

STATE OF ALASKA

Jay S. Hammond, Governor



Annual Performance Report for

EVALUATION OF INTERIOR ALASKA
WATERS AND SPORT FISH WITH
EMPHASIS ON MANAGED WATERS -
DELTA DISTRICT

by

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Job No. G-III-H Evaluation of Interior Alaska Waters and Sport Fish with Emphasis on Managed Waters - Fairbanks District
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Job No. G-III-I Evaluation of Interior Alaska Waters and Sport Fish with Emphasis on Managed Waters - Delta District
By: Richard D. Peckham

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Lake and Stream Investigations
Project No.: F-9-11
Study No.: G-III Study Title: Lake and Stream Investigations
Job No.: G-III-I Job Title: Evaluation of Interior Alaska
Waters and Sport Fish with
Emphasis on Managed Waters -
Delta District

Period Covered: July 1, 1978 to June 30, 1979

ABSTRACT

Fifteen lakes stocked with rainbow trout, *Salmo gairdneri* Richardson, silver salmon, *Oncorhynchus kisutch* (Walbaum), and Arctic grayling, *Thumallus arcticus* (Pallas), were sampled with gill nets to provide data on survival and growth. Factors affecting survival and growth such as stocking densities, size of fish stocked, and strains of fish are discussed. Morphoedaphic index (MEI) values are presented which allow a comparison of productivity for the study lakes.

Estimates of angler use and sport fish harvest were made on Quartz and George lakes. The Quartz Lake estimates utilized a randomly stratified sampling schedule to determine pressure. Estimated pressure for the season was 15,970 angler hours. Estimated total angler days at George Lake was 1,056 and total northern pike, *Esox lucius* Linnaeus, harvest was 1,890.

Two study sections in the lower Goodpaster River were sampled by electrofishing in late June, 1978, to determine population levels of Arctic grayling. Age, length, and species composition data were also collected. The Petersen population estimate for grayling was 468 grayling per kilometer (749 grayling per mile). Age Class IV grayling were predominant, comprising 56 percent of the sample. Over 62 percent of all grayling captured ranged from 170 to 229 millimeter in length. Capture rate and relative abundance of all species captured in the Goodpaster River is presented.

Electrofishing results for Shaw Creek are presented. Capture rates were 72 grayling and 13 round whitefish, *Prosopium cylindraceum* (Pallas), per hour. Four other fish species were captured.

Remote lake surveys were conducted on "T" Lake and Long Lake. Fish sampling results are presented as well as physical and chemical characteristics.

Counts of silver salmon spawners were made in the Delta Clearwater River and Clearwater Lake outlet in late October. The count of 4,798 in the Delta Clearwater River is nearly the same as 1977 (4,793) while the Clearwater Lake outlet count of 570 was down from the 730 of 1977.

BACKGROUND

The recreational fisheries in the upper Tanana River drainage generally fall into three categories: streams, lakes with indigenous fish species, and stocked lakes. (Table 1 lists common and scientific names of all fish species mentioned in the report.)

The principal fish species of recreational importance in area streams are Arctic grayling and round whitefish. Burbot are widely distributed in the larger glacial rivers and near the confluences of many tributary streams.

Lakes at lower elevations (generally below 2,000 ft) that connect to a river system usually contain populations of northern pike, burbot, and humpback whitefish, while lakes at higher elevations support populations of lake trout, grayling, round whitefish, and burbot.

Landlocked lakes are typically barren. Since statehood most lakes near the highway system have been surveyed and several that were found to contain undesirable fish populations have been chemically rehabilitated. Many capable of supporting fish have been stocked with rainbow trout or silver salmon. A few have been stocked with Arctic grayling. Various stocking rates, sizes, strains, and timing have been assessed to provide optimum survival and growth of stocked fish.

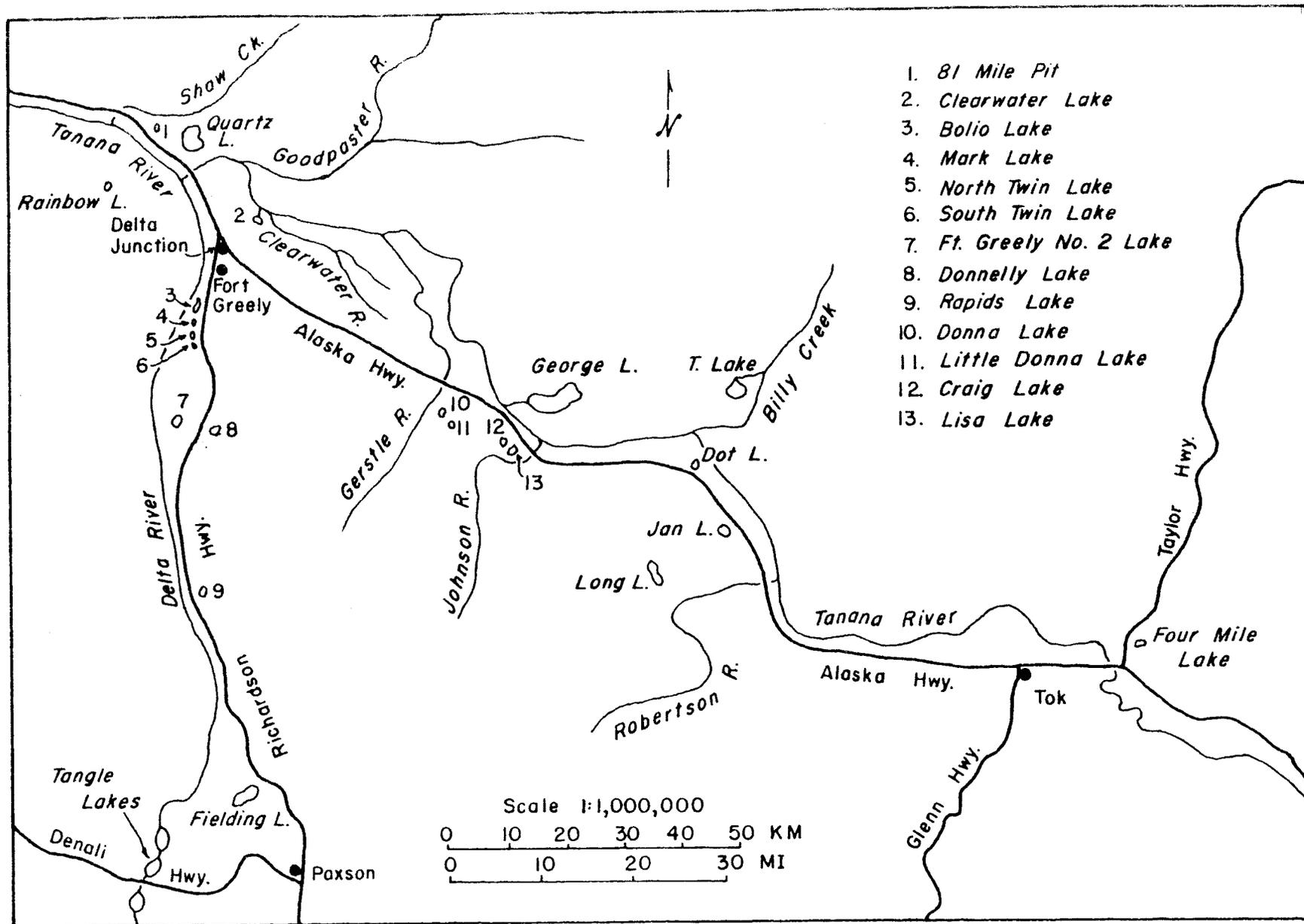
Research and management of selected waters are directed at monitoring fish population levels and angler utilization. The location of waters within the study area is shown in Figure 1.

RECOMMENDATIONS

1. Evaluations of survival and growth of stocked rainbow trout, silver salmon, and grayling in selected waters should continue.
2. Angler use and sport fish harvest estimates on Quartz Lake and George Lake should continue, and efforts to monitor grayling harvest on Shaw Creek should be expanded.
3. Sampling of established study sections on the Goodpaster River to determine grayling population levels, age, length, and species composition should be continued. Upper sections of the river should be sampled every third year.
4. Surveys of remote area waters in the Delta and Tok areas should continue.

Table 1. List of common names, scientific names and abbreviations.

Common Name	Scientific Name & Author	Abbreviation
Chum salmon	<i>Oncorhynchus keta</i> (Walbaum)	CS
Silver salmon	<i>Oncorhynchus kistuch</i> (Walbaum)	SS
Lake trout	<i>Salvelinus namaycush</i> (Walbaum)	LT
Rainbow trout	<i>Salmo gairdneri</i> Richardson	RT
Humpack whitefish	<i>Coregonus pidschian</i> (Gmelin)	HWF
Round whitefish	<i>Prosopium cylindraceum</i> (Pallas)	RWF
Least cisco	<i>Coregonus sardinella</i> Valenciennes	LCI
Arctic grayling	<i>Thymallus arcticus</i> (Pallas)	GR
Northern pike	<i>Esox lucius</i> Linnaeus	NP
Slimy sculpin	<i>Cottus cognatus</i> Richardson	SSC
Burbot	<i>Lota lota</i> (Linnaeus)	BB
Inconnu (sheefish)	<i>Stenodus leucichthys</i> (Guldenstadt)	SF
Longnose suckers	<i>Catostomus catostomus</i> (Forster)	LNS



1. 81 Mile Pit
2. Clearwater Lake
3. Bolio Lake
4. Mark Lake
5. North Twin Lake
6. South Twin Lake
7. Ft. Greely No. 2 Lake
8. Donnelly Lake
9. Rapids Lake
10. Donna Lake
11. Little Donna Lake
12. Craig Lake
13. Lisa Lake

Figure 1. Location of waters in the Delta District.

OBJECTIVES

1. To evaluate stocking policies for rainbow trout and silver salmon and formulate stocking recommendations for optimum survival and growth.
2. To obtain estimates of existing or potential angler use and sport fish harvest on Quartz Lake, George Lake, and other high use waters.
3. Monitor existing fish stocks in the Goodpaster River and Shaw Creek to determine changes in population structure.
4. To assist as required in the investigation of public access status to the area's recreational fishery waters.

TECHNIQUES USED

A boat mounted electrofishing unit described by Van Hulle (1968) was used to capture fish for population studies in the Goodpaster River and Shaw Creek.

Population estimates were based on a ratio of marked to unmarked fish in the sample using the Petersen equation described by Ricker (1958).

Fish were measured to fork length in millimeters. Fish scales used for age determination were cleaned, mounted on gummed cards, then impressed on 20 mil acetate using a heated press at 35,000 psi for 20 seconds. A Bruning 200 microfiche reader was used to read the scales.

Water samples were collected using a Kemmerer water sampler, and chemical analysis was done with a Hach model AL-36-WR kit. Lake depths were determined with a Lowrance echo sounder. Conductivity was measured with a Hach model 2510 conductivity meter.

Graduated mesh monofilament gill nets, 125 ft x 6 ft with five mesh sizes ranging from 1/2 in to 2 1/2 in bar measure were used to sample fish populations in lakes.

FINDINGS

Fish Stocking Evaluation

Fish population sampling was conducted on 15 lakes stocked with rainbow trout, silver salmon, and Arctic grayling during late August and September, 1978, for evaluation of growth and survival of stocked fish. Donna and Little Donna lakes were also netted under the ice in November because of

poor net catches in prior sampling. Gill netting results, population characteristics, and stocking histories are summarized in Table 2. Most of the lakes were netted with two gill nets fished for a period of 24-hours; however, Quartz Lake was netted with three gill nets and 81 Mile Pit with one. The November netting of Donna and Little Donna lakes was with two nets fished in each lake for a 48-hour period.

A hatchery shortage of rainbow trout the past 3 years has forced a reduction in numbers of lakes scheduled for stocking and in the number of fish stocked in individual waters. Only three lakes, Quartz, Lisa, and Jan received rainbow trout in 1976. In 1977, Quartz and Four Mile lakes were stocked, and in 1978 rainbow trout were unavailable for stocking in any of the study lakes.

Donna and South Twin were stocked with silver salmon in 1976. Quartz and Bolio received silver salmon in 1977; and in 1978 Donnelly, Mark, Lisa, North Twin, and South Twin lakes were stocked with silver salmon.

Age I silver salmon comprised 81% of the net catch in Quartz Lake. The fish, stocked at a rate of 130 fish per acre, were from the Seward Lagoon source and had attained a mean length of 223 mm after 14 months of lake residence. The catch frequency was 1.03 fish per net hour. Only one Age I silver salmon from the Delta Clearwater source was netted in Bolio Lake. The fish had a fork length of 204 mm. The low net catch is believed to be a result of winter mortality. Dissolved oxygen levels on February 15, 1978, recorded at 1 m depth at five locations, ranged from 1.0 to 1.6 ppm.

Net catches were low for silver salmon stocked in Donna and South Twin lakes in 1976. Results in Donna Lake are known to be a poor representation of the fish populations, however. The lake was netted with two gill nets fished for a 24-hour period in September with only one silver salmon being captured. The lake was again netted under the ice in November. Two nets were fished for a 48-hour period with only two silver salmon being netted. On the same date and location as the November netting, four silver salmon were captured with sport fishing gear in one-half hour. An abundance of surface feeding fish were also observed during the summer.

The poor growth in Donna Lake as compared to other lakes suggests that the stocking density of 398 fish per acre was too high. With the high stocking survival usually experienced with silver salmon, a stocking density from 100 to 200 fish per acre has provided the best overall results on the study lakes during the past several years. Net catch and growth comparisons for silver salmon stocked in several Interior Alaska lakes are presented in Table 3. Silver salmon stocked in Interior Alaska lakes at these densities usually attain a harvestable size of 220 to 260 mm from 22 to 24-months after stocking. Exceptional growth was experienced in Quartz and Four Mile lakes. Silver salmon in Quartz Lake reached a mean length of 223 mm after 14 months of lake residency. Silver salmon in Four Mile Lake attained a mean length of 281 mm 16 months after being stocked.

Table 2. Population characteristics of stocked lakes determined by graduated mesh gill nets, Interior Alaska, 1978.

Lake	Date Sampled	Species	No.	Age Class	Length (mm)		Frequency	Date Stocked	Total No.	No. /lb.	No. /acre	Source
					Range	Mean						
Bolio	9/7	SS	1	I	204		.02	6/30/77	10,000	440	100	Delta Clearwater Bear Lake
			6	III	260-344	302	.13	7/17/75	11,800	369	118	
Donna	9/12	SS	1	II	172		.02	8/24/76	23,100	174	398	Bear Lake
	11/30	SS	2	II	182-200	191	.02					
Little Donna	9/12	RT	1	IV	516		.02	7/23/74	16,300	279	339	Winthrop
	11/30	RT	12	IV	435-508	467	.13					
Donnelly	9/27	SS	8	III	252-310	285	.17	7/17/75	8,850	369	148	Bear Lake
Ft. Greely #2	9/7	RT	30	III	188-231	214	.63	7/10/74	10,000	588	1,250	Winthrop
Jan	9/14	RT	4	II	405-473	442	.07	8/02/76	10,000	670	227	Oregon Ennis
		RT	4	V	450-495	470	.07	7/18/73	8,200	54	186	
Lisa	9/14	RT	3	II	358-377	367	.04	8/02/76	10,000	670	200	Oregon Delta Clearwater Seward Lagoon
		SS	1	IV	368		.02	7/23/74	9,900	227	198	
		SS	25	0	98-105	101	.37	8/15/78	15,000	145	300	
Mark	8/30	GR	3		301-312	208	.06	*	4,000	68	200	Seward Lagoon
		SS	30	0	100-110	104	.63	8/15/78				
		SSC	6				.13					
North Twin	8/30	RT	3	III	364-412	389	.06	7/24/75	15,000	171	652	Ennis
		SS	1		395		.02	*				
South Twin	8/30	SS	4	II	230-280	251	.08	8/24/76	6,000	78	286	Blind Slough Seward Lagoon
		SS	6	0	100-110	104	.03	8/15/78	6,000	68	286	

Table 2. (cont.) Population characteristics of stocked lakes determined by graduated mesh gill nets, Interior Alaska, 1978.

Lake	Date Sampled	Species	No.	Age Class	Length (mm)		Frequency	Date Stocked	Total No.	No. /lb.	No. /acre	Source
					Range	Mean						
Quartz	9/26	RT	1	I	264		.01	7/26/77	113,800	11-304	76	Alaska Ennis
		RT	5	II	350-408	377	.07	8/24/76	97,800	100-670	65	Oregon
		RT	10	III	478-513	499	.14	7/24/75	210,000	171-185	140	Ennis
		RT	1	V	548		.01	8/01/73	285,100	98-107	190	Winthrop
		SS	74	I	212-243	223	1.03	6/28-8/15/77	197,400	170-394	130	Seward Lagoon
Rainbow	8/25	RT	11	IV	363-462	425	.22	6/26-7/10/74	39,000	588-1,017	406	Winthrop
Rapids	9/7	RT	5	I	175-192	183	.10	**				
		RT	3	III	219-330	267	.06	7/24/75	2,000	171	400	Ennis
		RT	1	IV	354		.02	7/23/74	2,000	279	400	Winthrop
4 Mile	9/14	RT	23	I	236-292	268	.72	6/14/77	24,800	95	248	Winthrop
		SF	9	X	522-674	619	.28					
81 Mile Pit	9/26	GR	24	I	192-211	202	.98	6/21/77	5,000	fry	5,000	Tolsona

* Not stocked by the department

** Not stocked - natural recruitment

Table 3. Net catch and growth comparisons of silver salmon stocked in Interior Alaska lakes.

Lake	Date Stocked	No./lb.	No./acre	Date Sampled	Age Class	Number Captured	Mean Length (mm)	Frequency	Strain
Bolio	7/13/73	440	100	11/11/73	I	30	184	0.58	Green River
				10/03/75	II	30	248	0.42	
	7/17/75	369	100	08/18/76	I	63	163	1.45	Bear Lake
			09/09/77	II	38	236	0.90		
			09/07/78	III	5	302	0.13		
Donna	8/24/76	174	400	09/13/77	I	18	133	0.42	Bear Lake
				11/30/78	II	2*	191	0.02	
Donnelly	7/17/75	369	150	08/20/76	I	42	169	1.86	Bear Lake
				09/09/77	II	4*	255	0.20	
				09/27/78	III	8	285	0.17	
Craig	9/20/73	91	300	12/12/74	I	18	132	0.36	Kodiak
				08/21/75	II	8	154	0.18	
				08/25/76	III	4	227	0.17	
				09/16/77	IV	4	328	0.08	
Jan	7/08/68	510	180	06/12/69	I	2	155	0.11	Kodiak
				07/10/70	II	65	222	1.81	
				06/02/71	III	12	283	0.27	
Lisa	7/08/68	610	190	06/12/69	I	4*	187	0.42	Kodiak
				07/10/70	II	45	260	0.90	
				06/03/71	III	3	320	0.07	
	8/29/72	243	180	07/10/73	I	191	141	4.30	Delta Clearwater
			12/05/73	I	14	175	0.27		
			12/11/74	II	17	245	0.57		
			08/13/75	III	2	264	0.05		

Table 3. (cont.) Net catch and growth comparisons of silver salmon stocked in Interior Alaska Lakes.

Lake	Date Stocked	No./lb.	No./acre	Date Sampled	Age Class	Number Captured	Mean Length (mm)	Frequency	Strain
Lisa (cont.)	7/23/74	227	200	08/13/75	I	0*		0.00	Delta Clearwater
				08/25/76	II	20	199	0.42	
				09/16/77	III	2	330	0.06	
				09/14/78	IV	1	368	0.02	
Quartz	6/23-8/15/77	170-394	130	09/26/78	I	74	223	1.03	Seward Lagoon
South Twin	9/20/73	91	300	11/12/74	I	18	143	0.36	Kodiak
				08/22/75	II	35	213	0.73	
				08/18/76	III	12	256	0.25	
	8/24/76	78	290	08/26/77	I	12	158	0.25	Blind Slough
				08/30/78	II	4	251	0.08	
4 Mile	8/30/72	243	100	07/05/73	I	50	156	1.56	Delta Clearwater
				12/21/73	I	17	281	0.49	
				05/31/74	II	5	328	0.20	
				12/19/74	II	22	414	0.46	

* Poor net catch. Not representative of population numbers.

Silver salmon in most of the stocked lakes mature prior to the formation of their third scale annulus. Age IV silver salmon have been netted in only two lakes, Craig and Lisa. Precocious males have been noted as young as Age I. In Quartz Lake during July, 1978, a high percentage of larger silver salmon selectively kept by anglers were precocious males stocked in July, 1977.

Four age classes of rainbow trout were represented in the September netting of Quartz Lake. Age Class III rainbow trout from the 1975 stocking of 210,000 (140/acre) Ennis strain was predominant. Only one Age I and five Age II fish were captured from plants of 76 per acre (Alaska Ennis) in 1977 and 65 per acre (Oregon strain) in 1976.

Age Class III was also predominant in the sport harvest, comprising 40%, while Age I and II comprised 9% and 22% respectively (reported in more detail under creel census).

Some winter mortality was again noted immediately following spring breakup, although it was not as extensive as that observed the previous winter. Both winters were relatively mild and lowest recorded dissolved oxygen levels were 5.0 ppm. Observations from a boat in the shallow west end of the lake on May 16 revealed a total of 15 rainbow trout and 17 silver salmon carcasses. The silver salmon were all from the 1977 stocking. Of nine rainbow trout examined, one was Age I, three were Age III, four were Age IV and one was Age V.

Although the population level of rainbow trout in Quartz Lake is low, the large size of the fish has made them a popular target for a number of anglers who fish selectively for the species. The majority of rainbow trout harvested by sport anglers were in the 1.4 to 1.8 kg (3 to 4 pound) size range. Individual fish up to 2.7 kg (6 pounds) were caught.

Rainbow trout of the Alaska Ennis strain were stocked in Four Mile Lake in 1977 at a rate of 248 per acre. After 15 months of lake residency the fish had reached a mean length of 268 mm and were netted at a frequency of 0.72 fish per net hour. This catch rate is the highest for Age I rainbow trout of the study lakes stocked during the past four years. This survival is also quite good since a predator population of Age X sheefish, ranging in size from 522 to 674 mm in fork length is present.

The mean length of the rainbow trout in Four Mile Lake (268 mm) is greater than the mean length of 248 mm for Age I rainbow trout sampled from the study lakes over the past 4 years. Four Mile Lake is quite fertile and consists of 90% littoral area. Amphipods and other invertebrates are abundant.

Exceptional growth has been experienced on rainbow trout stocked in Quartz Lake. The mean length of Age I rainbow trout since 1973 has been 312 mm.

Quartz Lake is by far the most productive of the stocked lakes in Interior Alaska. Table 4 shows a comparison of the morphoedaphic index (MEI) values for 15 stocked Interior Alaska lakes. Rapids Lake, although rated second in productivity, has not provided fish growth commensurate to its rating. Its elevation of 2,375 feet is greater than any of the other stocked lakes, however.

Natural recruitment of rainbow trout was found in Rapids Lake during test netting. Five Age I fish having a mean length of 183 mm were netted. No fish have been stocked in the lake since 1975. Natural reproduction may have occurred previously, but went unnoticed since the lake was stocked annually from 1968 through 1975. The lake, located in mountainous terrain, has no inlet; but a small outlet flows about 30 m before entering Falls Creek. Falls Creek has a constant summer flow of clear water and a gravel substrate, providing suitable spawning habitat.

Although rainbow trout stocking in past years has provided poorer survival than obtained with silver salmon, it offers several advantages. First and probably foremost is the apparent angler preference for rainbows. The longer life span of rainbow trout allows them to contribute to the fishery over a longer period and attain a larger size. The larger size attained is an important attribute, although population density is usually less, resulting in lower catch success rates. A sample of 45 sport caught rainbow trout from Quartz Lake during 1978 was comprised of 40% Age III, 24% Age IV, and 4% Age V fish. Significant numbers of Age IV rainbow trout were also taken during test netting in Little Donna, Jan, and Rainbow lakes during 1978.

One managed lake containing stocked grayling was sampled. A total of 24 Age I grayling having a mean length of 202 mm was netted in 81-Mile Pit at a catch rate of 0.98 fish per hour. These fish resulted from a plant of 5,000 fry in the 1-acre roadside gravel pit. The lake had previously been stocked with rainbow trout, but in recent years experienced frequent winterkill.

Angler Pressure and Sport Fish Harvest Estimates

Quartz Lake:

Quartz is a 1,500 acre (607 ha) lake located near the Richardson Highway, approximately 16 miles (25.7 km) north of Delta Junction. The lake was rehabilitated in 1970 with powdered rotenone to eliminate stunted northern pike and least cisco, and it has been restocked annually with rainbow trout. Silver salmon totaling 197,400 were stocked for the first time in 1977, in addition to 113,800 rainbow trout.

A randomly stratified sampling schedule was used to determine angling pressure from May 18 through September 4, 1978. The schedule involved four hourly counts on every weekend and holiday and two weekdays throughout the season. The time period covered from May 18 to July 31, was 6 a.m. to midnight and from August 1 to September 4, it was 6 a.m. to 7 p.m.

Table 4. Morphoedaphic Index* values for stocked Interior Alaska Lakes, 1978.

Lake	Morphoedaphic Index
Quartz	34.9
Rapids	27.6
Bolio	11.5
South Twin	8.5
Mark	6.0
North Twin	5.7
Lisa	4.7
Jan	4.3
Rainbow	4.1
Donna	3.8
4 Mile	3.6
Little Donna	2.8
Ft. Greely #2	2.2
Craig	1.5
Donnelly	1.4

* Morphoedaphic Index (MEI) = Conductance divided by mean depth.

The pressure estimate for the season was 15,970 angler hours (Table 5). Sixty-four percent of the estimated pressure occurred on weekends and holidays.

Anglers returning to the boat landing during the sampling period were interviewed to determine catch success for completed trips. During the season a total of 613 anglers contacted fished 1,726 hours and caught 1,770 silver salmon and 63 rainbow trout. The catch rate for fish kept was 1.03 silver salmon per hour and 0.04 rainbow trout per hour (Table 6). Shore anglers comprised only 3% of those contacted and had a lower catch rate of 0.31 silver salmon per hour and 0.02 rainbow trout per hour.

The expanded total harvest based on the pressure and catch rate estimates was 16,449 silver salmon and 639 rainbow trout.

Silver salmon were first stocked in Quartz Lake in 1977 and began entering the creel in May, 1978. Catch rate was 0.47 silver salmon per hour in May, as anglers were selectively keeping only the larger fish. Catch success increased through the summer as the fish size increased, and during August and September was 1.69 silver salmon per hour. The mean length of silver salmon retained through the summer was about 220 mm.

Lengths and scale samples were collected from 45 of an estimated total rainbow trout harvest of 639. Age frequency and lengths are presented in Table 7. Age III rainbow trout comprised 40% of the total. The mean length of the sample was 456 mm.

A number of anglers interviewed fished specifically for rainbow trout; some were quite successful, catching several large trout in a single trip.

George Lake:

George Lake, located about 40 miles east of Delta Junction, continues to be the most heavily utilized northern pike fishery in the Delta area. Civilian and military anglers from the Delta and Fairbanks area are the principal users.

The Tanana River isolates this 4,500-acre lake from the Alaska Highway, making it accessible only by riverboat or float plane. Float plane use is presently light. Fishing pressure is heaviest from breakup (usually near the first of June) until mid-July.

During 1978, about 90% of the people fishing George Lake launched their own boats at George Lake Lodge near Mile 1385 Alaska Highway or were transported by the lodge owner. The remaining anglers launched at a landing about 15 miles downstream on the Tanana River. The use of a questionnaire, initiated in 1976, was again utilized to provide angler use and success information. People launching boats or being transported from the private landing at George Lake Lodge were given a questionnaire

Table 5. Quartz Lake angler pressure estimates, May 18 - September 4, 1978

Month	Weekdays Estimated Angler Hours	Percent of Total	Weekends and Holidays Estimated Angler Hours	Percent of Total	Total
May 18 - July 30 (6 a.m. to midnight)	4,050	34	7,921	66	11,971
Aug. 1 - Sept. 4 (6 a.m. to 7 p.m.)	1,720	43	2,279	57	3,999
Totals	5,770	36	10,200	64	15,970

Table 6. Quartz Lake creel census summary, May 18 to September 4, 1978.

	Contacted	Total Hrs. Fished	SS Caught	RT Caught	SS /Hr.	RT /Hr.	Total Fish /Hr.	Hrs. /Angler
<u>May</u>								
Shore	9	26	13	2	.50	.08	.58	2.9
Boat	109	341	159	21	.47	.06	.53	3.1
Both	118	367	172	23	.47	.06	.53	3.1
<u>June</u>								
Shore	7	30	6	0	.20	.00	.20	4.3
Boat	103	350	215	15	.61	.04	.66	3.4
Both	110	380	221	15	.58	.04	.62	3.5
<u>July</u>								
Shore	4	24	6	0	.25	.00	.25	6.0
Boat	213	569	718	13	1.26	.02	1.29	2.7
Both	217	593	724	13	1.22	.02	1.24	2.7
<u>Aug. & Sept.</u>								
Shore	0	0	0	0				
Boat	168	386	653	12	1.69	.03	1.72	2.3
Both	168	386	653	12	1.69	.03	1.72	2.3
<u>Totals</u>								
Shore	20	80	25	2	.31	.02	.34	4.0
Boat	593	1646	1745	61	1.06	.04	1.10	2.8
Both	613	1726	1770	63	1.03	.04	1.06	2.8

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Table 7. Age frequency and length of rainbow trout sport catch, Quartz Lake, 1978.

Age Class	Number	Percent	Length (mm)	
			Range	Mean
I	4	9.0	260-303	285
II	10	22.0	260-451	354
III	18	40.0	435-546	492
IV	11	24.5	265-575	529
V	2	4.5	556-615	586
	<u>45</u>			<u>456</u>

and asked to return the completed form at the end of their trip. Information obtained is summarized in Table 8. The response from 41 parties or 135 anglers represents a 34% return of questionnaires and about 30% of the estimated total use for the 3-month period. Expanding the reported harvest of 568 northern pike to cover the estimated total number of anglers fishing George Lake during the period provides an estimated total northern pike harvest of 1,890. Estimated total angler days is 1,036. Although the estimates reveal a 23% increase in the number of angler days over 1977, the harvest estimate for 1978 was down 4%. The number of northern pike kept per angler in 1978 was 4.2 as compared to 5.2 in 1977.

Goodpaster River Studies

Population Estimates:

Population levels of Arctic grayling were determined for two study sections in the lower Goodpaster River during a 1-week period in late June. During previous sampling (Tack, 1974 and 1975) grayling population estimates were made for each of three areas in the entire 185 km (115 miles) of the Goodpaster River. Population estimates from 1975 through 1977 (Peckham, 1976, 1977, and 1978) and again in this study are limited to two study sections, 4.8 km (3 miles) each in length, located in the lower 53 km (33 miles). The fish were captured using electrofishing gear, as in the previous work. Two passes were made through each section to capture fish for marking. Grayling greater than 150 mm were given an adipose fin clip. One day was allowed for random mixing of marked fish prior to a final run to examine for recaptures.

The Petersen estimates for grayling in Section 2 (4.8 - 9.6 km, 3 - 6 mi) and Section 6 (24 - 28.8 km, 15 - 18 mi) are 434 grayling per km and 502 grayling per km, respectively (Table 9). The estimate for the two study sections combined was 468 grayling per km (749 grayling per mile). The combined estimate is greater than estimates for 1977 and 1976, but are nearly the same as those for 1975 and 1973. A comparison of population estimates for the lower Goodpaster River from 1973 to 1978 is presented in Table 10.

Age and Length Frequency Data:

Age determinations by scale analysis were made from a random subsample of an equal number of grayling from each section.

Age Class IV was the predominant age group, comprising 56% of the total subsample (Table 11). In 1977 Age Class III was predominant with 66% of the total while Age Class IV grayling comprised only 5%.

This pattern of a predominant Age Class IV following a predominant Age Class III has occurred each year since yearly sampling was initiated in 1973.

Table 8. Angler use and northern pike harvest from 41 questionnaire responses, George Lake, 1978.

Month	Total Anglers	Average People /Party	Total NP Caught	Total NP Kept	Average Length of Stay (days)	Fish Kept/Angler
Late May and June	90	3.6	1,263	352	2.1	3.9
July	18	2.6	293	72	2.0	4.0
August and early September	$\frac{27}{135}$	$\frac{3.0}{3.1}$	$\frac{474}{2,030}$	$\frac{144}{568}$	$\frac{2.8}{2.3}$	$\frac{5.3}{4.2}$

Table 9. Population estimates for Arctic grayling (greater than 150 mm) in two sections of the Goodpaster River, June 20-23, 1978.

Section	Marked Fish in Population (m)	Fish Examined (c)	Recaps (r)	Petersen Estimate (N)*	GR/km	GR/km
2 (km 4.8-9.6)	248	167	19	2,083	434	694
6 (km 24-28.8)	373	212	32	2,408	502	803
2 and 6 combined	621	379	51	4,491	468	749

* $N = \frac{(m)(c+1)}{r+1}$

Table 10. A comparison of population estimates for Arctic grayling (greater than 150 mm) in the lower Goodpaster River for 1973 - 1978.

Year	Method of Estimate	Length of Area		Population GR/km	Estimate GR/mi
		km	mi		
1973	Schnabel	53.0	33	480	770
1974	Petersen	53.0	33	201	323
1975	Petersen	9.6	6*	475	760
1976	Petersen	9.6	6	351	563
1977	Petersen	9.6	6	377	604
1978	Petersen	9.6	6	468	749

* The six miles for which the estimates were made in 1975 through 1978 includes two index areas of three miles each (Miles 3-6 and Miles 15-18).

Table 11. Age frequency and length of Arctic grayling* captured in two sections (Section 2 and 6) of the Goodpaster River, June, 1978.

Age Class	Number	Percent	Length (mm)	
			Range	Mean
I	2	2	81-120	101
II	23	22	122-168	140
III	13	12	168-210	188
IV	58	56	188-237	208
I	8	8	233-287	268
	<u>104</u>			

* A sample of 104 fish was comprised of the first 52 grayling captured in each section.

Table 12. Length frequency of Arctic grayling captured in two sections of the Goodpaster River, June, 1978.

Length Range (mm)	Number	Percent
70-89	2	0.3
90-109	8	1.0
110-129	26	3.3
130-149	133	16.9
150-169	69	8.7
170-189	96	12.2
190-209	260	32.9
210-229	135	17.1
230-249	27	3.4
250-269	16	2.0
270-289	14	1.8
290-309	<u>3</u>	0.4
	789	

Mean = 187 mm

The 1978 subsample, which is comprised of the first 52 grayling captured in each section, contained no grayling in age classes greater than Age V. In the three previous years grayling in age classes greater than Age V comprised from 6 to 20 percent of the total. The lower 53 km (33 miles) of the Goodpaster River is characteristically a rearing area for smaller grayling, with the upper reaches of the river being inhabited by larger grayling (Tack, 1974).

As in past years the percent of grayling in Age Classes I and II may not accurately depict their relative abundance. Fish in the smaller size groups were commonly observed but are less effectively stunned by the boat shocker, and therefore are more difficult to net.

The length frequency of 789 grayling captured in the two study sections is shown in Table 12. The most abundant size group were grayling having a length range of 190 - 209 mm, which accounted for 33% of the total sample. The mean length of the total sample was 186 mm.

Capture Rate:

The capture rate of the fish species collected during electrofishing was recorded to provide an index of their relative abundance. The index may be biased because grayling was the target species and more effort was directed toward their capture; however, the data are intended to reveal trends in population abundance when compared with data from prior years.

The relative abundance of grayling, round whitefish, and longnose suckers, as revealed by fish captured per hour, was 167, 32, and 7, respectively. Grayling comprised 81% of the three species collected, which is the highest recorded since intensive sampling began in 1973, although capture rate of grayling per hour was highest in 1977. A comparison of capture rates for 1973 through 1978 is presented in Table 13.

Northern pike were captured at a rate of 2.3 fish per hour. Other fish species captured at rates of less than one fish per hour included burbot, humpback whitefish, and slimy sculpin.

Shaw Creek Studies

Fish population sampling was conducted on the lower 3.2 km (2 miles) of Shaw Creek on September 29, using boat mounted electrofishing gear to determine species composition, relative abundance and age, and length of grayling. The total stream length of Shaw Creek is over 60 km (37 mi). In addition there are nine named tributary streams. Riverboat access is limited to the lower 10 km due to a large number of fallen trees above that point.

Fish captured in one hour of actual shocking during a single downstream run included 72 grayling, 13 round whitefish, 6 humpback whitefish, 2 suckers, 1 silver salmon, and 2 chum salmon. The salmon were adult spawners taken at the confluence with the Tanana River.

Table 13. A comparison of fish capture rates using a boat mounted shocker, Goodpaster River, 1973-1978.

Species	1973		1975		1976		1977		1978	
	Fish/hr	Percent	Fish/hr	Percent	Fish/hr	Percent	Fish/hr	Percent	Fish/hr	Percent
Grayling	138	78	172	73	78	61	223	66	167	81
Round whitefish	38	21	50	21	31	24	89	26	32	16
Suckers	<u>2</u>	1	<u>14</u>	6	<u>18</u>	15	<u>28</u>	8	<u>7</u>	3
Total	178		236		127		340		206	

The capture rate of 72 grayling per hour is much higher than the 10 grayling per hour captured in similar sampling on August 29, 1977. The higher capture rate in 1978 is believed to be the result of timing.

A fall out-migration appears to peak around mid-September, as noted by increased sport harvest occurring at that time. While the 1977 sampling was apparently early, the 1978 sampling probably captured the late portions of the migration.

Age Class II grayling having a mean length of 176 mm comprised 44% of the sample (Table 14). Age Class II grayling comprising 40% of the sample were also predominant in a July, 1976 sample. In the small 1977 sample, Age III grayling were dominant with 44% of the total.

A preliminary survey of a portion of the stream about 30 km (18.6 mi) upstream from the mouth was conducted in early July. The area was reached by an all terrain vehicle, since boat access is not possible. Rapids Creek, a 3 meter (10 ft) wide tributary of Shaw Creek, was sampled with a backpack shocker. The depth of the stream exceeded 1.5 m (5 ft), which limited sampling to areas near the bank. Six young-of-the-year grayling were the only fish captured. A few larger grayling about 150 mm in length were observed but not collected with the shocker or sport fishing gear.

Remote Lake Surveys

"T" Lake:

This 400-acre lake located 17.7 km (11 mi) northeast of Dot Lake has a maximum recorded depth of 21.3 m (70 ft). It has one small inlet entering from the west and a small outlet on the northeast corner which connects to Billy Creek, neither were flowing on July 6. Lily pad beds are located near the outlet and along the west and south shore.

Being north of the Tanana River, the lake is accessible in the summer only by float plane. Present use is light, being limited primarily to local residents living in the Tok and Delta Junction areas.

Test netting was conducted on July 6 and 7 and results are shown in Table 15.

Although only six northern pike and two burbot were captured in two gill nets, fishing with sport gear was considered excellent for both species.

Six northern pike netted average 743 mm (29.3 in) and 3.4 kg (7.4 lbs) and seven burbot caught by netting and set lines averaged 678 mm (26.7 in) and 2.4 kg (5.3 lbs).

Water chemistry recorded was as follows: pH 9.5, total alkalinity 103 ppm, total hardness 103 ppm, and dissolved oxygen 10.0 ppm.

Table 14. Age frequency and length of Arctic grayling captured in Shaw Creek, September 29, 1978.

Age Class	Number	Percent	Length (mm)	
			Range	Mean
0	2	3	65-80	73
I	0	0	-	-
II	31	44	145-205	176
III	18	26	194-289	223
IV	14	20	224-279	252
V	3	4	305-315	308
VI	2	3	318-337	328
	<u>70</u>			

Table 15. Fish sampling summary, "T" Lake, July, 1978.

Species	No.	Length (mm)		Weight (kg)		Fish/ Net hr
		Range	Mean	Range	Mean	
NP	6	492-830	747	1.0-5.0	3.4	0.25
HWF	16	212-408	330			0.67
BB	7*	598-810	678	1.9-2.9	2.4	0.08
LCI	2	120-230	175			0.08

* Five were captured on set lines

Long Lake:

Long Lake is a 90-acre lake located 18.5 km (11.5 mi) southwest of Dot Lake. Maximum depth is 4.9 m (16 ft) and the water has a brownish stain. There are no visible inlets and a small outlet seeps from the south end of the lake, reaching the Robertson River about 4.8 km (3 mi) to the east. Lily pads are located around the margin of the lake.

There is no existing trail to the lake and accessibility by plane is marginal due to its small size. The elevation of the lake is about 2,050 ft.

The fish population was sampled on July 7, 1978 with one graduated mesh gill net fished for 24 hours. Four grayling having a length range of 256 to 306 mm and a mean length of 278 mm and nine suckers ranging from 102 to 330 mm in length were the only fish captured. The smallest grayling was Age III while the remaining three were Age IV.

Sport fishing for about 2 man-hours was unsuccessful although a few grayling were observed surface feeding. This lake appears to have poor sport fish potential due to its inaccessibility, small size, and apparent low fish population levels.

Water chemistry data recorded in July was as follows: pH 8.5, total alkalinity 51 ppm, total hardness 34 ppm, and dissolved oxygen 9.0 ppm.

Assessment of Anadromous Fish Populations

Silver salmon spawners were enumerated in the Delta Clearwater River and Clearwater Lake outlet on October 25 and 26, 1978. Counts were made by one observer from a riverboat utilizing an elevated platform.

The count of 4,798 in the Delta Clearwater River (Miles 0-17) is nearly the same as 1977 (4,793) while the Clearwater Lake outlet count of 570 was down from the 730 of 1977. A comparison of counts from 1971 to 1978 is presented in Table 16.

Sport fishing for the spawning silver salmon seems to be gaining some popularity; however, due to the relatively poor condition of the fish when they reach the river, a significant increase in pressure is not expected. Total sport harvest the past two seasons is probably less than 100 fish annually.

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Table 16. Silver salmon escapement counts for the Delta Clearwater River and Clearwater Lake outlet, 1971-1978.

Date	Delta Clearwater River	Clearwater Lake Outlet
Oct. 15, 1971	3,000*	...
Nov. 19, 1972	630**	...
Oct. 17 & 24, 1973	3,322	551
1974
Oct. 22 & 24, 1975	5,100	1,500
Oct. 21 & 22, 1976	1,920	460
Oct. 24 & 25, 1977	4,793	730
Oct. 25 & 26, 1978	4,798	570

* Estimate only. Counts from 1973 on were made utilizing an elevated platform mounted on the bow of a riverboat.

** Count made late in the season under poor conditions.

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