

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF SPORT FISH AND
SPORT FISH WATERS OF WESTERN ALASKA

Part A: Arctic Char Life History Study

by

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RESEARCH PROJECT SEGMENT

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Study

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ABSTRACT

This report presents background information and data from the first year of a 4-year life history study of Arctic char, Salvelinus alpinus (Linnaeus), in northwestern Alaska.

Spawning grounds were located on the Anisak, Nimiuktuk, Kelly, Kugururok and Eli Rivers of the Noatak River system and spawning counts were made when possible. The Kelly, Kugururok and Nimiuktuk Rivers had the most spawning activity.

Spawning grounds were also located and surveyed on the Wulik, Kivalina and Omikviorok Rivers.

A total of 992 Arctic char spawners was tagged in Noatak River tributaries and 276 overwintering char were tagged in the Kivalina River. Fifteen Noatak River tags were recovered in 1981, indicating a post spawning movement out of tributary streams into the Noatak.

Spawning char in the Noatak system ranged in fork length from 396 to 870 mm for males and from 425 to 724 mm for females, with a male to female sex ratio of 1:2.53. Modal gill raker counts were 22, 23 and 22 for samples from the Kivalina River, Kotzebue Sound and Trail Creek respectively. Pyloric caecae from 20 juvenile char taken in Trail Creek ranged from 23 to 33, with a mean of 28.2 and a mode of 27. Mean fecundity of Noatak River char was 5,696 ova/female.

Overwintering char counts of 101,826 for the Wulik River and 45,355 for the Kivalina River were obtained by aerial survey.

Scope

Kotzebue Sound and Chukchi Sea drainages of northwestern Alaska contain populations of Arctic char which presently support light sport fishing and locally intensive subsistence fishing efforts. Biological investigations of char in the region have been limited to the Wulik River and to a lesser degree the Kivalina River. In anticipation of increased sport fishing pressure and proposed mineral development, the Sport Fish Division of the Alaska Department of Fish and Game is undertaking a 4-year study to investigate various life history aspects of Arctic char populations in these drainages. No biological information on movements, discreteness of populations, system interchange, spawning, or early life history of Arctic char exists for the Noatak River, Kobuk River or the many smaller coastal streams in the area. This study addresses this informational gap and will compliment existing information in previously studied areas.

Age and growth, early life history, and physical/chemical survey data will be compiled as collected and reported when available on all streams for comparative purposes.

KEY WORDS

Arctic char, Western Alaska, Wulik-Kivalina, Noatak, Kobuk Rivers, aerial surveys, Floy tagging, spawning movements.

BACKGROUND

The Arctic char of northwestern Alaska is important to the local subsistence economies of Kivalina, Noatak and Kotzebue and is becoming an increasingly sought-after sport fish by local and non-local anglers. Mineral exploration in the upper Wulik and Kivalina Rivers and possible mineral development in other watersheds, with its associated population increases, could place additional demands on the char and their habitat.

Previous work in the area has primarily been focused on the Wulik and Kivalina Rivers. Sarrio and Kessel (1966) presented information on subsistence utilization of fish by Kivalina residents. They present harvest levels of 97,600 pounds for the fall of 1959 and 124,000 pounds for the fall of 1960. Winslow (1969) documented the fall subsistence harvest on the Wulik River, showing an estimated harvest of 120,000 pounds of char. Winslow also presented the first biological data on Wulik River char. He sampled 139 fish and presented age and growth data. Gill raker counts were taken on three fish. Alt (1978) presented information on various life history aspects of Wulik and Kivalina River char. Major spawning and overwintering areas were delineated and information on migrations and spawning was given.

There have been several surveys in the past, however, they were done by various biologists in different years and arrived at by different methods. As such, no conclusions can be drawn from these survey data, but they are valuable as relevant existing data. Aerial surveys conducted by the Division of Commercial Fisheries in 1968 enumerated 90,235 char

overwintering in the Wulik River and 27,460 in the Kivalina River. From these counts they estimated that 180,000 to 225,000 char were present in the Wulik River and 46,000 were present in the Kivalina River. A survey in 1969 by the Division of Commercial Fisheries showed 297,257 char present in the Wulik River. Alt (1981) presents estimated overwintering populations from subsequent aerial survey data as 137,545 for the Wulik River and 39,360 for the Kivalina River in 1979; and 124,908 for the Wulik River and 43,661 for the Kivalina River in 1980.

In 1966, 1967, and 1968 the Division of Commercial Fisheries tagged 143 Arctic char near Shashalik Spit and along the Baldwin Peninsula in Kotzebue Sound incidental to their chum salmon research efforts. Of a total of 33 tag recoveries; 19 were from the tagging area, 7 were from the Noatak River, 4 were from the Wulik River, 2 were from the Kobuk River and 1 was from Port Clarence on the Seward Peninsula. These tagging data indicate a mixing of char stocks in Kotzebue Sound.

There is increasing pressure on char stocks in the Noatak River. The river is known in the area as supporting a large char population. Residents of Noatak take char for subsistence use by seining in the fall and by "hooking" through the ice in winter. During the summer, the Noatak River is a popular wilderness float trip, and increased recreational activity due to the newly designated Park-Preserve status can be expected. National Park Service estimates of traffic in the area for 1981 were 1,000 floaters on the Noatak River and 800 floaters on the Kobuk River (Gil Hall, pers. comm.)

In August of 1980 Alt (1981) located char spawning areas by aerial survey on the Noatak River and 98 char in the Kelly River drainage were tagged.

Arctic char have been taken in subsistence catches on the Kobuk River at Noorvik, Kiana, and Ambler. Kobuk residents have reported taking small numbers of char in the upper Kobuk incidental to fall seining for sheefish and whitefish. Reports indicated that the Squirrel River was the most important char stream in the Kobuk system.

Common and Scientific names of fish found in the study area are given in Table 1.

RECOMMENDATIONS

Research

1. Research on the life history of Arctic char in northwest Alaska should continue.
2. Due to shortages of manpower and funding, the Kobuk River should be dropped from the study area.

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

Common Name	Scientific Name & Author	Abbreviation
Alaska blackfish	<u>Dallia pectoralis</u> Bean	BF
Arctic char	<u>Salvelinus alpinus</u> (Linnaeus)	AC
Arctic grayling	<u>Thymallus arcticus</u> (Pallas)	GR
Arctic Lamprey	<u>Lampetra japonica</u> (Martens)	AL
Bering cisco	<u>Coregonus laurettae</u> (Bean)	BCI
Broad whitefish	<u>Coregonus nasus</u> (Pallas)	BWF
Burbot	<u>Lota lota</u> (Linnaeus)	BB
Chinook salmon	<u>Oncorhynchus tshawytscha</u> (Walbaum)	KS
Coho salmon	<u>Oncorhynchus kisutch</u> (Walbaum)	SS
Dolly Varden	<u>Salvelinus malma</u> (Walbaum)	DV
Humpback whitefish	<u>Coregonus pidschian</u> (Gmelin)	HWF
Inconnu (sheefish)	<u>Stenodus leucichthys</u> (Guldenstadt) ["]	SF
Lake trout	<u>Salvelinus namaycush</u> (Walbaum)	LT
Least cisco	<u>Coregonus sardinella</u> Valenciennes	LCI
Longnose sucker	<u>Catostomus catostomus</u> Forster	LNS
Ninespine stickleback	<u>Pungitius pungitius</u> (Linnaeus)	NSB
Northern pike	<u>Esox lucius</u> Linnaeus	NP
Pink salmon	<u>Oncorhynchus gorbuscha</u> (Walbaum)	PS
Round whitefish	<u>Prosopium cylindraceum</u> (Pallas)	RWF
Slimy sculpin	<u>Cottus cognatus</u> Richardson	SSC

Management

1. Monitoring of the sport and subsistence char harvest should continue.
2. Monitoring of mineral exploration efforts in the area should continue.

OBJECTIVES

1. To begin a physical-biological survey of the Wulik-Kivalina and Noatak Rivers and selected Chukchi Sea drainages.
2. To determine movements, run timing, distribution, and system interchange of Arctic char in the waters of the study area.
3. To locate and describe Arctic char spawning areas within the study area.
4. To survey overwintering and spawning populations of Arctic char within the study area.
5. To collect angler and subsistence use information on important sport fish species within the job area with emphasis on the Wulik-Kivalina, Noatak, and Kobuk Rivers.

All the Job Objectives are listed, however only certain aspects could be addressed in this first year. Many findings, like physical survey data and char system interchange, will be reported on when data are more complete.

Study Area

The study area includes the drainages of the Kobuk, Noatak, Wulik and Kivalina Rivers, as well as smaller coastal streams flowing into the Chukchi Sea between the communities of Kivalina and Kotzebue. The total area included is 26,117 square miles. Kotzebue is the population and transportation center of the area, with outlying villages located on the major rivers in the area. Kivalina is located at the mouth of the Wulik River; Noatak on the Noatak River; Noorvik, Kiana, Ambler, Shungnak, and Kobuk on the Kobuk River. Arctic char occur in these rivers and many smaller streams. Research within the study area is confined to the major char-producing streams. This work area may change as more is learned of char distribution and abundance. During 1981 emphasis was placed on the Noatak River system. A map of the study area is presented in Figure 1.

TECHNIQUES

Float-equipped Cessna 185 and PA-18 aircraft and wheel-equipped PA-18 aircraft were used to transport field personnel and equipment to and from a base camp. Surveys to locate spawning grounds were conducted using the same aircraft. Spawning areas were located by flying along streams at low level and observing fish. Ground checks were made to confirm that species observed were Arctic char. Most major middle Noatak tributary streams were

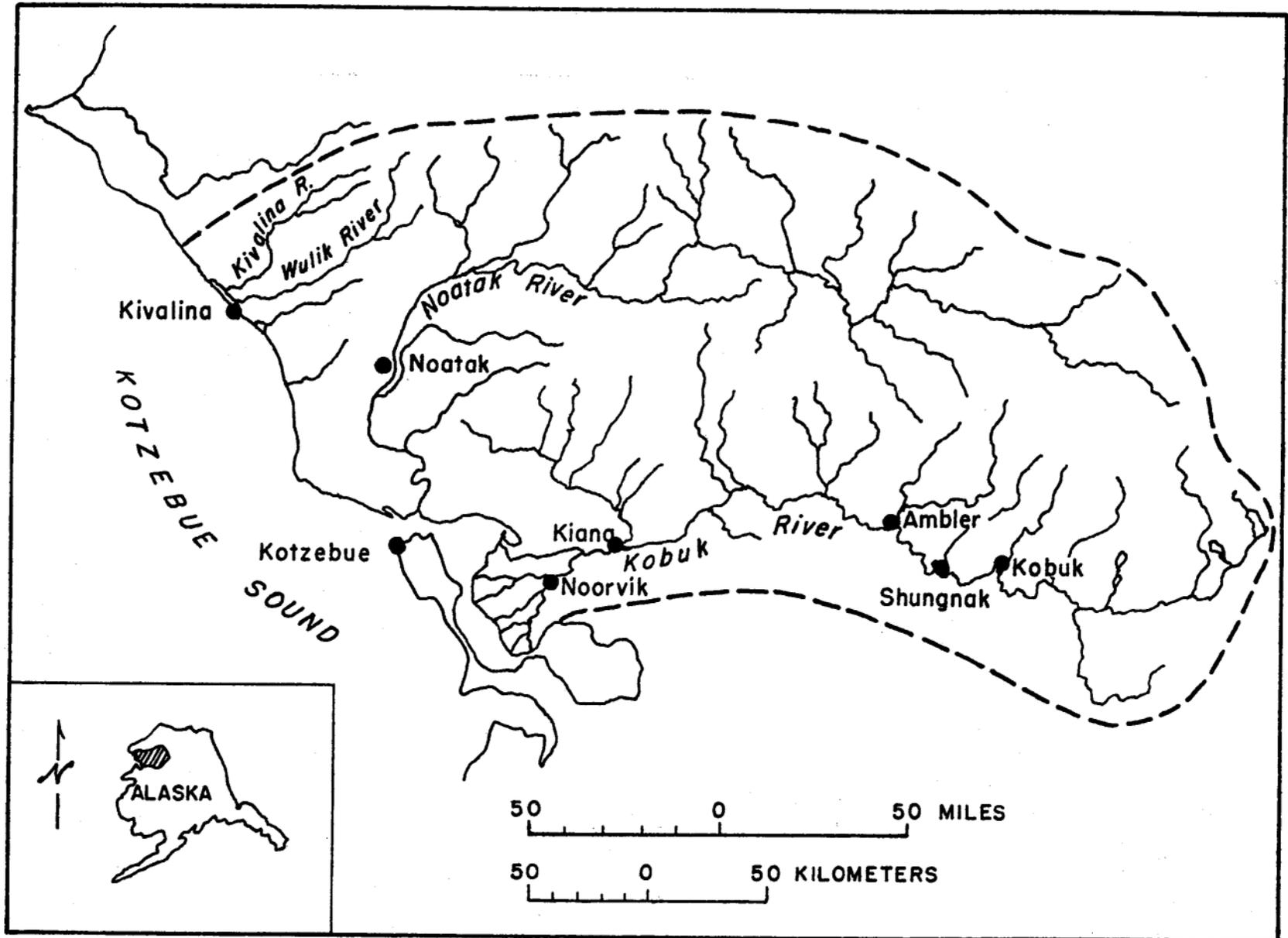


Figure 1. Study Area

initially surveyed during August of 1980. Spawning areas were delineated on U.S. Geological Survey 1:250,000 topographic maps.

Spawning ground aerial surveys were conducted from a wheel-equipped Piper PA-18 aircraft flying at low level. Numbers of fish were determined by counting individual fish and estimating larger concentrations by tens or hundreds. Some spawning areas were surveyed a second or third time if water, wind or sunlight conditions restricted visibility. Because of high water during the summer of 1981 all spawning areas were not surveyed with confidence.

Counts of overwintering fish were flown on the Wulik and Kivalina Rivers in late September using a PA-18 aircraft. Large concentrations of fish were estimated to the nearest thousand.

Char were captured for tagging using hook and line, a 80' x 10' 3/4" bar measure seine and a 90' x 6' 1 1/4" bar measure seine. Transportation to tagging areas was by Cessna 185 and Piper PA-18 aircraft. A Zodiac Mark II inflatable boat equipped with a 35hp outboard jet was used on the Nimiuktuk, Kelly and Kivalina Rivers. The Kelly River and Wrench Creek were floated using 12' Avon Redshank rafts in early August. Char were captured on spawning grounds in the Noatak drainage and tagged using Floy internal anchor tags inserted under the skin between the last two dorsal fin rays so that the tags lodged between adjacent pterygiophores. Tags were color-coded to major spawning streams on the Noatak River, the Wulik River and the Kivalina River; tags were inscribed with "ADF&G Kotz", indicating Alaska Department of Fish and Game, Kotzebue. A \$2.00 reward for char tags was paid by the Commercial Fisheries Division, which staffs a permanent office in Kotzebue. Char tags were recovered by Commercial fishermen in Kotzebue Sound, subsistence fishermen from Noatak village and ADF&G personnel. Additional recoveries will probably come from area sport fishermen. 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 grams using a 6 kilogram Chatillion spring scale and a basket net.

Spawning female char were captured for fecundity data using hook and line and a 90' x 6' 1 1/4" seine dragged by hand through a spawning area. Ovaries were weighed to the nearest 0.1 gram using an Ohaus Dial-a-gram balance. Egg diameters were taken by measuring 10 eggs to the nearest millimeter in the field. Ovaries were then preserved in 10% formalin and stored in 36-oz. Whirl Pacs. Ovaries were boiled in the laboratory and separated for counting. The number of ova was determined gravimetrically by weighing a sample of about one-fourth the ovary and counting the eggs. Checks by counting the complete ovary showed an error of about 3% using this method.

Saggital otoliths were taken for aging from char killed for fecundity data, from those killed incidental to tagging and from overwintering fish from the Kivalina River. Otoliths were stored dry in coin envelopes and aged in the laboratory by immersing them in loess solution (51 parts 95% alcohol, 7 parts glycerin, 42 parts distilled water) and examining them under a dissecting scope.

Juvenile char were captured using a small mesh dipnet. Outmigrating char smolts were captured using a beach seine in the lower Noatak River by

Commercial Fisheries Division incidental to chum salmon fry capture efforts.

Subsistence harvest data were collected by interviewing Noatak Village residents in conjunction with the collection of recovered tags. Sport fish harvest data were collected by personal interview.

FINDINGS

In the 1981 field season, 1,289 Arctic char (Salvelinus alpinus Linnaeus) were tagged in the study area; of these, 992 were tagged as spawners in Noatak River tributaries, 21 as spawners in the Wulik River, and 276 as overwintering fish in the Kivalina River. During preliminary work in 1980 an additional 98 spawners were tagged in the Kelly River, 28 in the Wulik River, 9 in the Kivalina River and 5 in the Omar River. The total number of char tagged, by sex, type, year and location, is presented in Table 2.

Fifteen tags have been recovered in the study area. Of these, two recovered in the Kotzebue Sound commercial salmon fishery were tagged in the Kelly River as spawners in 1980, and 11 recovered in subsistence seining on the Noatak River were tagged as spawners in the Noatak tributaries in 1981. These recoveries support the hypothesis that, after spawning, most fish in the Noatak system move into the main Noatak River to overwinter. The two remaining recoveries were made at the mouth of the Noatak. Both of these fish were tagged as spawners in the Nimiuktuk River in 1981. These recoveries are discussed in the section on movements.

Movements of Spawners

Noatak River:

There are both summer and fall movements of prespawning Arctic char into spawning areas on the Noatak River. Summer spawners do not migrate seaward in the spring, but school off the mouths of tributary streams used for spawning. Sometime between late June and the end of July they enter these streams and distribute themselves on spawning grounds. In 1981 this movement occurred between late June and early July. Anglers experienced good success sport fishing for char at the mouth of the Nimiuktuk River on June 28 (Bernd Gaedeke pers. comm.) but only six fish were observed in that area from the air on July 2. On July 5, an aerial survey showed char distributed in the lower 22 miles of the Nimiuktuk River. Observations on July 2 showed no char at the mouth of the Kugururok River and only few at the mouth of the Kelly River. On July 3, char were observed in the vicinity of spawning grounds on the Eli River, 68 miles from its mouth. Local reports indicate that char are usually available to anglers at Noatak tributary mouths until mid-July. June of 1981 was unusually dry, rendering the Noatak River very low and clear when I arrived in the study area on July 2. Low water conditions may have been responsible for the early movement of char into spawning streams.

After spawning most summer spawners move into the Noatak River where they mix with the in-migrating overwintering segment of the population. The non-spawning overwintering population may be comprised of immature,

Table 2. Number of char tagged in the study area by year, sex, type and location.

M/F	*	Kelly R.		Kugururok	Nimiuktuk	Kivalina		Wulik River		Omar River
		1980	1981	1981	1981	1980	1981	1980	1981	1980
F	S	76	265	210	229	5	4	18	15	3
M	S	21	93	83	112	4		10	6	2
U	S	1								
F	O						132			
M	O						78			
U	O						62			
Total Tagged		<u>98</u>	<u>358</u>	<u>293</u>	<u>341</u>	<u>9</u>	<u>276</u>	<u>28</u>	<u>31</u>	<u>5</u>

M = Male

F = Female

U = Unknown

* = S/Spawner O/Overwintering

developing and non-consecutive spawning individuals. Spent fish were captured intermixed with newly-arrived overwintering fish on September 19, 1979 at the mouth of the Kugururok River. Spent and overwintering char were also observed in subsistence catches at Noatak village on September 30, 1981.

Some summer spawners which spawn early probably migrate to sea for a month or two after spawning. This was indicated by the recovery of two char in the Kotzebue Sound commercial salmon fishery which were tagged as spawners in the Nimiuktuk River in early July. Both were recovered off the mouth of the Noatak River, one on July 28, 20 days after tagging and the other on August 8, 48 days after tagging. No information on sexual condition was available.

Fall spawners enter the Noatak River with the first group of overwintering char in mid-August. It is not yet known when these fish enter spawning streams or how much overlap there is with summer spawning, but a prespawning female was captured 20 miles up the Kugururok River on September 17, 1979. This fish had an egg diameter of 4 mm and, judging by its silvery color, had just recently entered fresh water. Fall spawners may remain in spring areas after spawning or may move into the main Noatak. Partially spent char were observed in a spring area above newly-building aufeis on Trail Creek on October 5, 1981. There may not have been enough flow through the aufeis to allow later passage of these fish out of this spring area.

Wulik/Kivalina Rivers:

Alt (1978) reported movements of spawners on the Wulik and Kivalina Rivers similar to those described above for the Noatak River. Between August 8-11, 1981, fall spawners were moving up the Wulik River between Tutak Creek and the mouth of Ikalukrok Creek. Fifteen char were captured on hook and line. The two examined had eggs over 3 mm in diameter, were silvery in color, had a slightly distended vent and light pink spots. The fish which were tagged and released were similar, with the males having darker spots and beginning to develop kypes. These fish would probably not spawn until September. At this time summer spawners were actively spawning and non-spawning overwintering fish had not yet entered the Wulik.

Overwintering Movements

Noatak River:

Arctic char destined to overwinter in the Noatak River begin entering the river in mid-August. Incidental char catches in the Kotzebue commercial salmon fishery indicate that the presence of char peaks in Kotzebue Sound during the third week of August. Sport fishermen caught overwintering char at the mouth of the Kelly River on August 21, 1981 and at the mouth of the Kugururok River on August 22, 1981. Bob Uhl (pers. comm.) indicated that there is an additional peak in-movement during mid-September in some years. In any event, the fall in-migration is prolonged, as four char were taken in one net night in Kotzebue Sound on September 25, 1979 (DeCicco unpublished). Timing of spring outmigration on the Noatak has not yet been determined.

Wulik/Kivalina Rivers:

Alt (1978) reported four overlapping runs of overwintering char into the Wulik and Kivalina Rivers, with the size of fish increasing in subsequent runs and the in-movement extending from early August until after freeze-up. On August 20, 1981 overwintering char were as far upriver as Kili Hill (13 mi) on the Kivalina River and Avenak Mountain (12 mi) on the Wulik River.

Out-migration takes place in the spring soon after the river breaks up.

Spawning

Noatak River:

Arctic char spawning takes place in the Noatak drainage over a prolonged period, with fish being observed in the vicinity of spawning grounds from early July to mid-October. I have designated two groups of spawners. Summer spawners are those char which after overwintering remain in fresh water, move into tributary streams and occupy spawning grounds from early July through mid-September. Fall spawners are those char which in-migrate with overwintering fish in the fall and remain in tributary streams to spawn from mid-September through freeze-up.

Surveys to locate spawning areas and enumerate summer spawners in the Noatak were flown during July and August. Arctic char spawning was observed in the Eli River, an unnamed creek below Kelly River, and in the Kelly, Kugururok, Nimiuktuk and Anisak Rivers. Table 3 presents aerial observations of spawners made in 1981. The highest total counts were 2,589 spawners in the Kelly River system and 3,284 in the Kugururok River system. A complete survey of the Nimiuktuk River was not accomplished due to high, turbid water during most of the spawning season. Counts in Table 3 do not represent an exact number of spawners in any of these systems due to movement into and out of spawning areas throughout the spawning period, but can be considered as an index of summer spawning for comparative purposes.

Fall spawners were observed on October 5, 1981 in four spring areas on the Kugururok River. Only one of these areas had been used for summer spawning. Other areas used for summer spawning were devoid of fish at this time.

Figure 2 shows known spawning and overwintering areas in the Noatak system.

Most documented Arctic char spawning areas in northern Alaska are very closely associated with ground water sources (Yoshihara 1973, McCart 1980, Bendock 1981). Although there are many spring areas in Noatak spawning streams, and some spawning has been observed in and around springs, most spawning occurs downstream of springs in the main channels of streams. The major spawning streams maintain a limited flow throughout the winter (Childers and Kernodle 1981) and should be considered under spring influence for much of their length.

Childers and Kernodle found no late winter flow in the Noatak River above the Kugururok River (mile 120). However, the Nimiuktuk River, entering the Noatak 77 miles above the Kugururok, does maintain some winter discharge

Table 3. Aerial observation of spawning char in the Noatak drainage.

Stream	Tributary to:	Date	Conditions	# Char Observed
Kagvik Creek	Kugururok R.	7/25/81	poor	317
Nunaviksak Creek	Kurururok R.	7/25/81	poor	38
Kugururok River	Noatak R.	7/25/81	poor	553
Unnamed Creek	Noatak R.	7/26/81	good	193
Seagull Creek	Nimiuktuk R.	8/16/81	poor	194
Kukakpilak Creek	Nimiuktuk R.	8/16/81	good	361
Tumit Creek	Nimiuktuk R.	8/16/81	good	853
Seagull Creek	Nimiuktuk R.	8/17/81	good	606
Upper Nimiuktuk	Noatak R.	8/17/81	fair	202
Trail Creek	Kugururok R.	8/17/81	good	419
Nunaviksak Creek	Kugururok R.	8/17/81	good	317
Kagvik Creek	Kugururok R.	8/17/81	good	792
Kugururok River	Noatak R.	8/17/81	good	1,756
Wrench Creek	Kelly R.	8/19/81	fair	1,005
No Name Creek	Kelly R.	8/19/81	fair	356
Avan River	Kelly R.	8/19/81	fair	346
Kelly River	Noatak R.	8/19/81	fair	882

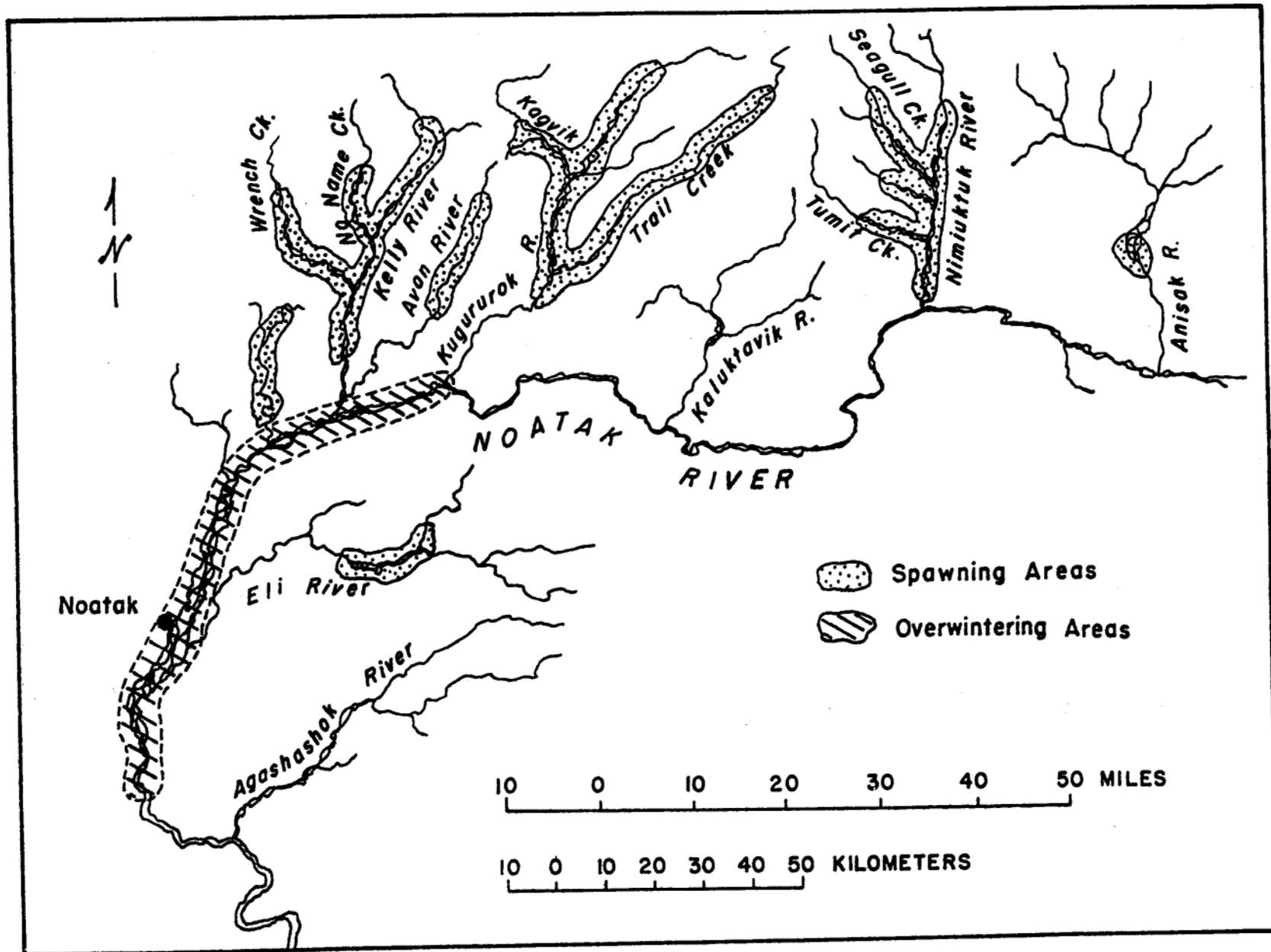


Figure 2. Known spawning and overwintering areas in the Noatak system.

and is the furthest upstream tributary on the Noatak where large numbers of spawning char have been found. An aerial survey in August 1980 revealed some char spawning in the Anisak River, which enters the Noatak 45 miles above the Nimiuktuk. Spawning was restricted to one spring area and only 18 fish were observed (Alt 1981). Bernd Gaedeke (pers. comm.) indicated having caught Arctic char spawners in the vicinity of tributary streams located 400 miles up the Noatak River.

Wulik/Kivalina and Coastal Waters:

Spawning char were also observed in the Kivalina and Wulik Rivers and in some coastal streams between Kivalina and Cape Krusenstern. On July 26, 1981, three char were observed in Rabbit Creek, 12 in Jade Creek and 114 in the Omikviorok River. An aerial survey of the Kivalina River on August 20, 1981 showed 106 spawners in Grayling Creek, 331 in the braided fork of the Kivalina River, 51 in Baqhalik, and 40 in the Kivalina below the forks. On September 25, 1981, 245 fall spawners were observed in Baqhalik.

An aerial survey of the Wulik River on August 20, 1981 showed 44 char spawning in Sheep Creek, 89 in Ikalukrok Creek and 129 in the main Wulik. Large numbers of chum salmon present in the Wulik River made it difficult to differentiate char. Alt (1978) estimated that 3,000 to 4,000 char spawn in the Wulik and Kivalina Rivers. Figure 3 shows known spawning and overwintering areas on the Wulik, Kivalina, and Omikviorok Rivers.

Overwintering

Noatak River:

Char overwinter in the mainstem of the Noatak River from below Noatak Village to at least as far upstream as the Kugururok River.

The Noatak River between the Kelly and Kugururok Rivers was aerielly surveyed on September 29. No counts could be made because of slush ice, but char were observed off the mouths of both streams and in concentrations at several locations between. On September 31, Noatak residents were catching overwintering char through the ice in front of the village and they indicated that char are caught all winter in an area from about 6 miles below the village to 7 miles above (Fig. 2).

A survey flown on September 21, 1980 by the Commercial Fisheries Division enumerated 45,185 char between Noatak Village and the Kelly River (Frank Bird, pers. comm.).

Wulik/Kivalina:

An aerial survey of overwintering char flown on September 25, 1981 enumerated 101,826 char on the Wulik River and 45,355 on the Kivalina River. These counts compare with counts from past years (Alt 1981). An additional survey was attempted on September 29, 1981 but the lower Wulik was frozen at that time and shelf ice forming along the riverbanks obscured visibility and provided shelter for fish (Fig. 3).

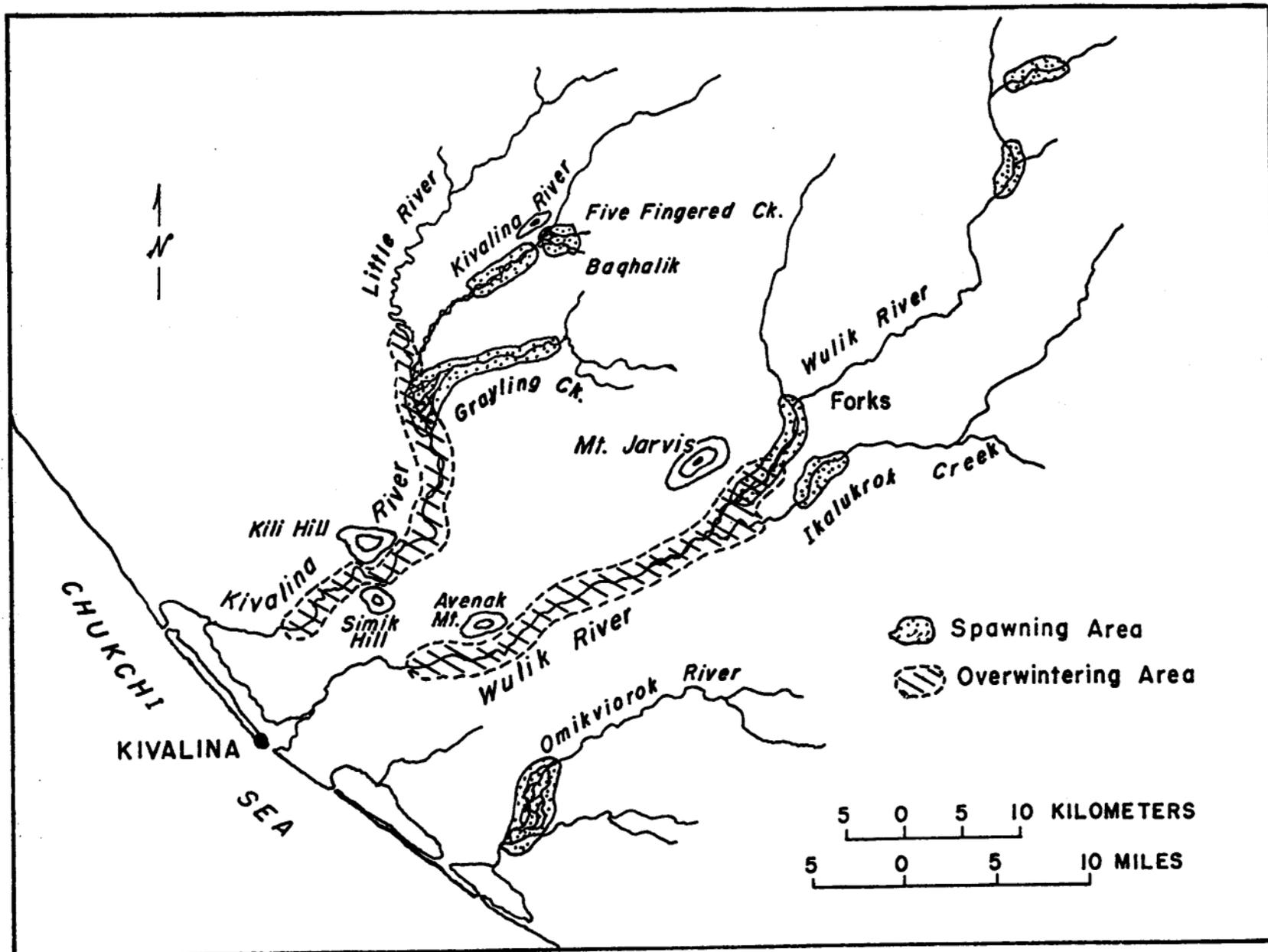


Figure 3. Known spawning and overwintering areas in the Wulik, Kivalina and Omikviorok Rivers.

Observations of Juvenile Char

Young-of-the-year char were first observed in the Kugururok River on July 25. During work on the Kelly River on 16 and 17 July, no young-of-the-year were observed; thus, emergence probably began sometime between 17 and 25 July in the Noatak system. Young-of-the-year were observed on Trail Creek on July 28, and during the first week of August they were abundant in side channels and slow shallow areas along the length of Wrench Creek.

Eight Age I and II juveniles captured in small tributaries of Wrench Creek in early August ranged in fork length from 85 to 127 mm. In July and October a sample of 47 juvenile and residual char (stream resident males which develop and spawn at a small size) from Trail Creek ranged in size from 46 to 253 mm and in age from young-of-the-year to 7 years. Seven of these were found to be developing or prespawning residual males and two were spent males captured in a spring area which contained anadromous spawners on October 10, 1981. Yoshihara (1973) used the presence of residual male char to help explain the differential sex ratio of spawning char in the Sagavanirktok River.

Seven outmigrating char smolts were captured by a Commercial Fisheries Division chum salmon research crew in the lower Noatak River. They ranged in size from 126 to 141 mm and in age from 2 to 4 years. Table 4 summarizes smolt data.

Biological Aspects

Gill raker counts:

The modal gill raker count from 109 overwintering char collected in the Kivalina River was 22, from 48 char collected in Kotzebue Sound was 23, and from 20 juvenile char collected from Trail Creek was 22 (Table 5).

Pyloric caecae counts:

Pyloric caecae collected from 20 juvenile char from Trail Creek ranged in number from 23 to 33 with a mean of 28.2 and a mode of 27.

Sex ratios:

The male to female ratio of 1,088 spawning Arctic char tagged in the Noatak River system was 1:1.53 (Table 6). Yoshihara (1973) found a male to female ratio of 1:1.29 for all spawning char in the Sagavanirktok River. He used a seine as capture gear for most of his samples, while rod and reel was the primary capture gear in the present study. In the Kivalina River, a male to female ratio of 1:1.87 was found in a sample of 129 overwintering char caught in one seine haul on September 21, 1981.

Length Frequency:

Spawning char on the Noatak ranged in fork length from 396 to 870 mm for males and from 425 to 724 mm for females (Table 7, Fig. 4).

Table 4. Char smolts captured on the lower Noatak, June 14, 1981.

Fork Length (mm)	Weight (gm)	Sex	Age
126	15.0	M	2
130	17.9	F	4
133	18.3	F	3
133	19.3	M	4
136	20.3	F	3
141	21.2	F	3
141	22.6	M	3

Table 5. Gill raker counts.

	Kivalina River	Kotzebue Sound	Trail Creek
Range	19-26	20-25	20-23
n	109	48	20
Mean	22.1	23.1	21.7
Mode	22	23	22

Table 6. Sex ratio of Arctic char spawners in Noatak River tributaries.

<u>Sex</u>	<u>Location</u>			<u>Total</u>
	<u>Kelly R.</u>	<u>Kugururok R.</u>	<u>Nimiuktuk R.</u>	
Male	114	83	112	309
Female	340	210	229	779
Male:Female	1:2.98	1:2.53	1:2.05	1:2.53

Table 7. Length frequency of Noatak River spawners and Kivalina River overwintering char by sex.

<u>Fork Length (mm)</u>	<u>Kelly R.</u>		<u>Kugururok</u>		<u>Nimiuktuk</u>		<u>Kivalina</u>		
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>Unknown</u>
350 - 374								3	1
375 - 399					1		1	7	4
400 - 424	1						7	11	14
425 - 449	5	1					17	31	24
450 - 474	5	4			3	2	15	36	15
475 - 499	9	31	10	26	12	25	18	17	3
500 - 524	22	88	22	63	22	59	6	10	1
525 - 549	29	72	11	56	18	68	4	6	
550 - 574	8	59	14	27	14	33	6	4	
575 - 599	10	39	4	19	6	19	3	2	
600 - 624	5	20	6	8	3	10	1		
625 - 649	2	13	3	4	8	5		4	
650 - 674	9	8	4	3	11	2			
675 - 699		2	2	4	4	5			
700 - 724	1	3	4		6	1			
725 - 749	2				1				
750 - 774	2				1				
775 - 799			3		1				
800 - 824	2								
825 - 849	1								
850 - 874	1								

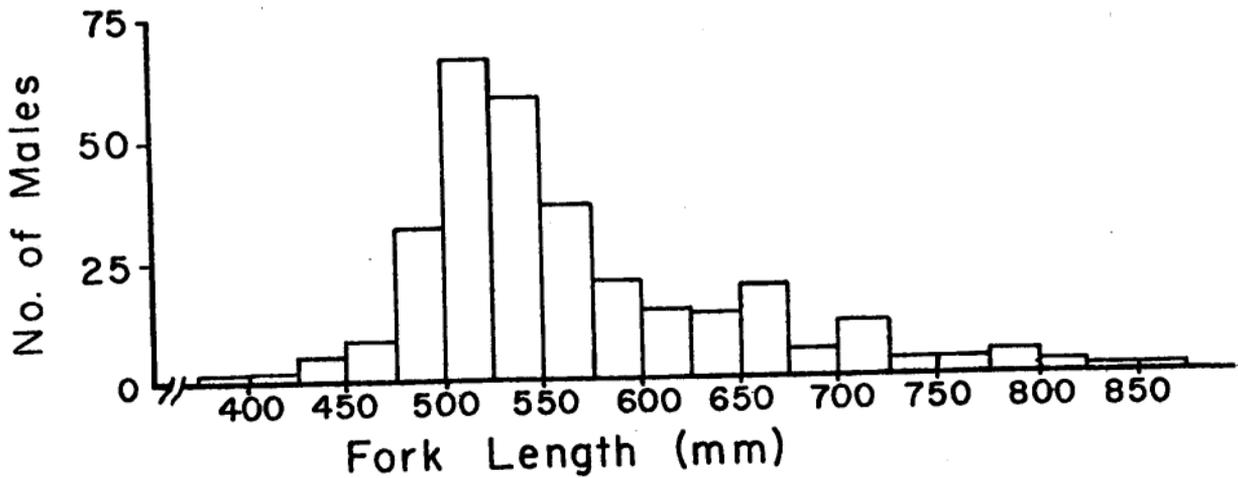
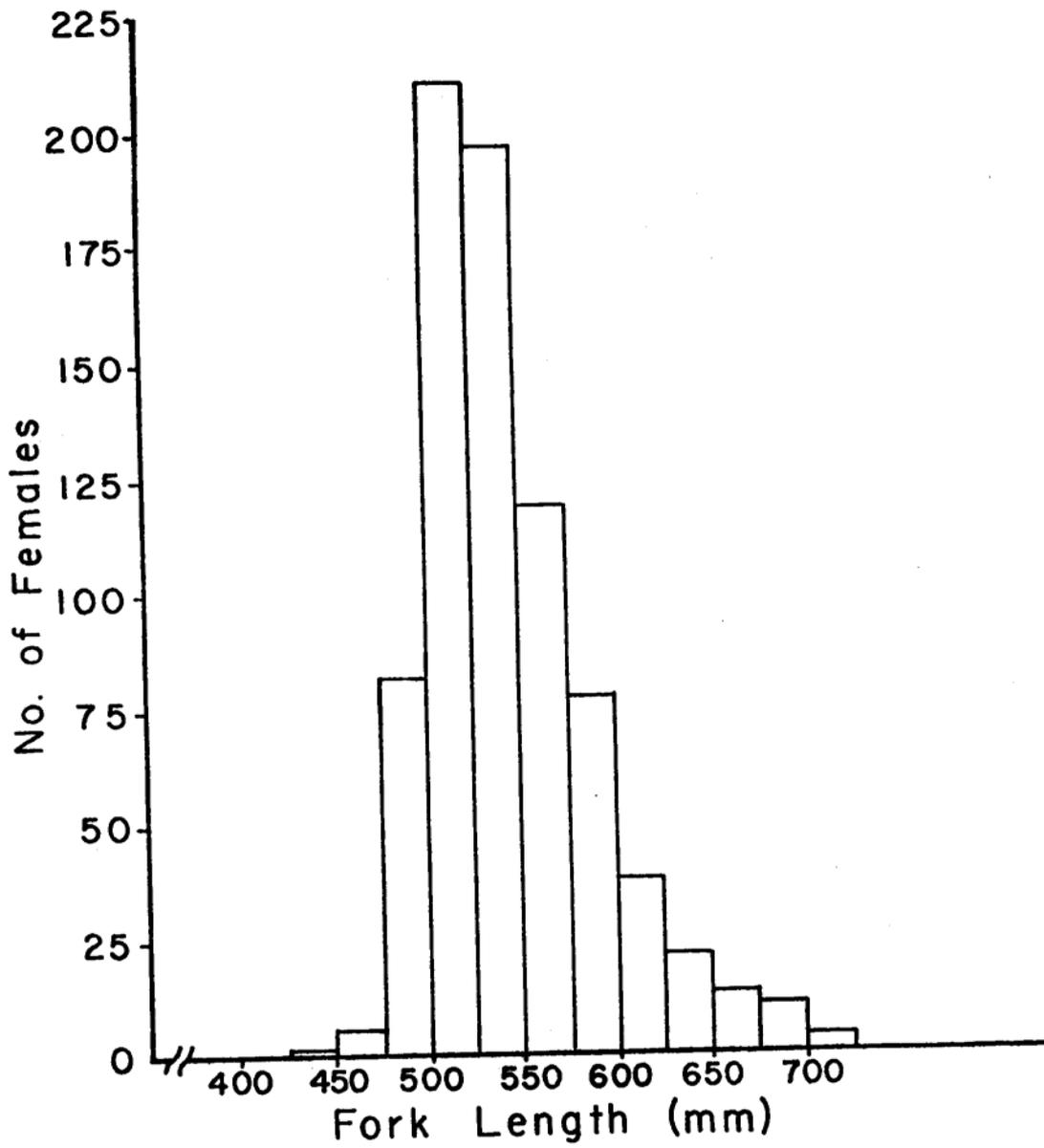


Figure 4. Length frequency by sex of char tagged in the Noatak system.

Overwintering char tagged in the Kivalina River ranged in length from 311 to 648 mm (Table 7).

Fecundity:

Ovaries were collected from 10 female Arctic char in Tunit Creek on the Nimiuktuk River on August 16 and from 10 females from the Kugururok River on August 18. Fish ranged in fork length from 482 to 652 mm with a mean of 533 mm. The number of eggs per female ranged from 3,717 to 8,618 (Table 8). Fecundity of Noatak River char was compared to that of comparably sized North Slope char from the Sagavanirktok River (Yoshihara 1973). Thirty-two Sagavanirktok char ranged in fork length from 483 mm to 630 mm with a mean of 519 mm. The number of ova per female ranged from 3,112 to 6,226. The mean fecundity for Noatak River spawners (5,696) was significantly higher than that of Sagavanirktok fish (4,532), ($t=3.69$; $p < 0.01$).

Kobuk River Char:

Anadromous Arctic char occur in the Kobuk River. On June 13, 1978 Alt (unpublished) captured five out-migrating char smolts in Melvin channel on the lower Kobuk River. Village residents of Ambler and Kiana report taking char in early summer on hook and line and in subsistence nets near the mouths of the Ambler and Squirrel Rivers. They indicate that char are running into the Kobuk River from these tributary streams and are destined for the ocean. They also report taking fresh-run in-migrating char in the fall at these same locations. John Cooper (pers. comm.) observed the capture of two prespawning male char 60 miles up the Ambler River in August of 1976. He indicated that these brightly colored fish weighed 4 to 5 pounds and had pronounced kypes. Judging by their size, these were probably anadromous char. Jerry Covey (pers. comm.), a Kobuk resident, stated that a few char are taken on sport gear each year in Akpilak, Killak and Dahl Creeks, small Kobuk tributaries. Small-stream resident char, called "Old-man fish", have been reported in Dahl Creek by Kobuk residents. Ken Alt (pers. comm.) indicates that some large sized anadromous char are taken by Kobuk residents in the fall above Kobuk village during subsistence seining for sheefish and whitefish and that sport anglers also take some in this area of the main Kobuk. Char to 8 pounds have been captured. In 1968 two tagged char were recovered at Noorvik, both of these fish were tagged by Commercial Fisheries Division in Kotzebue Sound, one in 1967 and one in 1968. These reports, coupled with Division of Commercial Fisheries aerial surveys on the Squirrel River which indicated large concentrations of char in August, led us to believe that there was a sizable population of char in the Kobuk River system.

On August 28, 1980 an aerial survey of the Squirrel River system was conducted and only 54 char were observed. In order to confirm low aerial counts, the Omar River, where 20 char were observed from the air, was floated in early September 1980. Twenty-nine char were observed while floating and walking side channels; of these, five were captured and tagged. While on the Squirrel River below the Omar several large schools of humpback whitefish were observed. These may have mistakenly been reported as char by Commercial Fisheries Division surveyors. In August 1981, Commercial Fisheries Division salmon tag recovery crews

Table 8. Ova counts of 20 female Arctic char ovaries from the Noatak River drainage.

F.L. (mm)	Weight (gm)	Ovary Weight (gm)			Ovum diameter (mm)	Number of Ova
		Left	Right	Combined		
Tumit Creek:						
492	1125	90.0	97.1	187.1	3.7	4,780
497	1175	77.3	108.0	185.3	3.8	3,717
501	1100	95.1	89.4	184.5	3.8	3,984
510	1175	104.9	122.9	227.8	4.0	4,886
516	1230	109.6	113.2	222.8	...	4,345
574	1700	184.5	173.2	357.7	4.0	6,475
577	1900	207.6	188.2	395.8	4.4	8,307
600	1925	227.0	251.3	478.3	4.7	8,618
640	2500	250.6	300.9	551.5	4.4	8,182
652	2500	283.4	305.9	589.3	4.6	8,014
Kugururok River:						
482	1100	120.7	104.6	225.3	4.0	4,855
487	1060	81.0	95.5	176.5	4.0	4,200
490	1100	101.8	115.6	217.4	4.0	4,553
492	1150	112.0	95.5	207.5	3.7	5,304
495	1175	128.5	108.0	236.5	3.7	6,465
510	1175	97.0	117.5	214.5	3.7	4,548
525	1300	108.9	100.3	209.2	3.8	5,172
525	1500	115.9	128.8	244.7	3.8	5,083
538	1450	160.9	146.4	307.3	4.2	5,975
560	1625	167.8	165.2	333.0	3.9	6,451

floated the Salmon and Squirrel Rivers. No char were observed on the Salmon River and only a few were seen on the Squirrel.

Due to the apparent low incidence of char on the Kobuk, as compared to other rivers in the study area, and our limited budget and manpower, I am recommending that the Kobuk River no longer be included in the study plan for this project. If money and time become available at some future date, Arctic char investigations might be considered for the Kobuk, but at this time I feel our efforts should concentrate on the Noatak, Wulik, Kivalina and coastal streams where char are more abundant and more important to both subsistence and sport users.

Utilization

Noatak River:

The major use of Arctic char within the study area is for subsistence. Fall seining takes place on the Noatak River by residents of Noatak. In 1981 four groups of people seined a total of 123 sacks of char. Their estimates of the number of fish per sack varied between 40 and 200, depending on fish size. At 100 fish per sack this would give an estimated fall harvest of 12,300 char. In addition to seining, Noatak residents fish through the ice in the vicinity of the village all winter long. On September 30, 1981, 15 people were observed fishing in front of the village. Two women fished 5.5 hours each and caught 24 and 26 char respectively, or approximately five fish per hour. Kotzebue residents also subsistence fish for char on the Noatak River in some years, but no harvest data are available.

Local and non-local sportsmen fish char at the mouths of Noatak tributary streams and area fishing guides bring clients to the Kelly and the Nimituk Rivers. In 1981 two guided anglers captured about 60 char on the Kelly River, retaining six for personal use (Phil Driver pers. comm.).

Wulik/Kivalina River:

Alt (1981) estimated the annual average subsistence harvest for the village of Kivalina at 30,000 fish. The majority of these fish are taken by fall seining in overwintering areas. In 1981 only two boats got upriver to seine due to early freeze-up. It is estimated that the 1981 fall take of 15,000-18,000 was lower than in previous years. In 1979 an estimated 30,000-35,000 char were taken in fall seining by four groups (boats) of seiners. Usually when early freeze-up prevents seining, people from Kivalina make winter trips by snow machine to open water areas of the Wulik and seine char. Some winter ice fishing also occurs. See Alt (1981) for general utilization trends in northwestern Alaska.

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