

**Fishery Data Series No. 97-19**

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# **The 1996 Delta Clearwater River Creel Survey**

by

**Jerome E. Hallberg**

and

**Allen E. Bingham**

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September 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 <sup>3</sup> /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 <sub>A</sub>
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, $\chi^2$ , 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 <sub>2</sub> , etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H <sub>0</sub>
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

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## ABSTRACT

A creel survey was conducted at the Delta Clearwater Arctic grayling *Thymallus arcticus* fishery during 1996. A single access survey with information obtained from individual (completed-trip) anglers was used to describe the age and length compositions of the Arctic grayling harvest along with angler ratings of the quality of fishing at the Delta Clearwater River fishery. At the Delta Clearwater River, 70% (SE = 3%) of the Arctic grayling sampled in the harvest were of the “preferred” Relative Stock Density (RSD) length category. Age 6 Arctic grayling comprised 35% (SE = 3%) of the harvest sample. Sixty-five percent (SE = 2%) of those anglers interviewed who expressed an opinion as to the quality of fishing at the Delta Clearwater River rated the quality of fishing as “good” and 28% (SE = 2%) rated the fishery as “excellent”.

Key words: Creel survey, Arctic grayling, age composition, Relative Stock Density, Delta Clearwater River, interior Alaska, Tanana River drainage.

## INTRODUCTION

The Arctic-Yukon-Kuskokwim (AYK) Region encompasses an area that covers almost two-thirds of the State of Alaska and includes all of Alaska north of Bristol Bay and the Alaska Range (Figure 1). Within this area, the state's largest river systems (Yukon, Kuskokwim, Colville, and Noatak) are found, along with thousands of lakes, and thousands of miles of streams. These waters support a large number of recreational fisheries for both freshwater and anadromous fish species that include Arctic cisco *Coregonus autumnalis*, Arctic char *Salvelinus alpinus*, Arctic grayling *Thymallus arcticus*, anadromous chinook salmon *Oncorhynchus tshawytscha*, anadromous and land-locked coho salmon *O. kisutch*, anadromous chum salmon *O. keta*, burbot *Lota lota*, Dolly Varden *S. malma*, humpback whitefish *C. pidschian*, lake trout *S. namaycush*, least cisco *C. sardinella*, northern pike *Esox lucius*, rainbow trout *O. mykiss*, round whitefish *Prosopium cylindraceum*, and sheefish *Stenodus leucichthys*.

Even though the AYK Region encompasses a very large area, the majority (approximately 75%) of the recreational angler effort and harvest occurs near the major population centers (Fairbanks, Delta Junction, and Tok) within the Tanana River drainage (Mills 1979-1994 and Howe et al. 1995).

Monitoring of the Tanana River drainage recreational fisheries is important to evaluate the effectiveness of the newly-imposed restrictive regulations on indigenous fish populations. Conservation of indigenous stocks is desired in interior Alaska and one method of assessing the success of conservation efforts is through the use of creel surveys.

The long term goals of the creel survey program are to: (1) develop historical databases to allow monitoring of both the recreational fisheries and the exploited fish populations; (2) develop regulations that reflect the desires of the angling public while ensuring the sustained health of the resource; and (3) estimate the effects of management regulations on the fisheries, fish populations, and recreational angling public.

During 1996, the Delta Clearwater River recreational fishery was surveyed to collect information on the size and age composition of harvested Arctic grayling. A comprehensive analysis of data from this creel survey, conducted by the Alaska Department of Fish and Game (ADF&G) in the AYK Region is presented in this report.

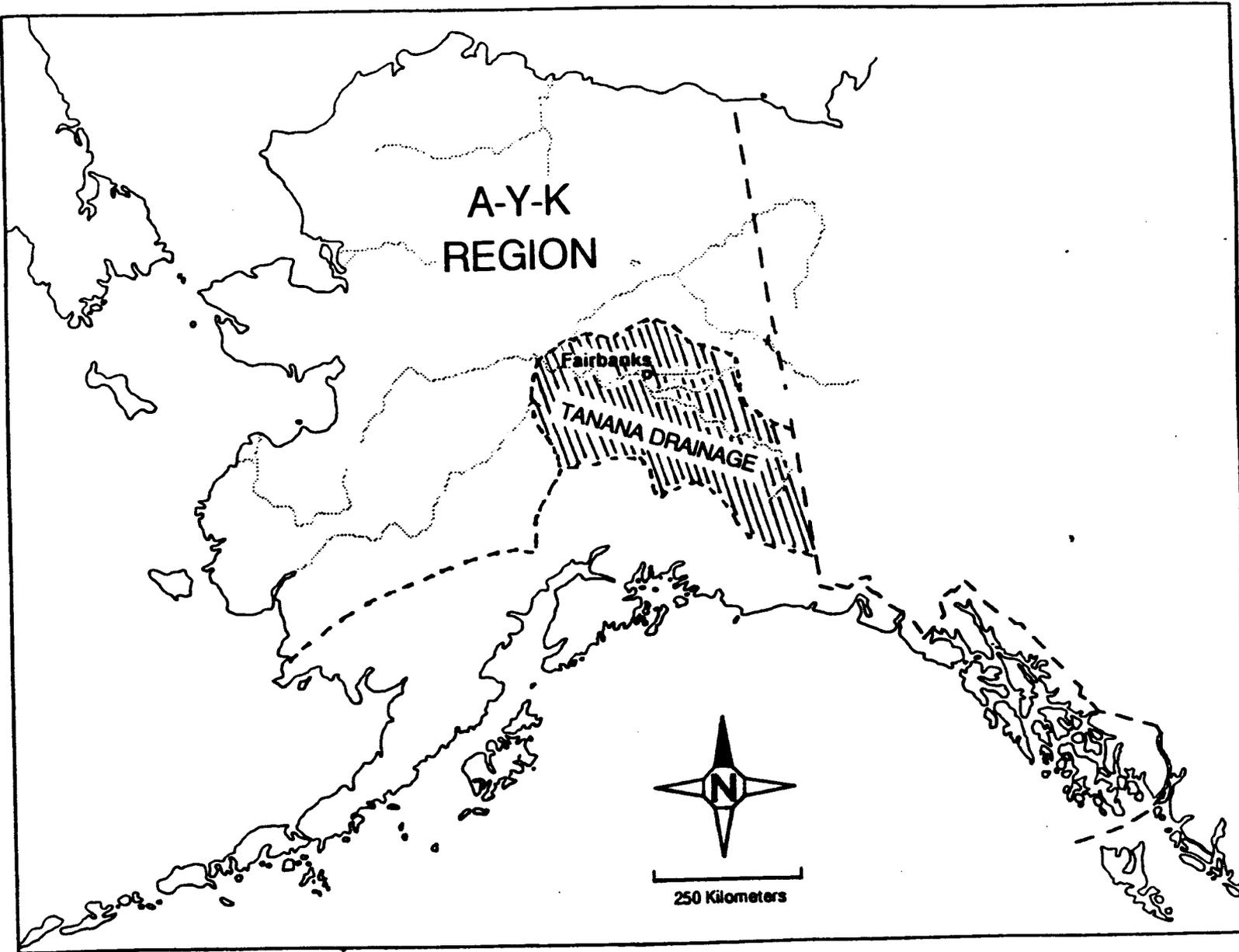


Figure 1.-Map of Arctic-Yukon-Kuskokwim (AYK) Region and Tanana River drainage, Alaska.

The Delta Clearwater River located approximately 13 km northeast of Delta Junction supports a popular Arctic grayling fishery during the summer months. The main channel of the river is approximately 32 km long. The river drains an area of about 1,000 km<sup>2</sup>. Public access to the river is available at the State of Alaska Clearwater Campground at kilometer 13 of the river (Figure 2).

Fishing generally begins on the Delta Clearwater River in mid to late May, when larger Arctic grayling begin to migrate to their summer feeding areas in the upper part of the river. From 1977 to 1988, an average of 6,340 angler-days were expended annually to harvest an average 5,158 Arctic grayling (Mills 1979-1989). Angler effort peaked in 1986 at 10,137 angler-days. However, in 1986, harvest dropped to the lowest level (2,343) since 1977. Because of concern for the fishery and the decline in harvest, emergency regulations were set forth on the Delta Clearwater River to protect the Arctic grayling stock(s) in 1987. These emergency regulations became permanent regulations in 1988 and remain in effect today. The regulations implemented were:

1. a 12-inch minimum length limit for Arctic grayling;
2. a no-bait restriction (only artificial flies and lures may be used); and,
3. catch-and-release fishing from 1 April through 1 June (spring closure).

#### **OBJECTIVE**

To examine the effects of these new regulations, an onsite creel survey was initiated on the Delta Clearwater River grayling fishery in 1986 and continued until 1990. Since 1991 the ADF&G has relied upon the Statewide Harvest Survey to provide estimates of catch, harvest and angler effort for Arctic grayling in the Delta Clearwater River. However, the Statewide Harvest Survey does not provide data on the age and size compositions of the harvest. In 1994 the onsite creel survey was reinstated with the objective of obtaining information on the size and age compositions of the harvest of Arctic grayling from the Delta Clearwater River. The objectives used during the 1994 creel survey were again used for the 1995 Delta Clearwater River Arctic grayling creel survey. On July 13, 1995, when grayling exploitation was predicted to exceed sustainable levels, managers issued an emergency order reducing the daily bag and possession for Arctic grayling in the Delta Clearwater River from five fish down to two. This regulation remained in affect for the rest of the 1995 season and during the entire 1996 fishing season. The specific objective for the 1996 Delta Clearwater River creel survey is listed below.

1. Estimate of the percent age composition and percent Relative Stock Density (RSD) for Arctic grayling harvested in the Delta Clearwater River sport fishery:
  - a) such that the percent age composition for each age class are within 7.5 percentage points of the true percentages 95% of the time; and,
  - b) the percent Relative Stock Density (RSD) for each length categorization are within 7.5 percentage points of the true percentages 95% of the time.

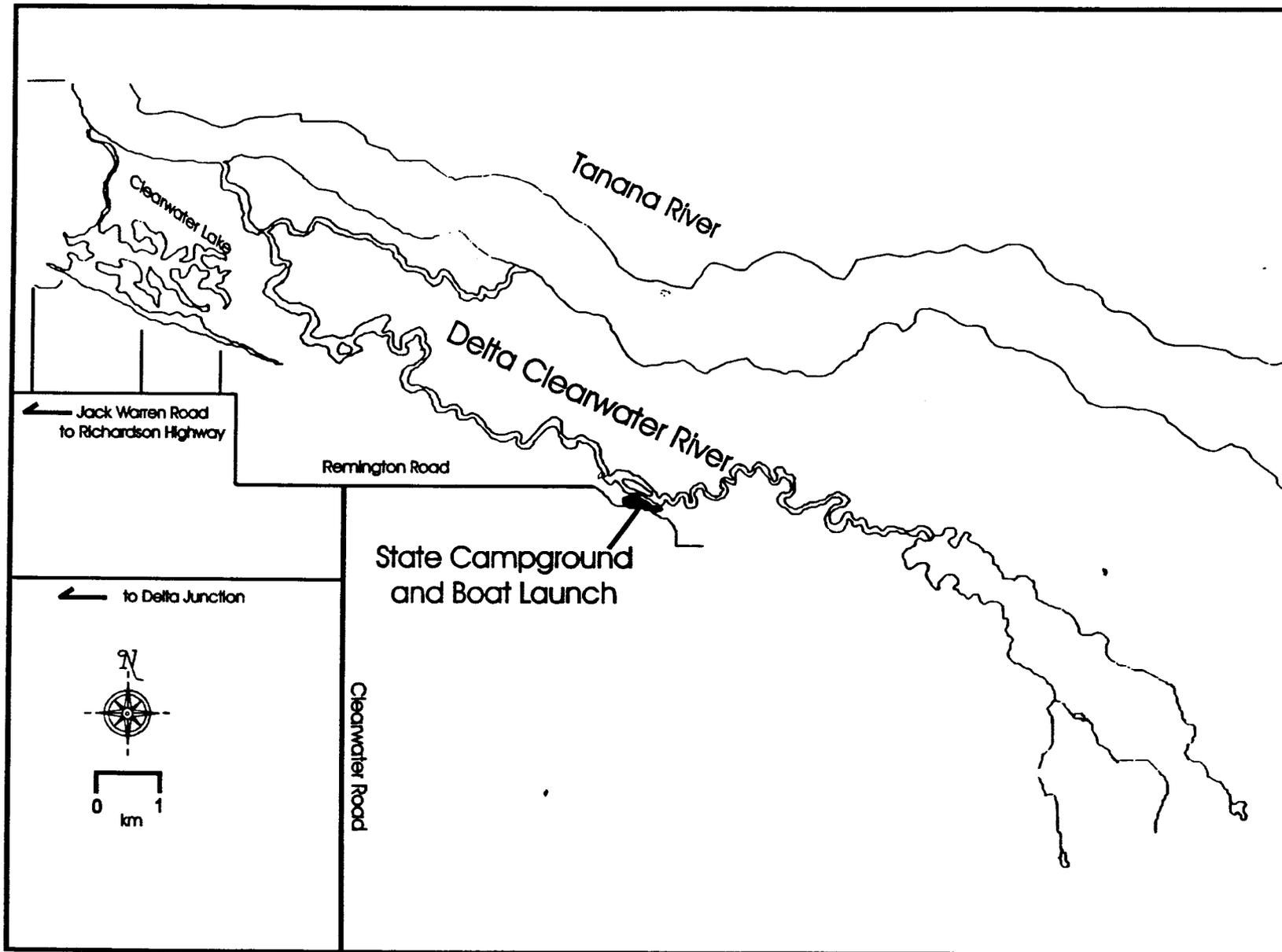


Figure 2.-Map of the Delta Clearwater River, Tanana River drainage, Alaska.

## METHODS

### STUDY DESIGN

A single access survey with information obtained from interviews of individual (completed-trip) anglers was used to estimate all parameters. The majority of anglers fishing the Delta Clearwater River gain access to the river at the State of Alaska Clearwater Campground, consequently all angler interviews were conducted at this location.

In order to maximize angler contacts, sampling was conducted during those times (days and hours) when the most angler-trips and subsequently the most catch and harvest had occurred in the past.

Evaluation of the most recent (1990) full-coverage creel survey conducted at the Delta Clearwater River indicated that 83% of the anglers interviewed and 60% of the angling effort (angler-hours) occurred on the weekend days, Friday, Saturday and Sunday (Hallberg and Bingham 1991). The 1990 data also showed that 80% of the angler interviews and 63% of the angling effort (angler-hours) occurred between 1500 and 2200 hours. Consequently, the creel surveys used in 1994 and 1995 at the Delta Clearwater River focused all its sampling on these periods of heavy use. A similar study design was used during 1996, however, with the decrease in the daily limit for Arctic grayling (from five down to two fish) it was decided that more angler interviews (resulting in more fish sampled) were needed to obtain the appropriate sample sizes to meet the stated objectives.

To maximize angler contacts, the creel clerk interviewed all anglers who had completed fishing and exited the campground area between 1300 to 2200 hours every Friday, Saturday, and Sunday from 1 June through 31 August 1996. However, in order to bolster the number of fish sampled, interviews were also conducted between 1700 and 2200 hours on two consecutive weekdays each week for the duration of the creel survey. The time of day was selected after again reviewing the 1990 data which showed that by sampling at these times (1700 through 2200 hours) during the week day period we would maximize angler contacts. This procedure was primarily directed at obtaining a consistent proportional sample of the harvest throughout the survey, and secondarily at obtaining the maximum number of samples possible.

### DATA COLLECTION

The creel survey at the Delta Clearwater River in 1996 focused on obtaining size (RSD) and age composition data from Arctic grayling harvested by those anglers who had completed fishing and were exiting the Delta Clearwater River at the State of Alaska Clearwater Campground. During the interview the creel clerk measured all Arctic grayling to the nearest mm (fork length) and collected a scale sample for age determination. Scale samples were collected from the preferred area approximately six rows above the lateral line just posterior to the insertion of the dorsal fin (W. Ridder, ADF&G, Delta Junction, unpublished information on refinement of methods described by Brown 1943). In the laboratory, the scales samples were processed by immersion in a solution of hot water, soap and hydrolytic enzyme and then mounted on gum cards. Impressions of the scales were made on triacetate film using a scale press (30 s at 137,895 kPa, 20,000 psi, at a temperature of 97°C). Ages were then determined by counting the annuli on these impressions with the aid of a microfiche reader. An individual fish's age was determined only once for each readable set of scales.

The creel clerk recorded the fish's length, date and location of capture and any other pertinent information directly onto the coin (scale) envelopes. This information was then transferred to mark-sense forms, to be read by an optical-character reader and converted to a standard format data file.

All interview data were recorded on mark-sense forms. All age and length data, along with the interview data has been archived (Appendix A1).

## DATA ANALYSIS

Estimates of age composition for the sampled Arctic grayling were calculated. All data were treated as if they were obtained by a simple random sampling procedure. The age composition data collected from the sampled harvest at Delta Clearwater River were assumed to be the result of a self-weighting sample survey (i.e., equal proportions of the harvest sampled throughout the survey). Accordingly, the resultant age composition estimates should be unbiased for the entire harvest during the surveyed period in 1996.

The proportion of the sampled Arctic grayling harvested that are age  $u$  was estimated by:

$$\hat{p}_u = \frac{n_u}{n} \quad (1)$$

where:  $n_u$  equaled the number of the sampled Arctic grayling that were age  $u$ ; and  $n$  equaled the total number of Arctic grayling sampled for age determination.

The variance of the estimated proportion was estimated by the standard equation for the variance of a binomial proportion (Cochran 1977, equation 3.8, page 52, omitting the finite population correction factor):

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

Standard errors were calculated by taking the square root of the variance estimates.

Estimates of age composition in percentages were calculated simply as the proportions multiplied by 100% (the same conversion is used for the standard errors).

Size composition was estimated in a similar manner, replacing age class with the RSD categories of Gabelhouse (1984) for Arctic grayling. The RSD categories used were: "stock" (150 to 269 mm FL); "quality" (270 to 339 mm FL); "preferred" (340 to 449 mm FL); "memorable" (450 to 559 mm FL); and, "trophy" (greater than 559 mm FL).

Estimates of the proportion of angler-trips by demographic, gear type, or angler satisfaction categories were also calculated as described above. The various categories represented the ages (the  $u$  subscript) and the number of anglers interviewed represented the sample size ( $n$ ) in equations (1) and (2). As with the age and size composition estimates, the estimates obtained by these procedures were assumed to be unbiased if the survey is of the self-weighted type as designed. However, since the schedule only called for sampling on selected days of the week, then estimates of angler demographics may be slightly biased if the make-up of the fishery varies among the days in the week. Avid anglers (anglers who fish more often than less-avid anglers) were more likely to be interviewed than less-avid anglers. Therefore these estimates are assumed to be only representative of angler-trips not anglers.

## RESULTS

The 1996 creel survey began on 1 June and was terminated on 25 August. Sampling occurred as scheduled between 1300 and 2200 hours on every Friday, Saturday and Sunday; and between 1700 and 2200 hours for two consecutive week days (either Monday and Tuesday, or, Wednesday and Thursday) for the duration of the survey. Interviews were obtained only from those anglers who had completed fishing and were exiting the Delta Clearwater River at the State of Alaska Clearwater River campground.

Scale samples were collected from a total of 250 Arctic grayling, of which 22 (8%) were regenerated scales and were judged to be illegible. Harvested Arctic grayling ranged in age from 3 to 13 years. Age 6 was the predominant age class accounting for 35% (SE = 3%) of the harvest (Table 1).

Length data were collected from 251 Arctic grayling. The predominant RSD category for the harvested Arctic grayling was preferred, comprising 70% (SE = 3%) of the harvest (Table 1). Twenty-six percent (SE = 3%) of the harvest was of the quality category. Four percent (SE = 1%) of the fish were in the memorable category and no fish were harvested in the trophy category.

A total of 588 anglers were interviewed during this period. Of those anglers interviewed 79% (SE = 2%) were male, 85% were adult (SE = 1%), and 70% were residents of Alaska (SE = 2%). Only 2% (SE = 1%) of those interviewed were military personal, permanently stationed in Alaska. Fifty-eight percent (SE = 2%) of those anglers interviewed were using fly fishing gear.

Of the 588 anglers interviewed, only 14 had no opinion as to the quality of fishing at the Delta Clearwater River.

Of the 574 anglers expressing an opinion, 28% (SE = 2%) rated the fishery as excellent, 65% (SE = 2%) rated it as good, 6% (SE = 1%) rated it fair, and only 1% (SE = 1%) rated the fishery as poor.

## DISCUSSION

The main emphasis of the 1996 creel survey of the Delta Clearwater River Arctic grayling fishery was to obtain age and size compositions of the harvest. The creel survey began as scheduled on 1 June and was to run through the month of August. However, because angling effort had declined dramatically, the survey ended six days early on 25 August. Our concern over ending the survey at this time was lessened because the required sample sizes to meet the objectives had been met. A total of 588 completed-trip angler interviews were obtained, during which a total of 250 and 251 samples were collected for age and length composition, respectively. The sample size necessary to meet the objective criteria for estimating the length (RSD) and age composition of the Arctic grayling harvest was set at 239 fish. The decision to expand the sampling period to include two consecutive weekdays (Monday through Thursday) to

**Table 1.-Estimates of the contributions of each age class, mean length at age, and Relative Stock Density of Arctic grayling in the harvest sample from the Delta Clearwater River Arctic grayling fishery, 1 June through 25 August 1996.**

Age	Age Composition			Mean FL (mm)
	Number	Percent	SE(%)	
3	3	1	1	296
4	8	4	1	320
5	52	22	3	338
6	79	35	3	355
7	35	15	2	379
8	18	8	2	410
9	18	8	2	401
10	6	3	1	418
11	4	2	1	457
12	4	2	1	466
13	1	<1	<1	
<b>Total</b>	<b>228</b>	<b>100</b>		

Category	Relative Stock Density (RSD)			
	FL Length Range (mm)	Number	Percent	SE(%)
Small	≤149			
Stock	150-269			
Quality	270-339	66	26	3
Preferred	340-449	175	70	3
Memorable	450-559	10	4	1
Trophy	≥560			
<b>Total</b>		<b>251</b>	<b>100</b>	

ensure that sample sizes were achieved appeared to pay off in that 26% of the angler interviews and 30% of scale samples were collected during these times.

The length composition of harvested Arctic grayling in 1996 changed slightly over that observed in both the 1994 and 1995 fishery. The preferred category of fish from 340 to 449 mm fork length comprised nearly 52% of both the 1994 and 1995 samples (Hallberg and Bingham 1995 and 1996), but accounted for 70% of the sample in 1996. Concurrently, the quality size category (fish from 270 to 339 mm fork length) accounted for 46% in 1994 and 48% in 1995, but represented only 26% in 1996. The increase in the proportion of larger-sized Arctic grayling in the angler's creel in 1996 may be the result of anglers being selective in the fish they kept due to the restricted daily bag and possession limit of only two Arctic grayling.

The age composition data of Arctic grayling harvested in 1996 differed only slightly from the individual ages observed in the 1995 data. The strong 5 year age class that dominated the 1995 sample, representing 34% of that sample (Hallberg and Bingham 1996), appeared as the dominant age 6 year class in 1996, accounting for 35% of the total 1996 sample.

The average annual harvest of Arctic grayling from 1977 through 1986 (the 10 years prior to when the special regulations went into effect) was more than 6,500 fish (Mills 1979-1987). The annual harvest of Arctic grayling for the past 9 years (1987-1995) has averaged about 1,700 fish (Mills 1988-1994, and Howe et al. 1995-1996). Angler effort for all sport fish species on the Delta Clearwater River for the past 9 years (1987-1995) averaged just over 5,000 angler-days which is about 25% less than what was reported during the preceding 10 years (1977-1986) when effort averaged more than 6,500 angler-days.

While both effort and harvest have declined, anglers' opinion of the quality of fishing for Arctic grayling in the Delta Clearwater River in 1996 remained high in that 28% of those interviewed who registered an opinion, rated their experience as excellent and 65% rated it as good. Why 93% of the anglers in 1996 rated the fishery as excellent or good is unclear. Many of the Delta Clearwater River anglers that were interviewed have fished the river for many years and they frequently commented (during the interview) that the size of the fish they were catching this year were much larger than in previous years. Concurrently, anglers would often voice their support for the bag limit reduction and did not seem to be discouraged at all by the restriction.

Anglers continue to practice considerable catch-and-release fishing for Arctic grayling in the Delta Clearwater River. The 1995 Statewide Harvest Survey reported a harvest of 926 legal size, (12 inch or greater) Arctic grayling from a total catch of 4,354 similar size fish from the Delta Clearwater River (Howe et al. 1996). This equates to anglers releasing 79% of the Arctic grayling they catch. While the objectives for the 1996 creel survey at the Delta Clearwater River did not include estimating the distribution of Arctic grayling catch and harvests from individual angler-trips, these statistics along with standard errors were obtained ancillary to other objectives and have been summarized (Appendix B2). While 53% of the angler-trips yielded a catch of one or more Arctic grayling only 34% yielded a harvest of one or two (two being the daily bag limit) Arctic grayling. Anglers interviewed reported a trip catch range from one to more than 10, with 66% reporting a harvest of zero fish. Another encouraging fact was that no anglers in 1996 were found to have harvested more than the legal limit of two Arctic grayling.

## ACKNOWLEDGMENTS

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## **APPENDIX A**

**Appendix A1.-Angler interview, angler count, and biological data files developed for creel surveys in interior Alaska in 1996.**

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U0060IA6.DTA     Delta Clearwater River Arctic grayling fishery, creel survey angler interview data. Interviews with anglers who had completed there fishing trip and were exiting the Delta Clearwater River at the State of Alaska campground.

U0060LC6.DTA     Delta Clearwater River Arctic grayling tagging length data.

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## **APPENDIX B**

**Appendix B1.-Estimates of various angler demographic categories for the Delta Clearwater River Arctic grayling fishery from 1 June through 25 August 1996.**

Category	Number Interviewed	Percent	SE (%)
Female	125	21	2
Male	463	79	2
Youth	88	15	1
Adult	500	85	1
Non-Resident	177	30	2
Resident	411	70	2
Military	12	2	1
Non-Military	566	98	1
Spin	342	58	2
Fly	168	29	2
Both	78	13	1

**Appendix B2.-Distribution of Arctic grayling catch and harvest among anglers interviewed at the Delta Clearwater River, 1 June through 25 August, 1996.**

Number of Fish	Catch Distribution			Harvest Distribution		
	n	Percent	SE (%)	n	Percent	SE (%)
0	274	47	2	389	66	2
1	121	21	2	95	16	1
2	68	12	1	104	18	1
3	28	5	<1			
4	28	5	<1			
5	14	2	<1			
6	25	4	1			
7	8	1	<1			
8	4	1	<1			
9	6	1	<1			
10 or more	12	2	<1			
Total	588	100%		588	100%	