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STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF SPORT FISH AND SPORT FISH WATERS OF WESTERN ALASKA WITH EMPHASIS ON ARCTIC CHAR LIFE HISTORY STUDIES

By

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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project No.: F-9-16

Study No.: G-I Study Title: INVENTORY AND CATALOGING

Job No.: G-I-P-A Job Title: Inventory and Cataloging of Sport Fish and Sport Fish Waters of Western Alaska with Emphasis On Arctic Char Life History Studies

Cooperator: Alfred DeCicco

Period Covered: July 1, 1983 to June 30, 1984

ABSTRACT

A survey of the Omikviorok River showed the presence in June 1983 of spent Arctic char, Salvelinus alpinus (Linnaeus), which had overwintered in the system. Fifty-eight tagged char in the Noatak and Wulik-Kivalina systems were recovered in 1983, 86% in local subsistence fisheries. Homing, alternate year spawning, and non site-specific overwintering are indicated. Intersystem movement of Noatak spawners to overwinter in the Wulik-Kivalina Rivers is shown. A slow, summer-long immigration of prespawning char was observed in the Noatak and Wulik Rivers.

Spawning surveys showed 1,180 char in the Wulik River, 695 in the Kivalina River, and 2,890 in the Kelly River, all greater than in the past 2 years. The sex ratio of spawning char in the Noatak River was 1 male to 2.48 females, while that in the Wulik was 1 male to 1.39 females. A higher proportion of larger fish was found in the Wulik spawning population.

Adult char show a closer relationship between age at smoltification and length than between age and length.

The fall 1983 subsistence catch was about 16,270 fish in Kivalina and 4,450 fish in Noatak. Historic catches are presented for the Kivalina subsistence fishery and the Kotzebue incidental commercial fishery.

BACKGROUND

The Noatak, Wulik and Kivalina Rivers have long been known to support large populations of Arctic char which are important to the subsistence economy of the region and sustain a light sport fishery of recognized quality. The Wulik and Kivalina Rivers drain a 1,520 sq mi area of the western slopes of the Brooks Range and empty into the Chukchi Sea at lat. 67° 54' N, long. 160° 31' W, near the village of Kivalina. The Noatak River, the ninth largest river in the state, drains a 12,597 sq mi area of northwestern Alaska and enters Kotzebue Sound at lat. 67° 00' N, long. 162° 30' W, about 5 mi north of Kotzebue.

The present life history study was begun in 1981 after preliminary survey work in 1980. Char spawning and rearing areas were located. Aerial surveys showed that Noatak River tributary streams supported more spawning activity than either the Wulik or Kivalina Rivers. Char were tagged in spawning areas on the Noatak system and in overwintering areas on the Kivalina River. Data on char movements, angling effort and harvest were collected. A summary of information on Arctic char of the region was presented by DeCicco (1982).

Recent mineral exploration and development has prompted an increase in environmental studies and focused attention on the Wulik River system where the Red Dog heavy metals deposit is located (Houghton and Hilgert 1983, E.V.S. Consultants 1983).

During the third year of this study, major emphasis was placed on tagging and counting spawning char in the Wulik and Kivalina Rivers, recapturing tagged char on Noatak tributary streams and obtaining harvest information from the subsistence and incidental commercial fisheries. Some activities, including overwintering counts and tagging of fall spawners, were not accomplished due to unseasonably bad weather and water conditions.

A map of the study area is presented in Figure 1 and a list of fish species occurring in the study area is presented in Table 1.

KEY WORDS

Arctic char, spawning, overwintering movements, life history, Wulik River, Kivalina River, Noatak River, Kotzebue.

RECOMMENDATIONS

Research

1. Continue tag recovery in selected areas on the Noatak and Wulik River system.

2. Enumerate overwintering and spawning char.

Table 1. List of common names, scientific names and abbreviations of fish found in study area.

Common Name	Scientific Name & Author	Abbreviation
Alaska blackfish	Dallia pectoralis Bean	BF
Arctic char	Salvelinus alpinus (Linnaeus)	AC
Arctic grayling	Thymallus arcticus (Pallas)	GR
Arctic flounder	Liopsetta glacialis (Pallas)	AF
Arctic lamprey	Lampetra japonica (Martens)	AL
Bering cisco	Coregonus laurettae (Bean)	BCI
Broad whitefish	Coregonus nasus (Pallas)	BWF
Burbot	Lota lota (Linnaeus)	BB
Chinook salmon	Oncorhynchus tshawytscha (Walbaum)	KS
Coho salmon	Oncorhynchus kisutch (Walbaum)	SS
Dolly Varden	Salvelinus malma (Walbaum)	DV
Fourhorn sculpin	Myoxocephalus quadricornis (Linnaeus)	FSC
Humpback whitefish	Coregonus pidschian (Gmelin)	HWF
Inconnu (sheefish)	Stenodus leucichthys (Guldenstadt)	SF
Lake trout	Salvelinus namaycush (Walbaum)	LT
Least cisco	Coregonus sardinella Valenciennes	LCI
Longnose sucker	Catostomus catostomus Forster	LNS
Ninespine stickleback	Pungitius pungitius (Linnaeus)	NSB
Northern pike	Esox lucius Linnaeus	NP
Pacific herring	Clupea harengus pallasi Valenciennes	PH
Pink salmon	Oncorhynchus gorbuscha (Walbaum)	PS
Round whitefish	Prosopium cylindraceum (Pallas)	RWF
Slimy sculpin	Cottus cognatus Richardson	SSC
Starry flounder	Platichthys stellatus (Pallas)	SFL

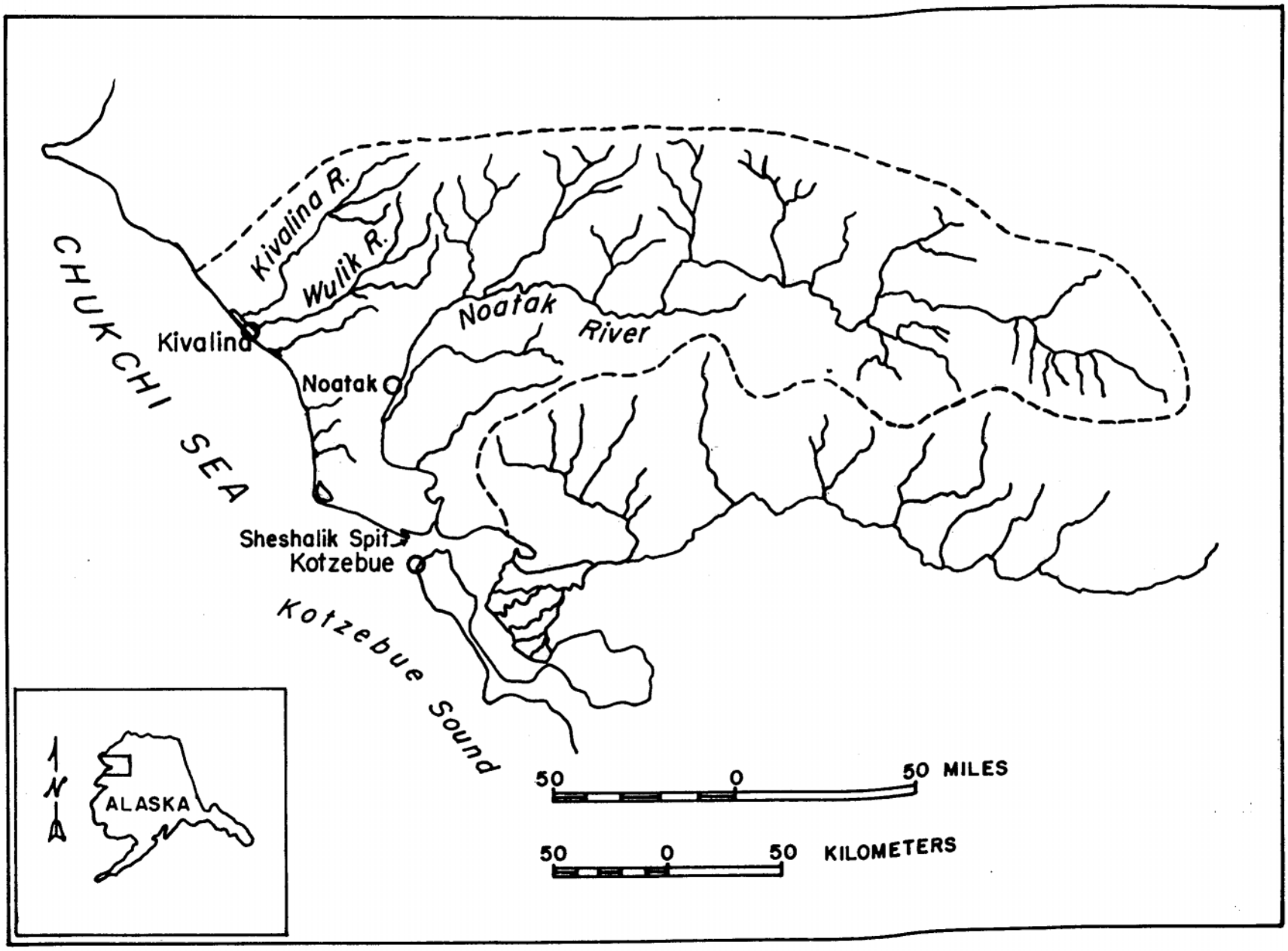

Figure 1. Study Area.

3. Collect life history information with emphasis on summer vs. fall spawning, incremental growth, and early life history.

Management

1. Collect angler use and subsistence harvest information in the study area.

2. Monitor the development of the Red Dog Mine Project and other development in the area with emphasis on potential impacts on char and char habitat.

OBJECTIVES

1. To complete a physical/biological inventory of the Omikviorok River.

2. To determine movements and run timing of Arctic char in the Wulik-Kivalina and Noatak Rivers.

3. To enumerate spawning char in the Wulik-Kivalina and Noatak Rivers and overwintering char in the Wulik-Kivalina Rivers.

4. To collect angler use information on char in the study area.

Note: Objectives are not exactly as in Job Description because G-I-P Job Objectives cover Jobs G-I-P, parts A and B. Those objectives not referred to in part A are omitted.

TECHNIQUES USED

Float-equipped Cessna 185 and wheel-equipped Piper PA-18 aircraft were used to transport field personnel and equipment to and from a base camp near the mouth of the Kugururok River.

Surveys to locate spawning grounds and to enumerate spawning fish were conducted from a Piper PA-18 aircraft flying at low level using standard aerial survey techniques.

Char were captured for tagging using hook and line. An inflatable boat equipped with an outboard jet motor was used on the Nimiuktuk, Kugururok, Kelly and Wulik Rivers. Char captured on spawning grounds in the Noatak and Wulik drainages were tagged using Floy FD 67 internal anchor tags. Tags were numbered, color coded to major streams in the study area and inscribed with "ADF&G Kotz." A $2.00 reward was paid for char tags returned. Posters indicating the presence of tagged char in the area were circulated to all the villages in the study area. All

char tagged were measured to the nearest millimeter from the upper snout to the fork of the tail and weighed to the nearest 25 g using a 6 kg Chatillion spring scale and a basket net. Tagged char were recovered by subsistence fishermen from Sheshalik, Noatak and Kivalina; sport anglers; and ADF&G personnel.

Sagittal otoliths were taken in the field, stored dry in coin envelopes and examined in the laboratory under a dissecting scope by immersing them in loess solution (51 parts 95% alcohol, 7 parts glycerin, 42 parts distilled water). Ages were determined by counting the translucent rings on the otolith.

Age at smoltification of adult char was determined after observation of many otoliths from both juvenile and adult char and noting a growth pattern in the center of adult otoliths which was similar to that found in smolts. Divergence from this pattern was noted by the presence of a wide growth band after 2, 3, or 4 years of normal pre-smolt growth. This wide band was interpreted as representing the first ocean year's growth. Yoshihara (1973), by measuring otoliths, found the greatest yearly growth increment to occur at Age III which corresponded to the age at first seaward migration of most char in the Sagavanirktok River.

Juvenile char were captured with small, mesh gill nets and seines.

Use statistics on the Noatak River were acquired from the National Park Service in Kotzebue. Noatak and Kivalina subsistence harvest information was acquired from Braund and Burnham (1983), Ernest S. Burch Jr. (1983), and by personal interviews in both villages. Catches of fishermen not interviewed were estimated as the mean catch per fishermen.

FINDINGS

Omikviorok River Survey

The Omikviorok River drains an area of 192 sq mi between the Wulik River and the Mulgrave Hills. It is approximately 38 mi long and enters Ipiavik Lagoon on the Chukchi Sea coast at lat. 67° 37'N, long. 164° 12'W (Fig. 2).

Except for the lower 5 mi, the Omikviorok is mostly a single channel stream. Most tributaries drain the north slopes of the Mulgrave Hills and enter the Omikviorok from the south. From mile 2 to mile 5 the channel exhibits extensive braiding through an area with many groundwater sources. For the lower 2 mi and a 2 mi section immediately above the braiding, the Omikviorok meanders through coastal wetland. Bank vegetation throughout the lower third of the stream consists of coastal tundra with some willows. There are a few small gravel bars. The upper reaches of the stream flow through upland tundra with some willow- covered banks.

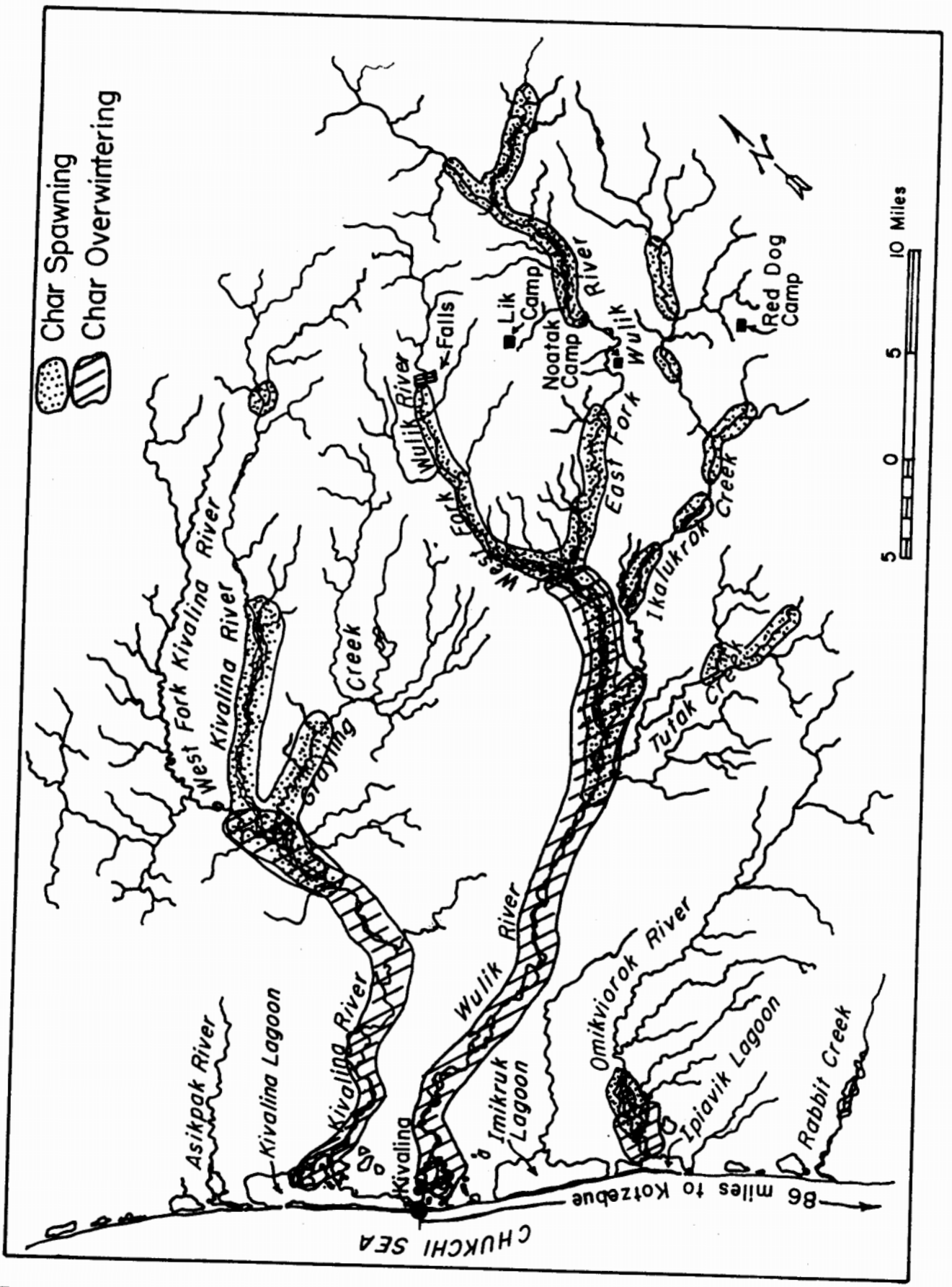

Figure 2. Map of Wulik, Kivalina and Omikviorok Rivers showing char overwintering and spawning locati

Arctic char, Arctic grayling, Bering cisco, pink salmon, chum salmon, humpback whitefish, starry flounder, Arctic flounder, Pacific herring and ninespine stickleback have been documented from the Omikviorok system (Houghton and Hilgert, 1983). Other species probably present include fourhorn sculpin, slimy sculpin and least cisco.

Arctic char, chum salmon and pink salmon spawn in the braided section between mile 2 and mile 5. Aerial counts in 1981, 1982 and 1983 showed 114, 37, and 138 char spawning in this section of the river. In 1983 the major tributaries and mainstem were surveyed up into the hills and large-sized fish were observed only in the lower braided area. Three hundred pink salmon and 60 chum salmon were also seen in this lower section in 1983.

Char smolts, adult char and grayling were captured in gill nets set in Ipiavik Lagoon and the mouth of the Omikviorok on June 15, 1983. Some adult char overwinter in this small system as shown by the capture during this same netting period of a spent female which had not yet been to sea. Two other large fish observed from the air in the lower 200 yards of the Omikviorok on June 15 were probably spent char moving seaward.

Char Movements and Tag Recovery.

Movements indicated by 1983 tag recoveries were similar to those shown previously (DeCicco 1983). Noteworthy movements include the following:

a) That char return to spawn the same stream in which they have previously spawned was demonstrated by the recovery in 1983 of prespawning char which were tagged as spawners in 1981. One recovery each was made in the Wulik, Kelly, Kugururok and Nimiuktuk Rivers, the same streams in which they were tagged.

b) Some char do not overwinter in the same stream every year. In 1983 four overwintering char were recovered in the Wulik River which were tagged in preceding years while overwintering in the Kivalina River.

c) A movement of some Noatak River spawners out to sea or to the Kivalina River for overwintering during the year after spawning was shown by eight 1983 recoveries. These fish represented three different Noatak spawning streams and had been tagged in the summer of 1982.

Tag recoveries occurred in the spring, fall and winter subsistence fisheries at Kivalina, Noatak, and Sheshalik Spit; in tagging operations by staff biologists and in the summer sport fishery. Local subsistence fisheries accounted for 86% of the 58 recoveries made in 1983.

A midsummer upstream movement of prespawning char in the Noatak River was indicated through test netting in the lower river by Commercial Fisheries Division. Spawners made up the majority of their gill net

Table 2. Tag Recovery 1983. The left section shows recovery location and season in which recovery was made. Spring and fall recoveries are from subsistence fisheries in the mainstem of the indicated river. Fish captured in summer are spawning fish. The number recovered in each of these fisheries is indicated by (n). The right section shows location and year of tagging. All fish not footnoted were tagged as spawners. The number following the year is the number recaptured.

Recovery Location	Fishery/Number	Number, Location and Year of Tagging					
Wulik River/ Kivalina Lagoon	Spring n=11	Kivalina R.[a] 1981 - 2 1982 - 6 1983 - 1		Wulik R.[a] 1982 - 1	Nimiuktuk R.[b] 1982 -1		
	Summer n=4	Wulik R.[c] 1981 - 1 1983 - 3					
	Fall n=17	Kivalina R.[a] 1981 - 1 1982 - 3		Wulik R.[a,b] 1982 - 2 1983 - 3	Kugururok R. 1982 - 2	Kelly R. 1982 - 4	Eli R. 1982 - 2
	Winter n=1			Wulik R. 1982 - 1			
Noatak River	Spring n=2	Eli R. 1982 - 1		Nimiuktuk R. 1982 - 1			
	Fall n=16	Eli R. 1982 - 1	Kelly R. 1980 - 1 1981 - 3 1093 - 4	Kugururok R. 1983 - 1	Nimiuktuk R. 1982 - 3 1983 - 3		
Kelly River	Summer n=1	Kelly R.[c] 1981 - 1					

(continued)

Table 2. (Cont'd) Tag Recovery 1983. The left section shows recovery location and season in which recovery was made. Spring and fall recoveries are from subsistence fisheries in the mainstem of the indicated river. Fish captured in summer are spawning fish. The number recovered in each of these fisheries is indicated by (n). The right section shows location and year of tagging. All fish not footnoted were tagged as spawners. The number following the year is the number recaptured.

Recovery Location	Fishery/Number	Number, Location and Year of Tagging
Kugururok River	Summer n=1	Kugururok R.[c] 1981 - 1
Nimiuktuk River	Summer n=1	Nimiuktuk R.[c] 1981 - 1
Sheshalik Spit	Spring n=1	Wulik R.[a] 1982 - 1
	Fall n=2	Kugururok R. 1982 - 2
Kivalina R.	Summer n=1	Kivalina R.[a,c] 1981 - 1

a Tagged as overwintering fish

b One of these fish was recovered in the ocean off of Kivalina

c Recaptured as spawners

catches from July 3 through August 10, and were 100% of their catch from July 15 through August 6. These fish were probably moving into the Noatak to spawn.

A tag recovery in 1982 indicated that some fish, which winter in the Wulik River, travel around the coast to spawn in the Noatak the following summer. By the week ending August 10, the proportion of spawners in the lower Noatak catch had dropped to 25% as the fall migration of overwintering fish had entered the river.

A similar movement occurs in the Wulik River, where two silvery prespawners were captured 32 mi upriver on July 30, 1983. These fish had recently left the sea and were mixed in with other prespawning fish which had not gone to sea that summer.

Aerial Surveys of Spawning Char

Aerial counts of spawning char were conducted in late August 1983; 4,542 fish were enumerated in the Noatak River, 1,180 on the Wulik River and 695 on the Kivalina (Table 3). Because of poor weather conditions, not all known spawning streams were surveyed. Detailed surveys were conducted on the Wulik, Kivalina, Kelly and Eli Rivers. Only a small portion of the Kugururok River was surveyed. Figure 2 shows char spawning and overwintering areas in the Wulik, Kivalina and Omikviorok Rivers. Table 4 compares spawning counts from the past 3 years.

Aerial Surveys of Overwintering Char

Due to unusually poor weather conditions during late September 1983, aerial overwintering counts could not be conducted on either the Wulik or Kivalina Rivers. For past years' counts see DeCicco (1983).

Sex Ratio Of Spawners

The overall sex ratio of 963 spawning char sampled on the Noatak River in 1983 was one male to 2.48 females, which compares to a ratio of 1:2.53 in 1981 and 1:1.87 in 1982 (DeCicco, 1982, 1983). Char appear to be alternate year spawners and the sex ratios from 1981 and 1983 are similar. The sex ratio of 372 spawning char tagged on the Wulik River in 1983 was one male to 1.5 females (Table 5).

Length Frequency of Spawning Char

The length frequency of spawning char on the Noatak in 1983 was similar to that found in 1982 (DeCicco, 1983). Females were most common from 550 to 575 mm and males were most common from 575 to 600 mm (Fig. 3). Modal size range for Wulik River males was 625-650 mm and for females from 550 to 575 mm (Fig. 4). The Wulik River spawning population contained a higher percentage of larger males, with 19.3% being over 625 mm compared to 8.2% for the Noatak. Size distribution of females was similar in both systems.

Table 3. Aerial observations * of spawning char, August 24 and 25, 1983.

River	Stream	No. Spawners
Eli River	Eli main fork	199
	Ahliknak Creek	102
Kelly River	Avan River	254
	Wrench Creek	1,066
	No Name Creek	661
	Kelly to No Name	366
	Kelly above No Name	577
Kugururok River (Incomplete survey)	Mouth to Kagvik	923
	Kagvik Creek	463
Wulik River	Sheep Creek	123
	Wulik - E. Fork	223
	Wulik - W. Fork	196
	Ikalukrok Creek	201
	Tutak Creek	43
	Wulik - Mainstem	394
Kivalina River	Braided Fork	412
	Slow Fork	10
	Grayling Creek	183
	Kivalina Mainstem	90
Omikviorok River		138

* Observation conditions were good for all surveys.

Table 4. Comparative counts of spawning char 1981-1983.

Location	Year 1981	1982	1983
Eli River	...	237	301
Kelly River	2,589	2,326	2,894
Kugururok River	1,756	3,986	1,386[1]
Nimiuktuk River	2,022	2,170	...
Wulik River	262[1]	478	1,180
Kivalina River	428	452	695
Omikviorok River	114	37	138

[1] Partial or incomplete survey.

Table 5. Sex ratio of spawning char on Noatak and Wulik River 1983.

Sex	Kelly River	Kugururok River	Nimiuktuk River	Noatak Total	Wulik River
Male (n)	79	150	48	277	146
Female (n)	253	290	153	686	204
M:F	1:3.21	1:1.93	1:3.19	1:2.48	1:1.39

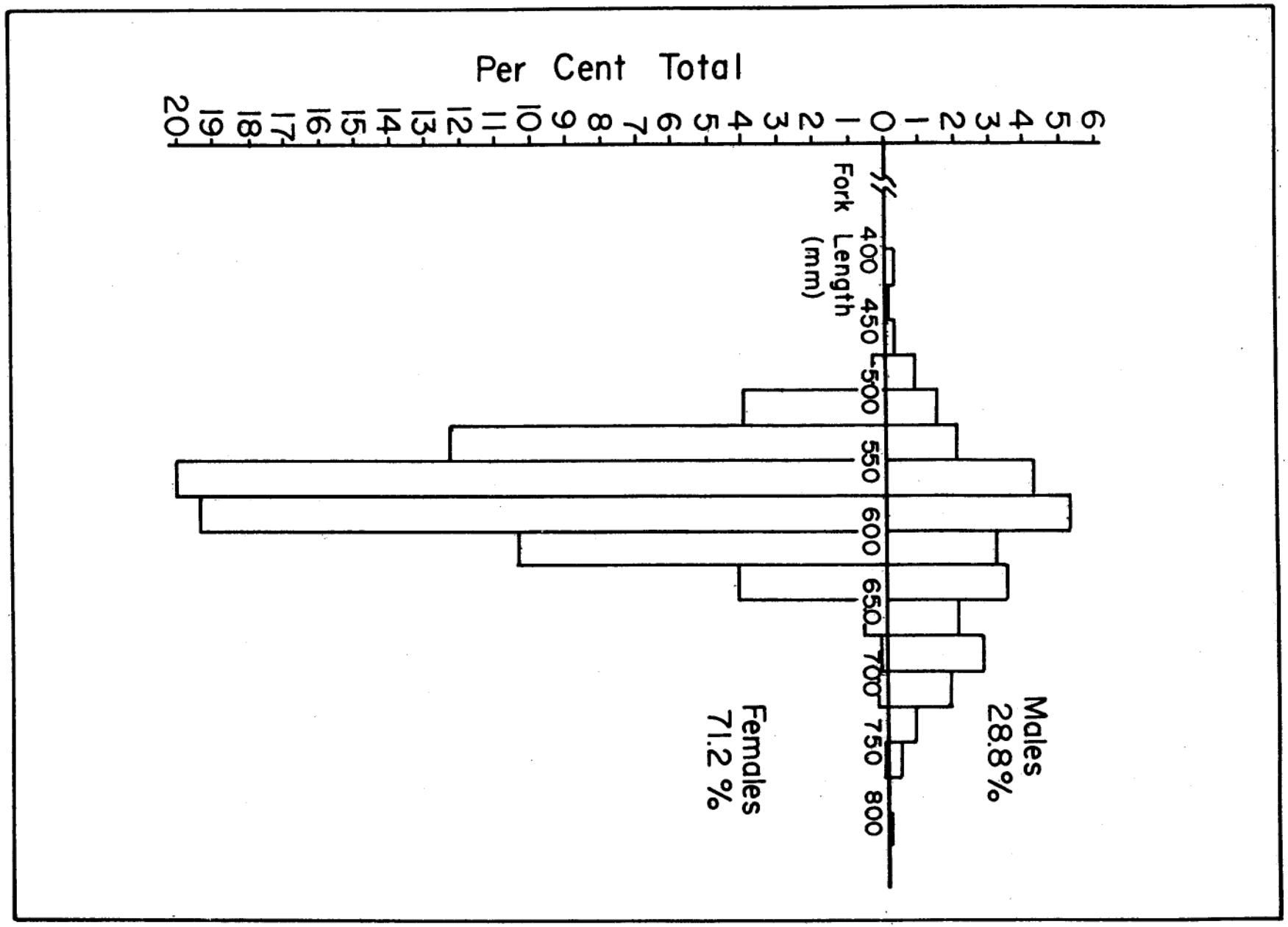

Figure 3. Length frequency of spawning char on the Noatak River

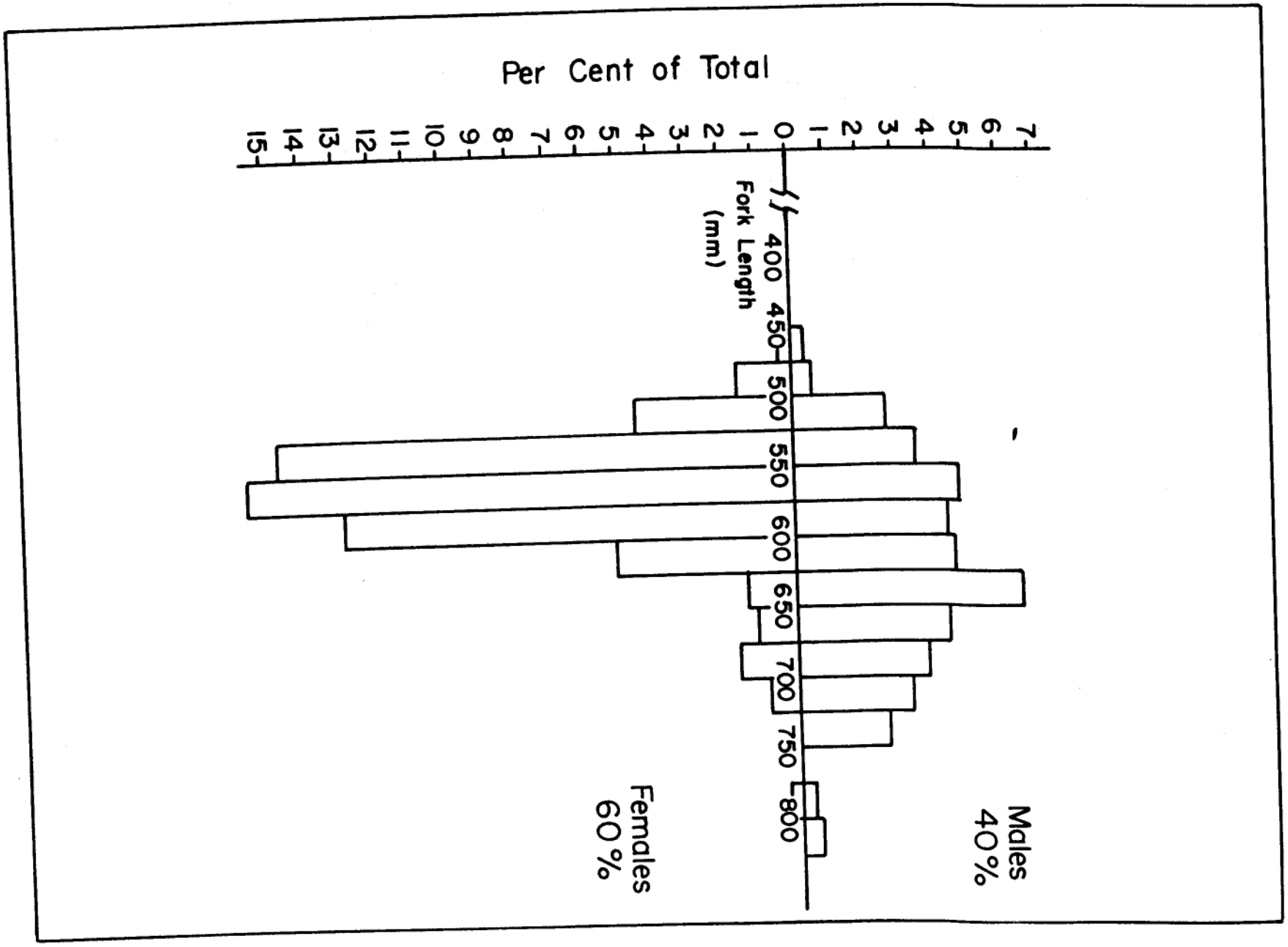

Figure 4. Length frequency of spawning char on the Wulik River in 1983. n=372

Differences in length distribution and sex ratio may be due to the smaller sample size on the Wulik but are more likely due to differential exploitation, in that Wulik River spawners are probably less likely to enter the Kotzebue Sound commercial salmon fishery than are Noatak fish.

Age At First Seaward Migration

Most char in the Noatak River system migrate to sea for the first time at Age II, III or IV. Downmigrating smolts were captured in 1981 and 1983. Of the individuals examined, 5 were Age II, 15 Age III and 4 Age IV. Examination of the otoliths of adult char from the Noatak yielded an age of smoltification determination for 131 additional fish. Combining these data gave a smolt-age composition of 30% Age II, 56% Age III, and 14% Age IV. Average fork length of smolts at Age II was 119 mm, Age III - 140 mm, and Age IV - 143 mm (Table 6).

Age and Growth by Smolt Group

Age-length relationships were determined for 155 char captured in the Noatak River for which age at smoltification could be determined. When grouped by age at smoltification and plotted, three different curves show that growth is more dependant on years at sea than age (Fig. 5) (Table 7). Size range at a given age overlapped for each group and is probably due to attainment of sexual maturity, time spent in streams during spawning years and individual growth variation. Little is known about fall spawners and their migratory pattern or spawning frequency. Differing growth rates based on a different migratory pattern of fall spawners may be shown and inclusion of some of these fish in the sample could account in part for length range overlap at a given age.

Char Harvest

Subsistence:

The total char harvest in the Wulik-Kivalina Rivers from the village of Kivalina was 28,900 for the subsistence year July 1982 through June 1983 (Burch, 1983). The September 1982 seine fishery accounted for 21,970 char or 76% of the annual catch; the winter ice fishery, October through April, yielded 1,771 char (6%); while the spring fishery (May-June) accounted for 4,873 char (17%). Summer fishing (July-August) yielded only 1% of the annual harvest. These figures are based on a conversion of 2.5 lbs per char. Table 8 presents historic Kivalina Village char harvests.

The 1983 fall harvest in Kivalina is estimated at 16,270, char with an additional harvest occurring on the upper Wulik River by people from Noatak for which no data are available.

The seine fishery in Noatak Village produced an estimated catch of 4,450 char from the Noatak River in September 1983.

Table 6. Age and size at first seaward migration. Fork length in mm.

	Smolts	Prespawners	Total	%
Age II	$\bar{x}$ FL = 119 range 108-136 n = 5	n = 41	n = 46	30%
Age III	$\bar{x}$ FL = 140 range 118-185 n = 15	n = 72	n = 87	56%
Age IV	$\bar{x}$ FL = 143 range 130-161 n = 4	n = 18	n = 22	14%

Table 7. Age and growth of char grouped by age at smoltification. Fork length in mm.

		Age									
		II	III	IV	V	VI	VII	VIII	IX	X	XI
Age II smolts	$\bar{x}$ FL	119	...	...	500	563	597	672	...	...	...
	range	108-136			475-532	537-600	529-665	600-720			
	n	5			11	17	9	4			
Age III smolts	$\bar{x}$ FL	...	140	392	481	502	570	655	676	760	744
	range		118-185	392	470-500	432-537	510-654	605-740	650-742	760	744
	n		15	1	5	14	38	8	4	1	1
Age IV smolts	$\bar{x}$ FL	...	...	143	...	484	506	578	623	...	...
	range			130-161		478-490	460-531	501-622	620-625		
	n			4		2	6	8	2		

Table 8. Kivalina subsistence char harvests.

Year	Season	#Pounds	#Char @2.5#/char	Source
1959	fall	85,600	34,240	Sarrio & Kessel, 1966
1960	fall	124,300	49,720	Sarrio & Kessel, 1966
1964/65[1]	year	84,611	33,845	Burch, 1983
1965/66[1]	year	35,218	14,087	Burch, 1983
1968	fall	...	49,512	Winslow, 1969
1969	spring	...	8,402	Roguski & Winslow, 1970
1971	fall	...	29,281	Yoshihara, 1973
1972	fall	...	35,733	Yoshihara, 1973
1979	fall	...	14,600[2]	DeCicco, 1982
1981	fall	...	15,000-18,000	DeCicco, 1982
1982	fall	...	18,438	Braund & Burnham, 1982
	winter	4,426	1,771	Burch, 1983
1982/83	year	72,352	28,900	Burch, 1983
1983	spring	12,183	4,870	Burch, 1983
1983	fall		16,270	present study

[1] Subsistence year June-July

[2] Original estimate based on 365 tubs at 89 char/tub (Winslow, 1969). This estimate is based on 40 char/tub (DeCicco-present study)

Table 9. Incidental commercial Arctic char catches, Kotzebue, 1966-1982 (Dinnocenzo, 1982).

Year	Number of Fish[1]	Pounds[6]
1966	3,325	1
1967	367	2,606
1968	3,181[2]	21,949
1969	1,089[2]	5
1970	2,095[3]	5
1971	3,828[3]	23,353
1972	7,746	56,545
1973	640[4]	4,608
1974	2,605[4]	20,580
1975	5	5
1976	5	5
1977	5	5
1978	1,229	9,094
1979	2,523	12,523
1980	3,049[7]	17,015
1981	3[8]	16
1982	3,447[9]	23,648
1983	835[9]	

1 Reported 7-10 pound average, all numbers are fish sold except for 1983.
2 Includes 269 taken by permit
3 Includes 179 taken by permit
4 Includes 234 taken during commercial inconnu fishery
5 No catch/poundage reported
6 Some data extrapolated from average weight reported
7 No market for char this year, many more char either used for subsistenc or dumped.
8 Limited market, many char either utilized at home or dumped
9 Total catch 835 of which 190 were sold (present study)

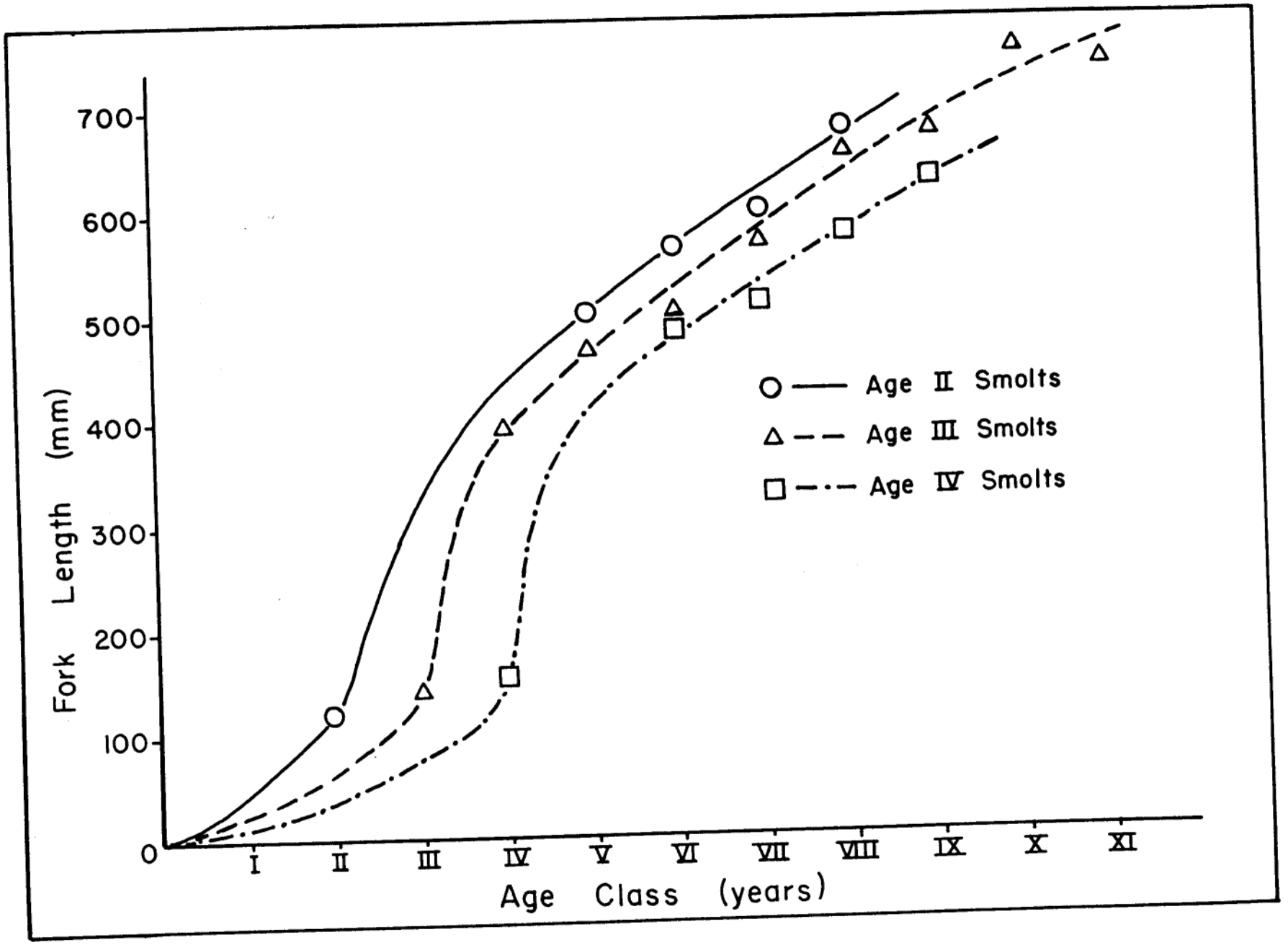

Figure 5. Age-length relationships of char in the Noatak River grouped by age at smoltification.

Recreational:

The 1982 harvest was estimated at 860 char for the Noatak River and at 545 char for the Wulik River by a statewide postal harvest study (Mills 1983). In 1983 the National Park Service estimated that 300 people floated the middle reaches of the Noatak River where char are most available (Gil Hall pers. comm.). The estimated harvest from these float anglers based on the interview of 78 persons in 1983 was 150 char. An additional 178 char were released. Other local and non-local use, including some guided anglers, account for additional harvest.

Commercial:

During the 1983 Kotzebue Sound commercial salmon season, an estimated 835 char were killed, of which 190 were sold. This incidental harvest is lower than in past years (Table 9). The low harvest is due to later than normal timing of the fall char run and an early closure of the commercial fishery due to low salmon escapements. The majority of the char catch (93%) occurred during the last commercial fishing period on August 18-19.

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