Fishery Management Report No. 95-8

Area Management Report for the Recreational Fisheries of the Upper Copper/Upper Susitna River Management Area, 1994

by

Nicole J. Szarzi

November 1995

Alaska Department of Fish and Game

Division of Sport Fish

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd

Spell out acre and ton.

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s

Spell out year, month, and week.

Physics and chemistry

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

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
id est (that is)	i.e.,
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

FISHERY MANAGEMENT REPORT NO. 95-8

AREA MANAGEMENT REPORT FOR THE RECREATIONAL FISHERIES OF THE UPPER COPPER/UPPER SUSITNA RIVER MANAGEMENT AREA, 1994

by
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The Fishery Data Series was established in 1987 for the publication of technically-oriented results for a single project or group of closely related projects. Fishery Data Series reports are intended for fishery and other technical professionals. Distribution is to state and local publication distribution centers, libraries and individuals and, on request, to other libraries, agencies, and individuals. This publication has undergone editorial and peer review.

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MANAGEMENT AREA DESCRIPTION

The Upper Copper River-Upper Susitna River sport fish management area (UCUSMA) consists of all waters and drainages of the Copper River upstream from a line crossing the Copper River between the south bank of the mouth of Haley Creek and the south bank of the mouth of Canyon Creek in Wood Canyon, and all waters and drainages of the Upper Susitna River upstream from the confluence of the Oshetna River (Figure 1). Located within the UCUSMA are the communities of Glennallen, Gulkana, Gakona, Chitina, McCarthy, Kenny Lake, Copper Center, Paxson, Mentasta, Slana and Nabesna. The state's major highways, together with numerous secondary roads and trails, provide relatively good access to most of the area's sport fisheries. Float equipped aircraft are commonly used to access the area's many remote lake and stream fisheries not accessible by road during the summer. Snowmachines are the popular mode of travel to remote fisheries in the winter. Principal land managers in the UCUSMA are the National Park Service, Bureau of Land Management, Ahtna Incorporated, and the Alaska Department of Natural Resources.

Regulations governing the sport fisheries in the UCUSMA are found in Chapter 52 of Title 5 of the Alaska Administrative Code. Effort and harvest statistics for UCUSMA fisheries are reported in the statewide harvest survey (SWHS) by Mills (1994), under the heading "Glennallen Area" (Area I).

Management and research of UCUSMA sport and personal use fisheries are directed from the Anchorage and Glennallen area offices. The Area Management Biologist (Andrew Hoffmann) is stationed in Anchorage. The Assistant Area Management Biologist (Nicole Szarzi) is stationed in Glennallen. A permanent full-time field office assistant is also stationed in Glennallen. This assistant is shared with the Division of Wildlife Conservation. The professional staff is assisted by numerous seasonal technicians and biologists whose employment ranges from 2 to 11 months. Expertise on experimental design is provided to the area staff by the Division of Sport Fish's Research and Technical Support section stationed in Anchorage.

FISHERIES RESOURCES

The UCUSMA offers a unique blend of freshwater fishing opportunities to sport and personal use anglers. Three species of North Pacific salmon (chinook *Oncorhynchus tshawytscha*, coho *O. kisutch*, and sockeye *O. nerka*) are available to anglers fishing upper Copper River drainage waters. The upper Susitna River drainage has no anadromous salmon. A velocity barrier in Devil's Canyon prevents upstream migration in the Susitna River. Anglers can also target salmon stocked into various landlocked lakes of the UCUSMA.

Popular fisheries also occur on the area's resident stocks of Arctic grayling *Thymallus arcticus*, burbot *Lota lota*, Dolly Varden *Salvelinus malma*, rainbow and steelhead trout *O. mykiss*, and lake trout *Salvelinus namaycush*. Smaller fisheries occur on the area's resident stocks of whitefish *Coregonus* and *Prosopium*.

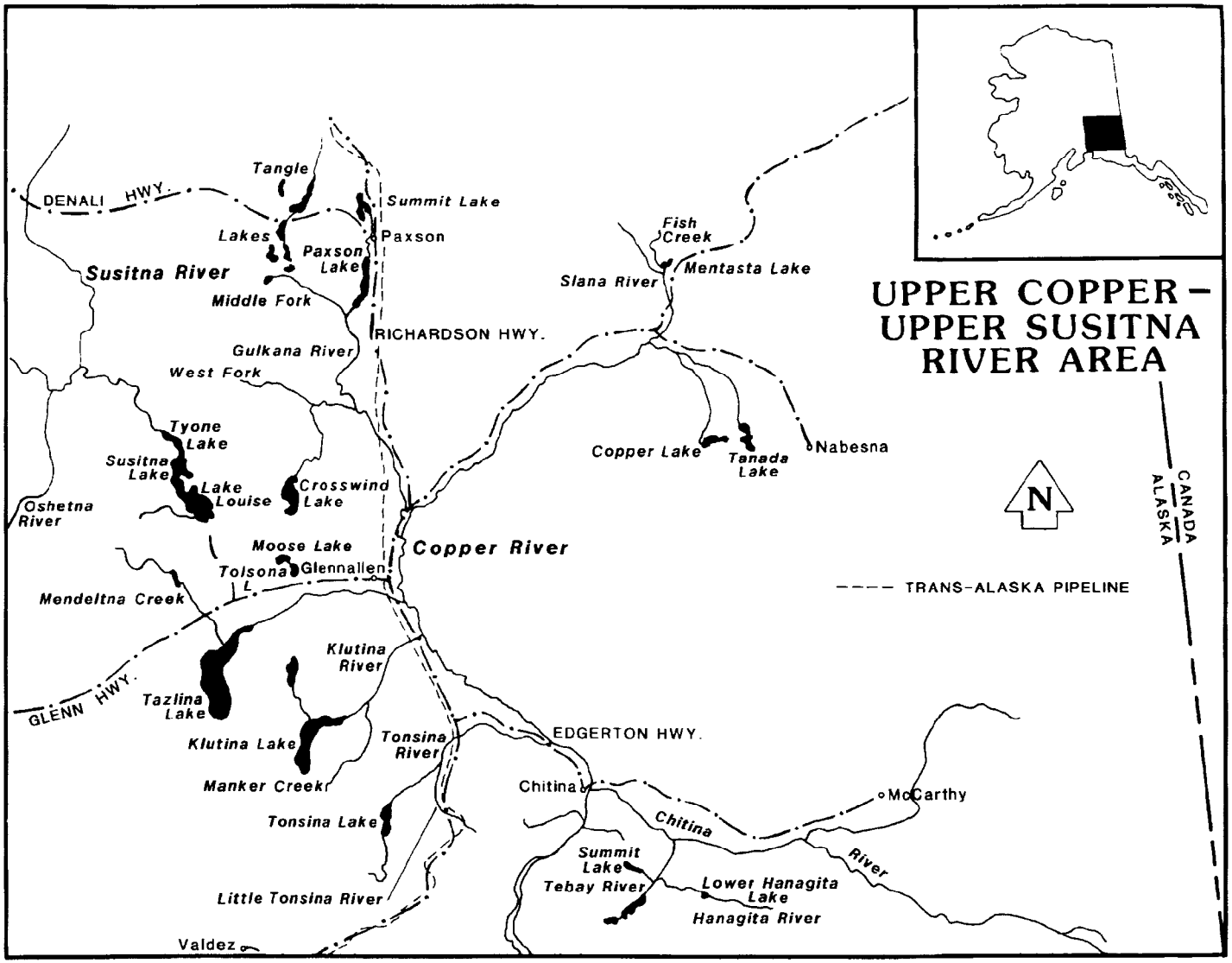


Figure 1.-The Upper Copper-Upper Susitna Management Area (UCUSMA).

ALASKA BOARD OF FISHERIES ACTIVITIES

The development of regulations for fisheries in the UCUSMA occurs within the established Alaska Board of Fisheries (BOF) process. The public provide their input concerning regulation changes and allocation by various means including, testifying directly to the BOF, by participating in local fish and game advisory committee meetings or by becoming members of local fish and game advisory committees. Advisory committees have been established throughout Alaska to assist the BOF in assessing the effects fisheries issues and proposed regulations have on communities local to the resource under consideration. Most active committees meet at least once each year, usually in the fall prior to scheduled BOF meetings. Staff from the Division of Sport Fish and other divisions are often invited to attend the committee meetings. In this way, advisory committee meetings allow the public to interact with the staff involved with resource issues of local concern. Within the UCUSMA there are three advisory committees that serve resource users of the area: the Tok Cutoff/Nabesna Road, Copper Basin, and Paxson advisory committees.

Under the current operating schedule, the BOF meets on a 3-year cycle. Proposals regarding UCUSMA fisheries were last heard during the February 1994 BOF meeting. The next BOF meeting to address proposals regarding UCUSMA sport and personal use fisheries is scheduled for February 1997. The deadline for submission of proposals for the next BOF meeting is April 10, 1996.

To address conservation concerns and to implement BOF adopted management plans, the department has emergency order authority (5 AAC 75.003) to modify time, area, and bag/possession limit regulations. Emergency orders issued under this authority during 1987 through 1994 are summarized in Table 1.

ESTABLISHED MANAGEMENT PLANS AND POLICIES

Some UCUSMA fisheries have been the focus of allocative conflicts. These conflicts have lead the BOF to establish several management plans and policies to guide the area's fisheries. The goals of these plans are to allocate fish resources among users and to provide managers with guidelines to maintain a sustained yield of the area's fish stocks. The following management plans and policies have been adopted by the BOF for UCUSMA fish stocks:

Copper River Personal Use Salmon Management Plan (5 AAC 77.590). This management plan establishes weekly and seasonal harvest quotas for a personal use fishery in the Copper River. The plan contains spawning escapement goals for sockeye and chinook salmon, harvest guidelines for the subsistence and sport fisheries in the drainage, and hatchery brood stock and hatchery surplus goals. These goals are met through regulation of the commercial fishery at the mouth of the river.

Copper River Subsistence Salmon Management Plan (5 AAC 01.647). This management plan establishes a seasonal target count of salmon which must pass the sonar in the lower Copper River. It also establishes the open area, gear, season, bag and possession limits and permit requirements for a subsistence fishery near the traditional fishing village, Batzulnetas, along a portion Tanada Creek and its confluence with the Copper River.

Table 1.-Emergency orders issued for UCUSMA sport fisheries during 1987 through 1994.

Year	E.O. Number	Explanation
1987	2-BB-3-xx-87	Closure of Hudson Lake to burbot fishing.
1988	2-BB-3-17-88	Closure of Hudson Lake to burbot fishing.
1988	2-RT-3-18-88	Closure of Summit Lake and Bridge Creek to all fishing by regulation from April 15 through July 10 to protect spawning rainbow trout.
1988	2-RS-3-08-88	Opening of portions of Paxson and Summit lakes to the taking of sockeye salmon.
1989	2-BB-3-19-89	Closure of Hudson Lake and Lake Louise to burbot fishing and prohibition of setlines in the Tyone River drainage.
1990	2-KS-3-10-90	Closure of Indian River, Ahtell Creek, and all waters within a one-quarter mile radius of their confluence with the Copper River, and Bernard Creek and all waters within a one-quarter mile radius of its confluence with the Tonsina River to fishing for chinook salmon.
1990	2-BB-3-34-90	Extends the closure of Hudson Lake and Lake Louise to burbot fishing and continues the prohibition of setlines in the Tyone River drainage and Hudson Lake.
1991		No emergency orders issued
1992	2-RS-3-09-92	Opened the personal use salmon fishery in the Chitina Subdistrict of the Upper Copper River Area from 12:00 noon Friday, June 5 through 6:00 p.m. Sunday, June 7 (a total of 54 hrs).
1992	2-RS-3-11-92	Established the season for the 1992 Copper River personal use salmon fishery.
1992	2-RS-3-20-92	Changed the open periods for the Copper River personal use salmon fishery to 12:00 noon Thursday and continuing through Sunday at midnight effective July 16. Thereafter, the fishery was opened 4 days a week, noon Thursdays until midnight Sundays, through August 6.
1993	2-BB-3-38-93	Opening of Hudson Lake to burbot fishing.
1994		No sport fish E.O.s issued in 1994

Lake Burbot Management Plan (5 AAC 52.045). This management plan stipulates that the lake burbot fisheries of the UCUSMA be managed to ensure maximum sustainable harvests and provides the department the authority to, through emergency order, establish periods to reduce time/area and/or prohibit setlines to accomplish this management objective.

Cook Inlet & Copper River Basin Rainbow/Steelhead Trout Management Policy. This management policy was adopted by the BOF to provide future Boards, fisheries managers, and the sport fishing public with: (1) management policies and implementation directives for area rainbow and steelhead trout fisheries; (2) a systematic approach to developing sport fishing regulations that includes a process for rational selection of waters for special management; and (3) recommended research objectives. This management policy was never adopted as regulation.

Copper River District Salmon Management Plan (5 AAC 24.360). This management plan stipulates that during years when Copper River District sockeye salmon returns are forecast to be weak or are demonstrated to be weak by inseason stock assessment monitoring tools and a *strong* harvestable surplus of chinook salmon can be demonstrated, the department may, by emergency order, authorize the use of large mesh gear in the Copper River District commercial salmon fisheries.

RECREATIONAL ANGLER EFFORT

Recreational angler effort in the UCUSMA has been estimated since 1977 using a mail survey (Mills 1979-1994). This survey estimates the number of angler-days of fishing effort expended by sport anglers fishing Alaskan waters as well as the harvest of important sport species. The survey is designed to provide estimates of effort and harvest on a site-by-site basis and, unfortunately, is not designed to provide estimates of effort directed towards a single species. Beginning in 1990, the survey was modified to include estimation of catch (release plus harvest) on a site-by-site basis. Additionally, creel surveys have been selectively used to ground truth the mail survey for fisheries of interest or for fisheries that require more detailed information or inseason management. The following summary of sport angler effort in the UCUSMA is based on mail survey data.

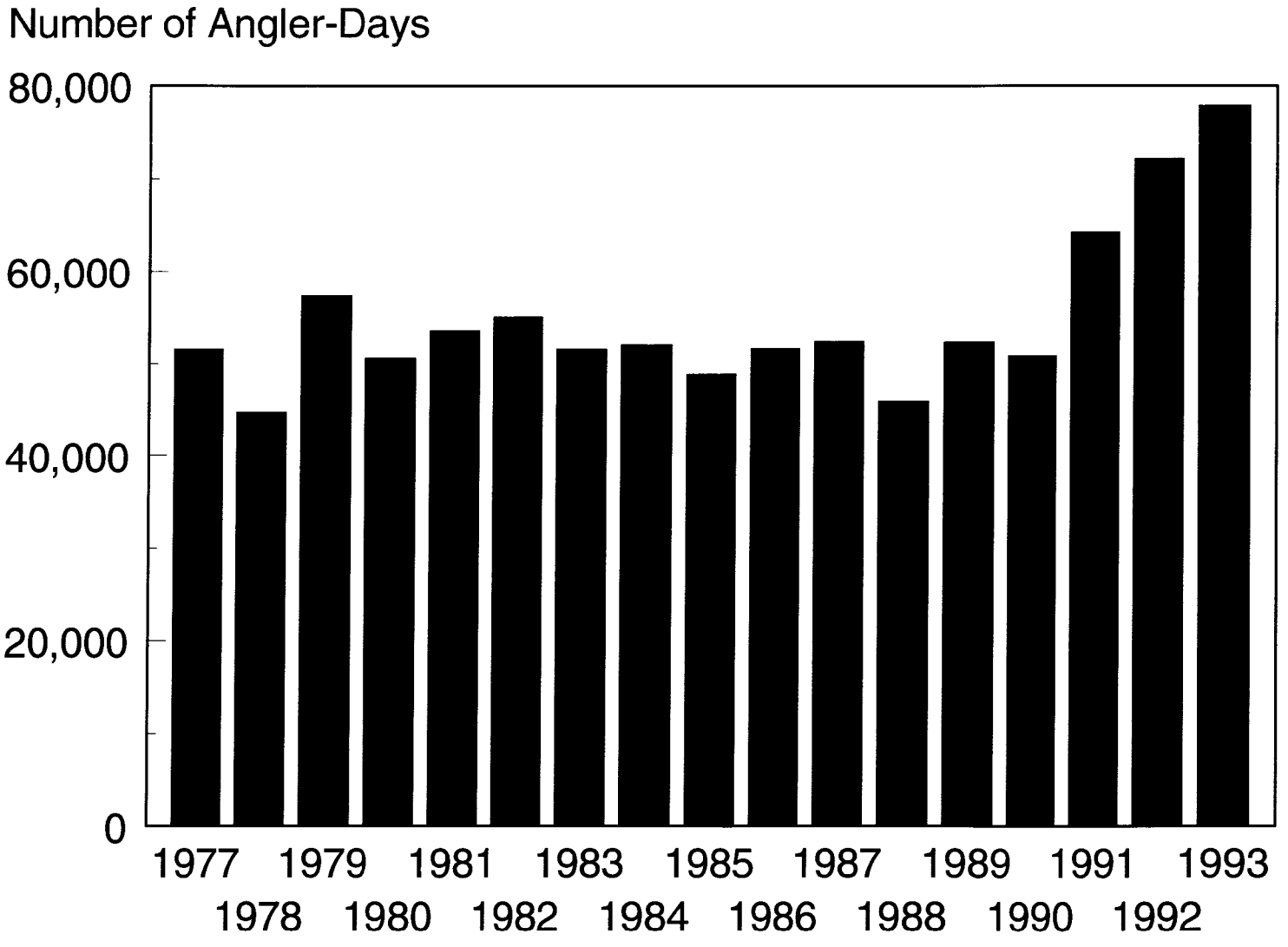
From 1977 through 1993 sport anglers have expended an average of 54,789 angler-days fishing UCUSMA waters, an average of 3.1% of the annual statewide sport angling effort and about 4.1% of the annual southcentral sport angling effort over this period (Table 2). Recreational angler effort was relatively stable until 1991 when it began to increase (Figure 2).

The upper Copper River drainage has supported an average of 74% of the sport effort expended in the UCUSMA from 1983 through 1992 (Table 3). In this drainage, the Gulkana River drainage has supported a vast majority of the sport angling effort (Table 3). The Klutina River is the other upper Copper River drainage which supports a popular sport fishery (Table 4). The major sport fishery in the upper Susitna River drainage is located in the Tyone River drainage and includes Lake Louise and Susitna and Tyone lakes.

Table 2.-Number of angler-days of sport fishing effort expended by recreational anglers fishing UCUSMA waters, 1977-1993.

Year	UCUSMA Effort	Alaska Effort	% by UCUSMA	Region II Effort	% by UCUSMA
1977	51,485	1,198,486	4.3%	828,351	6.2%
1978	44,566	1,285,063	3.5%	913,417	4.9%
1979	57,266	1,364,739	4.2%	1,014,018	5.6%
1980	50,518	1,488,962	3.4%	1,072,384	4.7%
1981	53,499	1,420,172	3.8%	1,016,731	5.3%
1982	54,953	1,623,090	3.4%	1,131,358	4.9%
1983	51,512	1,732,528	3.0%	1,212,916	4.2%
1984	51,964	1,866,837	2.8%	1,341,658	3.9%
1985	48,707	1,943,069	2.5%	1,406,419	3.5%
1986	51,563	2,071,412	5.1%	1,518,712	3.4%
1987	52,324	2,152,886	2.4%	1,556,050	3.4%
1988	45,867	2,311,291	2.0%	1,679,939	2.7%
1989	52,262	2,264,079	2.3%	1,583,547	3.3%
1990	50,791	2,453,284	2.1%	1,745,110	2.9%
1991	64,207	2,456,328	2.6%	1,782,055	3.6%
1992	72,052	2,540,374	2.8%	1,889,930	3.8%
1993	77,870	2,559,408	3.0%	1,867,233	4.2%
Average	54,789	1,925,412	3.1%	1,385,872	4.1%

Data from: Mills (1979-1994)



Source: Mills 1979-1994.

Figure 2.-Number of angler-days expended by recreational anglers fishing UCUSMA waters, 1977-1993.

Table 3.-Number of angler-days of sport fishing effort expended by recreational anglers fishing upper Copper River and upper Susitna River drainage waters in the UCUSMA, 1977-1993.

	Upper Susitna		Upper Copper River					
	Upper Susitna River		Gulkana River		Other		Total	
Year	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]
1977	14,899	28.9%	12,446	24.2%	2,010[b]	3.9%	14,456	28.1%
1978	13,161	29.5%	15,487	34.8%	2,584[b]	5.8%	18,071	40.5%
1979	12,199	21.3%	25,073	43.8%	1,099[b]	1.9%	26,172	45.7%
1980	10,539	20.9%	21,477	42.5%	1,866[b]	3.7%	23,343	46.2%
1981	14,397	26.9%	22,332	41.7%	1,473[b]	2.8%	23,805	44.5%
1982	14,024	25.5%	23,834	43.4%	1,844[b]	3.4%	25,678	46.7%
1983	13,723	26.6%	25,544	49.6%	10,407	20.2%	35,951	69.8%
1984	16,288	31.3%	19,937	38.4%	13,354	25.7%	33,291	64.1%
1985	12,173	25.0%	23,392	49.1%	11,061	22.7%	34,453	70.7%
1986	17,100	33.2%	19,018	36.9%	11,500	22.3%	30,518	59.2%
1987	9,727	18.6%	25,789	49.3%	15,607	29.8%	41,396	79.1%
1988	10,222	22.3%	19,295	42.1%	14,313	31.2%	33,608	73.3%
1989	9,899	18.9%	24,069	46.1%	16,352	31.3%	40,421	77.3%
1990	9,446	18.6%	26,688	52.5%	12,668	24.9%	39,356	77.5%
1991	9,239	14.4%	30,509	47.5%	23,207	36.1%	53,716	83.7%
1992	12,078	16.8%	35,658	49.5%	22,150	30.7%	57,808	80.2%
1993	16,925	21.7%	36,677	47.1%	21,195	27.2%	57,872	74.3%
Average	**11,990[c]**	**22.6%**	**24,990[c]**	**46.1%**	**15,062[c]**	**27.5%**	**40,052[c]**	**73.5%**

Data from: Mills (1979-1994)

[a] Percent of total effort expended in the UCUSMA during each year.

[b] Estimates were combined into general categories precluding estimation of harvests from specific drainages.

[c] 10-year average (1983-1992).

Table 4.-Sport fishing effort (angler-days) in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage								
Lakes	8,445	9,086	9,071	7,223	7,872	7,810	7,900	6,970
Upper	6,812	7,152	5,817	4,134	4,193	3,624	3,747	10,412[a]
Lower	21,134	19,271	15,533	15,188	11,942	7,861	14,008	
Total	**36,391**	**35,509**	**30,421**	**26,545**	**24,007**	**19,295**	**25,655**	**17,382[a]**
Upper Susitna/Tyone Drainage								
Lakes	14,434	10,594	8,376	8,402	9,569	9,768	9,539	
Streams	2,491	1,420	829	959	3309	454	188	
Total	**16,925**	**12,014**	**9,205**	**9,361**	**12,878**	**10,222**	**9,727**	**13,850[a]**
Klutina River Drainage	8,177	6,366	12,145	5,556	6,053	6,094	6,394	2,779[b]
Tazlina Drainage	3,143	4,321	2,144	2,491	2,153	3,212	3,592	2,125[b]
Copper River Upstream of Gulkana	1,282	945	938	1,098	2,084	1,440	676	1,149[b]
Copper River Downstream of Klutina	872	1,702	534	860	1,387	530	386	987[b]
Stocked Lakes/Streams	4,786	6,629	4,861	2,376	3,629	2,132	3,849	1,922
Other Sites								
Lakes	2,132	1,317	486	1,198	1,185	1,601	721	
Streams	4,162	3,249	3,453	1,306	1,865	1,341	1,324	
Total	**6,294**	**4,566**	**3,939**	**2,504**	**3,050**	**2,942**	**2,045**	**16,923[c]**
Area Total	**77,870**	**72,052**	**64,207**	**50,791**	**52,262**	**45,867**	**52,324**	**51,603[d]**

Data from: Mills (1979-1994)

[a] Includes all flowing waters, data not broken out by specific area prior to 1983.

[b] Average for all the years 1983-1986 only because specific areas were not reported with effort for those areas included in "Other sites" listing.

[c] For the years 1977-1982, other sites include effort for all areas except Gulkana and upper Susitna drainages.

[d] Average of the total annual area harvest for the period from 1977-1986.

During 1993, almost 78,000 angler-days were expended by sport anglers fishing UCUSMA waters (Table 2). This was 30% above the historic average effort for this management area and was the highest on record for the third year in a row. The 1993 effort represented 3.0% of the total statewide angling effort (Table 2).

OTHER USER GROUPS

Returns of salmon to the Copper River support commercial fisheries in the Copper River District. From 1977 through 1994 about 14 million sockeye salmon and 593,000 chinook salmon were commercially harvested in the Copper River District (Steve Morstad, ADF&G, Cordova, personal communication, Table 5). Average harvests over this period have been 788,840 sockeye salmon and 33,027 chinook salmon.

A personal use and a subsistence salmon fishery have been established by the BOF in the upper Copper River. The Division of Commercial Fisheries has lead management authority for the subsistence fishery while the Division of Sport Fish has the lead management responsibility for the personal use fishery.

From 1977 through 1994, a total of over 1.4 million salmon has been harvested in these fisheries (Table 6). Sockeye salmon have comprised the largest portion of this catch, accounting for about 95% of the total catch. These fisheries are described in detail in a separate chapter of Section II of this report, and thus will not be described in further detail here.

ECONOMIC VALUE OF RECREATIONAL FISHERIES

The Jones and Stokes (1987) survey of Southcentral Alaska sport fisheries only estimated the value of the Gulkana River fisheries and the winter fisheries of the Lake Louise complex (Lake Louise and Susitna and Tyone lakes). Based on this survey, anglers expended $451,000 to fish for grayling in the Gulkana River during 1986 and expressed a net willingness to pay (net WTP) of an additional $351,000 to assure the continuation of this fishery (Table 7). Most of the expenditures in this fishery were by resident anglers. Anglers participating in the winter fisheries of the Lake Louise complex for lake trout and burbot expended $66,000 and expressed a net WTP of an additional $186,000 to assure the continuation of these fisheries (Table 7). The Jones and Stokes survey did not provide an estimate of the overall economic value of UCUSMA sport fisheries.

A rough approximation of the total economic value of the sport fisheries of the UCUSMA can be made by applying the direct expenditures per angler-day values estimated for Southcentral Alaska resident and nonresident sport anglers through the Jones and Stokes survey to the estimated sport effort expended in the UCUSMA (Table 8). Based on this approach, the economic value of all UCUSMA sport fisheries during 1986 was approximately 5 million dollars. This compares to an estimated value of 127 million dollars for all Southcentral Alaska sport fisheries during 1986 (Jones and Stokes Associates, Inc. 1987).

MAJOR ISSUES

The major issues associated with UCUSMA sport and personal use fisheries are summarized below:

Table 5.-Commercial harvests of chinook and sockeye salmon in the Copper River District, 1977-1994.

Year[a]	Chinook Harvest	Sockeye Harvest
1977	21,722	602,737
1978	29,062	249,872
1979	17,678	80,528
1980	8,454	18,908
1981	20,178	477,662
1982	47,362	1,177,632
1983	52,500	626,735
1984	38,957	900,043
1985	42,214	927,553
1986	40,670	780,808
1987	41,001	1,180,782
1988	30,741	576,950
1989	30,863	1,025,923
1990	21,702	844,778
1991	34,787	1,206,811
1992	39,810	970,938
1993	29,727	1,398,234
1994	47,061	1,152,220
Average	**33,027**	**788,840**

[a] 1977-1993 data from Donaldson et al. 1993.

1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication.

Table 6.-Reported subsistence and personal use harvests of chinook, sockeye, and coho salmon in the Copper River, 1977-1994.

Year	Chinook	Sockeye	Coho	**Total**
1977	2,213	36,349	454	**39,016**
1978	1,947	22,416	587	**24,950**
1979	2,515	23,599	752	**26,866**
1980	2,256	21,437	639	**24,332**
1981	1,913	53,008	849	**55,770**
1982	2,532	96,799	1,246	**100,577**
1983	5,421	100,995	1,690	**108,106**
1984	2,007	65,078	789	**67,874**
1985	1,673	50,488	544	**52,705**
1986	2,916	64,684	785	**68,385**
1987	3,280	61,900	498	**65,678**
1988	3,395	58,294	695	**62,384**
1989	2,904	80,221	890	**84,015**
1990	3,198	93,740	1,533	**98,471**
1991	5,164	111,788	3,477	**120,429**
1992	4,705	127,670	1,817	**134,192**
1993	4,037	138,211	1,428	**143,676**
1994	5,423	153,049	1,958	**160,430**
Average	**3,194**	**75,540**	**1,146**	**79,881**

Table 7.-Estimated expenditures and net willingness-to-pay (net WTP) in thousands of dollars, for recreational anglers fishing the Gulkana River and Lake Louise complex during 1986.

Fishery	Resident Anglers		Nonresident Anglers		All Anglers	
	Expenditures	Net WTP	Expenditures	Net WTP	Expenditures	Net WTP
Gulkana River fisheries						
Grayling fishery	$370	$346	$81	$5	$452	$351
Other fisheries	$732	$1,488	$331	$102	$1,063	$1,590
All fisheries	$1,102	$1,834	$412	$107	$1,514	$1,941
Lake Louise						
Winter fisheries	$66	$186	N/A	N/A	$66	$86

Data from: Jones and Stokes (1987).

Table 8.-Estimated economic value of UCUSMA sport fisheries during 1986.

Angler Type	Southcentral Alaska			UCUS Management Area	
	$/Ang-Day[a]	Angler-Days[b]	Expenditures[a]	Angler-Days[b]	Expenditures
Resident	64.29	1,153,660	74,163,000	43,880	2,821,045
Nonresident	262.51	201,488	52,892,000	7,683	2,016,864
Both	[c]	1,355,148	127,055,000	51,563	4,837,909

[a] Computed from Southcentral Alaska sport fisheries.

[b] Mills 1987.

[c] Not computed.

Burbot: The lakes of the UCUSMA have historically supported some of the largest sport fisheries for burbot in Alaska. Stock assessment work indicated that many of the larger lake burbot stocks were overfished in the early 1980s and as a result became depressed. Based on these findings, the BOF adopted a management plan for burbot stocks in UCUSMA lakes. Under this management plan, the Board has adopted a more conservative management regime for UCUSMA burbot fisheries that allows previously overfished stocks to recover to permit sustainable fisheries, and which protects healthy stocks from overharvest. Part of the current regulatory regime is the elimination of unattended setlines from the fishery. Many local anglers are not supportive of this action and wish to have unattended setlines reintroduced to the fishery and have submitted proposals to the Board to accomplish this. Staff do not currently support reintroduction of unattended setlines at this time. This gear issue will likely continue to remain an issue into the future. Lake Louise remains closed to burbot fishing due to depressed burbot stocks. Lake Louise will be reopened to burbot fishing when stock assessment work shows that the burbot stocks have recovered enough to permit a sustainable fishery. Local advisory committees are supportive of this closure.

Lake Trout: Lakes in the UCUSMA have historically supported some of the largest sport fisheries for lake trout in Alaska, with lakes of the Tyone River drainage (Lake Louise and Susitna and Tyone lakes) and Gulkana River drainage (Summit and Paxson lakes) having supported the largest fisheries. Concern was raised in the late 1980s that sport harvests in some of these lakes may have been exceeding sustainable levels. As a result, an 18 inch minimum size limit was enacted for the above stated lakes to assure that fish could spawn at least once prior to being subject to harvest. Subsequent stock assessment work suggested that an 18 inch size limit does not protect first-time spawners from harvest in these lakes. A 24 inch minimum size limit for these lakes was implemented in 1994. The lake trout bag and possession limit was also reduced to 1 in some lakes. These actions were supported by the local advisory committees.

Copper River Chinook Salmon: Under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590), the department is directed to manage the Copper River District commercial salmon fishery to attain a spawning escapement of 15,000 chinook salmon, 60,000 salmon (species not defined) for the personal use fishery, and 35,000 salmon (species not defined) for the subsistence fishery. Unfortunately, there is a lack of spawner-recruit data to assess the long-term productivity of the Copper River chinook salmon return or the validity of the established 15,000 fish spawning escapement goal. Most managers agree that current harvest levels are sustainable; however, concern has been raised that the Copper River chinook salmon return is nearing full utilization and recommend that total harvests on this stock not be expanded in the future. Commercial harvests, the largest component of the annual harvest, are projected to remain relatively stable into the future. However, increased participation in the area's subsistence, personal use, and sport fisheries is likely to result in increased harvests by these users. To assure that harvest of Copper River chinook salmon does not exceed sustainable levels, it may be necessary for the department to seek BOF direction in the allocation of this return.

Copper River Personal Use & Subsistence Salmon Fisheries: Since 1985, harvests in the Copper River subsistence and personal use salmon fisheries have increased, with most of the growth having occurred in the personal use fishery. Both fisheries are managed under BOF adopted management plans. Under these management plans, the subsistence harvest does not have a ceiling while the personal use fishery is managed to attain a harvest cap which varies depending upon inriver run strength. In recent years, harvests in the personal use fishery have been near or exceeded the harvest cap. Unless Board action is taken to raise the harvest cap, the department will need to reduce the harvest potential of the current fishery to assure that the harvest cap is not exceeded. The department will seek the Board's guidance in this matter during the next scheduled meeting on this area in February of 1997.

ACCESS PROGRAMS

The Wallop-Breaux amendment to the Federal Aid in Sport Fish Restoration Act mandates that at least 12.5% of the federal funds collected from taxes on sport fishing equipment be used by the states for the development and maintenance of boating access facilities. A broad range of access facilities can be approved for funding if constructed to achieve a state fishery management objective. These facilities can include boat ramps and lifts, docking and marina facilities, breakwaters, fish cleaning stations, rest rooms and parking areas. There is one completed access project in the UCUSMA, the boat launch along the Gulkana River at the Bureau of Land Management (BLM) campground at Sourdough. The Gulkana River is the most popular sport fishery for chinook salmon in the area and currently supports the largest Arctic grayling fishery in the state. In 1993, 39,391 angler-days of effort were expended on the Gulkana River, almost half of the total sport fishing effort expended in the area. Phase I of the Sourdough Campground upgrade was completed in 1991. Part of that upgrade was the improvement of the boat launch facilities. BLM received a contribution of $261,000 in Federal Aid monies toward the construction of the new boat launch.

In spite of the large land base in the UCUSMA, access to sport fishing is restricted near most popular fisheries. The causes for limited access are several: much of the land in the area is private, few roads and trails exist and suitable launches for boats are scarce. Locations where boat launch facilities would be appropriate follow, in order of priority:

The Gulkana River at the Richardson Highway Bridge crossing is privately owned by the Gulkana Village Native Townsite. Although access across native lands for hunting and fishing is expressly prohibited by all local Alaska Native landowners, the public routinely fishes, launches and camps at this site. A preliminary inquiry by Sport Fish staff into the willingness of the landowners to cooperate on development of the land has yielded no results.

There is currently no public access to the Copper River suitable for launching a power boat. Several fisheries along the Copper River in the vicinity of Glennallen could be accessed with a launch on the mainstem of the Copper River near Copperville, 4 miles south of Glennallen. The Klutina River, a popular chinook salmon fishery, and Gulkana River are within 10 and 15 miles of this location, respectively. The location is convenient for motor powered boats as well as rafts, which float from the Richardson Highway

bridge crossing of the Gulkana River. Preliminary research of land status at the site indicates that no public land is available.

A boat launch located along the Gakona River near its confluence with the Copper River would provide access to the nearby Gulkana River. Fishing guides currently launch from private property along the Gakona River to access the Gulkana River. Land ownership in the area has not been researched.

Many more sites for foot access to local fisheries are needed.

SECTION II: FISHERIES

The following text discusses, by species, the major sport fisheries in the UCUSMA. For each major fishery, a discussion is presented with respect to: (1) a historical perspective of the fishery, (2) fishery objectives, (3) inseason management approaches, (4) actions taken by the BOF during their last meeting dealing with the fishery, (5) the recent performance and status of the fishery, (6) any current biological and social issues related to the management of the fishery, and (7) recommended research and management activities. Discussion of recent performance of the fishery will center around the 1993 season, as the major source of data for most sport fisheries in the area is the Statewide Harvest Survey (SWHS) (Mills 1994) which is not yet available for 1994. However, observations or data regarding the 1994 fishery will also be presented when available. A summary of the historical harvest of fish in the UCUSMA by species is presented in Table 9 and Figure 3.

ARCTIC GRAYLING FISHERIES

More grayling have been harvested by sport anglers fishing UCUSMA waters since 1977 than any other fish (Figure 3). From 1977 through 1993, 407,654 grayling have been harvested (Table 9), accounting for about 43% of the fish harvested by anglers from these waters. Harvests remained relatively stable from 1977 through 1987 (Figure 4), averaging about 28,982 grayling. Since 1987, however, harvests have been lower (Figure 4), with the 1992 harvest of 11,125 grayling being the lowest on record (Table 10). This has been primarily the result of more restrictive regulations adopted to assure for the sustained yield of the area's grayling stocks. The 1993 harvest accounted for about 53% and 25% of the Southcentral and statewide harvest of grayling, respectively.

The largest grayling fishery in the UCUSMA has historically occurred in the Gulkana River drainage (Table 10). From 1987 through 1991, this drainage has accounted for about 45% of the grayling harvest from UCUSMA waters. Since 1991, harvests from the drainage have declined; 31% of the grayling harvest came from the drainage in 1993. A discussion of the Arctic grayling fishery in the Gulkana River drainage follows this areawide assessment. Other UCUSMA drainages that have supported significant grayling fisheries include the Klutina and Tazlina drainages and various upper Susitna River drainage lakes and streams. Various lakes stocked with grayling fry also provide fishing opportunity for this species.

To assure a sustainable yield of grayling, daily bag and possession limits for grayling in all flowing waters in the UCUSMA were reduced from 15 daily and 30 in possession to 10 fish daily and in possession in 1988. In 1989, the bag and possession limit for grayling in rivers was further reduced to 5 grayling. For the Gulkana River, anglers were permitted 5 grayling but only 1 grayling per day over 14 inches. This action was taken to maintain historic size compositions in this drainage. The bag and possession limits in stocked lakes and those lakes without management concern remained at 10 per day and in possession. Under these regulations, most grayling stocks in the UCUSMA are currently considered healthy.

Table 9.-Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1993.

Year	Arctic Grayling	Lake Trout	Burbot	Rainbow Trout	Dolly Varden	Sockeye Salmon	Whitefish	Chinook Salmon	Landlocked Salmon	Coho Salmon	Steelhead Trout	Other Fish
1977	25,991	7,699	5,628	2,808	2,251	3,662	2,445	532	1,750	269	187	236
1978	26,488	5,433	7,223	4,366	904	1,606	3,634	641	2,819	126	45	27
1979	37,232	7,271	3,808	3,372	5,890	1,599	2,408	2,948	1,918	412	55	645
1980	32,106	8,067	10,159	3,255	835	2,109	2,507	2,101	1,919	164	34	973
1981	32,982	8,337	9,007	5,358	2,452	1,523	2,420	1,717	3,251	0	76	293
1982	33,586	8,699	8,006	3,060	2,148	3,343	1,824	1,802	4,726	398	73	126
1983	27,094	7,246	6,555	2,460	4,509	2,619	2,810	2,579	4,175	84	21	63
1984	19,272	6,311	10,329	8,926	5,200	3,267	3,010	2,787	992	496	137	256
1985	32,511	8,686	19,355	8,149	6,001	4,752	3,745	1,939	2,238	410	162	417
1986	24,185	6,779	10,030	8,510	5,205	4,137	3,915	3,663	89	202	58	178
1987	27,359	6,721	486	6,990	2,023	4,876	2,096	2,301	0	330	134	76
1988	21,937	6,277	3,747	6,076	5,185	3,038	2,474	1,562	109	291	91	0
1989	16,629	7,147	3,396	5,835	3,979	4,509	2,991	2,219	281	18	84	0
1990	13,375	5,503	1,836	3,924	3,159	3,569	1,784	2,232	17	0	34	0
1991	13,278	4,864	793	6,854	2,140	5,511	717	4,427	111	69	114	47
1992	11,125	4,251	1,495	9,333	1,997	4,560	1,150	3,997	433	113	8	11
1993	12,504	4,569	1,694	7,039	3,173	5,288	815	7,620	56	249	0	9
Avg.	**23,980**	**6,698**	**6,068**	**5,666**	**3,356**	**3,528**	**2,397**	**2,651**	**1,464**	**214**	**77**	**197**
Sum	**407,654**	**113,860**	**103,151**	**96,315**	**57,051**	**59,970**	**40,745**	**45,067**	**24,884**	**3,631**	**1,313**	**3,357**

Data from: Mills (1979-1994)

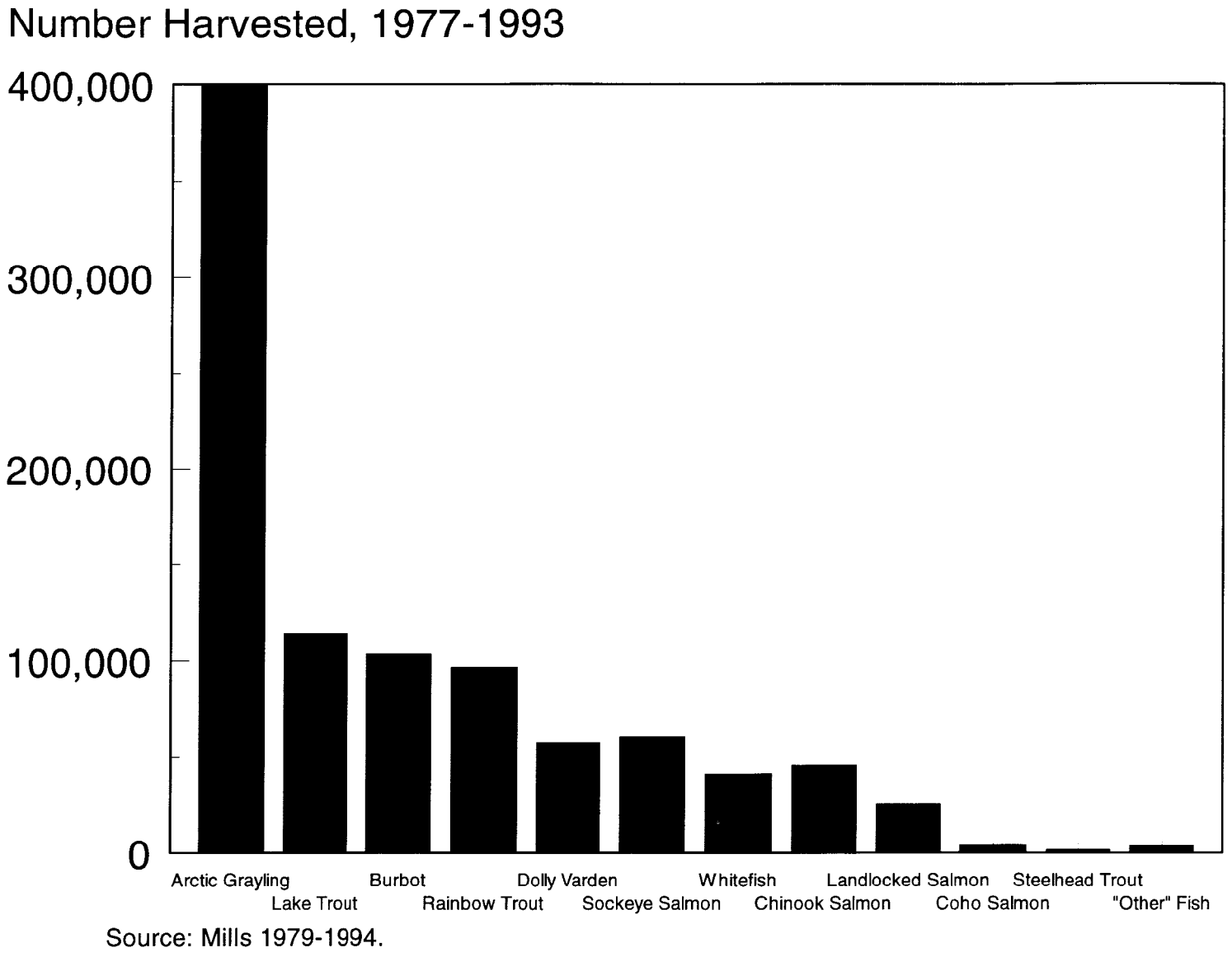
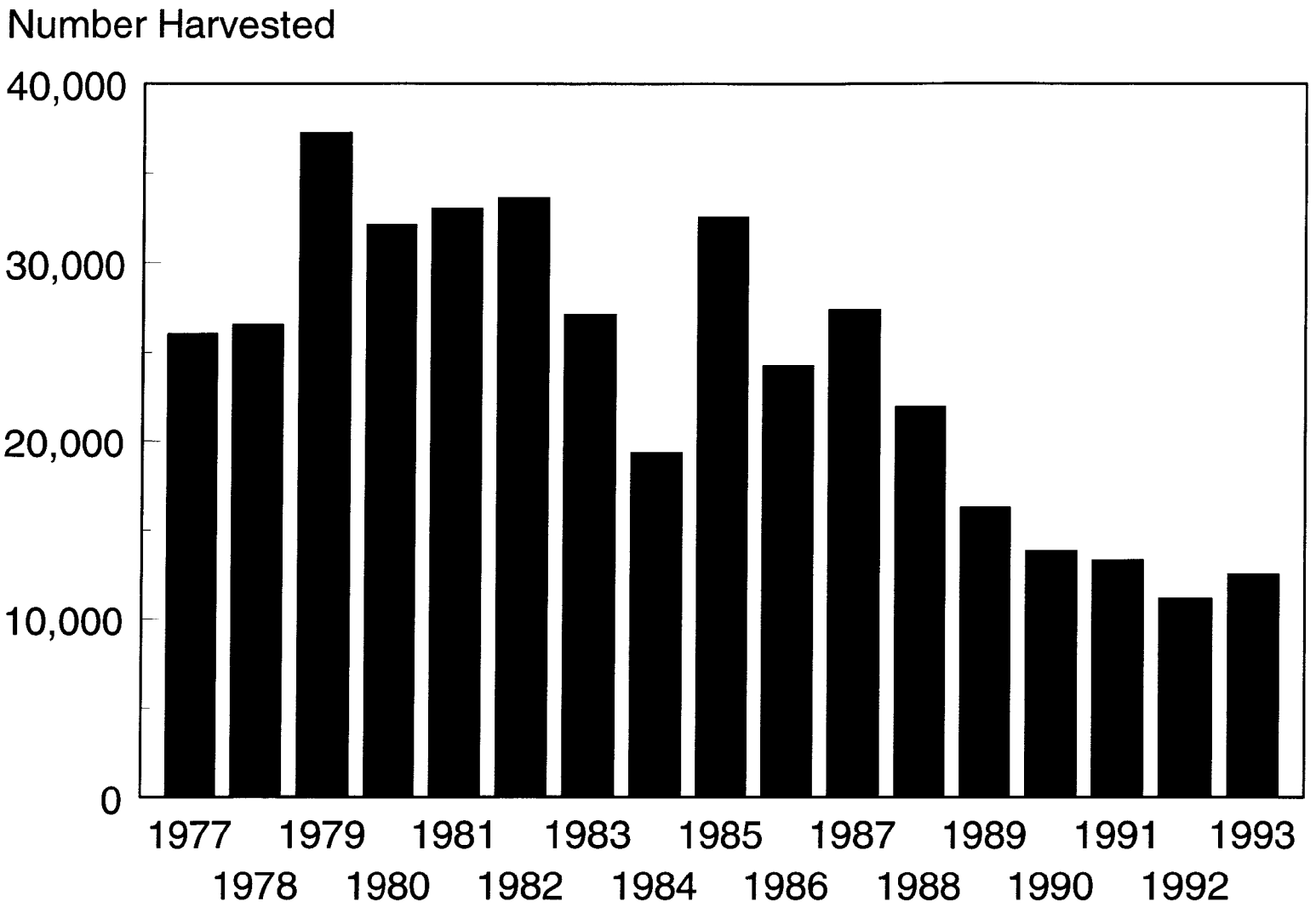


Figure 3.-Number of fish harvested, by species, by recreational anglers fishing UCUSMA waters, 1977-1993.



Source: Mills 1979-1994.

Figure 4.-Harvest of Arctic grayling by recreational anglers fishing UCUSMA waters, 1977-1993.

Table 10.-Harvest of Arctic grayling by recreational anglers fishing UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana R. Drainage								
Lakes	1,483	947	1,932	1,478	1,623	2,382	3,687	3,552
Upper River	1,409	1,880	2,888	2,020	2,608	4,421	3,211	10,656[a]
Lower River	936	1,398	1,638	2,072	2,598	2,310	7,331	
Total	**3,828**	**4,225**	**6,458**	**5,570**	**6,829**	**9,113**	**14,229**	**14,208**
Upper Susitna Drainage								
Lake Louise	994	481	875	1,613	1,576	1,855	1,086	3,652[b]
Susitna/Tyone Lk	661	639	330	119	300	455	1,190	
Other Lakes	93	218	125	646	683	0	208	282[c]
Streams	1,082	706	693	866	497	473	580	694[c]
Total	**2,830**	**2,044**	**2,023**	**3,244**	**3,056**	**2,783**	**3,064**	**3,612[d]**
Klutina R. Drainage	681	286	1,092	544	1,041	1,491	729	982[c]
Tazlina R. Drainage	1,479	1,760	876	1,308	1,191	3,148	2,811	1,663[c]
Copper R. Upstream of Gulkana								
Lakes	378	113	216	883	413	909	1,843	533[c]
Streams	364	30	534	136	656	674	1,026	579[c]
Total	**742**	**143**	**750**	**1,019**	**1,069**	**1,583**	**2,869**	**1,252[c]**
Copper R. Downstream of Klutina								
Lakes	317	278	363	255	600	327	669	421[c]
Streams	243	0	79	0	0	146	0	199[c]
Total	**560**	**278**	**442**	**255**	**600**	**473**	**669**	**619[c]**
Other Sites								
Stocked Lakes	964	774	818	816	1,060	382	148	171[c]
Other Lakes	342	376	68	458	675	1,346	59	2,092[c]
Other Stream	1,078	1,239	751	561	1,108	1,618	2,781	
Total	**2,384**	**2,389**	**1,637**	**1,835**	**2,843**	**3,346**	**2,988**	**2,263**
Area Total	**12,504**	**11,125**	**13,278**	**13,775**	**16,228**	**21,937**	**27,359**	**21,954**

Data from: Mills (1979-1994)

[a] Includes lower river estimated harvest.

[b] Includes Susitna and Tyone lakes estimated harvest.

[c] Includes 1983-1986 average only. Prior to 1983 harvest included in "Other sites."

[d] Harvest average prior to 1983 does not include other upper Susitna lakes and streams.

Gulkana River Arctic Grayling Fishery

Background and Historical Perspective

The Gulkana River drainage (Figure 5) supports the largest grayling population in the UCUSMA. This clearwater drainage originates in the Alaska Range and flows south to join the Copper River near the community of Gulkana (Figure 5). Access to the river is available from various secondary roads and trails off the Richardson Highway which parallels much of the river. Anglers utilize rafts and power boats to gain access to the more remote sections of the river. Raft anglers frequent the various sections of the river from Paxson Lake downstream to the Richardson Highway bridge. Power boat operators generally launch at Sourdough and utilize that section of the river from approximately 2 miles below Sourdough upstream to the confluence of the West Fork. More recently, power boat operators have begun launching from the Richardson Highway bridge and fishing the 5-mile reach of the river above the bridge. Power boat operators occasionally access the confluence of the Gulkana River with the Copper River using power boats launched from Gakona. The section of the Gulkana River upstream from Sourdough has been designated by the U.S. Congress as "wild" as part of the Wild and Scenic Rivers Act of 1968. The Gulkana River from the Richardson Highway bridge downstream to a department marker 500 yards downstream of its confluence with the Copper River is an area in which only single hook, artificial flies may be used. This area has low use and is utilized primarily by walk-in anglers from the Richardson Highway; however, power boat operators occasionally access the confluence of the Gulkana River with the Copper River after launching from Gakona or from the Richardson Highway Bridge.

The Gulkana River drainage has historically supported the largest sport fishery for grayling in the UCUSMA (Table 10). From 1977 through 1985, harvests of grayling from the Gulkana River drainage generally increased (Table 11, Figure 6). A peak harvest of 20,547 fish occurred in 1985 and accounted for 63% and 56% of the total harvest in the UCUSMA management area and Southcentral region, respectively (Mills 1986).

The peak harvest experienced in 1985 raised concern that the grayling stocks in the drainage were in danger of overharvest, given that grayling stocks in several interior Alaska streams near Fairbanks became severely depressed when subjected to similar harvest rates. Regulations were therefore adopted in 1988 that reduced the bag and possession limit to 5 fish per day. Also, past research data indicated that the maximum size of grayling observed in the Gulkana River drainage was decreasing as the result of anglers targeting larger fish (Williams and Potterville 1983). In an attempt to maintain historic size compositions, regulations were also adopted in 1988 that restricted anglers to only 1 grayling over 14 inches.

A research program was also initiated to assess the status of the various grayling stocks of the Gulkana River drainage. This research program was initiated by the Division of Sport Fish in 1986. Beginning in 1988, the study has been conducted in conjunction with the University of Alaska and has formed the basis of an M.S. thesis for a graduate student (Dan Bosch). Objectives of the research program are to determine stock structure; growth; annual abundance, survival, and recruitment; sustainable yields under a variety of management scenarios; and future monitoring strategies. This project was completed in June 1993 and the final report/thesis was completed in May of 1995.

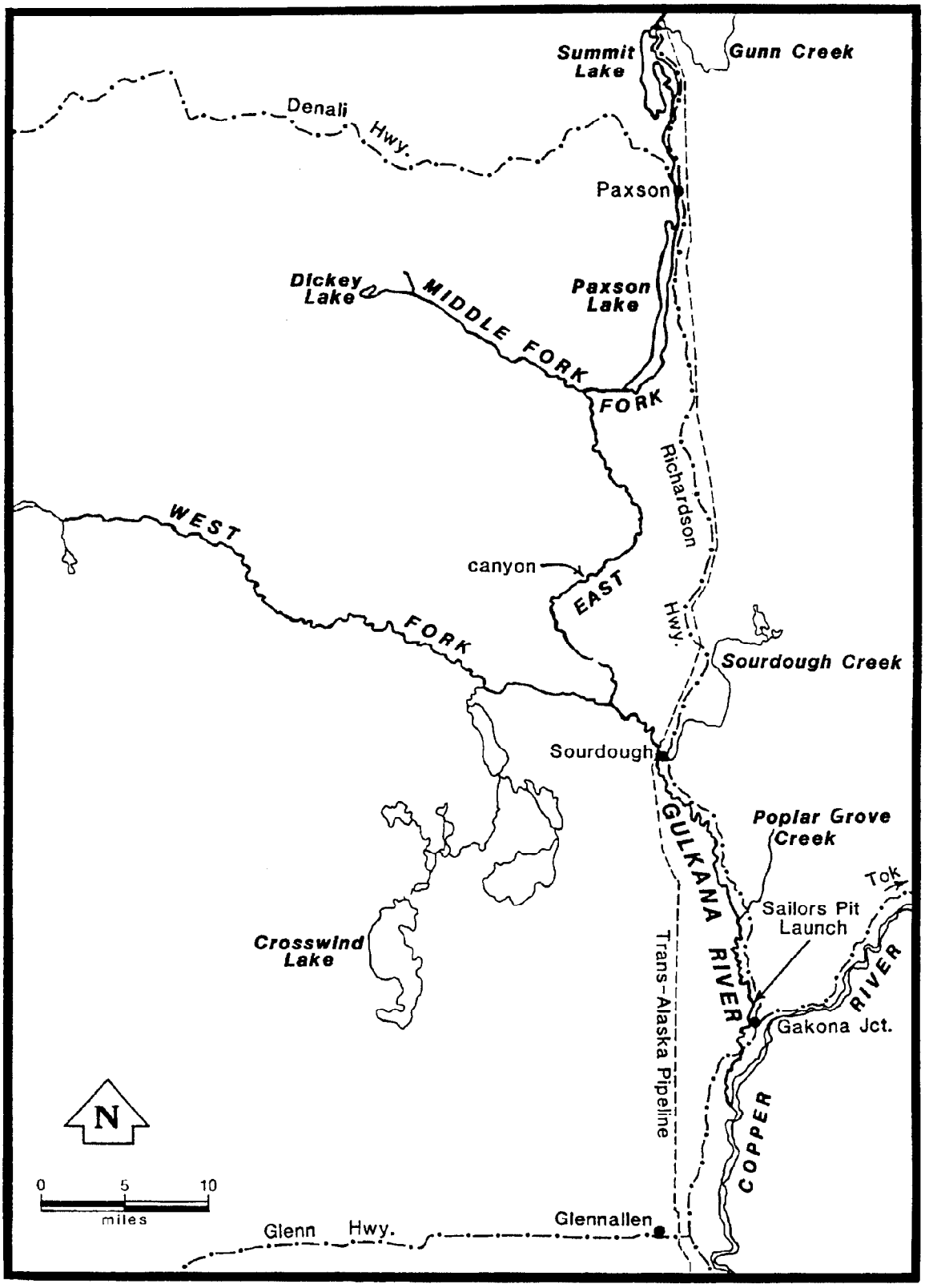


Figure 5.-The Gulkana River drainage.

Table 11.-Harvest and catch of Arctic grayling by recreational anglers fishing the Gulkana River drainage, 1977-1993.

Year	Harvest			Proportion total UCUS harvest	Number caught	Proportion released
	Rivers & Streams	Lakes	Total			
1977	3,355	2,574	5,929	0.23	[a]	
1978	7,494	2,125	9,619	0.36	[a]	
1979	8,726	5,063	13,789	0.37	[a]	
1980	6,776	3,754	10,530	0.33	[a]	
1981	9,158	2,775	11,933	0.36	[a]	
1982	9,149	5,124	14,273	0.42	[a]	
1983	10,417	3,325	13,742	0.51	[a]	
1984	6,362	3,659	10,021	0.52	[a]	
1985	16,126	4,421	20,547	0.63	[a]	
1986	10,710	2,703	13,413	0.55	[a]	
1987	10,542	3,687	14,229	0.52	[a]	
1988	6,731	2,382	9,113	0.42	[a]	
1989	5,206	1,623	6,829	0.41	[a]	
1990	4,092	1,478	5,570	0.42	42,924	0.88
1991	4,526	1,932	6,458	0.49	34,930	0.72
1992	3,278	947	4,225	0.34	34,871	0.89
1993	2,345	1,483	3,828	0.31	47,533	0.93
Mean	**7,353**	**2,886**	**10,238**		**40,065**	

Data from: Mills (1979-1994)

[a] Catch statistics not reported until 1990.

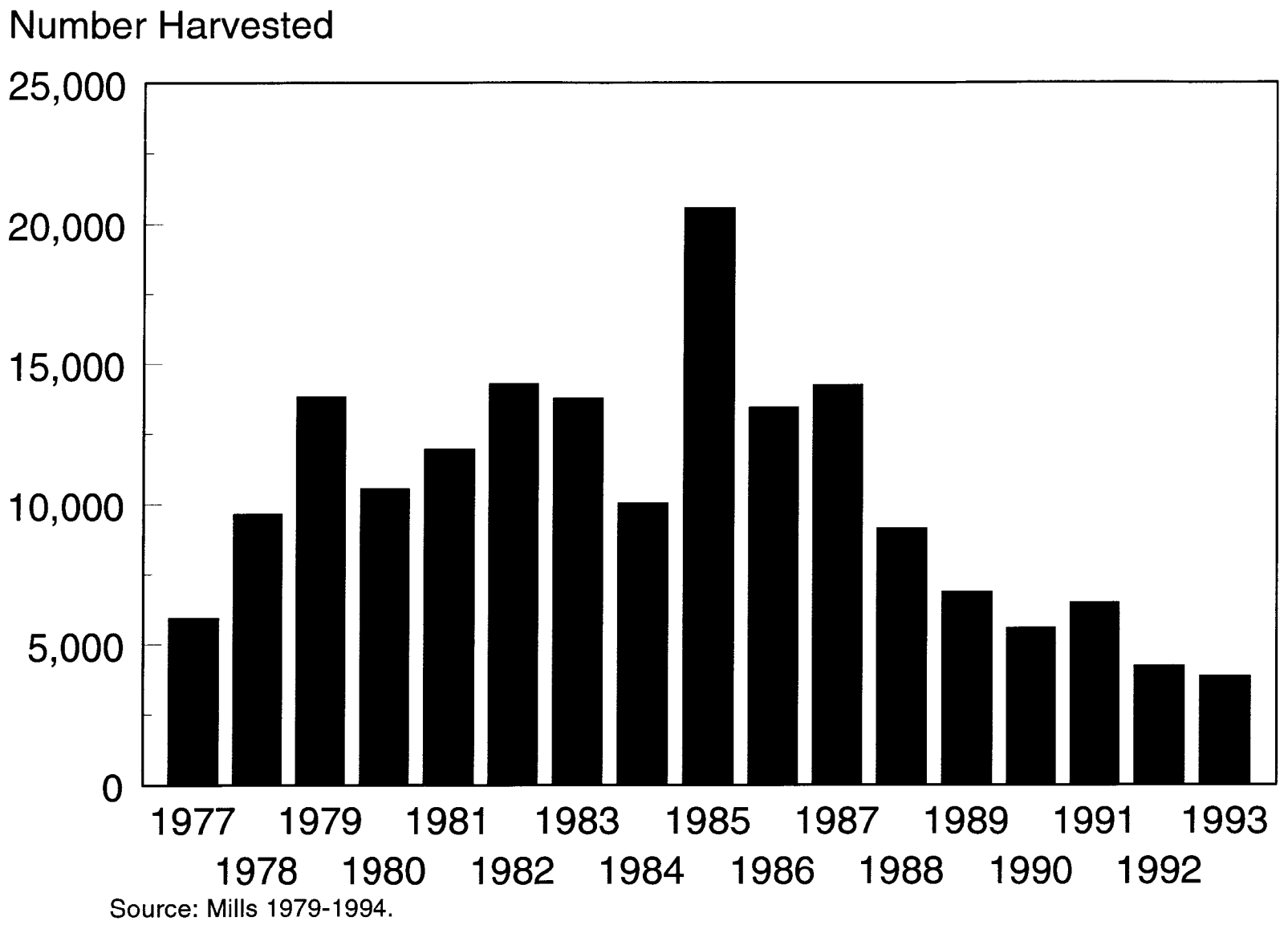


Figure 6.-Annual harvest of Arctic grayling from the Gulkana River drainage, 1977-1993.

Fishery Objectives
Grayling fisheries in the Gulkana River drainage are managed to assure for maintenance of historic age and size composition and stock abundance.

Recent Board of Fisheries Actions
The BOF took no action regarding this fishery at its 1994 meeting. Issues regarding this fishery will again be heard at the spring 1997 meeting.

Recent Fishery Performance
The restrictions placed on the fishery during 1988 have significantly reduced the total harvest of grayling in the Gulkana River drainage (Figure 6). Preliminary estimates of abundance indicate that current exploitation rates on the major stock units of grayling in the Gulkana River drainage appear sustainable given current harvest levels. Preliminary data from the research program also indicate that the restriction limiting anglers to only 1 grayling over 14 inches is allowing the population to reach and maintain historic levels.

Current Issues
Overall, Gulkana River drainage grayling stocks appear healthy. With the completion of the research project, a management plan for grayling in the Gulkana River drainage will be developed. The plan will strive to provide a diversity of fishing opportunities for grayling in the Gulkana River drainage under sustained yield management. This plan will be distributed for public comment and after completion will be forwarded to the BOF at the next scheduled meeting dealing with UCUSMA issues, likely fall 1997. Until completion of this management plan, we recommend continuation of the current management strategy and regulatory regime.

Data collected through the statewide mail survey suggest that many anglers fishing grayling in the Gulkana River drainage are practicing catch and release. Anglers have released over 70% of their catch annually since 1990 (Table 11). Assuming a 5% release mortality rate this appears acceptable given current harvest and abundance levels.

The upper reaches of the Gulkana River drainage above Paxson Lake, notably the Gunn Creek and Fish Creek drainages, contain small populations of large-sized grayling. Currently, these populations are not targeted by a large number of anglers and current exploitation rates appear sustainable given current harvest and abundance levels. However, if exploitation rates increase it may be necessary to reduce harvest to assure for sustained yield and maintenance of historic size compositions.

Recommended Research and Management
An objective of the current research program is to develop a monitoring program for assessing the status of grayling stocks in the Gulkana River drainage. We urge that the recommended monitoring program be conducted to assure for the sustained yield of this fishery.

LAKE TROUT FISHERIES

Background and Historical Perspective
Lake trout stocks of the UCUSMA provide significant fishing opportunities and economic benefit to the people of Alaska. Nowhere else in Alaska can lake trout be taken in such quantities and range of sizes along the road system. From 1977 through 1993, about 113,860 lake trout have been harvested from UCUSMA lakes and streams (Table 9, Figure 7) accounting

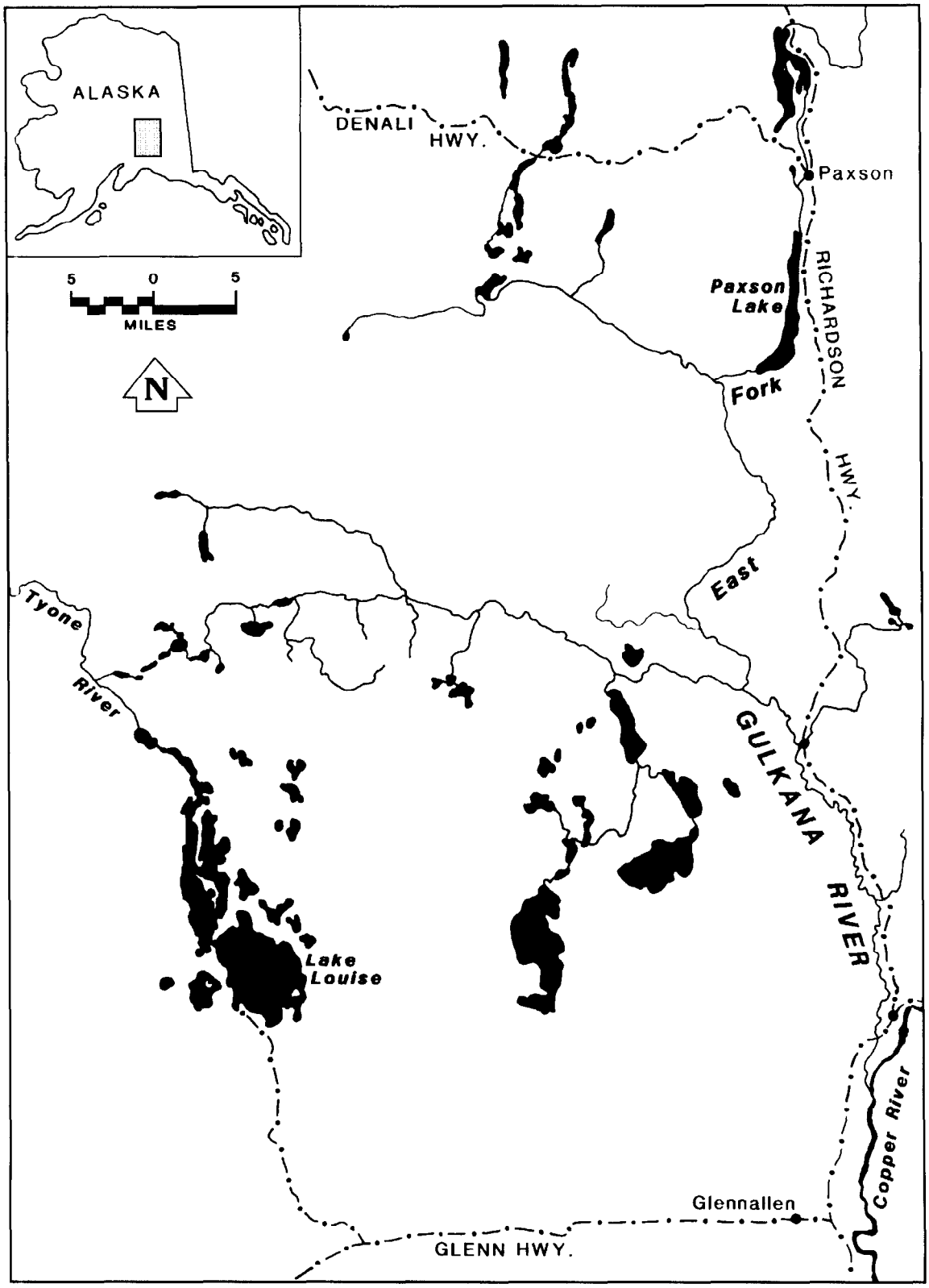


Figure 7.- Lakes supporting major lake trout fisheries in the UCUSMA.

for about 12% of the total fish harvest from UCUSMA waters over this period (Figure 3). Since 1977, lakes and streams of the UCUSMA have accounted for over 40% of the annual statewide harvest of lake trout.

Most of the lake trout harvest in the UCUSMA has come from lakes of the Upper Susitna River drainage (Lake Louise and Susitna and Tyone lakes) and Gulkana River (Paxson, Susitna, and Crosswind lakes) drainages (Table 12). Since 1977, these two drainages have accounted for just over 80% of the UCUSMA lake trout harvest and an average of 33% of the statewide lake trout harvest. Paxson Lake and Lake Louise have supported the largest fisheries for lake trout in the UCUSMA and Alaska. Together, these two lakes have accounted for about half of the UCUSMA lake trout harvest and an average of 20% of the annual statewide harvest of lake trout since 1984. Other major sport fisheries for lake trout in the UCUSMA occur in Summit and Crosswind lakes (in the Gulkana River drainage) and in Susitna Lake (in the Tyone River drainage). These lakes contribute between 3% and 5% of the statewide harvest of lake trout.

Prior to 1987, anglers fishing UCUSMA waters were allowed a daily take of 2 lake trout over 20 inches and 10 lake trout under 20 inches. Under these regulations, lake trout harvests from UCUSMA waters were relatively stable, averaging about 7,500 (Table 12, Figure 8). A study conducted in 1986, however, suggested that eight of nine study lakes in the upper Copper and Delta drainages were being harvested as much as seven times the annual harvest estimated to be sustainable for the lakes based on lake trout populations in Canada and the Great Lakes (Burr 1987). As a result of these research findings, the daily bag limit for UCUSMA waters was reduced to 2 fish and a minimum size limit of 18 inches was adopted for Summit and Paxson lakes, Lake Louise, and the remainder of the Tyone River drainage in 1987. The minimum size limit was imposed to allow female lake trout to spawn once before reaching harvestable size.

A research program was initiated in 1990 to evaluate the status of lake trout fisheries in the UCUSMA. The goal of the research program has been to determine appropriate management strategies that assure the sustained yield of lake trout in UCUSMA lakes.

The study is currently conducted in Paxson Lake and Lake Louise. The objective of the current program is to determine stock status of lake trout through annual assessment of abundance, survival, and recruitment. It is hoped that information gained from the study of these lakes can be applied to better manage other lake trout fisheries in the UCUSMA.

Fishery Objectives

Fishery objectives have yet to be defined for specific UCUSMA lake trout fisheries. To date, regulations have been written to assure that maximum sustained yield of the UCUSMA lake trout resource is not exceeded. It is likely that as fishery objectives are defined for specific lake trout fisheries, they will center around assuring for optimal, rather than maximal, sustained yield. For some lakes, optimal sustained yield will equal maximum sustained yield; for other lakes, however, optimal sustained yield will be lower than maximum sustained yield to accommodate angler's wishes for trophy or other type of special fisheries.

Recent Board of Fisheries Action

During the Board of Fisheries meeting in 1994, the minimum size limit for lake trout was increased from 18 to 24 inches in the Tyone drainage, Crosswind, Paxson and Summit lakes; the bag limit was reduced from 2 to 1 lake trout in the Tyone drainage and Crosswind Lake. The

Table 12.-Harvest of lake trout by recreational anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage								
Paxson Lake	778	1,118	1,248	2,139	1,557	1,310	1,457	
Summit Lake	344	524	981	968	863	528	1,368	
Crosswind Lake	311	378	463	306	272	382	401	386
Other Lakes	256	116	28	68	28	365	342	1,870[a]
Upper River	0	47	28	17	103	364	134	123[b]
Lower River	20	108	42	85	75	418	268	126
Total	1,709	2,291	2,790	3,583	2,898	3,367	3,970	2,505
Upper Susitna River Drainage								
Lake Louise	1,316	1,033	1,332	1,036	1,979	1,801	1,636	3,415[c]
Susitna Lake	669	324	308	187	441	418	401	
Other Lakes	375	348	252	187	958	55	253	307
Total	2,360	1,705	1,892	1,410	3,378	2,274	2,290	3,722
Klutina River Drainage	28	39	70	68	150	163	134	95[d]
Tazlina Drainage	0	62	42	51	0	55	149	33[d]
Copper River								
Upstream of Gulkana	145	38	42	102	506	400	104	100[d]
Downstream of Klutina	0	0	0	136	94	0	0	18[d]
Other Sites	327	116	28	153	121	18	74	6,087
AREA TOTAL	**4,569**	**4,251**	**4,864**	**5,503**	**7,147**	**6,277**	**6,721**	**7,453[e]**

Data from: Mills (1979-1994)

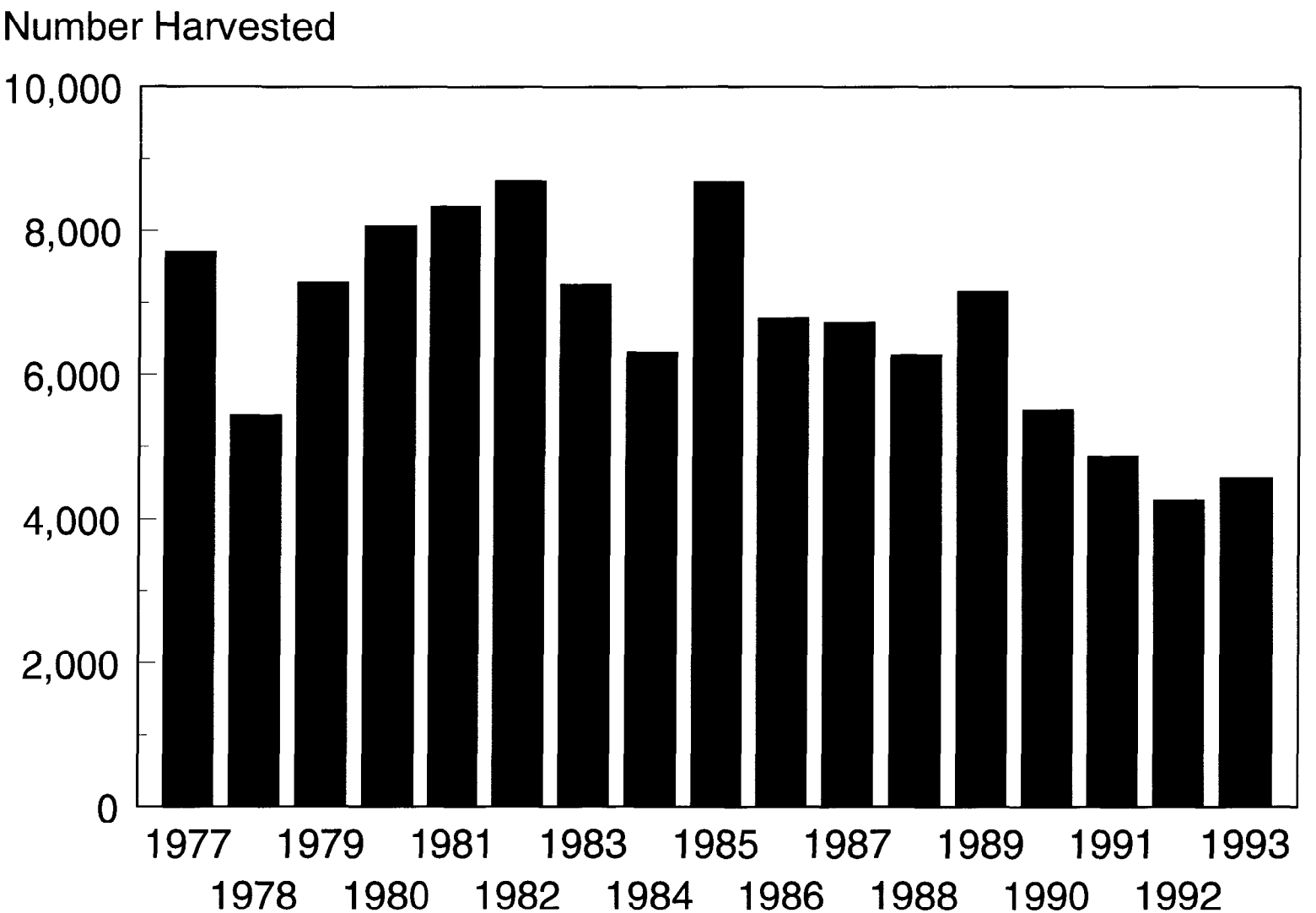
[a] Includes Paxson and Summit lakes.

[b] Includes lower river harvest.

[c] Includes Susitna and Tyone lake harvest estimates.

[d] Average harvest for years 1977-1982 includes harvest from all drainages except Gulkana and upper Susitna.

[e] Average of the total annual area harvest for the period from 1977-1986.



Source: Mills 1979-1994.

Figure 8.-Annual harvest of lake trout from the UCUSMA, 1977-1993.

minimum size limit was increased to better protect female lake trout spawning for the first time. The bag limit reduction was imposed on lakes with lake trout of greater than average length to prevent effort from being concentrated on these size classes.

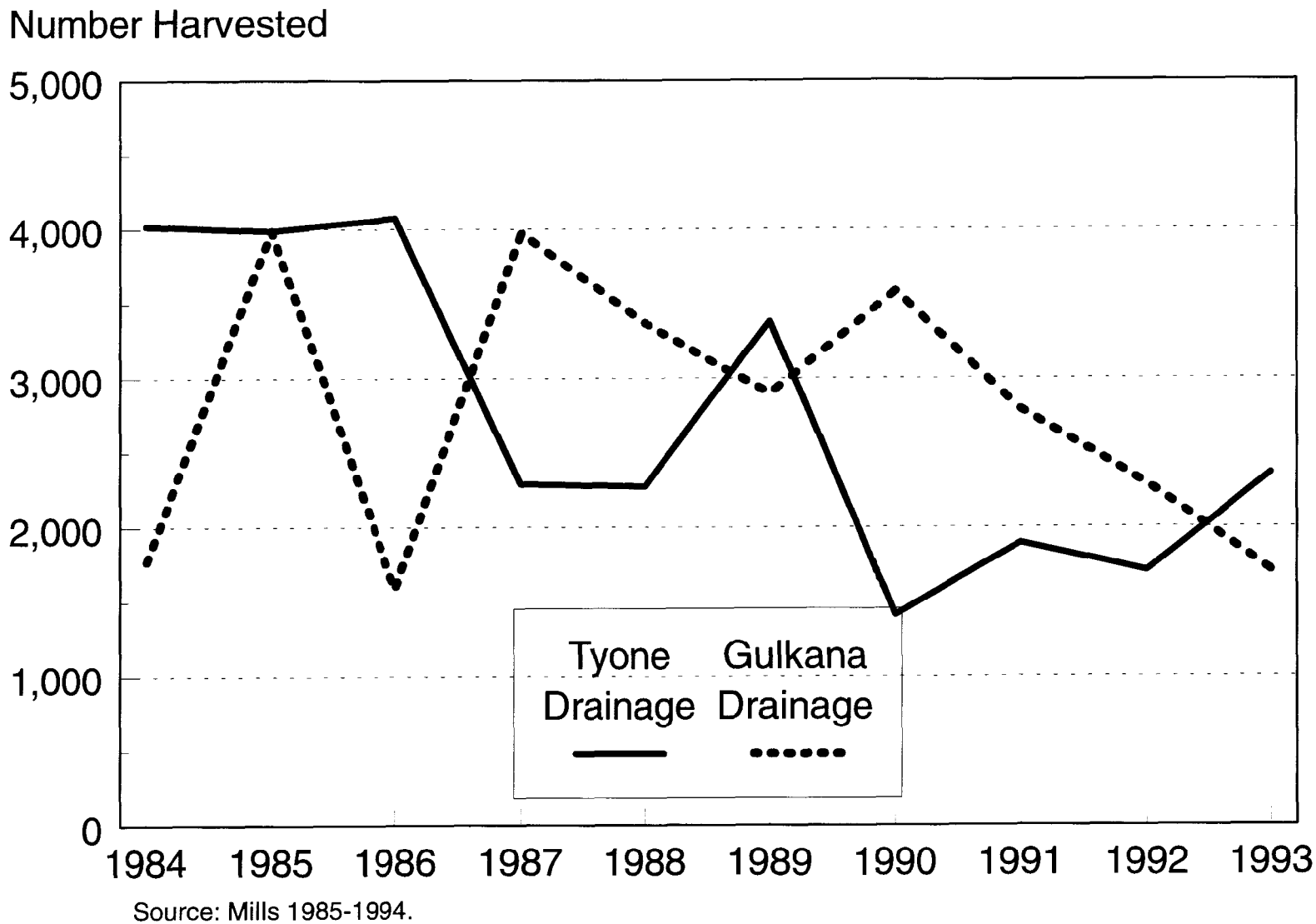
Recent Fishery Performance

Since adoption of the new regulations in 1987 lake trout harvests from UCUSMA lakes and steams have fallen (Figure 8). The 1992 harvest of 4,251 lake trout was the lowest on record since 1977 (Table 12). In general, harvests from the Gulkana River drainage have fallen while harvests in the Tyone River drainage have increased (Figure 9).

Two methods are available to assess the current status of lake trout fisheries in the UCUSMA. The first involves estimating the level of sustainable harvests for lakes based on an observed lake trout production-lake surface area relationship for northern latitude lakes (Healy 1970). Healy found that northern latitude lakes could sustain harvests at a rate of approximately 0.5 kg ha^{-1} y^{-1}. Because estimates of the average weight of lake trout from most lakes in the UCUSMA are unavailable, the sustainable harvest of lake trout has been estimated based on the probable range of lake trout weights: 1.0 to 3.5 kgs. Based on Healy's approach and these weights, lakes in the UCUSMA which are less than 500 ha appear capable of sustaining harvests of 70 to 250 lake trout annually depending, in part, upon their elevation, depth, acreage, and available spawning habitat. Based on these estimates, the harvest of lake trout from lakes smaller than 500 ha appears to be slightly below estimates of sustainable yield. For lakes larger than 500 ha which are not road accessible (e.g., Crosswind, Tanada, and Copper lakes), harvests also appear below estimates of sustainable yield. These larger lakes appear capable of sustaining annual harvests from about 250 to 700 lake trout.

For lakes larger than 500 ha which are road accessible (e.g., Paxson, Summit, and Susitna lakes and Lake Louise), Healy's methods plus an alternate approach based on the volume of water in the preferred temperature range for lake trout (8° to 12° C), termed the thermal habitat volume (THV), are used to estimate the current status of lake trout stocks in these lakes. Based on the THV approach, the sustainable yield for Paxson Lake is 0.92 kg ha^{-1} y^{-1}, for Lake Louise 0.89 kg ha^{-1} y^{-1}, and for Susitna Lake 0.90 kg ha^{-1} y^{-1}. Thermal habitat volume information is not available for Summit Lake. Using the average weight of lake trout harvested in each lake to convert yields to numbers of fish, the sustainable harvest from Paxson Lake is 804 trout, Lake Louise 2,123 trout, and Susitna Lake 1,191 trout. These yields compare to yields based on Healy's approach of 430 trout from Paxson Lake, 1,740 trout from Lake Louise, 660 trout from Susitna Lake, and 440 trout from Summit Lake. Based on these estimates, harvests of lake trout from Lake Louise and Susitna Lake appear to be below estimates of sustainable yield (Figure 10) while harvests from Paxson and Summit Lakes appear to be nearing sustainable levels (Figure 11).

Findings from the research program indicate that the abundance of lake trout on sampled spawning beds in Paxson Lake declined annually from 1988 through 1990 (Figure 12). Abundance during 1991 increased from past years, largely the result of a large number of new recruits to the spawning population. Abundance declined in 1992 and increased slightly in 1993. Recruitment into the lake trout population in this lake varies annually. This is corroborated by the presence of a few strong year classes in age samples from harvested lake trout. This may be



Source: Mills 1985-1994.

Figure 9.-Annual lake trout harvests from the Tyone and Gulkana river drainages, 1984-1993.

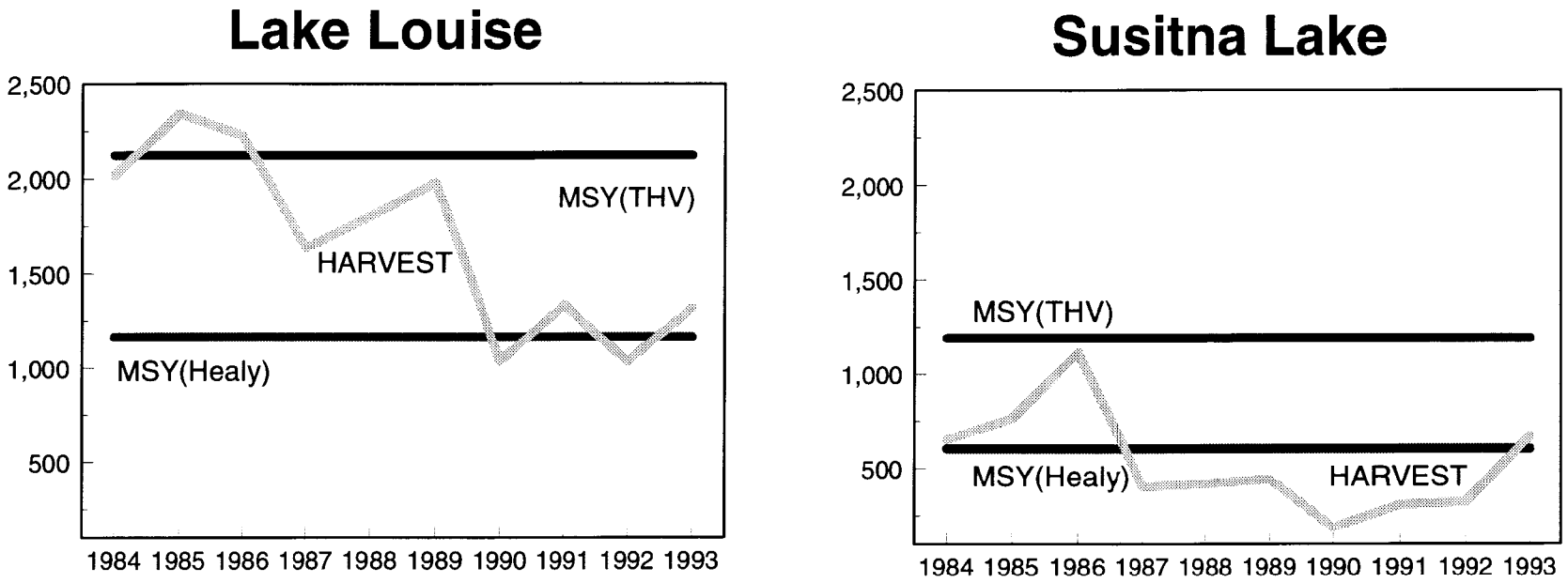


Figure 10.-Observed harvest versus maximum sustainable harvest of lake trout in Lake Louise and Susitna Lake.

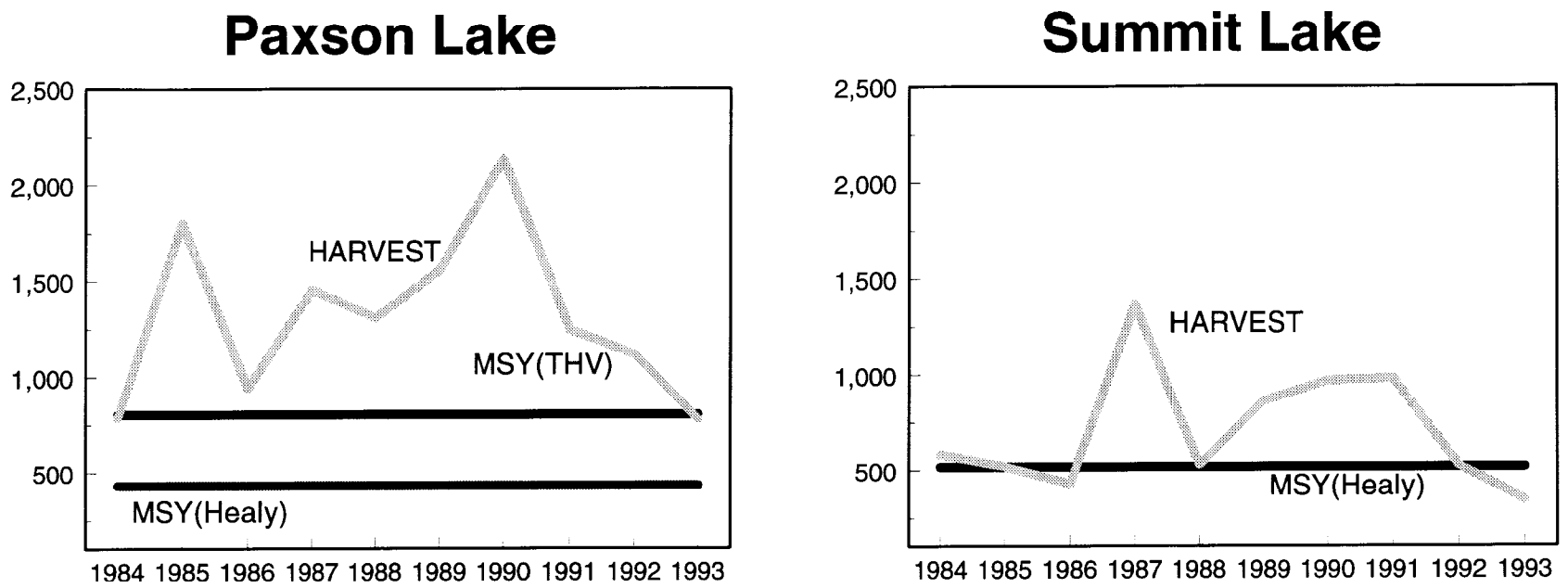


Figure 11.-Observed versus maximum sustainable harvests of lake trout in Summit and Paxson lakes.

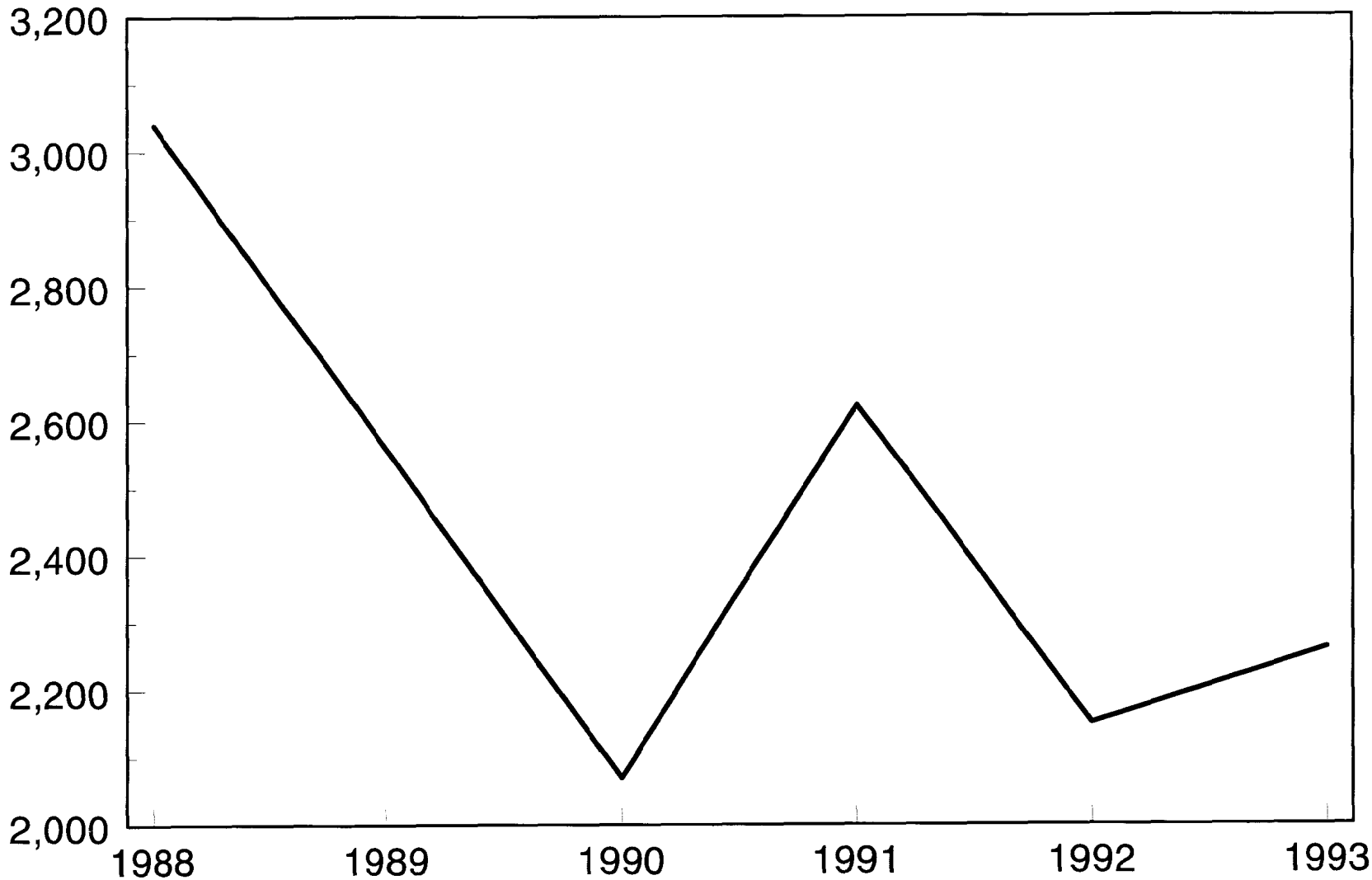


Figure 12.-Abundance of male lake trout sampled on spawning beds in Paxson Lake, 1988-1993.

the result of exploitation since year class strengths of long lived species have been found to be less variable (Martin and Olver 1980). Reduction of the harvest from the recent regulation changes should produce a stable lake trout population in Paxson Lake which will support sustainable harvests into the future.

Unfortunately, similar information on population trends are unavailable for Lake Louise, Susitna Lake, or Summit Lake. For Lake Louise, abundance of spawners on sampled spawning beds increased between 1992 and 1993. Recruitment is evident from population studies as well as length and age samples. Lake trout stocks in Lake Louise do not appear to be affected by harvest pressure to the extent of Paxson Lake stocks; length and age samples from Lake Louise are not dominated by a few strong year classes.

Current Issues

The present regulatory regime should protect all UCUSMA lake trout stocks from overharvest and allow the abundance to increase. Once the benefits of the new regulations are realized, regulations can be implemented that accommodate the full range of angler preferences for small lake trout to eat and trophies to admire while maintaining harvests at sustainable levels. A protected slot limit would achieve such an end.

Protected slot limits increase abundance by protecting the most productive fish while allowing a harvest of abundant small fish and less abundant but larger trophy-sized fish. Protected slot limits are in use on lake trout fisheries in Ontario but, to date, evaluation of their effect has not been determined (Hicks and Quinn 1990). Inappropriate application of slot limits was found to crop off larger fish and create a stockpile of small fish in a brown trout population studied by Barnhart and Engstrom-Heg (1984).

Slot limits are supported by anglers at Lake Louise and Susitna lakes; however, managers feel that a slot limit is not appropriate for Paxson Lake at this time as the abundance of immature lake trout has not been estimated. Increasing effort on this element of the population might reduce abundance by removing too much of the potential spawning stock needed to rebuild or sustain the population.

Recommended Research and Management

The current research program which focuses work on Paxson Lake and Lake Louise should be continued. In addition, more information is needed regarding the characteristics of the life history and harvest of other lake trout stocks which have the potential to be overexploited including: size and age structure, maturity schedules, abundance and yield, and the contribution of the winter fishery to the lake trout harvests. Of particular interest are Copper and Tanada lakes, accessed from the Nabesna Road via a 12-mile trail, and Kimball Pass Lake, accessed on a 16-mile long trail from the Richardson Highway.

BURBOT FISHERIES

Background and Historical Perspective

The many lakes and rivers of the UCUSMA (Figure 13) support some of the largest populations of burbot in Alaska and have supported up to 70% of the statewide sport harvest of this species (Table 13). The largest fishery has historically occurred in the Lake Louise complex (consisting of Lake Louise, Susitna and Tyone lakes, Table 14). Other significant fisheries occur in the

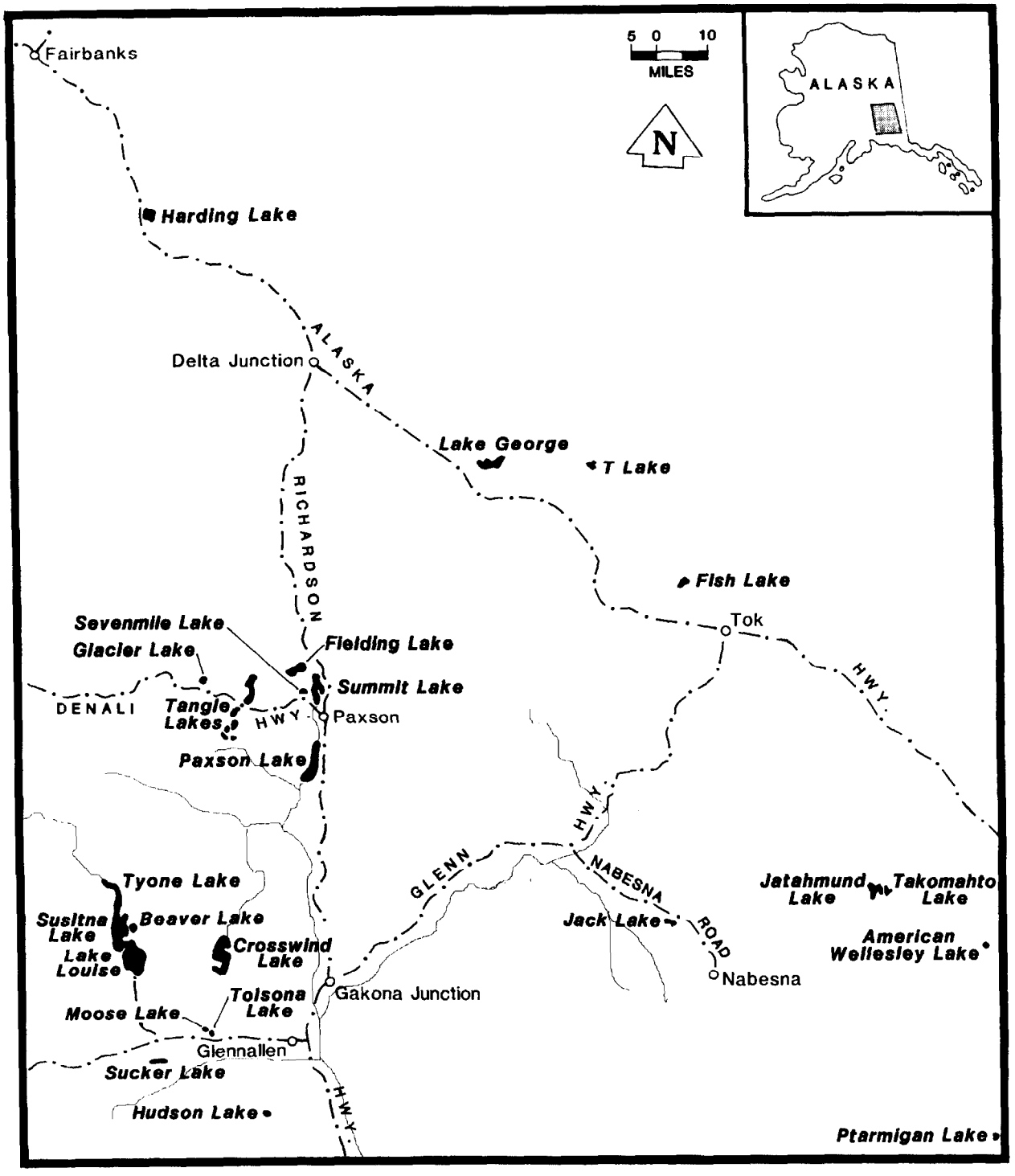


Figure 13.-Lakes supporting major burbot fisheries in the UCUSMA.

Table 13.-Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1993.

Year	UCUSMA Harvest	Alaska Harvest	Percent	Southcentral Alaska Harvest	Percent
1977	5,628	8,425	66.8	6,652	84.6
1978	7,223	9,988	72.3	8,099	89.2
1979	3,808	7,304	52.1	5,207	73.1
1980	10,159	14,948	68.0	11,585	87.7
1981	9,007	14,342	62.8	9,536	94.5
1982	8,006	15,445	51.8	9,662	82.9
1983	6,556	14,465	45.3	8,870	73.9
1984	10,329	19,164	53.9	13,231	78.1
1985	19,355	27,230	71.1	22,015	87.9
1986	10,030	18,849	53.2	13,238	75.8
1987	4,386	13,543	32.4	9,526	46.0
1988	3,747	9,478	39.5	5,600	74.8
1989	3,396	9,268	36.6	4,374	77.6
1990	1,836	10,577	17.4	5,094	36.0
1991	793	4,882	16.2	1,827	43.4
1992	1,495	7,245	20.6	2,992	50.0
1993	1,694	9,858	17.2	3,392	49.9
Mean	**6,320**	**12,648**	**45.7%**	**8,288**	**70.9%**

Data from: Mills (1979-1994)

Table 14.-Harvest of burbot caught by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage								
Lakes	257	329	343	561	441	637	550	858
Streams	0	127	27	17	19	18	45	81
Total	**257**	**456**	**370**	**578**	**460**	**655**	**595**	**939**
Upper Susitna Drainage								
Lake Louise	0	0	0	255	976	655	506	5,049[a]
Susitna/Tyone L	172	533	45	323	656	273	684	
Other Lakes	0	8	54	0	66	200	104	998
Total	**172**	**541**	**99**	**578**	**1,698**	**1,128**	**1,294**	**6,141[b]**
Klutina River Drainage	0	0	0	0	0	0	0	5[b]
Tazlina Drainage								
Moose/Tazlina	0	347	0	0	300	73	684	239
Hudson	0	0	0	0	0	327	446	299
Other	107	25	189	408	197	546	862	827
Total	**107**	**372**	**189**	**408**	**497**	**982**	**1,992**	**1,365**
Copper River								
Upstream of Gulkana	611	25	0	238	459	746	0	159[b]
Downstream of Klutina	0		0	0	113	0	59	5[b]
Other Sites	547	101	135	34	169	236	446	1,606[c]
Area Total	**1,694**	**1,495**	**793**	**1,836**	**3,396**	**3,747**	**4,386**	**9,010[d]**

Data from: Mills (1979-1994)

[a] Includes Susitna and Tyone lake catch estimates.

[b] Includes 1983-1986 average harvest estimate only. Prior to 1983, harvest included in "other sites."

[c] Specific area not reported during 1977-1988 in other drainages included in this average estimate.

[d] Average of the total annual area harvest for the period from 1977-1986.

various lakes of the Gulkana River drainage (e.g., Paxson, Summit, and Crosswind lakes), Tolsona and Moose lakes, and various smaller remote lakes scattered throughout the UCUSMA. The fishery occurs primarily during the winter months from November to April using closely attended set or hand jig lines.

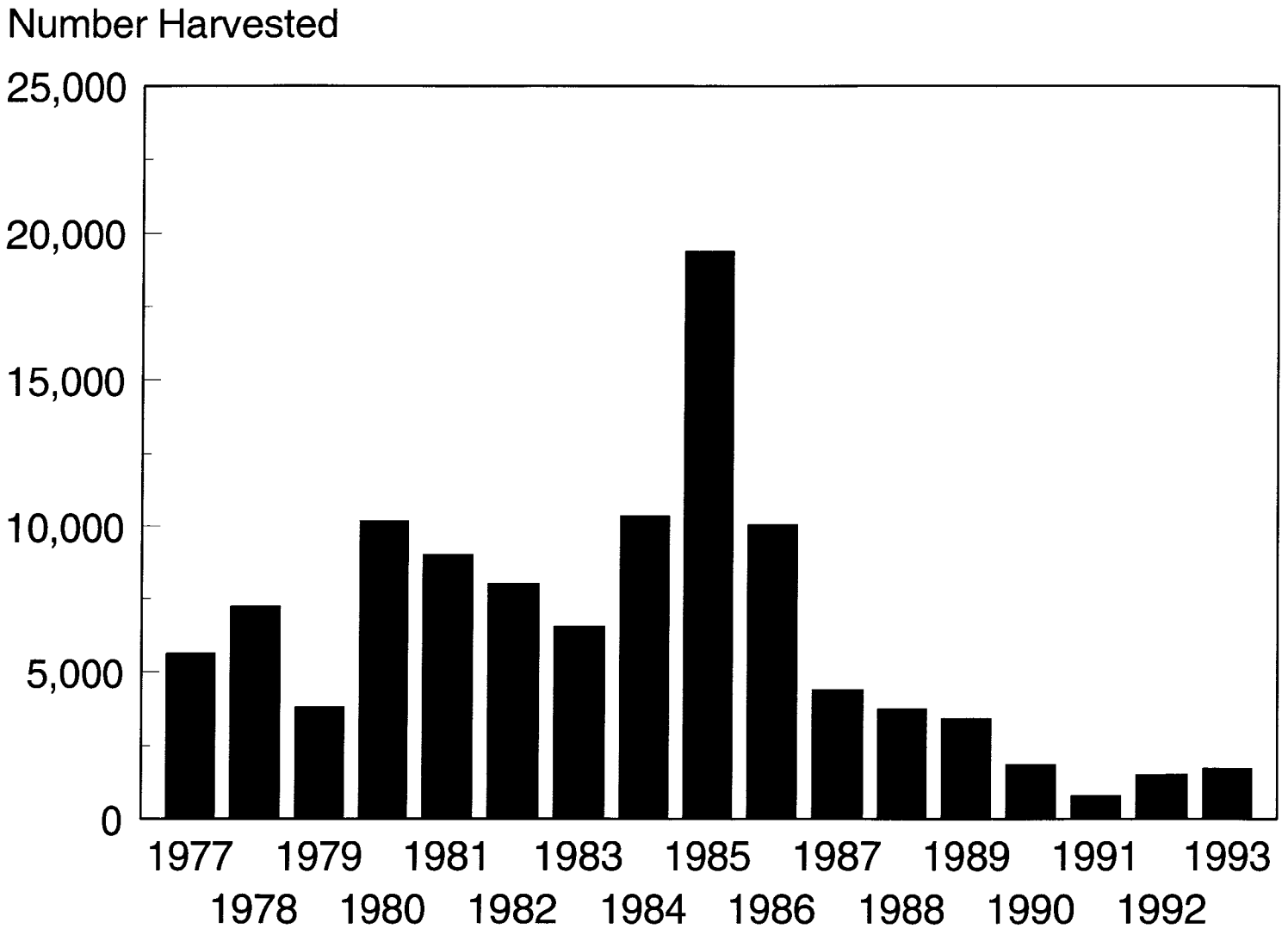
Prior to 1979, there were no daily bag or possession limits or gear restrictions governing the harvest of burbot in the UCUSMA. In recognition of burbot as an important sport species to be managed for sustained yield, a daily bag and possession limit of 15 burbot was enacted prior to the 1979 winter fishery. Anglers were allowed to harvest burbot by fishing multiple hand lines and unattended setlines with no more than a total of 15 hooks plus two hand-held jig hooks. Under these regulations, the sport harvest of burbot from UCUSMA waters increased dramatically, peaking in 1985 when a record harvest of 19,355 burbot were taken (Figure 14).

The rapid growth in the fishery raised concern that several UCUSMA burbot stocks were either being or in imminent danger of becoming overexploited. In response, in 1987 daily bag limits and the number of hooks an angler could fish in area lakes were reduced to 5, whether fished on unattended setlines or hand-held jig lines. In several road accessible lakes (Lake Louise, Tyone, Susitna, Tolsona, Moose, and Summit lakes), the daily bag and possession limits were further reduced to 2 fish and anglers were restricted to using only two hooks. Also, the sport fishery for burbot in Hudson Lake was closed by emergency order based on findings that this burbot stock had been severely overexploited and was depressed.

During their 1988 meeting, the Board of Fisheries adopted a management plan for the lake burbot fisheries of the UCUSMA. The plan was adopted as regulation (5 AAC 52.045) to insure that the department had the necessary tools through which to manage the area's lake burbot fishery for ***maximum*** *sustained yield and opportunity to participate*. In order to achieve this management objective, the plan gave the department the authority to use time and area closures *and* method and means restrictions to manage the area's lake burbot sport fisheries. In adopting the plan, the BOF stated their desire to not have the bag limits for burbot reduced to less than 2 for road accessible lakes and 5 for remote lakes, as it was considered unreasonable by Board members to participate in these fisheries at lower bag limits.

Further actions were implemented during 1989 under the newly adopted management plan. An emergency order was issued that closed the burbot fishery in Lake Louise based on research findings that showed the lake's burbot stocks had become severely depressed due to overfishing. In addition, an emergency order was issued to keep the burbot fishery in Hudson Lake closed, as research showed that burbot in this lake remained depleted. Emergency regulations were also enacted that eliminated setlines from the sport fishery in all remaining lakes of the Tyone River drainage given that anglers had begun to seek out previously unexploited lakes in the Tyone River drainage in response to restrictions and closures placed on other area lakes.

A research program was initiated in 1986 to evaluate the life history of interior Alaska burbot and to determine stock status and sustained yields of burbot fisheries in the UCUSMA. The goal of the research program has been to determine appropriate management strategies that assure for the maximum sustained yield of burbot from UCUSMA lakes. The study has been conducted in a variety of lakes. Results to date have provided managers with the tools to determine stock status



Source: Mills 1979-1994.

Figure 14.-Harvest of burbot by recreational anglers fishing UCUSMA waters, 1977-1993.

using a variety of assessment methods and an estimate of the productivity of the area's burbot fisheries. Annual results of the research project are summarized in Lafferty et al. (1990, 1991, 1992) and Lafferty and Bernard (1993).

Fishery Objectives

Based on the lake burbot management plan (5 AAC 52.045), the lake burbot fisheries of the UCUSMA are to be managed for ***maximum*** *sustained yield and opportunity to participate.* In order to achieve this fishery objective, the plan gives the department the authority to use time and area closures *and* method and means restrictions to manage the area's burbot sport fisheries. Healthy stocks are managed to permit maximum sustained yield while depressed stocks are managed to allow the stocks to rebuild. Fishing is permitted on some depressed stocks, however exploitation levels allow the stocks to rebuild to permit a fishery capable of maximum sustained yield.

The management goal is to develop an orderly fishery. As these fisheries rebuild, it is hoped to provide between 10,000 to 15,000 angler-days of ice fishing opportunity with a harvest of about 5,000 burbot on an annual basis in the UCUSMA.

Recent Board of Fisheries Actions

Although the more restrictive regulations greatly reduced harvest in the burbot fisheries of the UCUSMA, managers remained faced with a number of biological and social concerns regarding the management of the area's burbot fisheries. For example, in response to closures and restrictions placed on many popular fisheries (e.g., those in the Tyone River drainage), anglers began to target unexploited burbot populations in many of the smaller lakes of the UCUSMA. Many of these smaller burbot populations are capable of providing only limited sustainable yields. There was concern that some of these lakes could become overfished, requiring the department to take, on a lake-by-lake basis, emergency action to protect the stocks. This would be costly and result in a multitude of regulations throughout the management area.

For this reason, managers supported a new approach to the administration of the UCUSMA lake burbot fisheries. Various options were considered; however, managers submitted a proposal to the Board at its 1991 meeting calling for the elimination of ***unattended*** setlines from all burbot fisheries in the UCUSMA. This proposal was intended to reduce angler efficiency, thereby providing protection from overexploitation to small burbot stocks in the area. After lengthy discussion and consideration, the Board adopted this proposal. Other management options, such as spawning season closures, were considered, but due to insufficient data, were not selected as viable options to protect against overharvest. Managers believe this action should assure the long-term opportunity to fish for and harvest burbot in the UCUSMA.

Lake Louise and Hudson Lake were also closed to burbot fishing at the 1991 Board meeting. Both lakes had been closed through emergency orders for the past several years and were expected to be closed through additional emergency orders into the future. A decision was therefore made to close these fisheries through regulation.

A proposal to reopen Hudson Lake to burbot was submitted to the Board of Fisheries in 1994 following stock assessment which indicated that the population had recovered to a level that would support a fishery. A bag limit of 2 burbot was suggested to protect the stocks of this popular local fishery from overharvest. To accommodate local anglers, a proposal to allow

limited use of unattended setlines in the Copper River was submitted jointly by ADF&G and the Glennallen Advisory Committee. The Board of Fisheries approved both recommendations.

Recent Fishery Performance

With the adoption of the more conservative regulations, harvests of burbot from UCUSMA waters decreased (Table 13, Figure 14). The harvest of 793 burbot during 1991 was the lowest on record (Table 13). The reduction in harvest has allowed some of the previously overexploited burbot stocks in smaller lakes (e.g., Tolsona, Moose and Hudson lakes) and moderately sized lakes (e.g., Susitna and Paxson lakes) to recover to permit sustainable fisheries. For some lakes, however, these sustainable yields are substantially lower than maximum sustained yields the fisheries are capable of supporting. Larger lakes which were severely overexploited (e.g., Lake Louise) in the early to mid 1980s remain depressed. Stocks in larger lakes take longer to recover from overexploitation than do smaller and moderately sized lakes. In Lake Louise, historically the largest burbot fishery in Alaska, the burbot stock remains low. The number of mature burbot in this lake, however, has leveled off at 4,000 in recent years. The current level of burbot abundance in this lake, although stable, remains less than the minimal abundance level of 7,000 established by managers to open the fishery. Once opened, only limited fishing will be allowed so that the stock can rebuild to permit a fishery capable of maximum sustained yield. Unfortunately, a lack of recruitment into the Lake Louise burbot population continues to slow the recovery process.

Current Issues

Many anglers have been averse to what they perceive as rapid and drastic changes made to the burbot fisheries of the UCUSMA, and some remain convinced that the actions were unduly restrictive and unfair. This is particularly true with the action taken to eliminate ***unattended*** setlines from the burbot fisheries of the UCUSMA. Many anglers do not support this action and are choosing to not participate in this fishery because they cannot use this gear type. This reduces participation in fisheries capable of supporting effort and harvest. To promote participation, staff have encouraged anglers to shift to alternative gear types that are legal (attended setlines or tip ups); however, anglers continue to be reluctant. The use of unattended setlines in the mainstem of the Copper River was legalized during 1994 but use of this resource is low. Staff remain opposed to the reintroduction of unattended setlines to UCUSMA burbot fisheries. Historically, a few anglers using unattended setlines overharvested several UCUSMA burbot populations within a short period of time. Once overexploited, these fisheries needed to be restricted or closed. Given life history characteristics of burbot, recovery of a depressed stock is slow, often taking many years to rebuild to a condition capable of sustaining a fishery. Creation of the lake burbot management plan gave managers the necessary tools to arrest a fishery that had overexploited a burbot stock. However, actions taken under this management plan promote reactive management where the department bears the burden of detecting overexploited stocks with costly assessment programs. This fragments the burbot fisheries of the UCUSMA and leads to regulations which can be confusing due to superseding emergency orders.

Recommended Research and Management

The research program is currently limited to stock assessment of burbot populations in Lake Louise and Tolsona Lake. Both lakes will be sampled during the spring of 1994. The department is committed to monitoring burbot stocks in Tolsona Lake through the 1995 field season and stocks in Lake Louise through 1996, when evaluation of sustainable yield estimates

will be completed. Staff will continue to try to educate the angling public and seek their input to managing these important ice fisheries.

CHINOOK SALMON FISHERIES

In the UCUSMA, only the Copper River drainage supports anadromous runs of chinook salmon. No anadromous runs of chinook salmon return to the upper Susitna River drainage. Devil's Canyon is a hydraulic barrier which prevents upstream salmon migration in this drainage.

Chinook salmon returning to the Copper River drainage begin passing through the Copper River delta and entering the Copper River during early May. The peak migration into the river is generally from mid-May to mid-June, with the return essentially complete by July 1. However, small numbers of chinook salmon continue to enter the Copper River through August. Chinook salmon make their way to spawning areas in Copper River tributaries primarily through June and July with spawning beginning in mid-July and continuing through August.

Chinook salmon are broadly distributed throughout the Copper River basin, having been observed in approximately 40 tributaries. Aerial escapement surveys have been conducted in 35 of these systems; however, only nine of these systems have been surveyed consistently since 1966 (Roberson and Whitmore 1991). In general, chinook salmon returns to the these nine Copper River tributaries were above historical averages from 1982 through 1991 (Table 15, Figure 15). The 1992 escapement to these nine streams, however, was the lowest observed since 1969 (Table 15); the reasons for this are unknown. Many of the nine streams were not surveyed in 1993, so comparison to historical means for the Copper River is not possible. However, the 1993 escapement count of 1,156 chinook salmon in the Gulkana River is above the historical mean for that system and nearly twice the 1992 count. Unfortunately, assessment of chinook salmon spawning escapements through aerial survey evaluation of key index areas does ***not*** provide an estimate of the total spawning return. This is because not all spawning areas are surveyed and not all spawners are counted in surveyed areas.

Copper River chinook salmon stocks are harvested in a variety of fisheries including: (1) a commercial gillnet fishery on the Copper River delta, (2) a personal use dip net fishery in the Copper River near Chitina, (3) a subsistence dip net and fish wheel fishery in the Copper River between Chitina and the Slana River confluence, and (4) a sport fishery that occurs in various spawning tributaries. The total harvest of chinook salmon in these fisheries has been estimated since 1966 (Donaldson et al. 1993, Roberson and Whitmore 1991). Since 1982, the total harvest of chinook salmon in these fisheries has ranged from 29,000 to 59,000 (Table 16, Figure 16). Unfortunately, the contribution to the catch of fish by each spawning stock for these mixed-stock fisheries cannot be quantified at present (Brady et al. 1991, Roberson and Whitmore 1991). Thus, it is not currently possible to assess the productivity of each stock using spawner-recruit databases.

The Copper River Delta District commercial fishery management strategy provides for two, 24-hour periods per week commencing during the second or third week of May, with adjustments in the fishing schedule being made through emergency order. Early season management, when chinook salmon are of consequence in the fishery, is based on actual catches compared to anticipated catches. Under the *Copper River District Salmon Management Plan*, the department may, through emergency order, authorize the use of large mesh gear in the Copper River Delta

Table 15.-Upper Copper River chinook salmon aerial escapement index counts, 1966-1994.

Copper R. Upstream of Gulkana				Tazlina Drainage		Klutina Drainage		Tonsina Drainage		
Year	Gulkana R.	E. Fork Chistochina R.	Indian R.	Mendeltna Ck.	Kiana Ck.	St. Anne Ck.	Manker Ck.	Little Tonsina R.	Grayling Ck.	Total
1966	250	152	20[a]	12	272	48	64	42	22	982
1967	757[a]	291[a]	20[a]	6	123[a]	53	2	129[a]	48[a]	1,429
1968	757[a]	150	20[a]	100	100	26[a]	9	19	4	1,185
1969	147	200	20[a]	38[a]	34	26[a]	19[a]	129[a]	7	620
1970	364	368	20[a]	38[a]	162	35	17	129[a]	48[a]	1,181
1971	269	512	20[a]	56	81	4	30	200	45	1,217
1972	1,200	348	13	49	89	25	4	129[a]	47	1,904
1973	623	476	20[a]	15	172	26[a]	17	100	47	1,496
1974	1,317	137	4	15	55	32	29	65	49	1,654
1975	741	71	6	38[a]	123[a]	26[a]	19[a]	161	48[a]	1,233
1976	777	289	61	35	37	15	6	98	17	1,335
1977	1,090	132	20	73	91	10	15	35	48[a]	1,514
1978	921	137	9	52	125	24	20	285	92	1,665
1979	1,380	810	29	5	279	16	16	285	153	2,973
1980	718	575	24	3	247	8	35	70	66	1,746
1981	754[a]	120	20[a]	51	191	19	23	191	107	1,486
1982	1,656	1,260	179	70	200	35	49	440	127	4,016
1983	931	575	41	12	166	87	141	330	287	2,570
1984	2,189	577	17	26	382	89	264	568	279	4,391
1985	321	360	14	26	91	15	22	203	58	1,110
1986	3,182	618	29[a]	76	328	182	251	424	224	5,314
1987	1,228	764	33	10	80	192	141	247	112	2,807
1988	967	684	0	17	249	62	115	75	161	2,330
1989	1,993	740	3	185	344	90	165	65	72	3,657
1990	1,356	615	15	320	411	42	41	57	49	2,906
1991	1,303	865	18	305	520	115	101	54	151	3,432
1992	656	88	1	83	79	12	14	107	17	1,057
1993	1,156	[b]	[b]	126	65	[b]	[b]	[b]	[b]	[b]
1994	1,682	508	47	121	430	250	75	4	2	3,119
Mean	1,432	457[c]	27[c]	68	194	57[c]	62[c]	168[c]	88[c]	2,151[c]

[a] Estimated.

[b] No aerial surveys conducted in 1993.

[c] Average of 1966-1992 and 1994 data.

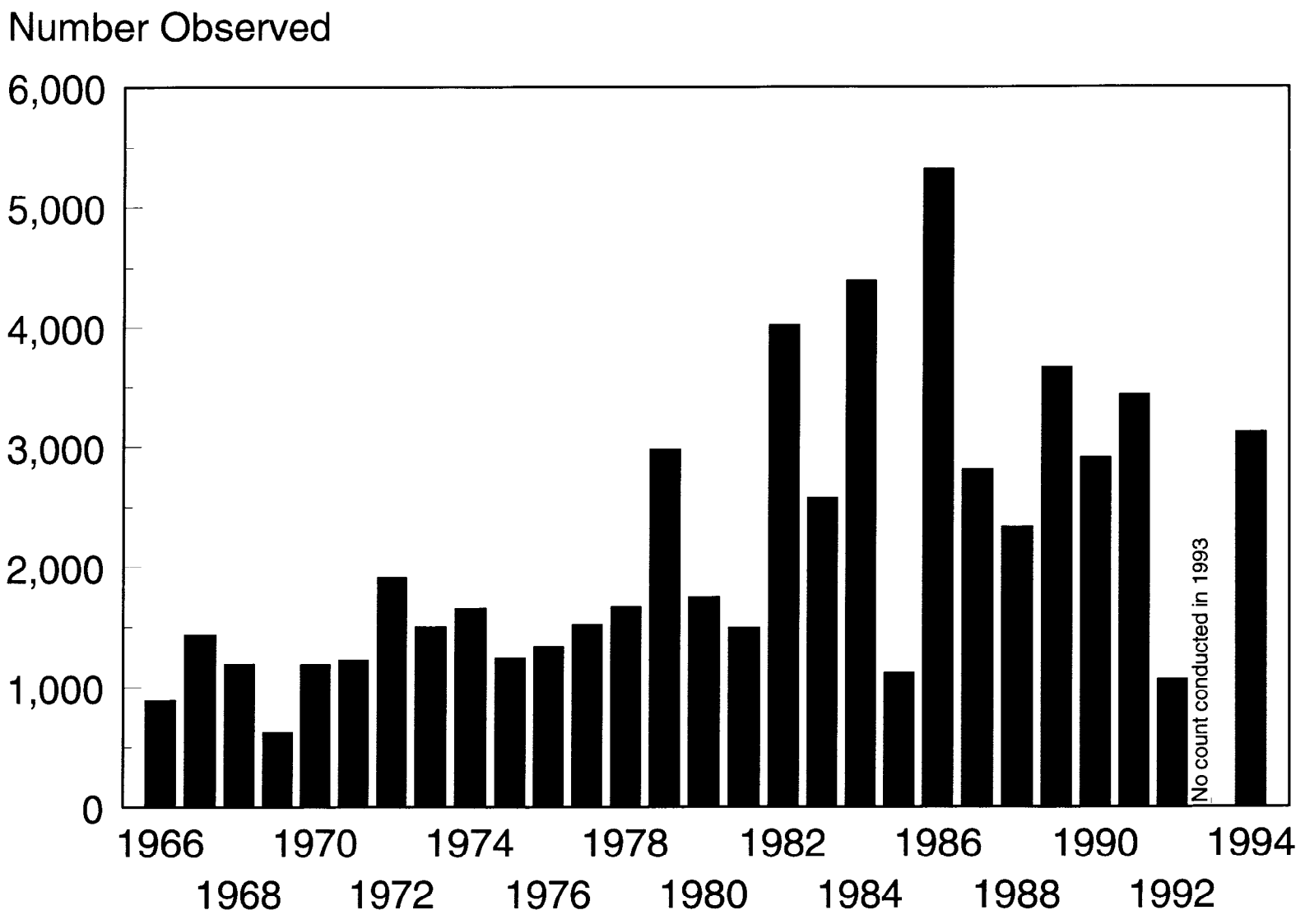


Figure 15.-Observed spawning escapement index counts for chinook salmon in the Copper River drainage, 1966-1994.

Table 16.-Copper River chinook salmon harvest and escapement index estimates, 1966-1994.

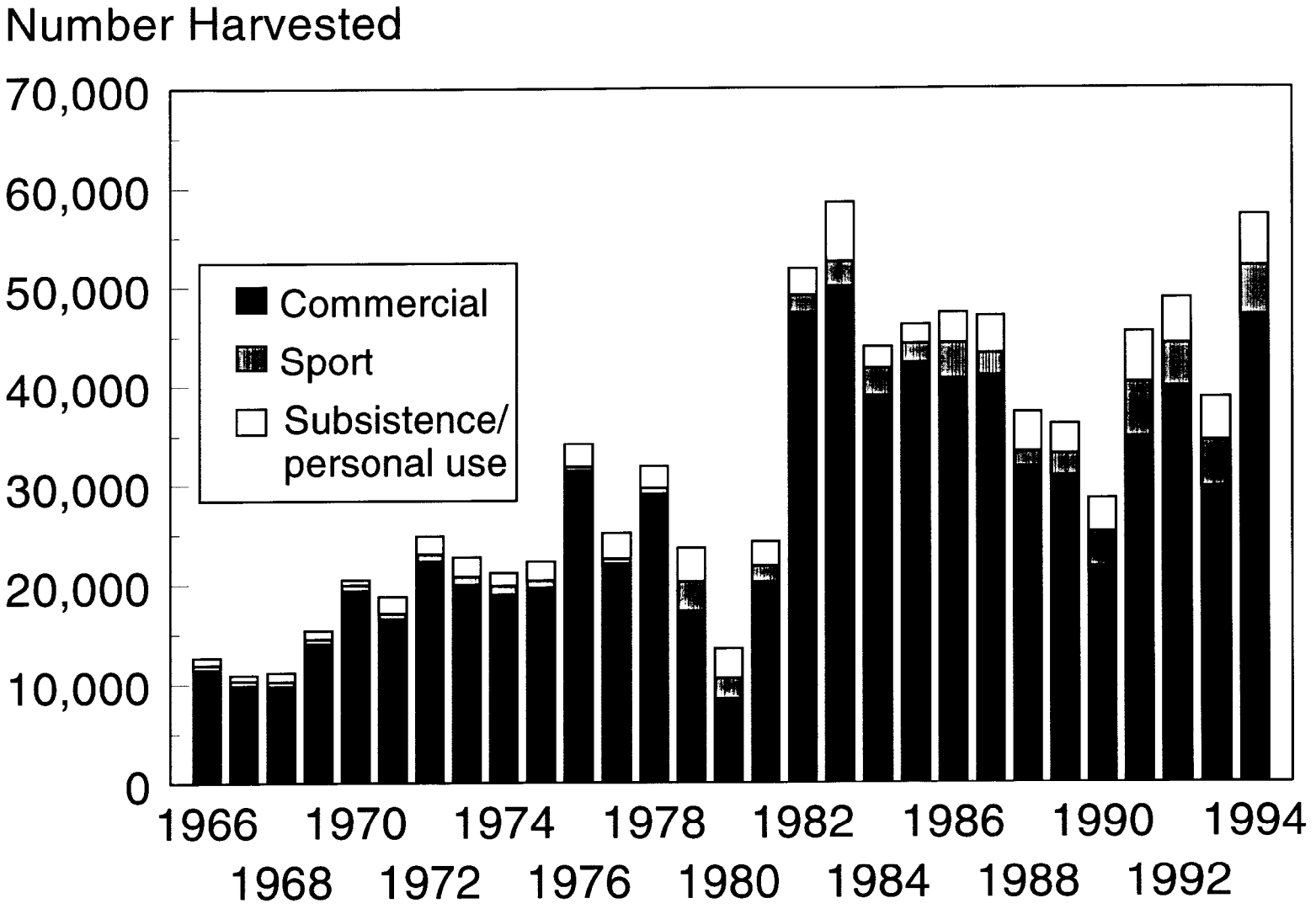
Year	Commercial Harvest[a]	Sport Harvest[b]	Subsistence/ Personal Use Harvest[c]	Total Harvest	Aerial Escapement Index
1966	11,422	500	727	12,649	882
1967	9,853	500	568	10,921	1,429
1968	9,743	500	923	11,166	1,185
1969	14,050	500	869	15,419	620
1970	19,375	600	551	20,526	1,181
1971	16,486	600	1,750	18,836	1,217
1972	22,349	750	1,797	24,896	1,904
1973	19,948	850	2,015	22,813	1,496
1974	18,980	900	1,297	21,177	1,654
1975	19,644	750	1,978	22,372	1,233
1976	31,483	400	2,335	34,218	1,335
1977	22,089	532	2,555	25,176	1,514
1978	29,062	641	2,239	31,942	1,665
1979	17,308	2,948	3,416	23,672	2,973
1980	8,449	2,101	3,035	13,585	1,746
1981	20,178	1,717	2,410	24,305	1,486
1982	47,362	1,802	2,764	51,928	4,016
1983	50,022	2,579	5,950	58,551	2,570
1984	38,955	2,787	2,269	44,011	4,391
1985	42,333	1,939	1,958	46,230	1,110
1986	40,670	3,663	3,052	47,385	5,314
1987	41,001	2,301	3,781	47,083	2,807
1988	31,741	1,562	3,982	37,285	2,330
1989	30,873	2,219	3,040	36,132	3,657
1990	21,702	2,232	3,325	28,596	2,906
1991	34,787	4,427	5,331	44,545	3,432
1992	39,819	3,997	4,826	48,642	1,057
1993	29,716	7,620	4,263	41,599	NA
1994	47,061	5,000[d]	5,699	57,760	3,119

[a] 1973-1992 data published in Donaldson et al. 1993, 1966-1972 data unpublished, 1993 and 1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication.

[b] Prior to 1977 the harvests were estimated. 1977-1993 from Mills (1979-1994).

[c] These figures are expanded to reflect unreported permits. See Table 6 for reported harvests.

[d] Estimated.



1973-1992 data published in Donaldson et al. 1993; 1966-1972 data unpublished; 1993 and 1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication

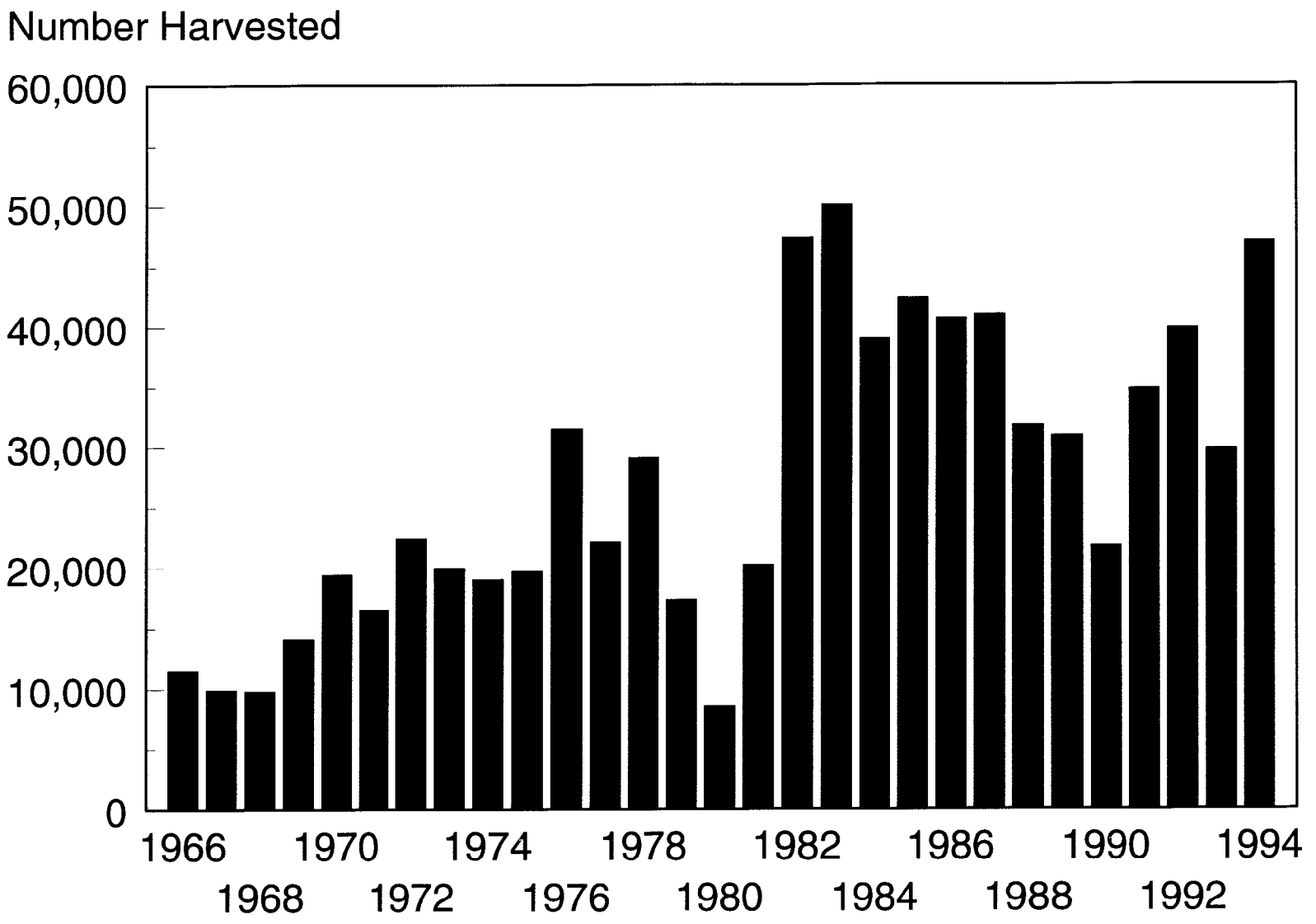
Figure 16.-Harvest of Copper River chinook salmon, by fishery, 1966-1994.

District if Copper River District sockeye salmon returns are forecasted or observed to be weak ***and*** a strong harvestable surplus of chinook salmon is demonstrated. By the third fishing period, with sockeye salmon harvests near 100,000 fish per period, fisheries management becomes directed toward sockeye salmon. Since 1984, chinook salmon harvest in the Copper River Delta commercial fishing district has averaged approximately 36,250 fish (Table 16), with harvests having remained relatively stable (Figure 17).

Subsistence and personal use harvests of Copper River chinook salmon have averaged approximately 3,800 fish since 1984 (Table 16), with harvests having generally increased in recent years (Figure 18). The subsistence fishery occurs from June 1 through September 30 in the mainstem Copper River from the upstream edge of the Chitina-McCarthy Highway bridge upstream to Slana. Fish wheels and dip nets are legal gear. Permits are a requirement of this fishery. The maximum harvest limit for a household of one person is 200 fish and for a household of two or more is 500 fish. There is no limit as to the number of chinook salmon within the annual permit limit for people using fish wheels, while a 5 chinook salmon limit is imposed on subsistence fishermen using dip nets. Chinook salmon are present in the fishery when the fishery is opened and, on average, 80% of the chinook salmon harvest is achieved by July 12 (Roberson and Whitmore 1991).

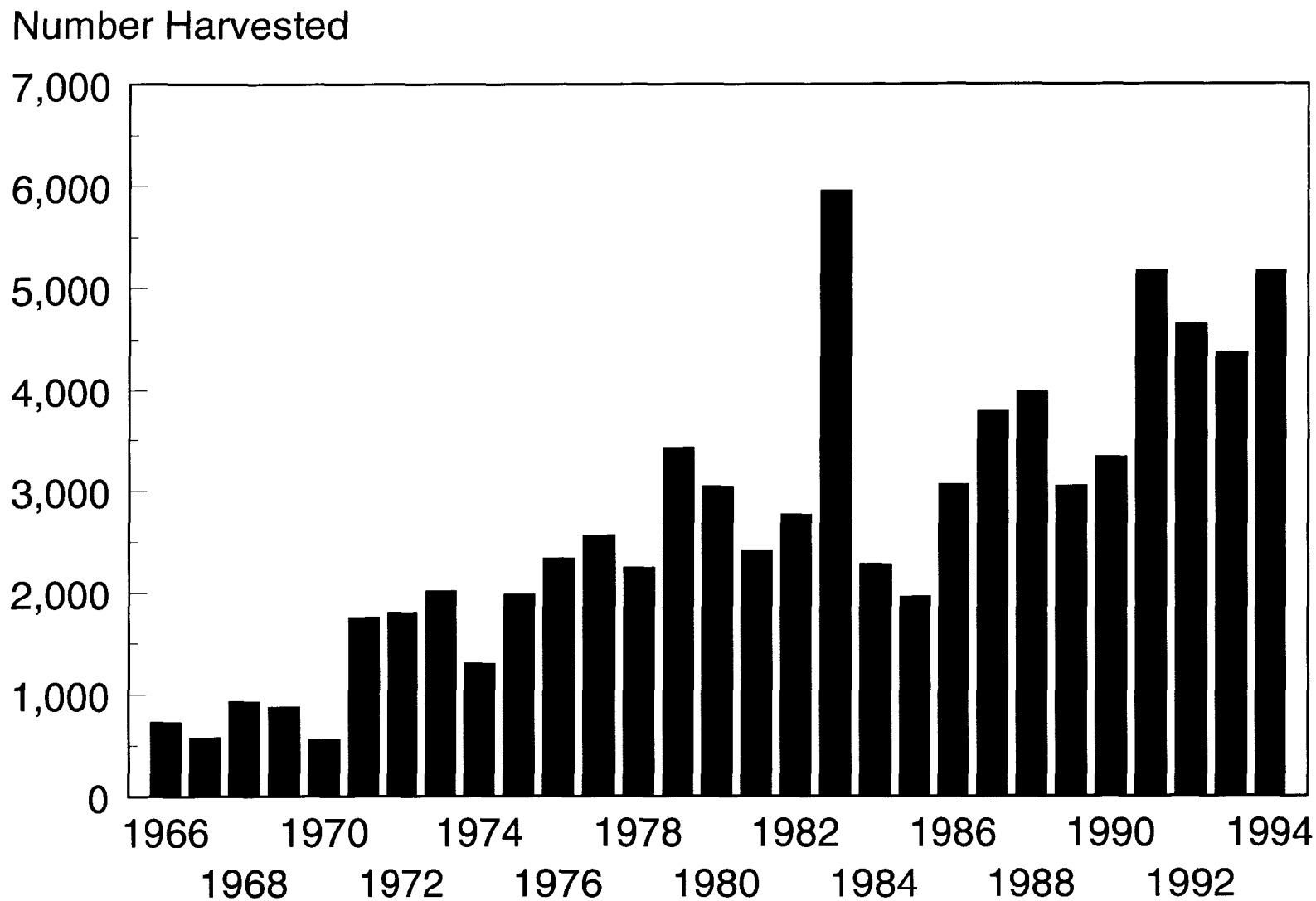
The personal use fishery is restricted to mainstem waters of the Copper River from the downstream edge of the Chitina-McCarthy Highway bridge downstream to a department marker located approximately 200 yards upstream of Haley Creek. The season is from June 1 through September 30. Fishing periods are established by emergency order. The schedule is designed to allow a total harvest of 60,000 sockeye salmon plus 25% of the Miles Lake sonar count of more than 516,000 salmon over the course of the season. Specific weekly harvest limits for each of the first 5 weeks of the fishery are incorporated into the schedule. If the harvest of salmon is less than 45,000 salmon by the end of the fifth week of the fishery the possession limit may increase for sockeye salmon, but not for chinook salmon. Participants in this fishery must be residents of the state and have a current sport fishing license. Permits are a requirement of this fishery. Permits limit households of one individual to 15 salmon of which no more than 5 can be chinook salmon and households of more than one person to 30 salmon of which no more than 5 can be chinook salmon. Chinook salmon are present in the catch when the fishery is opened. On average, 80% of the chinook salmon harvest is completed by July 1 and 95% by July 17 (Roberson and Whitmore 1991).

The sport harvest of chinook salmon from Copper River tributaries has increased substantially since 1982 (Figure 19), with the 1993 harvest of 7,620 being the highest on record (Table 16). Since 1982, the average harvest of chinook salmon by sport anglers fishing UCUSMA waters has been about 3,400 fish. The fishery primarily occurs in various tributaries to the Copper River with the largest fisheries occurring in the Gulkana and Klutina rivers (Table 17). Approximately 94% of the estimated sport harvest of chinook salmon taken from the Copper River drainage since 1983 has been taken from these two drainages. Since 1970, the sport harvest of chinook salmon over 20 inches in length in the sport fishery of the Copper River Basin has been limited by a bag and possession limit of 1 per day and 1 in possession. Further protection was afforded area chinook salmon stocks through spawning season closures beginning in 1989. In 1989, it was established that a chinook salmon removed from UCUSMA waters becomes part of the daily



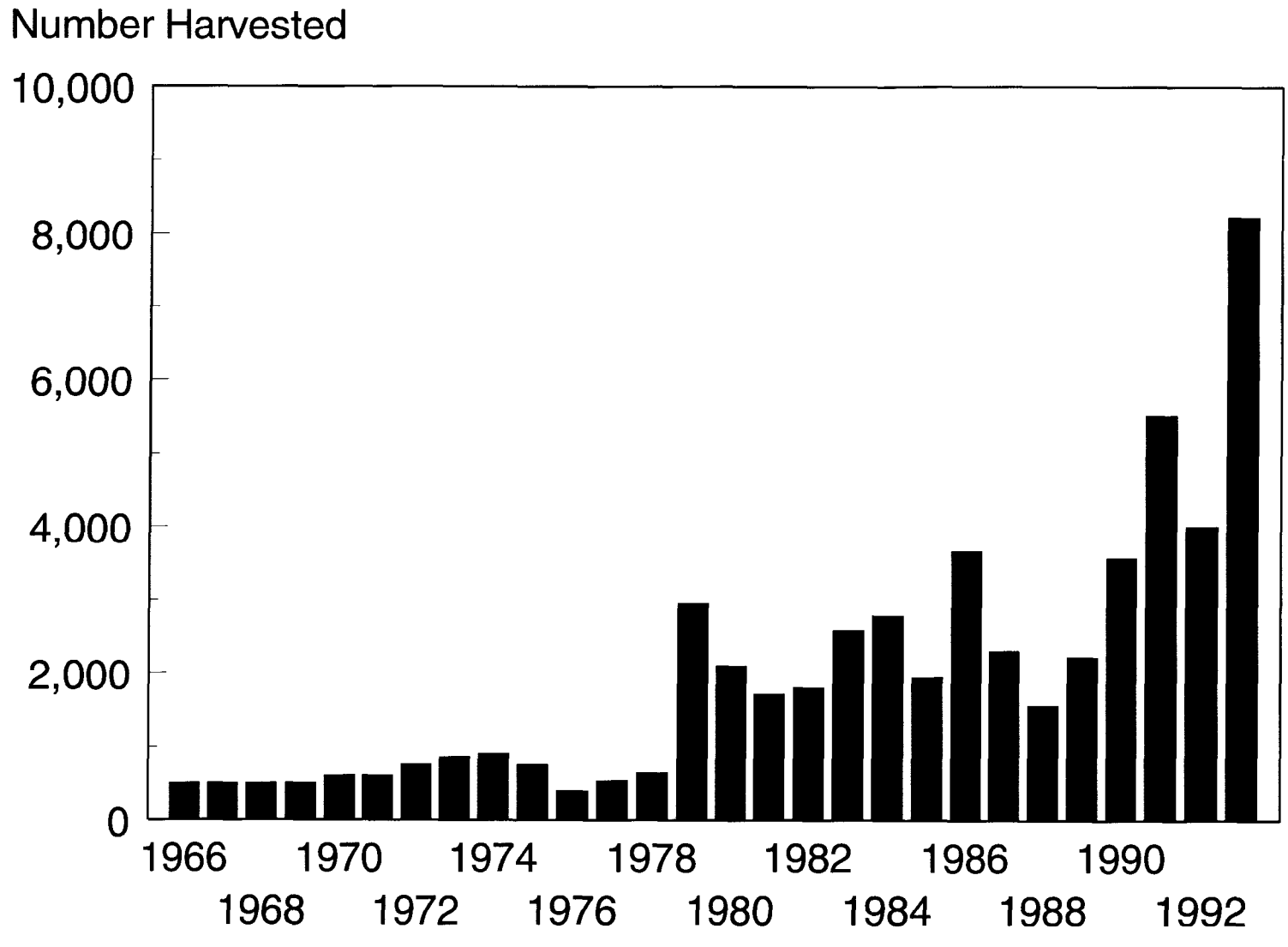
1973-1992 data published in Donaldson et al. 1993; 1966-1972 data unpublished; 1993 and 1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication

Figure 17.-Commercial harvest of Copper River chinook salmon, 1966-1994.



1973-1992 data published in Donaldson et al. 1993; 1966-1972 data unpublished; 1993 and 1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication

Figure 18.-Subsistence and personal use harvest of Copper River chinook salmon, 1966-1994.



1973-1992 data published in Donaldson et al. 1993; 1966-1972 data unpublished; 1993 and 1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication

Figure 19.-Sport harvest of Copper River chinook salmon, 1966-1993.

Table 17.-Harvest of chinook salmon by recreational anglers fishing in the UCUSMA averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage								
Upper River	620	328	470	239	362	313	194	694[a]
Lower River	4,831	2,505	2,197	1,353	1,189	720	1,437	1,358[a]
Total	**5,451**	**2,833**	**2,667**	**1,592**	**1,551**	**1,033**	**1,631**	**2,052**
Klutina R Drainage	1,843	952	1,588	554	606	483	495	454[b]
Tazlina Drainage	0	8	32	17	34	9	49	31[b]
Copper River								
Upstream of Gulkana	47	16	0	17	0	9	0	15[b]
Downstream of Klutina	73	55	19	0	11	28	0	49[b]
Other Waters	206	133	115	52	17	0	126	2,250[c]
AREA TOTAL	**7,620**	**3,997**	**4,421**	**2,232**	**2,219**	**1,562**	**2,301**	**2,071[d]**

Data from: Mills (1979-1994).

[a] Includes 1983-1986 average harvest only. Harvest prior to 1983 included in drainage total.

[b] Includes 1983-1986 average only. Prior to 1983, harvest included in other waters.

[c] Harvest for years 1977-1982 includes all drainages except Gulkana.

[d] Average of total annual harvest 1977-1986.

bag and possession limit of the person who hooked the fish. During 1991, sport chinook salmon fishing was closed in Indian, Bernard, Ahtell and Natat creeks and the Little Tonsina River. This action was taken in an effort to bolster escapements to these small clearwater tributaries which have showed decline in chinook salmon returns in recent years. Also during 1991, the portion of the Gulkana River 7.5 miles upstream of the confluence of the West Fork was designated as an area where only unbaited, single-hook artificial lures may be used. This action was taken as a conservation measure for rainbow trout and has had little or no effect on the chinook salmon fishery.

Under the *Copper River Personal Use Salmon Management Plan* (5 AAC 77.590), the Board established a harvest guideline of 2,500 chinook salmon, annually, to the sport fishery in the Copper River tributaries. This guideline has been exceeded five times during the last 10 years (Table 16). Given the increase in the popularity of the sport chinook salmon fishery in the Copper River basin, it is likely that the 2,500 fish quota will continue to be exceeded into the future unless actions are taken to reduce harvest or the quota is raised to accommodate the growth in the fishery.

Overall, Copper River chinook salmon stocks are considered healthy (Roberson and Whitmore 1991). Although harvests have increased over the past decade, observed spawning escapements have remained relatively stable (Figure 20). However, the 1992 observed spawning escapement of only 1,057 was the lowest on record since 1969 (Table 16). Future escapements will need to be monitored closely to determine if this relates to a long-term trend.

Gulkana River Chinook Salmon Fishery

Background and Historical Perspective

The Gulkana River drainage has historically supported the largest sport fishery for chinook salmon in the UCUSMA. This drainage originates in the Alaska Range and flows south to join the Copper River near the community of Gulkana (Figure 5). The section of the Gulkana River upstream from Sourdough has been designated by the U.S. Congress as "wild" under the Wild and Scenic Rivers Act of 1968. Access to the river is available from various secondary roads and trails off the Richardson Highway which parallels much of the river. Anglers utilize rafts and power boats to gain access to the more remote sections of the river. Raft anglers frequent the various sections of the river from Paxson Lake downstream to the Richardson Highway bridge. Power boat operators generally launch at Sourdough and use that section of the river from approximately 2 miles below Sourdough upstream to the confluence of the West Fork. More recently power boat operators have begun launching from the Richardson Highway bridge and fishing the 5-mile reach of the river above the bridge. Power boat operators occasionally access the confluence of the Gulkana River with the Copper River using power boats launched from Gakona.

Chinook salmon typically begin entering the Gulkana River in early to mid-June. The sport fishery typically peaks during late June; however, limited fishing for chinook salmon continues until the season closes. Spawning begins in mid-July and continues through late August. Most spawning occurs upstream of the confluence of the West Fork.

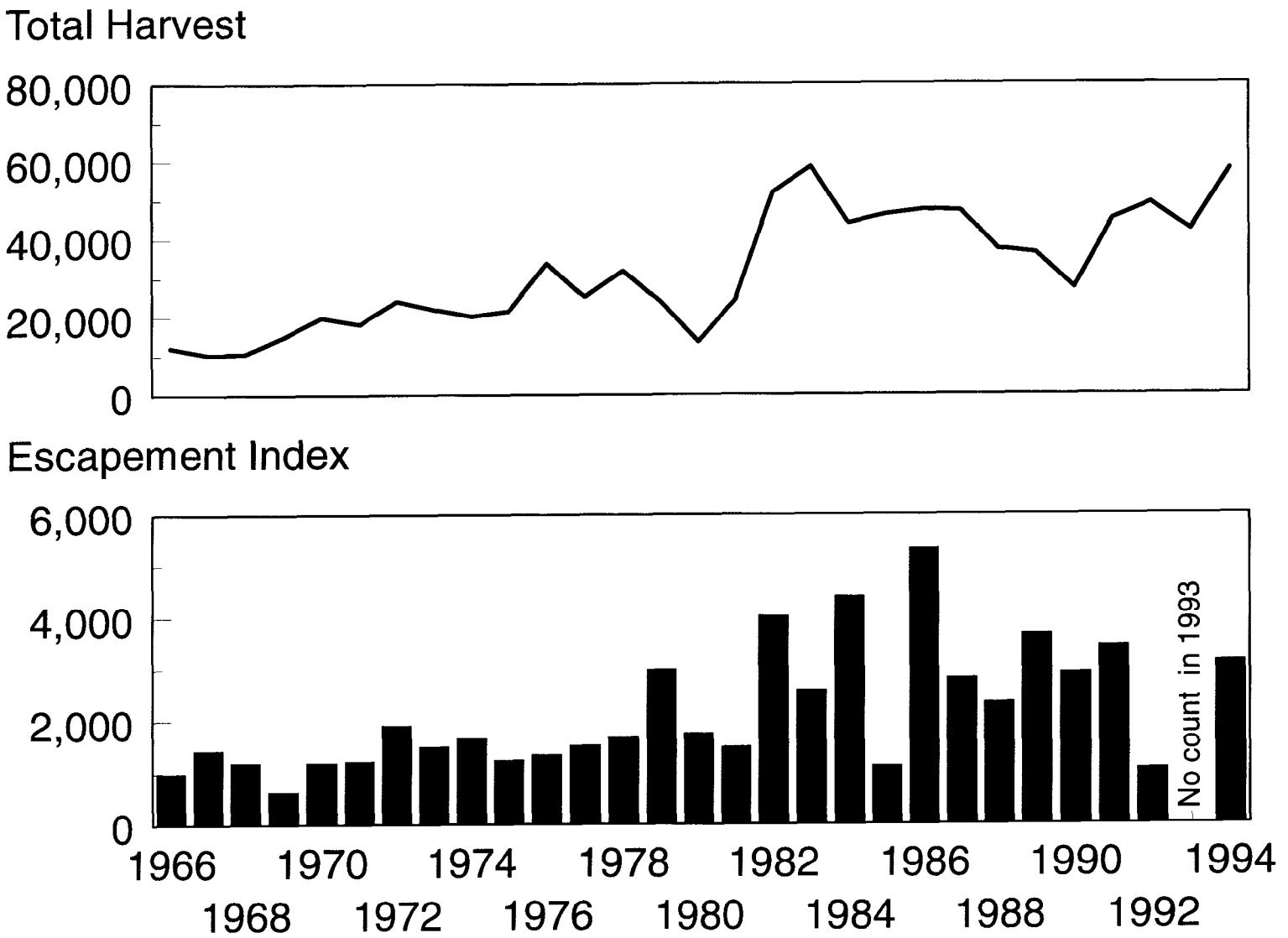


Figure 20.-Comparison of Copper River chinook salmon harvest and spawning escapement index counts, 1966-1994.

Under current regulations, anglers fishing the Gulkana River are allowed 1 chinook salmon over 20 inches daily and in possession and a total of 5 per year. All waters above the Middle Fork confluence with the mainstem Gulkana River are closed to fishing for chinook salmon year round to protect spawning fish. The rest of the river is open to chinook salmon fishing from January 1 through July 19. The closure date is intended to offer spawning fish protection. The Gulkana River from the Richardson Highway bridge downstream to a department marker 500 yards downstream of its confluence with the Copper River is an area that only single-hook, artificial flies may be used from June 1 through July 31. In all waters of the Gulkana River drainage upstream of a marker 7.5 miles upstream of the West Fork confluence with the mainstem only unbaited, artificial lures may be used. This regulation is intended to protect rainbow trout stocks that inhabit this area.

The primary source of information regarding the sport fishery is the statewide mail survey (Mills 1979-1994). Based on this survey, the sport harvest of chinook salmon in the Gulkana River has averaged about 2,000 fish annually since 1977 (Table 18, Figure 21). The 1993 harvest of 5,451 chinook salmon was the largest on record and accounted for nearly 72% of the sport harvest of chinook salmon in the UCUSMA. Sport fishing effort on the Gulkana River has averaged about 25,100 angler-days annually since 1983 (Table 3). Due to the nature of the mail survey, it is unknown how much of this effort was directed towards chinook salmon. Observations, however, suggest that a majority of the recent year's effort is directed towards chinook salmon.

A creel survey was conducted in 1989 to estimate the catch and harvest of and effort directed toward chinook salmon. Results of this survey (Potterville and Webster 1990) indicated that sport anglers expended 29,103 angler-hours to catch 2,398 chinook salmon. Sixty-one percent (1,461 fish) of the catch was estimated to be harvested. This estimate of harvest is close to that estimated from the mail survey (1,530 fish), indicating that the mail survey appears to accurately estimate the harvest of chinook salmon in this fishery. Approximately 50% of the harvest was estimated to have occurred on weekends. The majority of the sport harvest occurred in the 5-mile reach directly upstream of the Richardson Highway bridge and the 10-mile reach near the Bureau of Land Management campground and boat launch at Sourdough. Few anglers fished the single-hook, artificial fly-only area and, although many anglers floated the upper river, the harvest of chinook salmon was minimal in this reach due to the July 20 spawning season closure.

The spawning escapement of chinook salmon in the Gulkana River upstream of the West Fork has been documented since 1966 by aerial surveys of index sites in the drainage since 1966 (Brady et al. 1991, Roberson and Whitmore 1991). Through 1994, escapement indices averaged 1,432, ranging from a high of 3,182 fish in 1986 to a low of 147 fish in 1969 (Table 15). With the exceptions of a low escapement during 1985 and high escapement during 1986, escapements have remained relatively stable since 1977 (Figure 21).

Fishery Objectives

The underlying goal of past and current management has been to assure sustained yield. An annual escapement objective of 1,000 fish has been established, based on enumeration of spawning fish by aerial surveys. During years in which water clarity has been good enough to conduct area surveys, no action has been taken to restrict the fishery if spawning escapements of 1,000 fish are achieved in the area between the confluence of the Gulkana River with the Copper

Table 18.-Sport harvest and observed spawning escapements of chinook salmon in the Gulkana River drainage from 1977-1994.

Year	Sport Harvest[a]	Observed Spawning Escapement[b]
1977	421	1,090
1978	606	921
1979	2,440	1,380
1980	1,688	718
1981	1,469	754
1982	1,603	1,656
1983	2,224	931
1984	1,898	2,189
1985	1,256	321
1986	2,833	3,182
1987	1,631	1,228
1988	1,033	967
1989	1,511	1,993
1990	1,592	1,356
1991	2,667	1,303
1992	3,071	656
1993	5,451	1,156
1994	NA[c]	1,682
Mean	**1,988**	**1,305**

[a] Mills (1979-1994).

[b] 1979-1990 data from Roberson and Whitmore (1991), 1991-1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication.

[c] Data are not available at the time of publication.

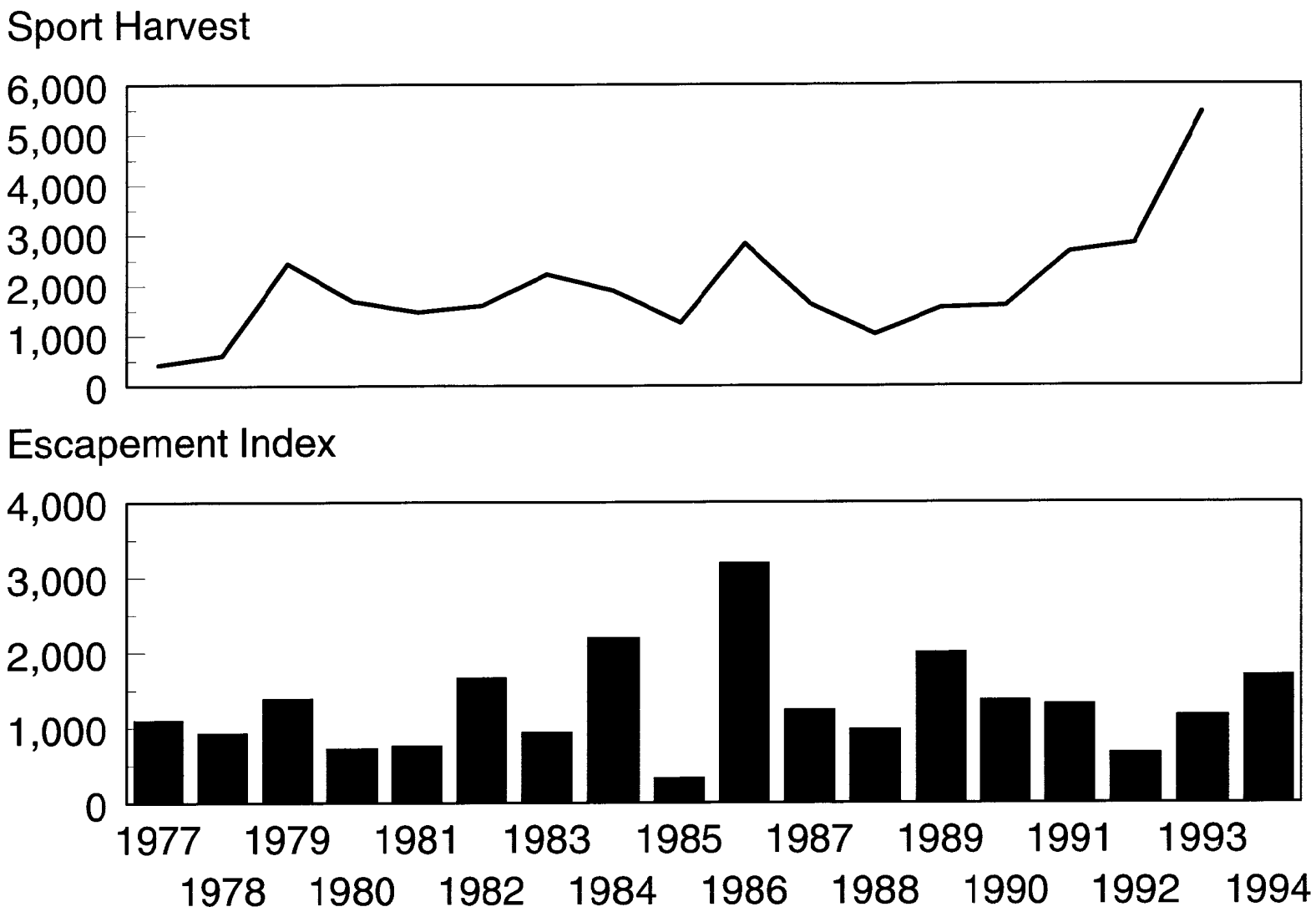


Figure 21.-Comparison of chinook salmon harvest and spawning escapement index counts in the Gulkana River, 1977-1994.

River to the confluence of the Gulkana River with the West Fork during the week following the Fourth of July weekend. Unfortunately, water clarity often prohibits conducting aerial surveys during this period.

Recent Board of Fisheries Actions

During 1994, a seasonal bag limit of 5 chinook was imposed on the UCUSMA fisheries and guides were restricted from fishing while accompanying paid clients. Both restrictions were implemented to reduce the harvest potential on chinook salmon stocks in the area which are considered fully utilized.

Recreational harvests are documented through the mail survey, the personal use and subsistence harvests are recorded through permits, and the commercial harvest is enumerated through fish tickets. In 1994, commercial fishermen were required to record their take of chinook salmon for personal use on ADF&G fish tickets to allow managers to estimated the total harvest of Copper River bound chinook.

Recent Fishery Performance

During 1993, 5,451 chinook salmon were harvested by sport anglers fishing the Gulkana River drainage (Table 17). Observed chinook salmon spawning escapement during 1993 (1,156) was near average (1,305) (Table 18). Harvest information is not yet available for the 1994 season but the spawning escapement was well above average.

Since 1991 there has been a significant increase in use of power boats from the Richardson Highway bridge upstream for about 5 miles. Also, a notable increase in the number of guides specializing in guiding anglers targeting chinook salmon has occurred on the lower river (below the West Fork confluence) over the past several years. Prior to the 1986 season, only one individual specializing in guiding anglers targeting chinook salmon on this section of the river. During the 1987 and 1988 seasons, a minimum of eight guides operated on the lower portions of the river, while the number increased to at least ten guides during 1989 and 1990. Available data indicate that guided anglers are more successful than unguided anglers. During 1990, back-trolling techniques similar to those used in the Kenai River were introduced on the Gulkana River. It is generally believed this technique has further increased catch rates for chinook salmon.

Current Issues

Increased use by float and power boat operators on the Gulkana River is intensifying conflicts between users. Float-boat operators fish primarily from the bank casting and drifting lures through the holes while power boats hover in the holes and back troll. Additionally, reports have been made by float-boat operators that power boats have bumped into them.

The majority of the land adjacent to the Gulkana River downstream of Sourdough is owned by the Ahtna Native Corporations. Beginning during the 1991 season, these corporations prohibited trespass across their lands for the purpose of hunting or fishing because they feel their customary and traditional lifestyle has been jeopardized by elimination of the rural preference in the subsistence law. They may, if requested, allow access for camping, hiking, or other nonconsumptive resource uses.

The allocation of chinook salmon between sport, personal use, and commercial uses remains a controversial issue. A significant portion of the total chinook salmon commercial harvest is

taken during the first week of the commercial fishery when only a small portion of the sockeye salmon harvest is taken. Many sport anglers think this fishery should begin at least a week later than historically conducted. Since stock status is considered healthy, this is an allocative rather than biological issue.

Proposed Research and Management Activities

It has been determined that the mail survey accurately estimates the harvest of chinook salmon in this drainage; therefore, it is not recommended that creel surveys be conducted on an annual basis. Managers depend on aerial surveys to estimate the escapement of chinook. These are at best indicators of relative spawning abundance rather than absolute abundance due to their dependence on survey conditions, surveyor and the residence of fish in the survey area. Beginning in 1996, a weir will be placed in the Gulkana to count returning adult chinook and verify aerial counts. In addition, the feasibility of coded wire tagging chinook smolts will be investigated in 1995 with the purpose of determining the contribution of Gulkana River chinook to the Copper River. Aerial surveys will be continued to index numbers of spawning salmon.

Klutina River Chinook Salmon Fishery

Background and Historical Perspective

The Klutina River supports the second largest sport fishery for chinook salmon in the UCUSMA. This semiglacial river drops rapidly out of Klutina Lake to enter the Copper River at the community of Copper Center. Access to the river is available along the Richardson Highway and from the Klutina Lake Road (also called the Brenwick-Craig Road) which parallels the river. Shore anglers participate in the fishery adjacent to the highway and the Klutina River Road. The distance between the Klutina River Road and the river varies along the course of the road, with the road running along the ridge above the river. Much of the land between the road and the river belongs to the Ahtna Native Corporation and permission to cross their land is required. Jet river boats are used by experienced operators to access the upstream portions of the river. Jet boats are launched from private land adjacent to the highway or from a site along the Copper River. The river has considerable stretches of white water and is considered to be very challenging to jet river boat operators. The fast water of the Klutina River limits the number of resting pools for chinook salmon; therefore, there are less than two dozen good fishing sites in the lower portion of the river accessible to most anglers.

Chinook salmon typically begin entering the Klutina River in late June, with the run continuing well into August. The sport fishery typically peaks during the second week of July; however, fishing for chinook salmon continues until the season closes on August 10. Peak spawning occurs from late July through August. Most spawning occurs upstream of a point adjacent to mile 19.2 on the Klutina Lake Road.

Chinook salmon spawning season closures were established in the UCUSMA during the 1989 Board meeting to allow chinook salmon to spawn unmolested. On the Klutina River upstream of a department marker located adjacent to Mile 19.2 of the Klutina Lake Road, chinook salmon may be taken only from January 1 through July 19. Downstream of this marker, the chinook salmon season is from January 1 through August 10. Current bag and possession limits governing the sport fishery for chinook salmon over 20 inches are 1 and 1, respectively. The areawide bag limit of 5 chinook per year includes the Klutina River.

Sport harvest of chinook salmon from the Klutina River drainage has been estimated using the mail survey Mills (1979-1994) since 1983. Based on this survey, the sport harvest of chinook salmon from the Klutina River drainage has averaged 761 fish from 1983 through 1993, ranging from a low of 189 fish in 1983 to a high of 1,843 fish in 1993 (Table 19). Harvests remained relatively stable from 1983 to 1990 (Figure 22). Over this same period, sport effort on the Klutina River has averaged approximately 7,500 angler-days, peaking at 12,145 in 1991 (Table 4). Due to the nature of the mail survey, it is unknown how much of this effort was directed towards chinook salmon versus other species. Observations in recent years, however, suggest that a majority of the recent year's effort is directed towards chinook salmon.

During 1988 and 1989, creel surveys of the sport fishery targeting chinook salmon in the Klutina River drainage were conducted. High water reduced effort and catch during a significant portion of the 1988 season whereas river conditions remained favorable throughout the 1989 season. Results of the 1988 survey (Roth and Delaney 1989) indicated that sport anglers caught a total of 1,048 chinook salmon of which 43% were retained. The estimated harvest (450) was close to that reported in the mail survey for 1988 (483), indicating that the mail survey fairly accurately estimates sport harvest in this fishery. During the 1989 survey, it was estimated that anglers caught 1,587 chinook salmon of which 65% were retained (Potterville and Webster 1990). The estimated harvest (1,031 fish) was again reasonably close to that reported in the mail survey for 1989 (606 fish). The 1988 survey showed that guided boat anglers accounted for nearly 90% of the catch and 80% of the harvest of chinook salmon. During the 1989 survey boat anglers accounted for 88% of the estimated total catch and exhibited significantly higher catch (3.3 fish per hour) and harvest (2.1 fish per hour) rates than did shore anglers (0.5 and 0.4 fish per hour, respectively). The vast majority of boat anglers that participated in the fishery were guided and therefore insufficient data were available to determine if guided boat anglers had different catch or harvest rates than unguided boat anglers. Daily estimates of CPUE from the 1988 survey were used to estimate the timing of chinook salmon into the fishery. These data indicate that CPUE peaks during mid-July, with 50% of the run having entered the river by late July. Approximately 12 guides operated on the Klutina River during 1989 and 1990, all of which conducted boat trips. The vast majority of shore anglers fished that portion of the river downstream from the Richardson Highway bridge.

The spawning escapement of chinook salmon to the Klutina River has been documented by aerial surveys of St. Anne and Manker Creeks since 1966 (Table 15). Spawning escapement has averaged 119 fish during 1966-1994, ranging from a high of 433 in 1986 to a low of 21 in 1976. Since 1986, observed escapements to this drainage have declined (Table 19, Figure 22). No escapements surveys were flown on the Klutina River index areas in 1993. The 2-mile stretch of river just below the lake is known to support chinook salmon spawning; however, due to the turbid water conditions in this area, it is not possible to assess abundance of spawning fish.

Fishery Objectives

No specific fishery objectives have been established for this stock. An underlying assumption of past and current management, however, has been to assure sustained yield. Aerial survey index evaluation does not appear to evaluate the majority of spawning fish in this system and has not been used to manage this fishery.

Table 19.-Sport harvest and observed spawning escapements of chinook salmon in the Klutina River drainage from 1983-1994.

Year	Sport Harvest[a]	Observed Spawning Escapement[b]
1983	189	228
1984	667	353
1985	249	37
1986	740	433
1987	495	333
1988	483	177
1989	606	255
1990	554	83
1991	1,588	216
1992	952	26
1993	1,843	[c]
1994	NA[d]	325
Mean	761	224

[a] Mills (1979-1994).

[b] 1979-1990 data from Roberson and Whitmore (1991), 1991-1994 data Steve Morstad, ADF&G, CFMD, Cordova, personal communication.

[c] No aerial survey conducted in 1993.

[d] Data are not available at time of publication.

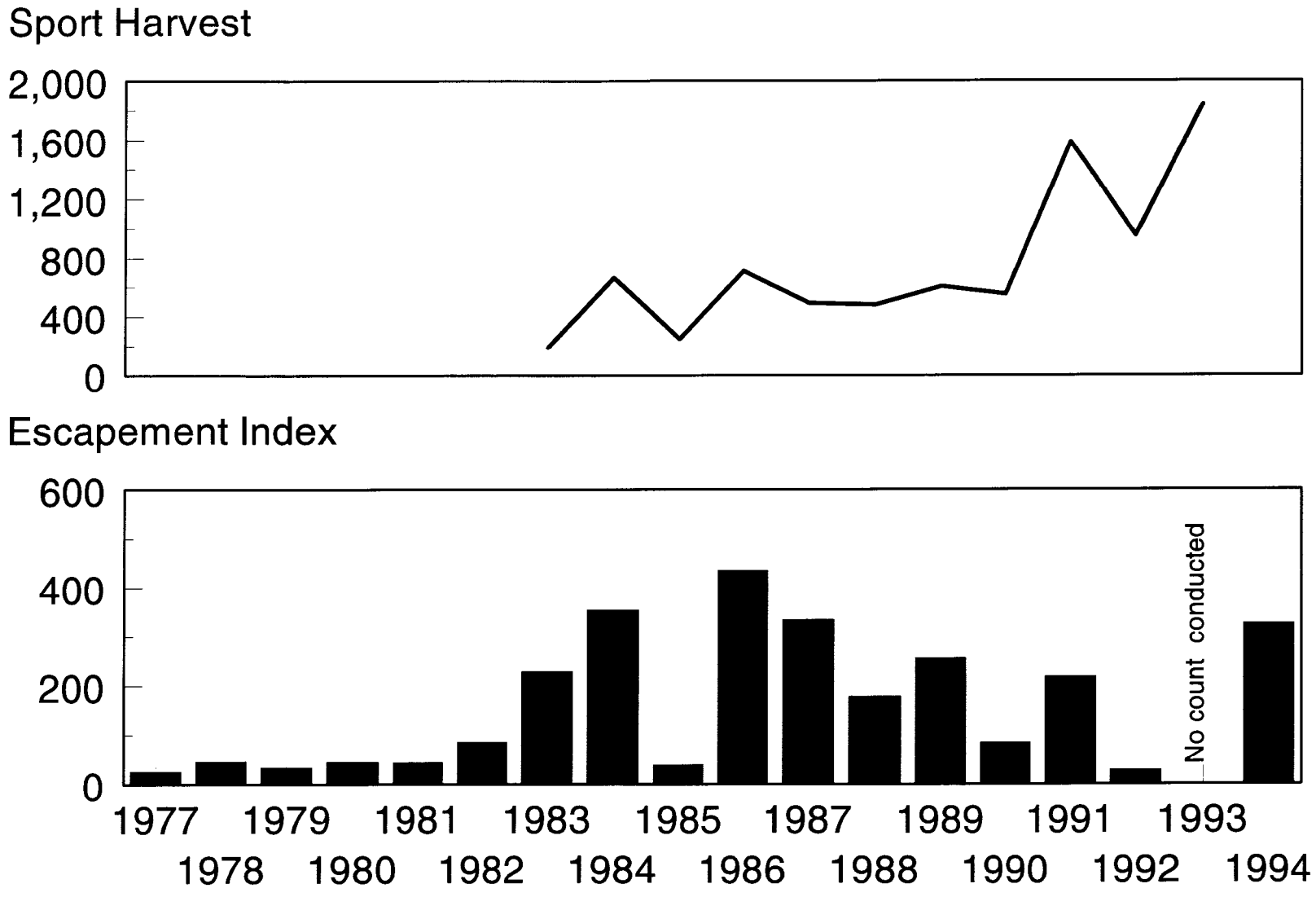


Figure 22.-Comparison of chinook salmon harvest and spawning escapement index counts in the Klutina River, 1977-1994 .

Recent Board of Fisheries Actions
Refer to the section on Board actions for the Gulkana River chinook salmon fishery.

Recent Fishery Performance
The 1993 sport harvest of 1,843 chinook salmon was the largest on record and accounted for about 35% of the estimated total sport harvest of chinook salmon in the UCUSMA. Escapement of chinook salmon to index sites in the Klutina River drainage, as documented by aerial surveys during 1994 was 325 fish (Table 15).

Current Issues
The sport fishery for chinook salmon in the Klutina River has, in recent years, taken a higher proportion of returning fish (Figure 22). This has resulted from an increase in the number of guides operating in the fishery, increased angler access to salmon holding areas, and a general increase in angler proficiency. Greater exploitation rates increase the risk of overharvest during years of low production and high angler effort. Further harvest increases may make further restrictions to the fishery necessary.

The majority of the land adjacent to the Klutina River upstream of the Richardson Highway is owned by Ahtna Native Corporations. Beginning during the 1991 season, this corporation prohibited trespass across their lands for the purpose of hunting or fishing. The corporations are not allowing access for hunting or fishing purposes because they feel their customary and traditional lifestyle has been jeopardized by elimination of the rural preference in the state subsistence law. They may, if asked, allow access for camping, hiking, or other nonconsumptive resource uses.

The allocation of chinook salmon between sport, commercial, personal use and subsistence fisheries remains a controversial issue. A significant portion of the total chinook salmon commercial harvest is taken during the first week of the commercial fishery while only a small portion of the sockeye salmon harvest is taken during this time period. Many sport anglers think this fishery should begin at least a week later than historically conducted.

Increasing use of the swift Klutina River by power boats and limited use by rafts creates a greater hazard to users. Many sections of the river are not wide enough to allow boats to pass.

Recommended Research and Management Activities
Aerial survey index evaluation does not appear to evaluate the majority of spawning fish in this system. Given the increased use of this system by guided and unguided anglers, a research program is needed to assess the spawning ground escapement. Overlapping run timing of chinook and sockeye salmon make the use of sonar impractical. A mark-recapture program may be the best way to address this issue.

A portion of the chinook salmon hooked in the Klutina River are lost in the fast water before they can be landed. It is suspected that many of these fish may not survive to spawn. The hooking mortality of these fish needs to be evaluated. Evaluation of hooking mortality could be addressed during the mark-recapture study.

Other Copper Basin Chinook Salmon Fisheries
Less than 10% of the harvest of chinook salmon in the UCUSMA occurs in systems other than the Gulkana and Klutina rivers. The majority of this harvest occurs in the Tonsina River. The glacial Tonsina River flows from Tonsina Lake into the Copper River downstream of the Klutina

River confluence. The Tonsina River crosses under the Richardson Highway at mile 79 and the Edgerton Highway at mile 19. Shore anglers participate in the fishery adjacent to the Edgerton Highway, some angling is conducted by raft between the Richardson and Edgerton highways and some angling is conducted by fly-in anglers fishing the outlet of the Tonsina River at Tonsina Lake and Grayling Creek, a tributary which flows into the Tonsina Lake. Chinook salmon run timing to the Tonsina River drainage is thought to be similar to that of the Klutina River; late June through August.

The Tonsina River chinook salmon sport fishery supports a harvest, as estimated by the mail survey, of less than 200 fish annually. Creel surveys or fishery monitoring of catch or catch rates have not been conducted on the Tonsina River due to low fishing effort and low chinook salmon catches within this drainage. Fish and Wildlife Protection and department personnel do, however, conduct enforcement monitoring of this fishery on a sporadic basis.

The spawning escapement of chinook salmon to the Tonsina River has been documented by aerial surveys of the Little Tonsina River and Grayling Creek since 1966 (Table 15). The spawning escapement to these index sites has averaged 256 fish through 1994, ranging from a high of 847 in 1984 to a low of 23 fish in 1968.

Current regulations allow sport fishing for chinook salmon in the Tonsina River from January 1 through July 19. The July 19 closure date was established in 1989 to allow chinook salmon to spawn unmolested. Current daily bag and possession limits for chinook salmon over 20 inches in this drainage river are 1 and 1, respectively.

The Little Tonsina River and Bernard Creek and all flowing waters within a 1/4 mile radius of their confluence with the Tonsina River are closed to chinook salmon fishing. A staff proposal was submitted during the 1989 Board meeting to open the Little Tonsina River, which had been closed to fishing since 1967, to a 2 day per week fishery. This proposal was for a 3 week long season and required closing all areas to fishing except when open to chinook salmon fishing. This area has a history of illegal fishing activity. The Copper Basin Advisory Committee recommended that additional emphasis be placed on enforcement of current regulations and until the illegal harvest could be curtailed, no changes should be made. They were also opposed to the restriction of the sport fishery which targets Dolly Varden. At this time, staff see no need to create a chinook salmon sport fishery given the lack of local support.

The primary biological concern regarding the Tonsina River drainage chinook salmon in recent years is the extremely low chinook salmon escapements. There has been no apparent trend of increasing angler participation or harvest within this drainage. The problem, therefore, is reduced production, overharvest within one of several other exploiting mixed-stock fisheries, or the result of illegal fishing activities within the Tonsina River drainage.

The run-timing of chinook salmon returning to the Tonsina drainage is thought to be similar to that of the Klutina drainage. Based on this, a public proposal was submitted to the Board to extend the fishery through August 10 rather than July 20 to give anglers a better opportunity to harvest fish. The proposal was defeated based on the poor returns to the index streams and the lack of information about the size of the run.

A limited fishery for chinook salmon also occurs on Kiana Creek in the Tazlina River drainage. The average escapement since 1966 has been 194 salmon (Table 15). Following poor returns in

1992 and 1993, the return to Kiana Creek in 1994 was 430 chinook. This was the second highest count since surveys were initiated.

WILD RAINBOW AND STEELHEAD TROUT FISHERIES

The UCUSMA is the northernmost extent of the natural range of rainbow and steelhead trout in North America. Given this, the area's widely distributed stocks of wild rainbow and steelhead trout display generally low and variable production. To assure that these stocks are not overexploited, a conservative regulation package has been developed to manage the fisheries targeting these stocks. This package has been guided by the *Upper Cook Inlet and Copper River Basin Rainbow/Steelhead Trout Management Policy*. This policy was adopted by the Board of Fisheries during 1986 and provides the department with:

1. management policies and implementation directives for Copper River basin rainbow and steelhead trout fisheries;
2. a systematic approach to developing sport fishing regulations that include a process for rational selection of waters for special management such as catch and release, trophy areas, or high yield fisheries; and,
3. recommended research activities needed to meet these goals.

Under this policy, the entire Gulkana River drainage has been managed as a catch-and-release fishery for rainbow and steelhead trout since 1990. Managers believe that the abundance of trout in this drainage is low and that the stocks are incapable of supporting any level of long-term sustainable harvest. Additional protection was afforded this drainage's trout stocks through the establishment of an unbaited, artificial lures only area in all flowing waters of the Gulkana River drainage upstream from an unnamed creek flowing into the Gulkana River 7.5 miles upstream from the confluence of the West Fork. This action was taken in 1990.

The policy has also guided the development of regulations for the Tebay River drainage. In Summit Lake and Bridge Creek in the Tebay drainage, rainbow/steelhead trout less than 32 inches in length may not be possessed or retained and the daily bag and possession limit for trout over 32 inches is 1. This trophy fishery was established in 1988 to provide anglers the opportunity to harvest a "trophy trout" in the UCUSMA. Research has shown that these waters contain the largest nonanadromous rainbow trout in the Copper River drainage, with individual fish measuring over 32 inches in length and weighing up to 20 pounds. Also, the waters of Lower Hanagita Lake and the Hanagita River from Lower Hanagita Lake to the Tebay River have been managed as a catch-and-release fishery for trout since 1988. In all these waters, only unbaited, artificial lures may be used. This special regulation was adopted in 1988 to afford additional protection to these trout stocks.

All other waters supporting wild rainbow/steelhead trout stocks are managed under a 2 fish daily and 2 fish possession limit of which only 1 trout may be over 20 inches. The season is year round with the exception of Our Creek (a tributary to Moose Lake) which is closed from May 5 through June 15 to protect spawning grayling.

Under this regulation package, the harvest of wild rainbow and steelhead trout has decreased (Tables 20 and 21, Figure 23). Managers currently believe that the area's stocks of rainbow and steelhead trout are healthy and adequately protected against overharvest.

Table 20.-Harvest of wild rainbow trout by sport anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage[a]								
Lakes	79	0	14	0	0	400	253	0
Upper River	0	0	0	204	375	600	283	
Lower River	40	111	150	221	281	272	1,011	1,384[b]
Total	**119**	**111**	**164**	**425**	**656**	**1,272**	**1,547**	**1,384**
Klutina River Drainage	108	63	96	17	56	18	208	107[c]
Tazlina Drainage	0	24	0	68	0	292	15	45[c]
Copper River Downstream of Klutina	20	278	68	34	601	18	744	9[c]
Other Sites	76	103	27	0	66	109	178	319[d]
Area Total	**323**	**579**	**355**	**544**	**1,379**	**1,709**	**2,692**	**1,581**[e]

Data from: Mills (1979-1994)

[a] In 1991 the river was closed to the harvest of rainbow trout.

[b] Includes average of upper and lower river.

[c] Includes 1983-1986 average harvest only. Prior to 1983, harvest included in the listing for other sites.

[d] Average harvest for years 1977-1982, includes harvest from all drainages except Gulkana and those from stocked lakes.

[e] Average of total annual harvest.

Table 21.-Harvest of steelhead trout by sport anglers fishing UCUSMA waters averaged for the period from 1977-1986 and annually for the period 1987-1993.

Areas	1993	1992	1991	1990	1989	1988	1987	1986-1977
Gulkana River Drainage	0[a]	8[a]	0[a]	34	47	18	104	23
Tazlina Drainage	0	0	0	0	0	0	0	
Copper River			0	0	0	0	0	
Upstream of Gulkana	0	0						
Downstream of Klutina	0	0	0	0	0	0	0	
Other Sites	0	0	114	0	37	0	30	62[b]
Total	**0**	**8**	**114**	**34**	**84**	**18**	**134**	**85**[c]

Data from: Mills (1979-1994)

[a] In 1991, the river was closed to the harvest of steelhead.

[b] Includes 1983-1986 average harvest only. Prior to 1983, harvest included in other sites.

[c] Harvest estimates for years 1977-1982 include harvest estimates from all drainages except Gulkana.

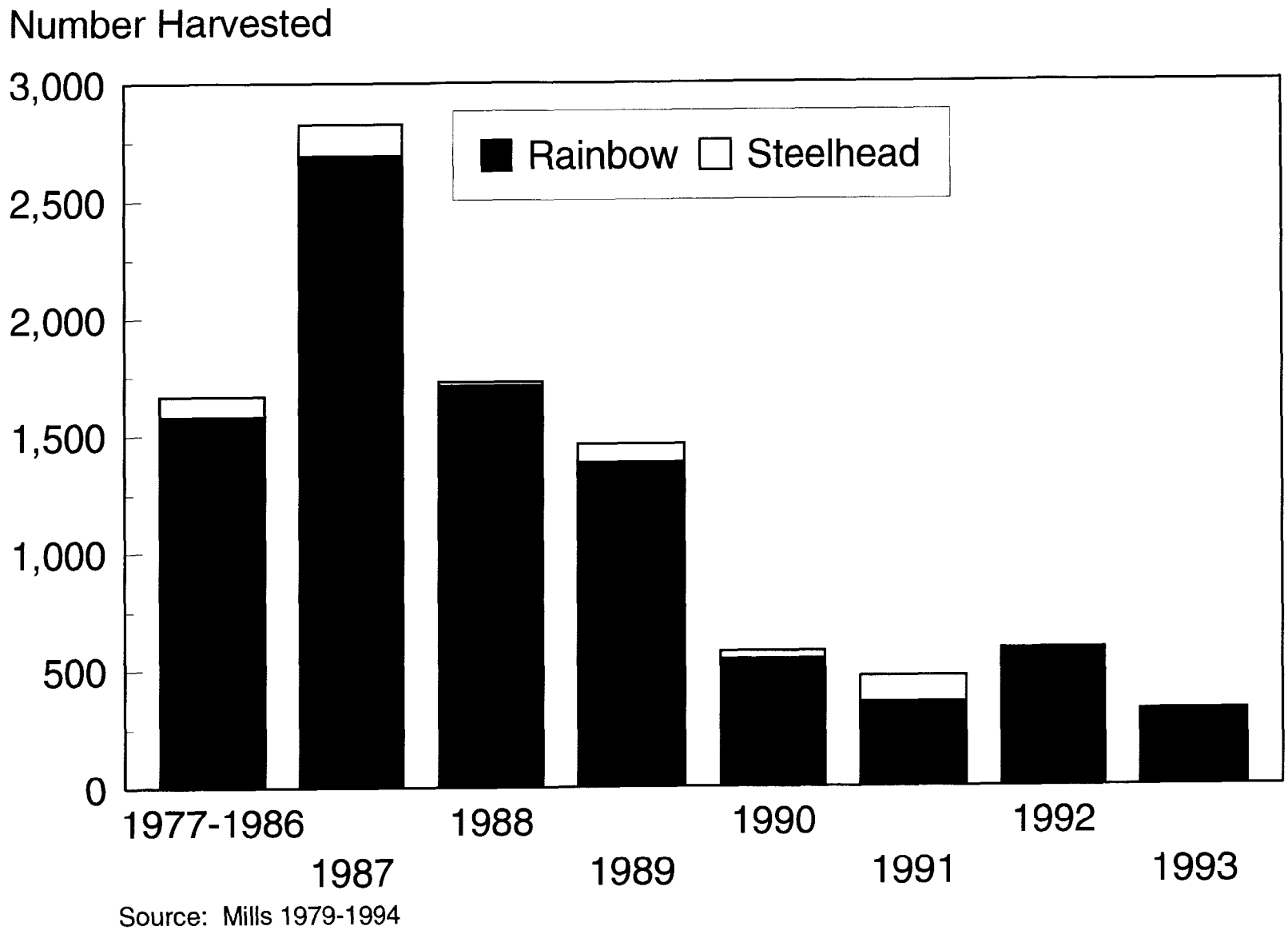


Figure 23.-Harvest of wild rainbow/steelhead trout by recreational anglers fishing UCUSMA waters, 1977-1993.

COPPER RIVER PERSONAL USE AND SUBSISTENCE SALMON FISHERIES

Background and Historical Perspective

There is a long history of salmon harvest for consumption as food or use as bait in the Copper River drainage. Prior to white settlement, Ahtna natives took salmon, mostly chinook and sockeye, with funnel traps and spears in clearwater tributaries. Weirs, gillnets, and dip nets were used in the turbid mainstem Copper River and at its delta. Haley Creek was one of the many traditional fishing camps along the Copper River. With white settlement, fish wheels were introduced to the Copper River. By 1920, fish wheels and dip nets took over as the traditional means of capturing salmon for personal needs in this river. Also, the popularity of the fishery increased substantially with the introduction of this gear.

Historically, the taking of salmon for consumption as food or use as bait in the Copper River drainage was governed under subsistence regulations. In 1978, Alaska passed its first subsistence law. This legislation guaranteed the "customary and traditional use" of fish and game harvest in Alaska and gave this harvest a priority in terms of allocation. Under this law, the Board of Fisheries adopted the *Copper River Subsistence Salmon Management Plan* (5 AAC 01.647). This management plan established seasons, open areas, legal gears, permit requirements, and bag limits for a subsistence salmon fishery in the Copper River. The plan also directed the department to manage the Copper River commercial salmon fishery to assure that an adequate escapement reaches the spawning areas and to provide for subsistence harvest.

In 1980, with the passage of the Alaska National Interest Lands Conservation Act (ANILCA), the federal government mandated a subsistence hunting and fishing preference for "rural" residents on federal lands. Subsequent rulings by the federal government stated that if the state failed to meet this requirement, the federal government would take over management of fish and game on all federal lands. To comply with this requirement and prevent federal takeover, the joint Boards of Fish and Game adopted a regulation in 1982 stating that only "rural" residents had "customary and traditional use" of fish and game and established eight criteria for identifying "customary and traditional uses." Under this plan, subsistence fishers were given one of four classes of permits depending upon their locality to the fishery, income, age, and past use. At times of low escapement, Copper River basin residents received priority over nonbasin residents. Due to growth in the fishery, the Board eliminated nonbasin residents from the Copper River subsistence fishery based on an analyses of the eight-point criteria in 1984.

This decision precluded many individuals from participating in the Copper River subsistence fisheries, thereby efficiently precluding them from harvesting fish for their personal use. This lead to the Board of Fisheries to establish a new category of fisheries, personal use fisheries (5 AAC 77.001), in 1982. These fisheries were created to provide Alaskans who became ineligible to harvest fish under new subsistence regulations the opportunity to harvest fish for consumption as food or use as bait. Personal use fisheries, like commercial and sport fisheries, were not given a "priority" in terms of allocation as were subsistence fisheries. In 1984 the Board of Fisheries created a personal use salmon fishery in the Copper River drainage under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590).

Personal use fisheries differ from sport fisheries in both their objective and management. Both fisheries provide Alaskans the opportunity to harvest fish for personal consumption (in either fishery, fish cannot be sold or bartered); however, personal use fisheries are managed to

maximize harvest potential whereby sport fisheries are managed to provide diversity of opportunity and to maximize economic benefit to Alaska. Also, whereas anyone can participate in Alaska's sport fisheries (provided they have a license), only Alaska *residents* may participate in personal use fisheries. The personal use fishery is managed by the Division of Sport Fish whereby the subsistence fishery is managed by the Division of Commercial Fisheries.

Both the subsistence and personal use salmon fisheries in the Copper River drainage have undergone changes since their establishment. Currently, all Alaskans are eligible to participate in the subsistence fishery based on the McDowell decision in 1989. The subsistence fishery occurs upstream of the Chitina-McCarthy bridge to Slana and can be prosecuted with fish wheels and dip nets. The season is from June 1 through September 30, unless closed by emergency order. Only Alaska residents can participate in this subsistence fishery. A special permit, which is free, is required to participate in the fishery. The permit can only be obtained at the Fish and Game office in Glennallen. Anglers must record their harvest on their permit and return the permit upon completing fishing. The limits are 30 salmon for a household of one, 60 salmon for a household of two, and 10 salmon for each additional person in a household of more than two people. Individuals may request additional salmon up to a maximum of 200 salmon and households may request up to 500 salmon. For people using dip nets, only 5 of the salmon may be chinook salmon. There is also a requirement that all anglers, upon landing a salmon while subsistence fishing, must immediately remove its caudal fin. A subsistence fishery is also allowed in a portion of Tanada Creek with spears and dip nets.

As is the case for the subsistence fishery, only Alaska residents can currently participate in the Copper River personal use salmon fishery. This fishery is opened by emergency order. Both a valid Alaska sport fishing license and a special permit are required to participate in the personal use fishery. The permit costs $10 and can only be obtained at the department trailer at Chitina. Anglers must record their harvest on their permit and return the permit upon completing fishing. The limits are 15 salmon for a single person and 30 salmon for a household of two or more, only 5 of which may be chinook salmon. Only dip nets may be used to harvest salmon. The entire mainstem Copper River between the downstream edge of the Chitina-McCarthy bridge and a department marker located about 200 yards upstream of Haley Creek (in Wood Canyon) is open to personal use fishing. The Board has mandated that Alaskans can participate in either the subsistence or personal use fishery in the Copper River drainage, but not both.

For a total return of 516,000 salmon past the Miles Lake sonar counter, the Board of Fisheries has authorized the following allocations and guidelines (in 5 AAC 77.590):

spawning escapement (sockeye)	300,000
spawning escapement (chinook)	15,000
subsistence harvest guideline	35,000
personal use harvest quota	60,000
sport fishery harvest guideline(sockeye)	3,500
sport fishery harvest guideline(chinook)	2,500
hatchery brood stock	20,000
hatchery surplus	80,000

Thus, the maximum harvest for the personal use and subsistence fisheries are 60,000 and 35,000 salmon, respectively, given a total return of 516,000 salmon, not including any salmon harvested after August 31. When an escapement of more than 516,000 salmon is projected to pass the sonar counter, the Board has mandated that 25% of the excess be allocated to the personal use fishery with the remainder being added to the spawning escapement, other user groups, and hatchery brood stock.

To spread effort and harvest over the return, the Board has also stipulated that the department shall manage the personal use fishery so as to apportion the harvest as follows:

Week	Percent of Total Harvest
1	10
2	20
3	25
4	20
5	15

The remaining 10% of the harvest may be taken during the rest of the season. When establishing these harvest quotas, the Board tried to reduce the harvest of wild stocks during the early portion of the run and increase harvest of hatchery-supported returns during the later part of the run.

Harvests by the subsistence fishery have been estimated since 1965 (Table 22). From 1965 through 1979, harvests in the subsistence fisheries remained relatively stable, averaging about 28,000 salmon (Figure 24). The fishery experienced rapid growth from 1980 through 1983, when a peak harvest of about 119,000 salmon was taken (Table 22, Figure 24). Under the subsistence fishery management plan, harvests decreased substantially in 1984 to about 28,000 salmon. Since 1984, subsistence harvests have gradually increased (Figure 24). Concern has been expressed regarding significant under-reporting of salmon harvest in this fishery, especially over the past decade. Trends in the number of permits issued to participate in this fishery closely resemble harvest trends (Table 22, Figure 24).

Harvests in the personal use fisheries have been estimated since their establishment in 1984 (Table 23). From 1984 through 1988, harvests remained relatively stable, averaging about 47,000 salmon annually (Figure 25). Since 1988, harvests in the personal use fishery have increased annually (Figure 25). Trends in the number of permits issued to participate in this fishery closely resemble harvest trends (Table 23, Figure 25).

Harvests in both the subsistence and personal use fisheries are dominated by sockeye salmon (Table 6). Sockeye salmon have comprised an average of 96.7% and 93.8% of the subsistence and personal use salmon harvests, respectively, since 1984. Chinook salmon comprise the second largest harvest, accounting for an average of 2.7% and 4.4% of the subsistence and personal use salmon harvests, respectively, over this period. The remaining harvest is made up of coho salmon.

Table 22.-Number of permits issued and salmon harvested during the subsistence salmon fishery in the Copper River, 1965-1994.

Year	Number Permits Issued	Estimated Salmon Harvest
1965	1,125	16,818
1966	1,270	21,896
1967	1,320	19,007
1968	1,378	20,383
1969	1,582	29,266
1970	3,487	42,757
1971	4,542	48,449
1972	3,690	32,468
1973	4,145	29,248
1974	3,593	26,001
1975	2,802	15,357
1976	2,963	23,623
1977	4,066	41,815
1978	3,705	22,029
1979	3,200	30,963
1980	3,203	35,081
1981	4,078	68,746
1982	6,090	110,006
1983	7,541	118,728
1984	562	28,617
1985	[a]	[a]
1986	405	28,417
1987	431	34,080
1988	409	30,313
1989	386	29,225
1990	406	32,283
1991	711	40,070
1992	655	46,395
1993	773	54,370
1994	970	69,598

[a] Data not available.

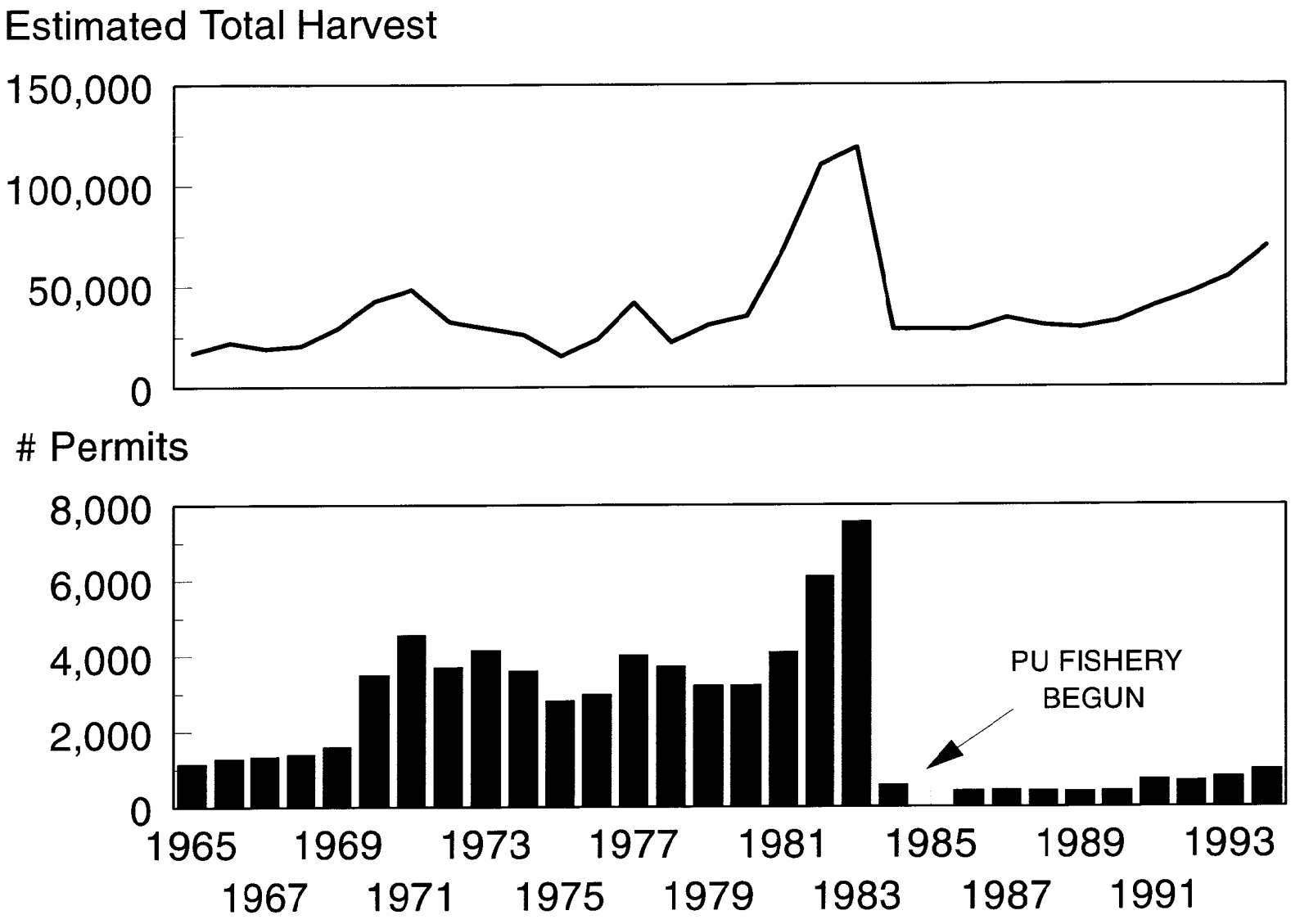


Figure 24.-Annual harvest of salmon, and number of permits issued in the Copper River subsistence fishery, 1965-1994.

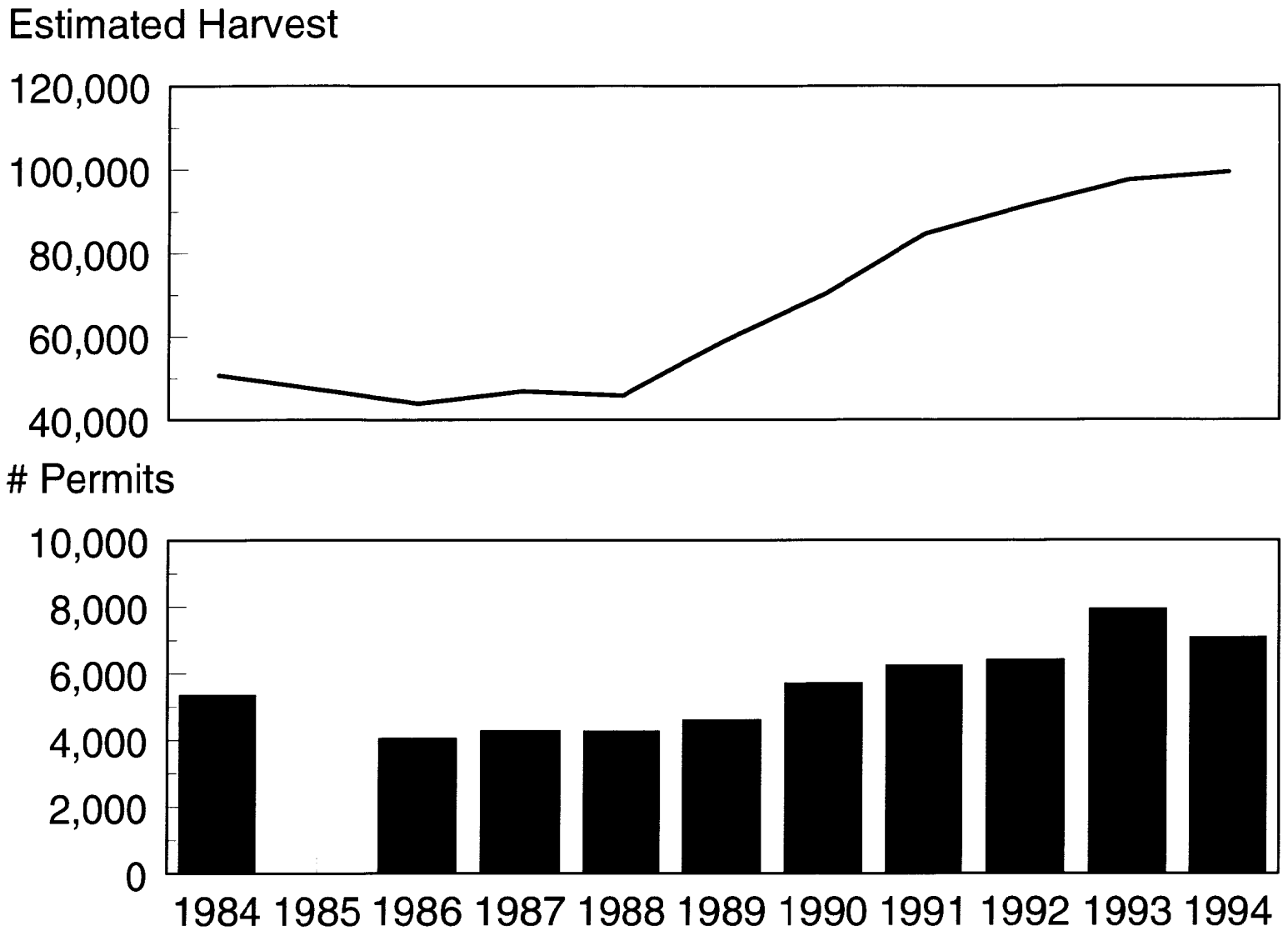


Figure 25.-Annual harvest of salmon, and number of permits issued in the Copper River personal use fishery, 1984-1994.

Table 23.-Number of permits issued and salmon harvested during the personal use salmon fishery in the Copper River, 1984-1994.

Year	Number Permits Issued	Estimated Salmon Harvest
1984	5,311	50,714
1985	[a]	[a]
1986	3,966	43,959
1987	4,186	46,884
1988	4,205	45,895
1989	4,447	58,858
1990	5,631	70,317
1991	6,222	84,622
1992	6,387	91,400
1993	7,914	97,500
1994	7,061[b]	99,430

[a] Data not available.

Fishery Objective

Both fisheries are managed under Board of Fisheries adopted management plans. The subsistence fishery is managed under the *Copper River Subsistence Salmon Management Plan* (5 AAC 01.647). The personal use fishery is managed under the *Copper River Personal Use Salmon Fishery Management Plan* (5 AAC 77.590). Both management plans stipulate management objectives and guidelines.

Inseason Management Approach

The inseason management of the personal use fishery follows the objectives and guidelines in *the Copper River Personal Use Salmon Management Plan* (5 AAC 77.590). The Board established weekly harvest quotas and also allocated 25% of any escapement in excess of the optimum escapement goal of 516,000 to the personal use fishery. The weekly fishing periods and limits are established by emergency order based on the projected inriver returns. Inriver returns are estimated by the sonar unit located at Miles Lake.

Recent Board of Fisheries Actions

Several proposals were submitted by members of the public regarding the personal use and subsistence fisheries at the 1994 Board of Fisheries meeting. It was proposed that the Board designate a working group to rewrite the personal use and subsistence fishery management plans. The board followed the department's recommendation that a review of the existing data and management strategies be conducted and presented at local advisory committee meetings to form the basis for department and public proposals for the 1997 board meeting. A proposal to increase the personal use allocation from 60,000 to 100,000 was rejected pending the department review. A proposed change in the mark of subsistence harvested salmon from removal of the dorsal fin to the caudal fin passed. It was felt this would ease in recognition of subsistence harvested salmon for enforcement purposes. A recommendation to require the release of chinook salmon taken in the personal use fishery also failed.

Recent Fishery Performance

The number of permits issued to participate in and salmon harvests in both the subsistence and personal use fisheries have increased in recent years. The 1994 harvest of 69,598 salmon in the subsistence fishery was the highest on record since the fishery has been managed under the subsistence fishery management plan (Table 22, Figure 24). The 1994 harvest of 99,430 salmon in the personal use fishery was the highest on record since the establishment of this fishery (Table 23, Figure 25). Although the number of personal use permits issued declined from the amount issued in 1993, the number of subsistence permits increased, possibly due to dipnetters switching from one fishery to the other to avoid the personal use fishery closures. There is no indication that would suggest that the popularity of either fishery will decrease in the near future; this participation and harvest are expected to increase.

Current Issues

Salmon harvests in the personal use fishery exceeded Board-allowed allocations during both the 1991 and 1992 seasons (Figure 26). The 1991 harvest exceeded the allowable harvest by about 8,800 salmon whereas the 1992 harvest exceeded the allowable harvest by about 9,900 salmon (Table 24). Expressed in terms of percent variation from the allowed harvest, this corresponds to a 12% overharvest during both 1991 and 1992. Given that there is no indication that the

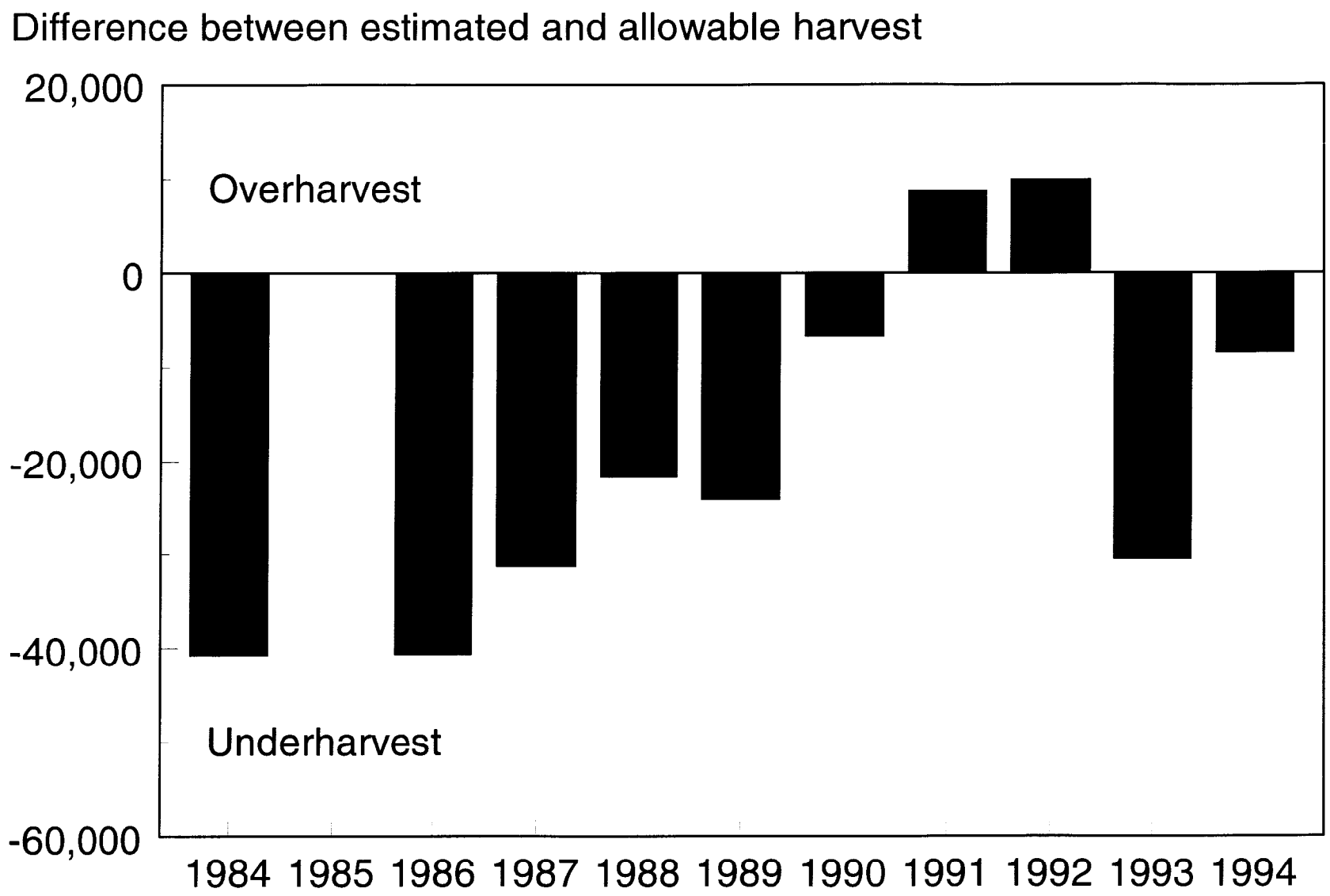


Figure 26.-Difference between estimated and allowable harvests during the Copper River personal use salmon fishery, 1984-1994.

Table 24.-Allowable versus observed salmon harvests during the personal use salmon fishery in the Copper River, 1984-1994.

Year	Sonar Goal	Estimated Sonar	Difference	Allowable Harvest[a]	Estimated Harvest	Difference[b]
1984	411,000	536,806	125,806	91,452	50,714	-40,738
1985	411,000	436,313	25,313	66,328	[c]	[c]
1986	411,000	509,275	98,275	84,959	43,959	-41,000
1987	411,000	483,478	72,478	78,120	46,886	-31,234
1988	411,000	488,398	77,341	79,335	45,895	-33,440
1989	411,000	607,797	196,797	109,199	58,858	-50,341
1990	516,000	581,859	65,859	76,465	70,317	-6,148
1991	516,000	579,435	63,435	75,859	84,622	8,763
1992	516,000	601,952	85,952	81,488	91,400	9,912
1993	516,000	797,902	271,902	127,976	97,500	-30,476
1994	516,000	715,181	191,481	107,870	99,430	-8,440

[a] If sonar difference less than 0, then guideline harvest equals 60,000.

[b] If sonar difference greater than 0, then guideline harvest equals 60,000 + (0.25 X sonar difference).

[c] Data not available.

popularity of the personal use fishery will decrease in the near future, it can be expected that harvest pressure will continue to increase into the future unless the allocation for this fishery is increased or actions are taken to curtail harvests. Subsistence salmon harvests exceeded harvest guidelines in 1992 and 1994 (Table 25, Figure 27).

The overharvest in the personal use fishery during 1991 and 1992 was apparently caused by overharvest during the later part of the season (Table 26). In both years harvests during the early part of the run were lower than allowed while harvests during the later part of the run exceeded allowable harvests (Figure 28). This was especially evident during the period after the fifth week of the fishery. Under the *Copper River Personal Use Salmon Fishery Management Plan,* 10% of the harvest may be taken during this period. During both years, however, harvests well exceeded this quota; by 500% in 1991 and by 425% in 1992. Managers used cautious incremental openings during the early portion of the run, to protect the wild stocks that comprise the early run of sockeye. Fishing opportunity, given to increase harvest during the later part of the season to replace that lost during the early portion of the run, shifted too much fishing pressure later in the season.

At their 1994 meeting, the Board of Fisheries gave the department leeway in regulating the personal use fishery openings in order to better mimic the run-timing of the wild and hatchery salmon runs while staying within the seasonal harvest quota. During 1994, fishery openings were liberalized early, and restricted during the fifth through the seventh week of the fishery. This resulted in fish being taken in excess of the weekly quota during the fifth week of the fishery (Table 24, Figure 28), but prevented the fishery from exceeding the overall harvest quota for the season.

Another issue regarding this fishery relates to access. Much of the land in the area open to subsistence and personal use fishing is privately owned. In 1985 and 1986, the Chitina Native Corporation blocked the road to O'Brien Creek and charged a fee for access. In 1987 the State of Alaska negotiated a $15,000 contract with the Chitina Native Corporation for access and to build and maintain outhouses and to collect and remove garbage. The contract was renewed in 1988. The legislature refused to appropriate funds for access in 1989 after road work done on the road in the fall of 1988 eliminated areas where the road passed on private land. In response, the Chitina Native Corporation refused dipnetters access to O'Brien Creek during the 1989 season. The legislature again appropriated funds for access to O'Brien Creek in 1991. Also, in 1991, at the urging of the Chitina Dipnetter's Association, the legislature instituted a $10 fee for the personal use fishery. The fee was to be used to develop a long-term lease. During 1994, a 5-year lease was negotiated with the Chitina Corporation. Trespass on lands not included in the lease agreement remains an issue.

Recommended Research and Management

At present, the Division of Sport Fish conducts a program to issue permits, monitor the fishery, and estimate harvests during the Copper River personal use salmon fishery.

Continued refinement of the criteria for opening and closing the fishery is needed. The relationship between the sonar count and fish passage rate through the personal use fishing area is poorly understood. Time series analysis of the factors affecting fish passage is necessary.

Table 25.-Guideline versus observed salmon harvests during the subsistence salmon fishery in the Copper River, 1984-1994.

Year	Sonar Goal	Estimated Sonar	Difference	Guideline Harvest[a]	Estimated Harvest	Difference
1984	411,000	536,806	125,806	33,839	28,617	-5,222
1985	411,000	436,313	25,313	22,784	[b]	8,804
1986	411,000	508,600	98,275	30,810	28,417	-2,393
1987	411,000	475,734	72,478	27,973	34,080	6,108
1988	411,000	488,398	77,341	28,508	30,313	1,806
1989	411,000	607,869	196,797	41,648	29,225	-12,423
1990	516,000	581,859	65,859	27,244	32,283	5,039
1991	516,000	579,435	63,435	41,978	40,070	-1,908
1992	516,000	601,952	85,952	44,455	46,395	1,940
1993	516,000	797,902	271,902	64,909	54,370	-10,539
1994	516,000	715,181	191,481	56,063	69,598	13,535

[a] If sonar difference less than 0, then guideline harvest equals 20,000 (from 1984-1990) or 35,000 (from 1991-present). If sonar difference greater than 0, then guideline harvest equals 20,000 (from 1984-1990) or 35,000 (from 1991-present) + (0.11 X sonar difference).

[b] Data not available.

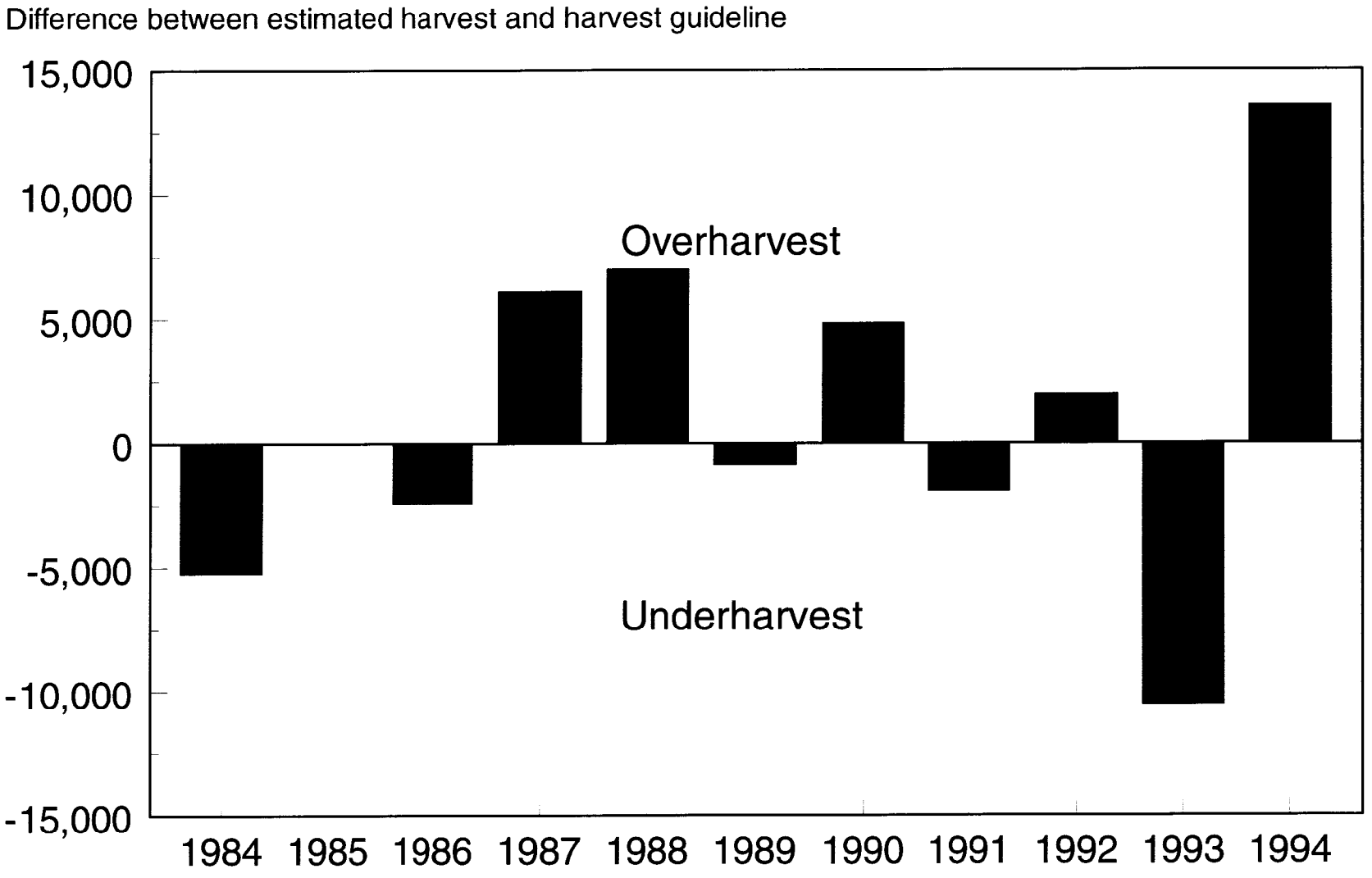


Figure 27.-Difference between estimated and allowable harvests during the Copper River subsistence salmon fishery, 1984-1994.

Table 26.-Allowable versus observed salmon harvests, by week, during the personal use salmon fishery in the Copper River, 1991-1994.

	Week	Allowed Harvest	Observed Harvest	Difference
1991	1	6,000	1,837	-4,163
	2	12,000	9,476	-2,524
	3	15,000	10,053	-4,947
	4	12,000	5,417	-6,583
	5	9,000	6,487	-2,513
	Rest	21,859[a]	45,591	23,732
1992	1	6,000	3,169	-2,831
	2	12,000	4,613	-7,387
	3	15,000	10,136	-4,864
	4	12,000	16,960	4,960
	5	9,000	8,810	-190
	Rest	27,488[a]	45,396	17,908
1993	1	6,000	6,879	879
	2	12,000	12,243	243
	3	15,000	12,913	-2,087
	4	12,000	12,735	735
	5	9,000	8,089	-911
	Rest	73,976[a]	39,438	-34,538
1994	1	6,000	6,424	424
	2	12,000	7,947	-4,053
	3	15,000	6,709	-8,291
	4	12,000	14,573	2,573
	5	9,000	18,979	9,979
	Rest	53,870[a]	38,742	-15,128

[a] 10% of the 60,000 salmon harvest quota, plus 25% of the escapement past the sonar counter that exceeds 516,000 salmon.

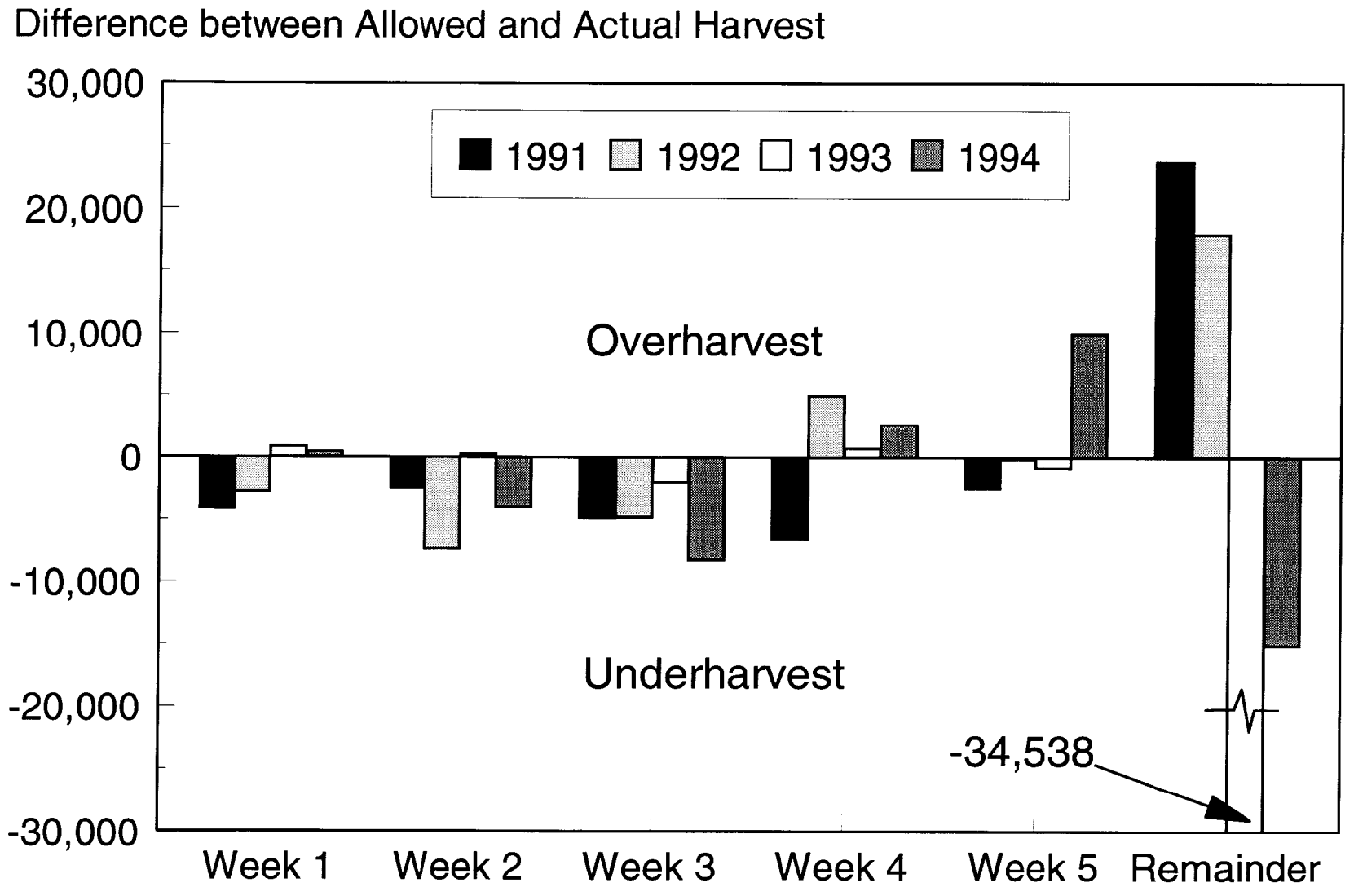


Figure 28.-Difference between estimated versus allowable harvests, by week, during the Copper River personal use salmon fishery, 1991-1994 .

During 1995, the proportion and timing of sockeye salmon produced by the Gulkana Hatchery will be estimated from coded wire tag (CWT) recoveries in the personal use fishery. This will allow managers to better exploit hatchery stocks while protecting wild fish.

Stocked Fisheries

The sport fish stocking program in the UCUSMA dates to 1965. At present 37 lakes in the UCUSMA are stocked (Table 27). Stocked species include rainbow trout, grayling and coho salmon. Stocked lakes have accounted for between 2,100 and 6,600 angler-days of effort spent in the UCUSMA. A hatchery on the Gulkana River currently enhances the sockeye salmon stocks of that drainage, primarily for the benefit of the commercial fishery which occurs in the Copper River delta. The hatchery contribution to the commercial, personal use, subsistence and sport fisheries was estimated to be 107,368 sockeye salmon in 1984 (John Wilcock, ADF&G Commercial Fisheries Management and Development Division, Cordova, personal communication).

Table 27.-Number and species of fish stocked (actual and planned) in UCUSMA waters, 1991-1995.

Species/Life Stage/Site	1991 (Actual)	1992 (Actual)	1993 (Actual)	1994 (Actual)	1995 (Planned)
Anadromous Chinook Salmon Fry					
Gulkana Drainage	26,209	65,245	0	0	0
Total	**26,209**	**65,245**	**0**	**0**	**0**
Anadromous Sockeye Salmon Fry					
Gulkana Drainage	22,868,313	27,079,618	13,627,595	27,812,516	28,425,000
Total	22,868,313	27,079,618	13,627,595	27,812,516	28,425,000
Landlocked Coho Salmon Fingerling					
Strelna Lake	0	59,000	0	17,812	0
Peanut Lake	3,861	0	2,000	0	0
South Jan Lk	20,000	0	20,400	13,000	1,500
Kettle Lake	2,970	0	3,500	0	Dropped
Total	**26,831**	**59,000**	**25,900**	**30,812**	**1,500**
Landlocked Chinook Salmon Catchables					
Meiers Lake	0	0	0	0	0
Tolsona Lake	0	24,000	25,061	0	0
Total	**0**	**24,000**	**25,061**	**0**	**0**

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Table 27.-Page 2 of 4.

Species/Life Stage/Site	1991 (Actual)	1992 (Actual)	1993 (Actual)	1994 (Actual)	1995 (Planned)
Landlocked Rainbow Trout Catchables					
Squirrel Crk Lk	600	500	486	516	500
Buffalo Lake	500	526	400	500	500
Mirror Lake	500	543	415	500	500
Round Lake	250	500	400	250	250
Old Road Lake	250	250	400	250	250
Tex Smith Lake	0	0	0	388	500
Total	**2,100**	**2,319**	**2,101**	**2,404**	**2,500**
Rainbow Trout Fingerling					
Sculpin Lake	28,000	30,341	28,000	19,000	28,000
Mirror Lake	9,000	9,000	9,000	9,000	9,000
Buffalo Lake	800	800	800	800	800
Tolsona Lake	30,000	30,067	0	0	0
Tex Smith Lake	0	34,000	0	1,607	0
Squirrel Crk Lk	0	1,000	0	2,000	0
Crater Lake	0	3,400	0	1,600	0
Blueberry Lake	0	2,000	0	2,000	0
Three Mile Lake	0	4,000	0	4,000	0
Van Lake		0		80,036	0
Two Mile Lake	3,400	0	3,400	3,400	0
14 Mile Lk (Den)	0	10,000	0	7,027	0
Kettle Lake	0	1,200	0	0	0

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Table 27.-Page 3 of 4.

Species/Life Stage/Site	1991 (Actual)	1992 (Actual)	1993 (Actual)	1994 (Actual)	1995 (Planned)
Rainbow Trout Fingerling (continued)					
D-J Lake	0	0	0	400	0
Little Crater Lk	0	400	0	400	0
North Jan Lake	0	10,000	0	11,600	0
Old Road Lake	0	350	0	300	0
Round Lake	0	450	0	200	0
Gergie Lake	0	9,000	0	8,925	0
Tiny Lake	500	0	500	0	500
Worthington Lake	8,014	0	8,000	4,000	8,000
Peanut Lake	2,400	0	2,400	2,400	2,400
Tolsona Mt. Lake	15,000	0	15,000	0	15,000
South Jan Lake	20,000	0	20,000	0	20,000
Meiers Lake	0	0	0	0	20,000
Total	**117,114**	**115,408**	**87,100**	**158,695**	**103,700**
Arctic Grayling Fingerling					
Moose Lake	33,500	0	0	0	0
Tolsona Lake	10,000	10,000	10,000	0	0
Caribou Lake	5,000	8,000	0	8,000	
Moose Crk(Taz)	0	5,000	0	5,000	5,000
Total	**48,500**	**23,000**	**10,000**	**13,000**	**5,000**

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Table 27.-Page 4 of 4.

Species/Life Stage/Site	1991 (Actual)	1992 (Actual)	1993 (Actual)	1994 (Actual)	1995 (Planned)
Arctic Grayling Fry					
Tolsona Lake	80,000	80,000	80,000	80,000	0
Moose Crk (Taz)	50,000	50,000	50,000	50,000	50,000
Two Mile Lake	0	5,000	0	5,000	0
Three Mile Lake	0	8,000	0	8,000	0
Thompson Lake	10,000	0	10,000	0	10,000
Junction Lake	3,500	0	3,500	0	3,000
Squirrel Crk Pit	5,000	0	5,000	0	5,000
Lower Twin Lake	0	90,000	0	0	0
Lit Junction Lake	0	5,000	0	5,000	0
Arizona Lake	0	10,000	0	10,000	0
Connor Lake	0	15,000	0	15,000	0
Dick Lake	0	10,000	0	10,000	0
Elbow Lake	0	5,000	0	5,000	0
Bearcub Lake	0	10,000	0	10,000	0
Meirs Lake	0	40,000	0	40,000	0
Forgotten Lake	0	10,000	0	10,000	0
Caribou Lake	0	8,000	0	8,000	0
Total	**148,500**	**346,000**	**148,500**	**256,000**	**68,000**

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