Volume 26 Study G-I

STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF ARCTIC AREA WATERS

by

Terrence N. Bendock
and
John M. Burr

ALASKA DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner

DIVISION OF SPORT FISH
E. Richard Logan, Director

Volume 26 Study G-I

RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project: F-9-17

Study: G-I Study Title: INVENTORY AND CATALOGING

Job: G-I-I Job Title: Inventory and Cataloging of Arctic Area Waters

Cooperators: Terrence N. Bendock and John M. Burr

Period Covered: July 1, 1984 to June 30, 1985

ABSTRACT

Fisheries surveys were conducted on 33 lakes and 8 streams in the Arctic coastal plain in an area bounded by the Topagoruk River on the west and the Ikpikpuk River on the east. Seventy-six percent of the lakes surveyed contained fish. Least cisco, *Coregonus sardinella* (Valenciennes), was the most common species found in lakes, while grayling, *Thymallus arcticus* (Pallas), had the widest distribution in streams. Life history data from fish captured are presented. Survey data from lakes east of the Ikpikpuk River are compared with data from the present study. Lakes were generally shallower west of the Ikpikpuk and fewer species of fish were encountered than in the area east of the river.

Preliminary surveys were conducted on Amiloyak Lake in the headwaters of the Chandler River and Agiak Lake at the head of the Hunt Fork of the John River. Arctic char, *Salvelinus alpinus* (Linnaeus), lake trout, *Salvelinus namaycush* (Walbaum), and grayling were captured.

Elusive Lake, near the confluence of the Sagavanirktok and Ribdon Rivers, was surveyed. Lake trout, round whitefish, *Prosopium cylindraceum* (Pallas), and least cisco were captured. Life history data for lake trout are given.

Five coastal plain lakes within the Kuparuk Oil Field were surveyed. Information on previously surveyed lakes in the area is also given. No fish were captured in any of the lakes surveyed within the area.

Radio-tagged burbot, *Lota lota* (Linnaeus), were used to locate and investigate overwintering habitat in the Chandler and Ikpikpuk Rivers. Overwintering habitat sites are described.

An investigation of overwintering habitat in the upper Colville River was initiated by radio tagging burbot between the mouths of the Killik and Etivluk Rivers.

Sport fishing pressure along the Dalton Highway was monitored. Sport fishing pressure north of the Yukon River continues to be light and concentrated near Alyeska pump stations and road maintenance camps. Age, weight and length data from burbot collected from the Yukon River near the Dalton Highway Bridge are presented.

Aerial index counts of Arctic char in the Sagavanirktok River system compared favorably with those of past years. The aerial count from the Anaktuvuk River index area was the lowest obtained in the 5 years of estimates.

KEY WORDS

Winter habitat, Chandler River, Dalton Highway, Arctic Coastal Plain, Ikpikpuk River, Colville River, Arctic char, *Salvelinus alpinus* (Linnaeus), burbot, *Lota lota* (Linnaeus), least cisco, *Coregonus sardinella* (Valenciennes).

BACKGROUND

The Alaska Department of Fish and Game, Division of Sport Fish, has conducted fisheries investigations on the North Slope since 1968. Emphasis of this work has varied between drainages and species in an effort to meet the changing patterns of use and activities within this region. Construction of the Dalton Highway (North Slope Haul Road) has tied the North Slope into the existing state highway system. Improved access has increased the demand for sport fishing, as well as for other recreational, municipal and commercial endeavors in this remote region.

Petroleum exploration and development is the overriding force that is shaping the future on the North Slope; municipalities are viewing the newly-found state oil wealth as the key to funding capital improvement projects with costs that have long been out of reach. Many of these activities place increasing demands on the aquatic resources of the region and point to the need for more knowledge of the fish species inhabiting North Slope waters. The Alaska National Interest Lands Conservation Act, in 1980, withdrew vast areas of the North Slope into the National Wildlife Refuge, National Park, and National Wild and Scenic Rivers systems.

The report findings for this study are presented in four sections, each treated as a separate phase of the project. The first section describes lake and stream surveys conducted in four North Slope areas: the Arctic Coastal Plain, upper Chandler River drainage, Elusive Lake and the Kuparuk Oil Field. The second section describes overwintering habitats in three drainages where radio-tagged burbot, *Lota lota* (Linnaeus), were

used to locate under-ice refugia for freshwater fish. Additional sections describe sport fishing effort along the Dalton Highway and Arctic char, *Salvelinus alpinus* (Linnaeus), aerial index counts.

Table 1 lists the species of fish inhabiting waters of the North Slope and found along the Dalton Highway north of the Yukon River. A map of the study area is shown in Fig. 1.

RECOMMENDATIONS

Research

1. Lake and stream surveys should continue on North Slope waters with emphasis on the National Petroleum Reserve-Alaska (NPR-A) and coastal plain lakes.

2. Assessment of overwintering fish habitats in North Slope waters should continue with emphasis on the Sagavanirktok and Colville River drainages.

3. Fall aerial surveys of Arctic char in the Sagavanirktok and Anaktuvuk Rivers should continue.

Management

1. Assessment of the fishing potential of area waters adjacent to the Dalton Highway should continue.

2. Sport fishing pressure on area waters should be monitored.

OBJECTIVES

1. To conduct fall aerial surveys of selected waters on the North Slope to determine locations and estimate abundance of Arctic char stocks, with emphasis on the Sagavanirktok and Colville River drainages.

2. To continue monitoring sport fishing pressure on selected waters of the North Slope, with emphasis on the Dalton Highway corridor north of the Yukon River.

3. To determine the availability and use of over-wintering fish habitat in lakes and streams of the North Slope, with emphasis on the Sagavanirktok and Colville River Drainages, and the Arctic Coastal Plain west of the Colville River Delta.

4. To continue inventory and cataloging of potential sport fish waters on the North Slope.

Table 1. Fish species found along the haul road and North Slope.

Common Name	Scientific Name and Author	Abbreviation
Alaska blackfish	*Dallia pectoralis* (Bean)	AB
Arctic char	*Salvelinus alpinus* (Linnaeus)	AC
Arctic cisco	*Coregonus autumnalis* (Pallas)	ACI
Arctic lamprey	*Lampetra japonica* (Martens)	AL
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Broad whitefish	*Coregonus nasus* (Pallas)	BWF
Burbot	*Lota lota* (Linnaeus)	BB
Chum salmon	*Oncorhynchus keta* (Walbaum)	CS
Fourhorn sculpin	*Myoxocephalus quadricornis* (Linnaeus)	FSC
Humpback whitefish	*Coregonus pidschian* (Gmelin)	HWF
King salmon	*Oncorhynchus tshawytscha* (Walbaum)	KS
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
Pink salmon	*Oncorhynchus gorbuscha* (Walbaum)	PS
Round whitefish	*Prosopium cylindraceum* (Pallas)	RWF
Sheefish	*Stenodus leucichthys* (Güldenstadt)	SF
Slimy sculpin	*Cottus cognatus* Richardson	SSC

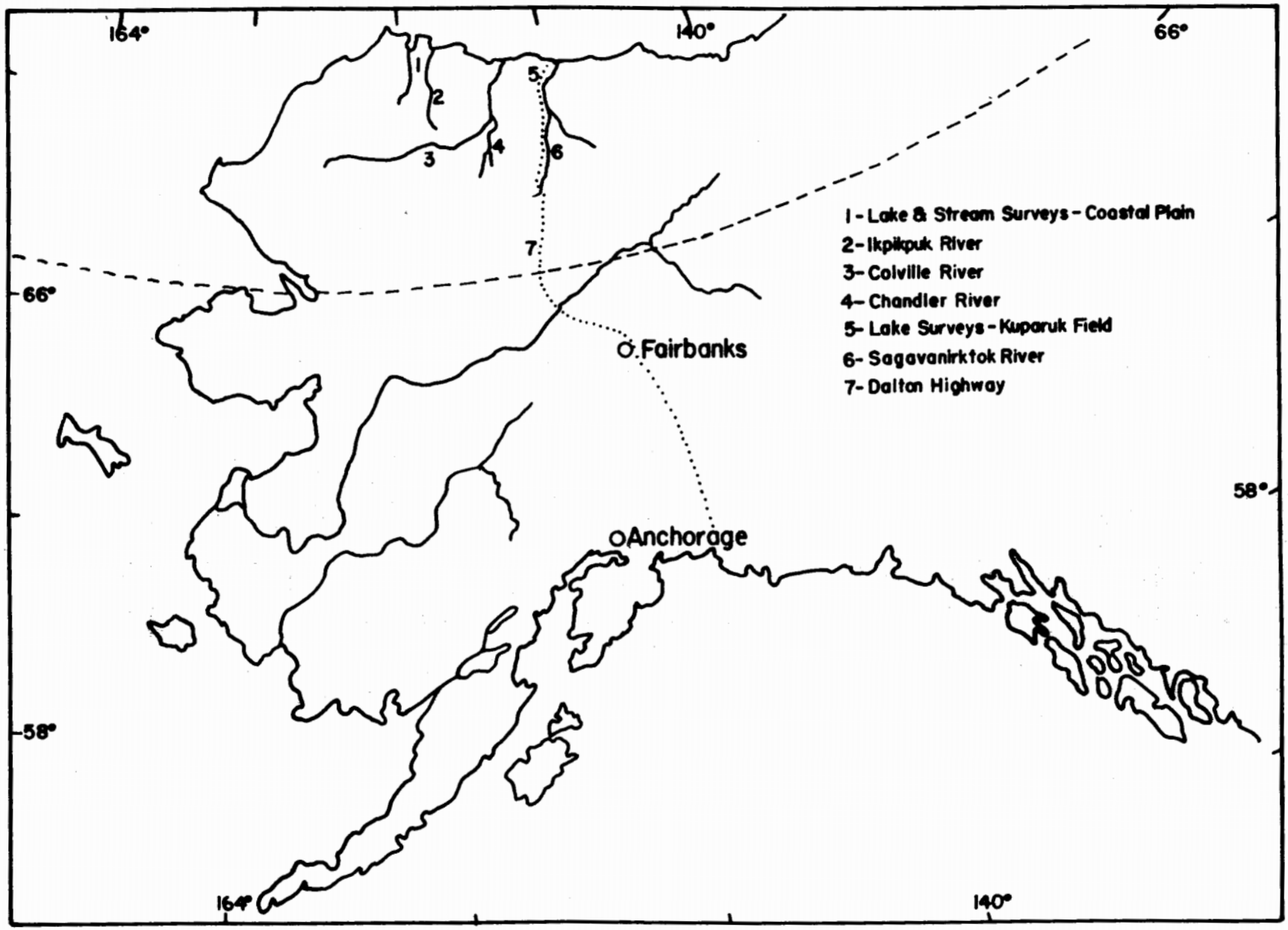

Figure 1. State of Alaska showing the North Slope and location of studies in 1984.

TECHNIQUES USED

Lake And Stream Surveys

Techniques and equipment used were the same as described by Bendock (1981; 1983).

Winter Samples

Locations of overwintering burbot in the Ikpikpuk and Chandler Rivers were determined using radio telemetry. Aircraft were then used to transport personnel and equipment to these sites during the sampling period. All other techniques used were the same as described by Bendock (1983).

FINDINGS

Lake And Stream Surveys

Arctic Coastal Plain:

To investigate freshwater fish distribution, surveys were conducted on 33 lakes and eight streams in a 3,000-sq-mi section of the central Arctic Coastal Plain (Fig. 2 and 3). The study area is bounded on the west by the Topagoruk River drainage, on the east by the Ikpikpuk River and on the south by the foothill divide between the Colville River and the Arctic Coastal Plain.

The principal drainages investigated are the Topogoruk River and the western tributaries of the Ikpikpuk River, including the Kigalik, Bronx, Titaluk, Oumalik, Chipp and Alaktak Rivers. Thousands of lakes, ranging in size from small, shallow ponds to lakes 5 mi in length, lie within the study area.

Streams. Twenty-three stream sites were surveyed in two river drainages (Fig. 2). Six sites were investigated in the Topagoruk River drainage, while 17 sites were surveyed in six tributaries to the Ikpikpuk River. Nineteen of the stream survey sites were investigated by the Sport Fish Division, while information from four sites was obtained from Netsch et al. (1977).

Streams within the study area originate in the low foothills north of the Colville River. Most of these are small, low gradient, single channel streams which meander widely and terminate in braided deltas. Stream beds and banks are generally sand and silt, although several streams have gravel bottoms in upper reaches where they cut through the foothills. Aquatic vegetation was either absent or extremely sparse in the stream sections surveyed.

Stream discharge peaked shortly after breakup in early June and declined throughout the open water season. From July through freeze-up, low discharge in the area's streams exposed vast unvegetated sand bars in

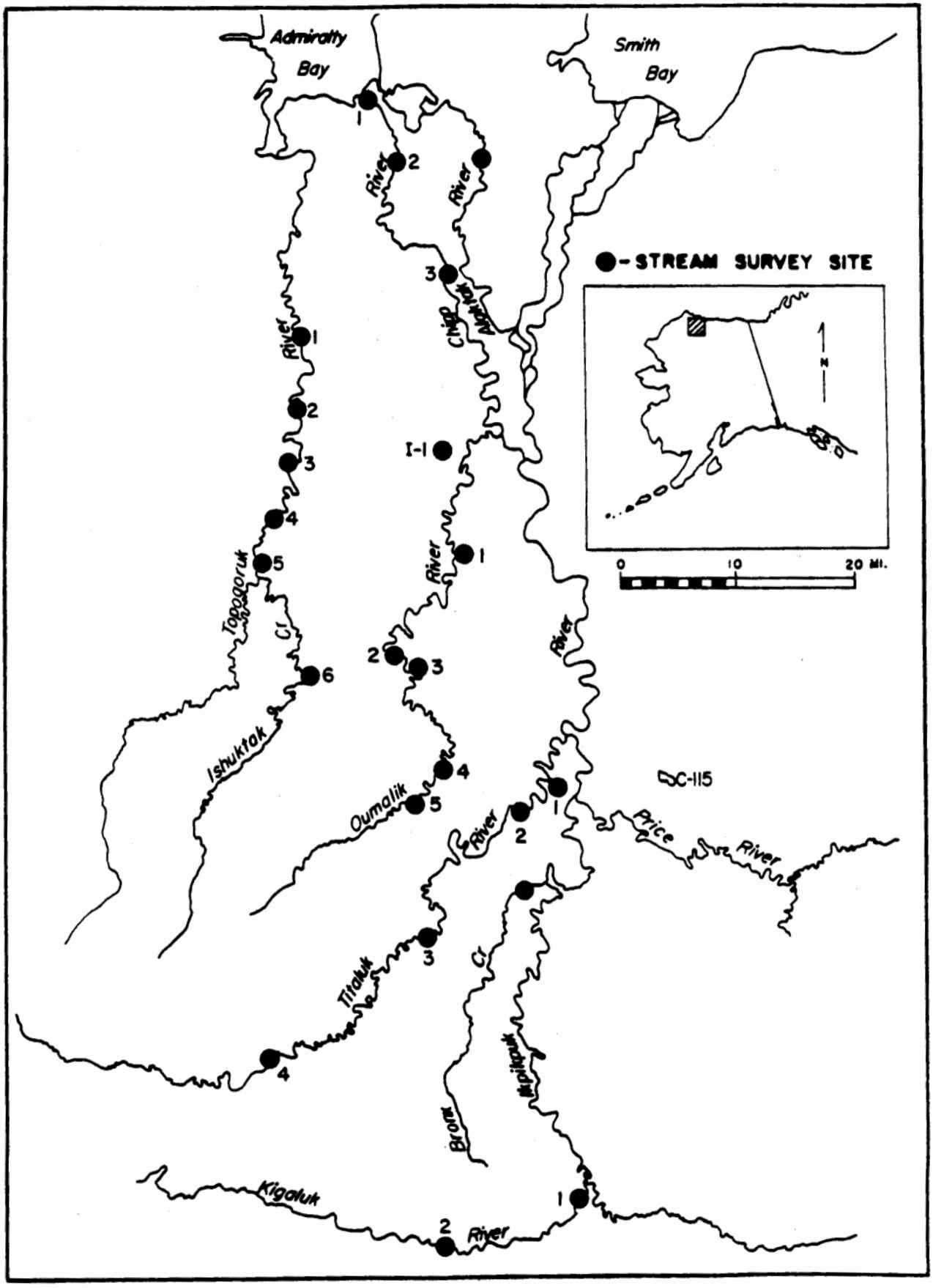

Figure 2. Stream survey sites, Arctic Coastal Plain.

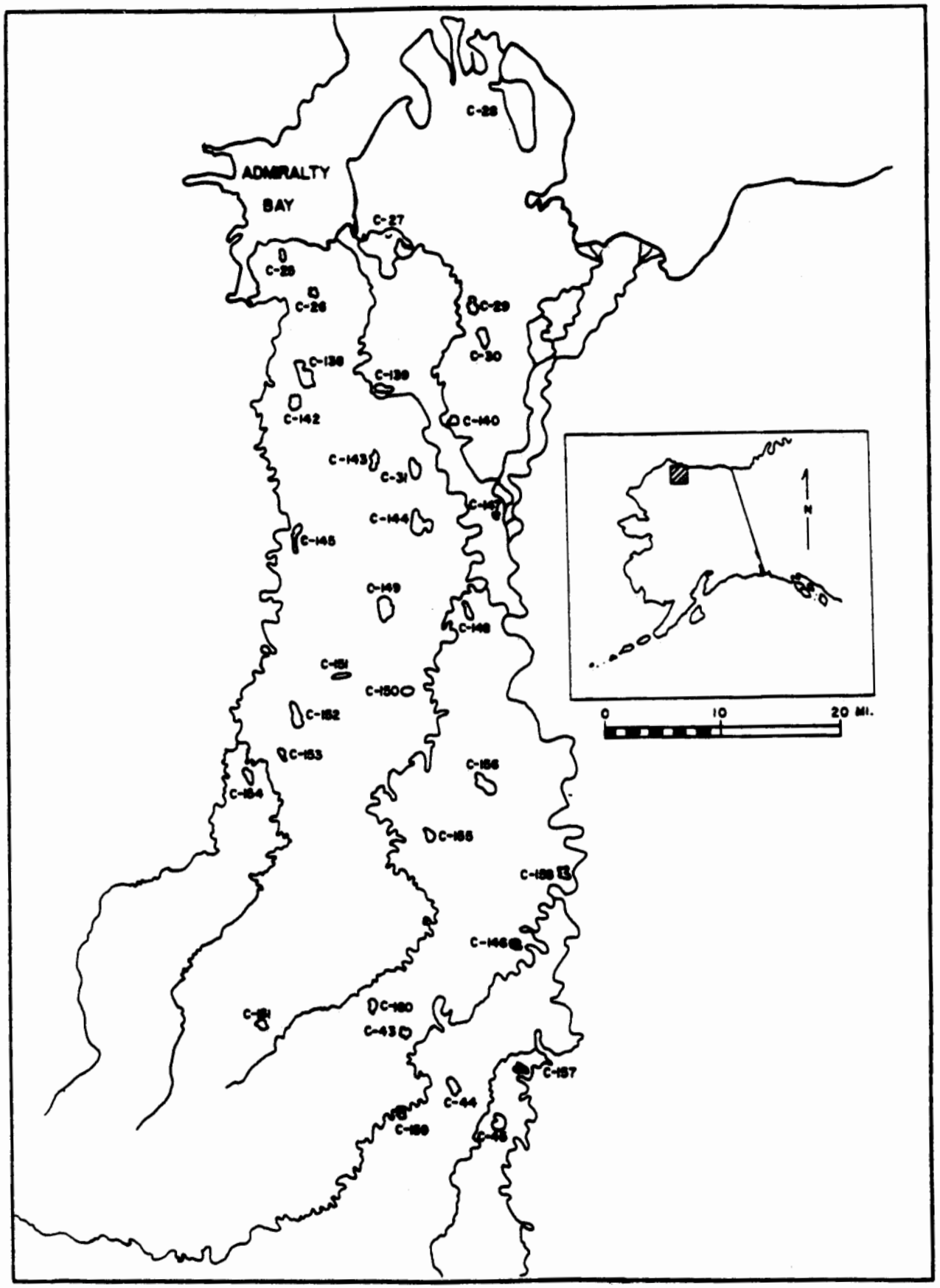

Figure 3. Lake survey sites, Arctic Coastal Plain.

all of the major flood plains and the shallow channels remaining represented only a small fraction of the stream size at breakup. Several streams within the study area became discontinuous in late July and the standing water remaining in pools warmed to 58°-75°F. All of the sample sites had standing water or velocities of less than 1 fps. Values for pH ranged from 8 to 9. Pools that were sampled by gill net ranged from 4 ft to 18 ft in depth. Table 2 lists the location, depth, pH and fish species captured at each stream site.

Lakes. During the 1984 report period 26 lakes were surveyed within the study area (Fig. 3). Seven lakes which were surveyed by Netsch et al. (1977) within this same area are included. Most of the lakes surveyed were moderately shallow. They ranged in maximum depth from 3 ft to 47 ft, with 76% of them 15 ft deep or less. Many of the lakes had extensive unvegetated shoal areas in which ice freezes to the bottom throughout the winter. Submerged aquatic vegetation is sparse and sand is the most common substrate. None of the lakes surveyed in 1984 are named on USGS 1:250,000 quadrangle maps. Two 125-ft graduated mesh gill nets were set overnight in each of the 26 lakes surveyed and a baited set line was attached to one end of the nets. Table 3 lists the locations, physical characteristics and fish species captured in each of the lakes surveyed.

Life Histories of Selected Species. Fourteen species of fish were captured in the study area, nine of which were captured in streams. Fish were taken at 21 of the 23 stream sample sites. Grayling had the widest distribution and were found in five of the seven streams that were surveyed. The other principal species, listed in frequency of occurrence, were humpback whitefish, broad whitefish, northern pike and least cisco. Catches for all species were low. Least cisco represented nearly half (44%) of the catch of principal species. Life history information for fish captured in these streams is presented by species in Tables 4 through 8.

Ten species of freshwater fish were found in lakes in the study area. Fish were captured in 25 of the 33 lakes surveyed. Least cisco had the widest distribution and were found in 20 lakes. Other principal species were: broad whitefish in 9 lakes, ninespine stickleback in 6, grayling in 3, lake trout in 2 and northern pike in 2.

Lake trout were captured in only two of the 33 coastal plain lakes that were surveyed. Three trout were sampled from Lake C-33, and two were taken from Lake C-144. In addition, Netsch et al. (1977) collected 47 trout from Lake C-33. Fork lengths for lake trout from both lakes ranged from 419 to 597 mm. Weights ranged from 548 to 2,450 g. Ages for five fish (lengths 479-550 mm) ranged from XII to XXXV. All of these five fish were mature.

Five lake resident Arctic char were captured in Lake C-139. This is the only lake of the 95 that have been surveyed within the area between the

Table 2. Locations of stream survey sites and species captured in coastal plain streams, 1984.

Stream *	North Latitude	West Longitude	Maximum Dept.(ft)	pH	Species Captured
Chipp River 1	70° 50'	155° 34'	> 6	-	LCI
Chipp River 2	70° 44'	155° 25'	> 6	-	BWF, HWF, LCI
Chipp River 3	70° 35'	155° 11'	18	8	BB, BWF, HWF, LCI, PS
Alaktak River *	70° 45'	155° 05'	13	9	BWF, GR, LCI
Oumalik River 1	70° 12'	155° 08'	6	9	0
Oumalik River 2	70° 04'	155° 25'	5	9	BWF, GR
Oumalik River 3	70° 02'	155° 19'	12	9	BB, GR, NP
Oumalik River 4	69° 54'	155° 14'	6	9	GR, HWF
Oumalik River 5**	69° 52'	155° 20'	12	9	GR, HWF, NSB, NP, SSC
Interlake Creek I-1	70° 20'	155° 16'	4	8	BWF, GR, LCI, RWF
Titaluk River 1	69° 53'	154° 94'	4	9	HWF, RWF
Titaluk River 2	69° 52'	154° 54'	5	9	LNS, NP
Titaluk River 3	69° 41'	155° 20'	6	9	GR
Titaluk River 4	69° 30'	155° 54'	5	9	HWF, NP
Bronx Creek	69° 44'	154° 56'	> 6	9	NP
Kigalik River 1	69° 19'	154° 41'	4	8	GR, LNS
Kigalik River 2	69° 15'	155° 13'	5	8	GR, LNS
Topogoruk River 1	70° 30'	155° 49'	10	9	HWF
Topogoruk River 2	70° 24'	155° 49'	5	8	0
Topogoruk River 3	70° 19'	155° 47'	6	9	GR
Topogoruk River 4	70° 15'	155° 54'	10	9	HWF
Topogoruk River 5	70° 11'	155° 57'	12	9	BWF, HWF
Topogoruk River 6	70° 02'	155° 45'	8	9	GR, HWF

* See Figure 2 for location.
** From Netsch et al. (1977).

Table 3. Locations, physical characteristics and species captured in 33 coastal plain lakes.

Lake # *	North Latitude	West Longitude	Surface Elevation (ft)	Approx. Length (mi)	Max. Dept. (ft)	Secchi Reading (ft)	Hardness (ppm)	pH	H_2O Temp. (°F)	Species Captured
C-25 **	70° 47'	155° 46'	10	1	3	.6		8.0	48	0
C-26 **	70° 46'	155° 40'	25	2.5	7	1.7	-	8.2	42	NSB
C-27 **	70° 50'	155° 20'	0	5	6	.3	-	7.8	59	BWF, HWF, LCI
C-28 **	70° 00'	154° 45'	0	6	9	2	-	9.0	50	LCI
C-29 **	70° 45'	155° 00'	10	1.5	12	2	-	7.9	50	LCI, NSB
C-30 **	70° 42'	154° 58'	9	2	9	bottom	-	8.8	59	BF, BWF, LCI
C-31 **	70° 32'	155° 15'	42	2	14	3.25	-	8	61	BWF, LCI, LT, NSB, SSC
C-43	69° 47'	155° 19'	180	1	23	12	119.7	9	48	0
C-44	69° 42'	155° 07'	250	2	22	15	102	9	56	0
C-45	69° 39'	154° 56'	290	1.5	8	8	136	9	54	GR
C-138	70° 39'	155° 12'	13	2.5	7	5	68	8	48	BWF, LCI
C-139	70° 38'	155° 22'	15	1.5	18	12	119	8	48	AC
C-140	70° 35'	155° 05'	9	0.75	11	6	68	8	49	LCI
C-142	70° 37'	155° 43'	17	1.25	7	6	51	7.5	47	0
C-143	70° 32'	155° 25'	40	2.0	12	7	85	8.5	50	BWF, LCI
C-144	70° 27'	155° 15'	55	2.5	23	12	51	7.5	50	LCI, LT, NSB
C-145	70° 26'	155° 43'	42	2.5	9	6	34	7.5	49	BWF, GR, LCI
C-146	69° 53'	154° 53'	200	1.0	9	bottom	34	8	52	LCI
C-147	70° 27' 30"	154° 57'	55	0.75	12	-	102	8.5	47	0
C-148	70° 20'	155° 03'	70	2.0	11	9	34	8	50	LCI, NSB
C-149	70° 20'	155° 25'	70	2.2	10	bottom	34	7.5	48	BWF, LCI
C-150	70° 14'	155° 17'	100	1.0	10	bottom	85	8.5	50	0
C-151	70° 15'	155° 32'	95	1.4	15	-	85	8	50	LCI
C-152	70° 12'	155° 44'	130	2.5	9	bottom	34	7.5	50	LCI
C-153	70° 09'	155° 47'	115	1.2	7	bottom	51	7.5	50	BWF, LCI
C-154	70° 07'	155° 55'	124	1.6	10	bottom	17	7.5	50	0
C-155	70° 02'	155° 13'	111	2.5	12	9	68	8	54	LCI

(continued)

Table 3. (Cont'd) Locations, physical characteristics and species captured in 33 coastal plain lakes.

Lake # *	North Latitude	West Longitude	Surface Elevation (ft)	Approx. Length (mi)	Max. Dept. (ft)	Secchi Reading (ft)	Hardness (ppm)	pH	H_2O Temp. (°F)	Species Captured
C-156	70° 06'	155° 00'	110	2.6	36	15	34	7.5	54	BWF, LCI
C-157	69° 43'	154° 52'	250	1.1	10	6	-	-	59	NP, NSB
C-158	69° 59'	154° 32'	100	1.5	16	-	51	7.5	55	LCI
C-159	69° 40'	155° 20'	150	1.0	16	-	34	7.5	59	LCI, NP
C-160	69° 48'	155° 37'	250	1.0	47	10	136	8.5	55	GR
C-161	69° 47'	155° 53'	300	1.0	7	bottom	68	8	59	0

* See Figure 3 for location.

** From Netsch et al. 1977.

Table 4. Grayling from coastal plain lakes and streams, Ikpikpuk and Topagoruk drainages.

Location	n	Length (mm)		Weight (g)		Sex		Age (years)
		Range	Mean	Range	Mean	Male	Female	
Lake 145	4	348-378	359	550-710	634	1	3	6-7
Lake 160	3	393-430	407	-	-	2	1	7-9
Alaktak R. *	4	355-383	-	378-512	-	-	-	-
Kigalik R.	8	90-370	263	25-650	291	5	2	1-7
Oumalik R.	5	215-320	283	200-400	320	1	4	3-6
Titaluk R.	1	250	-	150	-	0	1	4
Topogoruk R.	1	390	-	800	-	1	0	10
Total	26	90-430	-	25-800	-	10	11	1-10

* From Netsch et al. (1977).

Table 5. Humpback whitefish from coastal plain lakes and streams, Ikpikpuk and Topagoruk drainages.

Location	n	Length (mm)		Weight (g)		Sex		Age (years)
		Range	Mean	Range	Mean	Male	Female	
Lake 27 *	7	196-359	-	59-363	-	-	-	-
Chipp R. *	15	362-458	-	435-1,060	-	-	-	-
Oumalik R. *	25	73-457	-	3-990	-	-	-	-
Oumalik R.	1	400	-	950	-	1	0	13
Titaluk R.	5	385-410	401	500-900	810	4	1	10-14
Topogoruk R.	5	330-460	392	600-1,300	850	1	4	7-14
Total	58	73-460	-	3-1,300	-	6	5	?-14

* From Netsch et al. (1977).

Table 6. Broad whitefish from coastal plain lakes and streams, Ikpikpuk and Topagoruk drainages.

Location	n	Length (mm)		Weight (g)		Sex		Age (years)
		Range	Mean	Range	Mean	Male	Female	
Lake 27 *	1	423	-	650	-	-	-	-
Lake 30 *	3	499-585	-	800-2,100	-	-	-	-
Lake 31 *	3	612-680	-	2,800-3,960	-	-	-	-
Lake 138	1	374	-	690	-	-	-	-
Lake 141	6	490-614	558	1,800-4,000	2,950	3	3	10-18
Lake 143	6	356-454	401	600-1,400	941	4	2	6-10
Lake 145	3	357-400	377	640-960	792	2	1	7-8
Lake 149	3	375-441	415	690-1,300	1,063	3	0	10-11
Lake 153	4	422-473	454	1,000-1,560	1,325	2	2	12-13
Lake 156	5	132-550	396	-	-	2	2	2-15
Alaktak R. *	5	333-412	-	390-700	-	-	-	-
Chipp R. *	10	406-604	-	494-2,645	-		-	-
Chipp R.	1	385	-	650	-	0	1	10
Oumalik R.	1	530	-	2,600	-	0	1	8
Topogoruk R.	1	530	-	2,100	-	1	0	11
Total	53	132-680	-	390-4,000	-	17	12	2-18

* From Netsch et al. (1977).

Table 7. Northern pike from coastal plain lakes and streams, Ikpikpuk and Topagoruk drainages.

Location	n	Length (mm)		Weight (g)		Sex		Age (years)
		Range	Mean	Range	Mean	Male	Female	
Lake 157	4	547-640						
Bronx Cr.	1	510	-	1,050	-	1	-	-
Oumalik R. *	2	118-520	319	8-780	394	-	-	-
Oumalik R.	2	605-650	628	1,800-2,400	2,100	2	0	9
Titaluk R.	7	485-575	510	900-1,600	1,086	3	4	4-7
Total	16	118-650	-	8-2,400	-	6	4	4-9

* From Netsch et al. (1977).

Table 8. Least cisco from coastal plain lakes and streams, Ikpikpuk and Topagoruk drainages.

Location	n	Length (mm)		Weight (g)		Sex		Age (years)
		Range	Mean	Range	Mean	Male	Female	
Lake 27 *	55	94-362	-	11-380	-	-	-	-
Lake 29 *	6	65-410	-	1-578	-	-	-	-
Lake 30 *	31	365-438	-	222-845	-	-	-	-
Lake 31 *	7	130-400	-	14-541	-	-	-	-
Lake 138	4	319-381	348	350-590	479	2	2	9-13
Lake 140	5	232-423	350	110-800	496	2	3	3-13
Lake 143	1	369	-	550	-	1	0	9
Lake 144	2	408-484	446	1,110-1,400	1,250	1	1	13-18
Lake 145	5	327-389	363	540-740	641	3	2	6-8
Lake 146	1	377	-	775	-	0	1	6
Lake 148	15	128-435	204	<10-960	-	-	-	7-18
Lake 149	6	142-285	234	20-240	147	2	4	2-8
Lake 151	11	153-435	335	-	-	9	0	4-16
Lake 152	15	150-382	270	20-675	282	10	5	2-10
Lake 153	19	236-364	282	150-620	257	9	10	4-9
Lake 155	13	129-436	262	-	-	5	7	3-15
Lake 156	10	152-422	290	-	-	6	3	3-13
Lake 158	5	271-391	334	-	-	3	2	8-16
Lake 159	4	368-397	386	-	-	1	3	11-13
Alaktak R. *	24	30-370	-	1-395	-	-	-	-
Chipp R.	2	302-354	328	300-500	400	0	2	7-8
Total	241	30-484	-	1-1,400	-	54	45	2-18

* From Netsch et al. (1977).

Topagoruk and the Colville Rivers that contained Arctic char. The char ranged in fork length from 404 to 470 mm, with a mean of 429 mm. Weights ranged from 700 to 1,200 g and averaged 874 g. The male to female sex ratio was 1:0.67. Ages ranged from VIII to X and all five fish were mature. Gill raker counts ranged from 23 to 28, with a mean of 25.8.

Discussion. Fresh water fish distribution and abundance vary throughout the Arctic Coastal Plain. Netsch et al. (1977) surveyed several coastal lakes and streams north of the Colville River in the northern half of National Petroleum Reserve-Alaska. Bendock and Burr (1984 a,b) summarized freshwater fish distribution between the Colville and the Ikpikpuk Rivers. These and the present study indicate that species diversity is lowest on both the eastern and western margins of the coastal plain and greatest in the central region, lying south of Teshekpuk Lake, east of the Ikpikpuk River and west of the Colville River.

Comparison of survey data from lakes east of the Ikpikpuk River (Bendock and Burr, 1984 a,b) with survey data from lakes west of the Ikpikpuk River shows that suitable fishery habitat is more abundant and that fish populations are more diverse and abundant in the central portion of the coastal plain.

Lakes west of the Ikpikpuk River are generally more shallow than those to the east and few of the deep basin lakes found in the eastern area are found west of the Ikpikpuk River. Maximum depths of lakes which were found to support fish populations in the eastern area ranged from 6 to 70 ft, with a mean of 26 ft. Maximum depths of lakes found to support fish in the western area ranged from 6 to 47 ft, with a mean of 14 ft.

Sixty-two lakes have been surveyed in the area east of the Ikpikpuk River; of these, 53 (85%) contained fish populations. In the western area, 25 (76%) of the 33 lakes which have been surveyed contained fish. Fish populations in lakes to the east of the Ikpikpuk River were composed of 14 species, while 10 species were found in lakes to the west. Fish species in the eastern area that were absent in the western area include round whitefish, burbot, longnose sucker and Arctic cisco. Arctic char is the only species found in the western area which is not found to the east.

Upper Chandler River Lake Surveys:

In late July, preliminary fishery surveys were conducted on two small mountain lakes, Amiloyak Lake (68° 06' N, 152° 53'W) and Agiak Lake (68° 04' N, 152° 57' W) (Fig. 4). These lakes lie within the boundaries of Gates of the Arctic National Park.

Amiloyak Lake is the uppermost lake in the Chandler Lake system. The outlet stream flows from the lake into Chandler Lake. A spring-fed inlet stream which enters Amiloyak Lake at the southwest corner is used

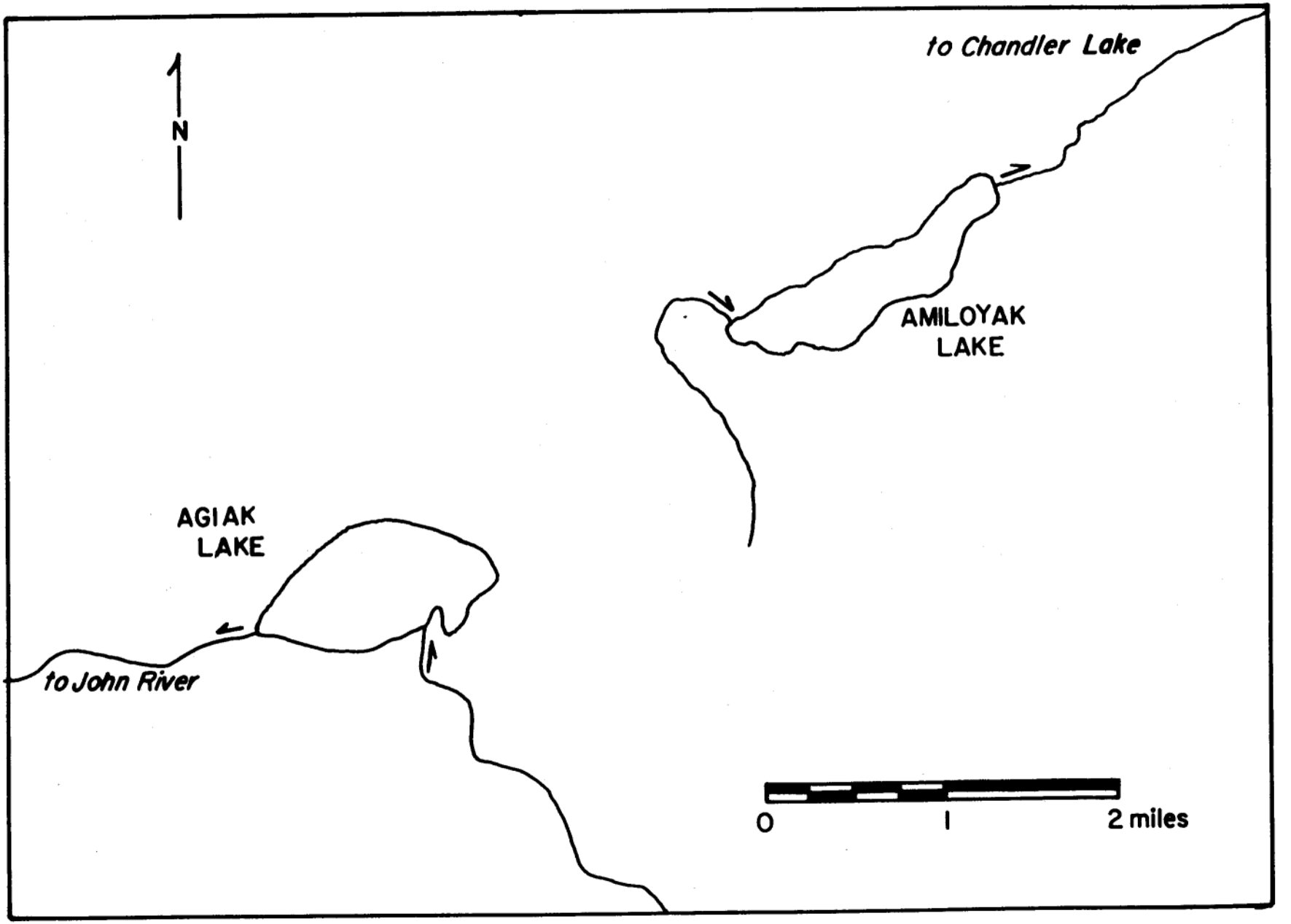

Figure 4. Amiloyak and Agiak Lakes.

for spawning by Arctic char during early August. Sampling effort was limited to a short period of angling. Amiloyak Lake provides excellent sport fishing for Arctic char, lake trout and grayling. On July 30, 1984, 0.2 hrs of angling produced five Arctic char, two lake trout, and one grayling.

Agiak Lake is located at the head of the Hunt Fork of the John River. No spawning activity was observed in late July in the outlet or inlet streams. Sampling effort was limited to angling. Good sport fishing is found in Agiak Lake for Arctic char and lake trout. Fifteen Arctic char and 12 lake trout were taken in 4 hours of angling. In addition grayling were found as food items in lake trout stomachs. Arctic char fork lengths ranged from 320 to 395 mm,($\bar{x}$=362 mm) and weights ranged from 300 to 600 g, ($\bar{x}$=492 g). Ages ranged from 7 to 9 years. Lake trout fork lengths ranged from 500 to 580 mm ($\bar{x}$=537 mm) and weights ranged from 300 to 2,200 g ($\bar{x}$=1,733 g). Ages for six lake trout ranged from 15 to 17 years.

Elusive Lake Survey:

Elusive Lake is located approximately 12 mi east of the Dalton Highway (68° 40' N, 148° 30' W) in the Ribdon River Valley (Fig. 5). A rough 450 ft airstrip is located on the east end of the lake and there is a cabin on the northeast shore. The lake is accessible by wheel plane and float plane in the summer months and by ski plane and snow machine from the Dalton Highway in winter. Elusive Lake provides good lake trout sport fishing and its relative accessibility makes it a popular recreation area.

Elusive Lake was surveyed during the open water season by Sport Fish Division personnel in late July 1973 (Furniss, 1974). In April 1984, department personnel returned to Elusive Lake to conduct a winter survey. Access to the lake was by snow machine from the road maintenance camp on the Dalton Highway. At this time, ice thickness was 5 ft and snow depth was 12-24". Water analysis gave a pH of 7.5 and total hardness of 187 ppm.

Graduated mesh gill nets set under the ice for a total of three net nights yielded 6 lake trout, 12 round whitefish, and 5 least cisco. Twelve baited set lines produced four lake trout, and 80 hours of angling produced nine lake trout. In addition to these three species, grayling and ninespine stickleback were captured in the 1973 summer survey.

The composition of fish in Elusive Lake is unusual compared to other large lakes in the Sagavanirktok River drainage. Elusive Lake has a large population of least cisco, but apparently lacks Arctic char and burbot. Galbraith, Island and Campsite Lakes have both Arctic char and burbot populations, but lack least cisco.

Age, length, weight, sex and maturity data for the 19 lake trout are given in Table 9. Eleven (58%) of the trout had empty stomachs. From stomach analysis of the remaining eight lake trout six (32%) contained fish, two (11%) contained snails and one (5%) contained insect larvae.

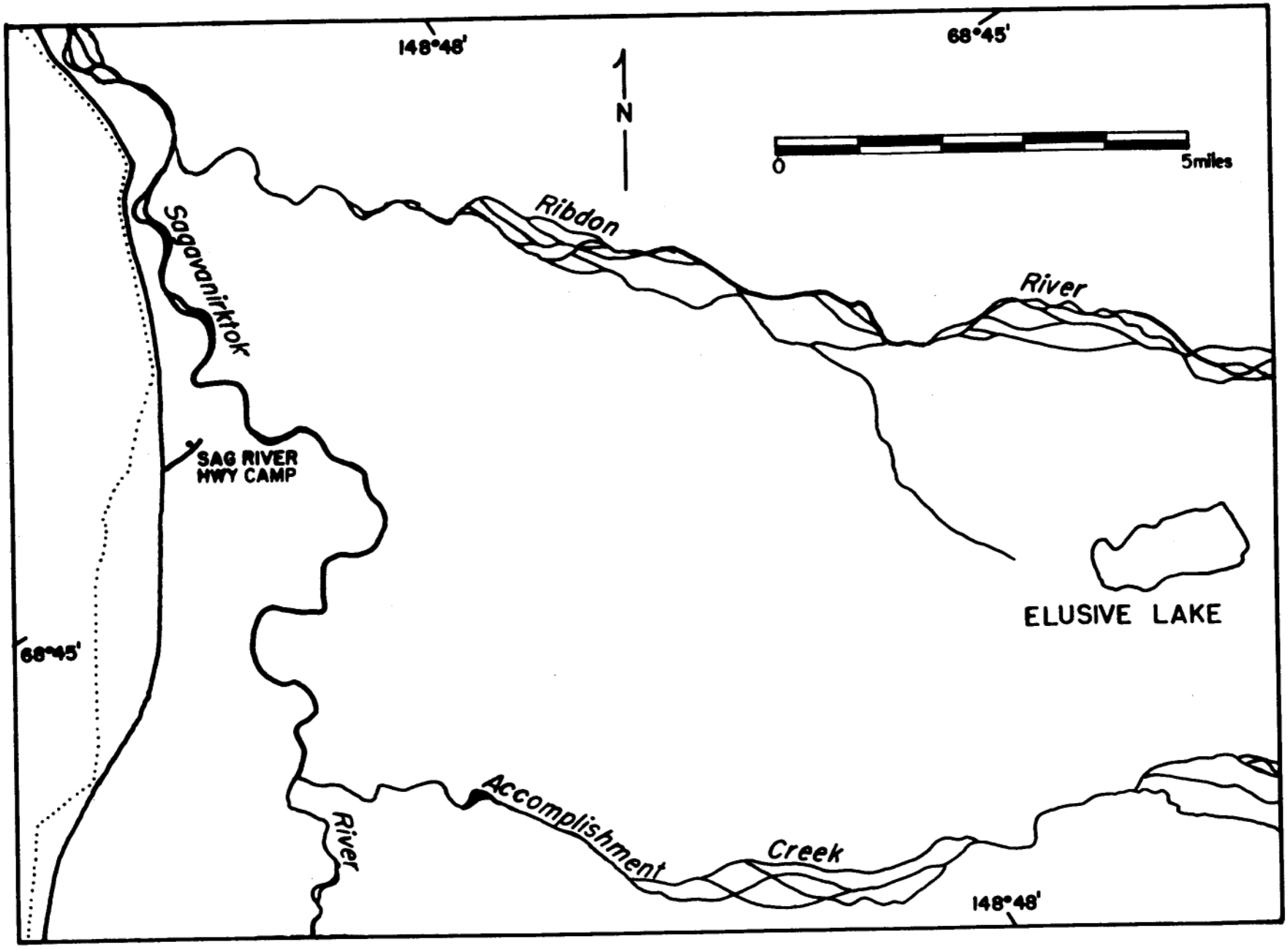

Figure 5. Location of Elusive Lake and the Dalton Highway.

Table 9. Length, weight, sex and maturity of lake trout from Elusive Lake.

Age Class	n	Length (mm)		Weight (g)		Sex		Maturity	
		Range	Mean	Range	Mean	Male	Female	Immature	Mature
VI	1	246	-	126	-	0	1	1	0
IX	3	297-328	311	219-379	293	2	1	2	1
XI	1	403		650		0	1	1	0
XIV	3	523-591	568	1,400-2,400	1,933	1	2	0	3
XV	2	562-600	581	1,800-2,000	1,900	1	1	0	2
XVII	2	564-655	609	2,000-4,100	3,050	2	0	0	2
XVIII	2	620-672	646	2,800-3,700	3,250	1	1	0	2
XX-XXIV	2	471-607	539	950-2,600	1,775	1	1	0	2
XXV +	3	657-797	718	3,300-7,500	5,100	3	0	0	3
Total	19	246-797		126-7,500		11	8	4	15

Kuparuk Oil Field Lake Surveys:

Five lakes on the coastal plain in the Kuparuk Oil Field were surveyed for depth and the presence of fish in response to a request by industry for information in an area of proposed development. All of the lakes surveyed were shallow with unvegetated silty bottoms. There were no active inlets or outlets. A 125-ft monofilament graduated mesh gill net was set in each of the lakes for 18 hours. In addition, a 30' x 4' x 1/4" beach seine was used to sample shore line habitats where possible.

No fish were captured in any of the lakes surveyed and potential overwintering fish habitat was not found. Location, depth and water chemistry information for these five lakes, as well as information on other lakes that have been surveyed in the area, is found in Table 10. The location of these lakes is illustrated in Fig. 6.

Overwintering Habitat Studies

Chandler River:

Nearly all fishery survey information from the Chandler River is from the open water season. During the summer months the Chandler River shows the greatest species diversity of any of the Colville River tributaries (Bendock, 1979). Fish species which have been found in the Chandler River include: grayling, lake trout, Arctic char, broad whitefish, humpback whitefish, round whitefish, burbot, longnose sucker, slimy sculpin and ninespine stickleback.

Overwintering habitat in the Chandler River appears to be limited primarily to a few holes up to 10 ft deep in the lower 40 mi of the river. Kogl and Schell (1974) made an aerial search of the Chandler River for potential overwintering habitat and observed a single open water section of river several hundred yards in length approximately 43 mi above the mouth. Juvenile grayling were the only fish found at this site.

To further investigate the presence of overwintering habitat in the Chandler River, three burbot were radio tagged at two sites in the river (Fig. 7). The lengths and weights of the fish tagged are listed in Table 11.

The movements of the radio-tagged burbot were monitored at intervals throughout the winter and spring. The two fish (C-1, C-2) tagged at site A showed a slow, but generally downstream movement in the first week following tagging. These fish may have already been in a downstream migration when they were tagged. One of these fish (C-1) moved downstream approximately 7 mi to an area just north of Big Bend and remained there through April. The other burbot tagged at site A (C-2) continued downstream and overwintered at Uluksrak Bluff in the Colville River, a downstream movement of approximately 50 mi. The third burbot, tagged at site B in the Chandler River, moved upstream approximately 6 mi to the Big Bend overwintering area near burbot #C-1.

Table 10. Locations, physical characteristics, and fish captured in 14 coastal plain lakes in the Kuparuk Oil Field.

Reference Number	North Latitude	West Longitude	Surface Elevation	Maximum Depth (ft)	Total Hardness	pH	Fish Captured
C-86 *	70° 17'	148° 43'	30	-	-	-	0
C-104 *	70° 27' 30"	149° 25'	28	5	205	7.5	0
C-105 *	70° 27' 30"	149° 27'	30	4	171	7.5	0
C-106 *	70° 28' 30"	149° 33'	7	7	103	7.5	0
C-107 **	69° 18'	149° 45'	65	-	-	-	0
C-108 **	69° 17'	149° 52'	93	-	-	-	0
C-109 **	69° 17'	149° 55'	96	-	-	-	0
C-110 **	69° 19'	149° 57'	85	-	-	-	0
C-111 **	69° 21'	149° 56'	70	-	-	-	0
C-162	70° 22' 30"	149° 23'	39	6	103	8	0
C-163	70° 22' 30"	149° 24'	39	3	103	8	0
C-164	70° 25'	149° 26'	35	4	103	8	0
C-165	70° 26'	149° 27'	30	3	120	8	0
C-166	70° 29'	149° 25'	7	2	154	8	0

* Surveys conducted by Sport Fish personnel, 1981.
** Surveys conducted by L. Moulton ADF&G, Habitat Division, 1981.

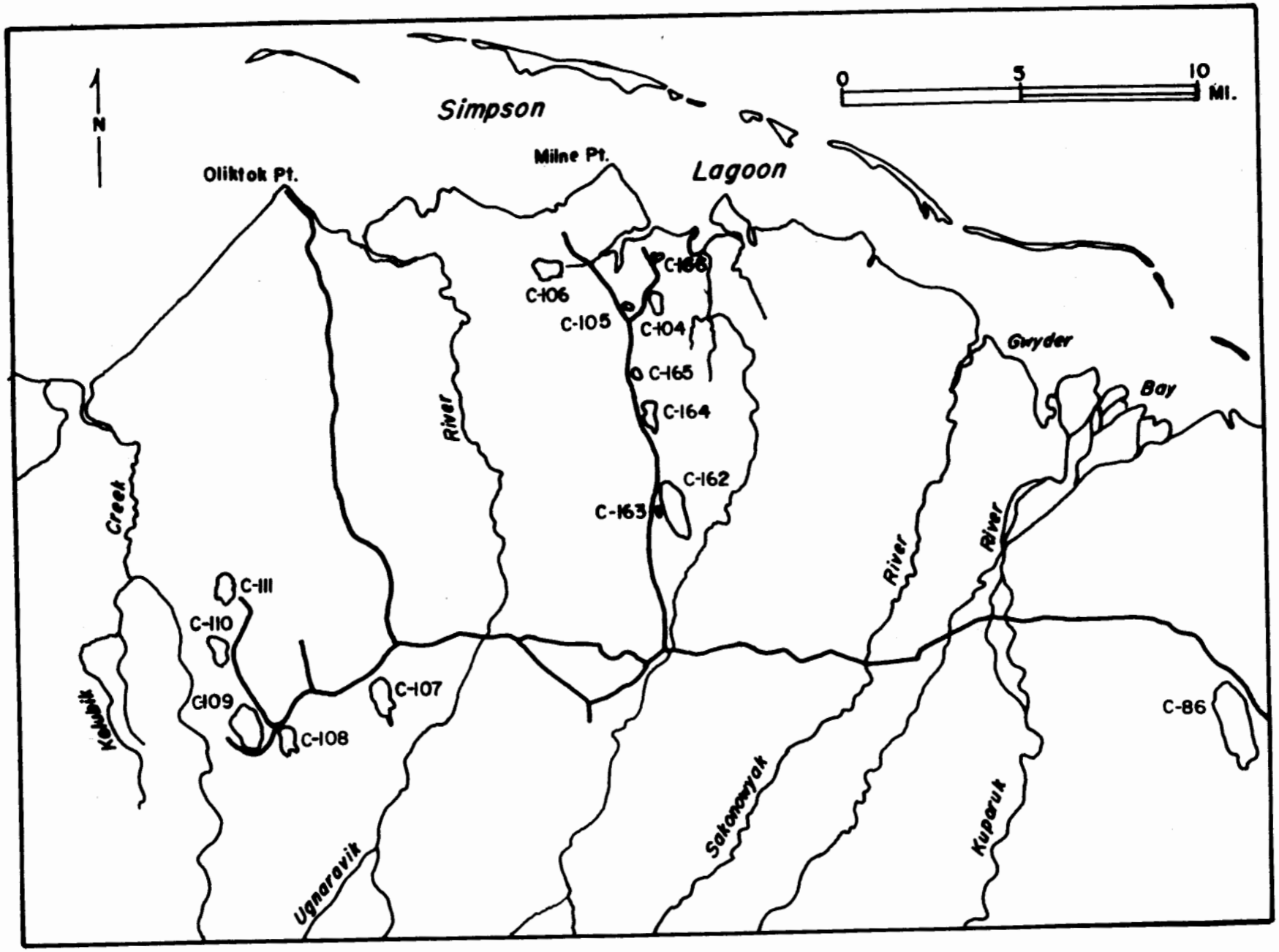

Figure 6. Lake survey sites in the Kuparuk Oil Field.

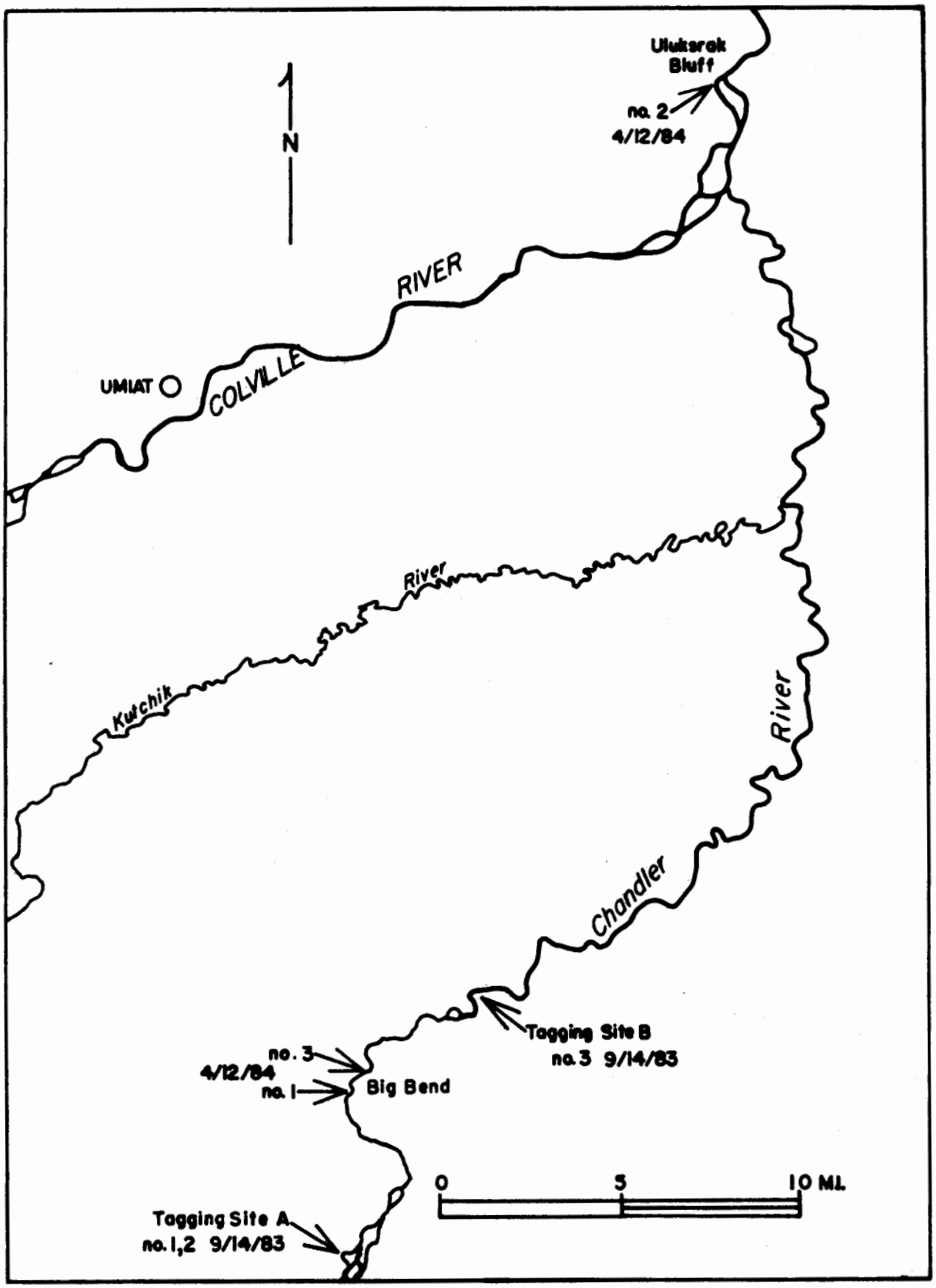

Figure 7. Movements of radio-tagged burbot, tagging locations and overwintering habitat sites.

Table 11. Fork length, weight and tagging location of five radio-tagged burbot in the Chandler and Ikpikpuk Rivers.

Tag #	Fork Length (mm)	Weight (g)	Tagging Location
C - 1	663	1,300	Chandler River site A. Approximately 5 miles upstream from the Big Bend.
C - 2	720	2,500	Chandler River site A. Approximately 5 miles upstream from the Big Bend.
C - 3	800	1,300	Chandler River site B. Located at Paunagaktuk Bluff.
I - 1	707	2,000	Ikpikpuk River at mouth of Tatalik River.
I - 2	810	3,600	Ikpikpuk River at mouth of Tatalik River.

The last attempt to locate the radio-tagged burbot was on June 14. At that time the burbot which had moved down to the Colville River (C-2) could not be located. The other two fish, which had wintered at the Big Bend site, were still in the general area. Tag #C-1 was located about 6 mi downstream from the Big Bend site and tag #C-3 was located about 2 mi downstream from the site.

On April 12 the Big Bend overwintering site was investigated to characterize the fish habitat and to determine the fish species present. At that time no open water was found, but there was a large, active overflow area approximately 2 mi in length. The upper end of the area, where tag #C-1 was located, was inaccessible due to fresh overflow. Holes were drilled through the thick ice near the location of tag #C-3. The shallow depth of water under the ice prevented sampling with a gill net at this site. A dead young-of-the-year longnose sucker was found in the water that flooded a recently drilled hole in the ice. The characteristics of the site are given in Table 12. The site characteristics were similar to those found in Sagavanirktok River overflow sites reported by Bendock and Burr (1984).

The Uluksrak Bluff site in the Colville River was investigated previously by Bendock (1980). Site characteristics are given in Table 12.

Ikpikpuk River:

Information is lacking on overwintering habitat in the Ikpikpuk River system. Fisheries investigations during the open water period are summarized elsewhere in this report and in previous reports (Bendock and Burr, 1983 a,b). Radio transmitters were placed in two burbot at the confluence of the Titaluk and Ikpikpuk Rivers on September 13, 1983 (Fig. 8). The lengths and weights of the radio-tagged burbot are listed in Table 11.

The movements of radio-tagged burbot were monitored throughout the winter and spring. During the first week following tagging both fish remained near the tagging site. In mid-March one of the fish (#I-2), could not be located. The other tagged fish (#I-1) had moved approximately 70 mi downstream to overwinter in a pool in the lower Chipp River. In mid-June, the radio-tagged burbot was located for the last time. The fish had moved approximately 20 mi upstream in the Chipp River. Figure 8 summarizes these movements.

Four sites in the Ikpikpuk River drainage were visited in mid-April to investigate overwintering fish habitat. The physical characteristics of each site and fish species present are given in Table 13. The locations of each of these sites is illustrated in Figure 8.

The Chipp River site was a long, deep, isolated pool covered by thick ice. The wind had kept the area nearly free of snow. There was no evidence of water beneath the ice other than the presence of a moving radio-tagged burbot. No salt water intrusion into the area could be detected. A 50' x 6' x 1½" gill net set under the ice for 4 hours captured least cisco and broad whitefish.

Table 12. Overwintering sites in Chandler River, April 1984.

Overwintering Site	Snow Depth (in)	Ice Thickness (in)	Water Depth (in)	Water Temp. (°F)	Dissolved O_2 (ppm)	Fish Species	Comments
Big Bend Site	20	102	12	32	1.4	BB, LNS	Active overflow area, unable to set net due to ice/water conditions. Dead YOY LNS taken from water in auger hole.
Colville River at Uluksrak Bluff *	10	62	112	-	2.6	BB, GR, RWF	Isolated pool of water created by deep basin in river bed. Layer of slush present in water column.

* Bendock (1980).

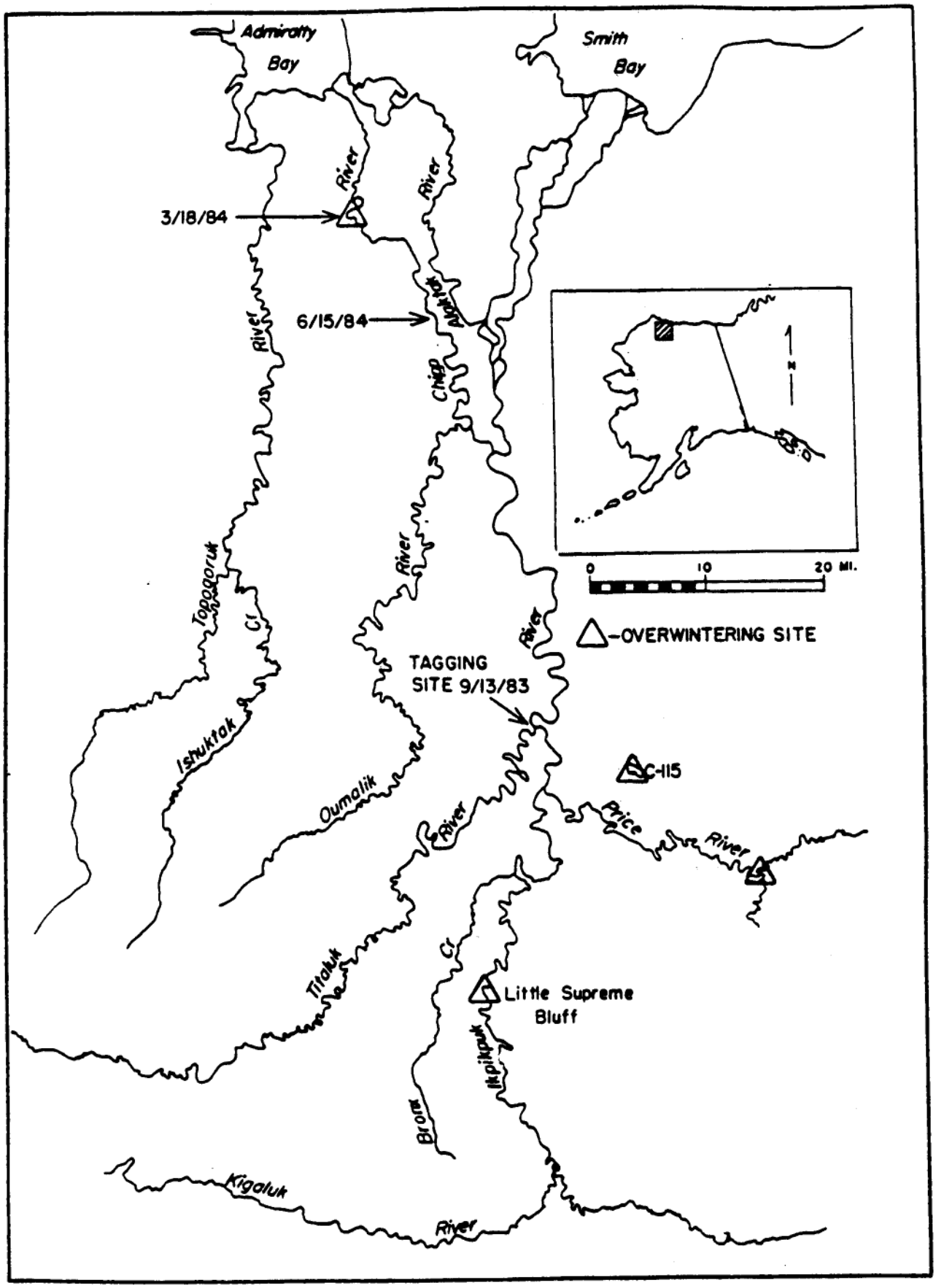

Figure 8. Movements of radio-tagged burbot in the Ikpikpuk and Chipp Rivers and location of overwintering habitat sites.

Table 13. Overwintering sites in the Ikpikpuk River drainage, April 1984.

Overwintering Site	Snow Depth (in)	Ice Thickness (in)	Water Depth (in)	Salinity (ppt)	Dissolved O_2 (ppm)	Fish Species
Chipp River	1	84	150	0	7.8	BB, BWF, LCI
Little Supreme Bluff	10	66	24	-	2.2	No net
Price River	2	72	48	-	4.6	No net
Lake C-115	10	66	12 *	-	10.4	BWF, LCI, RWF

* Lake C-115 has a maximum depth of 35 ft.

The Little Supreme Bluff site was located during the open water season for investigation as a potential overwintering site. Very little water was found in April 1984 and dissolved oxygen levels in the water were low. No net was set.

The Price River site was also located during the open water period as a potential overwintering site. At the time of our visit the water and dissolved oxygen levels may have been sufficient to support fish. No net was set.

The lake site was also sampled during the open water season (Bendock and Burr, 1984 a, b). The lake has a maximum depth of 35 ft. The dissolved oxygen level was 10.4 ppm in April, 1984.

Upper Colville River:

Overwintering habitat in the middle reaches of the Colville River was described by Bendock (1980). The present study was restricted to a 52-mi section of the Colville River between the Anaktuvuk River and Ninuluk Creek. Kogl and Schell (1974) and Craig and Halderson (1979) netted the Colville delta area during winter months. Information is lacking on winter habitat in the Colville River in the reaches upstream of Ninuluk Creek.

Radio telemetry is being used to investigate overwintering fish habitat in upper reaches of the Colville River. Five burbot were fitted with radio transmitters at five locations in the Colville River between the Killik and Etivluk Rivers. The lengths, weights and tagging locations for the five radio-tagged fish are given in Table 14. The location of the tagging sites are shown in Figure 9.

The movements of these radio-tagged fish in the Colville River will be monitored throughout the winter of 1984-1985, and results of this study will be reported at a later date.

Dalton Highway Sport Fishing

The Dalton Highway connects the Prudhoe Bay oil field with the remainder of Alaska's road system. It was built in 1974 and transferred to the state in 1978. The area adjacent to the highway was opened to sport fishing in 1979.

Access during 1979 was limited to permitted commercial users, which restricted sport fishing opportunities primarily to truckers and employees of Alyeska Pipeline Co. and the State Department of Transportation. Starting in 1981, the highway was opened during June, July and August for public travel from the Yukon River to Disaster Creek, approximately 150 mi north of the Yukon River. Since 1983 this section of the highway has been opened to public travel on a year-round basis.

Sport fishing pressure along the haul road has been monitored by observing fishermen, conducting creel census interviews and observing the location and intensity of fishing from overflights in fixed-wing aircraft.

Table 14. Total length, weight, and tagging location of five radio-tagged burbot in the Colville River, 1984.

Tag #	Date	Total Length (mm)	Weight (g)	Tagging Location
1	8/27	775	2,600	"Killik Bend", approximately 4 mi upstream of the mouth of the Killik River in the Colville River.
2	9/20	750	2,000	"Lower Aupuk", at the mouth of an unnamed creek entering the Colville River about 3 mi downstream from Aukpuk Creek.
3	9/19	960	4,000	"Upper Aupuk" - approximatley 10 mi upstream from the mouth of Aupuk Creek.
4	9/19	870	3,600	"Kurupa" - approximatley 1 mi upstream from the mouth of the Kurupa River in the Colville River.
5	8/29	840	2,500	"Etivluk Slough" - 1/2 mi below mouth of Etivluk River in slough mouth.

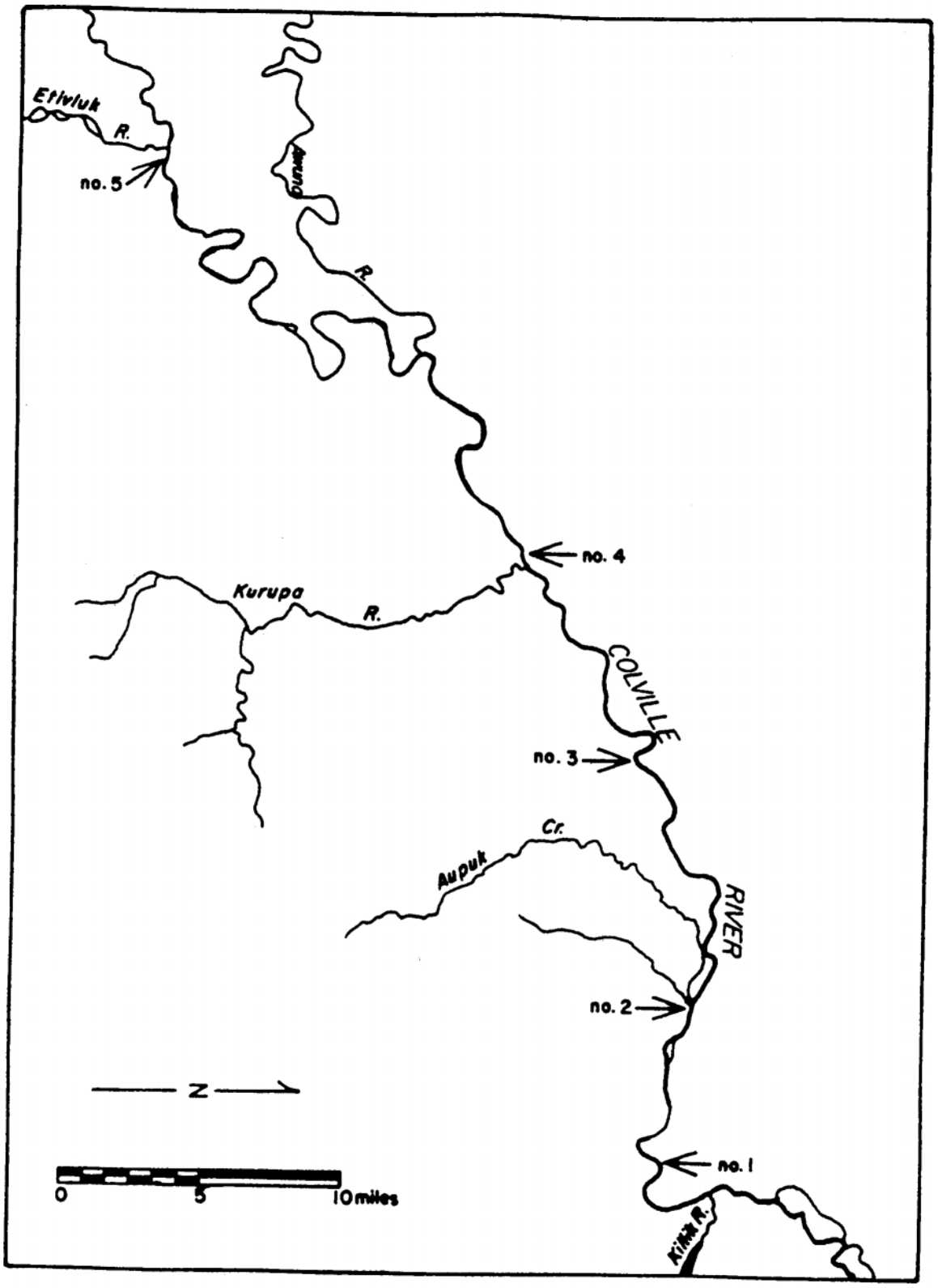

Figure 9. Locations of tagging sites for five radio-tagged burbot in the Colville River, 1984.

Sport fishing pressure continues to be light throughout the Dalton Highway corridor north of the Yukon River. Effort remains concentrated near Alyeska pump stations and state road maintenance camps. The most frequently fished locations south of Atigun Pass are Prospect Creek, Jim River and Grayling Lake. North of Atigun Pass, the lakes in the vicinity of Toolik Lake and the upper Kuparuk and Sagavanirktok Rivers are most frequently fished. Grayling are the principal species taken along the highway. Lake trout and Arctic char are also taken in smaller numbers north of the Brooks Range.

Data from the Alaska Statewide Sport Fish Harvest Studies (Mills, 1984) indicate similar intensity and distribution of fishing effort, although sample size is small.

The Dalton Highway has improved access to the Yukon River and its tributary streams. As a result, there is increasing interest in sport fishing the mouths of Yukon River tributary streams. During fall and early winter these areas provide excellent fishing for burbot. Additionally, northern pike and rearing sheefish are present, providing extra incentive to anglers.

One hundred and ninety-five burbot have been sampled from the Yukon River between the Dall and Ray Rivers from 1981 through 1984.

Fifty-seven of these fish were aged. These data, together with weight, and sex data, are given in Table 15. The length distribution and sex ratios for the 195 burbot are shown in Figure 10.

Arctic Char Aerial Counts

Aerial counts of Arctic char have been attempted annually in the Sagavanirktok River Drainage since 1971. All of the major tributaries to the Sagavanirktok River found to be char spawning areas were counted between 1971 and 1975. Since 1976, only the Ivishak and Echooka Rivers have been counted. The Ivishak River contains the largest aggregation of char in the system and is considered an index to overall population levels. Prior to 1977 counts were conducted by helicopter; however, subsequent counts have been made using fixed-wing (Piper PA-18) aircraft. All of the estimates have been made during mid-September. Aerial counts are not considered estimates of the char populations, but rather are a means of annually indexing both the distribution and general abundance of char. Safe flying weather has been a continual problem when conducting the char counts and poor weather has resulted in the loss of several years' counts.

Arctic char at two locations in the Anaktuvuk River drainage have been counted since 1979. At present, however, the counts in both drainages have been reduced to a single index area for each stream. Table 16 shows the estimates of anadromous Arctic char at index areas in the Sagavanirktok and Anaktuvuk River drainages. All of the counts have been conducted during the third week of September.

Table 15. Length, weight, age, sex and maturity of burbot from the Yukon River between the Dall and Ray Rivers, 1981-84.

Age Class	n	Length (mm)		Weight (g)		Sex		Maturity	
		Range	Mean	Range	Mean	Male	Female	Immature*	Mature
VII	4	550-690	625	900-1,700	1,350	3	1	3	1
VIII	1	590		1,200		0	1	1	0
IX	2	610-743	677	1,400-2,500	1,950	2	0	2	0
X	5	655-770	699	1,550-2,800	2,030	1	4	3	2
XI	10	625-775	714	1,800-3,200	2,010	6	4	4	6
XII	9	725-950	794	2,000-4,300	2,878	6	3	0	9
XIII	7	708-905	843	1,900-4,400	3,636	2	5	3	4
XIV	10	730-970	822	2,500-5,000	3,095	5	5	3	7
XV	4	730-1,005	851	2,400-6,250	3,688	2	2	1	3
XVI	3	767-983	892	3,000-5,750	4,483	0	3	1	2
XVII	1	950		4,600		0	1	0	1
XVIII	1	915		4,250		0	1	0	1
Total	57	550-1,005		900-6,250		27	30	21	36

* Fish may have never reached maturity or may be a nonconsecutive spawner.

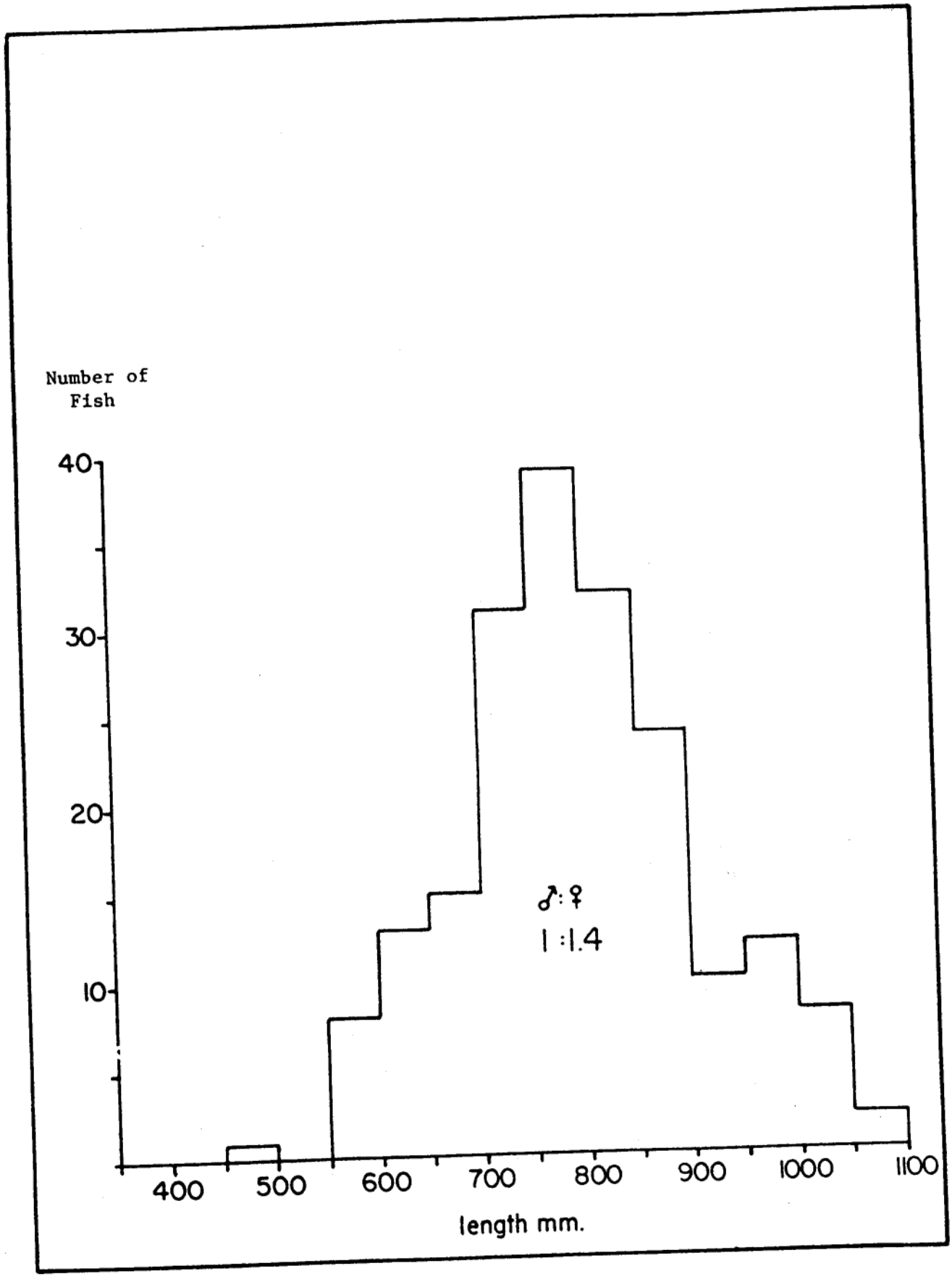

Figure 10. Length frequency of 195 burbot from Yukon River, 1981-84.

Table 16. Aerial estimates of Arctic char in index areas on the North Slope, 1971 to 1984.

Year	Date	Location	
		Ivishak River	Anaktuvuk River
1971		24,470	
1972		11,937	
1973		8,992	
1974		11,000	
1975	9/20	8,306	
1976	9/22	8,570	
1977		-	
1978		-	
1979	9/22	24,403	15,717
1980		-	-
1981	9/14	24,873	10,536
1982	9/19	36,432	6,222
1983	9/18	27,820	8,743
1984	9/18	24,818	5,462

The 1984 estimate for the Ivishak River index area compares favorably with those of past years. Although the number observed in the Ivishak was less than that obtained the last 2 years, it is well above the 11-year average. The Anaktuvuk River index area had the lowest estimate in the 5 years of surveying that stream. The distribution of fish in both the Ivishak and Anaktuvuk Rivers was similar to past years; however, the fish were not as densely concentrated in some of the areas.

LITERATURE CITED

Bendock, T. N. 1979. Inventory and cataloging of Arctic area waters. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1978-1979, Project F-9-11, 20(G-I-I): 64 p.

_____. 1980. Inventory and cataloging of Arctic area waters. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1979-1980, Project F-9-12, 21(G-I-I): 1-31.

_____. 1981. Inventory and cataloging of Arctic area waters. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1980-1981, Project F-9-13, 22(G-I-I): 1-33.

_____. 1983. Inventory and cataloging of Arctic area waters. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1982-1983, Project F-9-15, 24(G-I-I): In press.

Bendock, T. N. and J. M. Burr. 1984 a. Inventory and cataloging of Arctic area waters. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1983-1984, Project F-9-16, 20(G-I-I): 1-46.

Bendock, T. N. and J. M. Burr. 1984 b. Freshwater Fish Distribution in the Central Arctic Coastal Plain (Ikpikpuk River to Colville River). Alaska Dept. of Fish and Game. Sport Fish Division. 53 p.

Craig, P. and L. Halderson. 1979. Ecology of fishes in Simpson Lagoon, Beaufort Sea, Alaska in: Beaufort Sea Barrier Island-Lagoon Ecological Process Studies. U. S. Dept. of Commerce, NOAA. Research Unit 467.100p.

Furniss, R. A. 1974. Inventory and Cataloging of the Arctic Area Waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, Project F-9-6. Volume 15.

Kogl, D. and D. Schell. 1974. Colville River Delta Fisheries Research. P. 483-504 In: Environmental Studies of an Arctic Estuarine System. U.S. Environmental Protec. Agency, Ecol. Res. Series. EPA-660/3-75-026.

Mills, M. 1984. Statewide Harvest Survey, 1982 Data. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration and Anadromous Fish Studies, 1983-1984, 25(SW-IA):1-122.

Netsch, N., E. Crateau, G. Love, and N. Swanton. 1977. Freshwater fisheries reconnaissance of the coastal plain of the National Petroleum reserve-Alaska (NPR-A), July and August 1977, preliminary report. U.S. Fish and Wildlife Service, Anchorage, Alaska. 214p.

Prepared by:

Terrence N. Bendock
Fishery Biologist

John M. Burr
Fishery Biologist

Approved by:

E. Richard Logan, Ph.D., Director
Director, Division of Sport Fish

Louis S. Bandirola, Deputy Director
Division of Sport Fish