon, respectively, for the ARSHA.

The department's management concerns for Chinook stocks of the Alagnak River drainage are centered on our inability to estimate total exploitation rates. Allocation of commercial catches from the Naknek/Kvichak district to the river of origin is not possible, and the lack of inseason assessment of escapement makes it difficult to manage this stock. Run timing of Chinook stocks to the Alagnak coincides with peak periods of commercial sockeye salmon fishing in the Naknek/Kvichak district. When sockeye returns are sufficient to allow for liberal fishing schedules, the potential for substantial incidental harvest of the Alagnak Chinook salmon stocks exists. Conversely, when commercial fishing is limited in the district incidental harvest of Chinook salmon may decrease.

2006 Season

An average return of Chinook salmon was expected to the Alagnak River drainage in 2006 based on parent-year returns and the stock's performance in recent years. An aerial survey conducted in August counted 4,278 Chinook salmon within the drainage index areas which was below the 1970 through 2005 average of approximately 5,000 fish. Information from the public indicated that angling success in the sport fishery was average.

Table 4.-Aerial Index counts of escapement, and sport effort, catch, and harvest of Chinook salmon, Alagnak River, 1970-2006.

Year	Index Count ^a	Total Effort ^b	Catch ^b	Harvest ^b
1970	5,250			
1971	1,475			
1972	2,256			
1973	824			
1974	1,596			
1975	6,620			
1976	7,593			
1977	9,425			
1978	11,650			
1979				
1980	2,930			
1981	2,430	1,947		97
1982	3,400	2,252		220
1983	2,980	2,348		252
1984	6,090	5,119		661
1985	3,920	2,473		757
1986	3,090	7,628		680
1987	2,420	4,786		1,969
1988	4,600	1,182		93
1989	3,650	2,717		959
1990	1,720	6,571		474
1991	2,531	6,079	3,224	790
1992	3,042	12,323	7,636	1,160
1993	10,170	12,440	14,097	1,515
1994	8,480	10,949	1,884	1,048
1995	6,860	13,232	3,916	891
1996	9,885	8,121	4,899	931
1997	15,210	11,062	5,573	982
1998	4,148	7,715	9,087	1,531
1999	2,178	6,411	1,780	592
2000 ^c	2,220	7,589	1,765	501
2001 ^d	5,458	4,391	2,440	508
2002 ^e	3,765	7,886	4,404	305
2003 ^f	8,209	9,956	2,555	334
2004 ^e	6,755	8,267	6,600	1,146
2000-2004 Average	5,281	7,618	3,553	559
2005 ^g	5,084	11,228	6,526	1,008
2006 ^g	4,278	not available	not available	not available

^a Aerial maximum index counts, from Westing et al. 2006, Appendix Table 7. 2006 data from S. P. Morstad, Commercial Fisheries Biologist, ADF&G, King Salmon, AK; personal communication.

^b Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b. Effort is for all species.

^c Limited commercial fishing in the Kvichak District until 3 July, then fishing in the Naknek River Special Harvest Area for remainder of season.

^d Limited set net commercial fishing in the Kvichak district until 24 June, then fishing in the Naknek River Special Harvest Area for remainder of season.

^e No commercial fishing within the Kvichak District during the season.

^f Limited set net commercial fishing in the Kvichak district until 4 July, then fishing in the Naknek River.

^g Majority of commercial fishing in the Naknek River and some in the Alagnak River Special Harvest Area.

NUSHAGAK AND MULCHATNA RIVERS

Fishery Description

The Nushagak drainage supports the largest sport, commercial, and subsistence fisheries for Chinook salmon in the BBMA (Tables 3 and 5).

Sport fishing effort is concentrated in three areas (Figure 4): the lower Nushagak River near the village of Portage Creek, the middle section of the Nushagak River in the vicinity of the village of Ekwok, and the mid-section of the Mulchatna River between the Stuyahok and Koktuli rivers. Between 1992-1997, effort in the Ekwok area was highly variable. Since about 1999, the lower river fishery has begun to expand steadily upriver to Ekwok and the two areas are merging into a single, extended fishery. In addition, angling activity is increasing from the outlet of the Mulchatna River up to the village of Koliganek. Angling for Chinook salmon in the middle section of the Mulchatna River seems to have diminished since bait was prohibited there in 1992. Although sport fishing for Chinook salmon does occur in some of the tributaries of the drainage, the overall impact of that activity, in terms of harvest, is considered slight.

Uplands along much of the Nushagak River are privately owned. The Land Department of Choggiung Limited, an Alaska Native-owned corporation, administers a recreational land management program. Since its inception in the mid-1980s, this program has grown to include the lands of the adjoining villages of Ekwok, New Stuyahok and, in some years, Koliganek. This system has matured into a sound and profitable venture for the corporations. Private and commercial land-use permits sold by the program allow anglers access to desirable campsites while engaged in recreational fishing and hunting.

Chinook salmon stocks in the Nushagak/Mulchatna drainage are considered stable and above average levels, including the 2004, 2005, and 2006 returns. Total runs of Nushagak/Mulchatna Chinook salmon averaged 145,794 fish from 1986 to 2005, ranging from 75,000 to 241,000 fish (Table 5).

Chinook salmon escapement into the Nushagak and Mulchatna rivers was estimated by aerial surveys beginning in 1967 (Table 6). Starting in 1987, side scan sonar was used to estimate the inriver return of Chinook salmon to the Nushagak drainage. The sonar is considered a marked improvement over the aerial survey program since it gives real-time estimates of escapement on which management decisions can be based. In 1997, the sonar apparently underestimated the Chinook salmon escapement by half. This was evidenced by aerial survey escapement estimates of between 80,000 and 85,000 fish, compared to the sonar estimate of only 40,700 Chinook salmon (Regnart et al. 1998). To address this issue in 1997 and 1998, the Commercial Fisheries Division conducted an extensive test-netting program across the full width of the river at the sonar site. Results of the test net project showed clearly that the sonar counter does not count a significant number of Chinook salmon (Miller 1999). Test netting in 1999, when water levels were lower than the test period in 1998, produced the same results (Miller 2000). Based on only 3 years of data, it appears that the sonar counts of Chinook salmon are significant underestimates of the number of Chinook salmon returning to the Nushagak. However, if data from these 3 years are representative, the counts may be a consistent index of the escapement (Miller 2000).

Table 5.-Commercial, subsistence, and sport harvests, inriver return, and escapement of Chinook salmon, Nushagak River drainage, 1986-2006.

Year	Total Run	Harvests Below Sonar				Inriver Sonar estimate	Harvests Above Sonar		Spawning Escapement	
		Commercial Harvest ^a	Commercial Subsistence Removals ^b	Subsistence Harvest ^c	Sport Harvest ^d		Subsistence Harvest ^e	Sport Harvest ^f	Sonar Estimate ^g	Aerial Survey Estimate ^h
1986	117,478	65,783	798	6,834	628	43,434	4,725	4,162	34,547	
1987	139,814	45,983	318	7,919	1,286	84,309	3,139	3,173	77,997	
1988	80,184	16,648	528	4,911	1,192	56,905	4,037	1,626	51,242	
1989	102,872	17,637	632	4,898	1,404	78,302	2,217	2,210	73,875	
1990	86,990	14,812	1,197	6,228	797	63,955	3,325	2,689	57,941	
1991	134,740	19,718	1,971	6,907	1,793	104,351	3,127	3,758	97,466	
1992	140,850	47,563	907	7,688	1,844	82,848	2,499	2,911	77,438	
1993	175,614	62,976	1,867	10,552	2,408	97,812	2,919	3,492	91,401	
1994	229,583	119,480	1,126	8,587	4,436	95,954	3,775	6,191	85,989	
1995	177,801	79,942	1,327	8,672	2,238	85,622	2,420	2,713	80,489	
1996	136,812	72,011	730	9,598	2,346	52,127	3,055	3,045	46,027	
1997	156,096	64,294	544	8,328	931	40,705	3,192	2,567		82,000
1998	234,107	108,486	805	5,682	1,640	117,495	4,440	4,188	108,868	
1999	79,973	10,893	927	4,888	934	62,331	2,477	3,304	56,551	
2000	75,172	12,055	1,052	4,302	1,389	56,374	2,132	4,628	49,615	
2001	119,527	11,568	1,078	6,126	1,600	99,155	3,372	4,299	91,484	
2002	133,574	39,473	717	5,050	1,193	87,141	4,104	2,500	80,537	
2003	133,653	42,615	672	8,135	2,203	80,028	4,448	3,752	71,828	
2004	219,547	93,414	440	6,726	2,567	116,400	4,378	4,339	107,683	
2005	241,495	61,854	532	4,339	2,863	171,907	4,471	5,702	161,734	
1986-2005										
Average	145,794	50,360	908	6,819	1,784	83,858	3,413	3,562	79,090	
2001-2005										
Average	169,559	49,785	688	6,075	2,085	110,926	4,155	4,118	102,653	
2006	not available	83,679	not available	not available	not available	124,683	not available	not available	not available	

^a Total Nushagak District commercial harvest. Sources:1967-1970 Bucher et al. 1987, Appendix Table 39; 1971-1985 Brookover et al. 1991, Appendix Table 31; 1986-2005 Westing et al. *In prep.*, Appendix Table 19.

^b Nushagak Bay Commercial Harvest from Subsistence Division Subsistence Database. Source: ADF&G Subsistence Division, Subsistence Database from James Fall, Subsistence Division, Region II, Anchorage, Oct. 9, 2006.

^c Includes Nushagak Bay and Igushik. Source: ADF&G Subsistence Division, Subsistence Database from Charles Utermohle, Program Coordinator, Subsistence Division, Region II, Anchorage, Nov. 20, 2000. Data for 2000-2005 provided by James Fall, Subsistence Division, Region II, Anchorage.

-Continued-

Table 5.-Page 2 of 2.

- ^d 1977-1996 is 50% of Nushagak River system sport harvest. 1997-2005 is Nushagak River Black Point to sonar. Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b.
- ^e Includes Ekwok area, Iowithla River, Klutuk River, Koliganek area, New Stuyahok area, Portage Creek area, Kokwok area, Mulchatna River, and Nushagak watershed site unknown. Source: ADF&G Subsistence Division, Subsistence Database from James Fall, Subsistence Division, Region II, Anchorage, Nov. 20, 2000. Data for 2000 provided by James Fall, Subsistence Division, Region II, Anchorage.
- ^f 1977-1996 is 50% of Nushagak River system sport harvest, plus Mulchatna River system, Tikchik/Nuyakuk, and Kuktuli River harvest reported in Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996 2001a. 1997-2001 is 50% of Nushagak River Black Point to Iowithla, Nushagak upstream of Iowithla, Mulchatna River system, Tikchik/Nuyakuk and Kuktuli River (Howe et al. 2001b-d; Walker et al. 2003; Jennings et al. 2004); 2002 to 2005 is Nushagak River excluding Black Point to sonar (Jennings et al. 2006a-b, *In prep.* a-b).
- ^g 1986-1996, and 1998-2005 estimates are sonar estimates minus subsistence and sport harvest above sonar.
- ^h Source: Glick et al. 2000.

Table 6.-Historical aerial escapement counts of Chinook salmon in selected streams in the drainages of the Wood, Nushagak and Mulchatna rivers, 1967 to 2006.

Year	Wood R.	Nushagak and Mulchatna Drainages								Total
	Muklung River	Iowithla River	Kokwok River	Klutispak River	King Salmon River	Stuyahok River	Koktuli River	Nushagak River ^a	Mulchatna River ^b	
1967	350	200				2,500	3,300			6,000
1968 ^c	750	850		310	1,000	2,470	4,220	970	510	10,330
1969	520	580	90 ^c	90	670	1,220	1,600	910 ^c	680 ^d	5,840
1970	590	700	110 ^c	320	1,060	1,900	1,500	1,180 ^c	880 ^d	7,650
1971	280	390	80 ^c							470
1972	150	170		280	900	610	1,450	690 ^c	510 ^d	4,610
1973				380	1,470	1,220	950			4,020
1974 ^c	1,010	860	60 ^c	440	2,000	2,300	3,920	2,340	2,160	14,080
1975	660	1,040	270	670	2,900	2,530	4,080	2,320 ^c	1,710 ^d	15,520
1976 ^c	840	1,110	560	1,180	3,510	3,750	6,710	1,760	2,580	21,160
1977 ^c	940	840	310	650	1,420	2,700	4,630	820	1,980	13,350
1978 ^c	1,170	1,700	520	1,940	4,450	4,400	6,730	5,850	2,280	27,870
1979 ^c	950	1,350	170	1,040	2,150	3,570	6,260	2,880	1,730	19,150
1980	1,600	2,310 ^d	70	970	4,500	7,200	10,620	5,300 ^c	3,920 ^d	34,890
1981	2,260	2,630	70	1,650	2,950	5,980	9,960	4,960 ^c	3,670 ^d	31,870
1982	790	2,520	90	350	8,390	3,640	6,780	4,380 ^c	3,240 ^d	29,390
1983 ^c	1,830	2,430	350	2,090	5,990	2,910	8,060	6,330	4,260	32,420
1984 ^c	1,300	1,080	110	770	1,780	2,010	2,860	2,800	1,060	12,470
1985	1,250	1,610	60	1,950	4,460	2,690	4,940	3,420 ^c	2,390 ^d	21,520
1986	230	270		170	380	520	290	380 ^c	260 ^d	2,270
1987	160	140		340	570	280	440	390 ^c	270 ^d	2,430
1988	430	550		780	1,380	2,040	2,580	1,800	710	9,840
1989							190 ^c	240 ^c		430

-continued-

Table 6.-Page 2 of 2.

Year	Wood R.		Nushagak and Mulchatna Drainages							Total
	Muklung River	Iowithla River	Kokwok River	Klutispak River	King Salmon River	Stuyahok River	Koktuli River	Nushagak River ^a	Mulchatna River ^b	
1990	60	120		340	900	830	3,390	630	800	7,010
1991-1994 ^e										
1995	210	170	75	630	3,150	660	2,230			6,915
1996 ^e										
1997 ^f	1,240	640		1,190	8,900	1,460	6,220	21,818	1,496	41,724
1998	150 ^g	^g	150 ^g	2,620	5,510	550 ^g	720	8,390	180 ^g	18,120
1999	95	450	145	1,545	6,825	645	2,075	6,467		18,152
2000-2004 ^{e,h}										0
2005				1,450	3,120	1,130	3,200	7,175		16,075
2006 ^e										0
Mean	762	988	183	929	3,090	2,211	3,927	3,915	1,694	16,937

^a Nushagak River from the outlet of the Nuyakuk R. to outlet of King Salmon River (to Big Bend in 1997).

^b Mulchatna River from outlet of Mosquito Creek to outlet of Koktuli River (to outlet of Stuyahok River in 1997)

^c Minimal estimate - very poor survey conditions.

^d These numbers are proportional estimates rather than aerial live counts; estimates are based on the mean proportion of fish counted in these areas during year in which aerial coverage was complete.

^e No surveys conducted in 1991-1994, 1996, 2000, 2002-2004, and 2006. Surveys were conducted in 2001, 8/10 through 8/14, far past peak of spawning and are a poor indication of abundance; 2001 count is therefore omitted from the table; total count was 3,833.

^f Survey conditions in 1997 excellent, water very clear and very low.

^g Surveys conducted 8/11/98, well past peak of spawning; Iowithla River not surveyed. Remaining surveys conducted 7/29/98, before peak of spawning.

Total harvest by commercial, subsistence, and sport fisheries averaged 66,906 Chinook salmon from 2001 through 2005 (Table 5). The majority (74%) of the harvest was taken by the commercial fishery, 16% was taken by the subsistence fishery, and 9% by sport anglers Table 5. After a period of growth from 1978 through 1985, the sport harvest has been relatively stable (Table 5). Sport harvest of Chinook salmon averaged 6,203 fish from 2001 through 2005 (Table 5).

Fishery Management and Objectives

Under the Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361, adopted 1/92; amended 12/94, 11/97, 1/01, and 12/03) Chinook salmon are managed to attain an inriver return of 75,000 fish which provides 65,000 spawning fish, a reasonable opportunity to harvest Chinook salmon in the inriver subsistence fishery, and a guideline harvest level in the sport fishery of 5,000. If the inriver return exceeds 75,000, then the guideline harvest level does not apply. If the inriver return falls below 75,000, then restrictive actions are required for the sport fishery. If the inriver return falls below 55,000, then additional restrictive actions are required for the sport fishery. If the inriver return falls below 40,000, the sport fishery is to be closed and the subsistence fishery may be restricted.

Since 1972, smaller returns and increasing sport effort have prompted restrictive actions on the inshore commercial and sport fisheries. To remain within the sport fishery guideline harvest level of 5,000 fish, the daily bag and possession limit is two Chinook salmon per day, of which only one may be longer than 28 inches in length (ADF&G 2006). Only four of the five Chinook salmon allowed in an angler’s Bristol Bay annual harvest may come from the Nushagak/Mulchatna drainage. Additionally, in the Nushagak/Mulchatna drainage, there is a daily bag and possession limit of five per day for Chinook salmon under 20 inches. Chinook under 20 inches do not count toward the annual limit of four and are in addition to the daily bag limit for Chinook salmon 20 inches or longer.

A chronology of significant regulation changes follows:

Effective Year	Regulation
1990	Sport season established from January 1 to July 25 upstream of and including the Iowithla River. Spawning season closure adopted to afford drainage-wide protection to spawning Chinook salmon stocks.
1992	Gear restricted to single-hook artificial lures for the portion of the Mulchatna River between the Koktuli and Stuyahok rivers.
1992	Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is adopted, capping the sport harvest at 5,000 fish and establishing an escapement projection of 65,000 as the trigger for inseason restrictions in the sport fishery.
1994	Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) is amended, setting the sport allocation as a guideline harvest rather than a cap.
1997	Nushagak and Mulchatna Chinook Salmon Management Plan (5 AAC 06.361) was amended, by establishing an escapement projection of 55,000 Chinook salmon below which inseason restrictions in the sport fishery must be imposed. The 55,000 fish “trigger” was adopted when analysis showed this escapement level was not likely to show a difference in the expected productivity versus that expected at the 65,000 fish trigger. In addition, the 65,000 fish “trigger” had become quite disruptive to the sport fishery by precipitating frequent inseason restrictions.
1997	The daily bag and possession limit was reduced to 2 Chinook per day, only 1 over 28 inches. An annual harvest limit of 4 Chinook salmon was adopted for the whole Nushagak/Mulchatna drainage.
1997	Guides were prohibited from retaining any species of fish while guiding (Bristol Bay-wide)
1997	The Kokwok River and the Nushagak River upstream from its confluence with Harris Creek were closed to angling for Chinook salmon.

-continued-

Effective Year	Regulation
1997	A July 31 spawning season closure was adopted for the Nushagak River drainage downstream from the Iowithla River outlet.
1997	The commercial fishery was to be managed to allow pulses of Chinook salmon to enter the Nushagak River untouched.
2001	The Alaska Board of Fisheries amended the management plan to allow a catch-and-release fishery when the final inriver abundance is projected to be below 55,000 fish but above 40,000 fish. The amended plan also stipulates that when the Chinook sport fishery is restricted to catch-and-release or is closed for conservation, the use of bait must be prohibited.
2001	A regulation allowing a daily bag limit of 10 Chinook salmon less than 20 inches total length (508 mm TL) statewide, specifically excluded the Nushagak-Mulchatna river drainage until ADF&G could study the potential effects of the regulation on the spawning populations and the escapement goal.
2001	As with most other Bristol Bay drainages, the Nushagak drainage was included in the regulation prohibiting anglers from removing Chinook salmon from the water if the fish were to be released.
2003	A daily bag and possession limit for Chinook salmon under 20 inches of 5 per day is implemented on the Nushagak drainage. Chinook under 20 inches do not count toward the annual limit of 4 and are in addition to the daily bag limit for Chinook salmon 20 inches or longer.

2006 Season

The preseason forecast for the 2006 Nushagak/Mulchatna Chinook salmon run was 221,000 fish. In early to mid June, inriver escapement projections indicated that more than 55,000 fish would enter the river in 2006. By June 27, the actual escapement estimates had exceeded 55,000 Chinook salmon. The preliminary total estimate of Chinook salmon passing the sonar was 124,683 fish. Nine directed Chinook salmon commercial fishing periods allowing large mesh gillnets occurred in the Nushagak District. Along with Chinook salmon taken incidentally during periods targeting sockeye salmon, approximately 84,000 Chinook salmon were landed during commercial fishery openings. Harvest estimates for the sport and subsistence fisheries are not available, but anecdotal information suggests average harvests occurred in both fisheries. By assuming that the sport harvest in 2006 was near the guideline harvest level of approximately 5,000 fish and that an average subsistence harvest of approximately 11,000 fish occurred, the total 2006 run was probably about 225,000 Chinook salmon. This total was slightly above the preseason forecast and exceeds the 2001-2005 average run.

SOCKEYE SALMON FISHERIES

AREA-WIDE FISHERY DESCRIPTION

Sockeye salmon are the most abundant of the Pacific salmon species to spawn in Bristol Bay, the world's largest producer of sockeye salmon. Their prized table quality makes sockeye salmon the most popular species of salmon on the commercial market. Sockeye salmon are often indifferent to most fishing lures making them difficult to catch. However, anglers have discovered innovative ways to legally catch sockeye salmon with customary sport gear, and the species has gained favor as a hard fighting and delectable game fish. The most popular fisheries are in the Naknek and Kvichak drainages but effort occurs in other waters of the BBMA as well (Figure 6).

AREA-WIDE HARVEST

Sport harvests of sockeye salmon in the BBMA were at or below 10,000 fish from 1977 through 1988 (Figure 7). After 1988, the harvest of sockeye salmon increased substantially in number

and variability, with a peak of nearly 33,000 fish taken in 1989 and lows of approximately 8,000 to 16,000 fish in other years. From 2000 through 2004, the sport harvest averaged 12,306 sockeye salmon annually (Table 7). The most active sport fisheries occur in the Eastern Section of the management area where an average of about 10,000 fish, or 81% of the annual harvest, is taken. The Central Section fishery harvests nearly 2,500 sockeye salmon annually and harvests in the Western Section are approximately 300 fish annually (Table 7).

Even at its highest levels, the sport harvest is only 0.08% of the total average annual return of sockeye salmon. From 1995 through 2004, about 68% of the total annual Bristol Bay sockeye return was harvested in the commercial fishery (Westing et al. 2006). However, sockeye salmon are likely to play an increasingly important role in the development and expansion of the recreational fishery in the Bristol Bay Management Area. Subsistence fishermen harvested less than 1% of the annual sockeye salmon return from 1996 through 2006.

AREA-WIDE MANAGEMENT

Sockeye salmon share the same bag and possession limits with all salmon except Chinook: five salmon per day, no size limit. This region-wide limit has been in effect since 1972. The department's ability to manage for sustained yield is essentially unaffected by the recreational harvest of sockeye salmon.

KVICHAK RIVER

Fishery Description

The Kvichak River drainage (Figure 6) hosts the single largest sockeye salmon run in the world and the river itself is a popular destination for anglers targeting this species. Two locations within the drainage support the biggest sport fisheries for sockeye salmon in Bristol Bay (Table 7). The first location is the fishery on the Kvichak River at the outlet of Lake Iliamna. The other, often larger, fishery occurs on the Newhalen River near the community of Iliamna. Smaller tributaries within the drainage are fished much less intensively and sport harvests there are relatively minor in comparison to the two large fisheries.

The sockeye salmon return to the Kvichak River drainage has long been known for its 5-year abundance cycle where peak returns usually occur on the fifth and tenth year of each decade: 1975, 1980, 1985, etc. (Table 8). The first and second years following a peak abundance year are typically the lowest annual returns in the cycle, such as 1976, 1981, and 1982, and 1996 and 1997 (Table 8). In the intervening seasons, the total abundance of Kvichak drainage sockeye salmon builds to the next peak year. The reason for this cycle is not clear and it has been the source of a number of studies and much speculation (Rogers and Poe 1984; Fried 1984; Eggers and Rogers 1987; Cross 1991, 1994; Cross et al. 1997).

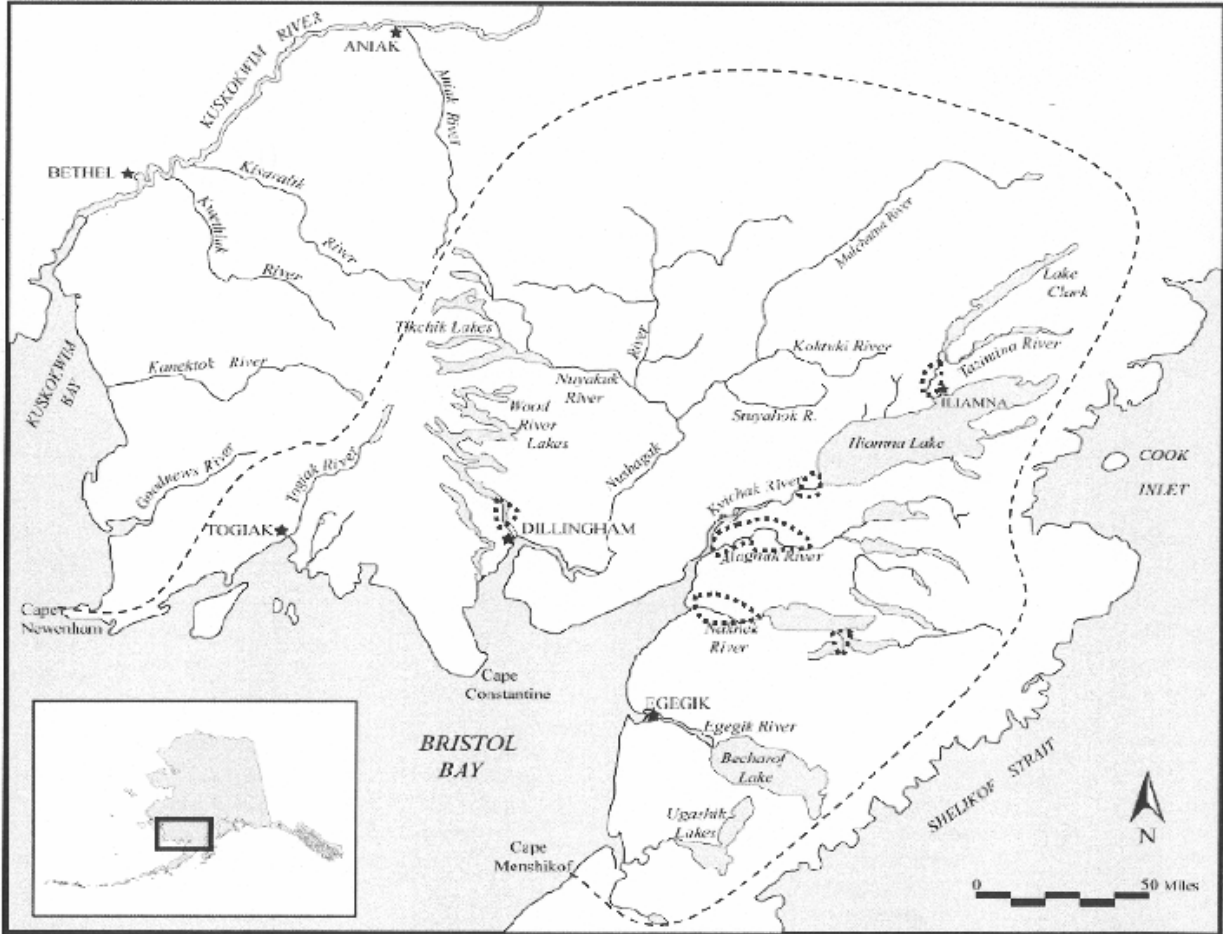
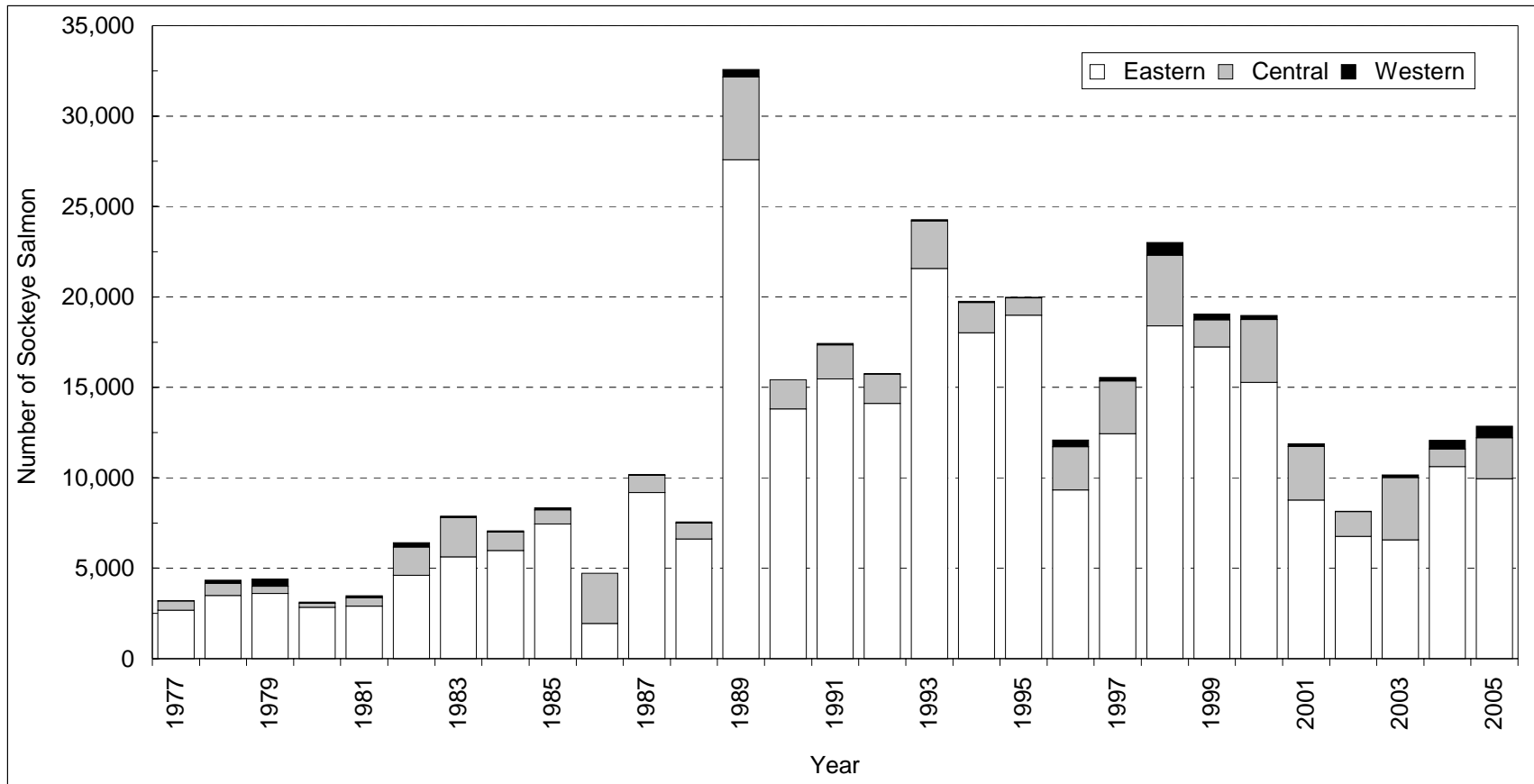


Figure 6.-Popular sockeye salmon sport fisheries in the Bristol Bay Sport Fish Management Area.



Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

Figure 7.-Sport harvest of sockeye salmon, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.

Table 7.-Sport harvest of sockeye salmon, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.	526	575	925	562	225	787	1,883	2,617	2,515	2,114	2,304	1,525	2,215	1,098
Brooks R.	441	331	567	433	434	490	85	506	422	653	177	996	551	133
Kvichak R.	1,264	4,001	3,811	1,604	1,404	2,910	3,516	3,554	0	848	864	2,210	1,495	2,431
Copper R.	326	844	391	325	293	850	825	668	0	220	274	73	247	97
Alagnak R.	404	725	1,496	1,240	2,182	2,519	1,249	1,034	445	606	727	2,121	987	3,340
Newhalen R.	3,817	7,973	7,859	3,513	4,348	6,838	6,356	3,414	1,099	801	1,616	2,741	1,934	1,528
Lake Clark	305	782	800	51	443	159	161	148	376	34	314	147	204	236
Other	<u>1,401</u>	<u>2,780</u>	<u>3,148</u>	<u>1,605</u>	<u>3,106</u>	<u>3,843</u>	<u>3,165</u>	<u>3,331</u>	<u>3,914</u>	<u>1,482</u>	<u>291</u>	<u>813</u>	<u>1,966</u>	<u>1,089</u>
Subtotal ^a	8,405	18,011	18,997	9,333	12,435	18,396	17,240	15,272	8,771	6,758	6,567	10,626	9,599	9,952
Central														
Nushagak	335	432	153	708	509	1,282	386	891	849	286	1,132	252	682	721
Mulchatna	330	219	153	320	697	258	137	206	167	39	323	67	160	355
Agulowak					253	457	11	276	193	209	326	22	205	618
Agulukpak					106	16	0	209	122	91	36	169	125	0
Wood River L. ^b	444	813	539	900	1,065	1,420	712	1,588	1,434	607	1,367	427	1,085	575
Tikchik/Nuyakuk	112	54	32	45	0	110	0	0	61	0	90	0	30	0
Other	<u>163</u>	<u>159</u>	<u>77</u>	<u>410</u>	<u>285</u>	<u>376</u>	<u>253</u>	<u>314</u>	<u>134</u>	<u>142</u>	<u>173</u>	<u>23</u>	<u>157</u>	<u>0</u>
Subtotal ^a	1,383	1,677	954	2,383	2,915	3,919	1,499	3,484	2,960	1,374	3,447	960	2,445	2,269
Western														
Togiak drainage	107	26	22	367	191	673	309	197	156	305	140	485	257	627
Other	<u>0</u>	<u>44</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>14</u>	<u>0</u>	<u>22</u>	<u>0</u>	<u>7</u>	<u>0</u>	<u>0</u>	<u>6</u>	<u>0</u>
Subtotal ^a	107	70	22	367	191	687	309	219	156	312	140	485	262	627
Total	9,896	19,758	19,973	12,083	15,541	23,002	19,048	18,975	11,887	8,444	10,154	12,071	12,306	12,848

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Sockeye salmon first appear in the Kvichak River during the last week of June. The run peaks in the first week of July, then declines steadily until late July or early August. In most years, anglers prefer to fish this river's clear waters during the first half of the run when the salmon are more readily taken on sport gear. In peak years, the sport fishery may be active for much of the month of July.

A modern airstrip in the village of Igiugig provides easy access to the river where it drains out of Lake Iliamna and floatplanes can land on the lake or on the river. Although much of the sport effort is from nonresident guided anglers, a growing component is the resident unguided angler arriving from Anchorage in private, chartered, or scheduled aircraft. The Igiugig Native Corporation owns most of the uplands along the upper Kvichak River, and charges anglers modest daily fees for access. Commercial operators are charged more substantial fees for annual leases.

Harvest and Effort

Historically, the Bristol Bay commercial salmon fleet harvests roughly half of the annual Kvichak River sockeye salmon run and, until 1995, the subsistence fishery took an average of nearly 75,000 fish annually, or about 1% of the total run (Table 8). Since 1995, the annual subsistence harvest has declined to less than 60,000. This decline is probably not related to run strength.

Kvichak River sockeye salmon sport harvests ranged between 300 and 600 fish per year until 1984 when nearly 900 fish were taken (Table 8). After 1984, estimates of the sport harvest ranged from 102 sockeye salmon in 1986 to nearly 4,800 in 1989. From 2001 through 2005, the annual sport harvest averaged 1,225 sockeye salmon from the Kvichak River alone (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b; Table 8). Even the highest estimates of sport harvest in 1989 and 2002 amounted to approximately 2% of the total Kvichak River sockeye salmon harvest. Drainage-wide, the average sport harvest from 2001 through 2005 was 3,850 sockeye salmon, effort was about 5,000 angler-days (effort is for all species, although anglers mainly fish for rainbow trout and sockeye salmon at the Kvichak River; Table 1). At such low levels, the sport fishery has little effect on the department's ability to manage for sustained yield.

In 1995, the department conducted a benchmark survey of the sockeye salmon sport fishery near Igiugig (Dunaway and Fleischman 1996). Harvest was found to be an important aspect of this fishery with nearly 60% of the angler trips harvesting the daily limit of five sockeye salmon. Virtually all anglers fished from the shore; fly tackle was used in 97% of the trips; 66% of the anglers were guided; and 81% were nonresidents (Dunaway and Fleischman 1996). The field survey's estimate of onsite effort was very similar to effort levels estimated by the annual Statewide Harvest Survey.

Table 8.-Commercial and subsistence harvests and escapements of sockeye salmon for the Kvichak River drainage, and sport harvests of sockeye salmon from the Kvichak River, 1974-2006.

Year	Commercial ^a Harvest	Subsistence ^b Harvest	Sport Harvest			Total Harvest	Escapement ^e
			Kvichak River ^c	All Other Tributaries ^d	Total		
1974	148,595	98,100				246,695	4,433,844
1975	1,605,407	115,500				1,720,907	13,140,450
1976	1,458,180	75,900				1,534,080	1,965,282
1977	739,464	72,000	583	1,683	2,266	813,730	1,341,144
1978	3,815,636	83,900	380	2,677	3,057	3,902,593	4,149,288
1979	13,418,829	65,500	283	3,160	3,443	13,487,772	11,218,434
1980	12,743,074	72,600	654	1,052	1,706	12,817,380	22,505,268
1981	5,234,733	75,600	400	2,215	2,615	5,312,948	1,754,358
1982	1,858,475	61,300	639	3,233	3,872	1,923,647	1,134,840
1983	16,534,901	96,500	603	3,768	4,371	16,635,772	3,569,982
1984	12,523,803	100,500	898	3,828	4,726	12,629,029	10,490,670
1985	6,183,103	86,500	1,827	3,620	5,447	6,275,050	7,211,046
1986	787,303	59,900	102	510	612	847,815	1,179,322
1987	3,526,824	72,000	1,805	5,334	7,139	3,605,963	6,065,880
1988	2,654,364	77,100	526	3,622	4,148	2,735,612	4,065,216
1989	11,456,509	71,400	4,769	18,845	23,614	11,551,523	8,317,500
1990	10,468,631	76,600	2,988	7,452	10,440	10,555,671	6,970,020
1991	3,837,923	66,786	1,249	11,467	12,716	3,917,425	4,222,788
1992	5,678,494	72,148	1,964	9,174	11,138	5,761,780	4,725,864
1993	5,239,770	74,123	2,923	13,222	16,145	5,330,038	4,025,166
1994	13,840,448	64,343	4,001	11,453	15,454	13,920,245	8,337,840
1995	17,509,862	54,679	3,811	11,212	15,023	17,579,564	10,038,720
1996	8,187,720	54,872	1,604	4,474	6,078	8,248,670	1,450,578
1997	182,000	59,508	1,404	6,471	7,875	247,965	1,503,732
1998	1,072,760	53,656	2,910	10,209	13,119	1,139,535	2,296,074
1999	6,781,260	57,723	3,516	9,244	12,760	6,851,743	6,196,914
2000	1,034,000	36,990	3,554	4,925	8,479	1,079,469	1,827,780
2001	324,963	32,808	1,364	3,174	4,538	362,309	1,095,348
2002	0	33,001	848	1,340	2,256	35,257	703,884
2003	35,742	38,805	823	2,245	3,068	77,615	1,687,000
2004	1,832,101	53,225	1,238	3,860	5,098	1,890,424	5,500,134
2005	557,186	48,263	1,852	2,440	4,292	609,741	2,320,332
1974-2005 Average	5,352,252	67,557	1,708	5,721	7,431	5,426,499	5,170,147
Percent	99%	1%			<1%		
2001-2005 Average	549,998	41,220	1,225	2,612	3,850	595,069	2,261,340
Percent	92%	7%			<1%		
2006	NA	NA	NA	NA	NA	NA	3,068,226

^a Estimated Kvichak River fish only - captured in Naknek Kvichak District commercial fishery.

^b Harvests are extrapolated for all permits issued, based on those returned. Harvest estimates prior to 1991 are rounded the nearest hundred fish. Harvest estimates prior to 1990 are based on the community where the permit was issued; estimates from 1990 to the present are based on community of residence and include fish caught only in the Kvichak District. Sources: 1974-1978 Brookover et al. 1991, Appendix Table 47; 1979-2000 Weiland et al. 2001, Appendix Table 32; 2001-2005 Westing et al. 2006 Appendix Table 30.

^c Kvichak River sport harvest only. Sources: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

^d Estimated sport harvest from other tributaries of the Kvichak River, excluding the Alagnak River. This is the Statewide Harvest Survey area S freshwater total, minus the Alagnak River. Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

^e Tower counts conducted at Igiugig. Sources: 1974-1978 Brookover et al. 1991, Appendix Table 14; 1979-2000 Glick et al. 2000 and Weiland et al. 2001, Appendix Table 13; 2001-2005 Westing et al. 2006, Appendix Table 11.

Fishery Management and Objectives

Kvichak River sockeye salmon stocks are managed to achieve a biological escapement goal (BEG) range of 2-10 million fish in off-peak years and 6-10 million in pre-peak and peak years (Table 9; Westing et al. 2005, 2006, *In prep.*).

In 2004, the minimum BEG was 2.0 million fish and the total run was expected to be 13.2 million sockeye. In 2005, the minimum BEG was 2.0 million fish and the total run was expected to be 2.3 million sockeye. For the 2006 season, the minimum BEG was 2.0 million fish and the total run was expected to be 1.9 million sockeye (Table 9).

The sport fishery is managed to provide increased participation and opportunity. The level of participation could grow quickly in the near future by improving access to desirable fishing sites, promoting the fishery as a destination, and working to assure necessary facilities are provided to accommodate the growth in a responsible manner. To this end, the department has worked closely with the Igiugig City Council on a project to build trails to desirable fishing locations close to the village airfield. For example, a trail was completed from the village road system to a prime sockeye salmon fishing site along the Kvichak River in fall 2001.

2006 Season

In 2006, the sockeye salmon run to the Kvichak River was the only Bristol Bay stock for which conservative management actions were taken.

Based on a preseason forecast of 1.9 million fish, which was below the minimum BEG of 2.0 million, the Division of Sport Fish issued an emergency order (2-RS-5-02-06) on March 7 reducing the bag limit for sockeye salmon from five to two fish per day for the entire Kvichak River drainage upstream of the Alagnak River outlet effective March 8. In addition, the waters named in the management plan that have potential for conflicts between sport and subsistence users were closed to sport fishing for sockeye salmon. The emergency order was issued in accordance with the Kvichak Drainage Sockeye Salmon Management Plan (5 AAC 67.025). The emergency order was rescinded on July 11 when the projected sockeye salmon escapement for the Kvichak Drainage exceeded 2 million.

The 2006 sockeye salmon run to the Kvichak River exceeded the preseason forecast of 1.9 million fish. Approximately 3.1 million sockeye were counted at the Igiugig tower. The counting tower on the upper Newhalen River, operated by United States Geological Survey Biological Research Division, estimated 552,798 sockeye entered the Newhalen River/Lake Clark drainages through August 2. Although no estimate is available at this time, we expect the subsistence harvest to be within the normal historical range of 40,000 to 60,000 sockeye salmon.

With the early season fishery restrictions, the number of sport anglers targeting sockeye in the Iliamna drainage during 2006 was likely lower than the long term average and it is therefore anticipated that the sport fishery harvest will be similar to the recent 5-year average. An estimate of the recreational harvest will not be available until SWHS results are reported in mid-2007.

Table 9.-Expected total returns (forecasts) of Bristol Bay sockeye salmon, 2004, 2005 and 2006.

District: River	Expected Total Return	Escapement Goal Range (millions)	Escapement Midrange (millions)	Actual Estimated Escapement
2004				
NAKNEK-KVICHAK:				
Kvichak	13,231,000	2.0 - 10.0	6.00	5,500,000
Alagnak	4,402,000	0.17 - 0.2	0.18	5,397,000
Naknek	4,664,000	0.8 - 1.4	1.10	1,939,000
Total	22,297,000	2.97 - 11.6	7.28	12,836,000
EGEGIK	12,095,000	0.8 - 1.4	1.10	1,290,000
UGASHIK	4,085,000	0.5 - 1.2	0.85	815,000
NUSHAGAK ^a				
Wood	4,445,000	0.7 - 1.5	1.10	1,543,000
Igushik	1,081,000	0.15 - 0.3	0.225	110,000
Nushagak	1,791,000 ^c	0.34 - 0.76	0.55	492,000
Total	7,317,000	1.19 - 2.56	1.88	2,145,000
TOGIAK ^b	812,000	0.1 - 0.2	0.15	136,000
BRISTOL BAY TOTAL	46,606,000	5.56 - 16.96	11.26	17,222,000
2005				
NAKNEK-KVICHAK:				
Kvichak	2,354,000	2.0 - 10.0	6.00	2,320,000
Alagnak	4,925,000	0.17 - 0.2	0.18	4,219,000
Naknek	3,755,000	0.8 - 1.4	1.10	2,745,000
Total	11,034,000	2.97 - 11.6	7.28	9,284,000
EGEGIK	10,376,000	0.8 - 1.4	1.10	1,622,000
UGASHIK	3,608,000	0.5 - 1.2	0.85	800,000
NUSHAGAK ^a				
Wood	5,034,000	0.7 - 1.5	1.10	1,497,000
Igushik	699,000	0.15 - 0.3	0.225	366,000
Nushagak	1,697,000 ^c	0.34 - 0.76	0.55	1,096,000
Total	7,430,000	1.19 - 2.56	1.88	2,959,000
TOGIAK ^b	388,000	0.1 - 0.2	0.15	156,000
BRISTOL BAY TOTAL	32,836,000	5.56 - 16.96	11.26	14,821,000

-continued-

Table 10.-Page 2 of 2.

District: River	Expected Total Return	Escapement Goal Range (millions)	Escapement Midrange (millions)	Actual Estimated Escapement
2006				
NAKNEK-KVICHAK:				
Kvichak	1,940,000	2.0 - 10.0	4.00	3,068,000
Alagnak ^c	2,860,000	0.185	NA	1,774,000
Naknek	7,180,000	0.8 - 1.4	1.10	1,953,000
Total	11,980,000	2.8 - 11.6	7.18	6,795,000
EGEGIK	9,300,000	0.8 - 1.4	1.10	1,465,000
UGASHIK	3,340,000	0.5 - 1.2	0.85	979,000
NUSHAGAK^a				
Wood	4,670,000	0.7 - 1.5	1.10	4,008,000
Igushik	840,000	0.15 - 0.3	0.22	305,000
Nushagak	2,010,000	0.34 - 0.76	0.55	541,000
Total	7,520,000	1.19 - 2.56	1.87	4,854,000
TOGIAK ^d	590,000	0.1 - 0.2	0.15	312,000
BRISTOL BAY TOTAL	32,730,000	5.39 - 16.96	11.15	14,405,000

Source: Westing et al. 2005, 2006, *In prep.*

^a Forecast for Snake River system was not included (1971 - 1991 average escapement was 18,000).

^b Forecasts for Kulukak, Kanik, Osviak, and Matogak River systems were not included. These systems may contribute an additional 62,000 (1992 - 2001 mean catch) to Togiak District harvest.

^c The Alagnak River spawning goal is based on aerial surveys.

^d Forecasts for Kulukak, Kanik, Osviak, and Matogak River systems were not included. These systems may contribute an additional 57,000 (1993-2002 mean catch) to Togiak District harvest.

RAINBOW TROUT FISHERIES

AREA-WIDE FISHERY DESCRIPTION

Wild rainbow trout stocks are a cornerstone to the multimillion-dollar recreational fishing industry of the BBMA. Sport fishing opportunity for both guided and unguided anglers occurs primarily during the ice-free season, generally from June through October, although fisheries in early and late winter are gaining some popularity. Found throughout the area, the most popular rainbow trout waters include tributaries of the Kvichak River drainage, the Naknek River drainage, portions of the Nushagak/Mulchatna River drainages, and streams of the Wood River Lakes system (Figure 8).

The rainbow trout fisheries within the BBMA underwent rapid growth from the late 1970s to mid-1980s, with annual harvests peaking in 1983 (Figure 9). From 2000 through 2004, annual harvests averaged 1,635 fish (Table 10). The species' importance to the recreational fisheries is not adequately described by estimates of harvest. Results of the SWHS as well as field studies show clearly that during the last 10 to 15 years, the retention rate, or the number of fish kept from total catch, has declined steadily while the total effort and catch remained stable or increased (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b; Minard 1989, 1990; Brookover 1989; Dunaway 1993). Estimates of catch (number of fish kept plus fish released) were first available from the SWHS in 1991, and have ranged from about 122,000 fish to 218,000 fish annually (Table 11). From 2000 through 2004 the annual catch averaged 177,831 rainbow trout. It is evident the angling public has embraced the concept of catch-and-release for rainbow trout, and has voluntarily reduced their harvests throughout the area.

Prior to 1993, rainbow trout were explicitly excluded from harvest under the subsistence priority. The status of rainbow trout as a subsistence species was changed in 1993 when the BOF allowed rainbow trout caught incidentally to other species to be retained by subsistence users. In 1994 the BOF recognized subsistence use of rainbow trout among all other finfish in Bristol Bay (5 AAC 01.336). In 2002, the Federal Subsistence Board adopted regulations allowing rod and reel subsistence harvest of rainbow trout in federally managed subsistence fisheries in the Bristol Bay area. The subsistence taking of rainbow trout from non-navigable waters located within federal land holdings (Refuges and National Parks) has been allowed since December 1991.

SOUTHWEST ALASKA RAINBOW TROUT MANAGEMENT PLAN

In February 1990, the BOF adopted regulations implementing a comprehensive management plan for rainbow trout in the area previously known as the Southwest Alaska Management Area. This area included the BBMA; the waters flowing into Kuskokwim Bay from Cape Newenham to the outlet of the Kuskokwim River; and the Kuskokwim River and tributaries from the Aniak River to Kuskokwim Bay (ADF&G 1990). Still in force, this plan is not a regulation but is used as a policy for guiding the BOF and the public. It provides a clear understanding of the underlying principles by which rainbow trout stocks are to be managed and provides guidance for the BOF in developing future regulations. In 1998, the BOF adopted Criteria for Establishing Special Management Areas for Trout (5 AAC 75.013). This regulation embodies most of the criteria that originated, and is still used, in the Southwest Alaska Rainbow Trout Management Plan.

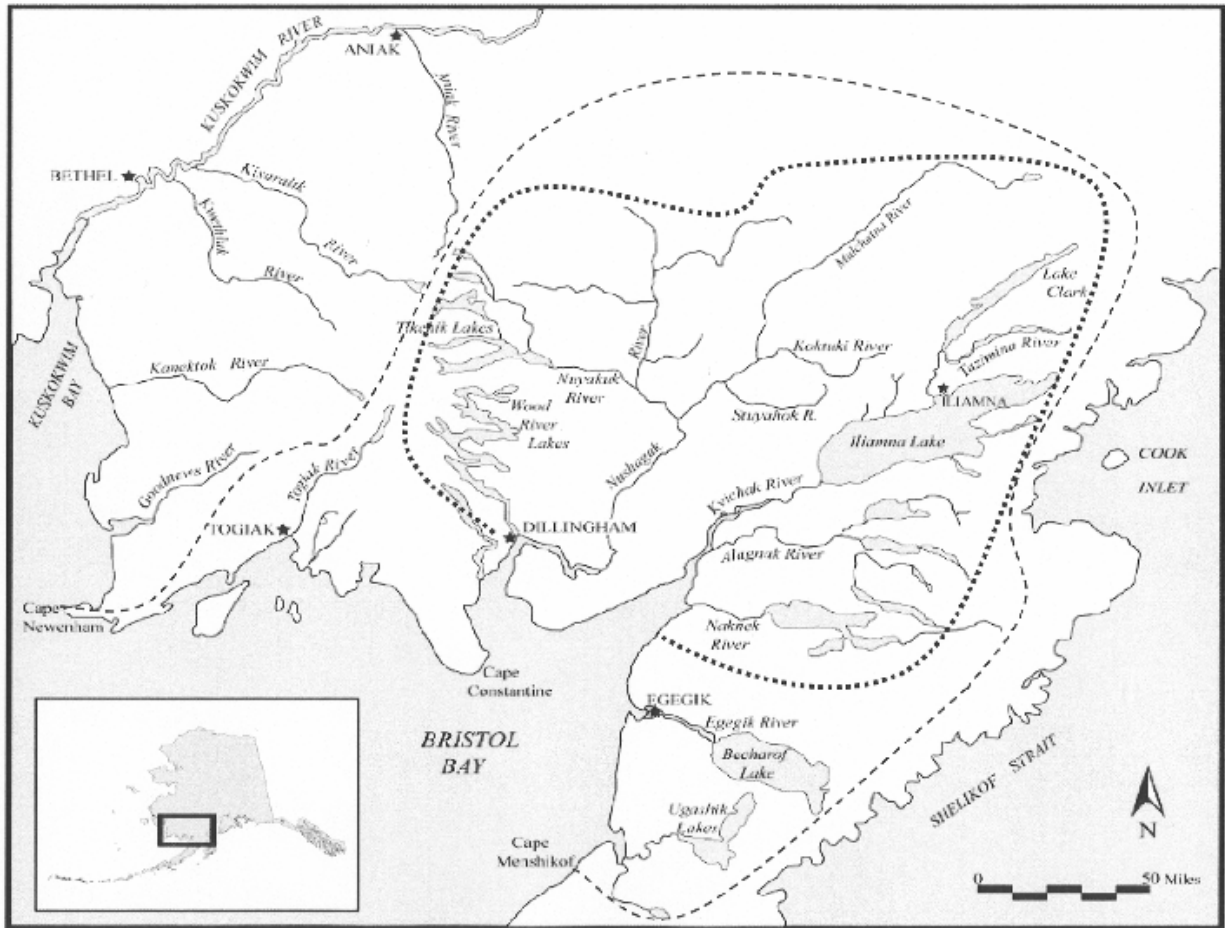
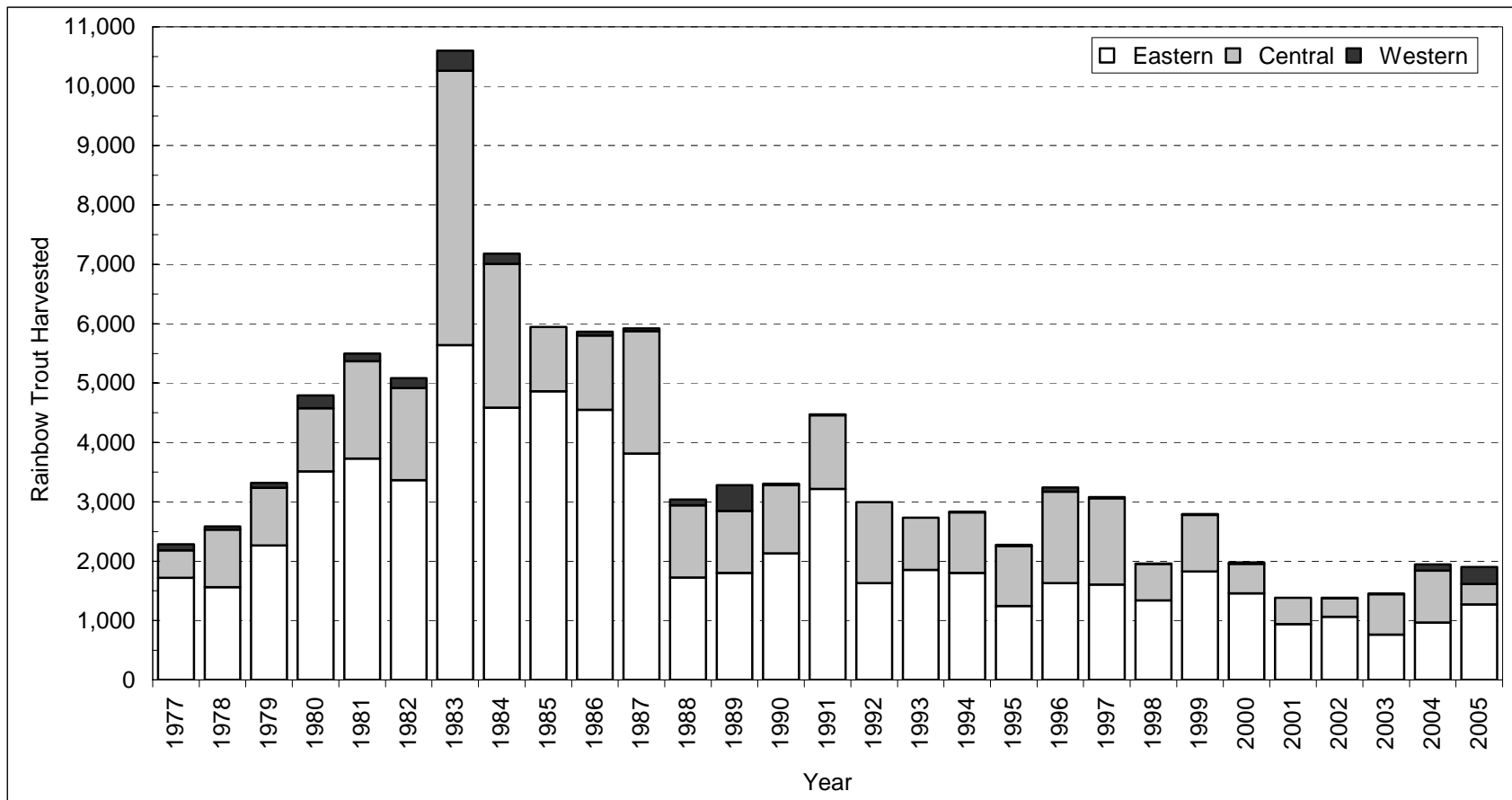


Figure 8.-Popular rainbow trout sport fisheries in the Bristol Bay Sport Fish Management Area.



Source: Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b.

Figure 9.-Sport harvest of rainbow trout, by section, from the Bristol Bay Sport Fish Management Area, 1977-2005.

Table 10.-Sport harvest of rainbow trout, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1990												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.		366	457	603	246	388	343	450	160	760	171	272	363	175
Brooks R.		19	9	0	0	0	0	24	0	0	0	0	5	358
Kvichak R.		191	12	58	27	25	135	506	155	176	497	193	305	221
Copper R.		0	0	0	0	0	49	56	0	0	0	14	14	0
Alagnak R.		74	107	26	254	35	57	33	166	71	11	163	89	413
Newhalen R.		175	208	82	254	377	724	101	371	48	54	89	133	77
Lake Clark		40	0	0	119	0	12	11	0	8	21	27	13	0
Other		<u>935</u>	<u>450</u>	<u>861</u>	<u>705</u>	<u>514</u>	<u>508</u>	<u>277</u>	<u>86</u>	<u>32</u>	<u>11</u>	<u>212</u>	<u>124</u>	<u>31</u>
Subtotal		1,800	1,243	1,630	1,605	1,339	1,828	1,458	938	1,095	765	970	1,045	1,275
Central														
Nushagak		230	172	334	84	257	251	87	229	72	220	164	154	74
Mulchatna		253	197	879	684	163	278	35	92	122	85	37	74	36
Agulowak					15	43	23	0	0	0	21	397	84	22
Agulukpak					0	0	0	0	0	13	33	0	9	21
Wood River L.		383	209	166	329	71	131	152	78	68	279	156	147	55
Tikchik/Nuyakuk		19	9	101	44	0	0	31	0	17	0	0	10	0
Other		<u>138</u>	<u>424</u>	<u>63</u>	<u>302</u>	<u>80</u>	<u>270</u>	<u>190</u>	<u>46</u>	<u>21</u>	<u>42</u>	<u>117</u>	<u>83</u>	<u>132</u>
Subtotal		1,023	1,011	1,543	1,458	614	953	495	445	313	680	871	561	340
Western														
Togiak drainage		8	19	58	15	8	11	24	0	8	10	102	29	287
Other		<u>0</u>	<u>0</u>	<u>13</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal		8	19	71	15	8	11	24	0	8	10	102	29	287
Total		2,831	2,273	3,244	3,078	1,961	2,792	1,977	1,383	1,416	1,455	1,943	1,635	1,902

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Table 11.-Sport catch of rainbow trout, by fishery, in the Bristol Bay Sport Fish Management Area, 1991-2005.

Drainage	1991-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.	15,035	10,113	14,501	16,888	13,737	12,795	17,946	30,738	16,198	30,635	26,183	20,497	24,850	16,431
Brooks R.	9,261	12,301	6,091	14,474	16,166	6,157	5,718	11,635	12,414	19,124	9,707	9,728	12,522	8,804
Kvichak R.	12,247	7,187	4,741	11,396	15,705	5,584	7,753	13,342	19,411	20,284	27,494	25,564	21,219	13,435
Copper R.	13,858	12,732	12,683	12,154	29,158	15,164	20,745	10,569	7,508	34,251	22,504	15,164	17,999	8,273
Alagnak R.	24,120	11,062	19,499	29,696	29,881	9,711	10,781	10,586	28,415	26,148	58,896	19,371	28,683	37,195
Newhalen R.	3,397	3,949	2,874	1,848	1,403	3,803	7,178	3,848	1,271	2,174	1,414	2,720	2,285	2,600
Lake Clark	598	309	642	119	1,104	432	344	33	732	496	151	2,043	691	415
Other	36,836	37,774	31,018	65,897	56,114	33,980	51,337	46,128	7,854	46,882	5,247	48,673	30,957	36,884
Subtotal ^a	115,352	95,427	92,049	152,472	163,268	87,626	121,802	126,879	93,803	179,994	151,596	143,760	139,206	124,037
Central														
Nushagak	7,708	6,530	5,808	19,540	12,304	10,649	15,575	8,599	11,177	12,810	13,268	11,956	11,562	6,638
Mulchatna	4,033	3,740	5,962	6,491	4,866	3,576	3,693	4,534	3,206	2,239	4,785	5,201	3,993	2,001
Agulowak					8,140	6,906	3,941	4,762	4,228	7,024	4,270	5,230	5,103	6,885
Agulukpak					11,382	3,413	6,122	6,526	4,156	4,982	3,803	8,335	5,560	4,966
Wood River L. ^b	7,686	8,677	7,260	12,939	5,366	3,856	2,504	6,081	4,019	3,952	3,978	4,575	4,521	7,270
Tikchik/Nuyakuk	1,940	1,350	1,315	2,537	3,531	1,708	1,104	3,483	1,380	1,544	2,584	5,167	2,832	1,038
Other	1,808	4,525	4,392	4,096	7,347	3,663	5,597	3,178	1,546	1,172	528	5,018	2,288	2,538
Subtotal ^a	23,175	24,822	24,737	45,603	52,936	33,771	38,536	37,163	29,712	33,723	33,216	45,482	35,859	31,336
Western														
Togiak drainage	817	1,206	1,873	2,872	1,810	1,773	1,691	1,924	1,907	1,694	2,041	5,716	2,656	3,475
Other	118	76	0	343	0	31	207	62	37	0	0	445	109	0
Subtotal ^a	935	1,282	1,873	3,215	1,810	1,804	1,898	1,986	1,944	1,694	2,041	6,161	2,765	3,475
Total	139,463	121,531	118,659	201,290	218,014	123,201	162,236	166,028	125,459	215,411	186,853	195,403	177,831	158,848

Source: Statewide Harvest Survey database, and Mills 1992-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Wood River Lakes includes Lake Nunavaugaluk. Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

Philosophy of the Plan

The overriding philosophy of the Southwest Alaska Rainbow Trout Management Plan is one of conservative wild stock management. Conservative wild stock management does not necessarily preclude limited harvest of rainbow trout for food or trophies. However, maximum yield principles which emphasize harvest are ruled out. Additionally, under a philosophy that emphasizes wild trout management, mitigating losses of wild stocks through enhancement or stocking is not considered a desirable management alternative.

Conservative wild stock management is guided by both biological considerations and social concerns. Growth in the region's rainbow trout sport fisheries is inevitable, but by managing the area's wild rainbow trout stocks conservatively, the potential for serious long-term resource problems is minimized. From a social perspective, conservative wild stock management is consistent with the priorities of most of the public presently using the resource. The Southwest Alaska Rainbow Trout Management Plan contains three policies which are intended to protect the biological integrity of the region's wild trout stocks and maximize their recreational benefit and economic potential. The policies guide the development of sport fishing regulations and provide management biologists in the Department of Fish and Game, BOF members, and the public with clear direction as to how rainbow trout fisheries in the BBMA should be managed. The three policies are as follows:

- **Policy I:** Native rainbow trout populations will be managed to maintain historic size and age compositions and at stock levels sufficient such that stocking is not needed to enhance or supplement the wild population.
- **Policy II:** A diversity of sport fishing opportunities for wild rainbow trout should be provided through establishment of special management areas by regulation. Selection of areas for special management will be based on criteria to be adopted by the Board of Fisheries.
- **Policy III:** Management strategies should be consistent with the prudent economic development of the state's recreational sport fishing industry while at the same time acknowledging the intrinsic value of this fishery resource to the people of Alaska.

Plan Implementation

Regulations based on the Southwest Alaska Rainbow Trout Management Plan were adopted by the BOF in February 1990. These regulations were designed to implement the three management policies contained in the rainbow trout management plan. Specifically, the Board:

- Expanded the Wild Trout Zone from the Iliamna drainage to include the drainages of Bristol Bay and Kuskokwim Bay and the Kuskokwim River from Aniak River downstream.
- Established eight catch-and-release areas in the Bristol Bay Management Area and three catch-and-release areas in the Lower Kuskokwim Management Area (Figure 10).
- Established six artificial fly-only/catch-and-release-only areas (Figure 11).
- Established 11 unbaited single-hook artificial lure only areas to protect rainbow trout stocks (Figure 12).

Adoption of regulations implementing the management policies contained in this plan was not expected to be a one-time effort. Rather, policy implementation was understood to be a long-term process, with the policies being used as the framework for development of a very important and unique resource. This has been the case and special management regulations have since been adopted using this process for the Kvichak River in Bristol Bay, and the Kanektok, Kwethluk, Kasigluk, and Kisaralik rivers in the Kuskokwim area during the BOF meetings held in the fall and winter of 1997. This plan has also proved to be a useful guide for rainbow trout management in other parts of the state.

BRISTOL BAY RAINBOW TROUT STUDIES

In 2005, Sport Fish Division funded a creel survey project at Lower Talarik Creek. Project objectives included the census of sport fishing effort and catch, estimation of size and age compositions of catchable trout, and angler demographics. Preliminary results show a generally stable level of effort as well as desirable catch rates and size compositions. In addition float trips were conducted on the Kaktuli River to document the length composition, catch per unit effort and distribution of rainbow trout and other resident species. Water quality information was collected at four locations in the survey area as well as information on the presence of adult and juvenile salmon species.

In 2006, the project collected data on size composition and catch per unit effort for rainbow trout on the upper Nushagak River between Harris Creek and the Chichitnok River. Preliminary size data were similar to that of data collected during 1998. Similar rainbow trout data were collected at Moraine Creek in the Alagnak River drainage. A creel survey was also conducted at Moraine Creek to validate sport operator freshwater logbook data.

In 2005 and 2006, a long-term study of Wood River lakes rainbow trout was funded by Division of Sport Fish. This project includes two phases and will allow the department to develop a long-term rainbow trout database and to identify factors limiting rainbow trout production in the Wood River lakes system. Phase one of the project involved identifying critical habitat areas and phase two, which was conducted in 2005 and 2006, involved the estimation of abundance and dynamic rates (e.g. survival, cause-specific mortality, movement, etc.) of rainbow trout at a spawning tributary of the Wood River lakes system.

LOWER TALARIK CREEK

Fishery Description

Lower Talarik Creek, located at the northwest corner of Lake Iliamna, is renowned for its high quality rainbow trout sport fishery. The creek is relatively small and most anglers only fish along the first 2 miles above its entrance into Lake Iliamna. The large fish, for which Lower Talarik Creek is so famous, enter the creek from Iliamna Lake to feed on salmon eggs and carcasses in the fall. The sport fishery takes advantage of this migration and is most active from mid-August until freeze-up in late September or October. Most anglers fishing Lower Talarik Creek are guided nonresidents who make daily fly-in trips from the many lodges operating in the Lake Iliamna area. From 10 to 30 anglers can be accommodated at any given time in the lower portion of the creek that is commonly fished.

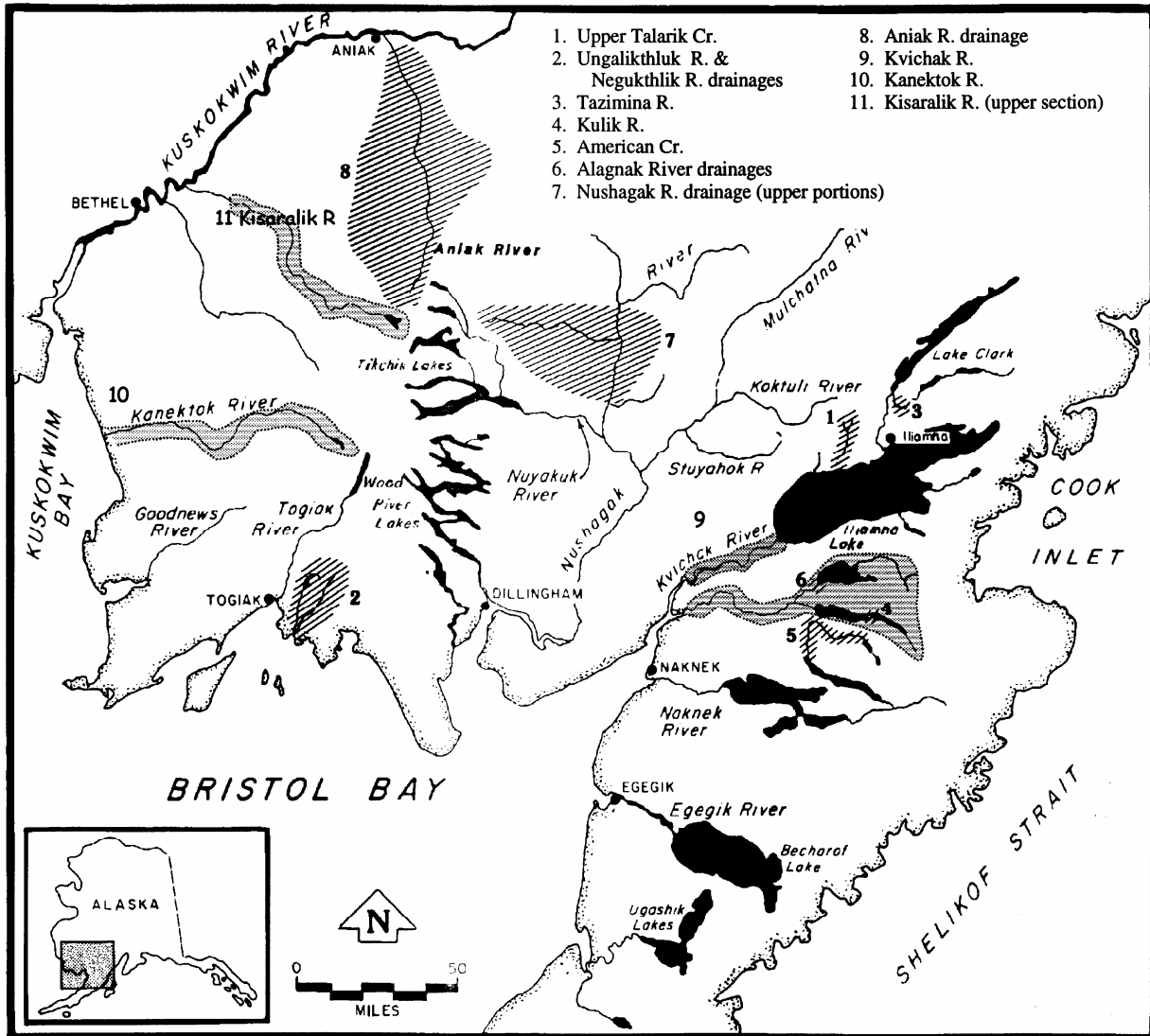


Figure 10.-Catch-and-release special management areas for rainbow trout.

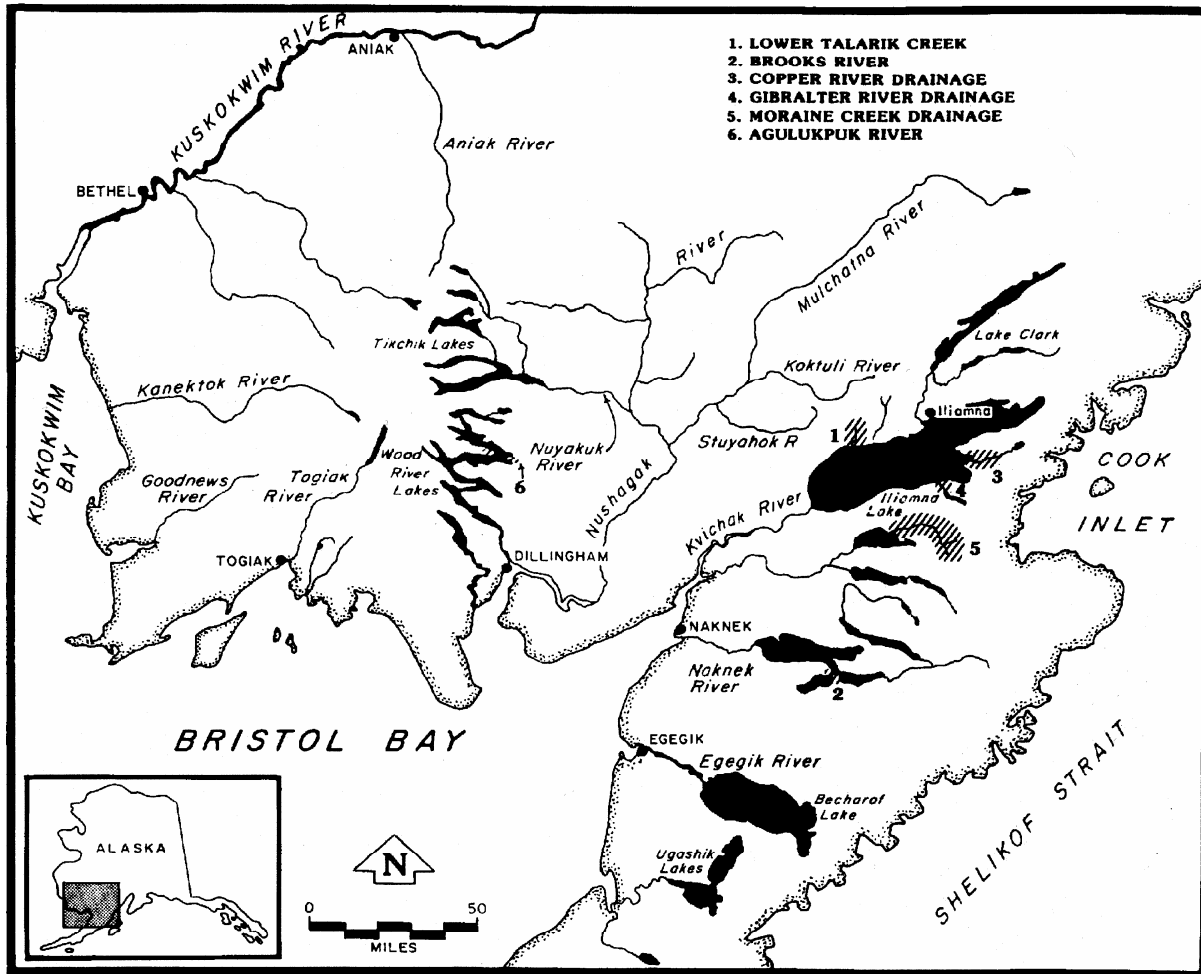


Figure 11.-Fly-only/catch-and-release special management areas for rainbow trout.

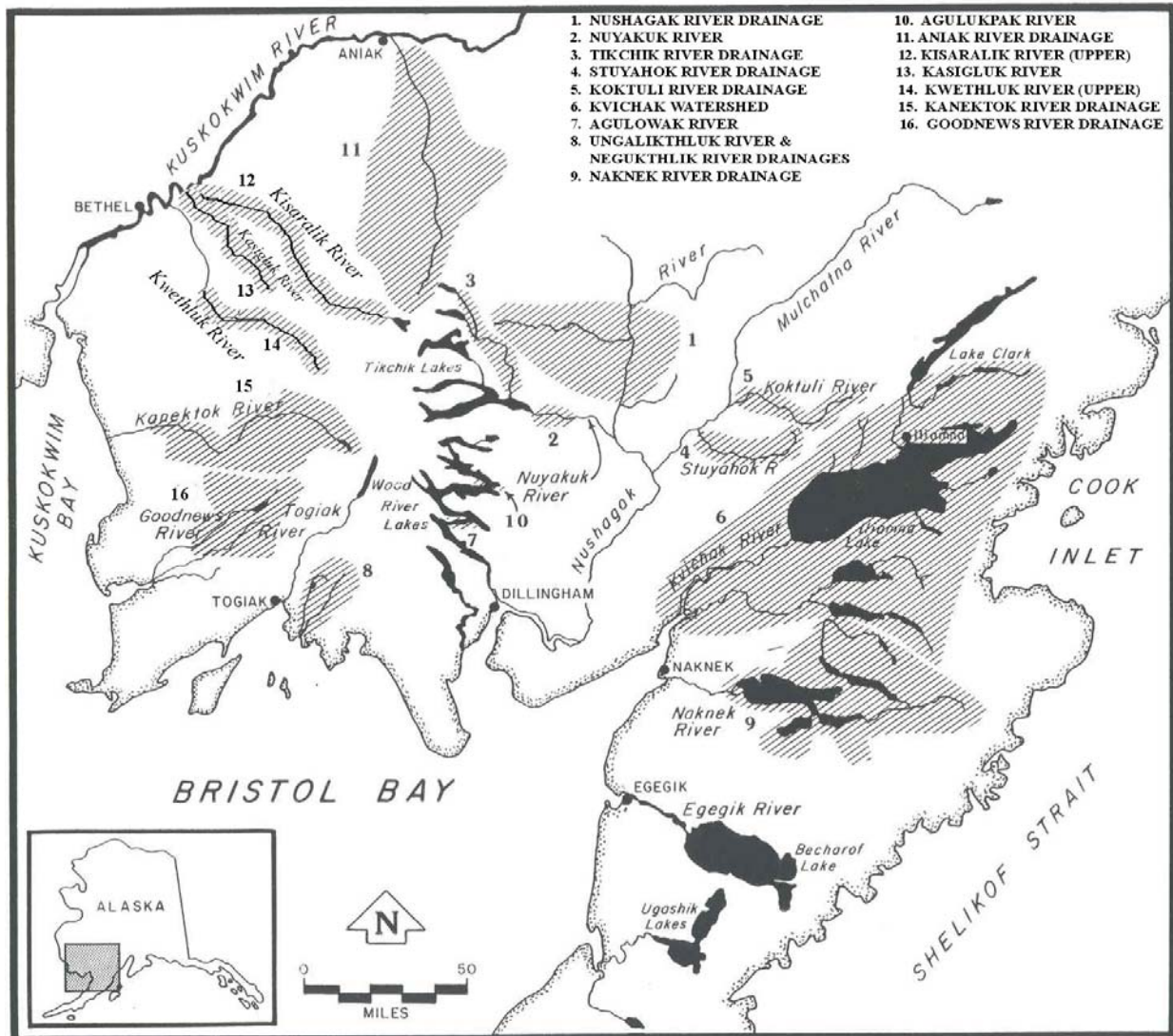


Figure 12.-Unbaited single-hook artificial lure special management areas for rainbow trout.

In 1992, a Native land claim had the potential to eliminate public access to this world-class rainbow fishery. Through an agreement with the claimant, the Nature Conservancy (TNC) obtained the land and coordinated a land management agreement with ADF&G and the Alaska Department of Natural Resources. One stipulation of the agreement was to create a Special Use Area along the lower reaches of Lower Talarik Creek that would allow public access. After extensive discussions with local leaders, the Special Use Area was created in August 1999. In the spring of 2001, the Nature Conservancy initiated a process to convey these lands to the state for management. The Department of Natural Resources Realty section is currently finalizing the transfer.

Harvest and Effort

Sport fishing effort and harvest on Lower Talarik Creek rainbow trout was first estimated with onsite creel surveys from 1970 through 1976 (Table 12). Annual harvest ranged from a high of 433 fish in 1971 to 73 fish in 1974. Creel surveys conducted during the fall fisheries of 1989, 1990, 1991, and 1993 through 2005 found effort was at the upper range of, but not significantly different from, the levels observed in the 1970s (Table 12). Low catch and effort in 1997 and 2001 are due to the short duration of surveys those years.

Based on the SWHS, effort on Lower Talarik Creek has been relatively constant at 600 to 900 angler-days per year. Harvests of Lower Talarik creek rainbow trout were less than 100 fish annually since 1977 and were virtually nonexistent after 1985 (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, *In prep.* a-b).

Since 1990, the length composition of the catchable population, estimated from creel surveys, appears to have shifted to fish larger than those sampled in the mid 1980s (unpublished data; see footnote 1).

Fishery Management and Objectives

The Lower Talarik Creek rainbow trout fishery is managed to maintain historical age and size composition and a diversity of angling opportunity by maintaining the special management designation with artificial fly-only, catch-and-release.

Lower Talarik Creek was designated a special management area in 1990 as part of the implementation of the Southwest Alaska Rainbow Trout Management Plan. Sport fishing is restricted to unbaited artificial flies, and the area is catch-and-release only for rainbow trout. A season closure from April 10 through June 7 provides protection for spawning rainbow trout during this critical life stage.

Table 12.-Angler effort, catch, retention rate, and catch/angler-hour for rainbow trout, Lower Talarik Creek, 1970-1976, 1986-1987, 1990-1991, 1993-2005.

Year	Angler-Hours	Catch	Catch per Hour ^a	Mean Angler-Hours per Day	Harvest	Percent Retained	Survey Dates
1970	1,315	600	0.46	27.4	119	20%	8/26-10/11
1971	2,604	2,300	0.88	26.3	433	19%	6/8-9/30
1972	1,718	834	0.49	17.4	141	17%	6/8-9/30
1973	1,376	780	0.57	13.9	113	14%	6/8-9/30
1974	1,037	498	0.48	10.5	73	15%	6/8-9/30
1975	1,048	1,648	1.57	10.6	127	8%	6/8-9/30
1976	438	843	1.92	21.9	92	11%	6/8-6/15; 9/12-9/23
1986	2,063	2,389	1.16	62.5	16	1%	6/8-6/15; 8/15-10/9
1987	1,893	2,844	1.5	59.2	4	1%	8/22-9/22
1990	2,086	2,910	1.4	77.3	0	NA ^b	9/1-9/27
1991	1,729	2,363	1.37	64	0		8/30-9/25
1993	1,080	699	0.65	98.2	0		9/10-9/20
1994	2,462	3,273	1.33	87.9	0		9/2-9/29
1995	2,496	3,200	1.28	86.1	0		9/1-9/29
1996	1,930	1,655	0.86	68.9	0		9/3-9/30
1997 ^c	1,210	1,794	1.48	80.7	0		9/1-9/15
1998	2,596	1,698	0.65	118	0		8/31-9/21
1999	2,121	1,192	0.57	81.6	0		8/29-9/23
2000	2,813	4,868	1.73	104.2	0		8/28-9/23
2001 ^c	934	692	0.74	77.8	0		9/2-9/13
2002 ^c	1,014	770	0.76	67.6	0		9/5-9/19
2003 ^c	789	685	0.87	60.7	0		9/1-9/13
2004	1,321	1,044	0.84	45.8	0		9/1-9/29
All Years Average	1,655	1,721	1.02	59.5	48.6		
Five Year Average	1,374	1,612	0.99	71.2	0		
2005	1,002	2,100	2.10	35.8	0		9/2-9/29

Sources: Russell 1977; Minard 1990; Minard et al. 1992; and unpublished data from a memo dated January 23, 2005 from T. Jaecks to J. Hasbrouck summarizing the Lower Talarik Creek rainbow trout project, 2004; located at Alaska Department of Fish and Game, Division of Sport Fish, Dillingham.

^a Unstratified CPUE, recalculated from total catch and hours in original reports.

^b Lower Talarik Creek became a catch-and-release fishery beginning in 1990.

^c Small total catch and effort is due to the short duration of the survey.

Lower Talarik Creek's small size, accessibility, and abundant large rainbow trout garnered early regulatory attention. A synopsis of significant regulation changes follows:

Effective Year	Regulation
1965	Spawning season closure imposed on Lower Talarik Creek. Lower Talarik Creek closed to all fishing from April 10 through June 7.
1968	Lower Talarik Creek was included in the "Bristol Bay Trophy Fish Area."
1969	Bag and possession limits reduced to 5 trout, only 1 over 20 inches in length. Helicopter access was forbidden, single hooks were required on tackle.
1974	The use of bait was prohibited during the summer months.
1977	Trophy Fish Area renamed the Bristol Bay Wild Trout Area, retaining the regulations accumulated since 1965.
1981	Gear was limited to single-hook artificial flies from June through October.
1984	Reduced the bag and possession limit to 2 rainbow trout, 1 over 20 inches.
1985	Reduced the bag limit to 1 rainbow trout during the summer.
1990	Adopted the Southwest Alaska Rainbow Trout Management Plan. Lower Talarik Creek was designated as a special management area, to be managed under artificial-fly only, catch-and-release restrictions.
1999	Alaska Department of Natural Resources designated the five sections of State-owned land immediately surrounding the lower reaches of Lower Talarik Creek as a Special Use Area. Guidelines for overnight camping, and commercial activities were established. Also, the ADNR entered into an Interagency Land Management Agreement (ILMA) for approximately two acres of land on which stands the Division of Sport Fish cabin.
2001	The Nature Conservancy initiated a transfer of its privately held lands to the ADNR with management responsibilities to be delegated to ADF&G Sport Fish.

UPPER NUSHAGAK RIVER

Fishery Description

The upper Nushagak River consists of the stretch of river upstream of the confluence with the Nuyakuk River. Nushagak rainbow trout are not as large as those in other rivers of the area, but they are abundant. Size composition data for rainbow trout between Harris Creek and the Chichitnok River was collected by the Division of Sport Fish in 1999 and 2006. The average size of fish was approximately 16 inches and no fish larger than 23 inches were sampled.

The upper Nushagak River provides an attractive alternative to more crowded rainbow trout fisheries in the area. There are approximately six camps situated in this section of river that are operated by sport guide services. In addition, this section of the river is popular for float trips. Angler effort averaged 15,858 angler days for all species (Table 1), and catch averaged 11,562 rainbow trout (Table 11) for 2000-2004.

Fishery Management and Objectives

The upper Nushagak rainbow trout fishery is managed to maintain the historical age and size composition of rainbow trout. The upper Nushagak River between Harris Creek and the Chichitnok River, including the King Salmon River, has been designated as a special management area, restricted to unbaited single hook tackle and catch-and-release for rainbow trout since 1990.

OTHER SPECIES FISHERIES

Bristol Bay offers diverse sport fishing opportunity for a large variety of species that often go unnoticed because of the publicity given the more popular species. Northern pike, Arctic char/Dolly Varden, Arctic grayling, lake trout, coho and chum salmon are species that contribute to the sport fishing pleasures of many anglers who fish the area. Harvest estimates are made annually for these other species and harvest and catch are monitored with the SWHS.

Only northern pike are addressed in proposals before the BOF in 2006.

NORTHERN PIKE

Northern pike are native and abundant throughout the BBMA, but drainages that support populations of large trophy northern pike are rare. When present, large northern pike are targeted by anglers and highly susceptible to exploitation. Large northern pike are important in maintaining the size structure of their populations by preying on small pike. A reduction in large pike can reduce the self-regulatory effect of cannibalism resulting in an abundant population of small pike. If small pike become more abundant growth rates can slow and it is difficult for big pike to recover. It has been recommended that management aimed at producing large pike must severely restrict the harvest of large pike (Pierce and Tomcko 2003).

In 2001, the BOF reduced the bag and possession limit for northern pike throughout the BBMA from 10 per day and in possession to five per day and in possession. In most cases, the older liberal bag limit was not causing biological problems, but growth of the sport fishery was a concern to many local residents. At the same time, the current ethic among many anglers tends to advocate very limited or no harvest. In addition to the changing recreational fishery ethics, northern pike are very important to the local subsistence economies and the bag limit reductions found considerable support from that constituency.

Northern pike catch and harvest have remained stable in the management area, averaging 9,916 and 1,140 in 2000-2004 (Tables 13, 14).

Chulitna River Drainage

The Chulitna River flows into Lake Clark near the village of Port Alsworth. The Chulitna River drainage is well known for producing northern pike over 40 inches, with reports of fish exceeding 50 inches. Preliminary results of 2006 Sport Fish Division research in the drainage showed that 20% of the fish sampled were over 30 inches and 4% were over 40 inches. Angling effort for the drainage from 1996 through 2005 has averaged 60 angler days, and an average catch and harvest of 130 and 3 northern pike for 2000-2004 (Tables 13, 14).

Lake Kulik

Lake Kulik is in the upper drainage of the Wood River Lakes system. The lake is locally known for producing large northern pike. Sport Fish Division research in 1997 and 2004 found that 28% of the fish were over 30 inches and 1% were over 40 inches (unpublished data). Several fish tagged in 1997 were recaptured in 2004. These fish exhibited slow growth and the number of fish observed and tag recoveries indicate a small population of northern pike. Angling effort in the lake for 2002 through 2005 has averaged 55 angler days, and an average catch and harvest of 54 and 10 northern pike for 2000-2004 (Tables 13, 14).

Table 13.-Sport catch of northern pike, by fishery, in the Bristol Bay Sport Fish Management Area, 1991-2005.

Drainage	1991-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Ugashik	334	938	150	1,091	223	269	102	0	0	0	22	0	4	0
Egegik/Becharof	17	0	0	53	77	0	0	0	0	0	0	0	0	0
Naknek R.	203	2,084	160	483	22	635	256	923	2,113	44	122	0	640	364
Naknek L.	264	134	50	1,040	30	67	167	345	0	0	0 ^a	0 ^a	69	24
Bay of Islands	1,328	869	547	1,323	1,435	1,053	160	139	250	459	109	453 ^a	282	400
Brooks R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brooks L.	6	0	0	106	0 ^a	8 ^a	0	0	0	0	0 ^a	0 ^a	0	0
American Cr.	56	0	0	293	0	9	0	0	28	14	0	0	8	72
King Salmon R (U)	0	0	0 ^a	0 ^a	0 ^a	0	0	0	0	0	0 ^a	0 ^a	0	0
Kvichak R.	474	767	490	466	439	438	418	215	137	137	73	429	198	306
Copper R.	93	0	100	0	0	30	505	101	14	0	11	13	28	36
Alagnak R.	512	83	241	1,611	381	266	189	421	28	205	433	1,412	500	2,691
Newhalen R.	17	9	111	108	41	135	291	0	84	0	206	0	58	0
L Talarik Cr.	76	0	11	0	0	0	0	0	158	10	87	0	51	0
Lake Clark	1,136	1,992	502	521	363	1,019	385	1,367	1,340	1,082	242	1,603	1,127	1,530
Chulitna River				69	30	259	663	0	153	303	130	63	130	848
Lake Iliamna	503	65	387	152	231	336	44	10	644	57	87	98	179	36
Kulik R.	0	37	0	0	0	0	0	56	0	0	0	0	11	0
Tazimina R.	0	0	0 ^a	0 ^a	0 ^a	0 ^a	0	0	0	0	0 ^a	0 ^a	0	0
Moraine Cr.	0	0	0	0	0	0 ^a	0	0	0	0	0	0	0	18
Other	958	812	708	730	661	492	604	487	1,677	39	1,474	392	814	1,674
Subtotal	5,976	7,790	3,457	8,046	3,933	5,016	3,784	4,064	6,626	2,350	2,996	4,463	3,417	7,999

-continued-

Table 13.-Page 2 of 2.

Drainage	1991-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Central														
Nushagak	3,864	1,831	2,325	2,926	719	1,624	2,144	1,703	1,452	2,878	2,481	1,923	2,087	3,137
Mulchatna	318	453	318	227	112	512	357	108	56	77	113	68	84	354
Agulowak					0	72	115	34	0	49	47	0	26	90
Agulukpak					0	351	88	469	0	397	0	0	173	0
Wood River L.	3,679	1,787	3,216	4,006	1,522	1,672	1,946	5,595	2,336	5,184	1,487	5,426	4,006	5,516
Lake Kulik								0	0	0	0	272	54	59
Tikchik/Nuyakuk	366	571	965	966	857	658	171	564	460	367	2,321	1,013	788	680
Koktuli R.	77	90	0 ^a	238	15 ^a	142 ^a	10	0	0	0	65 ^a	51 ^a	23	0
Other	692	551	436	1,135	311	778	656	309	40	56	336	975	343	358
Subtotal	8,971	5,283	7,260	9,498	3,536	5,809	5,487	8,782	4,344	9,008	6,850	9,728	6,452	10,194
Western														
Togiak	73	138	238	51	15	71	58	11	151	24	0	101	57	593
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	73	138	238	51	15	71	58	11	151	24	0	101	48	593
Total	15,020	13,211	10,955	17,595	7,484	10,896	9,329	12,857	11,121	11,382	9,846	14,292	9,916	18,786

Source: Statewide Harvest Survey database, and Mills 1992-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Unpublished estimates from Statewide Harvest Survey for sites with less than 12 responses.

Table 14.-Sport harvest of northern pike, by fishery, in the Bristol Bay Sport Fish Management Area, 1977-2005.

Drainage	1977-1993												2000-2004	
	Average	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average	2005
Eastern														
Naknek R.	67	350	106	108	0	45	146	261	0	0	24	30	63	129
Brooks R.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kvichak R.	16	118	33	74	21	41	81	0	40	24	73	30	33	53
Copper R.	2	0	100	0	0	18	16	0	0	0	0	0	0	0
Alagnak R.	50	9	118	212	15	0	9	0	14	0	0	38	10	95
Newhalen R.	16	9	0	108	34	25	19	0	0	0	85	0	17	0
Lake Clark	111	128	19	137	63	189	19	0	172	7	24	274	95	29
Chulitna River						0	115	0	13	0	0	0	3	0
Other ^a	313	467	123	702	306	228	470	274	306	57	393	235	253	251
Subtotal	575	1,081	499	1,341	439	546	875	535	545	88	599	607	475	557
Central														
Nushagak	197	591	521	145	248	132	309	144	305	647	405	221	344	299
Mulchatna	56	9	21	168	14	52	9	0	0	0	0	0	0	35
Agulowak					0	0	0	0	0	0	12	0	2	0
Agulukpak ^d					0	0	0	0	0	0	0	0	0	0
Wood River L.	174	126	373	201	351	54	164	291	423	324	141	634	363	521
Lake Kulik										0	0	30	10	0
Tikchik/Nuyakuk	42	0	45	40	0	0	11	10	42	8	94	151	61	0
Other ^a	60	64	70	228	0	138	23	29	0	0	205	83	63	108
Subtotal	529	790	1,030	782	613	376	516	474	770	979	857	1,119	840	963
Western														
Togiak	14	0	0	0	0	13	0	0	0	0	0	25	5	106
Other ^a	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	14	0	0	0	0	13	0	0	0	0	0	25	5	106
Total	1,118	1,871	1,529	2,123	1,052	935	1,391	1,009	1,315	1,067	1,456	1,751	1,140	1,626

Source: Statewide Harvest Survey database, and Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006a-b, In prep. a-b. 1996-1998 estimates were revised in 2001, so may not match previously published estimates.

^a Subtotals of averages may not be the sum of the drainages because information for some drainages is not available for some years.

^b Until 1997, Agulowak and Agulukpak rivers were included in Wood River Lakes.

ACKNOWLEDGEMENTS

We would like to thank several people who were instrumental to the completion of this report including: Dillingham Fish and Wildlife Technician III Ethan Ford updated several tables for this report. Regional Management Coordinator Dan Sharp also contributed significant edits to this report. Thanks also go to the people credited with personal communications throughout this report.

REFERENCES CITED

- ADF&G (Alaska Department of Fish and Game). 2006. 2006 Sport fishing regulations summary. Bristol Bay and Kuskokwim Bay drainages. Alaska Department of Fish and Game, Division of Sport Fish, Juneau.
- Brookover, T. E., D. L. Bill, R. B. Russell, J. R. Skrade, B. E. Cross, J. Woolington, B. Stratton, and K. A. Rowell (Alaska Department of Fish and Game). 1991. Annual management report 1990, Bristol Bay Area. Division of Commercial Fisheries, Regional Information Report No. 91-1, Anchorage.
- Brookover, T. E., III. 1989. Creel and escapement statistics for the Alagnak River during 1988. Alaska Department of Fish and Game, Fishery Data Series No. 89, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-089.pdf>
- Bucher, W. A., M. L. Nelson, D. L. Bill, R. B. Russell, J. R. Skrade, S. M. Fried, R. E. Minard, and H. Yuen. 1987. Annual management report 1986 Bristol Bay area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.
- Cappiello, T. and J. Dye. *In prep.* Survey of the Chinook salmon sport fishery in the lower Nushagak River, Alaska, 2001. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.
- Collins, C. N., and J. E. Dye. 2003. Survey of the Chinook and coho salmon sport fishery in the Alagnak River, Alaska, 2001 and 2002. Alaska Department of Fish and Game, Fishery Data Series No. 03-12, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-12.pdf>
- Cross, B. A. 1991. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Kvichak River sockeye salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A91-16, Anchorage.
- Cross, B. A. 1994. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Bristol Bay salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A94-46, Anchorage.
- Cross, B. A., D. A. Gray, and D. L. Crawford. 1997. Report to the Alaska Board of Fisheries spawning escapement goal evaluations for Bristol Bay salmon. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report 2A97-30, Anchorage.
- Dunaway, D. O. 1990. Creel and escapement statistics for the Alagnak River, Alaska during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-9, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds90-09.pdf>
- Dunaway, D. O. 1993. Status of rainbow trout stocks in the Agulowak and Agulukpak rivers of Alaska during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-41, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-41.pdf>
- Dunaway, D. O. 1994. Surveys of the Chinook and coho salmon sport fisheries in the Alaganak River Alaska, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-24, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-24.pdf>
- Dunaway, D. O., and A. E. Bingham. 1992. Creel surveys on the Chinook salmon sport fishery on the lower Nushagak River and Mid-Mulchatna River, Alaska, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-16, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-16.pdf>

REFERENCES CITED (Continued)

- Dunaway, D. O., A. E. Bingham, and R. E. Minard. 1991. Effort, catch, and harvest statistics for the Chinook salmon sport fishery in the middle Mulchatna River, Alaska, during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-40, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-40.pdf>
- Dunaway, D. O., and S. J. Fleischman. 1995. Surveys of the Chinook and coho salmon sport fisheries in the Nushagak and Mulchatna rivers, Alaska 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-18, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-18.pdf>
- Dunaway, D. O., and S. J. Fleischman. 1996. Surveys of the sockeye salmon sport fishery in the Upper Kvichak River, Alaska, 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-18, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-18.pdf>
- Dye, J. E. 2005. Survey of the Chinook salmon sport fishery in the lower Nushagak River, Alaska, 2000. Alaska Department of Fish and Game, Fishery Data Series No. 05-23, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds05-23.pdf>
- Eggers, D. M., and D. E. Rogers. 1987. The cycle of runs of sockeye Salmon *Oncorhynchus nerka* to the Kvichak River, Bristol Bay, Alaska: cyclic dominance or depensatory fishing? Pages 343-366 [in] H. D. Smith, L. Margolis, and C. C. Wood, editors. Sockeye salmon *Oncorhynchus nerka* population biology and future management. Canadian Special Publications of Fisheries and Aquatic Science 96, Ottawa, Canada.
- Fair, L. F., B. G. Bue, R. A. Clark, and J. J. Hasbrouck. 2004. Spawning escapement goal review of Bristol Bay salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A04-17, Anchorage.
- Fried, S. M. 1984. Bristol Bay Pacific salmon spawning escapement goal workshop. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 84-12, Anchorage.
- Glick, W. J., J. B. Browning, S. Morstad, K. A. Weiland, and C. J. Anderson. 2000. Annual management report 1999, Bristol Bay area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A00-20, Anchorage.
- Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds96-32.pdf>
- Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds95-24.pdf>
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001a. Revised Edition. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29 (revised), Anchorage. [http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-29\(revised\).pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/fds97-29(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001b. Revised Edition. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 (revised), Anchorage. [http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-25\(revised\).pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/fds98-25(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001c. Revised Edition. Participation, catch, and harvest in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41 (revised), Anchorage. [http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-41\(revised\).pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/fds99-41(revised).pdf)
- Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 2001d. Participation, catch, and harvest in Alaska sport fisheries during 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-8, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds01-08.pdf>
- Jennings, G. B., K. Sundet, and A. E. Bingham. *In prep.* Participation, catch, and harvest in Alaska sport fisheries during 2005. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.
- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2004. Participation, catch, and harvest in Alaska sport fisheries during 2001. Alaska Department of Fish and Game, Fishery Data Series No. 04-11, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds04-11.pdf>

REFERENCES CITED (Continued)

- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006a. Participation, catch, and harvest in Alaska sport fisheries during 2002. Alaska Department of Fish and Game, Fishery Data Series No. 06-34, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidpdfs/fds06-34.pdf>
- Jennings, G. B., K. Sundet, A. E. Bingham, and D. Sigurdsson. 2006b. Participation, catch, and harvest in Alaska sport fisheries during 2003. Alaska Department of Fish and Game, Fishery Data Series No. 06-44, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidpdfs/fds06-44.pdf>
- Jennings, G. B., K. Sundet, T. A. Wettin, K. R. Kamletz, and A. E. Bingham. *In prep.* Participation, catch, and harvest in Alaska sport fisheries during 2004. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.
- Miller, J. D. 1999. Sonar enumeration of Pacific salmon escapement into Nushagak River, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Regional Information Report No. 2A99-05, Anchorage.
- Miller, J. D. 2000. Sonar enumeration of Pacific salmon escapement into Nushagak River, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 2A00-19, Anchorage.
- Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Performance Report 1978-1979, Project F-9-11, 20 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-11\(20\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-11(20)SW-I-A.pdf)
- Mills, M. J. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-12\(21\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-12(21)SW-I-A.pdf)
- Mills, M. J. 1981a. Alaska statewide sport fish harvest studies - 1979 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13\(22a\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13(22a)SW-I-A.pdf)
- Mills, M. J. 1981b. Alaska statewide sport fish harvest studies - 1980 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1980-1981, Project F-9-13, 22 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13\(22b\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-13(22b)SW-I-A.pdf)
- Mills, M. J. 1982. Alaska statewide sport fish harvest studies - 1981 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1981-1982, Project F-9-14, 23 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-14\(23\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-14(23)SW-I-A.pdf)
- Mills, M. J. 1983. Alaska statewide sport fish harvest studies - 1982 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1982-1983, Project F-9-15, 24 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-15\(24\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-15(24)SW-I-A.pdf)
- Mills, M. J. 1984. Alaska statewide sport fish harvest studies - 1983 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1983-1984, Project F-9-16, 25 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-16\(25\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-16(25)SW-I-A.pdf)
- Mills, M. J. 1985. Alaska statewide sport fish harvest studies - 1984 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1984-1985, Project F-9-17, 26 (SW-I-A), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-17\(26\)SW-I-A.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-9-17(26)SW-I-A.pdf)
- Mills, M. J. 1986. Alaska statewide sport fish harvest studies - 1985 data. Alaska Department of Fish and Game, Federal Aid in Fish Restoration and Anadromous Fish Studies, Annual Performance Report 1985-1986, Project F-10-1, 27 (RT-2), Juneau. [http://www.sf.adfg.state.ak.us/FedAidPDFs/f-10-1\(27\)RT-2.pdf](http://www.sf.adfg.state.ak.us/FedAidPDFs/f-10-1(27)RT-2.pdf)
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-002.pdf>
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-052.pdf>

REFERENCES CITED (Continued)

- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report, 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-122.pdf>
- Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds90-44.pdf>
- Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds91-58.pdf>
- Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-40.pdf>
- Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds93-42.pdf>
- Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds94-28.pdf>
- Minard, R. E. 1987. Effort and catch statistics for the Chinook salmon (*Oncorhynchus tshawytscha*) sport fishery in the lower Nushagak River, 1986. Alaska Department of Fish and Game, Fishery Data Series No. 15, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-015.pdf>
- Minard, R. E. 1989. Effort, catch, and harvest statistics for the sport fisheries on the Agulukpak and Agulowak River, Wood River Lake system, Alaska, 1986-1988. Alaska Department of Fish and Game, Fishery Data Series No. 90, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-090.pdf>
- Minard, R. E. 1990. Rainbow trout stock status. Bristol Bay and Lower Kuskokwim Management Area. Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Dillingham.
- Minard, R. E., M. Alexandersdottir, and S. Sonnichsen. 1992. Estimation of abundance, seasonal distribution, and size and age composition of rainbow trout in the Kvichak River, Alaska, 1986 to 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-51, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds92-51.pdf>
- Minard, R. E., and T. E. Brookover III. 1988. Effort and catch statistics for the sport fishery for Chinook in the lower Nushagak River, 1987. Alaska Department of Fish and Game, Fishery Data Series No. 43, Juneau. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-043.pdf>
- Minard, R. E., D. O. Dunaway, and M. J. Jaenicke. 1998. Area management report for the recreational fisheries of the Southwest Alaska Sport Fish Management Area, 1997. Alaska Department of Fish and Game, Fishery Management Report No. 98-3, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr98-03.pdf>
- Naughton, G. P., and A. D. Gyska. 2000. Survey of the Chinook salmon sport fishery in the lower Alagnak River, Alaska, 1998. Alaska Department of Fish and Game, Fishery Data Series No. 00-26, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds00-26.pdf>
- Pierce, R. B., and C. M. Tomcko. 2003. Interrelationships among production, density, growth, and mortality of northern pike in seven north-central Minnesota lakes. Transactions of the American Fisheries Society 132: 143-153.
- Regnart, J. R., K. A. Weiland, J. B. Browning, T. E. Brookover, and C. J. Anderson. 1998. Annual management report 1997, Bristol Bay area. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 2A98-08, Anchorage.
- Rogers, D. E., and P. H. Poe. 1984. Escapement goals for the Kvichak River system. Unpublished Report FRI-UW-8407, Fisheries Research Institute, University of Washington, Seattle.

REFERENCES CITED (Continued)

- Russell, R. 1977. Rainbow trout life history studies in Lower Talarik Creek-Kvichak drainage. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1976-1977, Project F-9-9, 18 (G-II-E), Juneau.
- Walker, R. J., C. Olnes, K. Sundet, A. L. Howe, and A. E. Bingham. 2003. Participation, catch, and harvest in Alaska sport fisheries during 2000. Alaska Department of Fish and Game, Fishery Data Series No. 03-05, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds03-05.pdf>
- Weiland, K. A., S. Morstad, J. B. Browning, T. Sands, C. J. Anderson, L. Fair, D. Crawford, D. Gray, F. West, L. McKinley, and K. A. Rowell. 2001. 2000 Annual management report, Bristol Bay Area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A01-10, Anchorage.
- Westing, C., S. Morstad, K. A. Weiland, T. Sands, L. Fair, F. West, and C. Brazil. 2005. Annual Management Report 2004 Bristol Bay Area. Alaska Department of Fish and Game, Fishery Management Report No. 05-41, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/Fmr05-41.pdf>
- Westing, C., T. Sands, S. Morstad, P. Salomone, L. Fair, F. West, C. Brazil, and K. A. Weiland. 2006. Annual management report 2005 Bristol Bay area. Alaska Department of Fish and Game, Fishery Management Report No. 06-37, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fmr06-37.pdf>
- Westing, C, T. Sands, S. Morstad, P. Salomone, L. Fair, F. West, and C. Brazil. *In prep.* Annual management report 2006 Bristol Bay area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Fishery Management Report, Anchorage