Fishery Management Report No. 97-4

Monitoring the Sport Fisheries of the Aniak River, Alaska, 1996

by

Dan O. Dunaway

December 1997

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. 97-4

MONITORING THE SPORT FISHERIES OF THE ANIAK RIVER, ALASKA, 1996

by
Dan O. Dunaway
Division of Sport Fish, Dillingham

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

December 1997

This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-12, Job No. S-2-2.

The Fishery Management Reports series was established in 1989 for the publication of an overview of Division of Sport Fish management activities and goals in a specific geographic area. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. 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 regional peer review.

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

This document should be cited as:
Dunaway, Dan O. 1997. Monitoring the sport fisheries of the Aniak River, Alaska, 1996. Alaska Department of Fish and Game, Fishery Management Report No. 97-4, Anchorage.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

ABSTRACT

A study of recreational fisheries was conducted on the Aniak and Kuskokwim rivers near the town of Aniak, Alaska from 3 July to 5 August 1996. Roving survey techniques were used but the study was exploratory and not designed to generate unbiased estimates. A total of 240 angler interviews were conducted to obtain effort, catch, harvest and demographic information. Anglers fished an average 3.8 hours per angler per day (SE = 0.1). The total reported catch (fish kept + fish released) was 277 chinook salmon *Oncorhynchus tshawytscha*, 310 chum salmon *O. keta*, 461 Dolly Varden *Salvelinus malma*, 193 rainbow trout *O. mykiss*, 178 Arctic grayling *Thymallus arcticus*, and 57 coho salmon *O. kisutch*. Anglers reported harvesting 65 chinook salmon and 23 coho salmon but few fish of other species. Over 70% of the anglers were guided, nonresident men who used spinning gear. Guides and lodge operators indicated they expected to provide about 3,059 angler-days of effort in 1996. The sport fishery on the Aniak River did not appear to be a threat to salmon or resident species populations. Many people seemed to support additional restrictions on the sport harvest of resident species. The sport fishery did not appear to conflict with the subsistence fisheries.

Length, weight and scale samples were collected from 16 sport harvested chinook salmon and 12 coho salmon. Biological data were collected from 41 rainbow trout, 72 Dolly Varden, and 47 Arctic grayling caught with hook-and-line gear. Hoop traps were used to collect 24 rainbow trout and 36 Dolly Varden.

One day was spent sampling 13 Dolly Varden and 11 Arctic grayling from the lower Holokuk River.

Key words: Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, chum salmon *Oncorhynchus keta*, rainbow trout *Oncorhynchus mykiss*, Arctic char *Salvelinus alpinus*, Dolly Varden *Salvelinus malma*, Arctic grayling *Thymallus arcticus*, sport fishing, creel survey, angler success, bag limit, gear type, Aniak River, Kuskokwim River, southwest Alaska.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) has used fishery surveys extensively throughout southwest Alaska to estimate sport angler effort, catch, and harvest for over 20 years. Fiscal constraints dictate that surveys be directed at the larger fisheries of the area or the fisheries with pressing fishery management concerns on a rotational basis. Periodically, the department undertakes studies of growing or rapidly changing sport fisheries to acquire basic fishery information and to assess the potential for management problems. In 1996, an exploratory fishery study was conducted on the growing recreational salmon fisheries in the Aniak River as part of an ADF&G commitment to become more active in the sport fisheries of the lower Kuskokwim River drainage. The department refers to this area as the northwestern section of the Southwestern Alaska Management Area (SWAMA) (Figure 1).

Investigations of northwestern section sport fisheries are to be conducted in three phases. Phase one, conducted in 1996, was exploratory in nature: to collect and organize the current information on the fisheries, and to assess the need for more intensive studies of the fisheries and fish populations through onsite investigations. The Aniak River was the focus for the 1996 work. In subsequent years, the second phase will be to intensively study the high priority issues and locations identified during the first phase of work. The third phase will be to develop management strategies and monitoring programs for the significant recreational fisheries in the area.

BACKGROUND

The SWAMA supports several important salmon sport fisheries, notably in the Alagnak, Kanektok, Kvichak, Goodnews, Mulchatna, Naknek, Nushagak, and Togiak rivers. The

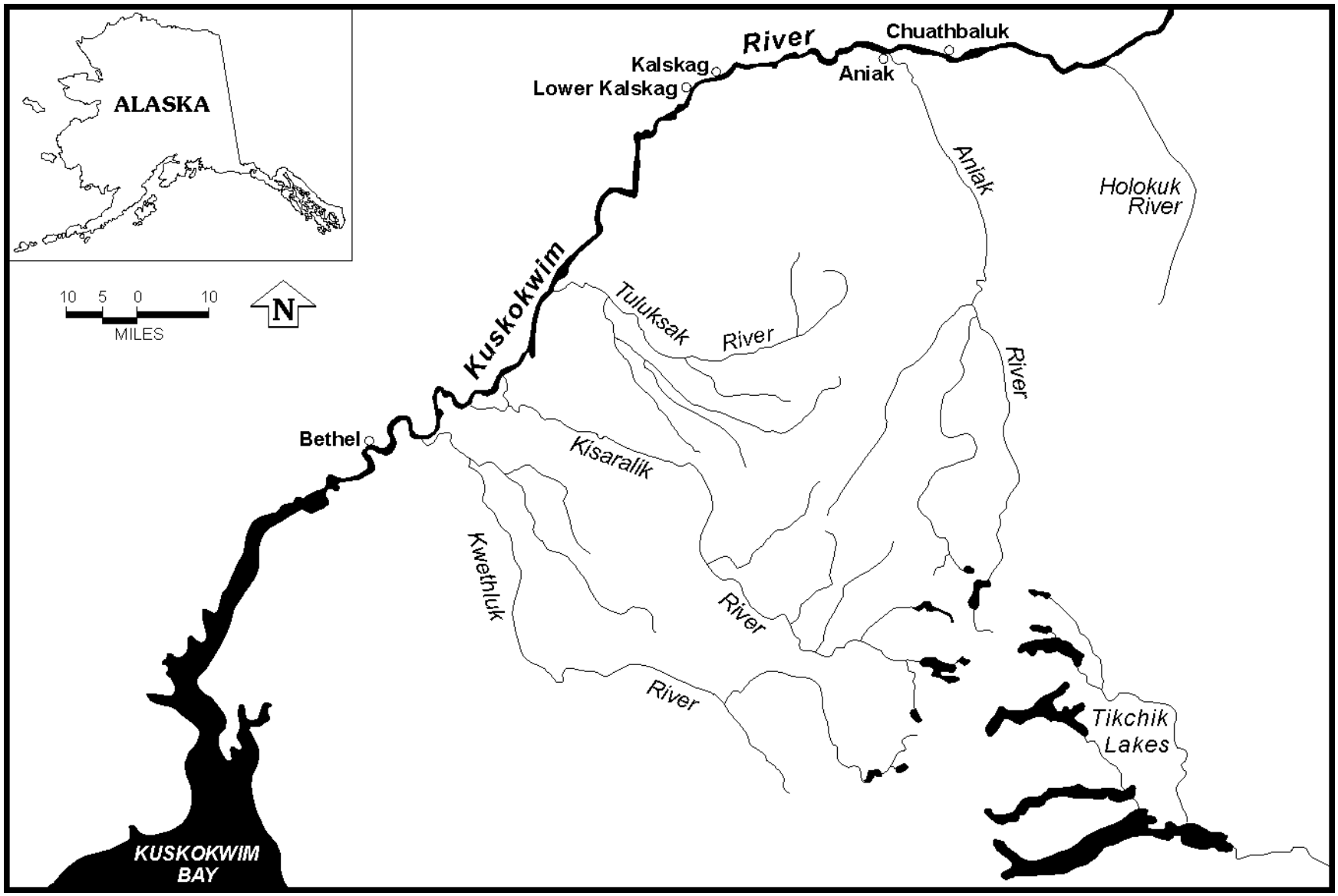

Figure 1.-The northwestern section of the Southwest Alaska Management Area.

northwestern section of SWAMA includes all tributaries entering the Kuskokwim River from the Aniak River to the Kuskokwim Bay. In the last 2 years anglers and recreationalists have shown a growing interest in the lesser known salmon streams of the northwestern section, particularly the Aniak, Kisaralik and Kwethluk rivers. Overall, the northwestern section of SWAMA accounts for about 5% of the annual effort estimated in the area, 2%-5% of the chinook salmon *Oncorhynchus tshawytscha* sport harvest, 6%-12% of the coho salmon *O. kisutch* harvest and less than 4% of the rainbow trout *O. mykiss* harvest (Minard and Dunaway 1995). The Aniak River has the longest history of significantly active sport fisheries in the northwestern section. The Statewide Sport Fish Harvest Surveys (SWHS) (Mills 1984-1994, and Howe et al. 1995 and 1996) provide some estimates of effort and harvest since 1983 (Table 1). Other information on the Aniak River fisheries includes a 10-day rainbow trout, Dolly Varden *Salvelinus malma* and Arctic grayling *Thymallus arcticus* sampling project conducted by the department in late July and early August of 1993 (Dunaway *Unpublished*). The Commercial Fisheries Management and Development Division (CFMD) has operated a sonar salmon counter on the river since 1980, and has conducted aerial surveys of spawning salmon since 1960 (Francisco et al. 1995). Information on the subsistence fisheries is limited to estimates of harvest of salmon by the community of Aniak (Francisco et al. 1995). The subsistence salmon harvest generally occurs in the Kuskokwim River and not necessarily on the Aniak River salmon stocks alone.

Table 1.-Historic estimates of sport fishing effort and harvests on the Aniak River, 1983-1995.

	Effort	Salmon			Rainbow		Arctic
Year	Angler-days[a]	Chinook	Coho	Chum	Trout	Dolly Varden	grayling
1983[b]	253	0	42	115	336	105	63
1984[b]	383	39	0	26	52	91	234
1985[b]	87	12	12	75	0	69	35
1986[b]	1,116	49	905	98	221	245	318
1987[b]	507	49	254	70	56	56	111
1988[b]	2,437	164	618	91	18	764	273
1989	4,035	738	939	1140	101	808	909
1990	1,964	285	182	159	35	598	422
1991	3,078	214	327	169	76	547	1085
1992	2,604	172	235	304	32	115	121
1993	2,056	300	213	101	10	260	288
1994	1,815	437	507	231	8	496	116
1995	3,569	279	852	127	0	481	53
Averages							
All Years	1,839	211	391	208	73	357	310
1991 -1995	2,624	280	427	186	25	380	333

Source: M. Mills, ADF&G, Division of Sport Fish, Research and Technical Services, personal communication 1983-1988, Mills 1990-1994, Howe et al. 1995, 1996.

[a] 1 angler-day is any portion of a day in which an angler participates in a fishery.

[b] Estimates based on less than 12 responses to the Statewide Harvest Survey. Estimates based on fewer than 12 responses do not meet the criteria to be included in the Statewide Harvest Survey reports but are included here as useful fishery indicators.

The Aniak River begins at Aniak Lake in the Kilbuck Mountains and flows north about 150 kilometers (94 miles) into the Kuskokwim River at the community of Aniak. Major tributaries include the Kipchuk and Salmon rivers. During normal flows, the water is slightly blue-green from glacial silt but quickly becomes muddy with rising waters from snow melt or heavy rains. The upper 2/3 to 3/4 of the Aniak River is moderately swift and shallow with much braiding among numerous gravel bars. Spring runoff and periods of heavy rain cause frequent course changes in the river. High water events regularly deposit large numbers of trees and other plant material on gravel bars and occasionally block or even dam large channels of the river. In the lower reaches, the river has a single deep channel that is slower and the water is less clear.

The Aniak River sustains a very large run of chum salmon *O. keta* and smaller yet important runs of the other four species of Pacific salmon *Oncorhynchus* (Tables 2 and 3, Figure 2). Populations of rainbow trout, Dolly Varden and Arctic grayling also inhabit the river. The drainage is gaining popularity with anglers as other rivers have become more heavily used. Chinook, coho, and chum salmon, rainbow trout, Dolly Varden and/or Arctic char (most likely Dolly Varden), and Arctic grayling are the most frequently sought species. Angling effort in this sport fishery averaged over 2,600 angler-days from 1991 through 1995 (Table 1), and constitutes over 40% of the sport fishing effort in the northwestern section. Annual harvests during the years 1991-1995 have averaged 280 chinook salmon, 427 coho salmon, 186 chum salmon, 380 Dolly Varden, and 333 Arctic grayling (Table 1). Since 1990, the Aniak River upstream of the outlet of the Doestock Creek has been restricted to catch-and-release angling for rainbow trout and the harvest has been very low.

Although sport harvests of all species are modest, two issues have affected the salmon fisheries in the Aniak River area since these salmon stocks contribute to commercial and subsistence fisheries. First, in 1985, management concerns for the Kuskokwim River drainage chinook salmon persuaded the Alaska Board of Fisheries (Board) to reduce sport anglers' bag limits from 15 to five fish per day and restrict the commercial fishery to gillnets with mesh less than 6 inches (ADF&G 1985**,** Francisco et al. 1987). By 1987 commercial fishing time during the chinook salmon run was reduced to further protect the salmon (Francisco et al. 1988). Beginning in 1988 the sport bag limit was reduced to one chinook salmon per day, and the commercial fishery for chinook salmon was eliminated (Francisco et al. 1989). However an incidental commercial harvest of chinook salmon continued and ranged from about 56,000 fish in 1988 to less than 9,000 fish in 1993 (Table 4) (Francisco et al. 1995). Gear and season adjustments in the commercial fishery changed the size and sex composition of the incidental commercial take to predominantly small males and by 1993 the management concerns had diminished. In November of 1994 the Board adopted a department proposal to increase the bag limit on Kuskokwim drainage chinook salmon from one fish per day to three per day (only two may exceed 28 inches in length) (ADF&G 1995). The increased harvest opportunity for chinook salmon may have attracted more effort to the Aniak River in 1995 and 1996.

The second issue affecting the Aniak River sport fisheries is the river's chum salmon population. The annual chum salmon return to the Aniak River has been as high as 1 million fish and averaged 238,236 fish from 1986 to 1996 (Table 2). This big run of chum salmon is very important to the Kuskokwim River commercial and subsistence fisheries. In 1993 the Aniak River chum salmon run was extremely low and extensive closures were made in the commercial,

Table 2.-Historic salmon escapement estimates from the Aniak River sonar project, 1980-1996.

Year	Operating Period	Species				
		Chinook[a]	Sockeye[a]	Coho[a]	Pink[a]	Chum
Escapement Objective						**250,000**
1980	6/22 - 7/30	56,469				1,169,470
	8/16 - 9/12			81,556		
1981	6/16 - 8/06	42,060				589,286
1982	6/21 - 8/01	33,864				442,461
1983	6/18 - 7/28	4,911				129,367
1984	6/16 - 7/30					266,976
1985	6/22 - 7/28					253,051
1986	6/26 - 7/24					209,080
1987	6/22 - 7/31					193,013
1988	6/22 - 7/31					401,511
1989	6/21 - 7/24					243,922
1990	6/23 - 8/06					232,260
1991	6/29 - 7/29					314,166
1992	6/22 - 7/29					84,269
1993	6/24 - 7/28					13,870
1994	6/28 - 7/28					388,163
1995[b]	6/22 - 7/23					
1996[c]	6/21 - 7/28					302,106
Average	1986-1996					238,236

Source: Francisco et al. 1995.

[a] No counts or incomplete counts; project was not operated during the species' migration.

[b] Equipment problems during the season and count was unreliable - no number used.

[c] Preliminary estimates, C. Burkey, ADF&G, Division of Commercial Fisheries Management and Development, A-Y-K, Bethel, and T. Vania, ADF&G, Division of Commercial Fisheries Management and Development, A-Y-K, Anchorage, personal communication. Note 1996 estimate was obtained with different equipment and personnel at a new site than in previous estimates. Results should be considered preliminary; revisions may occur.

Table 3.-History of aerial survey index counts of salmon in the Aniak River drainage, 1960-1996.

	Aniak River		Kipchuk River		Salmon River	
Year	Chinook	Chum	Chinook	Chum	Chinook	Chum
1960			531	70	233	
1966	2,184	5,681	491	3,132		
1967			319	3,000		
1968	1,950	98,218				2,000
1970	1,315	17,575	821	5,807	411	3,505
1975			94	905		1,620
1976			177	1,441		
1977					562	628
1978					289	
1980					1,186	14,815
1981					894	2,380
1982	2,645				185	
1983	1,909	7,591			231	992
1984	1,534					
1986	826				336	240
1987			193		516	2,090
1988	945	16,258			244	310
1989	1,880		994	230	631	130
1990	1,255	14,080	537	455	596	540
1991	1,564		885	500	583	850
1992	2,284	13,400	670	1,860	335	1,630
1993	2,687	4,295	1,248	610	1,082	1,385
1994	1,777		1,520	130	1,218	1,520
1995[a]	3,171	7,675	1,215	40	1,442	1,403
1996[a]	3,495	16,791			985	2,800

Source: Francisco et al. 1995.

[a] Survey conditions poor. Preliminary estimates from C. Burkey, ADF&G, Division of Commercial Fisheries Management and Development, A-Y-K, Bethel, personal communication.

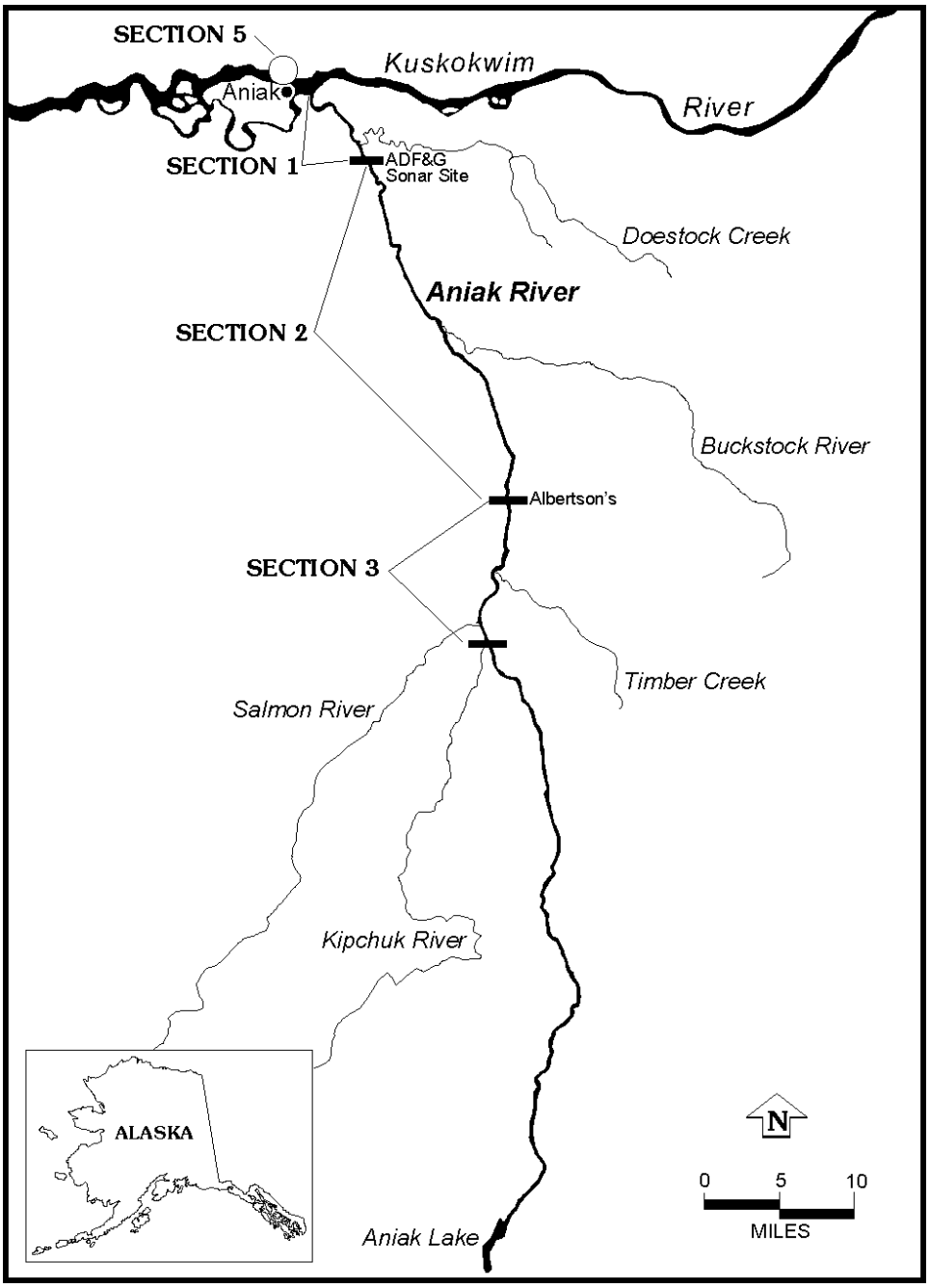

Figure 2.-The Aniak River drainage and study sites.

Table 4.-Lower Kuskokwim River, District 1, and middle Kuskokwim River, District 2, combined commercial salmon harvest, 1960-1996.

Year	Chinook	Sockeye	Coho	Pink	Chum	Total
1960	5,969	0	2,498	0	0	8,467
1961	18,918	0	5,044	0	0	23,962
1962	15,341	0	12,432	0	0	27,773
1963	12,016	0	15,660	0	0	27,676
1964	17,149	0	28,613	0	0	45,762
1965	21,989	0	12,191	0	0	34,180

1966	25,545	0	22,985	0	0	48,530
1967	29,986	0	56,313	0	148	86,447
1968	34,278	0	127,306	0	187	161,771
1969	43,997	322	83,765	0	7,165	135,249
1970	39,290	117	38,601	44	1,664	79,716
1971	40,274	2,606	5,253	0	68,914	117,047
1972	39,454	102	22,579	8	78,619	140,762
1973	32,838	369	130,876	33	148,746	312,862
1974	18,664	136	147,269	84	171,887	338,040
1975	21,720	23	81,945	10	181,840	285,538
1976	30,735	2,971	88,501	133	177,864	300,204
1977	35,830	9,379	241,364	203	248,721	535,497
1978	45,641	733	213,393	5,832	248,656	514,255
1979	38,966	1,054	219,060	78	261,874	521,032
1980	35,881	360	222,012	803	483,211	742,267
1981	47,663	48,375	211,251	292	418,677	726,258
1982	48,234	33,154	447,117	1,748	278,306	808,559
1983	33,174	68,855	196,287	211	267,698	566,225
1984	31,742	48,575	623,447	2,942	423,718	1,130,424
1985	37,889	106,647	335,606	75	199,478	679,695
1986	19,414	95,433	659,988	3,422	309,213	1,087,470
1987[a]	36,179	136,602	399,467	43	574,336	1,146,627
1988[b]	55,716	92,025	524,296	10,825	1,381,674	2,064,536
1989	43,217	42,747	479,856	464	749,182	1,315,466
1990	53,759	84,870	410,332	3,397	461,624	1,013,982
1991	37,778	108,946	500,935	378	431,802	1,079,839
1992	46,872	92,218	666,170	7,451	344,603	1,157,314
1993	8,735	27,008	610,739	64	43,337	689,883
1994	16,211	49,365	724,689	30,949	271,115	1,092,329
1995	30,846	92,500	471461	93	605,918	1,200,818
1996[c]	7,421	33,878	937,299	1,621	207,877	1,188,096
Average (1986-1995)	34,873	82,171	544,793	11,209[d]	517,280	1,184,826

Source: Francisco et al. 1995.

[a] 1987 Commercial fishing time reduced during chinook salmon fishery.

[b] 1988 Directed commercial fishery for chinook salmon eliminated.

[c] Preliminary estimates. These numbers include estimates of fish caught from which only roe was sold. Fish from which only roe was sold may be accounted for in subsistence harvest estimates but are included here since the fish were taken during commercial periods (C. Burkey, ADF&G, Division of Commercial Fisheries Management and Development, A-Y-K, Bethel, personal communication).

[d] Even years only (1986, 1988, 1990, 1992, 1994).

sport and subsistence salmon fisheries (Minard and Dunaway 1995). A portion of the 1994 sport fishing season was also closed for chum salmon fishing. While the annual sport harvest of chum salmon has averaged only 193 fish (1991 to 1994), the restrictions were necessary due to restrictions in the subsistence fishery (Minard and Dunaway 1995). The poor parent year escapements of 1992 and 1993 were expected to produce a poor chum salmon run in 1996 and restrictions to the sport fishery were anticipated.

Throughout the Kuskokwim River drainage, the current daily bag and possession limit is three chinook salmon, only two of which may exceed 71 cm (28 inches) in length. For the remaining four salmon species, the daily bag limit is five salmon of any combination of species except chinook salmon (ADF&G 1996). Terminal tackle in the Aniak River, upstream of the confluence of Doestock Creek, is restricted to unbaited single-hook-artificial lures year-round. Downstream of the outlet of Doestock Creek, the less restrictive, statewide methods and means regulations apply (ADF&G 1996). The daily bag limits for Arctic grayling, and northern pike are 10 fish. The daily bag limit for char/Dolly Varden is 10 fish, only 2 over 20 inches in flowing waters and 2 fish with no size limit in lakes and ponds (ADF&G 1996).

OBJECTIVES

The objectives of the 1996 Aniak River fishery studies were:

1. To identify issues such as:
    a. Potential for the sport fishery to overharvest the fish populations or different age/size groups of the fish populations,
    b. Potential conflicts among recreational and subsistence users of the fish populations, or
    c. Land-use conflicts that might necessitate indepth research in later phases of this study.
2. To ascertain the need and feasibility for future research into the Aniak River sport fisheries.
3. To collect information necessary to design future research studies of Aniak River sport fisheries.

TASKS

The following tasks were to be accomplished during the 1996 Aniak River salmon fisheries study:

1. Characterize the sport fisheries on the Aniak River:
    a. Describe the geographic distribution of sport fishing effort including identifying concentrations of effort and assessing the possibilities for obtaining angler counts;
    b. Identify periods of peak angling activity during the summer of 1996;
    c. Collect information on group size and fishing trip duration, and demographic information from anglers;
    d. Identify targeted species and terminal tackle choices of anglers interviewed along the Aniak River.
2. Characterize the age and size composition of sport harvested salmon, and the size and age composition of resident species encountered in anglers' bags in the Aniak River by:

a. Collecting age, and size information from salmon harvested by sport anglers during the 1996 season;

b. Collecting age and size data from rainbow trout, Dolly Varden, and Arctic grayling captured by sport anglers;

c. Collecting age and size data from rainbow trout, Dolly Varden, and Arctic grayling captured by project personnel using hook-and-line gear, and hoop traps.

3. Land ownership, current State of Alaska land use permits, and current State of Alaska recreational registrations were to be identified for the lands along the Aniak River.

METHODS

This project was very general and exploratory in nature and no rigorous survey design was developed. It was up to the project personnel to find the best system for obtaining information to complete the objectives and tasks.

FISHERY STUDIES

Several local leaders and most of the fishing guides were contacted to obtain their knowledge of locations fished, distribution of effort (geographic and seasonal), types of gear used, and species targeted. Each guide interviewed was asked to provide the number of clients served, the usual duration of a client's visit and the number of days typically fished by each client.

Roving angler survey techniques were employed to obtain onsite angling data and to test the feasibility of conducting a statistically rigorous survey. An 18-foot river boat with a 40 horsepower outboard jet was driven along the Aniak town beach (Kuskokwim River) and up the Aniak River from its outlet to the outlet of the Kipchuk River during July and early August. During the boat trips, anglers were counted and interviewed, and locations of angling and camping activities were noted.

Anglers encountered along the river were interviewed to obtain general information on the current day's effort, catch, harvest, tackle choice, and angler demographics (Tasks 1c and 1d). Length of anglers' stay on the Aniak River was also recorded to obtain general information on overall trip duration (Task 1c). Both completed-trip anglers (those who finished fishing for the day) and incompleted-trip anglers were interviewed as they were encountered. Anglers were interviewed only once on a given day. Angler interviews were recorded on Sport Fish Division Angler Interview Mark-sense Form version 1.1. Angler counts were recorded on Alaska Department of Fish and Game Creel Census-Angler Count Form 1.2.

The first 2 days of the study were spent getting familiar with the river. We saw natural dividing points along the river and divided the study area into the following three sections: river section 1 ran from the river mouth to the sonar site approximately 19.2 km (12 miles) upstream (Figure 2). Most fishing in the lower river appeared to occur downstream from the outlet of the Doestock River which is a short distance below the sonar counter operated by the Commercial Fisheries Management and Development Division of the Department of Fish and Game. Little angling was observed from the Doestock River to Midit's Cabin at 61^{o} 27.44' N, 159^{o} 20.59'W. River section 2 had its lower boundary at the sonar site and upper boundary at Lamont Albertson's camp (61^{o} 11.7' N, 159^{o} 6.88'W) (Figure 2). This area included the outlet of the Buckstock River and much of the water used by rafters, the upriver lodge-based guides and a few local

anglers. River section 3 constituted all waters above Albertson's camp to the outlet of the Kipchuk River (61° 2.82' N, 159° 10.44' W) (Figure 2). This area appeared to be most heavily used by rafters. Albertson's is not the best dividing point as fishing occurs all along that portion of the river, however, it was the best landmark. Over 48 km (30 miles) by air and possibly 64 to 80 km (40-50 miles) by river from the community of Aniak, Albertson's camp is the upper limit for a 1-day round trip of angler counts and interviews. The "Town Beach" was defined as section 5 because this fishery appeared to be significantly different in its makeup of anglers and species targeted (Figure 2). Angler counts and interviews in section 5 were usually obtained while driving the boat along this portion of the Kuskokwim River and occasionally by walking along the beach.

River sections 1, 2 and 5 were surveyed more frequently due to the proximity to town and the greater number of anglers that could be found there. In addition, we learned the schedules of most of the guide operations and could predict with some certainty when there would be activity in section 3. For the same reasons, many of the trips into section 2 terminated a short distance above the outlet of Buckstock River rather than at Albertson's camp. On days when a survey began from town, we would usually begin by surveying section 5, continue to 1 and 2 then count and interview again on the return trip downstream. Time only allowed one round trip per day. Trips usually began in mid day to allow anglers to capture some fish. Two or three guides began their day early (before 9:00 am) but others did not begin fishing until mid day; work schedules for most guides were not as unpredictable as in many Bristol Bay fisheries. Most local anglers did not become active before afternoon and frequently fished in the evening or very late into the night. Frequently our return (downstream) trip of the day included fishing time to collect samples from resident species. This was particularly true of days when we knew few anglers were on the water.

Section 3 was visited less regularly; visits to the area were timed to encounter guided anglers there, both raft and power boat based groups. While this strategy would bias a rigorous survey, in this study we were interested in learning about the sport angling activity in the section and wanted to be sure to find anglers to interview. Our trips to this section were usually of 3 days duration and required the surveyors to camp out for 2 nights on the sand bars. The upriver trips also included considerable time spent attempting to capture resident species for biological samples.

In addition to observing the fishery from the river boat, we conducted two aerial surveys of the length of the Aniak River and its main tributaries, the Salmon and Kipchuk rivers. A Cessna 207 and a Robinson R-22 helicopter were used for the aerial surveys. The flights were used to observe float trip departure sites, camp sites and angling locations.

Guided Effort

Early in the study it appeared that much of the angling effort on the Aniak River occurred with the assistance of guides. Since the angler counts and interviews were not collected in a manner expected to provide estimates of total effort, catch, or harvest, we contacted as many of the guiding businesses as possible to obtain an approximation of the guide related effort. Each guide business was asked the number of clients expected for the season, the number of guides usually employed, and the usual number of days fished by a client. The information was requested with the assurance that the details of individual businesses would remain confidential.

From the information provided by the guides, we were able to approximate the number of client angler-days and number of guide angler-days of effort that occurred on the Aniak River drainage during the 1996 fishing season. The information and assumptions used to approximate guide effort are highly speculative and should be used with caution.

Data Analysis

The numbers of hours fished or days fished, and fish caught and kept, as well as the percentages of anglers counted and interviewed, anglers by type (guided or unguided, local or nonlocal, rafter or power boater, etc.), and gear are presented to provide a general characterization of the Aniak River sport fisheries. These data identify important features of the Aniak River sport fisheries but do not constitute unbiased estimates.

BIOLOGICAL SAMPLING PROCEDURES

Study Design

We collected as many biological samples as possible for each species of fish commonly caught in the Aniak River sport fisheries.

Sport Harvest

Length, weight, and sex information and scale samples were collected from sport harvested salmon, rainbow trout, Dolly Varden, and Arctic grayling encountered during angler interviews (Task 2a and 2b). In addition, guides using the Aniak River from Aniak Lake to the confluence of the Kipchuk River, or the Kipchuk and Salmon rivers, were asked to collect samples from fish their clients caught.

Sampling Resident Species Populations

In addition to sampling the sport catch and harvest, department personnel used conventional hook-and-line tackle to collect length and sex information and scale samples from rainbow trout, Dolly Varden, and Arctic grayling (Task 2c). Weights were not collected from resident species to reduce handling injuries.

We also experimented with four hoop traps to assess their utility for capturing resident species (Task 2c). The hoop traps were 8 feet long by 24 inches diameter and covered with 1-inch mesh netting. The traps were set at 0.5 to 2 meters of relatively clear water where the current was slow enough to prevent them washing away. Gravel or sandy bottom sites were preferred particularly if they were near spawning salmon. The trap openings were set to point downstream or towards the location from which fish were expected to swim to reach the trap (following the bait scent). The traps were baited with perforated plastic jars containing salmon roe, fresh frozen cocktail shrimp or both. Site location, river section, latitude, longitude, date and time set and pulled, bait choice, and catch were recorded for most traps set.

Since the two gear types may show different selectivity and were not fished equally in time or geographic distribution, the data are presented separately. Fish captured were sampled for length, and sex (if possible to identify). Scales were collected for age determination in rainbow trout and Arctic grayling. Each sample was identified by species, gear type, date and river section.

Data Collection

Sport harvested salmon encountered during the study were measured to the nearest millimeter for mid-eye to fork-of-tail length, weighed to the nearest 10 grams (10 kilograms for chinook

salmon), and sexed based on external characteristics. In addition, three or four scales were removed from the preferred area[1] and mounted on an adhesive-coated card. Adhesive-coated cards were pressed against acetate cards in a heated hydraulic press and the resulting scale impressions displayed on a microfiche projector for age determination[2].

Standard age determination procedures were used (see Jearld 1983, and Lux 1971, for a general description of the principles used).

All biological data collected from harvested fish were recorded on Sport Fish Division age-weight-length mark-sense forms.

Data Analysis

The proportion of sport harvested salmon (by species), rainbow trout, Dolly Varden, and Arctic grayling that were age u was estimated as:

$$\hat{p}_u = \frac{n_u}{n}, \tag{1}$$

where n_u equals the number of the sampled fish (by species) harvested that were age u; and n equals the total number of fish (by species) sampled during the study.

The variance of the estimated proportion of fish (by species) harvested was estimated by the standard equation for the variance of a binomial proportion (Cochran 1977, equation 3.8, page 52):

$$\hat{V}[\hat{p}_u] = \frac{\hat{p}_u(1-\hat{p})}{n-1}. \tag{2}$$

Mean length-at-age of sport harvested salmon, rainbow trout, Arctic grayling, and Dolly Varden was estimated following standard procedures (Sokal and Rohlf 1981, Boxes 4.2 and 7.1, pages 56 and 139).

Samples of rainbow trout, Dolly Varden, and Arctic grayling collected by department personnel were evaluated in the same manner as the fish harvested in the sport fishery. Where there were sufficient samples the lengths of rainbow trout, Dolly Varden, and Arctic grayling were compared to samples from previous years using Kolmogorov-Smirnov tests.

The computer programs and electronic data files used to complete this report are listed in Appendix D1.

LAND OWNERSHIP AND LAND USE PERMITS

State, Federal, and private landowners were contacted to obtain maps identifying locations of lands and their ownership along the Aniak River and its major tributaries (Task 3). The Alaska Department of Natural Resources was contacted for a list of individuals and businesses issued commercial recreational permits and registrations to operate in the Aniak River drainage. The

---

[1] The left side of the fish approximately two rows above the lateral line and on the diagonal row downward from the posterior insertion of the dorsal fin as used on sockeye salmon by Clutter and Whitesel (1956), for chinook salmon (Welander 1940 and Lux 1971).

[2] For salmon, the numeral preceding the decimal is the number of freshwater annuli, whereas the numeral following the decimal is the number of marine annuli (European method). Total age from brood year is the sum of the two numerals plus one.

major private land holders in the area were asked to provide information about the locations of their lands and about any permits they may have issued for use of their lands.

RESULTS

FISHERIES STUDIES

General Information

Chinook salmon begin returning to the Aniak River in mid to late June. According to local residents, the run peaks during the first 2 weeks of July, then dwindles rapidly by the end of July. Chum salmon appear in the river around 15 June, peak in mid July, and continue until late July. A small run of sockeye salmon enter the Aniak River during the month of July. Coho salmon enter the Aniak River during the last few days of July and run throughout the month of August. Rainbow trout, Dolly Varden, Arctic grayling, and northern pike reside in the river all year, however, according to local residents, their distribution varies considerably throughout the year.

Local residents said they fish in the river, for subsistence or sport, throughout the year as long as there is safe access. Much of the river never freezes but most activity occurs during the months of May through September. During this study, subsistence fishing activity was only observed in the Kuskokwim River or within the lower 1 mile of the Aniak River. Estimates of subsistence harvests of resident fish species are apparently not available for the Aniak area.

Salmon sport fisheries begin in mid to late June with chinook and chum salmon the primary targets. The chinook and chum salmon sport fishery peaks during the first 2 to 3 weeks of July. After a brief hiatus in late July, anglers target coho salmon and rainbow trout until late August or early September. Rainbow trout, Dolly Varden and Arctic grayling are popular attractions throughout the season.

Throughout the study, water levels in the Aniak River were below normal and salmon had less area for spawning.

Angler Counts and Interviews

Though we began counting and interviewing on 3 July to obtain a feeling for the fishery during one of the potentially busiest weekends of the summer, we found relatively low levels of angling effort. We learned we had missed at least 1 week of guided angling and up to 2 weeks of local angling activity by starting the study in July. We also missed a substantial portion of the sport fishery for coho salmon by closing the study in early August. A locally run salmon derby coinciding with the annual State Fair in Aniak generates a modest burst of sport angling in mid-August. The 1996 coho salmon run was unusually early and large and may have attracted more recreational effort than usual.

Angler counts were collected from 3 July through 5 August and are summarized in Table 5 and Appendix A. In river sections 1 through 3, the greatest numbers of anglers were counted during the first 2 weeks of July (Appendix A). Angler counts along the "Town Beach" were relatively

Table 5.-Angler count summary 3 July to 5 August 1996, Aniak River.

	Counts Conducted	Anglers Counted	Anglers per Count	SE
Section 1 mouth to sonar site				
Weekdays	8	37	4.6	1.6
Weekend days	29	168	5.8	1.1
subtotal	37	205	5.7	0.9
Section 2 sonar site to Albertson's.				
Weekdays	6	24	4.0	1.3
Weekend days	23	133	5.8	1.5
subtotal	29	157	5.4	1.2
Section 3 upstream of Albertson's.				
Weekdays	0	0	0.0	
Weekend days	7	49	7.0	1.0
subtotal	7	49	7.0	1.0
Aniak River Subtotal				
Weekday	14	61	4.4	1.0
Weekend days	59	350	6.0	0.8
subtotal	73	411	5.6	0.7
Section 5 Aniak town beach				
Weekdays	23	75	3.3	0.8
Weekend days	14	48	3.4	0.8
subtotal	37	123	3.3	0.6
Study Summary All sections				
Weekdays	37	136	3.7	0.6
Weekend days	73	398	5.5	0.7
Total	110	534	4.9	0.5

low throughout the study with most anglers observed from 16 July to 27 July (Appendix A1). For the whole study, 110 counts were conducted, 534 anglers were observed, for an average of 4.9 anglers (SE = 0.4) per count (Table 5).

Results of the angler interviews are summarized in Tables 6 and 7 and Appendix B. Although anglers were never interviewed more than once a day, individual anglers were frequently interviewed on several different days, particularly in section 2. Float trip anglers and anglers in section 3 were probably less likely to be interviewed on more than one occasion during their trip than anglers using sections 1 and 5, though data were not recorded in a manner to allow testing for bias.

A total of 240 interviews were collected: 71 in section 1, 107 in section 2, 34 in section 3, and 28 in section 5 (Tables 6 and 7 and Appendix B). Only 22 interviews (about 9%) were from anglers who had completed their daily fishing trip. Therefore the number of fish kept and released, and total catch (kept + released) presented in Tables 6 and 7 and Appendix B represent

Table 6.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for chinook and chum salmon, Dolly Varden, rainbow trout and Arctic grayling reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

	Anglers Interviewed	Hours Fished	Chinook Salmon Kept	Chinook Salmon Released	Chinook Salmon Total Catch	Chum Salmon Kept	Chum Salmon Released	Chum Salmon Total Catch	Dolly Varden Kept	Dolly Varden Released	Dolly Varden Total Catch	Rainbow Trout Kept	Rainbow Trout Released	Rainbow Trout Total Catch	Arctic Grayling Kept	Arctic Grayling Released	Arctic Grayling Total Catch
Section 1 River Mouth to Sonar	71	330.3	37	78	115	2	47	49	1	17	18	1	5	6	0	3	3
Section 2 Sonar Site to Albertson's	107	369.5	24	90	114	5	216	221	2	313	315	0	110	110	0	62	62
Section 3 Upstream of Albertson's Camp	34	154.8	1	39	40	0	28	28	0	128	128	0	77	77	0	113	113
Aniak River Subtotal	212	854.6	62	207	269	7	291	298	3	458	461	1	192	193	0	178	178
Section 5 Aniak Town Beach (Kuskokwim River)	28	46.3	3	5	8	1	11	12	0	0	0	0	0	0	0	0	0
Study Summary All sections Total	240	900.9	65	212	277	8	302	310	3	458	461	1	192	193	0	178	178
Average hours fished/angler		3.8															
SE		0.1															
Fish kept or caught/hour			<0.1		0.3	<0.1		0.4	<0.1		0.5	<0.1		0.2	0		0.2
SE			<0.1		0.1	<0.1		0.1	<0.1		0.1	<0.1		<0.1	0		<0.1

Table 7.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for coho and sockeye salmon, sheefish and northern pike reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

	Anglers		Coho Salmon			Sockeye Salmon			Sheefish			Northern Pike		
	Inter-viewed	Hours Fished	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch
Section 1 River Mouth to Sonar														
	71	330.3	7	10	17	0	0	0	0	0	0	0	5	5
Section 2 Sonar Site to Albertson's Camp														
	107	369.5	0	0	0	0	1	1	0	1	1	0	0	0
Section 3 Upstream of Albertson's Camp														
	34	154.8	0	3	3	0	2	2	0	0	0	0	0	0
Aniak River														
Subtotal	212	854.6	7	13	20	0	3	3	0	1	1	0	5	5
Section 5 Aniak Town Beach (Kuskokwim River)														
	28	46.3	16	21	37	0	0	0	1	0	1	0	0	0
Study Summary All sections														
Total	240	900.9	23	34	57	0	3	3	1	1	2	0	5	5
Average hours fished/angler		3.8												
SE		0.1												
Fish kept or caught/hour			0.1		0.1	0		<0.1	<0.1		<0.1	0		<0.1
SE			<0.1		<0.1	0		<0.1	<0.1		<0.1	0		<0.1

the catch at the time the anglers were interviewed. Anglers had fished an average of 3.8 hours (SE = 0.1 hr.) and reported keeping 65 chinook salmon, 8 chum salmon, 3 Dolly Varden, and 23 coho salmon (Tables 6 and 7). Anglers reported total catches of 277 chinook salmon, 310 chum salmon, 461 Dolly Varden, 193 rainbow trout and 178 Arctic grayling (Table 6 Appendix B1). Only 57 coho salmon, 3 sockeye salmon, 2 sheefish and 5 northern pike were reported in the catch during the study (Table 7 and Appendix B2). For the study period, catch rates averaged 0.3 chinook salmon per hour fished (SE = 0.1 fish/hr), 0.4 chum salmon per hour (SE = 0.1 fish/hr), and 0.5 Dolly Varden per hour (SE = 0.1 fish/hr) (Table 6 and Appendix B1). Other species were caught at much lower rates during the study (Tables 6 and 7 and Appendix B1 and B2).

Angler Characteristics

Most interviews were collected from guided (75%), nonresident (78%) men (90%) (Table 8). Twenty-two percent of the interviews were collected from Alaskan residents, and most (14%) were from anglers who live in the local communities of Aniak or Chuathbaluk (Table 8). About 8% of the interviews were collected from foreign anglers; many of this group were visitors from Japan.

The mode of transportation to the fishing sites was very evenly divided among the interviewed anglers. About 90% of all anglers interviewed accessed their fishing sites in boats; 30% in jet power boats, 30% in propeller powered boats, and 30% in inflatable rafts (Table 8). Some rafters used outboard motors to traverse the lower reaches of the Aniak River or to occasionally assist with steering. The remaining interviews were collected from people who walked to their fishing site (usually "town beach") though three or four anglers were known to have landed on river sand bars in their airplanes.

While boats were a popular means of getting to the fishing site, most anglers (62%) fished from the shore (Table 8). It was more common to find anglers fishing from their boats in section 1 or in front of the community of Aniak. Most boat-based angling occurred from anchored boats.

Lures or spinning tackle were by far the favored gear (72%). Fly tackle was used by 18% of the interviewed anglers (Table 8) and was more commonly used in river sections 2 and 3. Bait was encountered infrequently even in sections 1 and 5 where its use is permitted. Children fishing in section 5 were frequently observed using bait; however we did not interview the children regularly, particularly during the first weeks of the project.

During the interviews, anglers were asked the total length of their stay or visit to the area. This question has most application to the nonlocal anglers. Local anglers who fished for part of a day were considered to be making a 1-day trip. Table 9 summarizes trip lengths reported by residency and whether a guide was employed. Most guided anglers visited for 5 to 8 days while most Alaskans made 1- to 3-day trips (Table 9).

Guided Effort

Before the study began, concern had been expressed that both guided and unguided float trips had increased substantially. Based on the guides we contacted, there may be as many as 3,000 angler-days of guided sport fishing on the Aniak River and its major tributaries (Table 10). Our research identified at least 15 guide businesses operating on the Aniak River: 7 were lodge based and 8 provided float trips (Table 10). As much as 500 to 1,000 additional angler-days of effort may arise from the guides themselves participating in the fishery. The information and

Table 8.-Percent of angler interviews by angler type, mode of transportation and gear choice during the Aniak River salmon sport fishery, 3 July through 5 August 1996.

Characteristic	Percent
ANGLER TYPE	
Guided	75
Unguided	25
RESIDENCY	
Alaskan Residents	22
Local Alaskan Residents	14
Nonlocal Alaskan Residents	8
Non-Alaskan Residents	78
U.S. Residents	69
Non-U.S. Residents	9
GENDER	
Men	90
Women	10
MODE OF TRANSPORTATION	
Jet boat	30
Propeller drive	30
Inflatable rafts	31
Other (foot, airplane)	10
Fished from boat	38
Fished from shore	62
TACKLE CHOICE	
Lures or spinning gear	72
Lures and bait	<1
Bait	2
Fly	18
Lures and Fly	8
TOTAL ANGLERS INTERVIEWED	240

Table 9.-Number of interviews, by trip length and angler characteristics, collected during the Aniak River salmon sport fishery, 3 July to 5 August 1996.

	Number of days in visit		
	1-4	5-8	9 or more
Nonresidents	21	163	2
guided	9	156	2
unguided	12	5	0
unknown	0	2	0
power boat	15	90	2
raft	3	65	0
other	3	10	0
Alaska Residents	40	11	1
guided	6	4	1
unguided	34	7	0
Local Residents	31	3	0
Nonlocal Alaskans	8	8	1
unknown	1	0	0
power boat	24	7	0
raft	0	5	0
other	1	1	0
	0	0	0
Unknown	0	2	0

Table 10.-Approximations of guided angling effort on the Aniak River during 1996.

Guide Type	Number of Businesses	Approximate Client Angler-days[a]
Lodge & Power Boats	7	1,872
Float Trip	8	1,187
Total	15	3,059

[a] All guide operations may not have been contacted; client counts are estimates provided by the businesses contacted. These estimates include very little sport fishing effort that may have occurred during guided big game hunts along the river.

assumptions used to approximate guide effort are highly speculative and should be used with caution.

During the study, we asked anglers for their opinions about the condition of the Aniak River fish populations and their suggestions for sport fishing regulations. Several individuals expressed concern about the increasing effort in the area. Another issue was the potential for sport anglers to "over-fish" or excessively harvest resident species. Some contended that Dolly Varden and Arctic grayling numbers and sizes of individual fish may be declining while the population of rainbow trout may be stable or increasing. Accordingly, there seemed to be general support for more restrictive regulations to protect resident species, particularly Dolly Varden and Arctic grayling. There was general support for lower bag limits or a catch-and-release regulation for Dolly Varden and Arctic grayling. Differential limits by season and/or by residency (in-state versus out-of-state) to accommodate local harvest practices seemed acceptable to most local anglers we met.

Biological Sampling

Chinook Salmon

During the project only 16 chinook salmon were sampled from the sport fishery. Of the fish kept during the study, many were dressed immediately upon capture, and it was difficult to find fish to sample. The chinook salmon we measured averaged 754 mm (SE = 43 mm) (29.7 in), and weighed an average 8.1 kg (SE = 1.2 kg) (17.8 pounds) (Table 11). Nearly half (46.2%, SE = 14.4%) were of age class 1.4, 30.8% (SE = 13.3%) were age class 1.5, and 23.1% (SE = 12.2%) were of age class 1.2 (Table 11).

Coho Salmon

Although the coho salmon run had only begun as the study was terminated, samples were obtained from 12 sport-caught fish. Ten of the fish sampled were males (Table 12). The coho salmon sampled averaged 578 mm (SE = 9 mm) (22.8 in) and averaged just over 3,200 grams (SE = 253 g)(14.6 pounds) (Table 12). All but one fish were age 2.1.

Other Salmon Species

Although many chum salmon enter the Aniak River and quite a few chum salmon were caught by anglers during the study, most were released and we were only able to sample one fish. Few sockeye salmon enter the river and they are infrequently caught in the sport fishery; only one sockeye salmon was sampled during the study.

Rainbow Trout

People familiar with the Aniak River frequently remarked that rainbow trout fishing was unusually good in 1996. The extremely low water levels and six seasons of catch-and-release regulations were commonly suggested as reasons for the good fishing. In spite of the "good" rainbow trout fishing, we only obtained 65 samples in 1996. Forty-one rainbow trout were caught using hook-and-line gear and 24 were caught in hoop traps. The hoop traps were fished in 21 different locations 32 times, mainly in section 2 (Table 13). Some locations were fished more than one time or with slight variations as to exact location, bait type, or trap orientation.

All rainbow trout samples for both gear types were collected in sections 2 and 3 though some effort was spent with both gear types in section 1. The 41 rainbow trout caught using hook-and-line tackle averaged 425 mm (SE = 12 mm) (16.7 in) (Table 14). Most of the hook-and-line

Table 11.-Mean mid-eye to fork lengths and weights of chinook salmon, by sex and age group, from samples collected in the Aniak River sport fishery, 4 to 17 July 1996.

	Age Group				
	UNKNOWN	1.3	1.4	1.5	TOTAL
FEMALES					
Percent			15.4	15.4	30.8
SE			10.4	10.4	13.3
Sample Size (known age)			2	2	4
Mean Length (mm)			882	912	897
SE			28	43	22
Sample Size			2	2	4
Mean Weight (kg)			8.7	12.4	11.2
SE				2.1	1.7
Sample Size			1	2	3
MALES					
Percent		23.1	30.8	15.4	69.2
SE		12.2	13.3	10.4	13.3
Sample Size (known age)		3	4	2	9
Mean Length (mm)	583	640	801	977	714
SE	74	92	36	38	50
Sample Size	5	3	4	2	14
Mean Weight (kg)	3.8	5.3	9.0	14.7	7.4
SE	1.4	2.6	1.7	2.3	1.4
Sample Size	4	3	4	2	13
ALL SAMPLES					
Percent		23.1	46.2	30.8	100.0
SE		12.2	14.4	13.3	
Sample Size (known age)		3	6	4	13
Mean Length (mm)	583	640	828	945	754
SE	74	92	30	30	43
Sample Size	5	3	6	4	18
Mean Weight (kg)	3.8	5.3	8.9	13.6	8.1
SE	1.4	2.6	1.3	1.4	1.2
Sample Size	4	3	5	4	16

Table 12.-Mean mid-eye to fork lengths and weights of coho salmon, by sex and age group, from samples collected in the sport fishery in the Aniak River and Kuskokwim River at the outlet of the Aniak River during 27 through 29 July 1996.

	Age Group			
	UNKNOWN	2.1	2.2	TOTAL
UNKNOWN				
Percent		33.3		33.3
SE		14.2		14.2
Sample Size (known age)		4		4
Mean Length (mm)				
SE				
Sample Size		0		0
Mean Weight (g)				
SE				
Sample Size		0		0
FEMALES				
Percent		8.3		8.3
SE		8.3		8.3
Sample Size (known age)		1		1
Mean Length (mm)	596	574		585
SE				11.0
Sample Size	1	1		2
Mean Weight (g)	3,170	3,300		3,235
SE				65
Sample Size	1	1		2
MALES				
Percent		50.0	8.3	58.3
SE		15.08	8.33	14.86
Sample Size (known age)		6	1	7
Mean Length (mm)	582	574	567	577
SE	8	20		11
Sample Size	4	6	1	11
Mean Weight (g)	3,325	3,100	3,200	3,200
SE	491	520		306
Sample Size	4	5	1	10
ALL SAMPLES				
Percent		91.7	8.3	100.0
SE		8	8	
Sample Size (known age)		11	1	12
Mean Length (mm)	585	574	567	578
SE	7	17		9
Sample Size	5	7	1	13
Mean Weight (g)	3,294	3,133	3,200	3,206
SE	382	426		253
Sample Size	5	6	1	12

Table 13.-Hoop trap catches from the Aniak River, 1996.

Set	Sub-location	Site	Latitude	Longitude	Date Set	Time Set	Date Pulled	Time Pulled	Hours Fished	Bait[a]	Catch[b] RBT	DV	Other
1	001	1	NR[c]	NR[c]	7/12	NR[c]	7/12	NR[c]		E			
2	001	2	NR[c]	NR[c]	7/12	NR[c]	7/13	NR[c]		E			
3	001	3	NR[c]	NR[c]	7/12	NR[c]	7/13	NR[c]		E			
4	002	4	NR[c]	NR[c]	7/14	13:30	7/14	19:55	6.08	E			
5	002	5	NR[c]	NR[c]	7/14	13:55	7/14	19:45	5.83	E			
6	003	6	NR[c]	NR[c]	7/17	20:00	7/18	12:00	16.00	E	5	16	2 chum
7	002	7	N 61 28.737	W 159 20.966	7/21	13:20	7/22	12:30	23.17	S			
8	002	8	N 61 27.435	W 159 20.591	7/21	14:18	7/22	13:00	22.75	E			
9	002	9	N 61 25.819	W 159 19.357	7/21	15:23	7/22	14:00	22.67	S	6		
11	002	10	N 61 22.979	W 159 16.898	7/21	17:48	7/22	15:00	22.25	S+E	2		
10	002	9	N 61 25.819	W 159 19.357	7/22	14:15	7/23	12:45	22.50	S	1		
12	002	10	N 61 22.979	W 159 16.898	7/22	15:05	7/23	13:15	22.17	S+E			
13	002	11	N 61 21.593	W 159 15.636	7/22	16:20	7/23	14:20	22.00	S+E		5	
15	002	12	N 61 20.579	W 159 13.970	7/22	17:45	7/23	14:45	21.00	S	1		
14	002	13	N 61 24.549	W 159 18.949	7/23	13:00	7/24	13:25	24.42	S	2	4	
16	002	14	N 61 22.093	W 159 16.440	7/23	13:40	7/24	14:25	24.75	S+E			1 sucker
17	002	11	N 61 21.593	W 159 15.636	7/23	14:30	7/24	15:30	25.00	S+E		5	
18	002	12	N 61 20.579	W 159 13.970	7/23	14:50	7/24	17:00	26.17	S			
19	002	15	N 61 24.163	W 159 18.833	7/24	14:00	7/25	17:01	27.00	S			2 suckers
20	002	14	N 61 22.093	W 159 16.440	7/24	15:20	7/25	16:30	25.17	S+E			1 sucker
21	002	16	N 61 20.965	W 159 14.063	7/24	16:40	7/25	17:30	25.83	S	2		
22	002	17	N 61 20.521	W 159 13.768	7/24	17:05	7/25	17:49	24.75	S			
24	002	16	N 61 20.965	W 159 14.063	7/25	17:38	7/25	18:01	0.42	S	2		
23	002	16	N 61 20.965	W 159 14.063	7/29	12:50	7/29	15:05	2.25	S+E	1		
25	002	18	N 61 18.503	W 159 09.749	7/29	14:05	7/30	17:00	26.92	S+E			
28	002	20	N 61 15.208	W 159 07.767	7/29	16:30	7/30	19:20	26.83	S+E		2	
29	002	19	N 61 16.693	W 159 07.484	7/29	16:40	7/30	18:50	26.17	S	2	4	
26	002	21	N 61 20.263	W 159 13.893	7/30	16:25	7/31	13:00	20.58	S			
27	002	18	N 61 18.503	W 159 09.749	7/30	18:35	7/31	13:35	19.00	S			
30	002	20	N 61 15.208	W 159 07.767	7/30	19:40	7/31	15:30	19.83	E			
31	002	21	N 61 20.263	W 159 13.893	7/31	13:00	7/31	19:05	6.08	S+E			
32	002	18	N 61 18.503	W 159 09.749	7/31	14:50	7/31	17:50	3.00	S			
Total sets		32				Total hours fished			551.5		24	36	
						Mean fishing time			19.33				

[a] Bait: E = Borax cured salmon eggs, S = frozen shrimp, E + S = salmon eggs and shrimp.

[b] Catch: RBT = rainbow trout, DV = Dolly Varden.

[c] NR = not recorded.

samples for which age could be determined (29 fish) were age-6 fish (27.6%, SE = 8.5%) followed by relatively large percentages of both age 4 and age 8 (17.2%, SE = 7.1%) (Table 14).

The 24 rainbow trout captured in the hoop traps averaged 382 mm (SE = 21 mm) (15 in) (Table 15). The trapped fish were mostly age 4 and 5 (23.5%, SE = 10.6%) with another 17.6 % (SE = 9.5%) age 6 (Table 15).

The cumulative length frequency distributions observed in 1993 and 1996 are presented here to provide reference for future work but may not be representative of the rainbow trout population (Figure 3). Both 1993 and 1996 samples appear to include similar percentages of rainbow trout 540 mm or greater (Figure 3). Only the hook-and-line captured samples are compared.

Table 14.-Mean fork lengths of rainbow trout, by sex and age group, from samples collected from the Aniak River using hook-and-line gear, 8 July through 5 August 1996.

	Age Group								
	UNKNOWN	3	4	5	6	7	8	9	TOTAL
Percent		3.4	17.2	13.8	27.6	10.3	17.2	10.3	100.0
SE		3.5	7.1	6.5	8.5	5.8	7.1	5.8	
Sample Size (known age)		1	5	4	8	3	5	3	29
Mean Length (mm)	468	303	341	379	401	416	462	506	425
SE	24		20	9	10	15	29	24	12
Sample Size	12	1	5	4	8	3	5	3	41

Table 15.-Mean fork lengths of rainbow trout, by sex and age group, from samples collected from the Aniak River using hoop traps, 18 July through 30 July 1996.

	Age Group									
	UNKNOWN	3	4	5	6	7	8	9	10	TOTAL
Percent		5.9	23.5	23.5	17.6	11.8	5.9	5.9	5.9	100.0
SE		5.9	10.6	10.6	9.5	8.1	5.9	5.9	5.9	
Sample Size (known age)		1	4	4	3	2	1	1	1	17
Mean Length (mm)	435	239	260	318	357	443	546	560	505	382
SE	33		7	15	5	7				21
Sample Size	7	1	4	4	3	2	1	1	1	24

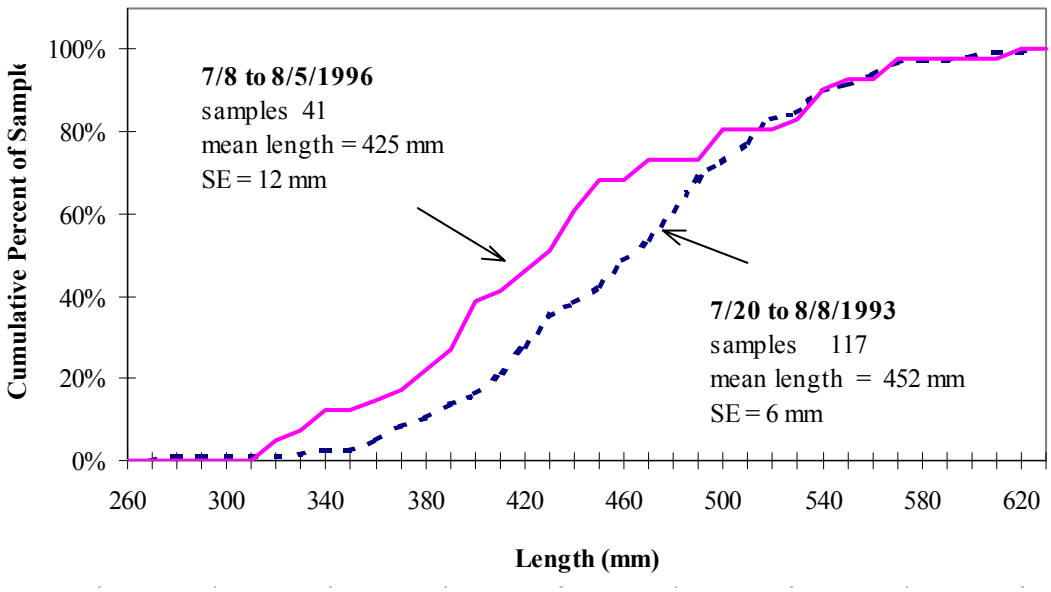

Figure 3.-Comparison of cumulative length frequencies of Aniak River rainbow trout captured by hook-and-line tackle in 1993 and 1996.

Dolly Varden

A total of 108 Dolly Varden were sampled during the study. As with rainbow trout, all Dolly Varden were captured in sections 2 and 3 though we attempted to catch fish in section 1. The 72 Dolly Varden captured with hook-and-line tackle averaged 348 mm (SE = 8 mm) (13.7 in). We caught 36 Dolly Varden in the hoop traps (Table 13) and these fish averaged 310 mm (SE = 12 mm) (12.2 in).

Arctic Grayling

Forty-seven (47) Arctic grayling were captured and sampled during the study. All Arctic grayling were caught on hook-and-line gear. Arctic grayling seemed to avoid or were not susceptible to the hoop traps. The Arctic grayling averaged 335 mm (SE = 6 mm) (13.2 in) (Table 16). Of the 44 Arctic grayling that could be assigned an age, most were age 6 (43.2%, SE = 8 %), or age 5 (29.5%, SE = 7 %) (Table 16).

Like the samples of other species, the small sample of Arctic grayling obtained in 1996 is inadequate for any meaningful discussion. Figure 4 and Appendix C2 are provided for reference.

Other Resident Species

Anglers reported catching other species of fish including sheefish and northern pike. We did not encounter sport-harvested sheefish or northern pike to sample.

Holokuk River

We visited the Holokuk River on 20 July. The Holokuk River, locally known as the Olokak River, flows into the south side of the Kuskokwim River about 25 miles upstream from the

Table 16.-Mean fork lengths of Arctic grayling, by age group, from samples collected in the Aniak River using hook-and-line gear, 8 through 30 July 1996.

	Age Group						
	UNKNOWN	3	4	5	6	7	TOTAL
ALL SAMPLES							
Percent		4.5	13.6	29.5	43.2	9.1	100.0
SE		3	5	7	8	4	
Sample Size (known age)		2	6	13	19	4	44
Mean Length (mm)	316	248	300	330	355	365	335
SE	36	9	18	7	6	4	6
Sample Size	3	2	6	13	19	4	47

Table 17.-Mean fork lengths of Arctic grayling, by age group, from samples collected in the Holokuk River using hook-and-line gear, 20 July 1996.

	Age Group					
	2	3	4	5	6	TOTAL
ALL SAMPLES						
Percent	9.1	9.1	27.3	45.5	9.1	100.0
SE	9.1	9.1	14.1	15.8	9.1	
Sample Size (known age)	1	1	3	5	1	11
Mean Length (mm)	180	217	279	316	325	285
SE			12	10		15
Sample Size	1	1	3	5	1	11

community of Aniak (Figure 1). The portion of the river we visited was very clear, moderately swift, approximately 50 m (55 yards) wide and generally less than 2 m (6.5 feet) in depth. While the Holokuk River is outside the boundaries of the SWAMA it is a popular alternative fishing location for some local Aniak area anglers and is a primary fishing site for one lodge. Chinook, chum, pink and coho salmon are known to spawn in the river and Dolly Varden and Arctic grayling are known to inhabit the river.

We captured and sampled 13 Dolly Varden and 11 Arctic grayling. The Dolly Varden averaged 442 mm (SE = 8 mm) (17.4 in). The Arctic grayling averaged 285 mm (SE = 15 mm) (11 in) and most were age 4 (27.3%, SE = 14.1%) or age 5 (45.5%, SE = 15.8%) (Table 17).

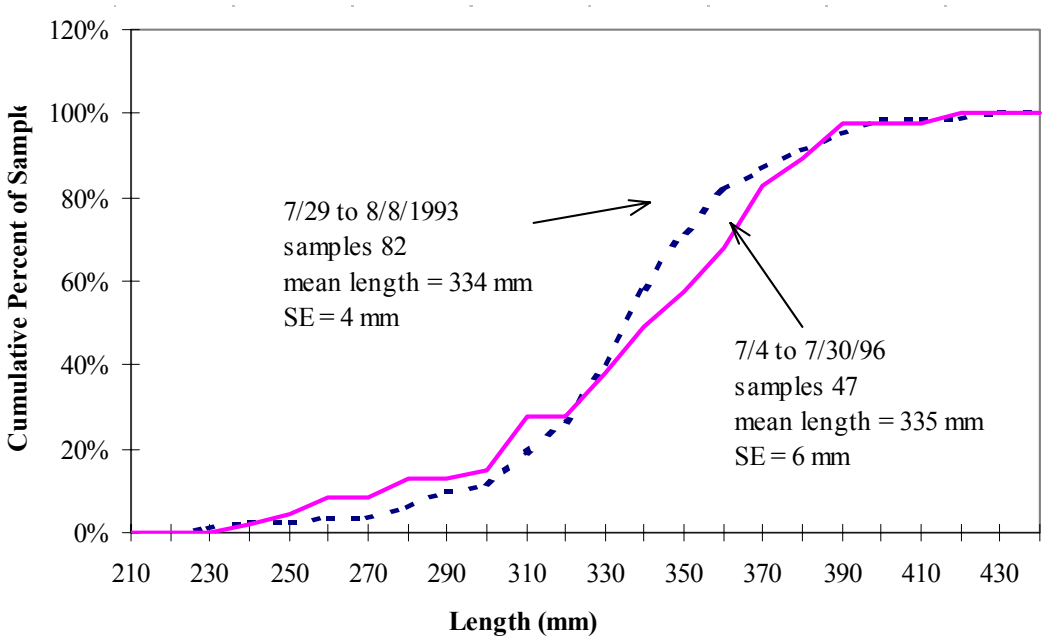

Figure 4.-Comparison of cumulative length frequencies of Aniak River Arctic grayling captured by hook-and-line tackle in 1993 and 1996.

LAND ISSUES

No conflicts relative to sport angling activities and land use or land ownership came to our attention during the study.

Land status and land ownership were found to be complex topics not easily sorted out. Simple maps or lists of owners were not readily available and no information was collected. A brief discussions of landowners by general category seems appropriate to the level of this report.

State Lands

The Aniak River and several of its main tributaries are considered navigable, therefore the lands below the ordinary high water level belong to the State of Alaska. Permits are not required for private individuals camping for less than 14 days on state lands. Groups using a site longer than 14 days and all commercial enterprises are required to register with the Alaska Department of Natural Resources and may require more extensive permitting depending upon the nature of the intended use. A number of businesses and individuals have permits to conduct big game guiding, sport fish guiding, or other recreational uses in the area. The exact number and nature of the commercial permits was never obtained despite several requests to the Alaska Department of Natural Resources.

Federal Lands

Portions of the Aniak River drainage from its outlet to a few miles upstream of the Buckstock River fall within the boundaries of the Yukon Delta National Wildlife Refuge and are subject to the regulations of the refuge. Specific locations of such lands were not obtained.

Native Owned Lands

Much of the lands along the Aniak River are Alaska Native owned, particularly along the river's lower reaches. Native lands include individual allotments and holdings belonging to various village and regional Native corporations. Signs identifying lands as belonging to individuals or Native Corporations were observed along the Aniak River. The TKC (The Kuskokwim Corporation) sells trespass permits to nonbeneficiaries desiring to use their land. This permit system seems geared more to the hunting season than to the sport fishery. The few cabins built along the river appeared to be located on allotments or sites permitted by TKC in Aniak.

Other Private Lands

Some lands in the area are held in private ownership as a result of homesteading or other government land disposal programs or by purchases from Native land holders.

DISCUSSION

CURRENT FISHERY

Several individuals experienced with the area emphasized that data collected from this season may not be representative of a "normal water" season, and rainbow trout fishing was thought to be better than in high water seasons.

Several guides and local anglers felt the Dolly Varden fishing has been below average for the last two seasons. We were surprised that we captured so few Dolly Varden in 1996. The few samples were due in part to dividing our efforts among several duties other than just collecting samples of fish, and to muddy water conditions during the last week of July when Dolly Varden should have been easily caught. In addition, the good escapement of salmon may have provided large food supplies (eggs) to compete with our sport tackle offerings. Further, the very poor chum salmon escapements observed in 1992 and 1993 could have influenced the populations of resident species such as Dolly Varden. As with the rainbow trout, the few samples collected in 1996 do not allow statistically valid comparisons and the information shown in Figure 5 is provided for future reference.

Judging from the low SWHS estimates of effort and harvest (Table 1) and the observations made during this study, the Aniak River sport fisheries are not likely to be a significant or immediate threat to the current fish populations. Anglers are showing increased interest in the Aniak River and effort can be expected to grow. The department should make periodic visits to the fishery to stay abreast of the fishery's development and the potential effects upon the fish populations.

The most immediate concern confronting the Aniak River sport fishery will be the 1997 chum salmon run. The very poor chum salmon escapements observed in 1992 and 1993 may not produce a run sufficient to sustain the normal commercial, subsistence and sport fisheries in 1997. If poor chum salmon escapements occur during 1997, the chum salmon sport fishery will be restricted to protect this species in observance of the state's priority for the subsistence fishery.

Occasional and more extensive observations of the resident species should be considered for several reasons, especially for Dolly Varden and Arctic grayling. First, the poor chum salmon escapements of 1992 and 1993 as well as other physical conditions may have influenced the food

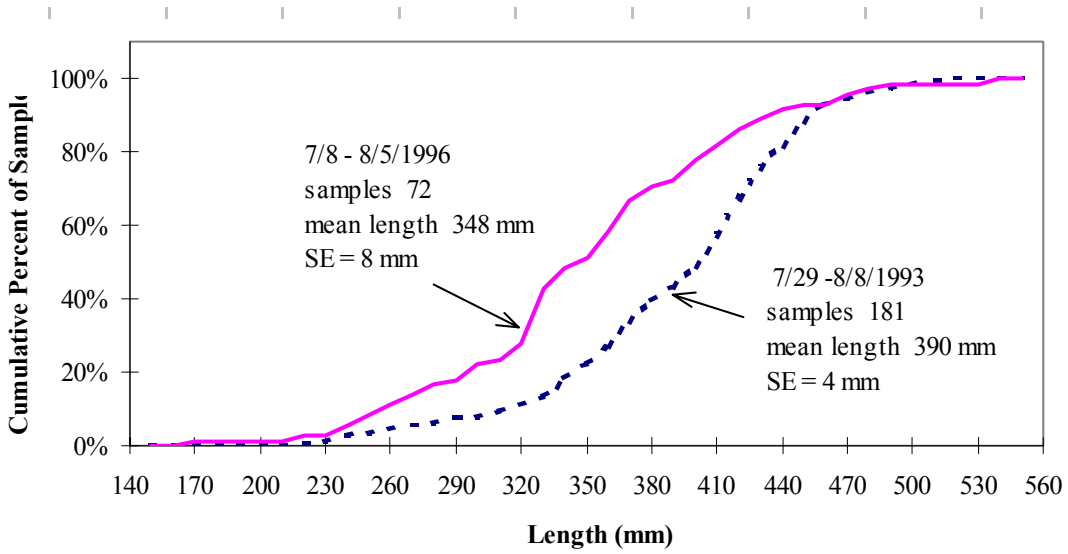

Figure 5.-Comparison of cumulative length frequencies of Aniak River Dolly Varden captured by hook-and-line tackle in 1993 and 1996.

supply or reproductive abilities of resident species. Second, some local residents and guides believe the Dolly Varden and Arctic grayling populations have declined; such concerns may have merit and should not be overlooked. Third, though the small sample sizes do not permit us to draw any statistically valid conclusions, the length frequency distributions for both rainbow trout (Figure 3 and Appendix C1) and Dolly Varden (Figure 5) raise the possibility that significant changes could occur in the size composition of these populations.

From the small amount of subsistence fishing activity observed on the Aniak River during this study, there seems to be little immediate potential for conflicts between subsistence and sport anglers during much of the sport fishing season. There did not appear to be any competition for fishing sites or for fish. Most sport anglers fished in locations that have little potential for conflicts.

FUTURE STUDY AND REGULATORY CONSIDERATIONS

Angling effort is spread widely throughout the Aniak River drainage. It would be difficult and expensive to survey all portions of the fishery at current levels of effort. A survey of the sport fishery would be most feasible in the lower Aniak River from the outlet of the Buckstock River to the community of Aniak; or downstream from the ADF&G sonar site. Although surveying portions of the drainage would be more feasible, the results may not provide a useful picture of the fisheries.

The very few samples collected from sport harvested salmon make it difficult to characterize the recreational harvest. It would be difficult to design a creel survey capable of obtaining adequate numbers of samples from the current sport fishery.

Collecting adequate samples of fish is not easy in the Aniak River. Hoop traps were not particularly effective but might be used to supplement other capture methods for Dolly Varden and rainbow trout. More experimentation with this gear may be worthwhile.

Though no conflicts were discovered during the study, the sport fishery will probably increase, and with it the potential for land use and trespass conflicts. Conflicts could be avoided if the public could more easily obtain information on the locations of private property. Readily available copies of maps and a better publicized land-use permit system would probably help reduce trespass problems.

ACKNOWLEDGMENTS

I thank Wes Jones for his dedication and help in conducting the project field work. Wes and I are especially grateful to Scott Gibbens of the State Fish and Wildlife Protection Division for his advice and support throughout the project and for providing two aerial surveys in the area. Angie Morgan, Carl Morgan and Ray Peterson of Kuskokwim Native Association (KNA) provided helpful information. Mayor and Fish and Game Advisory Committee Chairman Herman Morgan helped us understand the routines of the local commercial and subsistence fisheries. Calvin Simeon's interest and concern for the Aniak River and suggestions for the study design were beneficial to the project as well. We thank the guides and lodge operators including Pete Brown, Larry Jarrett, Wayne Dawson, Lamont Albertson, Woody Wooderson, Rick Townsend, Paul Allred, and all others for their patience and willing cooperation during this study. Thanks to Terry Hoffman and Larry Frisby of Alaska Department of Transportation for providing storage space and vehicles. The encouragement and support provided by the residents of Aniak contributed significantly to the success of this project. Thank you.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1985. 1985 Alaska sport fishing regulations summary. Alaska Department of Fish and Game, Juneau.

ADF&G (Alaska Department of Fish and Game). 1995. 1995 Sport fishing regulations. Arctic-Yukon-Kuskokwim region. Alaska Department of Fish and Game, Juneau.

ADF&G (Alaska Department of Fish and Game). 1996. 1996 and 1997 Sport fishing regulations. Arctic-Yukon-Kuskokwim region. Alaska Department of Fish and Game, Juneau.

Clutter, R. I. and L. E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin IX of the International Pacific Salmon Fisheries Commission , New Westminster, British Columbia, Canada.

Cochran, W. G. 1977. Sampling techniques, third edition. John Wiley and Sons, New York.

Dunaway, Dan O. *Unpublished.* Aniak River sampling trip. Memo ANIAKMEM to Mac Minard, August 1993. Located at: Alaska Department of Fish and Game, Division of Sport Fish, Dillingham.

Francisco, R. K., K. Schultz, D. Schneiderhan, D. Huttunen, C. Whitmore. 1987. Annual management report, Kuskokwim Area, 1985-1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bethel.

Francisco, R. K., K. Schultz, D. J. Schneiderhan, D. Huttunen, and R. Cannon. 1988. Annual management report, Kuskokwim Area, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3B88-35, Bethel.

LITERATURE CITED (Continued)

Francisco, R. K., K. Schultz, D. J. Schneiderhan, D. Huttunen, C. Burkey, H. H. Hamner, and R. J. Walker. 1989. Annual management report, Kuskokwim Area, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 3B89-08. Anchorage.

Francisco, R. K., C. Anderson, C. Burkey Jr., M. Fogarty, D. B. Molyneaux, C. Utermole, and K. Vaught. 1995. Annual management report for the subsistence and commercial fisheries for the Kuskokwim Area 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, AYK Region. Regional Information Report No. 3A95-15, Anchorage.

Howe, Allen L., Gary Fidler, Allen E. Bingham, and Michael J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage.

Howe, Allen L., Gary Fidler, and Michael J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage.

Jearld, A., Jr. 1983. Age determination. Pages 301-324 in L. A. Nielsen, editors. Fisheries techniques. The American Fisheries Society, Bethesda, Maryland.

Lux, F. E. 1971. Age determination of fishes (revised). National Marine Fisheries Service. Fishery Leaflet 637. Seattle, Washington.

Mills, M. J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984. Project F-9-16, 25 (SW-1-A), Juneau.

Mills, M. J. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-1-A), Juneau.

Mills, M. J. 1986. Alaska statewide sport fish harvest studies (1985). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.

Mills, M. J. 1987. Alaska statewide sport fisheries harvest report 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.

Mills, M. J. 1988. Alaska statewide sport fisheries harvest report 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.

Mills, M. J. 1989. Alaska statewide sport fisheries harvest report 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau.

Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage.

Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.

Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.

Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.

Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.

Minard, R. E. and D. O. Dunaway. 1995. 1994 Area management report for the recreational fisheries of the Southwest Alaska sport fish management area. Alaska Department of Fish and Game, Fishery Management Report No. 95-2, Anchorage.

Sokal, R. R. and F. J. Rohlf. 1981. Biometry, second edition. W. H. Freeman and Company, New York.

LITERATURE CITED (Continued)

Welander, A. D. 1940. A study of the development of the scale of the chinook salmon (Oncorhynchus tshawytscha). Master's thesis, University of Washington, Seattle.

APPENDIX A. ANGLER COUNT DATA

Appendix A1.-Angler counts summarized by river section and date, 3 July to 5 August 1996.

Date	Type of Day	Count Time Start	End	Total	Anglers Counted
Section 1 mouth to sonar site.					
7/3/96	WE	11:30	19:45	8:15	22
7/4/96	WE	12:20	12:50	0:30	11
7/4/96	WE	17:00	18:15	1:15	13
7/5/96	WE	14:20	16:00	1:40	17
7/5/96	WE	16:30	18:30	2:00	9
7/6/96	WD	10:00	10:55	0:55	12
7/6/96	WD	18:10	19:20	1:10	5
7/8/96	WE	11:05	12:05	1:00	7
7/10/96	WE	18:00	19:05	1:05	5
7/11/96	WE	15:25	16:00	0:35	7
7/11/96	WE	16:10	17:25	1:15	9
7/12/96	WE	12:30	13:15	0:45	17
7/12/96	WE	17:05	19:05	2:00	9
7/14/96	WD	11:45	12:45	1:00	11
7/14/96	WD	20:25	21:00	0:35	1
7/15/96	WE	10:20	11:00	0:40	3
7/15/96	WE	19:10	19:50	0:40	9
7/16/96	WE	11:00	12:00	1:00	4
7/18/96	WE	18:45	19:25	0:40	5
7/21/96	WD	10:55	11:45	0:50	0
7/21/96	WD	19:20	20:00	0:40	4
7/22/96	WE	11:05	11:50	0:45	0
7/22/96	WE	19:05	19:50	0:45	0
7/24/96	WE	11:40	12:15	0:35	0
7/24/96	WE	19:15	19:45	0:30	0
7/28/96	WD	17:00	17:35	0:35	2
7/28/96	WD	17:35	18:10	0:35	2
7/29/96	WE	10:50	11:35	0:45	9
7/29/96	WE	18:10	19:05	0:55	2
7/30/96	WE	13:20	14:00	0:40	3
7/30/96	WE	21:10	21:45	0:35	0
7/31/96	WE	10:30	11:05	0:35	3
7/31/96	WE	20:55	21:30	0:35	0
8/2/96	WE	11:35	12:10	0:35	1
8/2/96	WE	20:15	20:40	0:25	0
8/5/96	WE	13:45	14:25	0:40	2
8/5/96	WE	19:45	20:25	0:40	1

-continued-

Appendix A1.-Page 2 of 3.

Date	Type of Day	Count Time Start	End	Total	Anglers Counted
Section 2 sonar site to Albertson's					
7/4/96	WE	12:50	14:00	1:10	15
7/4/96	WE	14:30	17:00	2:30	10
7/6/96	WD	11:15	14:45	3:30	4
7/6/96	WD	15:15	17:45	2:30	6
7/10/96	WE	14:20	17:30	3:10	2
7/12/96	WE	13:15	15:00	1:45	23
7/12/96	WE	16:20	17:00	0:40	7
7/14/96	WD	12:45	14:30	1:45	2
7/14/96	WD	18:20	20:20	2:00	9
7/15/96	WE	11:35	13:45	2:10	19
7/15/96	WE	17:30	18:55	1:25	0
7/18/96	WE	12:00	16:05	4:05	11
7/18/96	WE	13:20	18:45	5:25	19
7/21/96	WD	11:45	15:30	3:45	0
7/21/96	WD	16:50	19:00	2:10	3
7/22/96	WE	12:15	17:00	4:45	4
7/22/96	WE	18:05	18:35	0:30	1
7/24/96	WE	12:15	17:00	4:45	0
7/24/96	WE	17:35	18:30	0:55	0
7/29/96	WE	11:35	16:00	4:25	0
7/29/96	WE	16:55	18:00	1:05	0
7/30/96	WE	14:00	19:30	5:30	0
7/30/96	WE	19:30	21:05	1:35	0
7/31/96	WE	11:25	16:30	5:05	3
7/31/96	WE	17:20	20:55	3:35	3
8/2/96	WE	12:20	15:20	3:00	12
8/2/96	WE	16:50	20:15	3:25	4
8/5/96	WE	14:25	18:20	3:55	0
8/5/96	WE	19:00	19:45	0:45	0

-continued-

Appendix A1.-Page 3 of 3.

Date	Type of Day	Count Time Start	End	Total	Anglers Counted
Section 3 upstream from Albertson's					
7/8/96	WE	12:15	15:30	3:15	8
7/8/96	WE	16:10	18:05	1:55	10
7/10/96	WE	12:25	13:30	1:05	2
7/16/96	WE	17:00	19:00	2:00	8
7/18/96	WE	12:20	13:00	0:40	9
8/2/96	WE	15:20	16:00	0:40	6
8/2/96	WE	16:20	16:50	0:30	6
Section 5 Aniak town beach					
7/4/96	WE	12:00	12:15	0:15	3
7/4/96	WE	18:15	18:30	0:15	8
7/5/96	WD	14:00	14:15	0:15	4
7/6/96	WE	9:50	10:00	0:10	2
7/8/96	WD	10:50	10:55	0:05	3
7/8/96	WD	11:00	11:05	0:05	4
7/11/96	WD	15:20	15:25	0:05	2
7/11/96	WD	17:30	17:35	0:05	2
7/12/96	WD	19:05	19:15	0:10	1
7/14/96	WE	11:25	11:30	0:05	1
7/14/96	WE	11:35	11:40	0:05	1
7/15/96	WD	9:50	9:55	0:05	3
7/15/96	WD	9:55	10:10	0:15	3
7/16/96	WD	10:00	11:00	1:00	3
7/16/96	WD	10:35	11:45	1:10	4
7/16/96	WD	20:00	20:10	0:10	12
7/24/96	WD	11:25	11:40	0:15	2
7/24/96	WD	19:45	19:50	0:05	14
7/24/96	WD	19:55	20:00	0:05	10
7/27/96	WE	13:10	13:20	0:10	6
7/27/96	WE	16:15	17:40	1:25	9
7/27/96	WE	21:45	22:50	1:05	7
7/28/96	WE	13:30	14:00	0:30	1
7/28/96	WE	17:30	18:00	0:30	6
7/30/96	WD	13:05	13:10	0:05	1
7/30/96	WD	13:15	13:20	0:05	0
7/30/96	WD	21:45	21:50	0:05	4
7/30/96	WD	21:50	21:55	0:05	3
7/31/96	WD	10:00	10:05	0:05	0
8/2/96	WD	11:20	11:25	0:05	0
8/2/96	WD	11:30	11:35	0:05	0
8/2/96	WD	20:45	20:50	0:05	0
8/3/96	WE	14:55	15:00	0:05	0
8/3/96	WE	20:55	21:05	0:10	1
8/4/96	WE	14:30	14:40	0:10	0
8/4/96	WE	20:00	20:15	0:15	3
8/5/96	WD	13:35	13:40	0:05	0

APPENDIX B. ANGLER INTERVIEW DATA

Appendix B1.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for chinook and chum salmon, Dolly Varden, rainbow trout and Arctic grayling reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

	Anglers		Chinook Salmon			Chum Salmon			Dolly Varden			Rainbow Trout			Arctic Grayling		
Date	Inter-viewed	Hours Fished	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch
Section 1 River Mouth to Sonar Site																	
7/4/96	13	72.1	14	22	36	0	18	18	0	1	1	0	0	0	0	0	0
7/5/96	9	29.8	5	14	19	0	0	0	0	1	1	1	2	3	0	0	0
7/6/96	8	19.2	0	7	7	0	3	3	0	1	1	0	0	0	0	0	0
7/10/96	5	31.7	8	6	14	0	2	2	0	6	6	0	0	0	0	0	0
7/11/96	9	55.8	7	16	23	1	7	8	1	3	4	0	0	0	0	0	0
7/12/96	8	51.8	2	10	12	1	2	3	0	2	2	0	0	0	0	0	0
7/14/96	5	9.8	0	3	3	0	1	1	0	0	0	0	1	1	0	0	0
7/15/96	4	24.0	0	0	0	0	13	13	0	3	3	0	2	2	0	3	3
7/16/96	4	14.0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7/28/96	2	4.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/29/96	2	12.0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
8/2/96	1	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/5/96	1	3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Section Total	71	330.3	37	78	115	2	47	49	1	17	18	1	5	6	0	3	3

-continued-

Appendix B1.-Page 2 of 3.

Date	Anglers Interviewed	Hours Fished	Chinook Salmon Kept	Chinook Salmon Released	Chinook Salmon Total Catch	Chum Salmon Kept	Chum Salmon Released	Chum Salmon Total Catch	Dolly Varden Kept	Dolly Varden Released	Dolly Varden Total Catch	Rainbow Trout Kept	Rainbow Trout Released	Rainbow Trout Total Catch	Arctic Grayling Kept	Arctic Grayling Released	Arctic Grayling Total Catch
Section 2 Sonar Site to Albertson's Camp																	
7/4/96	10	37.5	6	7	13	1	16	17	2	33	35	0	2	2	0	1	1
7/6/96	6	9.2	0	1	1	0	2	2	0	3	3	0	7	7	0	0	0
7/8/96	9	31.5	4	7	11	2	23	25	0	42	42	0	14	14	0	5	5
7/10/96	14	64.3	1	26	27	0	26	26	0	48	48	0	20	20	0	4	4
7/12/96	8	30.9	0	1	1	0	8	8	0	46	46	0	21	21	0	17	17
7/14/96	11	46.6	2	5	7	0	33	33	0	41	41	0	0	0	0	15	15
7/15/96	12	40.3	9	24	33	2	37	39	0	1	1	0	7	7	0	0	0
7/16/96	7	23.5	2	16	18	0	57	57	0	2	2	0	3	3	0	1	1
7/18/96	8	30.2	0	1	1	0	1	1	0	92	92	0	31	31	0	19	19
7/22/96	2	1.5	0	0	0	0	7	7	0	0	0	0	0	0	0	0	0
7/24/96	4	4.0	0	1	1	0	2	2	0	1	1	0	0	0	0	0	0
7/31/96	3	4.5	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0
8/2/96	13	45.5	0	1	1	0	4	4	0	3	3	0	4	4	0	0	0
Section Total	107	369.5	24	90	114	5	216	221	2	313	315	0	110	110	0	62	62

-continued-

Appendix B1.- Page 3 of 3.

Date	Anglers Interviewed	Hours Fished	Chinook Salmon Kept	Chinook Salmon Released	Chinook Salmon Total Catch	Chum Salmon Kept	Chum Salmon Released	Chum Salmon Total Catch	Dolly Varden Kept	Dolly Varden Released	Dolly Varden Total Catch	Rainbow Trout Kept	Rainbow Trout Released	Rainbow Trout Total Catch	Arctic Grayling Kept	Arctic Grayling Released	Arctic Grayling Total Catch
Section 3 Upstream of Albertson's Camp																	
7/8/96	10	64.3	1	9	10	0	15	15	0	36	36	0	22	22	0	11	11
7/10/96	9	28.0	0	28	28	0	7	7	0	29	29	0	25	25	0	13	13
7/17/96	13	58.0	0	2	2	0	6	6	0	58	58	0	28	28	0	89	89
8/2/96	2	4.5	0	0	0	0	0	0	0	5	5	0	2	2	0	0	0
Section Total	34	154.8	1	39	40	0	28	28	0	128	128	0	77	77	0	113	113
Aniak River																	
Total	212	854.6	62	207	269	7	291	298	3	458	461	1	192	193	0	178	178
Section 5 Aniak Town Beach (Kuskokwim River)																	
7/4/96	1	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/6/96	2	3.0	0	3.00	3.00	0	0	0	0	0	0	0	0	0	0	0	0
7/11/96	4	5.5	3.00	1.00	4.00	0	0	0	0	0	0	0	0	0	0	0	0
7/14/96	3	2.5	0	0	0	0	4.00	4.00	0	0	0	0	0	0	0	0	0
7/15/96	3	2.3	0	1.00	1.00	0	0	0	0	0	0	0	0	0	0	0	0
7/24/96	1	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/27/96	10	28.3	0	0	0	1.00	7.00	8.00	0	0	0	0	0	0	0	0	0
8/3/96	1	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/4/96	3	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Section Total	28	46.3	3	5	8	1	11	12	0	0	0	0	0	0	0	0	0
Study Summary																	
Total	240	900.9	65	212	277	8	302	310	3	458	461	1	192	193	0	178	178
Average hours fished/angler		3.8															
		0.1															
Fish kept or caught/hour			<0.1		0.3	<0.1		0.4	<0.1		0.5	<0.1		0.2	0		0.2
		SE	<0.1		0.1	<0.1		0.1	<0.1		0.1	<0.1		<0.1	0		<0.1
SE																	

Appendix B2.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for coho and sockeye salmon, sheefish and northern pike reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

Date	Anglers Interviewed	Hours Fished	Coho Salmon Kept	Coho Salmon Released	Coho Salmon Total Catch	Sockeye Salmon Kept	Sockeye Salmon Released	Sockeye Salmon Total Catch	Sheefish Kept	Sheefish Released	Sheefish Total Catch	Northern Pike Kept	Northern Pike Released	Northern Pike Total Catch
Section 1 River Mouth to Sonar Site														
7/4/96	13	72.1	0	0	0	0	0	0	0	0	0	0	0	0
7/5/96	9	29.8	0	0	0	0	0	0	0	0	0	0	1	1
7/6/96	8	19.2	0	0	0	0	0	0	0	0	0	0	0	0
7/10/96	5	31.7	0	0	0	0	0	0	0	0	0	0	0	0
7/11/96	9	55.8	0	0	0	0	0	0	0	0	0	0	1	1
7/12/96	8	51.8	0	0	0	0	0	0	0	0	0	0	1	1
7/14/96	5	9.8	0	0	0	0	0	0	0	0	0	0	2	2
7/15/96	4	24.0	0	0	0	0	0	0	0	0	0	0	0	0
7/16/96	4	14.0	0	0	0	0	0	0	0	0	0	0	0	0
7/28/96	2	4.0	4	0	4	0	0	0	0	0	0	0	0	0
7/29/96	2	12.0	3	9	12	0	0	0	0	0	0	0	0	0
8/2/96	1	3.0	0	0	0	0	0	0	0	0	0	0	0	0
8/5/96	1	3.1	0	1	1	0	0	0	0	0	0	0	0	0
Section Total	71	330.3	7	10	17	0	0	0	0	0	0	0	5	5

- continued -

Appendix B2.-Page 2 of 3.

Date	Anglers Interviewed	Hours Fished	Coho Salmon Kept	Coho Salmon Released	Coho Salmon Total Catch	Sockeye Salmon Kept	Sockeye Salmon Released	Sockeye Salmon Total Catch	Sheefish Kept	Sheefish Released	Sheefish Total Catch	Northern Pike Kept	Northern Pike Released	Northern Pike Total Catch
Section 2 Sonar Site to Albertson's Camp														
7/4/96	10	37.5	0	0	0	0	0	0	0	1	1	0	0	0
7/6/96	6	9.2	0	0	0	0	0	0	0	0	0	0	0	0
7/8/96	9	31.5	0	0	0	0	0	0	0	0	0	0	0	0
7/10/96	14	64.3	0	0	0	0	0	0	0	0	0	0	0	0
7/12/96	8	30.9	0	0	0	0	0	0	0	0	0	0	0	0
7/14/96	11	46.6	0	0	0	0	0	0	0	0	0	0	0	0
7/15/96	12	40.3	0	0	0	0	0	0	0	0	0	0	0	0
7/16/96	7	23.5	0	0	0	0	0	0	0	0	0	0	0	0
7/18/96	8	30.2	0	0	0	0	0	0	0	0	0	0	0	0
7/22/96	2	1.5	0	0	0	0	0	0	0	0	0	0	0	0
7/24/96	4	4.0	0	0	0	0	0	0	0	0	0	0	0	0
7/31/96	3	4.5	0	0	0	0	0	0	0	0	0	0	0	0
8/2/96	13	45.5	0	0	0	0	1	1	0	0	0	0	0	0
Section Total	107	369.5	0	0	0	0	1	1	0	1	1	0	0	0

-continued-

Appendix B2.-Page 3 of 3.

Date	Anglers Interviewed	Hours Fished	Coho Salmon Kept	Coho Salmon Released	Coho Salmon Total Catch	Sockeye Salmon Kept	Sockeye Salmon Released	Sockeye Salmon Total Catch	Sheefish Kept	Sheefish Released	Sheefish Total Catch	Northern Pike Kept	Northern Pike Released	Northern Pike Total Catch
Section 3 Upstream of Albertson's Camp														
7/8/96	10	64.3	0	0	0	0	0	0	0	0	0	0	0	0
7/10/96	9	28.0	0	0	0	0	0	0	0	0	0	0	0	0
7/17/96	13	58.0	0	3	3	0	1	1	0	0	0	0	0	0
8/2/96	2	4.5	0	0	0	0	1	1	0	0	0	0	0	0
Section Total	34	154.8	0	3	3	0	2	2	0	0	0	0	0	0
Aniak River														
Total	212	854.6	7	13	20	0	3	3	0	1	1	0	5	5
Section 5 Aniak Town Beach (Kuskokwim River)														
7/4/96	1	1.0	0	0	0	0	0	0	0	0	0	0	0	0
7/6/96	2	3.0	0	0	0	0	0	0	0	0	0	0	0	0
7/11/96	4	5.5	0	0	0	0	0	0	0	0	0	0	0	0
7/14/96	3	2.5	0	0	0	0	0	0	0	0	0	0	0	0
7/15/96	3	2.3	0	0	0	0	0	0	0	0	0	0	0	0
7/24/96	1	1.0	1	1	2	0	0	0	0	0	0	0	0	0
7/27/96	10	28.3	15	20	35	0	0	0	1	0	1	0	0	0
8/3/96	1	0.5	0	0	0	0	0	0	0	0	0	0	0	0
8/4/96	3	2.2	0	0	0	0	0	0	0	0	0	0	0	0
Section Total	28	46.3	16	21	37	0	0	0	1	0	1	0	0	0
Study Summary All sections														
Total	240	900.9	23	34	57	0	3	3	1	1	2	0	5	5
Average hours fished/angler														
SE		0.1												
Fish kept or caught/hour			0.1		0.1	0		<0.1	<0.1		<0.1	0		<0.1
SE			<0.1		<0.1	0		<0.1	<0.1		<0.1	0		<0.1

APPENDIX C. AGE AND SIZE FROM RAINBOW TROUT AND GRAYLING COLLECTED IN 1993

Appendix C1.-Mean lengths and weights of rainbow trout, by age group, from samples collected using hook-and-line gear in the Aniak River, 23 July through 30 August 1993.

	Age Group									
	UNKNOWN	3	4	5	6	7	8	9	10	TOTAL
Percent		1.3	6.5	28.6	18.2	9.1	14.3	14.3	7.8	100.0
SE		1.3	2.8	5.2	4.4	3.3	4.0	4.0	3.1	
Sample Size (known age)		1	5	22	14	7	11	11	6	77
Mean Length (mm)	485	263	337	395	429	450	475	493	505	452
SE	9		8	6	13	14	8	9	16	6
Sample Size	40	1	5	22	14	7	11	11	6	117
Mean Weight (g)	1,350	230	476	750	885	1,087	1,253	1,304	1,554	1,081
SE	100.7		27.7	28.5	54.5	117.6	81.6	113.5	183.3	52.3
Sample Size	21	1	5	17	6	4	6	7	5	72

Appendix C2.-Mean lengths of Arctic grayling, by age group, from samples collected using hook-and-line gear from the Aniak River, 29 July to 8 August 1993.

	Age Group								
	UNKNOWN	3	4	5	6	7	8	9	TOTAL
Percent		2.5	8.6	28.4	28.4	14.8	8.6	8.6	100.0
SE		1.7	3.1	5.0	5.0	4.0	3.1	3.1	
Sample Size (known age)		2	7	23	23	12	7	7	81
Mean Length (mm)	337	231	286	326	334	345	372	385	334
SE		6	8	4	3	5	10	4	4
Sample Size	1	2	7	23	23	12	7	7	82

APPENDIX D. DATA FILES AND COMPUTER PROGRAMS USED TO PRODUCE THIS REPORT

Appendix D1.-Data files and computer programs used to produce this report.

Data Files	
Angler count data:	
V0050CA6.DTA	Aniak River and Aniak "town beach" angler counts.
Angler interview data:	
V0050IA6.DTA	Aniak River angler interviews.
V005EIA6.DTA	Aniak "town beach" angler interviews.
V278IA6.DTA	Salmon River angler interviews.
Biological data:	
V0050BA6.DTA	Aniak River rainbow trout data.
V0050BB6.DTA	Aniak River area sport harvested chinook salmon data.
V0050BC6.DTA	Aniak River area sport harvested chum salmon data.
V0050BD6.DTA	Aniak River area sport harvested sockeye salmon data.
V0050BE6.DTA	Aniak River area sport harvested coho salmon data.
V0050BF6.DTA	Aniak River Arctic grayling data.
V0050BG6.DTA	Aniak River Dolly Varden data.
V198OBA6.DTA	Holokuk River Dolly Varden data.
V1980BB6.DTA	Holokuk River Arctic grayling data.

Analysis Programs	
CC91	A series of programs which sort raw data files and produce frequency reports and assist data editing. The programs also summarize some of the raw data.
BBXPEXE	A series of programs that uses data files in standard Age, Weight, Length format to produce tables of mean lengths and weights by sex and age group.
DOINT90	A set of Dbase® programs that reformats standard angler interview data files into a single row of data for each interview.

Table 6.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for chinook and chum salmon, Dolly Varden, rainbow trout and Arctic grayling reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

	Anglers		Chinook Salmon			Chum Salmon			Dolly Varden			Rainbow Trout			Arctic Grayling		
	Inter-viewed	Hours Fished	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch
Section 1 River Mouth to Sonar	71	330.3	37	78	115	2	47	49	1	17	18	1	5	6	0	3	3
Section 2 Sonar Site to Albertson's	107	369.5	24	90	114	5	216	221	2	313	315	0	110	110	0	62	62
Section 3 Upstream of Albertson's Camp	34	154.8	1	39	40	0	28	28	0	128	128	0	77	77	0	113	113
Aniak River Subtotal	212	854.6	62	207	269	7	291	298	3	458	461	1	192	193	0	178	178
Section 5 Aniak Town Beach (Kuskokwim River)	28	46.3	3	5	8	1	11	12	0	0	0	0	0	0	0	0	0
Study Summary All sections Total	240	900.9	65	212	277	8	302	310	3	458	461	1	192	193	0	178	178
Average hours fished/angler																	
SE		0.1															
		3.8															
Fish kept or caught/hour			<0.1		0.3	<0.1		0.4	<0.1		0.5	<0.1		0.2	0		0.2
SE			<0.1		0.1	<0.1		0.1	<0.1		0.1	<0.1		<0.1	0		<0.1

Table 7.-Summary of effort, harvest (fish kept), and catch (fish kept + fish released) for coho and sockeye salmon, sheefish and northern pike reported by anglers participating in the Aniak River area sport fishery, 3 July through 5 August 1996.

	Anglers		Coho Salmon			Sockeye Salmon			Sheefish			Northern Pike		
	Inter-viewed	Hours Fished	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch	Kept	Released	Total Catch
Section 1 River Mouth to Sonar														
	71	330.3	7	10	17	0	0	0	0	0	0	0	5	5
Section 2 Sonar Site to Albertson's Camp														
	107	369.5	0	0	0	0	1	1	0	1	1	0	0	0
Section 3 Upstream of Albertson's Camp														
	34	154.8	0	3	3	0	2	2	0	0	0	0	0	0
Aniak River														
Subtotal	212	854.6	7	13	20	0	3	3	0	1	1	0	5	5
Section 5 Aniak Town Beach (Kuskokwim River)														
	28	46.3	16	21	37	0	0	0	1	0	1	0	0	0
Study Summary All sections														
Total	240	900.9	23	34	57	0	3	3	1	1	2	0	5	5
Average hours fished/angler														
SE		0.1												
Fish kept or caught/hour			0.1		0.1	0		<0.1	<0.1		<0.1	0		<0.1
SE			<0.1		<0.1	0		<0.1	<0.1		<0.1	0		<0.1