STATE OF ALASKA

William A. Egan, Governor

Annual Progress Report for

MONITORING AND EVALUATION OF ARCTIC WATERS WITH EMPHASIS ON THE NORTH SLOPE DRAINAGES.

by

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RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-4 *Name:* Sport Fish Investigations of Alaska.

Study No.: G-III *Study Title:* Lake and Stream Investigations.

Job No.: G-III-A *Job Title:* Monitoring and Evaluation of Arctic Waters with Emphasis on the North Slope Drainages.

Period Covered: July 1, 1971 to June 30, 1972.

ABSTRACT

Investigations were directed toward the Sagavanirktok River drainage in the area between Prudhoe Bay and Accomplishment Creek. Areas of study were centered in the vicinity of oil development projects on the North Slope and directly along the proposed alignment of the trans-Alaska oil pipeline and the adjacent haul-road to ascertain magnitude of problem areas where fishery resources may be disrupted due to construction.

Data are presented from surveys conducted on waterways scheduled to be traversed by the pipeline and haul-road. Information concerning fish species present, migration timing, survey status, and biological productivity are discussed.

Lake and stream survey information describing chemical, physical and biological characteristics are presented. Aerial surveys to determine distribution and relative abundance of anadromous Arctic char, Salvelinus alpinus, are included. Some observations on ice conditions and possible overwintering areas are described.

Some life history aspects of Arctic char are described which include information concerning movements, spawning, and age.

RECOMMENDATIONS

1. Continue life history studies on Arctic char of the Sagavanirktok River drainage.

2. Continue assessment of the existing and potential fishery waters on the North Slope adjacent to the proposed trans-Alaska oil pipeline, haul-road and oil drilling sites.

3. Determine present utilization of fishery populations, subsistence, sport and commercial, of North Slope waters, especially the Sagavanirktok River drainage.

4. Evaluate development projects involving water use and their effects on North Slope lakes and streams.

5. Continue studies of the Sagavanirktok River drainage.

OBJECTIVES

1. To continue assessment of the existing and potential fishery waters of the North Slope adjacent to oil drilling sites and the proposed trans-Alaska pipeline.

2. To evaluate development projects involving water use and their effects on North Slope streams and lakes for the protection of the fishery resources.

3. Life history studies will be initiated on Arctic char in the Sagavanirktok River.

4. To determine present utilization of fishery populations, subsistence, sport and commercial, of North Slope waters, especially the Sagavanirktok River drainage.

5. To conduct a limnological study of the Sagavanirktok River and continue this work on the Colville River.

TECHNIQUES USED

Surveys

Lake and stream surveys were accomplished with the use of a rubber raft and helicopter. On large rivers, velocities (fps) were estimated by drifting a floated object through a measured length of stream. On small streams velocities were measured by velocity head rod. Water analyses to determine pH, alkalinity, and hardness were made with a Hach Model AL-36-WR kit.

Stream Surveys:

Stream surveys were conducted on Sagavanirktok River tributaries that the trans-Alaska oil pipeline may traverse and on streams which may be affected by the haul-road which parallels the pipeline north of the Atigun Canyon. Pipeline and haul-road water crossings are continually being resurveyed and alignments will probably not be definite until the pipe and road are laid. Surveys were conducted on waterways under survey alignments conducted by Michael Baker, Jr., Inc. as of August, 1971.

Pipeline crossings from the confluence of the Atigun River to Happy Valley were surveyed using a rubber raft. Surveys from Happy Valley to Prudhoe Bay were conducted by means of helicopter. Due to the swiftness and depth of the numerous Sagavanirktok River channels, approximations were made on channel widths and velocities. Flood height was determined from deposited debris on banks accumulated from previous floods.

Haul-road crossings usually involved smaller streams, and direct chemical-physical characteristics of the more important streams were measured.

Major tributary streams of the Sagavanirktok River drainage were also surveyed.

Lake Surveys:

Inlets, outlets, and possible spawning areas of lakes were noted. Depths were measured with a Ross P-100 Depth Finder. Fish were captured with 125' X 6' graduated mesh monofilament gill nets.

Aerial Surveys:

Aerial surveys by helicopter were made on all major tributaries of the Sagavanirktok River drainage to determine abundance and distribution of adult char.

Beaufort Sea:

A 21-foot cabin cruiser was used to examine areas in the vicinity of Prudhoe Bay. The boat conducted survey work in the area for a short period. The extreme shallowness of the inshore areas of the Beaufort Sea and the deep draft of the boat hampered operations.

Methods of Capturing Fish

Gill Nets:

Gill nets were the main capture gear for Prudhoe Bay and the Sagavanirktok River delta. Seventy-five-foot multifilament nylon gill nets with 1 1/2-inch bar mesh were used to capture fish in the delta. The area between Midway Islands and Cross Island was sampled with 250-foot monofilament graduated mesh nets consisting of five 50-foot panels of 1/2- to 3-inch bar mesh. A 125-foot graduated mesh monofilament net was used around Foggy Island.

On small streams in which fish were not readily visible, a 50-foot, 1/ 2-inch or 1-inch bar mesh monofilament gill net was used. A 125-foot graduated mesh net was used in lakes.

Beach Seines:

In areas of fish concentration such as on spawning grounds, a 50' X 6' bag seine proved most effective for capturing fish.

Hook and Line:

Hook-and-line sampling was employed to capture fish during short surveys and for the tagging study.

Rotenone:

Rotenone was used in small streams where adult fish were not visible and young-of-the-year or juveniles were suspected to be present.

Weir:

A weir was constructed on the Lupine River approximately 1/4 mile from the confluence with the Sagavanirktok River.

The weir was placed in Lupine River on July 18, 1971, and was in operation periodically until September 18, 1971, when ice conditions on the river forced dismantling. Due to high water conditions, sections of the weir were pulled from July 16 to 17 and from July 22 to 26. To prevent loss due to high water, the entire weir was dismantled from July 29 to August 11.

Processing of Fish

Samples:

Fish were weighed to the nearest 0.1 gram on a triple-beam balance. Fork lengths were measured to the nearest millimeter. Sex and stage of maturity were determined by examining gonads.

Ages of anadromous char were determined from otoliths as described by Heiser (1966), except that xylene rather than soapy water was used as a wetting agent. As a further aid in determining age, lengths were obtained from some otoliths. A binocular microscope with micrometer eye-piece was used to obtain otolith lengths.

Gonads were used to determine maturity and frequency of spawning of Arctic char. Male gonads were weighed on a triple-beam balance to the nearest 0.1 gram. When a balance was not available, gonads were preserved in 10% formalin or alcohol.

Ovaries were individually weighed and egg diameters measured. Ten randomly selected eggs, five from each ovary, were arranged along a millimeter rule and the mean egg diameter calculated.

Tagging:

All Arctic char and grayling over 200 mm in fork length that were not sampled were tagged. Arctic char were tagged with spaghetti tags or Floy internal anchor tags. All grayling were tagged with anchor tags.

FINDINGS

Surveys

Introduction:

Controversy over the trans-Alaska oil pipeline has prompted investigations into possible environmental problems which may occur. One concern connected with pipeline construction which should be emphasized to a greater degree is the haul-road. With the completion of the haul-road, exploration into mineral deposits in the region north of the Yukon River will be intensified. Although the amount of mineral deposits has not been assessed, mining will have a definite effect in areas made accessible by the haul-road. The haul-road will also serve as a gateway to the Arctic for numbers of people.

Haul-Road Crossings:

Plans thus far call for the haul-road to parallel the pipeline from Accomplishment Creek to Prudhoe Bay. Table 1 presents survey results of streams crossed by the haul-road in this area. Incorporated in the table are station number and location, fish species captured, timing of fish migrations, survey status, and biological productivity.

Abbreviations for fish species have been used:

AC - Arctic char, Salvelinus alpinus
ACi - Arctic cisco, Coregonus autumnalis
BWF - Broad whitefish, C. nasus
BB - Burbot, Lota lota
CS - Chum salmon, Oncorhynchus keta
GR - Grayling, Thymallus arcticus
LCi - Least cisco, C. sardinella
NSB - Ninespine stickleback, Pungitius pungitius
PS - Pink salmon, O. gorbuscha
RWF - Round whitefish, Prosopium cylindraceum
SSc - Slimy sculpin, Cottus cognatus

The world "unknown" inserted under the heading "Fish Species", indicates either no fish were captured or observed or no water was present at the crossing during the survey.

In many of the small tributaries to be crossed by the haul-road, grayling may be spawning during the first two weeks in June. Young-of-the-year grayling and juvenile char utilize these tributaries as rearing areas during June through September. Migrations of char within the Sagavanirktok River occur from break-up through September. Siltation or barriers which affect passage of migrating char and rearing fish either directly or indirectly should be avoided during this period.

Survey status is ranked from 1 to 3 where "1" denotes adequate knowledge of fish species composition and migration patterns within the stream. Notation "2" designates waters which have been physically and chemically surveyed and some knowledge of species composition has been noted. Designation "3" denotes those waters not extensively surveyed or surveyed by means of aircraft.

Biological productivity of these waters ranges from high to low as measured by abundance of fish at the time of survey.

Rotenone was used in some creeks to be crossed by the haul-road to obtain standing crop estimates (Table 2). Standing crop figures ranged from four and six pounds per acre in two creeks between the Ribdon and Lupine rivers to 84 pounds per acre in a stream between the Lupine River and Sagwon. The majority of fish captured were rearing Arctic char and grayling.

TABLE I Surveys of Sagavanirktok Drainage Streams Crossed by the Proposed Pipeline Haul Road, Summer, 1971.

Station No.*	USGS Quadrangle	Location	Stream Name	Fish Species**	Timing of Migration	Survey Status ***	Fish Productivity
1289 + 00	Philip Smith Mts.	T 9S R13E	Unnamed	GR, SSc, AC	6/1 - 9/30	2	High
1963 + 11	Philip Smith Mts.	T 7S R14E	Unnamed	GR, SSc, AC	6/1 - 9/30	2	High
1963 + 57	Philip Smith Mts.	T 7S R14E	Unnamed	GR, AC, SSc	6/1 - 9/30	2	High
1964 + 10	Philip Smith Mts.	T 7S R14E	Unnamed	GR, AC, SSc	6/1 - 9/30	2	High
2153 + 76	Philip Smith Mts.	T 7S R14E	Unnamed	GR	6/1 - 9/30	2	High
2206 + 00	Philip Smith Mts.	T 6S R14E	Unnamed	Unknown	Unknown	3	Low
2234 + 80	Philip Smith Mts.	T 6S R14E	Unnamed	Unknown	Unknown	3	Low
2262 + 10	Philip Smith Mts.	T 6S R14E	Unnamed	Unknown	Unknown	3	Low
2319 + 03	Philip Smith Mts.	T 6S R14E	Unnamed	Very little water	Unknown	2	Low
2352 + 00	Philip Smith Mts.	T 6S R14E	Unnamed	AC, BB, SSc	6/1 - 9/30	2	Moderate
2377 + 80	Philip Smith Mts.	T 6S R14E	Unnamed	Very little water	Unknown	2	Low
2386 + 20	Philip Smith Mts.	T 6S R14E	Unnamed	Dry (7/11/71)	Unknown	2	Low
2517 + 83	Philip Smith Mts.	T 6S R14E	Unnamed	GR	6/1 - 9/30	2	Moderate
2536 + 00	Philip Smith Mts.	T 6S R14E	Unnamed	AC, GR, BB, SSc	6/1 - 9/30	2	High
2597 + 00	Philip Smith Mts.	T 5S R14E	Unnamed	Unknown	Unknown	3	Low
3715 + 00	Sagavanirktok	T 2S R14E	Unnamed	Unknown	Unknown	3	Low
3840 + 25	Sagavanirktok	T 1S R14E	Unnamed	GR, SSc	6/1 - 9/30	2	Moderate
3910 + 00	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
3964 + 00	Sagavanirktok	T 1S R14E	Sagavanirktok River	AC, GR, PS, CS, NSB, SSc, BB, RWF, BWF, ACi, LCi	6/1 - 9/30	1	High
3977 + 20	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
3980 + 50	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
4001 + 00	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
4090 + 00	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
59 + 00	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
69 + 75	Sagavanirktok	T 1S R14E	Unnamed	Unknown	Unknown	3	Low
97 + 30	Sagavanirktok	T 1S R14E	Sagavanirktok River	AC, GR, PS, ACi, LCi, BB, RWF, BWF, NSB, SSc	6/1 - 9/30	1	High
100 + 01.83	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
114 + 05	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
2657 + 00	Philip Smith Mts.	T 5S R14E	Unnamed	Unknown	Unknown	3	Low
2670 + 60	Philip Smith Mts.	T 5S R14E	Unnamed	Unknown	Unknown	3	Low
2682 + 45	Philip Smith Mts.	T 5S R14E	Unnamed	Unknown	Unknown	3	Low
2771 + 00	Sagavanirktok	T 4S R14E	Unnamed	Unknown	Unknown	3	Low
2974 + 00	Sagavanirktok	T 4S R14E	Unnamed	Very little water	Unknown	2	Low
3083 + 25	Sagavanirktok	T 3S R14E	Unnamed	AC, GR, SSc	6/1 - 9/30	2	High
3259 + 58	Sagavanirktok	T 3S R14E	"Happy Valley Creek"	AC, GR, RWF, SSc, BB	6/1 - 9/30	1	High

TABLE 1 (Cont.) Surveys of Sagavanirktok Drainage Streams Crossed by the Proposed Pipeline Haul Road, Summer 1971.

Station No.*	USGS Quadrangle	Location	Stream Name	Fish Species**	Timing of Migration	Survey Status ***	Fish Productivity
3296 + 41	Sagavanirktok	T 3S R14E	Unnamed	GR, AC, NSB	6/1 - 9/30	2	Moderate
3467 + 35 (3471 + 59)	Sagavanirktok	T 3S R14E	Unnamed	AC, GR, BB, SSc	6/1 - 9/30	2	High
3535 + 47	Sagavanirktok	T 2S R14E	Unnamed	AC, SSc	6/1 - 9/30	2	Moderate
3670 + 52	Sagavanirktok	T 2S R14E	Unnamed	Dry	Unknown	2	Low
3673 + 50	Sagavanirktok	T 2S R14E	Unnamed	Very little water	Unknown	2	Low
3773 + 45	Sagavanirktok	T 2S R14E	Unnamed	Unknown	Unknown	3	Low
3692 + 75	Sagavanirktok	T 2S R14E	Unnamed	Little water	Unknown	3	Low
116 + 76.83	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
235 + 75 ?	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
268 + 50	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
486 + 00	Sagavanirktok	T 1N R14E	Unnamed	Unknown	Unknown	3	Low
740 + 37	Sagavanirktok	T 2N R14E	Unnamed	Unknown	Unknown	3	Low
740 + 95	Sagavanirktok	T 2N R14E	Unnamed	Unknown	Unknown	3	Low
823 + 00	Sagavanirktok	T 3N R14E	Unnamed	Unknown	Unknown	3	Low
1624 + 82	Sagavanirktok	T 5N R14E	Unnamed	Unknown	Unknown	3	Low
1645 + 25	Sagavanirktok	T 5N R14E	Unnamed	Unknown	Unknown	3	Low
1655 + 75	Sagavanirktok	T 5N R14E	Unnamed	Unknown	Unknown	3	Low
1709 + 00	Sagavanirktok	T 6N R13E	Unnamed	Unknown	Unknown	3	Low
1791 + 50	Sagavanirktok	T 6N R13E	Unnamed	Unknown	Unknown	3	Low
2232 + 47	Sagavanirktok	T 7N R14E	Unnamed	Unknown	Unknown	3	Low
2424 + 82	Beechey Point	T 8N R14E	Unnamed	Unknown	Unknown	3	Low
2451 + 50	Beechey Point	T 8N R14E	Unnamed	Unknown	Unknown	3	Low
2777 + 15	Beechey Point	T 9N R14E	Unnamed	Unknown	Unknown	3	Low
3040 + 00	Beechey Point	T 9N R14E	Unnamed	NSB	Unknown	3	Low
3041 + 15	Beechey Point	T 9N R14E	Unnamed	Unknown	Unknown	3	Low
3118 + 52	Beechey Point	T10N R14E	Unnamed	Unknown	Unknown	3	Low
3195 + 50	Beechey Point	T10N R15E	Unnamed	Unknown	Unknown	3	Low
3196 + 20	Beechey Point	T10N R15E	Unnamed	Unknown	Unknown	3	Low

*Station number refers to TAPS alignment system

** AC - Arctic char
ACi - Arctic cisco
BWF - Broad whitefish
BB - Burbot
CS - Chum salmon
GR - Grayling
LCi - Least cisco
NSB - Ninespine stickleback
PS - Pink salmon
RWF - Round whitefish
SSc - Slimy sculpin

***"1" - adequate knowledge
"2" - some knowledge
"3" - little knowledge

Numbers of adult and rearing fish were observed, though not captured, at the confluences of most creeks with the Sagavanirktok River.

TABLE 2 Standing Crop Estimates in Streams to be Crossed by the Haul-Road, Sagavanirktok drainage, Summer, 1971.

Date	Station No.*	Location	Fish Species**	Pounds/ 0.1 Acre
6/25	3083 + 25	T4S R14E	AC, GR, SSc	3.5
6/23	1963 +	T7S R14E	AC, GR, SSc	1.4
6/27	2536 + 00	T6S R14E	AC, BB, GR, SSc	0.6
6/29	2352 + 00	T6S R14E	AC, BB, SSc	0.4
7/15	3467 + 35	T3S R14E	AC, BB, GR, SSc	8.4

*Haul-road numbering system by Michael Baker, Jr., Inc.
**AC - Arctic char
BB - Burbot
GR - Grayling
SSc- Slimy sculpin

Pipeline Crossings:

The proposed trans-Alaska pipeline is scheduled to make approximately 20 crossings of the Sagavanirktok River. Pipeline alignments are continually being surveyed by Michael Baker, Jr., Inc., for alternate routes. The pipeline crossing surveys (Table 3) conducted by Alaska Department of Fish and Game utilized the Michael Baker, Jr., Inc., numbering system and alignment as of August, 1971.

A float trip via rubber raft to survey pipeline crossings was conducted July 31 to August 2 in the Sagavanirktok River from the confluence of the Atigun River to Happy Valley, a distance of approximately 50 miles.

Pipeline crossing surveys from Happy Valley to Prudhoe Bay were conducted using a helicopter for transport. The crossings from Sagwon (1400+) to Prudhoe Bay (1730+) are directed across braids and dry sloughs for the most part and locating these stations would be difficult unless accompanied by a surveyor.

TABLE 3 Physical Characteristics at Proposed Pipeline Crossings, Sagavanirktok River, 1971.

ALPS Segment No.*	Location	ALPS No.	River Channels	Width (Ft.)	Velocity (fps)	Flood Height (Ft.)	Bottom Type
10	T10S R13E Sec. 27	99 + 41	1	175	5.9	3 - 4	cobbles, gravel
10	T10S R13E Sec. 10	320 +	1	125	4.0	4 - 7	gravel, boulders
10	T10S R13E Sec. 2	344 + 00	1	130	4.3	4	gravel, cobbles, boulders
11	T 9S R13E Sec. 35	12 + 54	2	145	6.2	5	gravel, boulders
11	T 8S R14E Sec. 31	294 + 06	1	125	1.8	-	sand, gravel, cobbles
11**	T 8S R14E Sec. 31	328 + 76					
11	T 8S R14E Sec. 30	361 + 90	1	225	rapid	-	boulders
11	T 8S R14E Sec. 19	413 + 83	1	250	rapid	-	silt, cobbles
11**	T 7S R14E Sec. 28	688 + 58					
11	T 7S R14E Sec. 5	957 + 86	3	93	3.2	-	sand, gravel, cobbles
11	T 6S R14E Sec. 29	1042 + 45	1	235	5.9	4	
11	T 6S R14E Sec. 20	1084 + 25	1	300	rapid	-	gravel, cobbles, boulders
11	T 6S R14E Sec. 5	1242 + 73	1	260	6.3	-	
11	T 5S R14E Sec. 28	1357 + 61	2	200	7.1	4	gravel, cobbles
11	T 5S R14E Sec. 4	1546 + 72	1	239	6.7	-	gravel, cobbles, boulders
12**	T 4S R14E Sec. 8	65 + 45					
12**	T 3S R14E Sec. 29	228 + 15					
12**	T 3S R14E Sec. 5	405 + 66					
12	T 1S R14E Sec. 15	941 + 50	3	200	7.1	-	gravel
12	T 1N R15E Sec. 30	1177 + 49	2	500	6.6	4	gravel
13***	T 1N R15E Sec. 17	1400 +					
13***	T 4N R14E Sec. 33	976 +					

TABLE 3 (Cont.) Physical Characteristics at Proposed Pipeline Crossings, Sagavanirktok River, 1971.

ALPS Segment No.*	Location	ALPS No.	River Channels	Width (Ft.)	Velocity (fps)	Flood Height (Ft.)	Bottom Type
13***	T 6N R14E Sec. 30	175 +					
14***	T 7N R14E Sec. 17	612 +					
14***	T 8N R14E Sec. 22	853 + 69					
14***	T 9N R14E Sec. 33	1098 + 46					
14***	T 9N R14E Sec. 9	1350 + 21					
14***	T10N R14E Sec. 8	1628 + 34					
14***	T11N R14E Sec. 32	1730 +					

*Alyeska Pipeline Service numbering system.
**Will be completed during 1972.
***Surveys indicate proposed pipeline north of Sagwon (Ivishak River) crosses mostly braids and dry sloughs.

TABLE 4 Physical and Chemical Description of Major Tributary Streams of the Sagavanirktok River, 1971.

Stream	Survey Date	Fish Species*	Stream Length (Mi.)	Avg. Width (Ft.)	Flow (cfs)	Velocity (fps)	Water Temp. (°C)	pH	Alkalinity (ppm)	Hardness (ppm)
Atigun River	9/12	GR, SSc	40	85	-	2.6	1.0	8.0	102.6	85.5
Sag River East Branch	9/12	AC, GR	23	53	19.2	1.1	1.5	8.0	102.6	119.7
Accomplishment	8/ 1	AC, GR, SSc, RWF, BB	33	125	288.0	1.8	4.5	---	---	---
Section Creek	9/24	AC, GR	12	15	3.6	0.8	3.0	8.0	153.9	136.8
Ribdon River	9/14	AC, GR, SSc	48	100	200.2	1.4	1.5	8.0	136.8	161.1
Ribdon - South Branch	9/25	AC, GR, SSc	18	84	157.9	2.4	2.0	8.0	119.7	119.7
Lupine River	7/ 8	AC, GR, RWF, SSc, BB, CS	46	69	37.5	0.8	13.0	8.5	188.1	153.9
Unnamed	8/ 7	AC, GR	8	23	9.0	1.4	6.0	7.5	119.7	85.5
"Happy Valley Creek"	9/ 1	AC, GR, SSc, RWF, BB	33	28	10.0	0.8	3.0	7.0	51.3	34.2
Ivishak River	9/13	AC, GR, SSc	92	200	1,084.4	6.2	3.0	8.5	136.8	136.8
Flood Creek	9/16	AC, GR	20	60	48.8	1.1	4.0	8.5	153.9	136.8
Saviukviayak River	9/16	AC, GR	36	75	126.7	2.3	3.0	8.5	153.9	136.8
Gilead Creek	9/16	Unknown	22	38	10.7	0.8	2.0	8.0	136.8	153.9
Echooka River	9/16	AC, GR, SSc	64	80	97.9	1.4	0.0	8.0	171.0	153.9

*AC - Arctic char
BB - Burbot
CS - Chum salmon
GR - Grayling
RWF - Round whitefish
SSc - Slimy sculpin

Widths of channels range from 93 feet to 500 feet, depending upon the number of channels within a particular crossing. Velocities range from 1.8-7.1 fps. Flood height levels ranged from three to seven feet over the water level at the time of survey. Bottom materials ranged from silt to boulders, but gravel and cobbles predominated.

Stream Surveys:

Physical and chemical surveys were conducted on all major tributary streams of the Sagavanirktok drainage (Table 4). Physical characteristics noted included stream length, average width, flow, velocity, and water temperature. Chemical parameters measured were pH, alkalinity, and hardness.

Fish inhabit all the major tributaries except Gilead Creek where no fish were noted from aerial observation. Arctic grayling were found in all other tributaries, and Arctic char in all except the Atigun River. Other species of fish encountered were round whitefish, burbot, and slimy sculpin. In addition, two chum salmon were captured in the Lupine River in mid-August. One partially spawned female pink salmon was captured on August 27 in the Sagavanirktok River one mile below the Ivishak River confluence.

Aerial Surveys:

Estimated counts of adult Arctic char were made by helicopter on tributaries of the Sagavanirktok River (Table 5). The Kuparuk River (east of the Sagavanirktok drainage) was flown on September 22, but no adult char were observed.

Estimates conducted under fair to good observation conditions ranged from 11 adult char in Section Creek to 12,808 in the Ivishak River. Under poorer observation conditions, an estimate of 20,994 char was made on the Ivishak River on September 30.

TABLE 5 Aerial Estimates of Adult Arctic Char, Sagavanirktok Tributaries, 1971.

Date	Stream	Observed Adult Count	Observation Conditions
8/11	Echooka River	125	Fair
	Ivishak River	64	Fair
8/26	Accomplishment Creek	178	Good
	Ribdon River	400	Fair
	Ribdon-South Branch	49	Poor
	Lupine River	Few	Poor

TABLE 5 (Cont.) Aerial Estimates of Adult Arctic Char, Sagavanirktok Tributaries, 1971.

Date	Stream	Observed Adult Count	Observation Conditions
8/30	Saviukviayak River	321	Good
	Tributary between Saviukviayak and Flood	0	Good
	Flood Creek	350	Good
	Gilead Creek	0	Good
9/3	Ivishak River	12,470	Good
	Echooka River	1,137	Fair
9/9	Lupine River	Few	Poor
9/12	Sagavanirktok River (East Branch - Headwaters)	24	Fair
	Sagavanirktok River (Main Branch - Headwaters)	13	Fair
	Atigun River	0	Fair
9/22	Ivishak River	12,808	Good
	Kuparuk River*	0	Fair
9/24	Section Creek	11	Fair
9/30	Ivishak River	20,994	Poor

*Not in Sagavanirktok drainage.

Lake Surveys:

Four lakes were surveyed in the Sagavanirktok drainage (Table 6). Arctic grayling were found in all lakes surveyed. Lake trout, Salvelinus namaycush, were found in the two deeper lakes. Round whitefish, slimy sculpin, and ninespine stickleback were found in some lakes. Maximum depth of lakes ranged from 9 to 87 feet, while mean depths ranged from 6 to 36 feet.

Possible Overwintering Areas:

Overwintering areas for fishes in the Sagavanirktok drainage are limited due to the shallowness of the river, which averages less than six feet in depth. Since ice thickness can exceed six feet, major portions of the Sagavanirktok drainage freeze to the gravel. Spring areas at the headwaters of most tributaries provide some overwintering capabilities but it is believed the total fish population is not contained within these restricted areas (Figure 1).

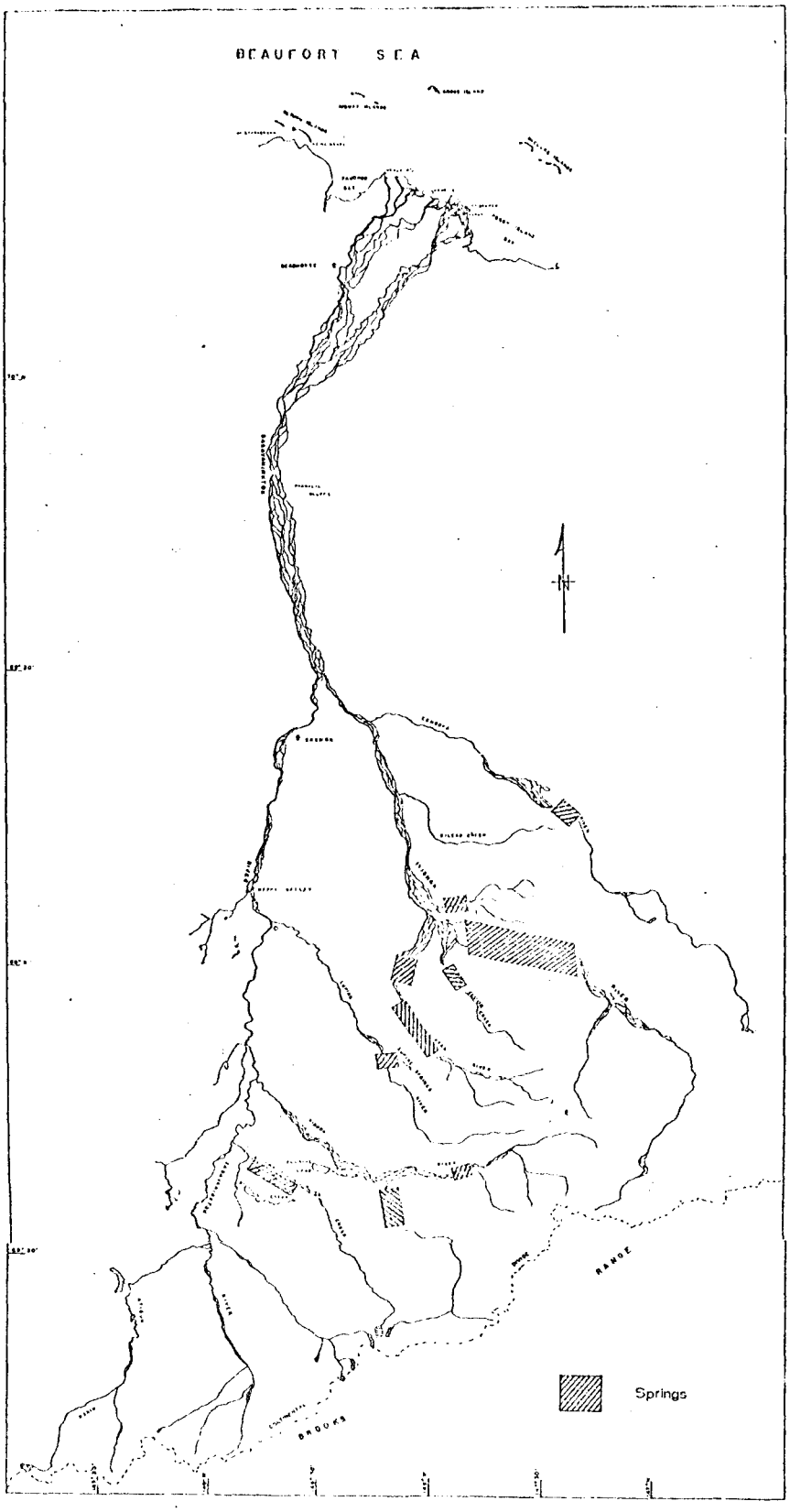

FIGURE 1 AREAS OF SPRING SOURCE OR GROUND WATER, SAGAVANIRKTOK DRAINAGE, 1971.

TABLE 6 Lakes of the Sagavanirktok Drainage Surveyed During Summer, 1971.

Lake	Location	Survey Dates	Surface Acres	Depth (Ft.) Maximum	Depth (Ft.) Mean	Fish Species*
Unnamed	T7S R16E Sec. 23 (68°50' 148°13')	8/ 8- 9	300	33	19	LT, GR, RWF, SSc, NSB
Unnamed	T5S R13E Sec. 13 (69°01' 148°54')	7/12-14	300	20	8	GR, RWF, NSB
Unnamed	T5S R16E Sec. 11 (69°02' 148°15')	8/ 8- 9	200	87	36	LT, GR
"Island"	T2S R13E Sec. 26 (69°14' 148°55')	7/16-19	470	9	6	GR, NSB

* GR - Grayling
LT - Lake trout
NSB - Ninespine stickleback
RWF - Round whitefish
SSc - Slimy sculpin

Thirteen possible overwintering areas in the Sagavanirktok drainage were located during the summer. Sites were chosen on the basis of water depth and pool dimensions. Areas with water depths ranging from 6 to 12 feet were selected. Pool dimensions ranged from 10 x 15 yards to 40 x 100 yards.

Studies were conducted from November 15-22, at six of the selected sites to determine presence of overwintering fish. Several holes were augered through the ice at each overwintering area. Hook and line served as the sampling gear.

Although no fish were captured from the suspected overwintering areas, sufficient volume of water and high dissolved oxygen levels (9-14 ppm) were present in all areas examined to permit fish survival. Fish may be present later when further freezing concentrates them into these areas. Ice depths ranged from 1.0 to 2.2 feet and large volumes of water could be heard flowing under the ice. Water depth ranged from 5.5 to 12.0 feet.

Five open-water spring areas were also examined during this period. Numbers of char within the spring areas ranged from one on the Sagavanirktok River (between Happy Valley and Sagwon) to an estimated 1,200 at the Ivishak River (Table 7). Spring areas at Accomplishment Creek had about 25 adult char and Lupine Springs contained about 50 adult char. Water temperatures at spring areas ranged from 0.5°C at the Ivishak to 1.5°C at Lupine Springs.

TABLE 7 Fishes Observed between November 15-22, 1971, in Spring Areas of the Sagavanirktok Drainage.

Location	Water Temp. (°C)	Fish Species Observed*	Estimated Count
Lupine Springs	1.5	AC (juvenile-size)	300
		AC (adults)	0
Lupine Creek	1.0	AC (juvenile-size)	100
		AC (adults)	50
		SSc	Few
Accomplishment Creek	-	AC (juvenile-size)	200
		AC (adults)	25
Ivishak River	0.5	AC (juvenile-size)	0
		AC (adults)	1,200
Sagavanirktok River (between Happy Valley and Sagwon)	0.5	AC (juvenile-size)	0
		AC (adults)	1
		GR	3

*AC - Arctic char
GR - Grayling
SSc- Slimy sculpin

Main capture gear at spring areas was hook and line. A 50-foot bag seine was used in the attempt to capture fish but proved unsuccessful because of shelf-ice.

Forty-five char were captured from the Ivishak springs, 32 of which were tagged and released. Thirteen char were sampled to determine age and sexual development of gonads. Two char tagged during the summer were recaptured from the Lupine Springs and sampled. Only one grayling was captured from the open water area in the Sagavanirktok River.

Utilization of Fishery

No commercial or subsistence fisheries exist in the Sagavanirktok River.

Sport Fishery:

Informal interviews were conducted with personnel at construction camps. Angling pressure was directed to catching Arctic char and very little effort was expended towards catching grayling. Catch per unit of effort data would not be appropriate because anglers either experienced extremely good char fishing or did not catch any char. Fishing success depended entirely upon time and location. Prime fishing period for Arctic char existed from the end of August to freeze-up, while angling prior to mid-August was poor. Areas of fish concentration centered around spawning grounds and along the entire length of the Ivishak River.

To determine the sport fishing potential, a record was kept on the number of fish caught within a given number of hours by department personnel.

"Campsite Lakes", located in the foothills of the Brooks Range approximately three miles east of the Sagavanirktok River, were fished for two hours by four anglers (eight angler hours) on July 19. Two Arctic char, each approximately 450 mm in length, and 16 lake trout ranging in length from 300 - 400 mm were caught.

Hook and line was used on the Ivishak River between September 16-21 to capture Arctic char. One thousand one char were caught, tagged, and released during this period, a total effort of 81 angler hours. Average catch per unit of effort was 12.4 fish per angler hour.

Arctic Grayling

Tagging:

To determine movement patterns of Arctic grayling in the Sagavanirktok drainage, 419 grayling were tagged, of which 329 were tagged in the Lupine River. Fifty-four were tagged in "Happy Valley Creek" by Craig and Bain, Alyeska Fish Survey, and data were transferred to Alaska Department of Fish

and Game for incorporation into the tagging study. An additional 27 fish were tagged in "Happy Valley Creek" by department personnel. Seven grayling were tagged at Accomplishment Creek and two grayling were tagged in the Sagavanirktok River two miles north of Sagwon.

Movement:

Grayling movement in the Lupine River was monitored by use of a weir between July 9 and September 18 (Figure 2). The weir was constructed after the spawning migration of grayling into the river. During the second and third weeks of July, an apparent migration into the system was noted. This movement is construed as a random feeding migration rather than a specifically directed pattern. Of the 81 grayling tagged at "Happy Valley Creek", two were recaptured at the Lupine River located five miles upstream from "Happy Valley Creek" and one was recaptured on the Sagavanirktok River approximately one mile upstream.

Maximum-minimum water temperatures and relative water levels were recorded daily at the weir site (Figure 3). Some grayling behavior patterns appear to be highly influenced by water temperatures. Tack (1972) indicated that Interior Alaska grayling commence spawning when water temperatures reach 3.9°C. Migration out of tributaries also appears to be associated with water temperature. A definite downstream migration of grayling was observed shortly after minimum water temperatures reached 0.0°C for the first time on September 2.

Food Habits:

A total of 457 grayling stomachs from various locations in the Sagavanirktok drainage were dissected to determine occurrence of organisms (Table 8). Sampling areas were located on a major tributary, a creek observed to contain spawning grayling, small tributaries which will be crossed by the haul-road, along the west branch of the Sagavanirktok delta and three lakes.

Aside from unidentified insect remains, the most frequently occurring items were beetles, chironomids, caddis, vegetative debris, mosquitoes, and snails.

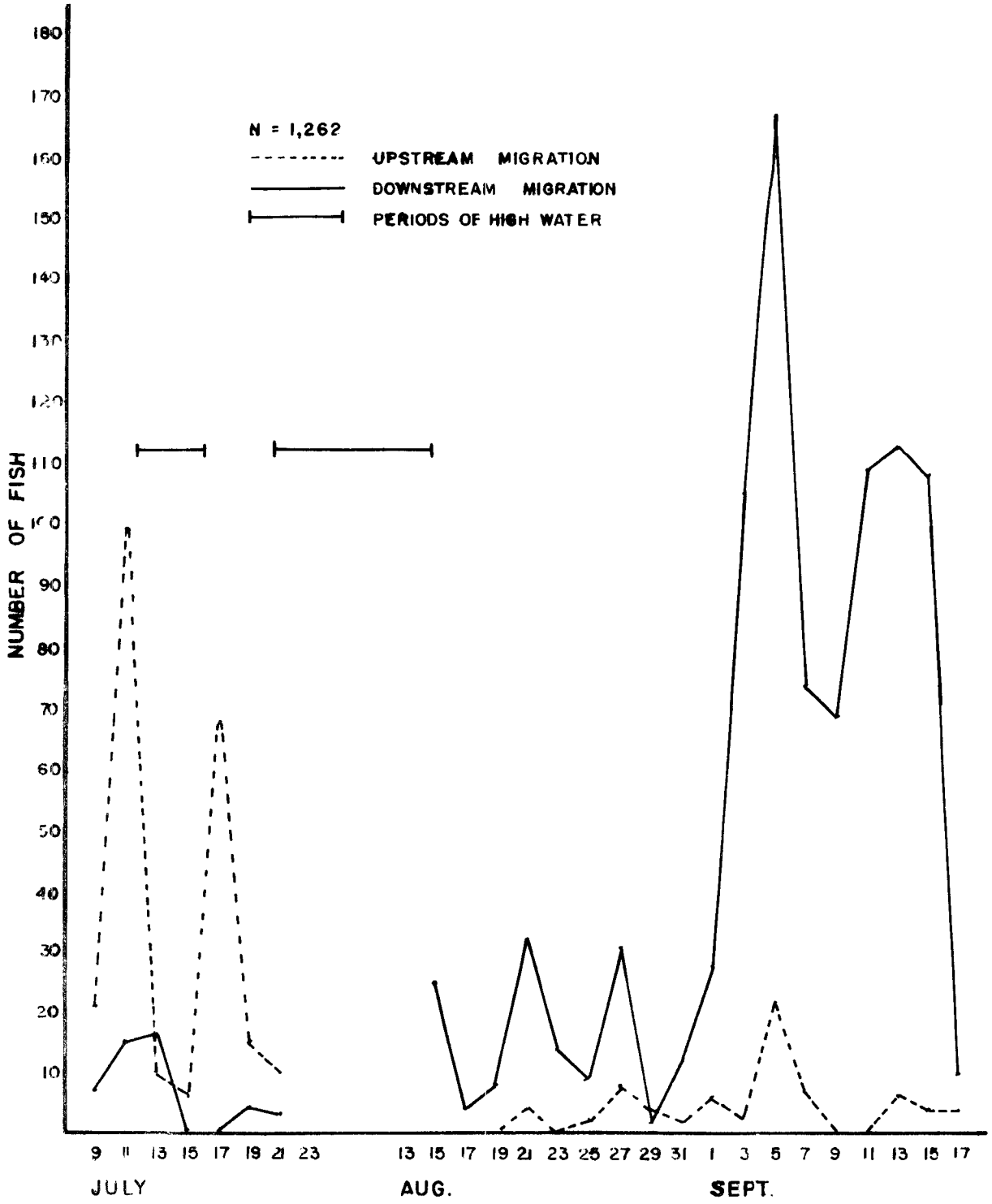

FIGURE 2 ARCTIC GRAYLING MOVEMENT THROUGH WEIR ON LUPINE RIVER, JULY 9 - SEPTEMBER 18, 1971.

TABLE 8 Occurrence of Food Items in Grayling Stomachs, Sagavanirktok Drainage, Summer, 1971.

	Lupine River			"Happy Valley Creek"	Creeks 1, 2, 3 & 4	West Branch Sag Delta	Lakes	Totals
	Upstream Trap	Wulf Trap	Mouth					
Sampling Period	7/19-9/14	8/19-9/16	6/13-6/29	6/11-6/28	6/24-6/27	6/16-7/23	7/17-7/19	
No. of Stomachs	122	103	30	76	32	18	76	457
Grayling Length Range (mm)	102-264	144-409	232-382	115-371	122-388	302-412	108-376	102-412
% (No.) Food Items Occurring in Stomachs:								
Empty	12.7 (22)	3.2 (6)	-	-	-	3.5 (1)	-	3.5 (29)
Vegetative Debris	1.7 (3)	9.7 (18)	12.7 (8)	11.9 (22)	12.7 (10)	34.5 (10)	-	8.5 (71)
Zooplankton	0.6 (1)	1.1 (2)	-	-	-	3.5 (1)	14.9 (18)	2.6 (22)
Insect Remains	60.7 (105)	32.4 (60)	-	3.8 (7)	1.3 (1)	24.1 (7)	14.0 (17)	23.6 (197)
Hexapoda								
Coleoptera	13.3 (23)	8.1 (15)	30.2 (19)	26.5 (49)	19.0 (15)	3.5 (1)	5.0 (6)	15.3 (128)
Plecoptera	0.6 (1)	10.3 (19)	3.2 (2)	-	1.3 (1)	-	-	2.7 (23)
Diptera								
Chironomidae	6.4 (11)	3.2 (6)	12.7 (8)	15.7 (29)	2.5 (2)	10.3 (3)	47.1 (57)	13.9 (116)
Culicidae	1.2 (2)	-	30.2 (19)	15.7 (29)	20.2 (16)	6.9 (2)	0.8 (1)	8.3 (69)
Misc. Diptera	-	2.2 (4)	1.6 (1)	1.6 (3)	7.6 (6)	-	-	1.7 (14)
Trichoptera	-	24.9 (46)	3.2 (2)	6.5 (12)	5.1 (4)	3.5 (1)	14.0 (17)	9.8 (82)
Orthoptera								
Locustidae	2.3 (4)	4.9 (9)	-	-	-	-	-	1.6 (13)
Hymenoptera	-	-	-	3.8 (7)	8.9 (7)	-	-	1.7 (14)
Gastropoda	-	-	4.8 (3)	12.4 (23)	17.7 (14)	-	4.1 (5)	5.4 (45)
Fish Remains	0.6 (1)	-	1.6 (1)	1.1 (2)	1.3 (1)	10.3 (3)	-	1.0 (8)
Fish Eggs	-	-	-	1.1 (2)	2.5 (2)	-	-	0.5 (4)
Total Occurrences	100.1 (173)	100.0 (185)	100.2 (63)	100.1 (185)	100.1 (79)	100.1 (29)	99.9 (121)	100.1 (835)

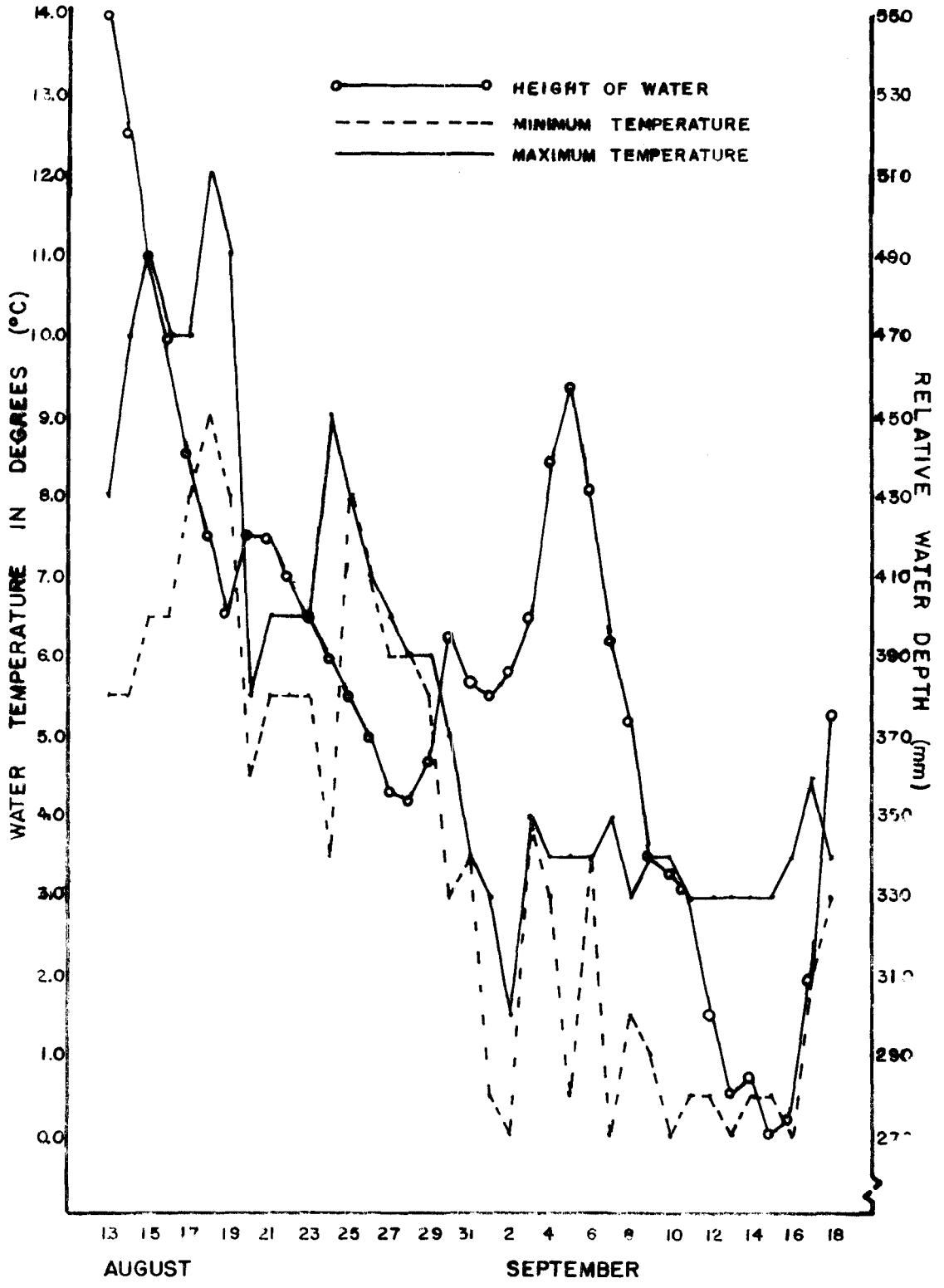

FIGURE 3 RECORD OF MAXIMUM - MINIMUM WATER TEMPERATURE AND RELATIVE WATER DEPTH MEASURED AT LUPINE RIVER WEIR, 1971.

Data may indicate beetles to be the major food item but this can be partially attributed to the tendency of the chitinous material of beetles to remain undigested for longer periods, and thus easier to identify.

Although volumetric analysis was not conducted, it is probable that chironomids were both the most numerous food items and constituted the greatest bulk.

Length-Frequency:

Fork length measurements were obtained from 1,140 grayling captured at the Lupine River weir (Figure 4). Although the weir was dismantled prior to completion of downstream migration, it is believed that the length-frequency is representative of the population for fish larger than 99 mm.

Age, Growth and Maturity:

Information concerning age and growth and maturity of grayling has been collected, but will be presented when it can be combined with data to be gathered in 1972.

Round Whitefish

Round whitefish movement through the Lupine River weir was monitored from July 9 to September 18 (Figure 5). No definite upstream movements within this period were detected. Out-migration was closely associated with grayling movement. Peak of downstream migration occurred on September 3 and 4. About 37% of the recorded downstream movement of round whitefish was observed during this two-day period.

Length-frequency of the 401 round whitefish captured in the Lupine River is presented in Figure 6.

Other Whitefish Species:

Fragmentary data on other whitefish species have been collected but will be reported on next year when additional data are available.

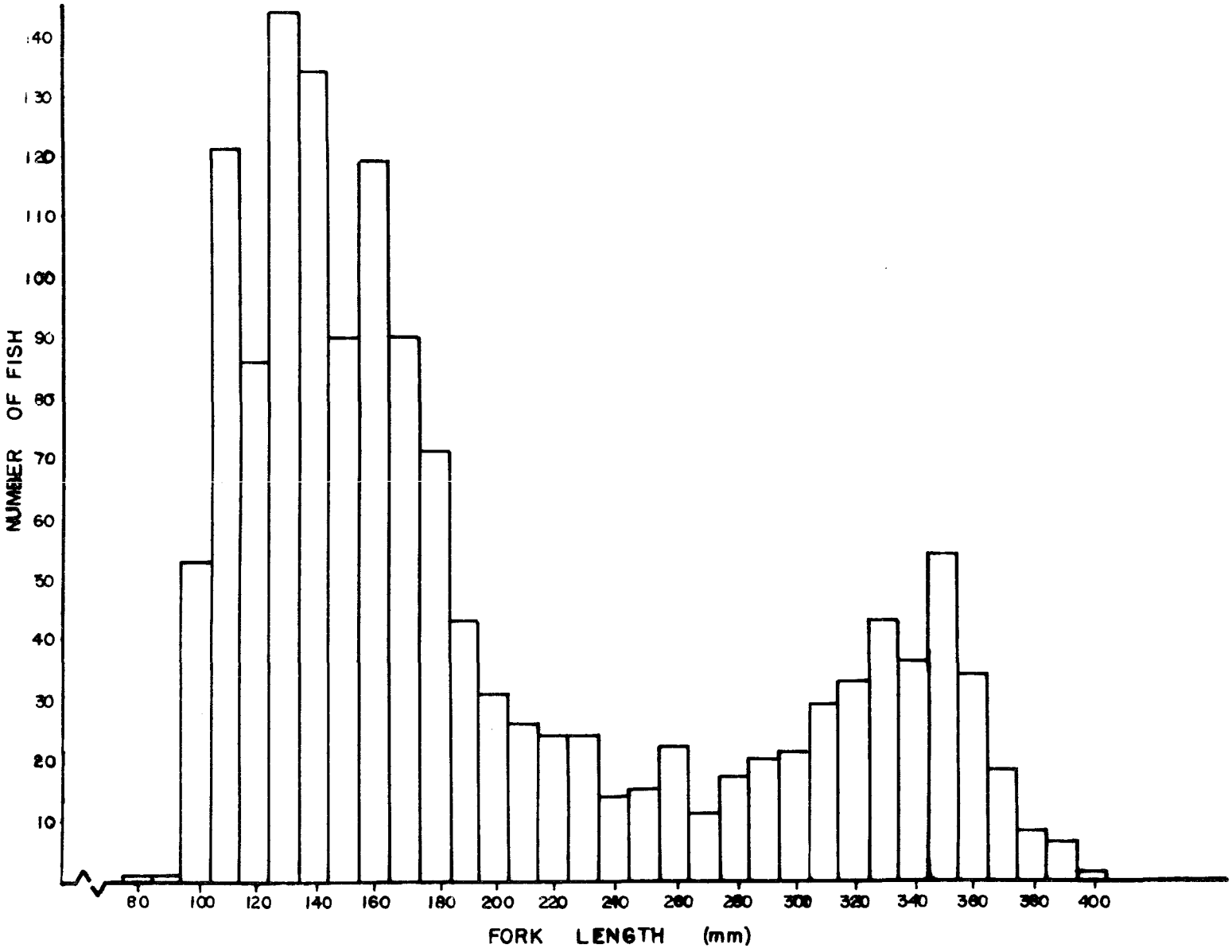

FIGURE 4 LENGTH-FREQUENCY OF 1,140 ARCTIC GRAYLING FROM LUPINE RIVER, 1971.

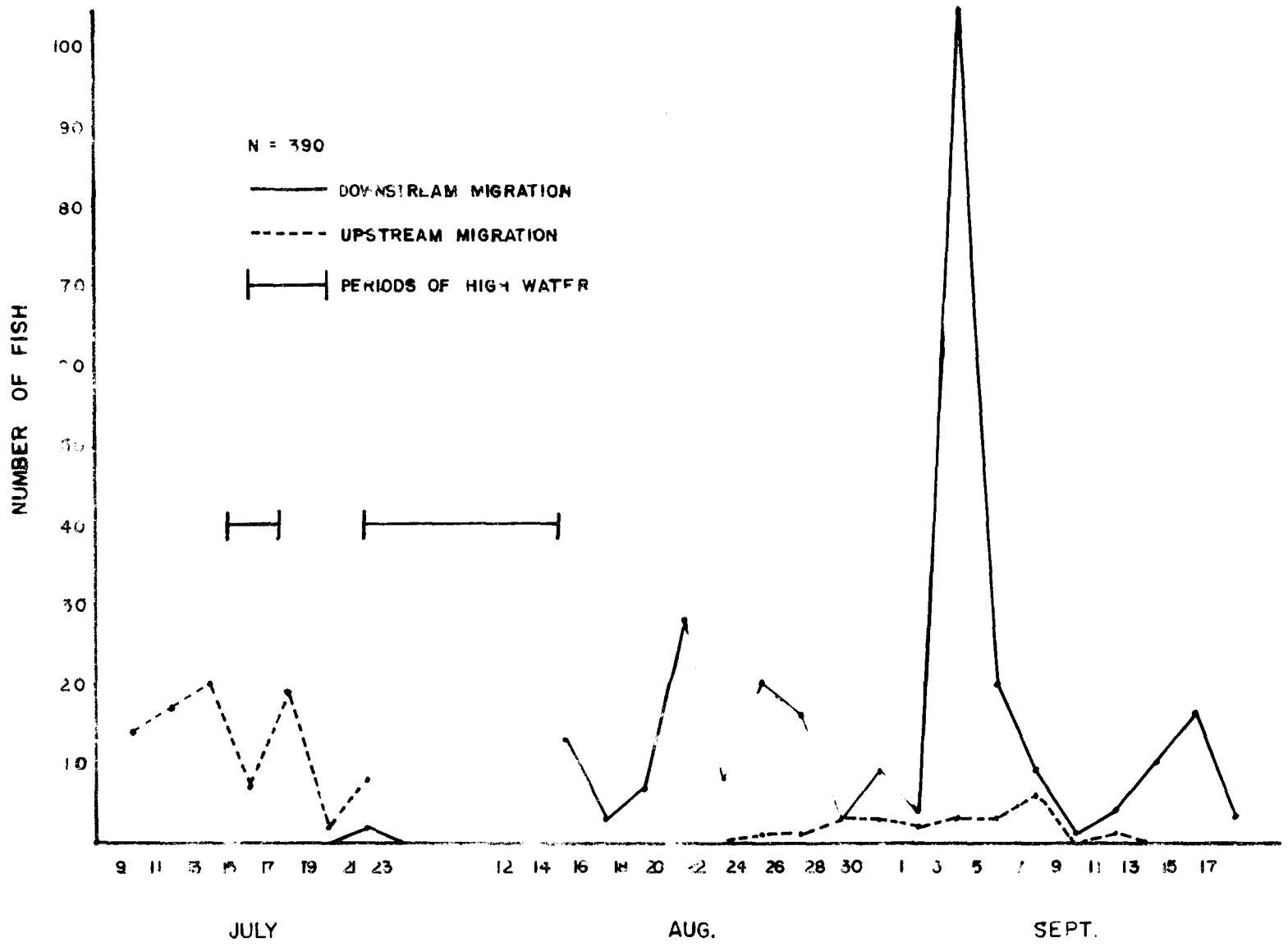

FIGURE 5 MOVEMENT OF ROUND WHITEFISH THROUGH LUPINE RIVER WEIR, JULY 9-SEPTEMBER 18, 1971.

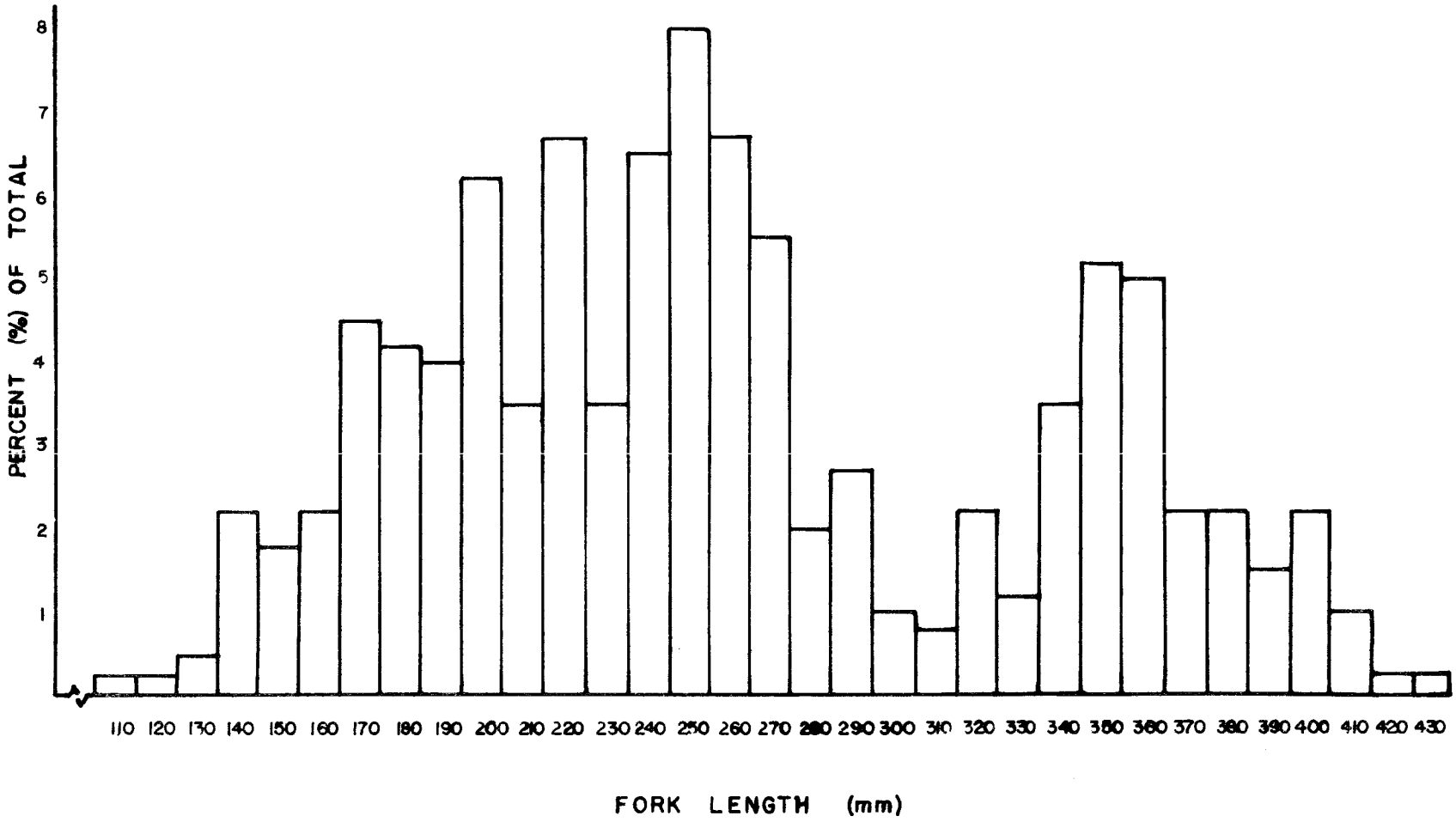

FIGURE 6 LENGTH-FREQUENCY OF 401 ROUND WHITEFISH CAPTURED AT THE LUPINE RIVER WEIR, 1971.

Tagging:

A total of 2,776 Arctic char was tagged in the Sagavanirktok drainage, of which 633 were tagged in the vicinity of Prudhoe Bay and 2,143 from the area south of Franklin Bluffs (Table 9). Tagging locations extended from the area of the barrier islands of the Beaufort Sea to tributary headwaters of the Sagavanirktok River. Major tagging sites were located on the west branch of the Sagavanirktok delta, the Ivishak River, at the Lupine River weir, and at spawning grounds of the Lupine River and Accomplishment Creek.

Foot surveys, beach seine samples, and underwater observations on the spawning grounds of the Lupine River revealed an estimated 85% of the adult Arctic char spawning population were tagged. Approximately 50% of the adult population in Accomplishment Creek was tagged. These estimates were made on September 27 and 28, respectively. Estimates were based on the assumption that no influx of spawning fish occurred after these dates. Aerial surveys support this assumption. Added support was derived from observations made at Lupine weir. No Arctic char were captured at the weir after September 9.

TABLE 9 Locations and Numbers of Arctic Char Tagged in the Sagavanirktok Drainage, Summer, 1971.

Location	Number of Tagged Fish
Southern District of Sagavanirktok Drainage	
Lupine Weir	520
Lupine Springs	94
Accomplishment Creek	462
Ivishak River	1,033
Miscellaneous	34
	2,143
Northern District of Sagavanirktok Drainage	
Delta-West Branch	554
Foggy Island	55
Outer Islands	24
	633
Total	2,776

Movement:

Information concerning Arctic char movement from mid-June to mid-July is limited. Fishing effort increased from mid-July and catch data were recorded daily in the vicinity of Prudhoe Bay. Due to turbid water conditions during June and July, aerial surveys were not conducted. Observation conditions improved from August to freeze-up and aerial surveys became an important means of interpreting movement.

Gill net catches between July 15 and August 11 averaged approximately 0.5 fish per net hour at Prudhoe Bay. Few fish were observed during an aerial survey of the Sagavanirktok River on August 11. An aerial survey of the Ivishak River on the same day revealed 64 char. Catches at Prudhoe Bay increased to about two fish per net hour from August 12 until the third week in August. Angus Gavin (ARCO ecologist) reported large numbers of char between Prudhoe Bay and Franklin Bluffs on August 16, five days after a similar survey revealed few fish. Gill net catches at the river delta reflected this influx of fish and by the end of August, catches had increased to about eight fish per net hour. The majority of in-migrants moved through the Lupine River weir between August 15 and September 4, with peak migration recorded on August 25 (Table 10). On September 3, about 13,000 char were observed in the Ivishak River, where three weeks before, 64 were counted. An aerial count on September 22 indicated no major influx of fish since September 3.

A change in size composition of migrating fish was noted during this period. Fish averaged approximately 475 mm in length at the delta when captured during the second week of August. By the last week of August, average size of fish in the delta decreased to approximately 300 mm. This change in average size was also observed at the Lupine River weir. During the first three weeks of August, captured fish averaged about 475 - 500 mm in length. Fish in the 250 mm class first appeared at the weir on August 26 and average size of fish had decreased to about 400 mm.

Although out-migration was not fully monitored immediately following break-up, some information is available from gill net results and otolith interpretation. Gill net sampling at the delta on June 17 and 18 indicated some out-migration. Gill net catches during this period averaged about one fish per net hour, with the majority of captured fish aged III, IV, and V.

Indication of migration to sea for the first time was gathered from 237 pairs of otoliths (Table 11). Initial migration to sea varied from age 0 to VII, with major migration occurring at age IV. Age at first out-migration appears to be younger in tributaries, like Accomplishment Creek, farther from the sea. On the Ivishak River, which is the closest tributary to the sea, initial seaward migration occurs with older fish.

Detection of first migration to sea by otolith interpretation is subjective and further analysis will be conducted to correlate scale reading with otoliths.

TABLE 10 Upstream Movement of Arctic Char through Lupine River Weir, Summer, 1971.

Date	No. of Char	Fork Length (mm) Range	Fork Length (mm) Mean ($\bar{x}$)
July 9	3	507 - 651	575.7
10	2	494 - 635	564.5
11	1	609	609.0
12	0	---	---
13	0	---	---
14	5	485 - 539	513.2
15	1	496	496.0
16	1	549	549.0
17	High Water		
18	2	480 - 560	520.0
19	5	449 - 608	527.2
20	4	484 - 615	560.8
21	High Water		
22	2	483 - 507	495.0
23	High Water		
24	High Water		
25	High Water		
26	1	550	550.0
27	3	468 - 560	509.3
28	4	469 - 595	523.5
29	High Water		

TABLE 10 (Cont.) Upstream Movement of Arctic Char through Lupine River Weir, Summer, 1971.

Date	No. of Char	Fork Length (mm) Range	Fork Length (mm) Mean ($\bar{x}$)
August 10	3	463 - 509	486.3
11	0	---	---
12	8	447 - 619	498.9
13	3	471 - 595	516.0
14	10	474 - 563	507.9
15	26	414 - 577	491.4
16	8	425 - 605	506.5
17	28	416 - 609	498.1
18	24	427 - 608	494.0
19	2	452 - 512	482.0
20	22	433 - 610	488.8
21	33	428 - 636	480.2
22	15	397 - 639	477.2
23	17	369 - 671	510.8
24	53	402 - 705	507.9
25	93	424 - 663	509.9
26	60	240 - 596	480.4
27	32	239 - 723	449.5
28	39	229 - 627	444.8
29	28	235 - 569	441.8

TABLE 10 (Cont.) Upstream Movement of Arctic Char through Lupine River Weir, Summer, 1971.

Date	No. of Char	Fork Length (mm) Range	Fork Length (mm) Mean ($\bar{x}$)
August 30	20	231 - 596	432.6
31	17	241 - 493	378.8
September 1	7	245 - 517	374.6
2	13	225 - 581	475.0
3	9	242 - 623	394.9
4	12	227 - 607	367.9
5	3	250 - 487	333.3
6	3	247 - 467	386.0
7	2	428 - 453	440.5
8	4	222 - 235	229.2
9	0	---	---
10	0	---	---
11	0	---	---
12	0	---	---
13	0	---	---
14	0	---	---
15	0	---	---
16	0	---	---
	628		

TABLE II Percent of Arctic Char Migration to Sea for the First Time as Determined from 237 Otoliths, Sagavanirktok Drainage, Summer, 1971.

Location	Percent of Fish to Sea by Year of Life (Summer)								Percent
	0	I	II	III	IV	V	VI	VII	Total
Accomplishment Creek	4.5	4.6	4.6	22.7	54.5	9.1	-	-	100.0
Lupine River	-	6.1	19.5	25.6	31.7	13.4	3.7	-	100.0
Ivishak River	-	-	2.8	11.4	60.0	20.0	2.9	2.9	100.0
Miscellaneous	-	5.1	10.2	26.5	36.7	18.4	3.1	-	100.0
Mean	0.5	4.6	11.8	23.6	40.1	16.0	3.0	0.4	100.0

Maturity:

Gonad samples were collected from immature, potential spawners, adult non-spawners, and spawned-out char. Egg diameters were measured to determine sexual development. To correlate sexual development, egg diameters were determined from ripe females and from deposited eggs within redds.

Ovary weights ranged from 0.3 - 284.0 gm. Egg diameter measurements from immature fish and potential spawners ranged from less than 1.0 - 4.5 mm. Eggs from ripe females averaged about 3.7 mm. Eleven redds were disturbed to obtain measurements from deposited eggs. These eggs averaged about 4.7 mm in diameter.

Data on maturity will be analyzed and presented at a later date.

Spawning:

Estimates of spawning populations were made on Accomplishment Creek, the Ivishak and Lupine rivers. Estimates were based on weir counts, tagging operations, aerial surveys, underwater observations, and beach seine results on spawning grounds. Data indicate a spawning population of about 870 Arctic char in the Lupine River, 925 in Accomplishment Creek, and 1,488 in the Ivishak River.

An estimated 90 to 95% of the adults entering Accomplishment Creek and Lupine River were potential spawners. The Ivishak River was the only major tributary examined where a large percentage of adult non-spawners was encountered. An aerial survey of the Ivishak River conducted on September 22 showed 12,808 Arctic char, 1,488 of which were believed to be potential spawners. A segregation of non-spawners from potential spawners was noted during the survey. Non-spawners were counted within the entire length of the Ivishak to the confluence with the Saviukviayak River. Few fish and no large concentrations were encountered from the Saviukviayak River to the area of the springs, a distance of approximately 10 miles. No redds were seen up to this area. From this point, in the area of the canyon mouth where springs emerge, concentrations were again encountered. Approximately 360 redds were counted in this area.

Segregation of spawners from non-spawners was substantiated from 64 adult Arctic char sampled from the portion of the Ivishak River where non-spawners were believed apparent. Sampled char ranged from age groups VI to X. Of the 64 char examined, eight (12.6%) were potential spawners with the remainder of fish categorized as non-spawners.

One limiting factor for Arctic char may be the extent of spawning areas. Arctic char were found to spawn in spring areas or groundwater (Figure 7).

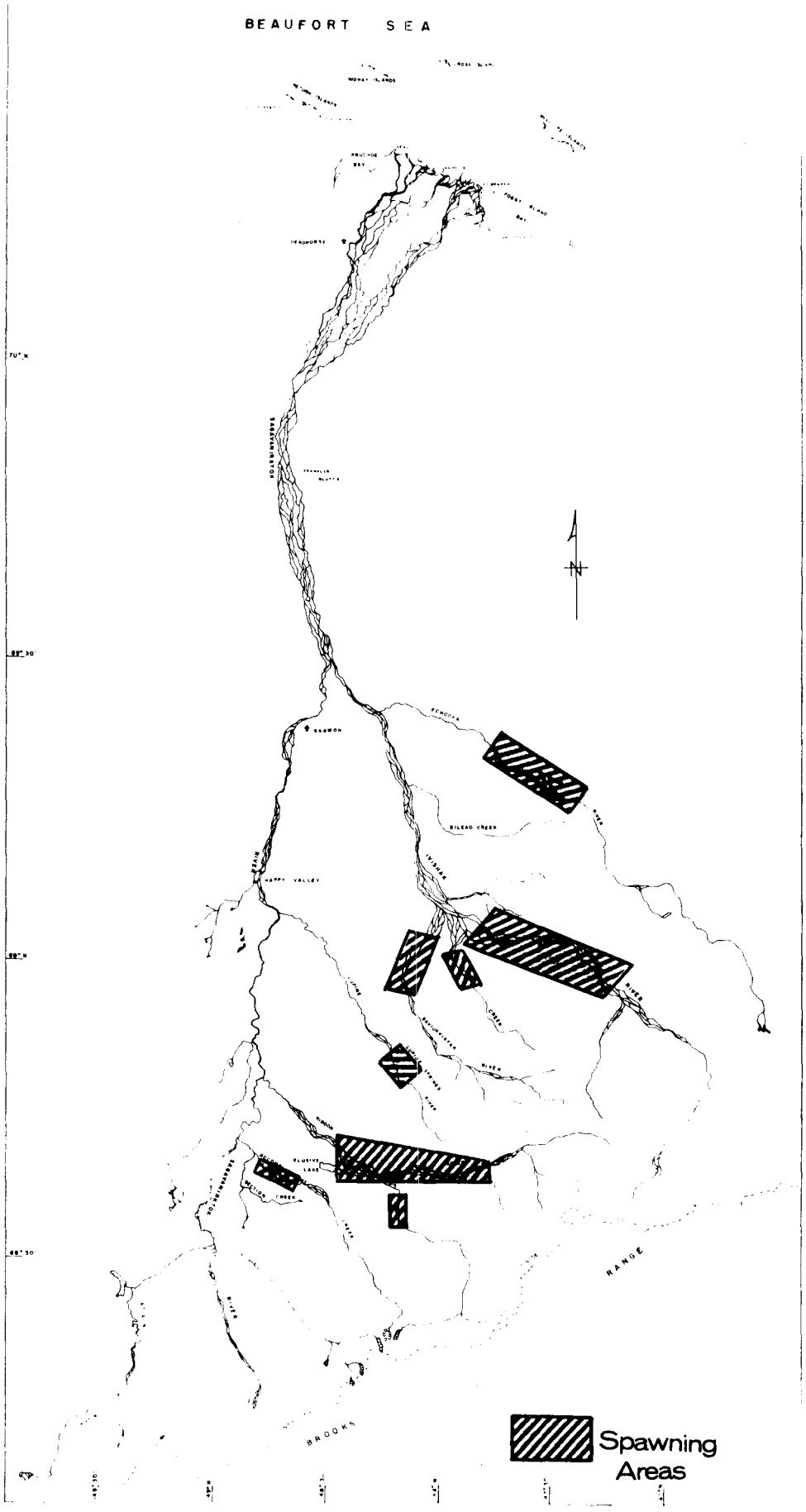

FIGURE 7 MAJOR ARCTIC CHAR SPAWNING GROUNDS, 1971.

TABLE 12 Spawning Period of Arctic Char, Sagavanirktok Drainage, 1971.

Date	Spawning Location	Sample Size (n)	Sex Ratio Male:Female	% of Spawning Population Ripe	% of Spawning Population Spent
8/28	Accomplishment Creek	200	11:3.8	7.5	0.5
9/14	Lupine River	Observed Estimate	---	--	10.0
9/24	Accomplishment Creek	39	1:3.9	18.0	30.8
9/27	Lupine River	194	1:4.5	14.4	36.1
9/28	Accomplishment Creek	259	1:4.0	27.4	33.2
11/1-5	Echooka River	12	Spawners	25.0	75.0
11/19	Ivishak River	45	68.9 (non-spawners)	7.1 (spawners)	92.9

*Personal Communication - Peter Craig, Alyeska Fish Crew

Usually these areas were limited. Ivishak River spawning grounds encompassed approximately 30 miles but the majority of spawning fish were located within a six-mile stretch. Two miles of Accomplishment Creek were utilized by spawning char. Arctic char were observed spawning in 1 1/2 miles of the Lupine River.

Spawning period of anadromous Arctic char was determined (Table 12). Data indicate spawning period extends from the last week of August to the third week of November. Char in various tributaries of the Sagavanirktok system differed in commencement of spawning by less than two weeks.

Sex ratios on spawning grounds were determined with the use of a beach seine. A total of 692 fish was sampled. Male:female sex ratios ranged from 1:3.8 at Accomplishment Creek to 1:4.5 at Lupine River.

Age:

Of the 820 anadromous char otoliths read for age and growth, 526 (64.1%) were incorporated. Crystalization of otoliths and disagreement between readers caused rejection of the remainder.

Fish from age groups 0 to XVI were represented although only four fish were found between ages XII and XVI (Table 13).

TABLE 13 Mean Lengths and Ranges by Age Group of 526 Arctic Char Aged from Otoliths, Sagavanirktok Drainage, Summer, 1971.

Age	Sample Size (n)	Fork Length (mm) Range	Mean	Growth Increment (mm)
0	25	53 - 83	66.0	
I	78	43 - 115	77.6	11.6
II	35	72 - 134	96.1	18.5
III	42	84 - 284	174.1	78.0
IV	71	135 - 292	211.4	37.3
V	23	216 - 398	297.6	86.2
VI	26	310 - 481	393.6	96.0
VII	67	387 - 503	447.9	54.3
VIII	68	396 - 566	475.3	27.4
IX	72	423 - 602	504.8	29.5
X	12	484 - 595	537.6	32.8
XI	3	519 - 575	549.7	12.1
XII-XVI	4	535 - 621	578.0	

To determine whether more precise growth rates could be obtained, ages derived from previous otolith readings (Table 13) were arranged by area from which fish were captured (Table 14). Growth patterns arranged by area became more sporadic rather than more confined. By examining average growth increments, it appears that first migration to sea occurs with the majority of fish at age IV or V.

TABLE 14 Age Classes and Lengths of 515 Arctic Char Arranged by Area, Sagavanirktok Drainage, May-September, 1971.

Location	Age Class	Sample Size (n)	Length Range (mm)	Mean ($\bar{x}$)
Lupine Weir	III	8	211 - 246	231.4
	IV	30	225 - 292	253.5
	V	6	235 - 281	261.7
	VI	3	342 - 409	381.7
	VII	9	443 - 500	468.7
	VIII	20	434 - 539	472.0
	IX	14	427 - 540	497.5
		90		
Lupine Springs	0	12	61 - 83	71.2
	I	5	89 - 106	100.2
	II	5	91 - 134	112.8
	III	11	93 - 185	141.0
	IV	23	135 - 209	162.5
	V	--	---	---
	VI	1	481	481.0
	VII	4	436 - 484	459.5
	VIII	5	469 - 496	483.0
	IX	5	487 - 602	528.8
		71		
Creeks #1, 2, 3, 5, 6 & 8	0	13	53 - 66	61.2
	I	73	43 - 115	87.4
	II	27	73 - 114	94.2
	III	6	101 - 146	122.2
		119		
Sagavanirktok River	III	6	148 - 190	169.5
Ribdon River	IV	4	179 - 213	194.8
Accomplishment Creek	V	2	396 - 398	397.0
	VI	4	380 - 431	404.2
	VII	13	396 - 554	448.8

TABLE 14 (Cont.) Age Classes and Lengths of 515 Arctic Char Arranged by Area, Sagavanirktok Drainage, May-September, 1971.

Location	Age Class	Sample Size (n)	Length Range (mm)	Mean ($\bar{x}$)
Sagavanirktok River (Cont.)	VIII	16	425 - 566	494.6
	IX	29	423 - 554	500.2
	X	7	515 - 583	540.7
		81		
Ivishak River	II	3	73 - 92	85.0
	III	2	84 - 95	89.5
	IV	4	143 - 160	153.2
	VV	2	269 - 346	307.5
	VI	3	395 - 431	408.0
	VII	12	418 - 498	447.2
	VIII	9	443 - 545	482.8
	IX	12	466 - 578	512.5
	X	1	567	567.0
		48		
Foggy Island and West Fork of Sagavanirktok Delta	III	9	146 - 284	220.1
	IV	10	148 - 273	227.2
	V	12	216 - 365	303.2
	VI	15	310 - 440	384.4
	VII	27	387 - 503	436.4
	VIII	15	396 - 500	455.5
	IX	11	474 - 533	509.3
	X	3	489 - 538	518.3
	XI	3	519 - 575	549.7
	XII	--	---	---
	XIII	1	584	584.0
		106		

One hundred fifty-six total length measurements were obtained from otoliths (Table 15). Growth patterns beyond age IV become less uniform due to differences in timing of first out-migration.

Length-frequencies:

Length-frequencies of Arctic char were constructed from various locations of the Sagavanirktok drainage. Fish less than 200 mm in fork length were handled as one group while fish equal to or greater than 200 mm were incorporated into a second group.

TABLE 15 Length Range and Mean of 156 Arctic Char Otoliths Arranged by Age.

Age Group	Sample Size (n)	Otolith Measurements (micrometer units)* Length Range	Mean (x)
0	42	.011 - .022	.017
I	42	.017 - .034	.024
II	18	.024 - .039	.030
III	9	.029 - .048	.037
IV	9	.033 - .053	.043
V	4	.045 - .066	.053
VI	2	.048 - .048	.048
VII	11	.068 - .079	.072
VIII	9	.064 - .083	.072
IX	10	.070 - .087	.076
	156		

*.020 micrometer units equal approximately 1 mm.

Rotenone was used to sample juvenile char from the Lupine Springs in May (Figure 8). Two modes are apparent, one at approximately 75 mm and another at approximately 97 mm. Four small tributary creeks entering the Sagavanirktok River from the west were sampled in late June (Figure 9). Three distinct modes appear at approximately 28, 58, and 86 mm. An additional small tributary was sampled in early August (Figure 10). Two modes appear at approximately 60 and 100 mm.

Otolith readings and length-frequencies were combined to follow age groups of Sagavanirktok drainage juvenile char through one season (Table 16). Mean lengths of 0 year fish ranged from about 24 mm at the beginning of the growth period to approximately 71 mm at the end of that period. A mean range of 58 - 100 mm was calculated for 1 year fish. Age group II fish ranged from 90 mm to approximately 127 mm. A mean range of 112 - 172 mm was found for age group III fish.

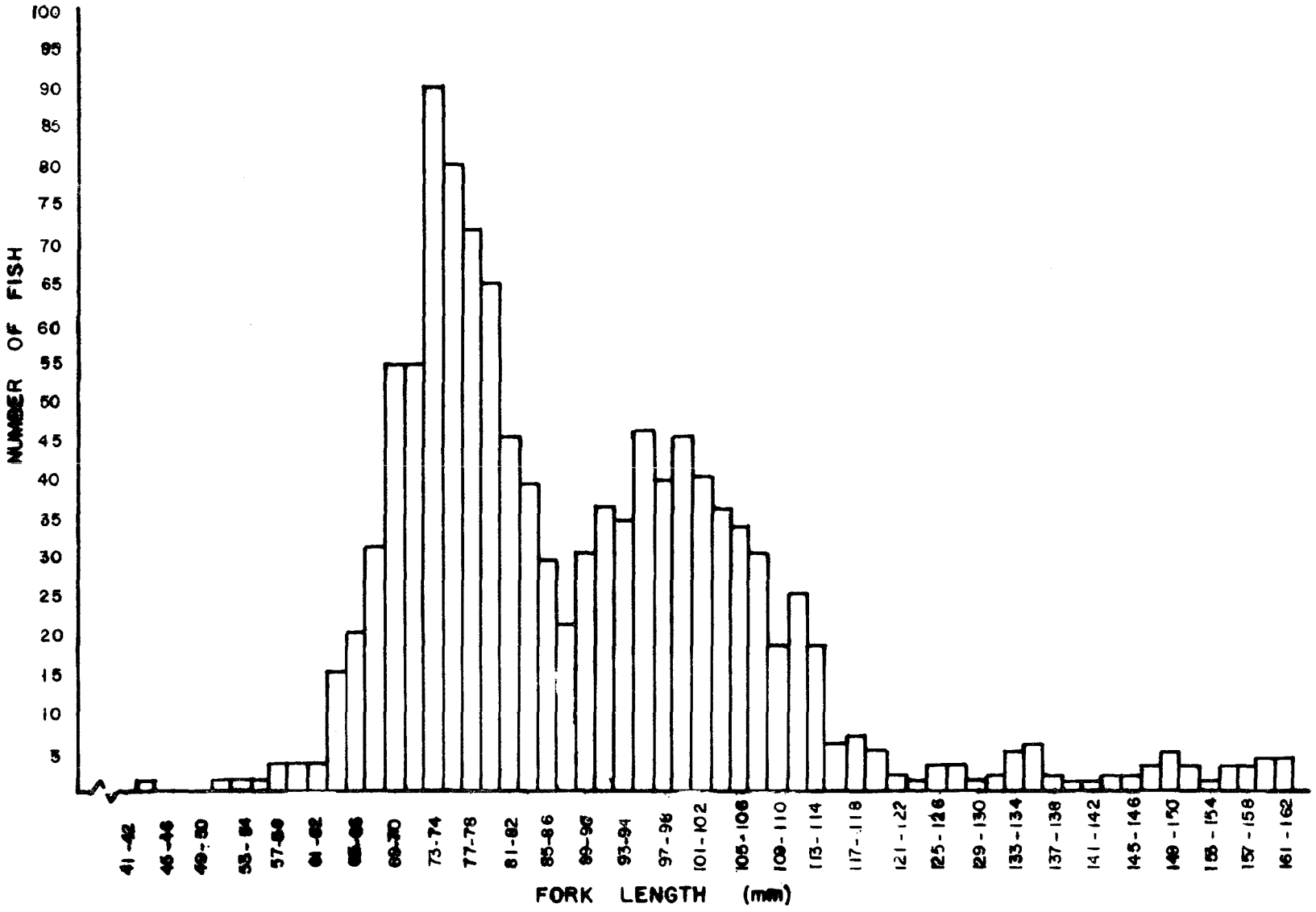

FIGURE 8 LENGTH-FREQUENCY OF 1,135 ARCTIC CHAR CAPTURED WITH ROTENONE, LUPINE SPRINGS, MAY 11, 1971.

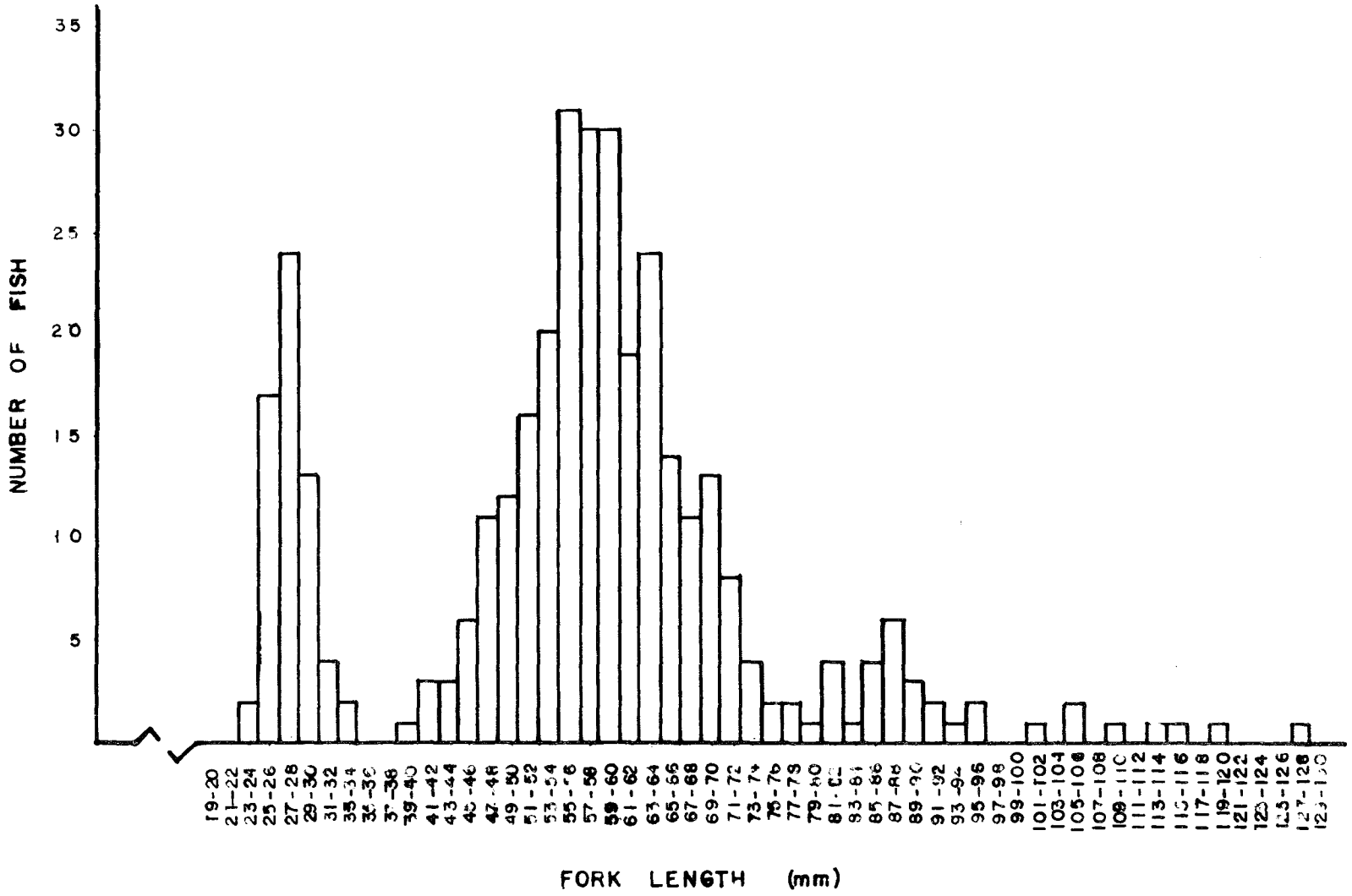

FIGURE 9 LENGTH-FREQUENCY OF 354 ARCTIC CHAR CAPTURED WITH ROTENONE IN CREEKS #2, 3, 4, and 5, SAGAVANIRKTOK DRAINAGE, JUNE 25-29, 1971.

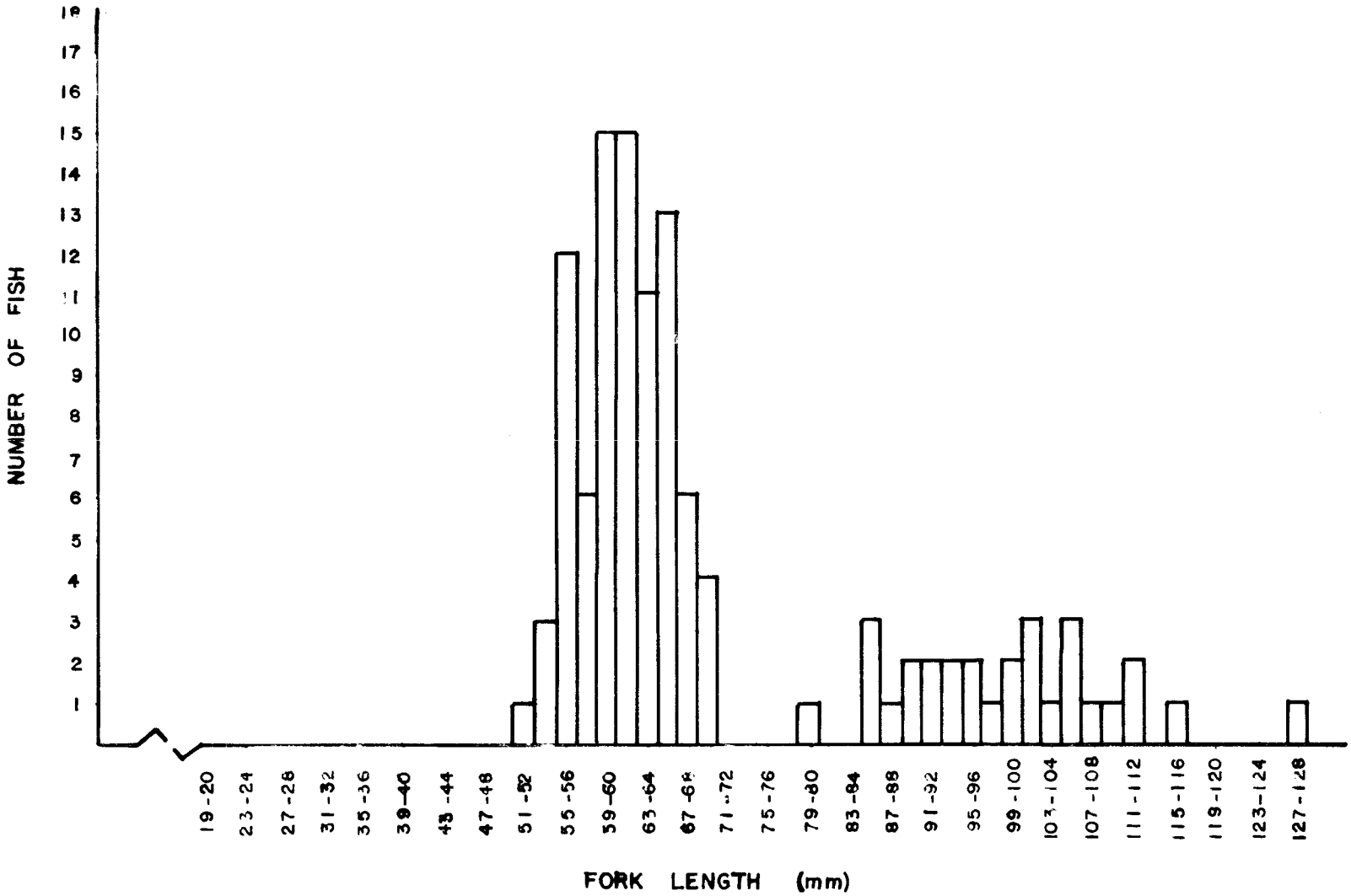

FIGURE 10 LENGTH-FREQUENCY OF 115 ARCTIC CHAR CAPTURED BY ROTENONE, CREEK #8, SAGAVANIRKTOK DRAINAGE, AUGUST 7, 1971.

TABLE 16 Growth of Juvenile Char Prior to First Migration to Sea, Sagavanirktok Drainage, 1971.

Date	Age	Sample Size (n)	Length Range (mm)	Mean ($\bar{x}$)
5/11	(0)	(1)	(24)	(24.0)*
6/24-27	(0)	(62)	(23 - 34)	(27.7)*
8/ 7	0	13	53 - 66	61.2
9/27	0	12	61 - 83	71.2
6/24-27	(I)	(258)	(39 - 76)	(58.4)*
6/24-27	I	47	43 - 96	64.3
7/15	I	7	74 - 96	87.4
8/ 7	I	19	70 - 115	100.5
9/27	I	5	89 - 106	100.2
5/11-13	II	6	73 - 102	90.0
6/24-27	(II)	(26)	(77 - 96)	(86.4)*
6/24-27	II	21	72 - 110	91.4
7/15	II	5	97 - 114	104.6
9/27	II	3	123 - 134	127.0
5/11-21	III	11	84 - 148	125.0
6/24-27	(III)	(8)	(101 - 128)	(112.2)*
6/26-7/15	III	5	105 - 147	121.2
8/ 7	III	1	127	127.0
9/27-28	III	8	148 - 190	171.5
		163		
		(355)*		
		518		

*Age groups from length-frequency.

Length-frequencies of larger Arctic char equal to or greater than 200 mm from various locations were constructed. Numbers of sampled fish were different from the various locations; consequently, percent of total was calculated for purposes of comparison. Fish were combined into 10 mm size groupings.

A sample size of 3,361 fish ($\geq$ 200 mm) comprised the over-all Sagavanirktok River drainage length-frequency (Figure 11). All size groupings from 200 - 720 mm were represented except for the 710 mm size group. Modal length occurred at 460 mm while mean length was 455.5 mm.

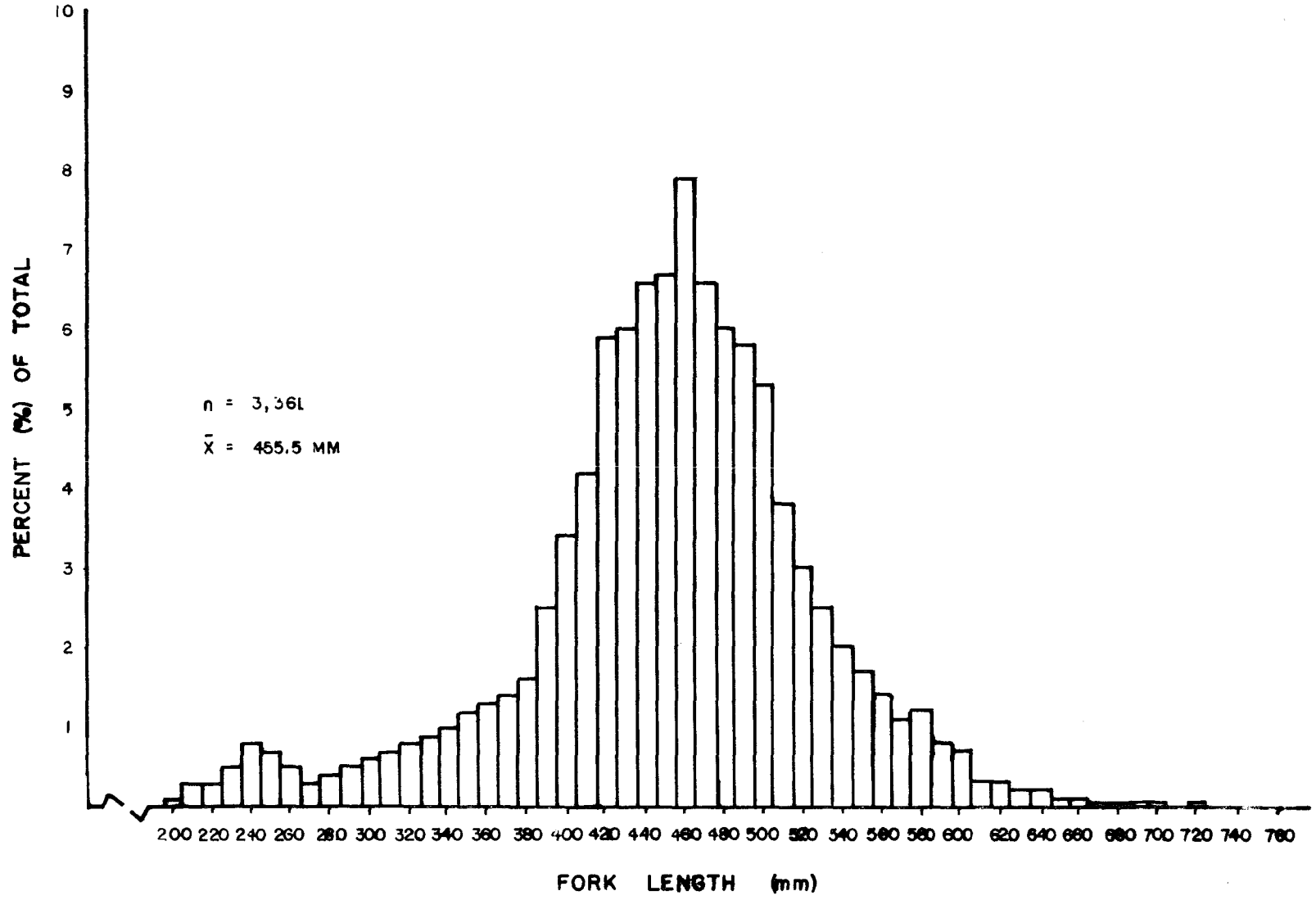

FIGURE 11 COMBINED LENGTH-FREQUENCY OF ARCTIC CHAR ≥ 200 MM CAPTURED FROM WATERS OF THE SAGAVANIRKTOK DRAINAGE, 1971.

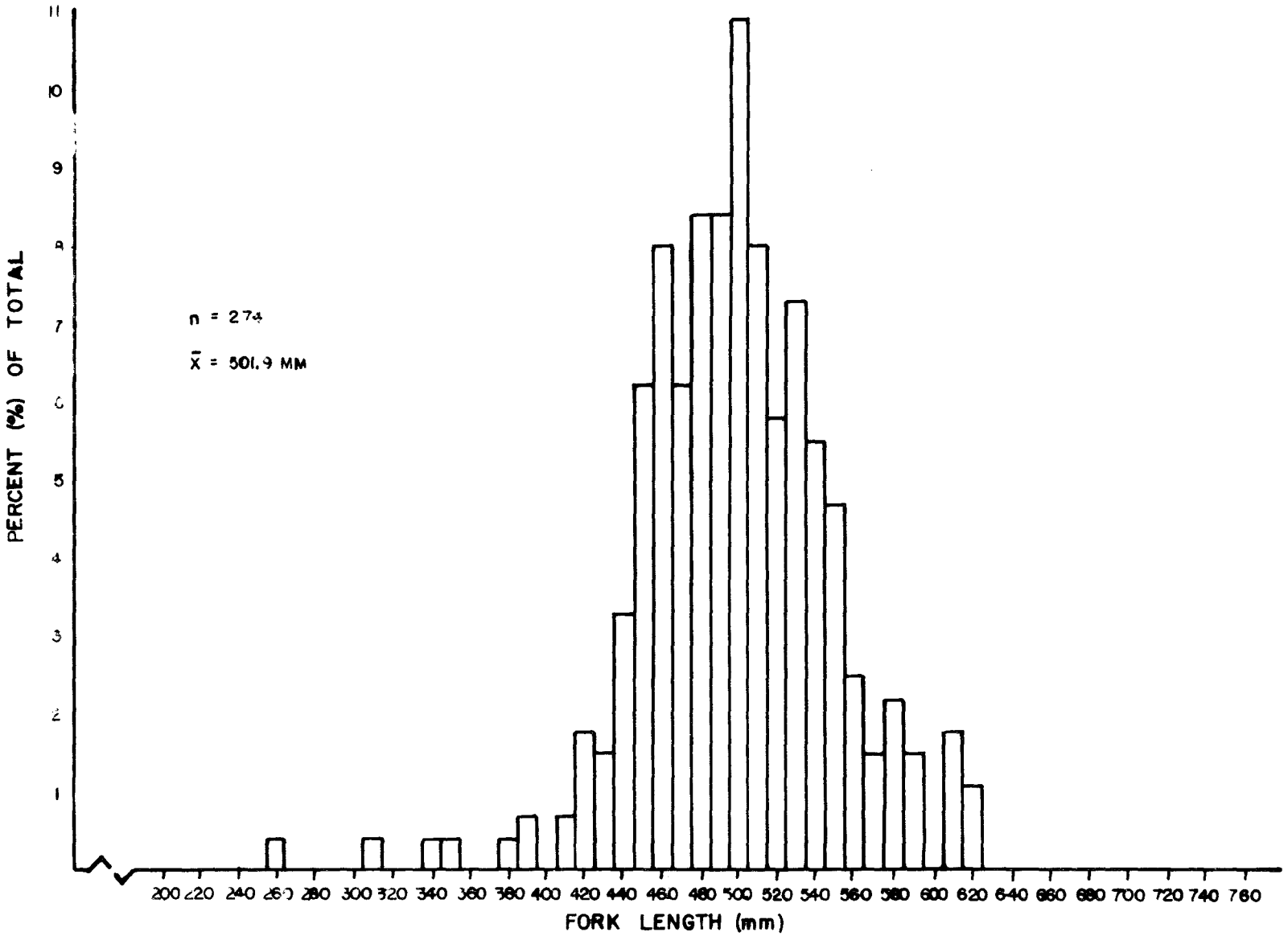

FIGURE 12 LENGTH-FREQUENCY OF ARCTIC CHAR ≥ 200 MM FROM ACCOMPLISHMENT CREEK, 1971.

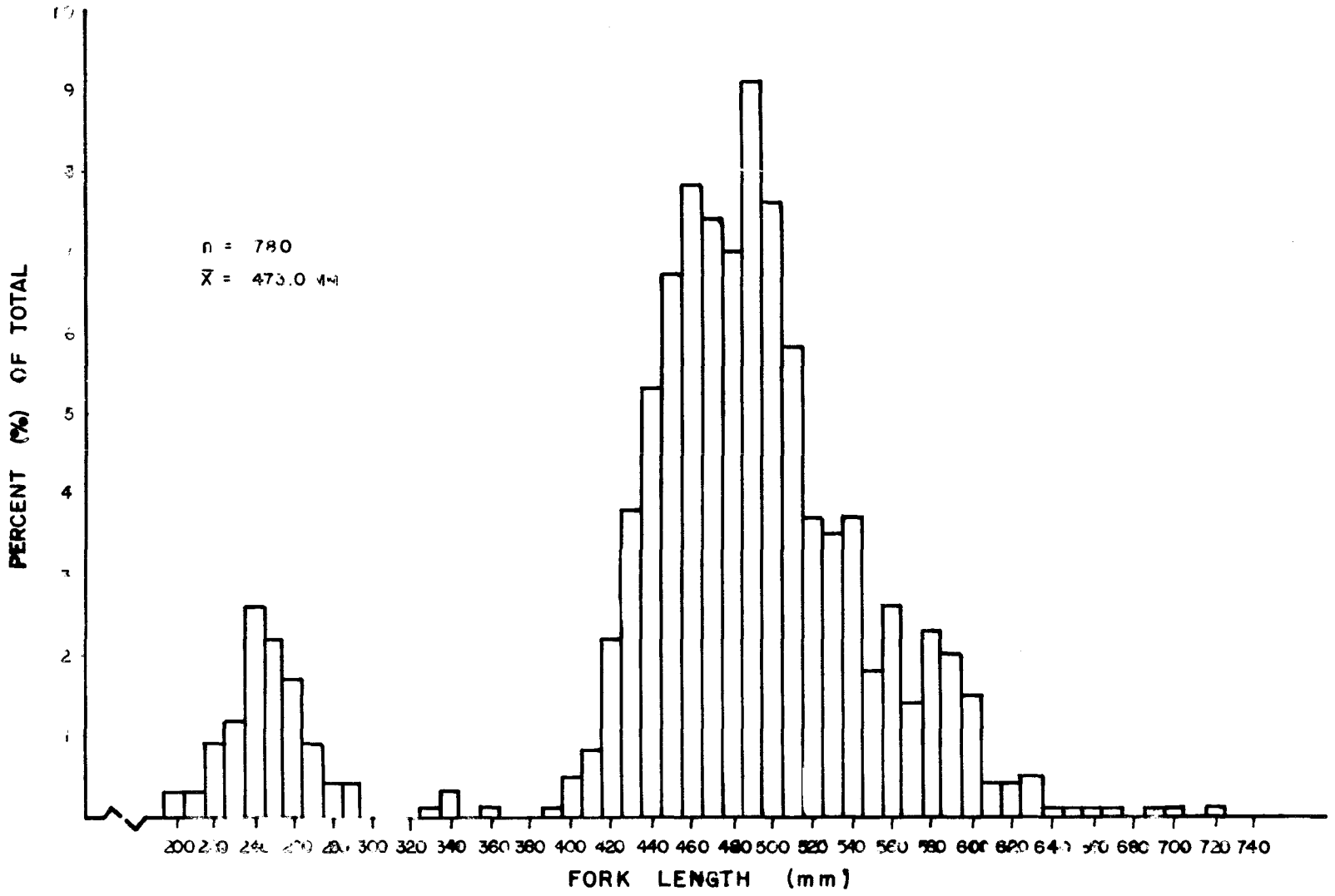

FIGURE 13 LENGTH-FREQUENCY OF ARCTIC CHAR ≥ 200 MM CAPTURED FROM LUPINE RIVER, 1971.

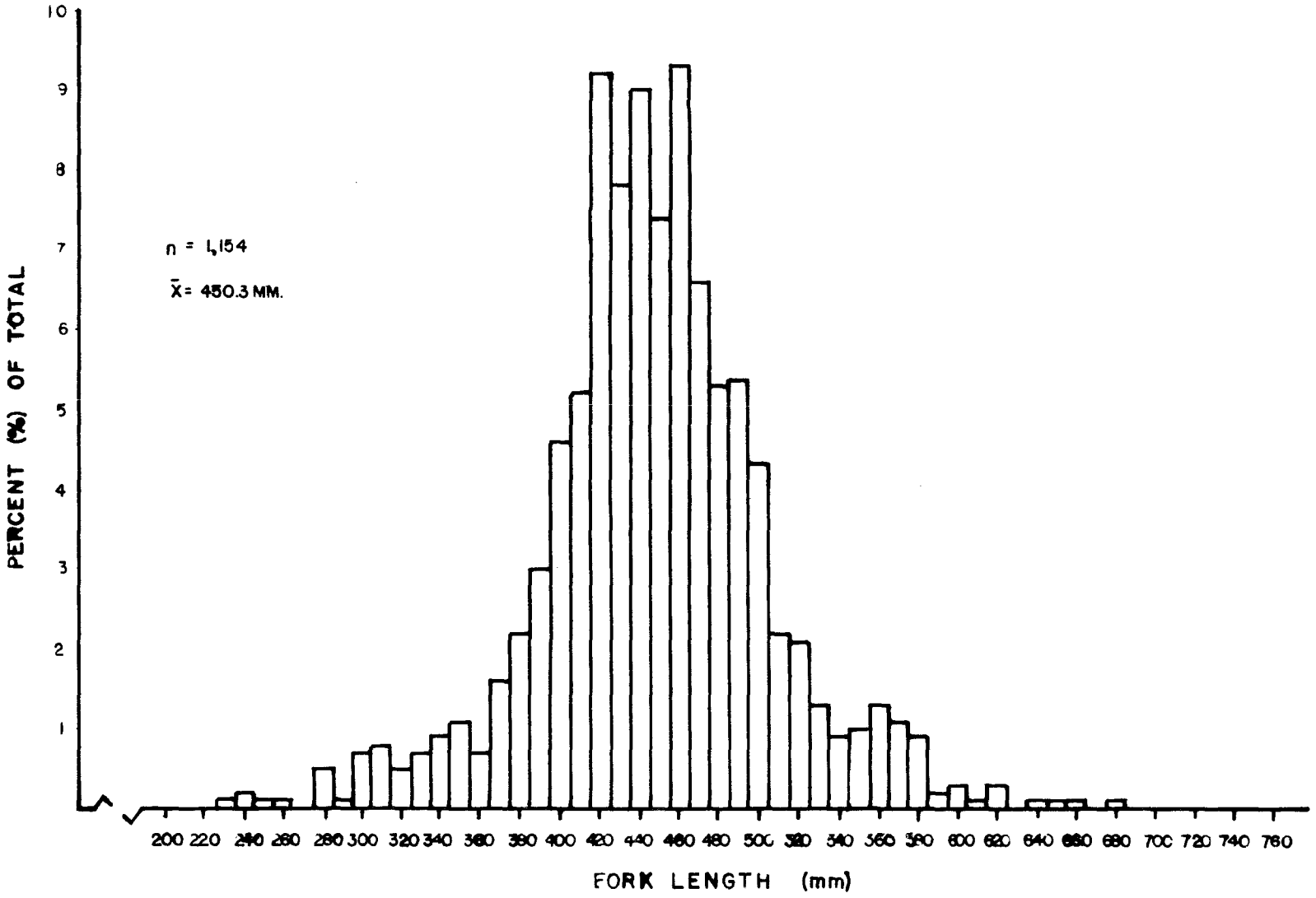

FIGURE 14 LENGTH-FREQUENCY OF ARCTIC CHAR ≥ 200 MM FROM IVISHAK RIVER, 1971.

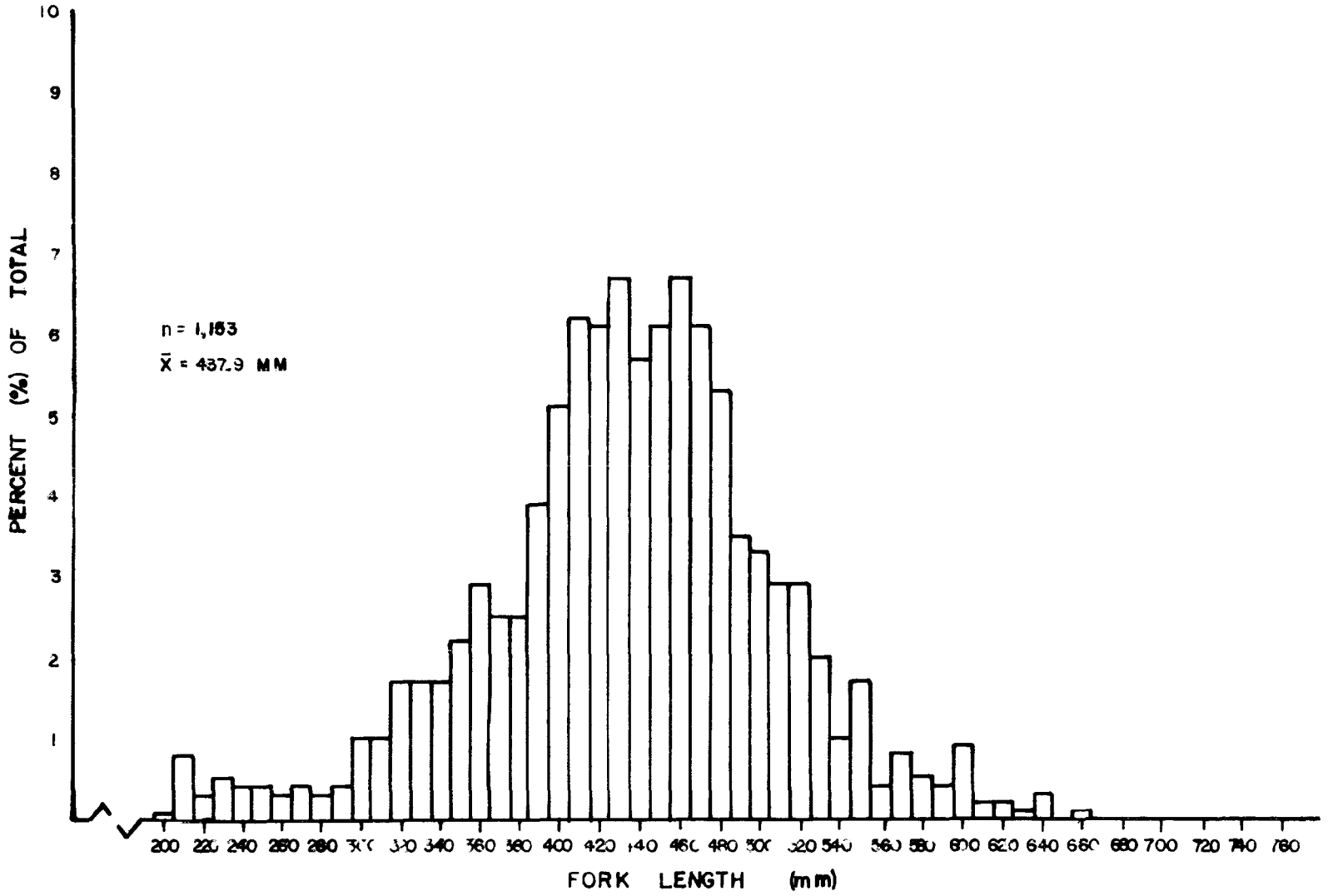

FIGURE 15 LENGTH-FREQUENCY OF ARCTIC CHAR ≥ 200 MM FROM THE VICINITY OF PRUDHOE BAY, 1971.

Lengths of fish from Accomplishment Creek ranged from 260 - 620 mm with a mean at 501.9 mm (Figure 12).

The most widely distributed length-frequency was from fish captured at Lupine River (Figure 13). Lengths ranged from 200 - 720 mm with a mean of 473.0 mm.

The length distribution of Ivishak River char ranged from 230 - 680 mm with a mean length of 450.3 mm (Figure 14). This segment of the population consisted mostly of non-spawners, whereas populations of Accomplishment Creek and Lupine River contained mainly potential spawners.

Char captured from the vicinity of Prudhoe Bay ranged in length from 200 - 660 mm with a mean at 437.9 mm (Figure 15). The modal length centered about the 450 mm size grouping.

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