

Fishery Data Series No. 00-11

**Survey of the Sport Fishery at Ugashik Narrows,
1998**

by

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and

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August 2000

Alaska Department of Fish and Game

Division of Sport Fish



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Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H_A
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	and	&	catch per unit effort	CPUE
hectare	ha	at	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, χ^2 , etc.
kilometer	km	east	E	confidence interval	C.I.
liter	L	north	N	correlation coefficient	R (multiple)
meter	m	south	S	correlation coefficient	r (simple)
metric ton	mt	west	W	covariance	cov
milliliter	ml	Copyright	©	degree (angular or temperature)	°
millimeter	mm	Corporate suffixes:		degrees of freedom	df
Weights and measures (English)		Company	Co.	divided by	÷ or / (in equations)
cubic feet per second	ft ³ /s	Corporation	Corp.	equals	=
foot	ft	Incorporated	Inc.	expected value	E
gallon	gal	Limited	Ltd.	fork length	FL
inch	in	et alii (and other people)	et al.	greater than	>
mile	mi	et cetera (and so forth)	etc.	greater than or equal to	≥
ounce	oz	exempli gratia (for example)	e.g.,	harvest per unit effort	HPUE
pound	lb	id est (that is)	i.e.,	less than	<
quart	qt	latitude or longitude	lat. or long.	less than or equal to	≤
yard	yd	monetary symbols (U.S.)	\$, ¢	logarithm (natural)	ln
Spell out acre and ton.		months (tables and figures): first three letters	Jan,...,Dec	logarithm (base 10)	log
Time and temperature		number (before a number)	# (e.g., #10)	logarithm (specify base)	log ₂ , etc.
day	d	pounds (after a number)	# (e.g., 10#)	mideye-to-fork	MEF
degrees Celsius	°C	registered trademark	®	minute (angular)	'
degrees Fahrenheit	°F	trademark	™	multiplied by	x
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	not significant	NS
minute	min	United States of America (noun)	USA	null hypothesis	H_0
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	percent	%
Spell out year, month, and week.				probability	P
Physics and chemistry				probability of a type I error (rejection of the null hypothesis when true)	α
all atomic symbols				probability of a type II error (acceptance of the null hypothesis when false)	β
alternating current	AC			second (angular)	"
ampere	A			standard deviation	SD
calorie	cal			standard error	SE
direct current	DC			standard length	SL
hertz	Hz			total length	TL
horsepower	hp			variance	Var
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA SERIES NO. 00-11

SURVEY OF THE SPORT FISHERY AT UGASHIK NARROWS, 1998

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ABSTRACT

A creel census of the Ugashik Narrows sport fishery was conducted from 20 June to 14 September 1998. Biological data were collected from sport-caught resident species and salmon. Sport angler effort was 1,340 angler-hours. Catch totaled 991 Arctic grayling, 878 Arctic char and Dolly Varden combined, 177 coho salmon, 100 sockeye salmon, 24 lake trout, and 14 pink salmon. Harvest totaled 44 coho salmon, and 23 Arctic char and Dolly Varden combined. The typical angler at the Ugashik Narrows was guided, non-resident, and fished from shore. The length distributions of Arctic grayling, Arctic char, Dolly Varden, and coho salmon sampled from the sport fishery were examined. The modal age for Arctic grayling was 6 years old, and for coho salmon the 2.1 age class. Biological data collected from Arctic grayling during this project were not sufficient for making valid comparisons with data from 1987 and 1988. Review of previous mark-recapture projects at the Ugashik Narrows indicates a need for a large-scale mark-recapture project over at least a 3-year period, in conjunction with a radiotelemetry study, before the current population status of Arctic grayling is properly understood.

Key words: Arctic char, *Salvelinus alpinus*, Dolly Varden, *Salvelinus malma*, Arctic grayling *Thymallus arcticus*, biological composition, creel census, angler demographics, Ugashik Narrows, Southwest Alaska.

INTRODUCTION

The Ugashik Lakes are located on the Alaska Peninsula, 560 km southwest of Anchorage (Figure 1), and are within the Ugashik unit of the Alaska Peninsula National Wildlife Refuge. Two popular sport fishery areas are the Ugashik Narrows, which connect the Upper and Lower Ugashik Lakes, and the Outlet, which includes the upper 2 km of the Ugashik River between Lower Ugashik Lake and a large lagoon (Figure 1). The Ugashik Narrows has an approximate length of 0.5 km, and consists of two main channels with moderately fast water (Figure 2). The Outlet consists of shallow, braided channels with moderately fast water. The Ugashik Lakes area is accessible only by float plane or by boat from the village of Ugashik, 40 km downstream from the Outlet.

Angler effort in the Ugashik Lakes area is concentrated at the Narrows and Outlet, with limited effort expended in other parts of the drainage. Due to the inclement weather of the Alaska Peninsula and the remote nature of the Ugashik Narrows, fishing pressure is moderate. Only four sport fishing lodges are located in the Ugashik Lakes area: one active lodge at Upper Ugashik Lake, one inactive lodge at the Narrows, one active lodge at Lower Ugashik Lake, and one active lodge at the Outlet. Private lands are available in the area such that new lodges could be built.

Species of interest in the sport fishery include Arctic grayling *Thymallus arcticus*, coho salmon *Oncorhynchus kisutch*, sockeye salmon *O. nerka*, Arctic char *Salvelinus alpinus*, Dolly Varden *S. malma*, and lake trout *S. namaycush*. Drainage-wide sport harvest during 1977-1997 and sport catch during 1991-1997 has been estimated through the Alaska statewide sport fish harvest and participation survey. Harvests were typically highest for Arctic char, Dolly Varden, and coho and sockeye salmon, and lowest for lake trout (Table 1; Mills 1979-1994, Howe et al. 1995-1998). Harvest of each species is relatively minor, averaging less than 500 fish per year. Catch is typically highest for Arctic char and Dolly Varden, coho salmon, and Arctic grayling, and lowest for lake trout (Table 1). Although rainbow trout *O. mykiss* have never been officially documented in the drainage, estimated catch of rainbow trout during 1991-1997 has ranged from 169 (1996) to 896 (1997) fish (Mills 1992-1994, Howe et al. 1995-1998).

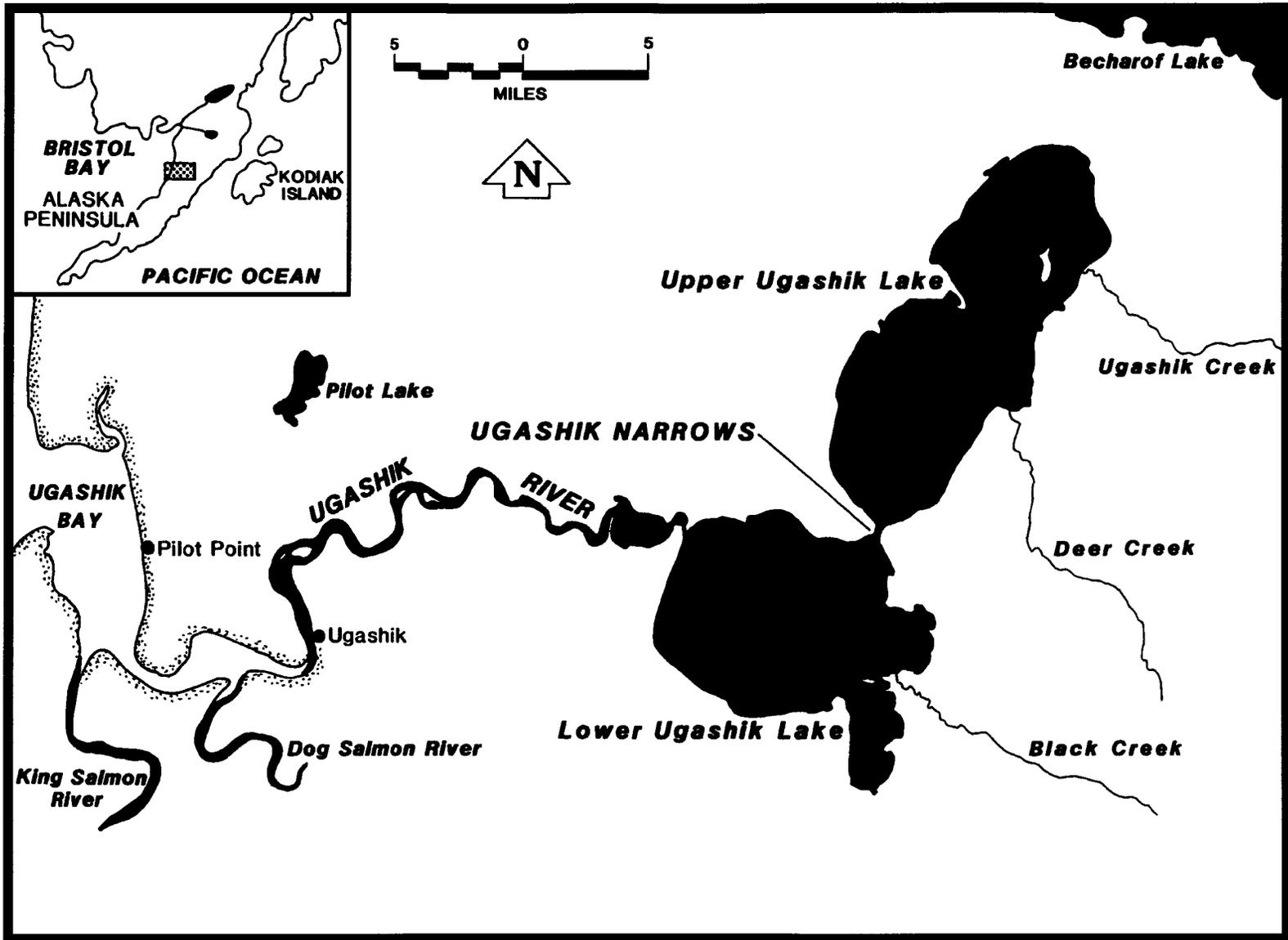


Figure 1.-The Ugashik lakes and major tributaries.

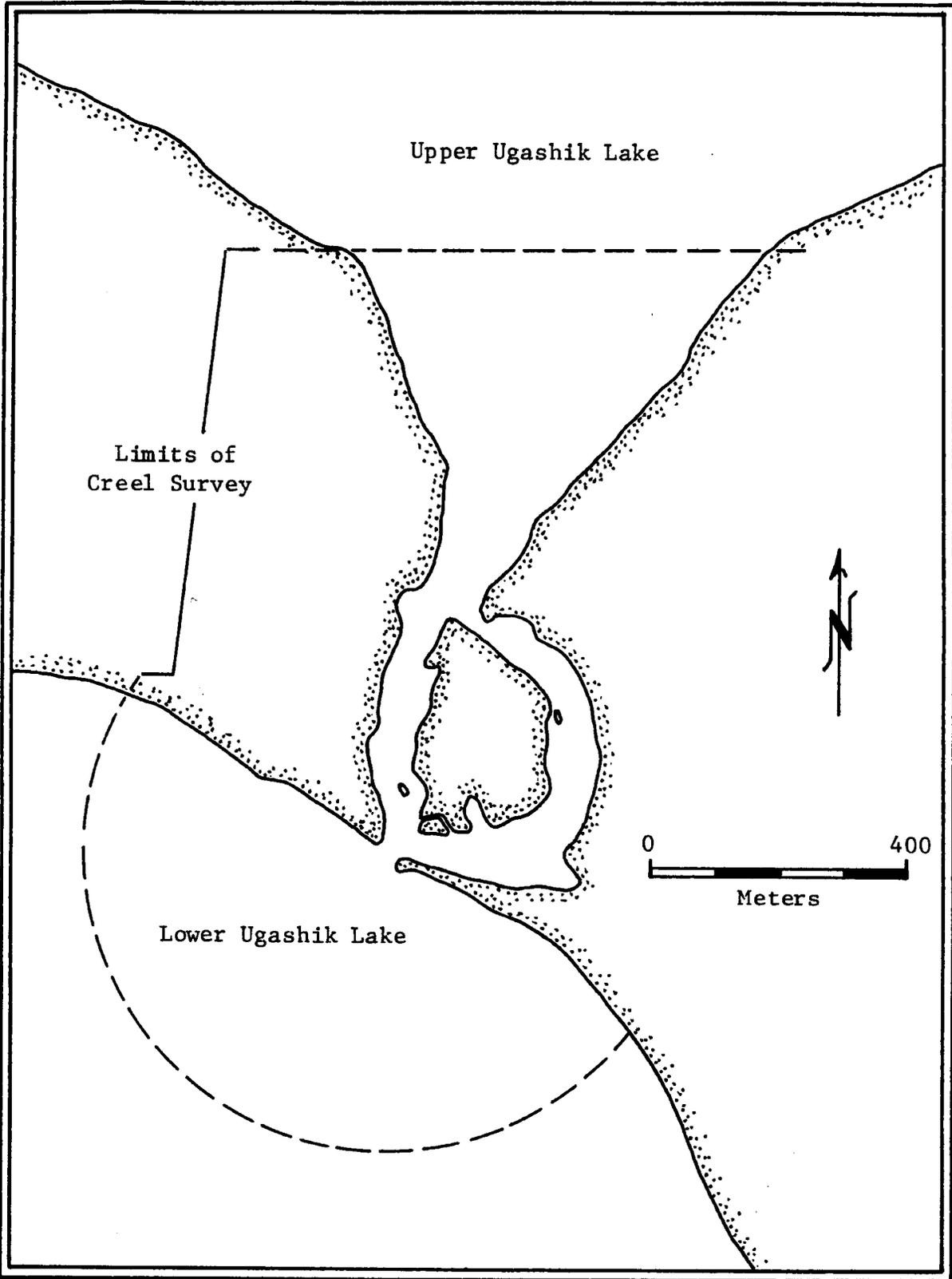


Figure 2.-The Ugashik Narrows creel census site.

Table 1.-Effort (angler-days), harvest, and catch in sport fisheries in the Ugashik River drainage, 1977-1997.

Year	Estimated Angler-days	Estimated Number of Fish Harvested					Estimated Number of Fish Caught ^a				
		Arctic Grayling ^u	Coho Salmon	Sockeye Salmon	AC/DV ^c	Lake Trout	Arctic Grayling ^u	Coho Salmon	Sockeye Salmon	AC/DV ^c	Lake Trout
1977	707	141	26	213	51	14					
1978	2,477	72	163	127	389	45					
1979	1,399	145	125	189	200	9					
1980	472	215	17	379	164	9					
1981	671	195	87	11	270	11					
1982	870	142	314	126	304	10					
1983	769	168	157	55	73	10					
1984	1,609	237	611	100	486	37					
1985 ^u	NA	NA	NA	NA	NA	NA					
1986 ^u	NA	NA	NA	NA	NA	NA					
1987	1,682	278	215	370	493	172					
1988 ^u	NA	NA	NA	NA	NA	NA					
1989	998	41	234	884	104	114					
1990	1,383	0	840	20	164	33					
1991	1,627	0	97	77	165	17	337	592	403	1,711	222
1992	2,001	0	445	8	41	39	518	1,166	625	499	170
1993	1,918	0	92	174	248	72	568	837	566	3,288	131
1994	2,315	0	739	263	275	59	889	1,586	1,020	3,951	121
1995	905	0	346	96	77	66	1,263	891	325	1,309	114
1996	2,918	0	451	726	90	64	2,968	1,302	1,861	2,420	592
Average 1992-1996	2,011	0	415	253	146	60	1,241	1,156	879	2,293	226
1997	3,325	71	651	738	274	172	1,976	2,215	3,476	3,487	898

Source: Estimates are from the ADF&G Statewide Harvest Survey (Mills 1979-1994; Howe et al. 1995-1998). Catch not estimated until 1991.

^a Annual estimates of catch are only available since 1991.

^b Fisheries for Arctic grayling in Ugashik Narrows and Ugashik River have been catch-and-release since 1990. However, harvest of Arctic grayling is allowed in the Ugashik River drainage in locations other than Ugashik River and Ugashik Narrows.

^c AC/DV = Arctic char or Dolly Varden.

^d The number of surveys was inadequate to generate reliable estimates in 1985, 1986, and 1988.

The Ugashik Narrows contains trophy-size Arctic grayling. In fact, the Alaska state record for sport-caught Arctic grayling, a fish weighing 2.2 kg (4 lb, 13 oz) with a length of 584 mm (23.0 in), was caught in the Ugashik Narrows in 1981. From 1967 to 1998, 66 trophy fish certificates or honorary catch-and-release certificates were issued for Arctic grayling (minimum weight of 1.4 kg [3 lb]) in the Ugashik River drainage (Jim Andel, Fisheries Biologist, Alaska Department of Fish and Game, Division of Sport Fish, Juneau, personal communication).

Management of the sport fishery for Arctic grayling in the Ugashik River drainage has been conservative since 1969, when the bag limit was reduced to two fish per day (Table 2). The entire drainage was closed to the taking of Arctic grayling during 1990-1994. The daily bag limit for Arctic grayling in the Ugashik River drainage, excluding the Ugashik Narrows and Ugashik River, was five fish per day, no size restrictions during 1995-1997, and in 1998 was reduced to two fish per day, no size restrictions. The Ugashik Narrows has been designated as a catch-and-release Arctic grayling fishery since 1995. The Ugashik River has been closed to Arctic grayling fishing since 1995 (Table 2).

The 1998 sport fishing regulations for other species were: Arctic char and Dolly Varden - three fish per day, no size limit (species not differentiated in regulations); lake trout - four fish per day, no size limit; northern pike *Esox lucius* - 10 fish per day, no size limit; chinook salmon *O. tshawytscha* - three per day (only two over 28 inches; annual bag limit of five chinook salmon for Bristol Bay); and other salmon (coho, sockeye, chum *O. keta*, and pink *O. gorbuscha*) - five fish per day (ADF&G 1998).

Creel censuses were conducted cooperatively by Sport Fish Division and the U.S. Fish and Wildlife Service (USFWS) Alaska Peninsula/Becharof National Wildlife Refuge Complex (APB NWRC) at the Ugashik Narrows during 1987 and 1988 (Meyer 1991). Estimated sport fishing effort at the Ugashik Narrows during 22 June through 30 August 1987 was 2,028 angler-hours (SE = 249.9, relative precision = 24.2%), and 2,148 angler-hours (SE = 43.4, RP = 4.0%) during 20 June to 21 September 1988. Most anglers in both years were guided non-residents that flew in for the day from sport fishing lodges outside of the drainage (Meyer 1991).

Two population estimation studies were conducted on the Arctic grayling population in the Ugashik Narrows by Meyer (1990) during 1987-1989, and Villegas (1993) during 1991-1992. The mark-recapture events for these two studies occurred primarily during June through August. Hook and line and beach seines proved most efficient for sampling. Results from these studies indicated that the Ugashik Narrows area is primarily a summer feeding ground for Arctic grayling of the Ugashik drainage (Meyer 1990). Villegas (1993) believed that some Arctic grayling spawn in or near the Narrows during the spring (April and May) as well. Different sub-populations of Arctic grayling may be present in the Ugashik Narrows during different times of the year (Meyer 1990, Villegas 1993). Given that situation, a statistically valid population estimate based on mark-recapture would have become prohibitively complex for the scope of this project. Therefore, none was attempted.

Meyer (1990) and Villegas (1993) determined that the Arctic grayling populations utilizing the Ugashik Narrows area were potentially lower in abundance and length composition than historical levels. In 1990, the Alaska Board of Fisheries closed the Ugashik drainage to Arctic

Table 2.-Summary of daily bag and possession limits and size limits for Arctic grayling in the Ugashik River drainage during 1960-1998.

Period	Daily bag and possession limit	Size limit/restrictions
1960 – 1968	10 fish	only 2 fish over 20 inches
1969 ^a – 1975	2 fish	no size limit
1976 – 1982	2 fish	only 1 fish over 20 inches
1983 – 1989	2 fish	no size limit
1990 – 1994	Entire drainage closed to taking of Arctic grayling, all Arctic grayling caught must be released immediately	
1995 – 1997	Ugashik River drainage, except Ugashik Narrows and Ugashik River 5 fish	no size limit
	Ugashik Narrows: no retention allowed, all Arctic grayling must be released immediately	
	Ugashik River: closed to Arctic grayling fishing	
1998	Ugashik River drainage, except Ugashik Narrows and Ugashik River 2 fish	no size limit
	Ugashik Narrows: no retention allowed, all Arctic grayling must be released immediately	
	Ugashik River: closed to Arctic grayling fishing	

Source: ADF&G Sport Fish Regulations (1960-1998)

^a Conservative management of Arctic grayling in the Ugashik River drainage was specifically identified in the sport fish regulations beginning in 1969.

grayling harvest, to allow for the population to rebuild. In 1995-97 harvest was allowed in the Ugashik drainage, excluding the narrows and river; thus harvest was 0 or very low (Tables 1 and 2).

The 1998 study at Ugashik Narrows originated from a need to update public-use data for a revision of the comprehensive conservation plan of the APB NWRC. The Narrows were identified by staff of the King Salmon Fishery Resource Office (KSFRO) and the APB NWRC as the top priority among sites within the refuge complex where public-use records were not

current. A creel census with the objectives of monitoring the status of sport fishing and gaining information on the status of Arctic grayling in the Ugashik Lakes was therefore initiated. Field and data collection operations were funded through the USFWS initiative for revising comprehensive plans of national wildlife refuges in the Bristol Bay region. Sport Fish Division personnel trained field staff in census methods and analyzed resulting data.

Objectives of the creel census and biological sampling during 20 June to 14 September 1998 at Ugashik Narrows consisted of the following:

1. Census the recreational fishing effort (angler-hours and angler-days).
2. Census the catch (number landed) of Arctic grayling.
3. Census the catch (number landed) and harvest of lake trout, Dolly Varden, Arctic char, and coho and sockeye salmon.
4. Census the distribution of catch and harvest success of lake trout, Dolly Varden, Arctic char, and coho and sockeye salmon among anglers (angler-day).
5. Census the percent of angler-days by angler type (shore/boat, guided/unguided, chartered/non-chartered, outfitted/non-outfitted, local/Alaska/U.S./not U.S. residency, and adult/youth).
6. Estimate the length and age composition of catchable Arctic grayling, coho salmon, and sockeye salmon, and length composition of catchable Dolly Varden, Arctic char, and lake trout.

METHODS

STUDY AREA

The entire area from the outlet of Upper Ugashik Lake to the small delta in Lower Ugashik Lake at the outlet of the Ugashik Narrows (Figure 2) comprised the Ugashik Narrows study area.

CREEL CENSUS

A direct expansion creel census (Bernard et al. 1998), conducted at the Ugashik Narrows from 20 June through 14 September 1998, resulted in effort, catch, harvest, distribution of catch success, and angler demographics. Although the Arctic grayling fishery was strictly catch-and-release, regulations allowed for harvest of the other fish species.

There were at least two USFWS field personnel on duty to interview all anglers fishing at the Ugashik Narrows at the completion of the angling day, 7 days per week. This level of sampling constituted a census, which simplified the estimation procedures and ensured attaining the objective criteria. Participation in the study was voluntary; data were collected only from consenting anglers. A daily count of anglers not interviewed was also maintained; however, less than 5% of anglers were not interviewed. Field personnel lived onsite at a camp near the southwestern shore of the Ugashik Narrows (Figure 2).

Because both Arctic char and Dolly Varden are present at the Ugashik Narrows, field personnel were trained to identify these two closely-related char species by morphological differences (e.g., relative width of the caudal peduncle, the shape of the tail, and the size of spots relative to size of pupil) described by Morrow (1980). Because sport anglers probably could not differentiate

between Arctic char and Dolly Varden, we pooled catch and harvest data for these two species. However, biological data were recorded separately for each species.

BIOLOGICAL COMPOSITION

The USFWS field personnel collected biological data from fish harvested or released by recreational anglers at the Ugashik Narrows. Fork length to the nearest millimeter was collected from resident species, while mid-eye to fork-of-tail length was collected from salmon. Scale samples were collected from Arctic grayling and salmon. We did not attempt to determine sex for any of the species, and weight information was not collected. All fish sampled were marked with a notch in their adipose fin. If a fish with the adipose fin notch was encountered during the project, it was recorded as a recaptured fish, measured for length, and released. However, no scale samples were collected from recaptured Arctic grayling or salmon. Field personnel also recorded the color and number of Floy tags encountered on fish sampled during the creel census. Arctic grayling had been tagged with Floy tags during previous studies (Meyer 1990; Villegas 1993).

The field technicians walked through the fishery at various times throughout each day to sample fish caught by anglers. This improved chances of obtaining a representative sample of each species. Estimation of length composition required sampling a minimum of 150 Arctic grayling (Thompson 1987) to attain the desired objective criteria. This level of sampling provided the desired precision and accuracy assuming 15% of the scales could not be aged due to scale regeneration or other problems. When anglers were absent, field staff caught and sampled fish in a test fishery using hook and line. The same data were collected from fish captured in the test fishery as for fish sampled in the sport fishery.

Data for sampled fish were recorded on Rite-in-the-Rain® field notebooks for Dolly Varden and Arctic char, and on scale coin envelopes for Arctic grayling and salmon. At the end of each day, data recorded on notebooks or envelopes were transferred to Age-Weight-Length (AWL) mark-sense forms (Heineman *In prep*). The field crew maintained a daily tally of the number of fish by species caught and sampled, and noted the hours worked and any equipment problems.

At the end of the field season, scale smears from Arctic grayling and salmon were sorted under a microscope and the three or four best scales mounted on adhesive-coated cards. Mounted scales were pressed on acetate cards in a heated hydraulic press and the resulting scale impressions displayed on a microfiche projector for age determination (Jerald 1983). Utilizing the procedure described by Coggins (1994), scale impressions were read three times, and only readings which had at least two out of three age determinations matching were considered as a known age. The occurrence of aging error (no modal ages, regenerated scales, inverted scales, or missing scales) was recorded.

DATA ANALYSIS

CREEL CENSUS

Sampling at the Ugashik Narrows was a census of all anglers using the area. Analysis of the data amounted to summing the reported hours of effort and number of fish caught or harvested by species, and summing the number of angler-days by gear type, demographic information, and other interview data. To stratify the 1998 creel census data, the temporal components identified by Meyer (1991) for the 1988 creel census data were utilized. Meyer's strata were: component

1, 20-30 June; component 2, 2-26 July; component 3, 27 July-9 August; component 4, 10 August-8 September; and component 5, 9-14 September. The distributions of catch and harvest by species were calculated as binomial proportions (Cochran 1977).

BIOLOGICAL COMPOSITION

Mean length and the associated variance were estimated by species using normal procedures. The proportions of each age class (p_i), and associated variances were estimated as binomial proportions (Cochran 1977):

$$\hat{p}_i = \frac{c_i}{c}, \quad (1)$$

and

$$\hat{V}(\hat{p}_i) = \frac{\hat{p}_i(1-\hat{p}_i)}{c-1}, \quad (2)$$

where:

c_i = number of fish in age class i , and

c = total number of fish sampled.

A Kolmogorov-Smirnov test (test statistic = D , Sokal and Rohlf 1981) or an Anderson-Darling k-sample test (test statistic = T_{akn} , Scholz and Stephens 1987), at a significance level of $\alpha = 0.05$, was used to test the null hypotheses that the length distributions of sampled resident species did not differ over time. To detect change over time, the data were divided into monthly groups. If no differences were detected by these series of tests, then the sample should provide unbiased estimates of the length and probably the age distribution of the catchable population. If the length distributions were different between the groups, then the data were poststratified. Plots of the cumulative length frequency were visually inspected to evaluate differences in length distributions.

RESULTS

CREEL CENSUS

The creel census was conducted daily from 20 June to 14 September 1998. A total of 348 anglers were interviewed (Appendix A1). Only 12 anglers were not interviewed, so we considered this a complete census. Weekly angler effort ranged from 10 to 57 angler-days (Figure 3), and peaked during the week of 11 July ($n = 43$) and again on the week of 29 August ($n = 57$).

Anglers expended a total of 1,340 hours of effort (Table 3, Appendix A1). The majority of the catch consisted of three resident species: Arctic grayling (991 released), and Dolly Varden and Arctic char (855 released, 23 kept; Table 3). Additional resident species included lake trout, round whitefish, and coho, sockeye, pink, and chum salmon.

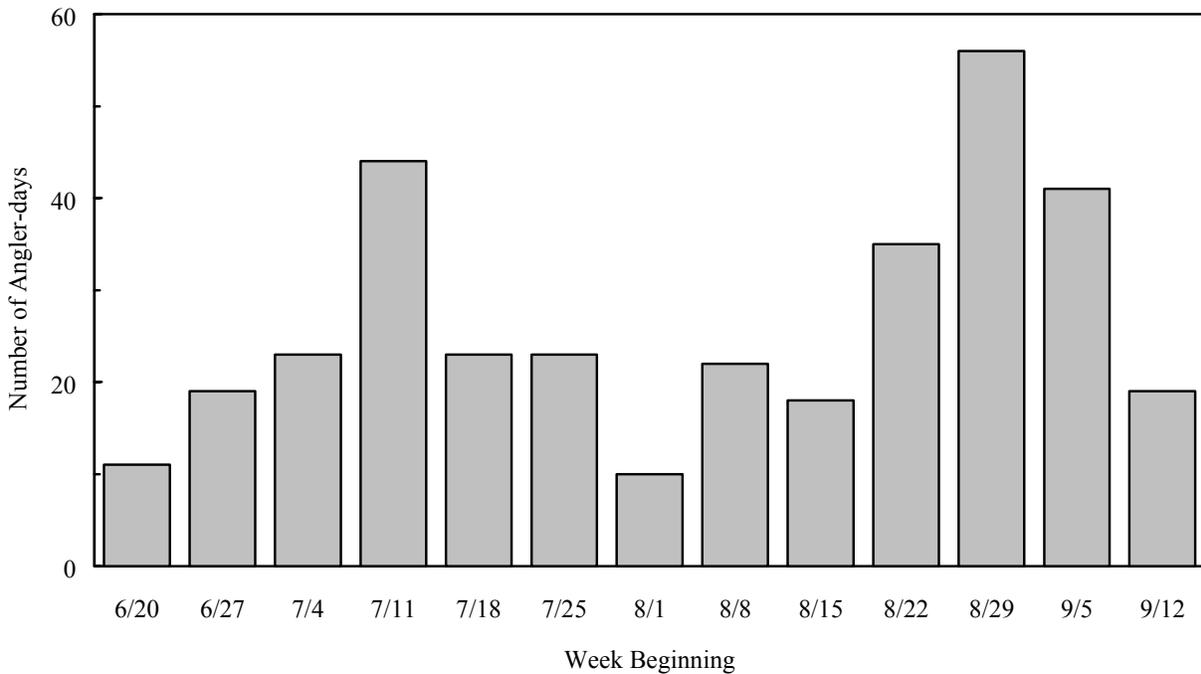


Figure 3.-Weekly number of angler-days at Ugashik Narrows, 20 June–14 September 1998.

Seasonal catch rates ranged from highs of 0.74 fish per hour for Arctic grayling and 0.66 fish per hour for Arctic char and Dolly Varden to the low of 0.02 fish per hour for lake trout (Table 3). Harvest rates were substantially lower, ranging from 0 fish per hour (sockeye salmon and lake trout) to 0.25 fish per hour (coho salmon).

The highest stratified CPUE was 1.91 fish-per-hour for Arctic char and Dolly Varden during 9 to 14 September, followed by a CPUE of 1.80 fish-per-hour for Arctic grayling during 27 July to 9 August. Almost the entire coho salmon catch occurred during 10 August to 8 September, when 167 coho salmon were caught, and the CPUE for coho salmon was 0.27 fish per hour.

At least one Arctic grayling was caught by the end of 58% of the angler-days (Figure 4), at least one Arctic char or Dolly Varden was caught by the end of 64% of the angler-days (Figure 5), and at least one coho salmon was caught by the end of 39% of the angler-days (Figure 6). At least four Arctic grayling and four Arctic char or Dolly Varden were caught by the end of about 25% of angler-days (Table 4; Figures 4 and 5).

One to three Arctic char or Dolly Varden were harvested by the end of only 5% of angler-days (Figure 5), and one to five coho salmon were harvested by the end of 15% of angler-days (Figure 6).

The typical angler was guided (66%), not an Alaskan resident (77%), used air charter to access the area (89%), fished from shore (99%), and used fly fishing gear (70%) (Table 5).

Table 3.-Comparison of estimated CPUE and HPUE by species and date for the sport fishery at Ugashik Narrows during 1998.

Date	Angler effort (angler-hours)	Catch	CPUE ^a	Harvest	HPUE ^b
Arctic Grayling					
6/20-6/30	101.3	85	0.84	0	0.00
7/02-7/26	391.2	361	0.92	0	0.00
7/27-8/09	137.5	248	1.80	0	0.00
8/10-9/08	616.4	286	0.46	0	0.00
9/09-9/14	94.0	11	0.12	0	0.00
Total	1340.4	991	0.74	0	0.00
Arctic char or Dolly Varden					
6/20-6/30	101.3	41	0.40	2	0.05
7/02-7/26	391.2	209	0.53	6	0.03
7/27-8/09	137.5	60	0.44	0	0.00
8/10-9/08	616.4	388	0.63	10	0.03
9/09-9/14	94.0	180	1.91	5	0.03
Total	1340.4	878	0.66	23	0.03
Coho Salmon					
6/20-6/30	101.3	0	0.00	0	0.00
7/02-7/26	391.2	0	0.00	0	0.00
7/27-8/09	137.5	6	0.04	3	0.50
8/10-9/08	616.4	167	0.27	41	0.25
9/09-9/14	94.0	4	0.04	0	0.00
Total	1340.4	177	0.13	44	0.25
Sockeye Salmon					
6/20-6/30	101.3	0	0.00	0	0.00
7/02-7/26	391.2	2	0.01	0	0.00
7/27-8/09	137.5	2	0.01	0	0.00
8/10-9/08	616.4	60	0.10	0	0.00
9/09-9/14	94.0	36	0.38	0	0.00
Total	1340.4	100	0.07	0	0.00
Lake Trout					
6/20-6/30	101.3	0	0.00	0	0.00
7/02-7/26	391.2	13	0.03	0	0.00
7/27-8/09	137.5	5	0.04	0	0.00
8/10-9/08	616.4	6	0.01	0	0.00
9/09-9/14	94.0	0	0.00	0	0.00
Total	1340.4	24	0.02	0	0.00

^a CPUE is calculated by dividing total catch by total effort.

^b HPUE is calculated by dividing total harvest by total effort.

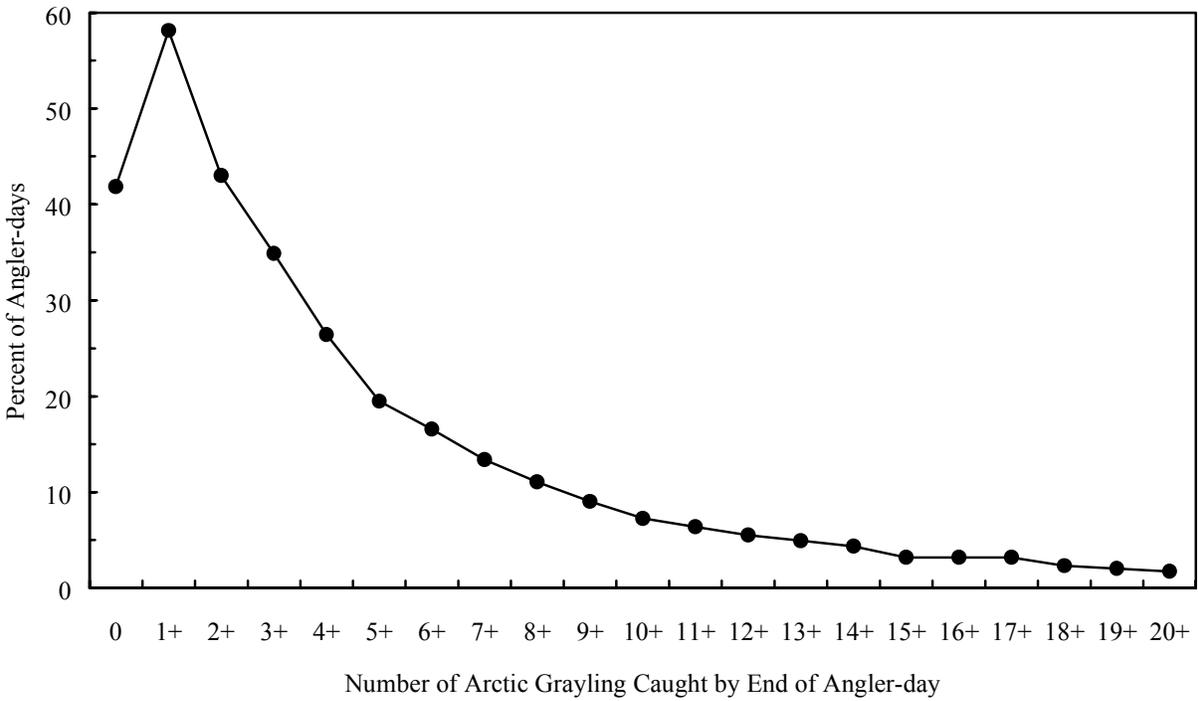


Figure 4.-Angler success for Arctic grayling caught during the creel census at Ugashik Narrows, 20 June–14 September 1998.

BIOLOGICAL COMPOSITION

Field technicians fished with hook and line a total of 78.34 hours on 27 days from 24 June 1998 through 26 August 1998. This effort resulted in the following:

Species	Released	Kept	Total
Arctic Grayling	73	0	73
Arctic Char	5	0	5
Dolly Varden	17	1	18
Lake Trout	11	0	11
Sockeye Salmon	1	0	1
Coho Salmon	28	1	29

Only 50 of the Arctic grayling captured in the test fishery were subsequently sampled for biological data. Given that the catch of resident species was spread over a long period and given the differences observed in size composition over time, these catches did not provide sufficient data to be included in the analysis. Larger sample sizes were obtained from anglers participating in the sport fishery and are more representative of the fishery. Therefore test fishery data were excluded from the remaining analyses.

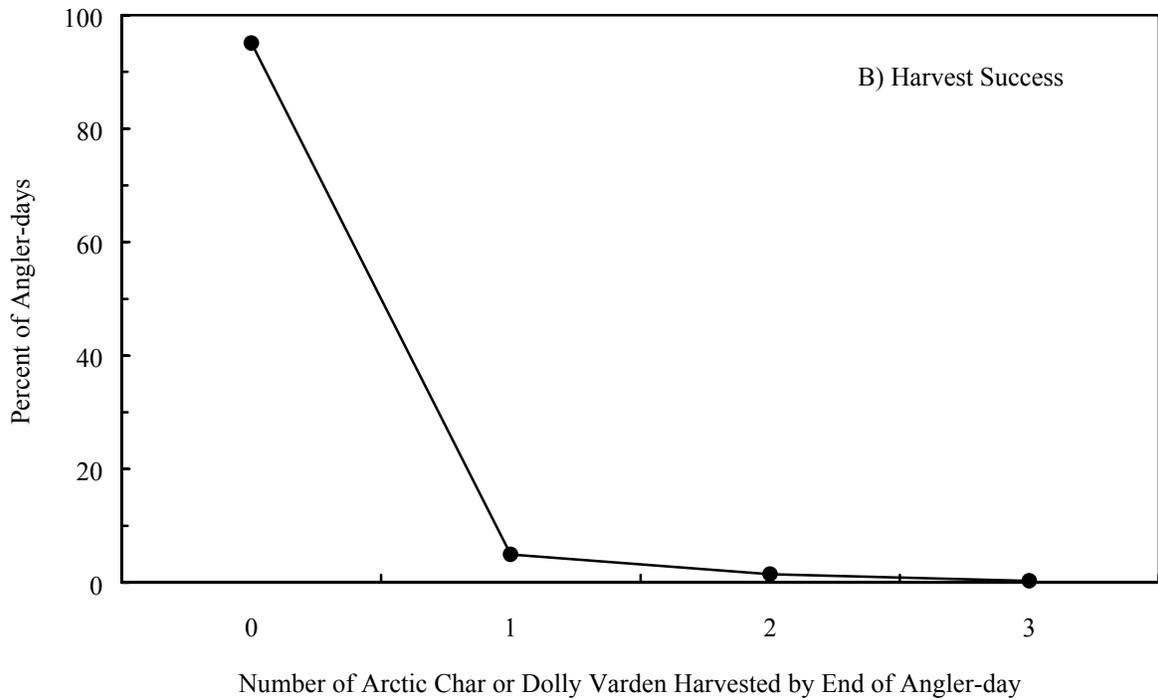
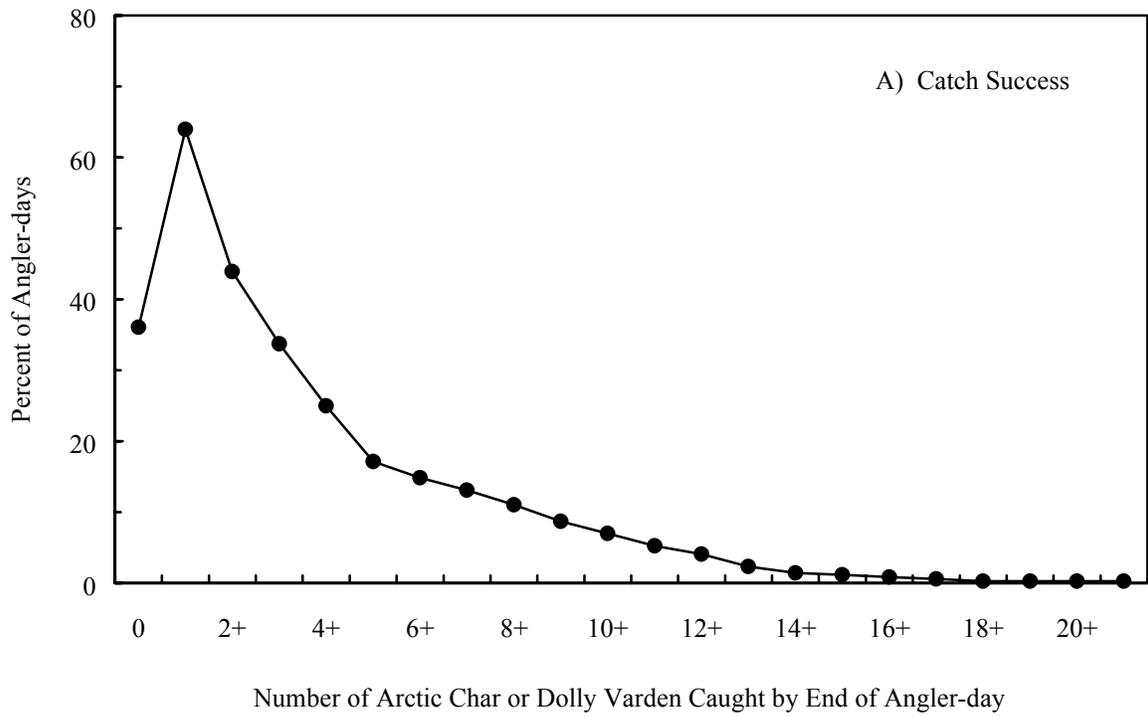


Figure 5.-Angler success for Arctic char or Dolly Varden caught (A) and harvested (B) during the creel census at Ugashik Narrows, 20 June–14 September 1998.

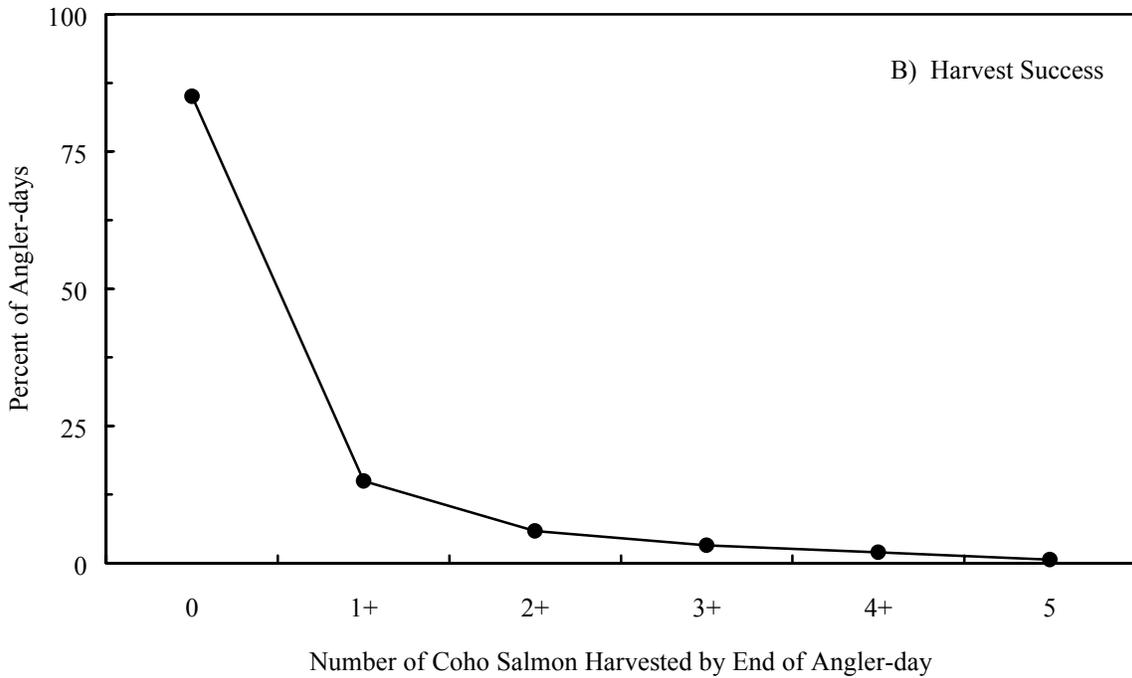
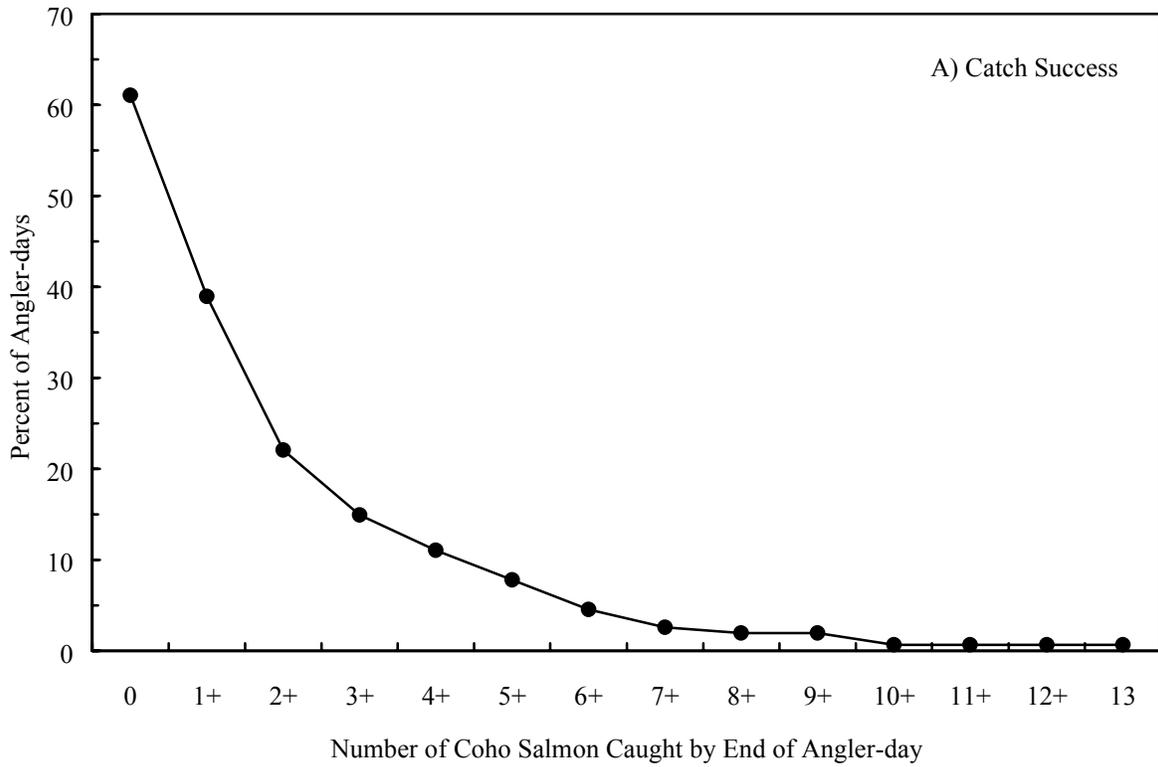


Figure 6.-Angler success for coho salmon caught (A) and harvested (B) during the creel census at the Ugashik Narrows, 10 August–8 September 1998.

Table 4.-Catch and harvest success (%) by species at the Ugashik Narrows during 20 June to 14 September 1998. Success is defined as the percent of angler-days in which the respective number of fish were caught.

Number of fish	Catch						Harvest			
	Arctic Grayling		Arctic Char or Dolly Varden		Coho Salmon ^a		Arctic Char or Dolly Varden		Coho Salmon ^a	
	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent
0	144	41.9	124	36.0	94	61.0	327	95.1	131	85.1
1+	52	58.1	69	64.0	26	39.0	12	4.9	14	14.9
2+	28	43.0	35	43.9	11	22.1	4	1.5	4	5.8
3+	29	34.9	30	33.7	6	14.9	1	0.3	2	3.2
4+	24	26.5	27	25.0	5	11.0			2	1.9
5+	10	19.5	8	17.2	5	7.8			1	0.6
6+	11	16.6	6	14.8	3	4.5				0
7+	8	13.4	7	13.1	1	2.6				
8+	7	11.0	8	11.0	0	1.9				
9+	6	9.0	6	8.7	2	1.9				
10+	3	7.3	6	7.0	0	0.6				
11+	3	6.4	4	5.2	0	0.6				
12+	2	5.5	6	4.1	0	0.6				
13+	2	4.9	3	2.3	1	0.6				
14+	4	4.4	1	1.5		0				
15+	0	3.2	1	1.2						
16+	0	3.2	1	0.9						
17+	3	3.2	1	0.6						
18+	1	2.3	0	0.3						
19+	1	2.0	0	0.3						
20+	6 ^b	1.7	1 ^c	0.3						
Total	344		344		154		344		154	

^a Coho salmon catch and harvest success was examined only for 10 August to 8 September 1998.

^b Catch levels of 20 Arctic grayling (n = 3 angler-days), 28 (n = 1), 32 (n = 1) and 41 (n = 1) fish were recorded.

^c One angler caught 21 Arctic char/Dolly Varden.

Table 5.-Demographic information from anglers interviewed during the creel census at Ugashik Narrows during 20 June to 14 September 1998.

Characteristic	Angler-trips	Percent
ANGLER TYPE		
Guided	228	66
Unguided	120	34
Alaska Residents	79	23
Local Alaskan Residents	26	7
Nonlocal Alaskan Residents	53	15
Non-Alaskan Residents	269	77
U.S. Residents	235	68
Non-U.S. Residents	32	9
Access to Ugashik Narrows		
Used air charter service	310	89
Used private plane	38	11
Outfitted ^a	110	32
Not outfitted	238	68
SEX		
Male	301	86
Female	47	14
YOUTH/ADULT		
Adult	327	94
Youth	21	6
BOAT/SHORE		
Fished from boat	3	1
Fished from shore	345	99
TACKLE TYPE		
Spin	91	26
Fly	245	70
Both Spin and Fly	12	3
TOTAL ANGLER TRIPS	348	

^a Outfitted defined as angler that was provided with gear, rental boat, or camp equipment;
Not outfitted defined as angler that used personal gear.

Arctic Grayling

We sampled 504 unique Arctic grayling for length and age during the study. The cumulative length distributions of Arctic grayling for June, July, August, and September were significantly different (Anderson-Darling test, $T_{akn} = 3.527$, $P = 0.007$; Figure 7). During June, most fish in the area were over 400 mm, but small fish moved into the Ugashik Narrows as the summer progressed (Figure 8).

The mean fork length of Arctic grayling caught in the sport fishery during the entire census was 390 mm (SE = 3; 15.2 in), and ranged from 181 mm to 503 mm (7.1 in to 19.8 in). The modal age of Arctic grayling was 6 years, and ranged from 2 years to 10 years (Table 6).

Dolly Varden

During 1998, 294 unique Dolly Varden were caught and sampled at Ugashik Narrows. Cumulative length distributions for July, August, and September were significantly different (Anderson-Darling test, $T_{akn} = 3.842$, $P = 0.006$; Figure 9). Only eight Dolly Varden were sampled in June, thus this month was disregarded in the analysis. The July length distribution was bimodal, with fish greater than 450 mm well represented. Fewer large fish were available in August and September (Figure 10).

The mean fork length of the Dolly Varden sampled in the sport fishery during the entire census was 416 mm (SE = 5; 16.4 in), and ranged from 219 mm to 689 mm (8.6 in to 27.1 in).

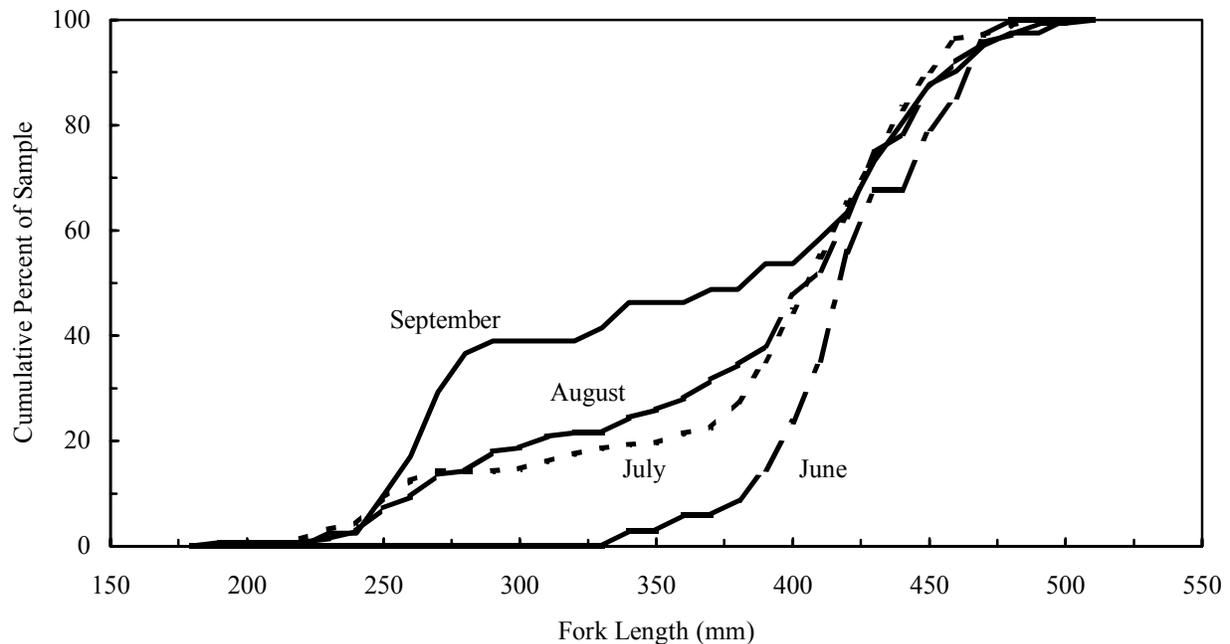


Figure 7.-Cumulative length distributions of Arctic grayling in the sport fishery at Ugashik Narrows during June (n = 34), July (n = 280), August (n = 139), and September (n = 41) 1998.

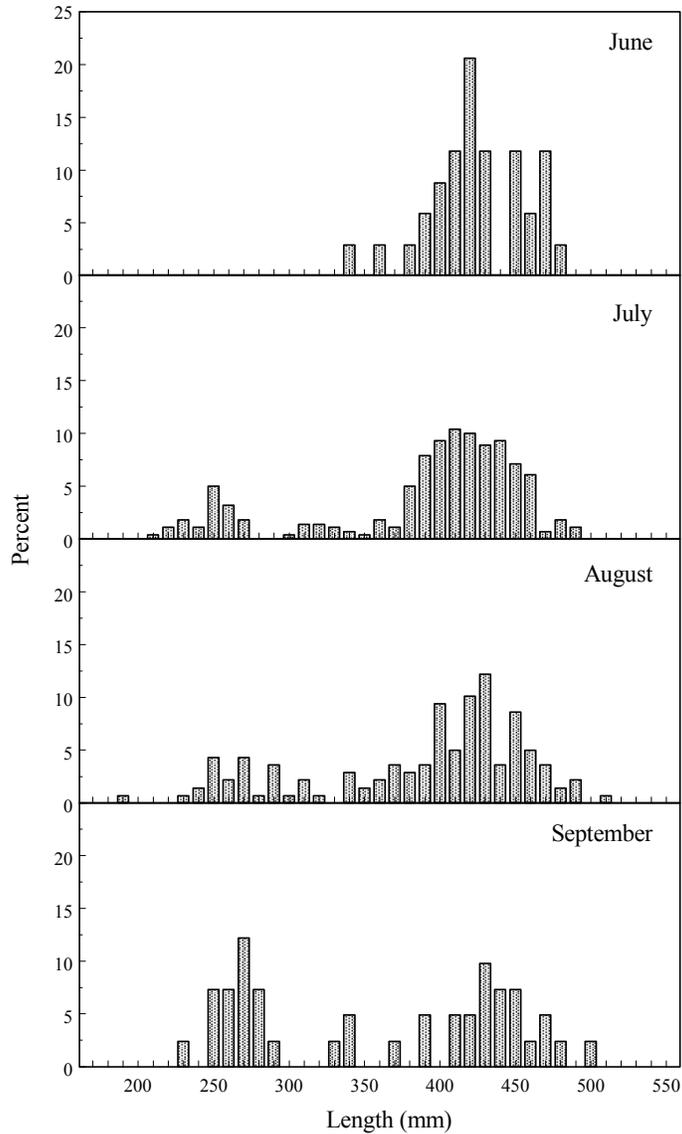


Figure 8.-Length frequency distributions of Arctic grayling in the sport fishery at Ugashik Narrows during June (n = 34), July (n = 280), August (n = 139), and September (n = 41) 1998.

Arctic Char

The cumulative length distributions of Arctic char for July, August, and September were not significantly different (Anderson-Darling test, $T_{akn} = -0.223$, $P = 0.473$; Figure 11). Most of the 196 Arctic char sampled were between 440 mm and 650 mm (17.3 in to 25.6 in; Figure 12). Only six Arctic char were sampled in June, thus this month was disregarded in the analysis.

The mean fork length of the Arctic char caught in the sport fishery during the entire census was 508 mm (SE = 6; 20 in), ranging from 260 mm to 676 mm (10.2 in to 26.6 in).

Table 6.-Estimated mean length (in millimeters), by age class, of Arctic grayling caught in the sport fishery on the Ugashik Narrows, 20 June to 14 September 1998.

Statistic	Age Class										Total
	Unknown	2	3	4	5	6	7	8	9	10	
n	0	48	40	39	99	130	79	31	12	2	480
Percent	0	10	8	8	21	27	17	7	3	0	100
SE		1	1	1	2	2	2	1	1	0	0
Sample Size	177	47	40	39	98	130	79	31	11	2	654
Mean Length	398	245	286	355	394	418	441	457	474	487	390
SE	5	2	5	5	2	1	2	2	7	8	3

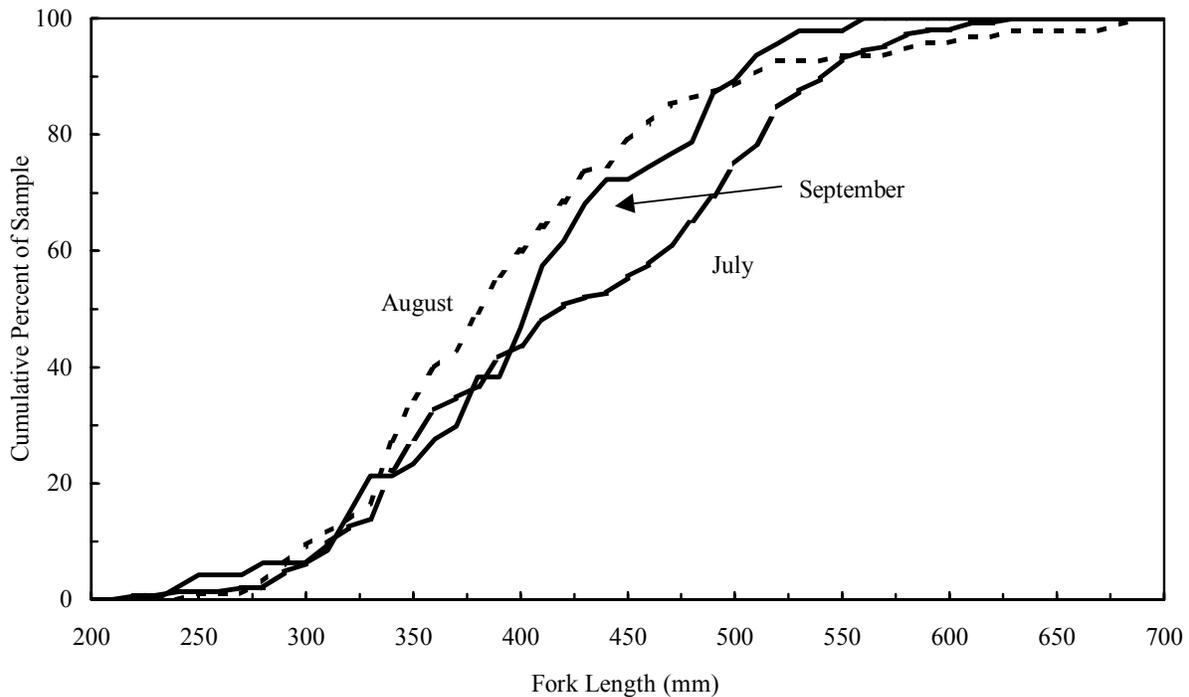


Figure 9.-Cumulative length distribution of Dolly Varden in the sport fishery at Ugashik Narrows in July (n = 144), August (n = 95), and September (n = 47) 1998.

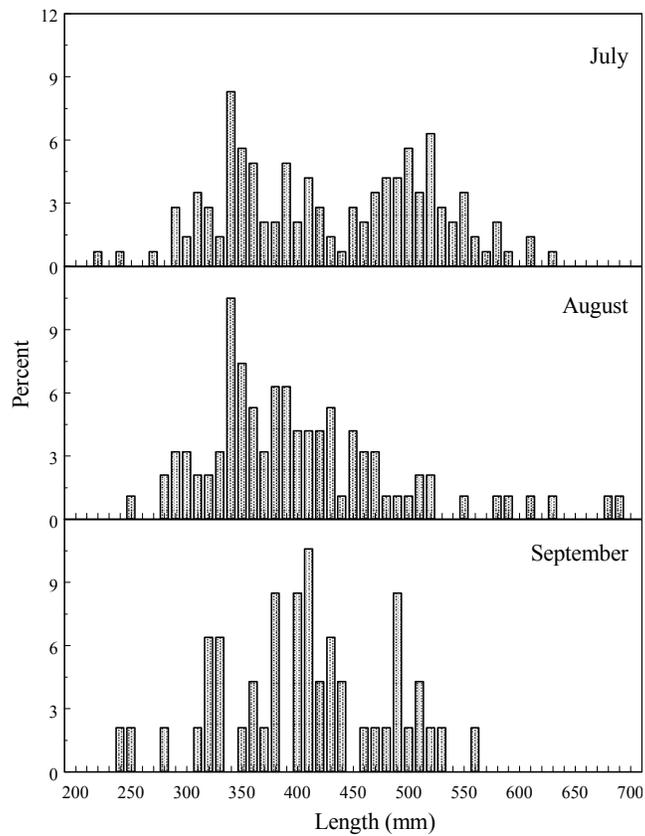


Figure 10.-Length frequency distributions of Dolly Varden in the sport fishery at Ugashik Narrows, during July (n = 144), August (n = 95), and September (n = 47) 1998.

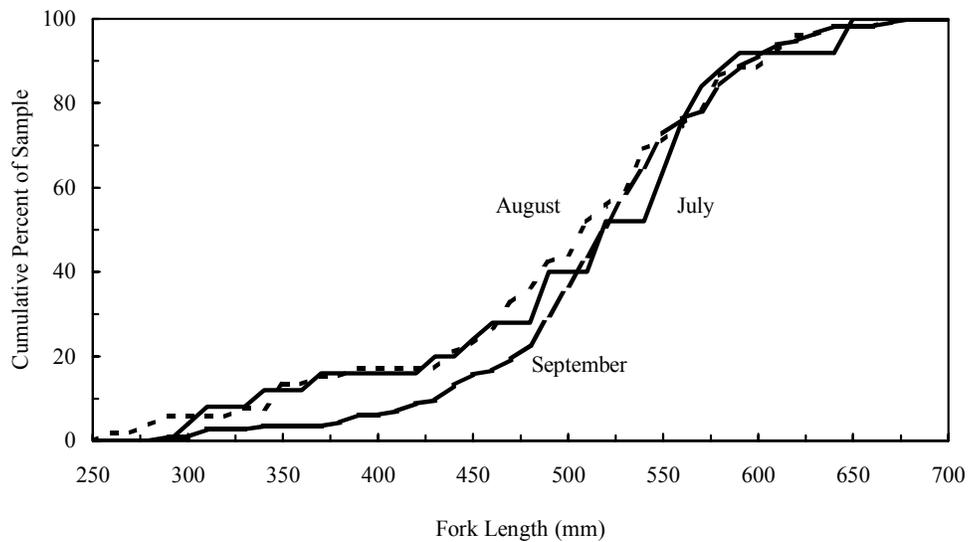


Figure 11.-Cumulative length distributions of Arctic char in the sport fishery at Ugashik Narrows in July (n = 25), August (n = 52), and September (n = 114) 1998.

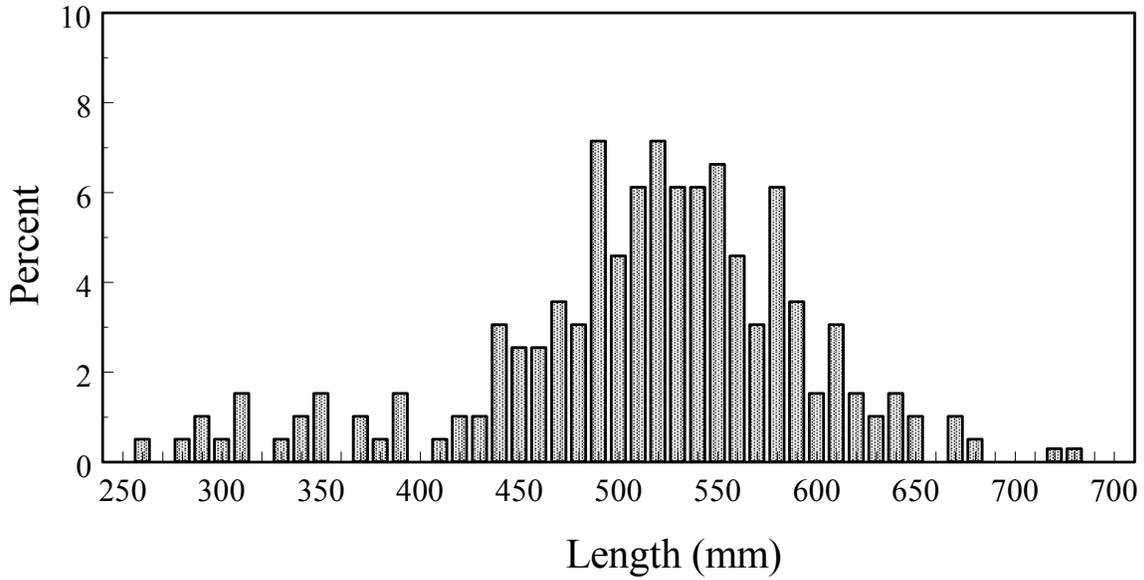


Figure 12.-Length frequency distribution of Arctic char in the sport fishery at Ugashik Narrows, during July-September (n = 196) 1998.

Coho Salmon

The mean length of coho salmon caught from 9 August to 7 September in the sport fishery was 573 mm (SE = 7; 22.6 in; n = 66), ranging from 410 to 683 mm (16.1 in to 26.9 in; Figure 13).

Ages were obtained from 35 of the 66 sampled coho salmon scales (Table 7). Most coho salmon were age 2.1 (62.9%, n = 22), 25.7% were age 1.1 (n = 9) and 5.7% were age 2.2 (n = 2).

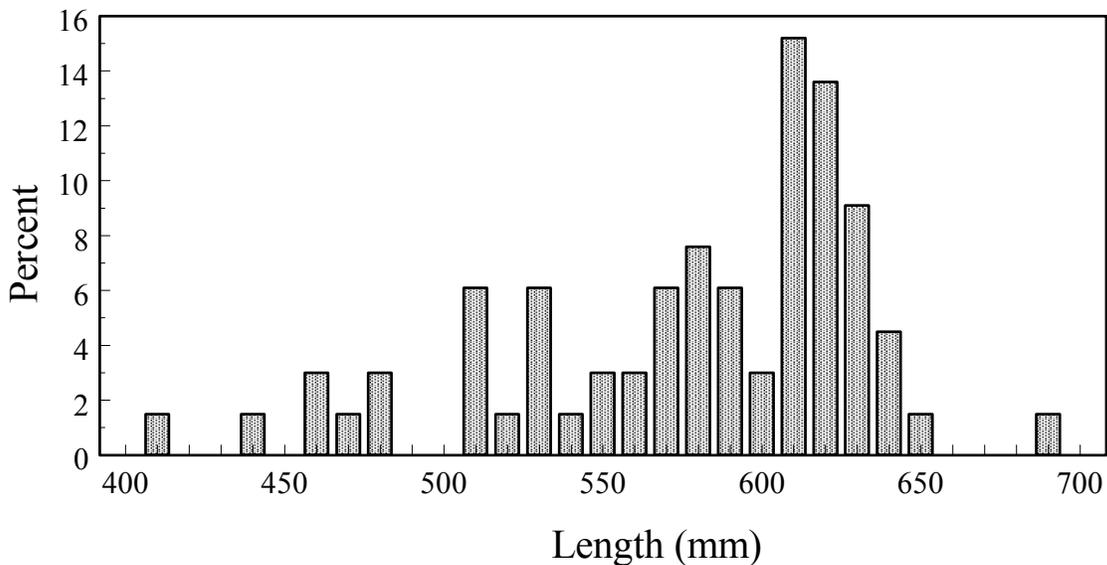


Figure 13.-Length frequency distribution of coho salmon sampled in the sport fishery at Ugashik Narrows, 9 August-7 September 1998 (n = 66).

Table 7.-Estimated mean length (in millimeters), by age class, of coho salmon caught in the sport fishery on the Ugashik Narrows, 20 June to 14 September 1998.

Statistic	Age Class				Total
	Unknown	1.1	2.1	2.2	
n	0	9	23	3	35
Percent	0	26	66	9	100
SE		8	8	5	0
Sample Size	31	9	23	3	66
Mean Length	562	608	587	489	573
SE	11	7	9	42	7

Sockeye Salmon

Length data (mid-eye to fork of tail) were collected from 42 sockeye salmon, with 40 of those sampled between 18 August and 13 September. The mean length was 490 mm (SE = 10; 19.3 in), ranging from 350 mm to 636 mm (13.8 in to 25.0 in). Ages could not be obtained from any of the scales collected from sockeye salmon.

Other Species

The mean fork length of the 13 lake trout sampled in the sport fishery was 476 mm (SE = 6; 18.7 in), and ranged from 434 mm to 520 mm (17.1 in to 20.5 in). The majority of these lake trout (11 out of 13 fish) were sampled in July, the remaining two fish were sampled in August.

The mean length (mid-eye to fork of tail) of the eight pink salmon sampled in the sport fishery during July to September was 445 mm (SE = 16; 17.5 in), and ranged from 387 mm to 525 mm (15 in to 20.7 in).

Two round whitefish, with fork lengths of 333 mm (13.1 in) and 442 mm (17.4 in), were sampled during the project. Although the field crew observed whitefish in the same areas as Arctic grayling, whitefish were rarely captured by hook and line.

Although never captured on hook and line during the creel census, a few northern pike were observed by the field crew in the slower water, marsh areas of Ugashik Narrows.

FLOY TAG RECOVERY SUMMARY

Eleven Arctic grayling sampled during 1998 had orange Floy tags attached near the posterior base of the dorsal fin (Appendix A2). These Arctic grayling were tagged in 1991 and 1992 (Villegas 1993). Three of the 11 tagged grayling sampled in 1998 were captured twice during the 1998 season (Appendix A2).

Data files and computer programs used to produce this report are listed in Appendix B1.

DISCUSSION

The 1,340 angler-hours of effort at the Ugashik Narrows during 20 June to 14 September 1998 was significantly less than the effort estimated during 1987 (2,028 angler-hours: 22 June to 30 August; Meyer 1991) and 1988 (2,148 angler-hours, 20 June to 21 September; Meyer 1991). Much of this decrease in effort is probably because the lodge located at the outlet of Upper Ugashik Lake was inactive during the 1998 season. Review of the USFWS public-use records for the Ugashik Narrows indicate that this now inactive lodge contributed approximately 160 angler-days in 1987 and 250 angler-days in 1988.

Our 1998 creel census documented 348 angler-days at Ugashik Narrows, compared to 3,325 angler-days in the Ugashik drainage area from the 1997 statewide harvest survey (Howe et al. 1998). If the estimate of angler-days in the 1998 statewide harvest survey is similar in magnitude to 1997, there are several possible causes that might explain the difference. The majority of the effort may occur at locations other than the Ugashik Narrows, or at times other than mid-June to mid-September; or the SWHS estimates may be biased because this is such a small fishery.

Angler demographics have not changed significantly from the 1987 and 1988 creel censuses (Meyer 1991). The majority of anglers still are guided, non-Alaskans, fishing from shore. One major change of interest is that the primary fishing gear being used has switched from spin gear in 1987 (63%) and 1988 (70%), to fly-fishing gear in 1998 (70%).

Comparison of the estimated effort, and catch and harvest by species during similar temporal components for the 1988 and 1998 creel censuses provided some indication of changes, as well as similarities (Appendices A3 and A4). When compared to 1988, the 1998 creel census indicated that angler effort had decreased, catch of Arctic grayling had increased, catch of Arctic char and Dolly Varden, coho salmon, and sockeye salmon had decreased substantially, and catch of lake trout remained low. In both 1988 and 1998, catches of sockeye salmon began in the sport fishery in July, and coho salmon began appearing in the sport catch in early August.

In an analysis of the combined data from mark-recapture projects in 1987-1989 (Meyer 1990), and 1991-1992 (Villegas 1993), it was determined that the abundance of Arctic grayling in the Ugashik Narrows increased from 777 fish in August 1989 to 1,777 fish in August 1991 and May 1992 (James Hasbrouck, Alaska Department of Fish and Game, Anchorage, personal communication). The increase in abundance was due primarily to relatively high survival ($\phi = 0.70$) and recruitment ($B = 1,593$) between August 1989 and July 1991. From this analysis, it appears that abundance of Arctic grayling in the Ugashik Narrows is most influenced by recruitment and overwinter survival (September to June), and that the catch-and-release sport fishery during the summer probably does not impact the population. This baseline information will be helpful for planning and future analysis of mark-recapture data in July from the Ugashik Narrows.

Future projects should be conducted on the Arctic grayling population in the Ugashik River drainage, particularly at the Ugashik Narrows. It would be extremely beneficial to estimate abundance of Arctic grayling at the Ugashik Narrows for comparison with estimates from the late 1980s and early 1990s. Care must be taken to design and conduct such a project to minimize the problems encountered with the previous studies; e.g., lack of a closed population as indicated by tagged fish quickly leaving the Ugashik Narrows area, and the possibility of a transitory and resident population of Arctic grayling utilizing the Ugashik Narrows during the course of a

season (Villegas 1993). Prior to, or in conjunction with, a population estimation project, we strongly recommend that a radiotelemetry project be conducted to provide information about migrations of Arctic grayling in the Ugashik River drainage.

ACKNOWLEDGMENTS

USFWS personnel conducted the creel census and biological sampling at Ugashik Narrows; included were Biological Technicians Aaron Poetter and Robert Anderson; Biological Aides Alexis Paul and Armando Herrera; Deputy Refuge Manager Steven Hill; Public Use Planner Helen Clough; Subsistence Regional Coordinator Cliff Edenshaw; and Volunteers Holly Gittlein, Claire Varian, and Rollin Young. The field crews collected the project's data in an efficient and accurate manner. The transportation to and from the field project, provided by USFWS Pilot Bill Smoke, was critical to the project's success. The expedient work of ADF&G Fisheries Technicians Craig and Corey Schwanke of mounting and aging the Arctic grayling and salmon scale samples from the Ugashik Narrows was greatly appreciated. Finally, the guidance on the data analysis section and text editing provided by ADF&G Biometrician Jim Hasbrouck was a great help.

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APPENDIX A. SUPPORTING STATISTICS

Appendix A1.-Daily summary of sampling at the Ugashik Narrows during the 1998 creel census.

Date	No. of Anglers Inter-viewed	No. of Anglers Missed	Effort (hrs)	Mean Effort per Angler	Catch						Harvest		
					Arctic Grayling	Coho Salmon	Sockeye Salmon	Arctic char or Dolly Varden	Lake Trout	Pink Salmon	Coho Salmon	Arctic char or Dolly Varden	
20-Jun	0	0											
21-Jun	5	0	27.00	5.40	20				23				
22-Jun	7	4	9.00	1.29	2			2					
23-Jun	0	0											
24-Jun	0	0											
25-Jun	0	0											
26-Jun	3	0	14.25	4.75	17				5				
27-Jun	2	0	5.50	2.75	3				5				1
28-Jun	8	0	28.00	3.50	27				5				1
29-Jun	3	0	17.50	5.83	16				1				
30-Jun	0	0											
01-Jul	0	0											
02-Jul	4	0	16.00	4.00	7				10				
03-Jul	2	0	14.00	7.00	33				3				
04-Jul	0	0											
05-Jul	5	0	7.50	1.50	1				5				
06-Jul	5	0	15.00	3.00	2				5	2			1
07-Jul	0	0											
08-Jul	6	0	21.00	3.50	6				3				
09-Jul	0	0											
10-Jul	7	0	36.50	5.21	33				9				
11-Jul	4	0	16.00	4.00	3				11	1			
12-Jul	0	0											
13-Jul	13	0	62.09	4.78	50				19				1
14-Jul	5	0	15.00	3.00	10				4				
15-Jul	5	0	15.00	3.00	16				9				
16-Jul	9	0	34.59	3.84	31				23	1			
17-Jul	7	0	22.00	3.14	14				17				
18-Jul	2	0	9.34	4.67	5				2	2			
19-Jul	4	0	11.51	2.88	16				23				2
20-Jul	7	0	22.93	3.28	65			1	15				
21-Jul	4	0	13.50	3.38	3					7			
22-Jul	0	0											
23-Jul	0	0											
24-Jul	6	0	28.51	4.75	10				35		1		
25-Jul	3	0	5.41	1.80	4				1				
26-Jul	5	0	25.33	5.07	52			1	15				2
27-Jul	0	0											
28-Jul	0	0											
29-Jul	7	0	24.50	3.50	21								
30-Jul	4	0	26.00	6.50	73				7				
31-Jul	4	0	4.34	1.09					1	4			

-continued-

Appendix A1.-Page 2 of 3.

Date	No. of Anglers Inter-viewed	No. of Anglers Missed	Effort (hrs)	Mean Effort per Angler	Catch						Harvest	
					Arctic Grayling	Coho Salmon	Sockeye Salmon	Arctic char or Dolly Varden	Lake Trout	Pink Salmon	Coho Salmon	Arctic char or Dolly Varden
01-Aug	0	0										
02-Aug	0	0										
03-Aug	0	0										
04-Aug	3	0	21.51	7.17	37		1	27		1		
05-Aug	0	0										
06-Aug	7	0	33.33	4.76	45			17		1		
07-Aug	0	0										
08-Aug	0	0										
09-Aug	5	1	27.84	5.57	72	6	1	8	1	1		3
10-Aug	0	0										
11-Aug	0	0										
12-Aug	0	0										
13-Aug	0	0										
14-Aug	17	0	70.50	4.15	30	9		17	1	1		8
15-Aug	0	0										
16-Aug	0	0										
17-Aug	0	0										
18-Aug	14	4	68.66	4.90	36	18	3	21				3
19-Aug	0	0										
20-Aug	0	0										
21-Aug	7	0	15.50	2.21	3	19	1	9	2			1
22-Aug	5	0	22.50	4.50	12	7	1	4				
23-Aug	5	0	7.50	1.50		3	2	2				2
24-Aug	0	0										
25-Aug	3	0	15.75	5.25	10	7		14				6
26-Aug	4	3	33.00	8.25	1	18	3	4		4		13
27-Aug	9	0	69.17	7.69	81	16	8	47	1	1		2
28-Aug	9	0	24.50		4	8	2	37		1		2
29-Aug	15	0	77.39	5.16	34	20	6	49	2			2
30-Aug	15	0	50.00	3.33	6	20	8	24		1		3
31-Aug	7	0	12.82	1.83	1	1		21		1		5

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Appendix A1.-Page 3 of 3.

Date	No. of Anglers Inter-viewed	No. of Anglers Missed	Effort (hrs)	Mean Effort per Angler	Catch						Harvest		
					Arctic Grayling	Coho Salmon	Sockeye Salmon	Arctic char or Dolly Varden	Lake Trout	Pink Salmon	Coho Salmon	Arctic char or Dolly Varden	
01-Sep	9	0	30.25	3.36	3		5	45					2
02-Sep	3	0	3.25	1.08	2		1	1					
03-Sep	4	0	18.00	4.50	16	2	1	14				1	
04-Sep	3	0	13.09	4.36	10	1		7					
05-Sep	6	0	32.00	5.33	15	11	5	34					
06-Sep	7	0	14.50	2.07	10		2	8					
07-Sep	12	0	33.02	2.75	10	6	12	24		1			
08-Sep	4	0	5.00	1.25	2	1		6					
09-Sep	0	0											
10-Sep	4	0	3.00	0.75				1					
11-Sep	6	0	28.50	4.75	4		10	64					2
12-Sep	5	0	6.50	1.30	1		8	9					
13-Sep	9	0	31.25	3.47	1	4	18	66					3
14-Sep	5	0	24.75	4.95	5			40					
Total	348	12	1,340.38	3.85	991	177	100	878	24	14		44	23

Appendix A2.-Summary of data for Arctic grayling tagged with Floy tags in previous Ugashik Narrows studies and recaptured during 1998.

Floy Tag Number	Original Tagging Data			Data from 1998			No. of Years Since Tagging	Change in Length (mm) since tagging
	Floy Tag Color	Date Tagged	Fork Length (mm)	Date Recaptured	Sampled Fishery	Fork Length (mm)		
4047	Orange	08/06/1991	265	07/23/1998	Test	460	7.0	195
4047	Orange			08/25/1998	Sport	463		
4095	Orange	07/11/1991	320	09/04/1998	Sport	448	7.2	128
4100	Orange	07/12/1991	245	08/18/1998	Sport	478	7.1	233
4167	Orange	07/13/1991	295	06/26/1998	Sport	457	7.0	162
4167	Orange			07/30/1998	Sport	465		
4330	Orange	05/22/1992	310	06/27/1998	Sport	442	6.1	132
4330	Orange			07/13/1998	Sport	440		
4357	Orange	05/20/1992	280	08/09/1998	Sport	473	6.2	193
4415	Orange	05/22/1992	395	07/13/1998	Sport	456	6.1	61
4435	Orange	05/21/1992	345	06/26/1998	Sport	450	6.1	105
4505	Orange	06/21/1992	315	07/30/1998	Sport	437	6.1	122
4556	Orange	07/15/1992	320	06/25/1998	Test	Na ^a	5.9	NA
4814	Orange	NA	NA	07/10/1998	Sport	450	NA	NA
4814	Orange			07/13/1998	Sport	450		

^a NA = Not available.

Appendix A3.-Comparison of angler effort by date for the Ugashik Narrows sport fishery during 1988 and 1998.

Date	1988		1998	
	n	%	n	%
Anglers-Days				
6/20-6/30	12	3	24	7
7/02-7/26	133	28	104	30
7/27-8/09	64	13	30	9
8/10-9/08	231	48	156	45
9/09-9/14 ^a	<u>39</u>	8	<u>30</u>	9
Total	479		344	
Anglers-Hours				
6/20-6/30	31	1	101	8
7/02-7/26	622	29	391	29
7/27-8/09	231	11	138	10
8/10-9/08	1,075	50	616	46
9/09-9/14 ^a	<u>190</u>	9	<u>94</u>	7
Total	2,148		1,340	

^a 9/09–9/20 in 1988.

Appendix A4.-Comparison of 1988 and 1998 estimated catch and harvest by species and date for the Ugashik Narrows sport fishery.

Date	Catch		Harvest		Percent Harvested	
	1988	1998	1988	1998	1988	1998
Arctic Grayling						
6/20-6/30	4	85	0	0	0.0	0.0
7/02-7/26	140	361	9	0	6.4	0.0
7/27-8/09	1	248	0	0	0.0	0.0
8/10-9/08	57	286	5	0	8.8	0.0
9/09-9/14 ^a	1	11	0	0	0.0	0.0
Total	203	991	14	0	6.9	0.0
Arctic char or Dolly Varden						
6/20-6/30	24	41	7	2	29.2	4.9
7/02-7/26	221	209	34	6	15.4	2.9
7/27-8/09	81	60	10	0	12.3	0.0
8/10-9/08	608	388	49	10	8.1	2.6
9/09-9/14 ^a	426	180	9	5	2.1	2.8
Total	1,360	878	109	23	8.0	2.6
Coho Salmon						
6/20-6/30	0	0	0	0		
7/02-7/26	0	0	0	0		
7/27-8/09	16	6	8	3	50.0	50.0
8/10-9/08	321	167	166	41	51.7	24.6
9/09-9/14 ^a	12	4	2	0	16.7	0.0
Total	349	177	176	44	50.4	24.9
Sockeye Salmon						
6/20-6/30	0	0	0	0		
7/02-7/26	85	2	79	0	92.9	0.0
7/27-8/09	13	2	10	0	76.9	0.0
8/10-9/08	49	60	1	0	2.0	0.0
9/09-9/14 ^a	145	36	12	0	8.3	0.0
Total	292	100	102	0	34.9	0.0
Lake Trout						
6/20-6/30	0	0	0	0		
7/02-7/26	7	13	2	0	28.6	0.0
7/27-8/09	12	5	10	0	83.3	0.0
8/10-9/08	3	6	2	0	66.7	0.0
9/09-9/14 ^a	0	0	0	0	0.0	0.0
Total	22	24	14	0	63.6	0.0

^a 9/09–9/20 in 1988.

**APPENDIX B. COMPUTER FILES FROM 1998 AND
SOFTWARE USED TO PRODUCE THIS REPORT**

Appendix B1.-Computer files from 1998 and software used to produce this report.

<u>Data files:</u>	<u>Description</u>
R-020200I011998ALL.DTA	Ugashik Narrows creel census angler interview data
R-020200C011998N.DTA	Ugashik Narrows creel census angler count data
R-020200B011998N.DTA	Ugashik Narrows Arctic grayling sport fish AWL samples
R-020200B111998.DTA	Ugashik Narrows Arctic grayling test fish AWL samples
R-020200B031998.DTA	Ugashik Narrows Arctic char sport fish AWL samples
R-020200B171998.DTA	Ugashik Narrows Arctic char test fish AWL samples
R-020200B021998N.DTA	Ugashik Narrows Dolly Varden sport fish AWL samples
R-020200B091998.DTA	Ugashik Narrows Dolly Varden test fish AWL samples
R-020200B081998.DTA	Ugashik Narrows lake trout sport fish AWL samples
R-020200B161998.DTA	Ugashik Narrows lake trout test fish AWL samples
R-020200B191998.DTA	Ugashik Narrows sockeye salmon sport fish AWL samples
R-020200B131998N.DTA	Ugashik Narrows coho salmon sport fish AWL samples
R-020200B271998.DTA	Ugashik Narrows chum salmon sport fish AWL samples
R-020200B071998.DTA	Ugashik Narrows whitefish sport fish AWL samples

<u>Analysis programs:</u>	<u>Description</u>
KS2M.EXE	A program developed by ADF&G Sport Fish Division, Research and Technical Services staff for conducting Kolmogorov-Smirnov two-sample tests.
ADK2.EXE	A program developed by ADF&G Sport Fish Division, Research and Technical Services staff for conducting Anderson-Darling K-Sample tests.
BBX.SAS	A SAS program that uses biological data (AWL files) to produce tables of mean length and weight by sex and age group.