STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING INTERIOR ALASKA

by

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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project No.: F-9-8

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

Job No.: G-I-O Job Title: Inventory and Cataloging of North Slope Waters

Period Covered: July 1, 1975 to June 30, 1976

ABSTRACT

A study was conducted on the Sagavanirktok River and its tributaries to identify fish overwintering habitat and, if possible, capture overwintering fish. A gill net set under the ice of the Sagavanirktok River near Franklin Bluffs resulted in capture of adult grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas), but failed to reveal the presence of Arctic char, Salvelinus alpinus (Linnaeus).

Three headwater spring areas of Sagavanirktok tributaries were sampled with minnow traps, capturing 167 juvenile char.

Thirty-two adult Arctic char were tagged at the confluence of the Echooka and Ivishak rivers in June 1975, in an effort to determine if these fish would remain in the river throughout the summer or migrate to the ocean. Aerial observations of two of the tagged fish in the upper Echooka in August indicated that the fish remained in the river.

A July survey of the upper Kuparuk River and its headwater lake revealed the presence of lake trout, Salvelinus namaycush (Walbaum) and grayling in the lake. The river survey revealed the presence of grayling fry and adults. A population estimate in the vicinity of the haul road indicated a density of 90 adult grayling per kilometer.

Creel census in the Prudhoe Bay area in July and August showed only limited angling activity for Arctic char.

The annual aerial index of Arctic char in Sagavanirktok River tributaries was continued. Surveys in early September indicated populations in the Echooka and Ivishak rivers were reduced compared to previous years' counts at that time. Surveys of these two streams later in September gave much higher counts, but still below the average of previous yearly counts.

RECOMMENDATIONS

It is recommended that:

1. Annual aerial index of Arctic char in Sagavanirktok River system be continued.

2. Creel census of important sport fishing waters in the area be conducted.

3. Monitoring and evaluation of projects involving water use and their effects on North Slope waters be continued.

OBJECTIVES

1. To conduct a fish overwintering habitat survey and attempt to observe and capture Arctic char in the Sagavanirktok River drainage.

2. To determine the status of the adult char in the lower Echooka River in late May and early June.

3. To survey the Kuparuk River headwaters and conduct population estimates and an age and growth study on Arctic grayling in this river.

4. To monitor the sport fishery for Arctic char in the Prudhoe Bay area.

5. To continue annual aerial index counts of char in the Sagavanirktok drainage and initiate an aerial survey of char in the Canning River drainage.

6. To monitor near shore fish movements in the Beaufort Sea between Harrison Bay and Flaxman Island.

TECHNIQUES USED

Fish populations were sampled with a 30 m graduated mesh gill net, minnow traps baited with salmon eggs, and sport fishing gear.

Dissolved oxygen readings were taken with a WR 36 Hach Kit. Under-ice water temperatures were measured with a YSI model 33 meter.

Echooka River char were tagged with orange spaghetti tags to which 0.3 m lengths of white surveyor's tape were attached for greater visibility. Grayling in the Kuparuk River were marked by caudal fin punches. The standard Petersen estimate formula was used to estimate Kuparuk River grayling populations.

Stage of sexual maturity was based on size, color, and consistency of gonads, and egg diameter.

Otoliths were taken for aging char and lake trout, and scales were taken from grayling and whitefish. Age determination using otoliths was done as described by Heiser (1966), except that xylene was used as the wetting agent.

Identifications of food items eaten by grayling and lake trout were made in the laboratory. Results of stomach analysis are expressed as frequency and number of occurrences. In this analysis, each food item is given equal weight regardless of amount or size of organism consumed. Percentage occurrence of each food item was obtained by dividing the number of stomachs containing a specific food item by the total number of stomachs containing food.

Aerial counts of adult char in the Sagavanirktok River system were made from a helicopter.

FINDINGS

Overwintering Study

Overwintering remains one of the least known facets of fish life history in the Arctic, primarily resulting from extremely difficult working conditions created by the harsh winter climate, and the limited applicability of standard techniques to the observation and collection of fish under two meters or more of ice.

Five potential fish overwintering habitat types exist in Arctic Alaska: 1) lakes, 2) unfrozen pockets of water under thick ice in the main stems of large rivers (some associated with spring upwelling in the river channel), 3) cold water spring tributaries of rivers, 4) delta regions of large rivers, principally within the marine influence zone, and 5) the ocean.

Small Arctic streams may freeze completely during the winter and larger rivers such as the Sagavanirktok freeze to the bottom intermittently along their entire length, leaving only isolated pockets of unfrozen water in the deeper holes. These pockets are usually located in pools deeper than two meters during ice-free periods, since winter ice normally reaches that depth. Heavy demand by the oil industry for water from the lower Sagavanirktok River has the potential of dewatering these winter pools with resultant loss of overwintering fish.

With few exceptions, ice-free water exists during the winter only at perennial spring locations originating from fracture zones in the Lisburne Limestone Formation along the northern front of the Brooks Mountain Range (Williams, 1970). These spring streams, tributaries to larger mountain streams, have been described by Childers et al. (1973).

Yoshihara (1972, 1973) found that Arctic char, Salvelinus alpinus (Linnaeus), spawning in the Sagavanirktok River drainage occurred exclusively within these spring areas. Brief late winter surveys of open water springs by Yoshihara (1973) and McCart et al. (1972) indicated that some adult and juvenile char did overwinter in spring areas of eastern tributaries of the Sagavanirktok River. Spring areas in other Arctic rivers have been found to be important spawning areas for Arctic Char and some overwintering has been documented at these locations (Craig and McCart, 1974; Ward and Craig, 1974).

Investigations in the Main Stem of the Sagavanirktok River:

The main stem and delta region were aerial surveyed in late fall 1974 to locate potential overwintering sites. Eleven potential sites were identified between the Atigun River and the Beaufort Sea. From these potential areas three major sites were selected for intensive investigations. These three sites were located at Sagwon Bluffs-Site 5, a low bluff 10 km north of Sagwon-Site 7, and Franklin Bluffs-Site 11 (Table 1).

Winter investigations began March 24, 1975, and continued until ice-out in early June.

Franklin Bluffs (Site 11):

Twenty-five holes were drilled at this site between March 26 and May 6. Ice depths encountered ranged from 2.0 to 2.7 m, with water depths under the ice ranging from 0.9 to 1.8 m. Water temperature was approximately 0°C at all locations tested and dissolved oxygen on April 10 at two holes was 4.8 ppm.

Hook and line fishing by jigging lures and baited set lines failed to capture any fish.

On May 6, 1975, a gill net was set under 2.7 m of ice in 1.2 m of water at the Franklin Bluffs site. Twenty hours of fishing resulted in capture of 28 grayling, Thymallus arcticus (Pallas), (Table 2) and 7 round whitefish, Prosopium cylindraceum (Pallas), (Table 3).

Insect remains were found in all but 1 of 26 stomachs examined from grayling captured at Franklin Bluffs. The only identifiable remains were stoneflies. Eight of the 26 stomachs contained eyed fish eggs with diameters ranging from 2.8 to 3.2 mm. These were probably round whitefish eggs.

Two of the seven round whitefish stomachs examined contained insect remains and five were empty.

Sagwon Bluffs Site:

Between March 27 and April 9, 29 holes were drilled in the Sagavanirktok River at Sagwon Bluffs. Ice depths ranged from 1.1 to 2.0 m and water depths under the ice ranged from 0.2 to 0.7 m. Temperatures approximated 0°C and disolved oxygen readings from two holes on April 9 were 1.6 ppm.

Table 1. Location and dimensions of potential fish overwintering sites in the main stem of the Sagavanirktok River.

	General Location	Township, Range & Section Umiat Meridian	Approximate Pool Dimensions (m) Length	Width	Depth
1)	8 km N. of Ribdon R. west bank	T7S R14E Sec 5	25	15	3.0
2)	0.5 km N. of Ribdon R. west bank	T7S R14E Sec 21	35	25	3.0
3)	Between Ribdon R. and Accomplishment Cr. N. E. bank	T8S R14E Sec 21	30	15	3.0
4)	3.25 km S. of Accomplishment Cr. E. bank	T9S R14E Sec 7	60	12	2.5
5)	Sagwon Bluffs west bank	T1S R14E Secs 2,3,10	450	15	3.0
6)	6.5 km N. of Sagwon E. bank	T1N R14E Sec 35	25	15	3.0
7)	10 km N. of Sagwon E. bank	T1N R15E Sec 18	100	15	2.5
8)	10 km N. of Ivishak R. E. bank	T3N R14E Sec 36	55	25	3.4
9)	16 km N. of Ivishak R. E. bank	T3N R14E Sec 1	32	15	3.0
10)	20 km N. of Ivishak R. E. bank	T4N R14E Sec 26	15	9	3.4
11)	Franklin Bluffs-east bank between haul road MS 131-3 and MS 132-1	T5N R14E Secs 5,8, 9,16	500	45	4.6

Table 2. Age, length, weight, sex and maturity data for 26 Arctic grayling captured in the Sagavanirktok River near Franklin Bluffs, May, 1975. Two grayling were not examined.

Age	n	Length (mm) Range	Length (mm) $\bar{x}$	Weight (gm) Range	Weight (gm) $\bar{x}$	Sex ♂	Sex %	Sex ♀	Sex %	Maturity* Imm	Mat	Unk
III	1	...	160	...	40	1	100	0		1	0	0
IV	0	...	...	...	...	...	...	...	...	...	...	...
V	12	205-224	216	93-114	103	8	67	4	33	9	0	3
VI	9	217-252	238	98-169	138	6	67	3	33	6	0	3
VII	4	240-330	269	145-350	212	3	75	1	25	2	1	1
Total	26	160-330	230	40-350	130	18		8		18	1	7

* Imm-Immature
Mat-Mature
Unk-Unknown

Table 3. Age, length, weight, sex, and maturity of seven round whitefish captured in the Sagavanirktok River near Franklin Bluffs, May, 1975.

Age	n	Length (mm)		Weight (gm)		Sex		Maturity		
		Range	$\bar{x}$	Range	$\bar{x}$	♂	♀	Imm	Mat	Unk
VI	3	253-276	264	137-175	157	3	0	3	0	0
VII	4	275-283	278	175-189	181	3	1	3	0	1
Total	7	253-283	272	137-189	171	6	1	6	0	1

* Imm-Immature
Mat-Mature
Unk-Unknown

No gill net was set because of the shallow water depth. Hook and line fishing with lures and baited set lines failed to capture fish.

Site #7:

No water was located by drilling at site #7.

Investigations at Springs and Spring Influence Areas:

Helicopter surveys in open water areas of eastern tributaries of the Sagavanirktok drainage between April 6 and June 8 determined that juvenile size Arctic char were abundant but adult anadromous char were absent in all but two locations (Table 4). Six adult anadromous char were observed grouped together in a stretch of open water in the large aufeis area immediately downstream of the Echooka River springs and two adult char were observed in a headwater spring tributary of the Ivishak River where spawners concentrate in the fall.

Minnow traps placed in open water spring areas of the Ivishak, Echooka, and Lupine rivers from April 7 to 17 captured 167 char and 2 slimy sculpin, Cottus cognatus Richardson, (Table 5). Dissolved oxygen varied from 11 to 14 ppm at twelve sites in three areas. Water temperatures were less than 1°C at Ivishak and Lupine springs and approximately 2°C at Echooka Springs.

Most char were ages II, III, and IV (Table 6). None exceeded age V. The growth of these fish is similar to that noted by Yoshihara (1973) in these rivers.

The age data are somewhat biased since the capture method did not allow for capture of fish exceeding about 200 mm. However, fish larger than 200 mm were considerably less frequent in aerial observations than fish below this size.

Four holes were drilled at potential overwintering sites in the spring influence area of the Ivishak River between the Saviukviayak River and Gilead Creek. Ice depth at these locations exeeded the 4 m maximum drilling capability of the auger. This was the greatest ice depth observed during winter work. Several layers of water flowing between layers of ice were encountered. The velocity of water was considerable. A visual estimate of this velocity was 1.5-3.0 meters per second. The following parameters were measured at one location: Dissolved oxygen 12 ppm, temperature 0.3°C, conductivity 100 µMhos. Fall surveys indicated that the middle section of the Ivishak River would probably be an overwintering area. Observations during late winter reinforced this probability since spring water overflow was greater at this location than at any other location in the Sagavanirktok drainage.

Investigations of Char Outmigrations During Breakup:

On June 6, breakup conditions allowed three nets to be placed in the Sagavanirktok River drainage to monitor outmigration of char and any up-

Table 4. Aerial observations of Arctic char in open water spring areas of eastern tributaries to the Sagavanirktok River, April-June, 1975.

Date	Location	Adults	Juveniles*
April 7	Ivishak Springs	0	400
April 10	Ivishak Springs	0	200
April 11	Echooka Springs	6	800
April 17	Lupine Springs	0	300
April 17	Saviukviayak River	0	200
April 18	Lupine Springs	0	250
April 18	Ribdon River	0	600
April 18	Accomplishment Creek	0	100
April 28	Echooka Springs	0	650
April 29	Ivishak Springs	0	200
April 29	Echooka Springs	0	600
June 6	Ivishak River (spring tributary)	2	300
June 7	Ivishak River (spring tributary)	0	250

* Fish in this category were substantially less than 300 mm in length. No distinction could be made between juvenile anadromous and resident char, thus this category represents fish of both types.

Table 5. Arctic char captured in minnow traps at three open water spring tributaries of the Sagavanirktok River, April and May, 1975.

Location	Hours Fished	n	Length (mm)	Weight (gm)	Sex ♂	Sex ♀	Sex Unk
Ivishak R.	72	52	61-197	2.0-84.9	31	18	3
Echooka R.	24	86	80-169	4.6-56.2	59	27	0
Lupine R.	48	29	73-161	3.4-36.5	15	14	0

Table 6. Age-length relationship of 160 Arctic char captured by minnow trap in April and May, 1975, at three open water spring tributaries of the Sagavanirktok River.

Location	Age Class	n	Length (mm) Range	Length (mm) $\bar{x}$
Ivishak R.	II	3	61-85	75
	III	40	95-134	121
	IV	7	127-148	136
	V	1	197	197
Echooka R.	II	8	80-105	94
	III	45	95-151	125
	IV	24	115-169	138
	V	4	141-155	150
Lupine R.	I	1	73	73
	II	18	84-112	102
	III	8	119-161	144
	V	1	160	160

stream migration of grayling. A gill net was placed in a deep area where two channels converged at the following locations:

1. Sagavanirktok River 15 km downstream of the Ivishak - Sagavanirktok confluence at the lower end of haul road material site 130-1;

2. Sagavanirktok River 2 km upstream of the Ivishak - Sagavanirktok confluence;

3. Ivishak River 1.6 km upstream of the Ivishak - Sagavanirktok confluence.

Results of netting in the Sagavanirktok and Ivishak rivers are presented in Table 7. The water in both rivers was high, extremely turbid, and still running large amounts of ice. The net upstream of the Ivishak River confluence was taken out by ice and debris sometime between June 9 and June 11 and was not recovered.

Discussion:

Potential overwintering fish habitat exists in the main stem of the Sagavanirktok. However, only one area (Franklin Bluffs) was suitably sampled and no char were found.

An attempt was made in April to sample the large numbers of nonspawning char found in the Ivishak River in September but ice thickness did not allow the auger to penetrate the ice, thus no nets could be set. Flowing water and possible overwintering fish could have been present.

Helicopter surveys located only eight adult char in the open water spring areas but char could have been present under the extensive aufeis areas below the springs.

Limited gill-netting during the peak of spring high water in June took only one char. Since breakup had begun some days before, it is possible that the char outmigration had already occurred, or possibly char were only migrating down in the swift current where nets could not be set. According to Yoshihara (1973), outmigrant char were not captured until June 12 in the delta near Foggy Island and most of the char taken were smolts and juveniles.

Echooka River Tagging

In June, 1974, a large number of adult size char were noted by aerial observation at the mouth of the Echooka River. It was hypothesized that these fish may have been a group of nonspawning (in 1973) adults that overwintered in the Sagavanirktok River drainage and would not migrate to the ocean in the spring of 1974 but rather remain in the river and spawn in the Echooka River or some nearby stream in the fall. By mid-July, 1974, many of the group had moved out and only 78 char could be captured for tagging. These fish were all potential spawners. In late July the fish had dispersed from the mouth of the Echooka River. A group of approximately 200 char were found near the Echooka spawning grounds and possibly were the same fish. Smaller numbers were located in the Ivishak River.

Table 7. Results of netting in the Sagavanirktok and Ivishak rivers between June 6-11, 1975.

Location	Total Hours Fished	Catch*			Temperature
		AC	GR	RWF	
Sagavanirktok R. below Ivishak confluence	119	1	1	1	2.3 to 2.9°C
Sagavanirktok R. upstream of Ivishak confluence	72	0	0	0	2.0 to 2.7°C
Ivishak R.	74	0	6	3	...

* AC-Arctic char
GR-Grayling
RWF-Round whitefish

In late May and June, 1975, water in the Ivishak and Echooka rivers was very turbid, thus aerial observation of fish at the mouth of the Echooka River was not possible. Hook and line sampling on June 21 and 22 took 35 char, 32 of which were tagged. High, turbid waters prevented char capture after that date. A 15 m gill net was fished for two days but failed to capture fish. The 35 fish captured ranged in length from 420 to 588 mm ($\bar{x}$=526). Physical characteristics of the fish suggested they would spawn in the fall.

In early August the Echooka River was surveyed by helicopter in an effort to locate char, especially tagged char. Only a few fish were sighted in the lower reaches of the river, but sightings increased upriver and 200-300 fish were observed in a deep, slack water area below the concentration of perennial aufeis. Two of these fish carried white tags, indicating that they had been tagged at the mouth of the Echooka River on June 21 or 22, 1975. Angling in the area of the Echooka River springs produced no adult char and only juvenile char were observed. A float trip from the spring area to the aufeis concentration (≈ 6 km) on August 4 resulted in capture of 17 adult char by hook and line. The catch was composed of 13 females and 4 males, all potential spawners.

Discussion:

Prior to the June, 1974, sighting of adult char in the Echooka River it was believed that all adult char, spawners and nonspawners, in the Sagavanirktok River system entered the river, its tributaries, or both in late summer or fall, remained over winter and returned to the ocean the following spring or summer. Even though no great concentration of downstream adult migrants has ever been noted, the July and August upstream migration of adult fish from the ocean has been well documented (Yoshihara, 1973).

Two possibilities exist to account for presence of these fish at the mouth of the Echooka River: 1) They have overwintered in this location or nearby in the Sagavanirktok system. 2) There is a slight possibility that they had overwintered in the ocean and had begun inmigration at breakup instead of during late summer as has generally been observed.

It is probable from the two tagged sightings in August that this group of fish did not outmigrate to the ocean to feed during the summer of 1975 but remained in the Echooka River until fall spawning.

Kuparuk River Survey

The Kuparuk River is located west of the Sagavanirktok River and flows 300 km north to Gwydyr Bay, 13 km southeast of Beechy Point. It is crossed by the Trans-Alaska Pipeline Haul Road approximately 30 km downstream from its headwater lake.

The Kuparuk River water in July was clear with a slight tundra stain. Water temperature was 13.5° to 16.5°C. Conductivity was 29 µMhos, pH was 7.5, and water volume was 0.38 cu meters per second (13.5 cfs) at the road crossing.

The entire drainage has suitable spawning habitat for grayling. On July 11 large schools of emergent grayling fry (20-30 mm in length) were noted in quiet side pools adjacent to the haul road. The Kuparuk system has one of the best grayling fisheries on the North Slope, with many fish over 300 mm in length. Angling with artificial flies took 6.8 fish/hr while spinning gear with lures took 5.2 fish/hr during capture efforts for a population estimate.

Population Estimate:

A population estimate of Kuparuk River grayling was conducted from 6.1 km above the haul road to 1.4 km below the haul road. Fish were captured for initial marking by angling with artificial flies. Only fish larger than 200 mm fork length were used in the estimate. Three days were spent capturing and marking 262 fish. Immediately following initial marking the area was again sampled using spinning gear as a capture tool. Three days of angling using this method resulted in capture of 163 fish, of which 63 were recaptures.

Mark and recapture data are as follows:
No. grayling marked (M) 262
No. grayling recaptured (C) 163
No. marked grayling recaptured (R) 63
Petersen pop. estimate: $N=\frac{MC}{R}$

Total population = 677 fish, confidence limits at 95% level are 541 to 906.

The number of fish for the 7.5 km section averages 90 fish per km. This is considerably less than population estimates for more southerly streams. Tack (1975) found up to 2,338 grayling per km in the prime grayling habitat of the Chena River and Netsch (1975) found populations in the lower 1.6 km of Prospect Creek ranging from 954 in July to 756 in August. However, both the Chena River and Prospect Creek are considerably larger than the Kuparuk River, with mean discharges of approximately 42 and 2.4 cu meters per second (1,500 and 85 cfs) respectively.

Age and Growth:

A randomly selected sample of 57 grayling was aged. Fish ranged in length from 245 to 380 mm and in weight from 169 to 509 gm (Table 8). Ages V through X were represented in the sample with the majority of fish in the classes VII and VIII. This is considerably slower than growth recorded for Chena River grayling (Tack, 1975). All fish sampled were mature by age VI.

Food Habits:

Stomachs from 30 Kuparuk River grayling were examined. The fish were systematically selected by retaining every fifth fish captured.

Insects, especially Diptera and Tricoptera larvae, comprised the bulk of the stomach contents (Table 9).

Table 8. Age and length-weight relationships for a sample of Kuparuk River grayling, July, 1975.

Age	Fork Length (mm)			Weight (gm)		
	n	$\bar{x}$	Range	n	$\bar{x}$	Range
V	7	267.9	245-298	4	211.0	169-289
VI	8	317.1	294-342	5	338.8	298-374
VII	13	328.9	310-356	8	384.0	334-452
VIII	24	343.2	321-370	13	411.8	294-509
IX	4	355.8	328-368	...	...	...
X	1	380.0	380	...	...	...
	57			30		

Table 9. Occurrence of food items in 30 grayling stomachs, Kuparuk River. All stomachs examined contained food. Grayling ranged in length from 245 to 370 mm.

Food Item	Occurrence	
	No. of Stomachs	%
Insects		
Tricoptera	30	100
Coleoptera	27	90
Plecoptera	20	66
Ephemeroptera	13	43
Hymenoptera	9	30
Diptera	30	100
Chironomidae	30	100
Simulidae	19	63
Culicidae	13	43
Tipulidae	2	7
Other		
Araneida (spiders)	3	10
Acarina	2	7
Pulmonata (snail)	1	3
Fish eggs	1	3

"Kuparuk" Lake:

An unnamed lake located at 68°32'N, 149°12'W forms the headwaters of Kuparuk River and was surveyed on July 11-13. This lake has a surface area of 25 ha and a maximum depth of 11 m. The lake has approximately 30% shoal area and heavy bottom growth of submergent vegetation. This remote lake is accessible by float plane during open water periods. Sport angling for lake trout, Salvelinus namaycush (Walbaum), is excellent. Surface water temperature was 17.5°C.

A gill net set for 36 hours took 27 grayling and 20 lake trout, of which 6 lake trout were released. Five man-hours of angling captured 13 lake trout (257-459 mm) and 2 grayling (277-352 mm). Grayling from Kuparuk Lake were age V through X with most being age VII and VIII (Table 10).

The selected sample of 12 lake trout was aged and fish ranged from age X to XXVIII (Table 11). All fish over age X were mature.

Creel Census of Prudhoe Bay Area

A blanket type creel census of the Prudhoe Bay area was conducted in July, 1975, to monitor the sport fishery for Arctic char. A new 4,500 foot dock facility constructed in 1974 was expected to increase sport fishing access to an important char feeding and migration area (Furniss, 1975). Areas checked during the 1975 creel census in addition to the new dock, included the old Atlantic Richfield Co. (ARCO) dock, Sagavanirktok River near the ARCO storage pad and pump station, and the Kuparuk River near its mouth. All these areas were accessible by road.

Previous to our July census, reports were received that as many as 40 anglers per day were utilizing the new dock. This was a period of extremely good weather.

The creel census was discontinued after four days when it became apparent that, due to inclement weather and ARCO's discouragement of use of the new dock for fishing, no substantial fishing pressure would develop. Inclement weather continued through August and spot checks of the areas during this month failed to reveal any increase in effort.

Arctic Char Annual Index Counts of Spawning Streams

Annual aerial counts of Sagavanirktok drainage Arctic char have been conducted since 1971. These counts are only an index to relative abundance of char. The counts will vary somewhat each year due to differences in observers, skill of pilots, observation conditions, natural changes in river configuration, timing, and fish behavior. Therefore, these counts should be used over a moderate time period to show trends. Minor fluctuations in counts should be regarded as normal products of the technique. Also, it should be obvious that in an index count similar to this, not all fish are counted. We estimate that the index counts represent 50-90% of the actual char population in the areas counted.

Table 10. Age, length and weight relationships for grayling from Kuparuk Lake July 12-13, 1975. Sex data was not recorded for nine grayling.

Age	Length (mm)			Weight			Sex	
	n	Range	$\bar{x}$	n	Range	$\bar{x}$	♂	♀
V	1	277	277	1	248	248		1
VI	4	277-322	300	1	284	284		1
VII	7	313-333	325	3	396-398	397	1	2
VIII	9	320-351	335	7	374-436	404	1	6
IX	3	326-360	346	3	381-476	429	2	1
X	3	333-364	350	3	400-545	489	2	1
	27			18			6	12

Table 11. Age, length and weight relationships for 12 "Kuparuk Lake" lake trout.

Age	n	Length (mm)		Weight (gm)		Sex	
		Range	$\bar{x}$	Range	$\bar{x}$	♂	♀
X	1	295		250			1
XI	1	335		414		1	
XIV	1	370		547		1	
XVI	1	356		550			1
XVIII	1	384		770			
XXI	2	366-415	391	511-829	670	3	
XXII	3	370-395	394	592-705	648	2	1
XXIII	1	382		693		1	
XXVIII	1	455				1	3
	12					9	

The annual counts indicated fairly stable counts through 1974. In early September, 1975, helicopter counts by the same observer as in 1973-1974, showed comparable numbers of fish in most tributaries but significantly lower numbers of fish in the Echooka, Ivishak, and South Fork of the Ribdon rivers (Table 12). The Ivishak nonspawning aggregation count was only one-fifth of the 1974 count. Because of this alarming decrease in numbers, the counts for the Echooka and Ivishak rivers were repeated on September 21 and 22. These counts were made by a new observer. Observation conditions during the Ivishak counts were poor, with periodic snow storms and the river running ice. A total of 8,643 char was counted. The following day conditions on the Echooka were excellent and the aerial count, while nearly doubling the early September count, was only approximately 50% of the 1971-1974 mean Echooka River count.

As noted by Yoshihara (1973), and Furniss (1975), year classes from 1965-1967 were weak. As these age classes would now comprise a large part of the spawning population, it was expected that the spawning population would show a decrease beginning in 1975. In spite of the poor Ivishak conditions the counts made on September 21 indicated a population not substantially different from previous years. Evidently many of the char had not yet reached the Ivishak River overwintering grounds by the September 7-10 survey. No reason can be advanced for their late arrival.

Table 12. Comparative aerial counts of char in the Sagavanirktok River systems from 1971 to 1975.

Location	1971	1972	1973	1974	1975*	1975**
Accomplishment Cr.	178	322	512	505	270	...
Ribdon R.-Main Stem	400	467	123	240	153	...
South Fork	49	276	1,183	1,330	395	...
Lupine R.	Few	...	318	260	195	...
Savuikviayak R.	321	378	264	650	584	...
Flood Cr.	350	508	512	370	300	...
Echooka R.	1,137	1,688	1,883	2,160	473	851
Ivishak R. Echooka to Flood Cr.	12,470	11,937	8,992	11,000	2,485	8,306
Upstream From Flood Cr.	1,488	...	1,017	2,140	710	337

* Counts September 7-10
** Counts September 21-22

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