STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

A STUDY OF A TYPICAL SPRING-FED STREAM OF INTERIOR ALASKA

by

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Job No. G-III-G
A Study of a Typical Spring-Fed Stream of Interior Alaska

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RESEARCH PROJECT SEGMENT

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Period Covered: July 1, 1977 to June 30, 1978

ABSTRACT

The Delta Clearwater River from Mile 17 to the mouth was sampled with an electrofishing boat as part of an ongoing project to monitor existing stocks of Arctic grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas). Comparisons of relative abundance with like sampling in 1973, 1975 and 1976 are presented. The percent composition of grayling was 22.2% in 1977 compared to 17.3% in 1976, 14% in 1975, and 15.7% in 1973.

As in 1976, Age Class VI was predominant, comprising 26% of the total. Grayling in the smaller age and length classes represent a higher percentage of the total sample in 1977, indicating contribution from stocking of pond reared grayling.

Similar sampling was conducted on the Richardson Clearwater River. Age, length and capture rates are discussed.

Angler harvest was monitored on the Delta Clearwater River from May 1 to September 6, providing 307 angler interviews with a recorded catch success of 0.56 fish/hour. Pressure counts provided an estimated 5,923 anglers fished during the period covered. Age analysis of grayling entering the sport harvest is presented.

Stock enhancement through the stocking of pond reared grayling into spring areas of the Delta Clearwater River was assessed. Sample results and scale circuli analyses indicate survival of both the 1975 and 1976 plants. Observation and collection of juvenile grayling in spring areas in early April indicate that overwintering in these areas does occur.

Results of pond rearing of grayling fry stocked in four lakes is discussed. A total of 6,700 age 0+ and 371 age I+ grayling were captured by fyke nets and removed from two of the lakes in late September. Population estimates for both lakes provide percent survival and percent removal estimates.

An electrofishing boat and fyke net were utilized to sample fish entering Mile One Slough during late April and early May. The total catch of round whitefish greater than 150 mm during the two week period was 1,287.

July sampling of the Delta Clearwater River with an electrofishing boat shows a continuing decline in the percentage of round whitefish.

Round whitefish comprised 86.0%, 82.7% and 77.8% of the sample in 1975, 1976 and 1977, respectively.

A total of 1,292 grayling was captured at Mile One Slough from April 21 to May 5. Grayling larger than 180 mm in length, totaling 578 fish, were tagged with Floy FD 67 tags, while 714 grayling less than 180 mm were given left pelvic fin clips. Length frequency and age composition of the tagged grayling are presented as well as locations of 28 tag returns reported in 1977.

BACKGROUND

The Delta Clearwater River is a spring-fed system located approximately 13 km (8 miles) northeast of Delta Junction (Figure 1). The main channel of the river is approximately 32 km (20 miles) in length and the north fork is about 10 km (6 miles) in length. The stream is characterized by relatively constant flows, levels and water temperatures. The river has a popular summer sport fishery for Arctic grayling. Public access is available at the State of Alaska Clearwater Campground near Mile 9 of the river. A boat launching ramp provides riverboat access to the rest of the river.

Past work, going back to the United States Fish and Wildlife Service studies initiated in 1952, is described by Pearse (1976). Recent studies by Pearse (1974 and 1976) provided life history information regarding length frequencies and distribution, length-weight relationships, condition factors, age and sex composition, and maturity for Arctic grayling and round whitefish. Estimates of abundance indicated 2,267 grayling and 13,611 round whitefish were present in 1973. As many as 5,000 silver salmon, Oncorhynchus kisutch (Walbaum), spawn annually in this system.

Work in 1975 and 1976 and the present study deal with monitoring existing fish stocks and determining the feasibility and effects of round whitefish removal. Enhancement of the grayling population by transplanting pond reared grayling into spring areas of the Delta Clearwater is being evaluated.

RECOMMENDATIONS

1. Index sampling of Arctic grayling and round whitefish in the Delta Clearwater River should be continued.

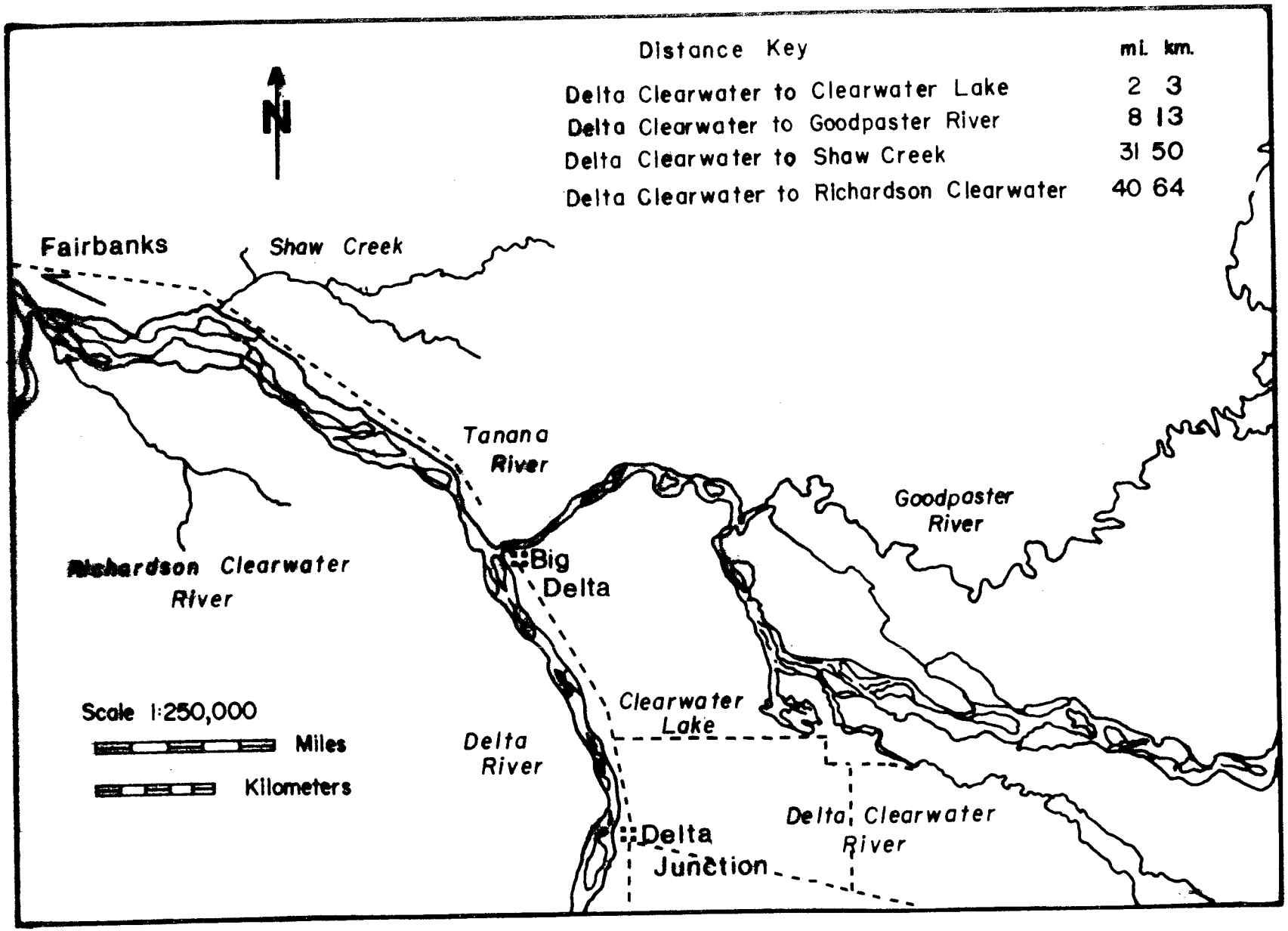

FIGURE 1. TANANA - CLEARWATER STUDY AREA

2. Monitoring of sport fish harvest in the Delta Clearwater River and Clearwater Lake outlet should continue.

3. The experimental program of pond rearing and transplanting of Arctic grayling to the Delta Clearwater River should be continued.

4. Assessment of results of the grayling transplants into spring areas of the Delta Clearwater River should continue.

5. The suitability of grayling enhancement utilizing grayling pond reared for two summers versus one summer of pond rearing should be continued.

6. Monitoring of early spring fish movement into the Delta Clearwater River and the removal of round whitefish should continue.

OBJECTIVES

1. Monitor existing stocks of Arctic grayling and whitefish in the Delta Clearwater River.

2. Continue enhancement of grayling stocks in the Delta Clearwater River.

3. Determine the feasibility of controlling competition between grayling and round whitefish in the Delta Clearwater River.

TECHNIQUES USED

Fish population sampling to obtain estimates of relative abundance in the Delta Clearwater River was done by utilizing an alternating current boat mounted shocker described by Van Hulle (1968). Grayling and whitefish were captured during a single downstream run. At the end of each one-mile section, lengths and scale samples were taken from all grayling and whitefish were counted. Grayling were released within the section in which they were captured.

Spring areas previously stocked with pond reared grayling were sampled with a Coffelt back-pack dc shocker. Fish scales used for age determination were cleaned and mounted between glass slides, then read using a Bausch and Lomb microprojector. Fish were measured to fork length in millimeters and weight in grams.

Monthly samples of grayling in rearing ponds were collected using a 50' bag seine. The fish were preserved in 10% Formalin and lengths, weights and scale samples were obtained from preserved specimens.

Fall removal of grayling from rearing ponds was accomplished using fyke nets. The fish were transported in a pickup-mounted stainless steel tank. Condition factors were determined by the formula K = weight

divided by fork length^3 X 10^5. Population estimates were made using the standard Petersen formula: N = number of fish marked and released, multiplied by the number of fish examined for marks, divided by the number of marked recaptures.

Pond reared grayling stocked in 1977, were spray marked with powdered fluorescent pigment applied with a sandblast gun at 80-100 psi pressure. A 115v air compressor with storage tank was powered by a portable Homelite generator.

Sampling at Mile One Slough utilized a New Hampshire style fyke net with a 50' seine attached to one wing to block the slough.

Grayling greater than 180 mm fork length were tagged at Mile One Slough with Floy FD 67 tags.

FINDINGS

Monitoring of Arctic Grayling and Round Whitefish Stocks

Fish population sampling was conducted on the Delta Clearwater River from Mile 17 to the mouth on July 6 and 7, 1977. All Arctic grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas), stunned with an electrofishing boat were dipnetted during a single downstream run through each 1 mile section.

Table 1 compares the relative capture rates of grayling and whitefish in 1977 with like sampling in 1973, 1975 and 1976 (Pearse, 1974, 1976; Peckham, 1977). The total number of grayling captured was the highest and the number of whitefish was the lowest recorded in the four sample years.

The relative abundance of grayling and whitefish continues to show a trend of increasing abundance of grayling since grayling stock enhancement and whitefish removal efforts were initiated two years ago. The percent composition of grayling was 22.2% in 1977 compared to 17.3% in 1976, 14.0% in 1975 and 15.7% in 1973.

In addition to the 101 grayling captured, 129 grayling were observed but avoided capture due to deep water or quick recovery. Also noted was a dramatic increase in the number of small grayling (less than 200 mm) observed as compared to 1976. While small grayling are seldom captured with electrofishing gear, over 60 were seen while shocking in 1977 compared to only one in 1976.

The rate of capture of grayling and round whitefish is low when compared to boat shocking results in the Goodpaster River (Peckham, 1978). In the Delta Clearwater River the capture rate was 14 grayling/hour and 51 round whitefish/hour compared to 223 grayling/hour and 89 round whitefish/hour in the Goodpaster River. Depth of pools and clarity of the water in the Delta Clearwater are major factors contributing to the

Table 1. Relative capture rates per section for Arctic grayling and round whitefish during a single downstream pass with an electroshocker, Delta Clearwater River, 1973, 1975-1977

River Section	Grayling				Round Whitefish			
	6/27/73	7/2/75	6/30/76	7/6/77	5/18/73	7/2/75	6/30/76	7/6/77
17	25	36	9	5	48	142	2*	13
16	10	1	14	8	28	21	24	36
15	22	5	12	18	22	76	60	59
14	9	1	6	18	65	0	42	43
13	8	3	5	1	14	65	48	16
12	0	0	3	1	34	0	14	16
11	2	3	3	5	16	21	13	24
10	3	0	2	2	52	16	27	11
9	2	0	5	1	14	0	50	14
8	5	2	9	15	29	15	11	26
7	4	4	6	3	48	0	9	14
6	1	2	1	5	34	0	23	19
5	2	6	3	18	33	27	29	45
4	0	1	1	0	33	10	18	2
3	2	0	0	0	29	0	10	2
2	0	0	1	1	12	0	17	14
1	0	0	5	0	0	0	10	0
Totals	95	64	85	101	511	393	407	354
% comp. 1973	15.7				84.3			
% comp. 1975		14.0				86.0		
% comp. 1976			17.3				82.7	
% comp. 1977				22.2				77.8

* 296 round whitefish were captured by boat shocker and removed in sections 17 and 16 on May 6 and 7, 1976.

difference. Stream sections with the higher capture rates in the Delta Clearwater River have a greater frequency of riffle areas and a more confined channel.

The age frequency and length of 98 grayling from a total of 101 captured in the Delta Clearwater River are presented in Table 2. As in 1976, Age Class VI was predominant, comprising 26% of the total. Six age II grayling were collected compared to one in 1976. Five of the six age II grayling had circuli counts to the first annulus of 12 or more which suggest they originated from enhancement efforts through pond rearing and fingerling stocking in the Delta Clearwater.

The oldest grayling captured in 1977 was an age X fish 451 mm in length.

Length frequency comparisons for grayling sampled in the Delta Clearwater River since 1973 are presented in Table 3. Grayling in the smaller length classes represent a higher percentage of the total in 1977 than in any of the previous three study years. In 1977 grayling from 115-264 mm comprised 39% of the sample compared to 16% in 1976, 6% in 1975 and 29% in 1973.

Three additional spring-fed areas, the north fork of the Delta Clearwater River, Clearwater Lake outlet and the Richardson Clearwater River were sampled with an electrofishing boat to determine species and age composition and to establish baseline information for future sampling.

The north fork of the Delta Clearwater River is physically and chemically similar to the south fork, but has about one-fourth of the flow. In April, 1973, Pearse (1974) reported a flow of 80 cfs in the north fork.

On July 21 the entire north fork (a distance of 8 km or 5 miles) navigable with a jet riverboat was inspected. Only small rearing silver salmon, Oncorhynchus kisutch (Walbaum), were observed. The lower 4.8 km (3 miles) were subsequently electrofished, and three round whitefish (254-305 mm) were taken in the lower mile.

Clearwater Lake outlet is a deep channeled stream flowing a distance of about 2.4 km (1.5 miles) to the Tanana River. The channel is generally 3 to 4 m deep with only a 200 m section of riffle near the confluence with the Tanana River. While many round whitefish were observed, only 12 round whitefish and 4 grayling (174-275 mm) were captured on July 12. Most of the fish were collected where the clear and glacial waters mixed.

Observations and sampling were conducted on the Richardson Clearwater River on two occasions during 1977. On June 14 and 15, most of the spring tributaries entering the Richardson Clearwater River were visually inspected. Rearing silver salmon were numerous, but no grayling were observed.

Most of the main channel of the river was visually inspected to about Mile 9, the limit of access with a jet riverboat. Grayling and round whitefish were observed to the fork near Mile 7, but no fish were seen above that point.

Table 2. Age frequency and length of Arctic grayling captured in the Delta Clearwater River, July, 1977.

Age Class	Number	Length (mm) Range	Mean
II	6*	154-205	179
III	15	175-250	215
IV	19	222-334	256
V	13	253-325	276
VI	26	256-371	303
VII	16	292-384	333
VIII	1	370	
IX	1	400	
X	1	451	
	98	154-451	277

* Five of the six grayling had circuli counts of 12 or more.

Table 3. Length frequency of Arctic grayling electrofished in the Delta Clearwater River, 1973-1977.

Length Class (mm)	1973 %	1975 %	1976 %	1977 %
115-164	0	0	1	1
165-214	7	0	4	12
215-264	22	6	11	26
265-314	19	40	39	36
315-364	33	41	34	15
365-414	16	11	11	9
415-464	3	2	0	1
No. Fish	413	63	76	100

On August 30, the Richardson Clearwater River from the fork at Mile 7 was sampled with an electrofishing boat during a single downstream run.

A total of 104 grayling and 123 round whitefish was captured. The grayling had a length range of 182-416 mm with a mean of 291 mm. Age frequency and lengths of 100 grayling are presented in Table 4. As in the Delta Clearwater River Age Class VI was predominant, comprising 33% of the total. Grayling in each age class had slightly higher mean lengths in the Richardson Clearwater than in the Delta Clearwater River.

Only five grayling less than 215 mm in length were collected, showing a general lack of young age class recruitment, as was the case in the Delta Clearwater River prior to enhancement efforts.

The capture rate of grayling and round whitefish was 69 grayling/hour and 82 round whitefish/hour. As discussed earlier the capture rate for the Delta Clearwater River was 14 grayling/hour and 51 round whitefish/hour. The higher capture rate in the Richardson Clearwater River is believed to be primarily due to the physical difference in the stream. The greater frequency of riffle areas and a more confined channel made electrofishing much more effective in the Richardson Clearwater River.

Angler Harvest and Pressure

Angler harvest was monitored on the Delta Clearwater River from May 1 to September 6. During the period 307 anglers interviewed fished 596 hours and caught 331 grayling, for a catch success of 0.56 fish/hour. Most of the contacts represented incomplete trips and the average number of hours fished was 1.9. Twenty-three anglers contacted with completed trips fished an average of 4.4 hours. Monthly catch figures are shown in Table 5.

A sample of 139 grayling harvested ranged from 174-370 mm in length with a mean of 284 mm. Grayling in Age Class V were most frequently harvested, accounting for 33% of the total (Table 6). Five age II grayling were included in the creel sample in 1977, while none were recorded in 1976. Scales from each of the age II grayling had circuli counts of 13 or 14 to the first annulus, indicating that they are from the pond rearing enhancement program. Fishermen interviewed also reported catching and releasing small grayling (150-180 mm), although the number could not be accurately determined.

To determine total fishing pressure, angler counts were made during 9 weekdays (10%) and 15 weekend days and holidays (38%) from May 1 to September 6, then expanded to cover the entire 129 day period. Counts included three daily periods as follows: morning (7 a.m. - 12 noon), afternoon (12 noon - 6 p.m.) and evening (6 p.m. - 12 midnight).

Estimated total anglers for the period was 5,923. Of the total 3,016 (51%) were recorded on weekdays and 2,907 (49%) on weekends and holidays. Multiplying 5,923 anglers by 4.4 hours/angler (for completed trips) provides an estimated 26,061 angler hours. At a harvest rate of 0.56 fish/hour the calculated total grayling harvest for the period is 14,594 or 2.5 grayling/angler.

Table 4. Age frequency and length of Arctic grayling captured in the Richardson Clearwater River, August, 1977.

Age Class	Number	Length (mm) Range	Mean
II	2	182-208	195
III	15	198-254	228
IV	10	241-295	262
V	21	265-310	283
VI	33	243-366	310
VII	15	317-388	348
VIII	4	361-416	385
	100	182-416	291

Table 5. Creel census summary, Delta Clearwater River, 1977.

Month	Anglers Contacted	Angler* Hours	Grayling Caught	Catch/ Hour	Length (mm) Range	Mean
May	60	155	74	0.48	255-370	306
June	56	92	69	0.75	212-362	296
July	136	260	145	0.56	174-365	276
August	37	55	34	0.62	199-274	225
September	18	34	9	0.26	245-310	276
	307	596	331	0.56	174-370	284

* Includes both incompleted and completed trips. Twenty-three anglers with complete trips fished an average of 4.4 hours.

Table 6. Age frequency and length of sport harvested Arctic grayling, Delta Clearwater River, May 1-September 6, 1977.

Age Class	Number	Percent	Length (mm) Range	Mean
II	5	3	174-210	197
III	16	11	184-218	212
IV	33	24	234-286	267
V	46	33	222-365	294
VI	26	19	289-357	320
VII	12	9	282-356	338
VIII	1	1	370	
	139		174-370	284

Grayling Stock Enhancement

Assessment of Grayling Transplanted in 1975 and 1976:

Three spring tributaries of the Delta Clearwater River stocked with pond reared fingerling grayling in October 1975 and September 1976 were sampled with a backpack dc shocker during April and May 1977. An additional spring area (1A) located approximately one-fourth mile downstream from a stocked spring (1) was also sampled. Grayling from the 1976 plant were captured in each of the spring areas and grayling from the 1975 plant were collected in all but one (Table 7).

The 41 age I grayling had a mean length of 114 mm, a mean weight of 14.8 g and a mean circuli count of 14.2 to the first annulus. This compared to a mean length of 106 mm, a mean weight of 13.5 g and mean circuli count of 12.5 from 11 fish sampled from 7,900 pond reared grayling transplanted into the spring areas in September 1976.

Six age II grayling had a mean length of 155 mm, a mean weight of 41.2 g and a mean circuli count of 12.7 to the first annulus.

In addition to the fish collected in the four spring tributaries, approximately 150 more grayling (mostly age I) were observed in the spring areas or at their mouths.

Several non-stocked spring areas were also inspected and only rearing silver salmon were seen. Rearing silver salmon are abundant in all stocked and non-stocked spring tributaries.

No grayling were observed or collected in the north fork of the Delta Clearwater River although 4,200 pond reared grayling were planted in September, 1976. The size and flow make sampling difficult, however.

The high circuli count of grayling sampled in the spring areas appears to substantiate that the fish are from the transplanting of pond reared grayling. Circuli counts from a sample of 11 grayling stocked in the spring areas in September 1976 ranged from 12 to 14 and averaged 12.5. The 41 grayling sampled in April and May, 1977 from the spring areas had circuli counts ranging from 13 to 16 and averaging 14.2. Samples of larger grayling from the Delta Clearwater River in 1975 and 1976 revealed mean circuli counts of 8.7 (Pearse, 1976) and 8.8 (Peckham, 1977) to the first annulus.

Although larger grayling and whitefish are absent in the Delta Clearwater River during the winter months, it appears that some juvenile grayling overwinter in spring areas. Thirteen juvenile grayling were captured and another 40 were observed in one spring area on April 5, 1977. Larger grayling and whitefish typically enter the Delta Clearwater River from the Tanana River in mid to late April.

During fyke net sampling in late April and early May at Mile One Slough, which enters the lower Delta Clearwater, 436 grayling having fork lengths of 150 mm or less were captured. A total of 242 was recorded during a

Table 7. Summary of age length, weight and scale circuli counts from Arctic grayling sampled from spring areas of the Delta Clearwater River, April and May, 1977.

Location	Date	Number	Age	Length (mm)		Weight (g)		Circuli Counts	
				Range	Mean	Range	Mean	Range	Mean
Spring #1	4/5	12	I	103-113	110	11.2-16.5	14.0	13-15	13.9
		1	II	168		55.5		13	
Spring #1A	5/12	15*	I	104-120	112	13.0-20.0	15.2	13-14	13.6
		3	II	123-164	150	19.9-43.0	35.3	12-13	12.3
Spring #2	5/12	12	I	111-128	119	10.9-23.2	15.5	12-16	15.2
		2	II	150-162	156	38.9-47.0	42.9	12-14	13
Spring #3	5/12 & 5/16	2	I	112-125	119	10.5-15.4	12.9	14	14
Totals		41	I	103-128	114	10.5-23.2	14.8	13-16	14.2
		6	II	123-168	155	19.9-55.0	41.2	12-14	12.7

* One 76 mm grayling weighing 6.8 g and having 9 circuli was captured, but excluded from the table since it was probably not from stocking efforts.

similar period in 1976. Age, length, and circuli counts are presented in Table 8, for 125 grayling less than 200 mm in length sampled in 1977. Of 46 age I grayling, 35 (76%) had circuli counts of 11 or more and averaged 13.5. Of 70 age II grayling, 22 (31%) had circuli counts to the first annulus of 11 or more and averaged 13.3. Age II grayling with low circuli counts comprising 69% of the sample may be from a plant of 100,000 fry in spring areas in 1975.

Nine age III grayling having circuli counts to the first annulus of 10 or fewer and averaging 8.4 were sampled. Stocking of pond reared grayling was initiated in 1975, therefore age III grayling with high circuli counts would not be expected. None were present in the sample. The age III grayling could be from a plant of 100,000 fry stocked in the north fork of the Delta Clearwater in 1974.

Assessment of 1977 Pond Rearing:

Three small natural lakes ranging in size from 0.8 to 3.6 surface hectares (2.0-8.8 acres) and one larger lake (Big Lake, 32 hectares or 80 acres) were stocked with grayling fry in late June, 1977. Big Lake received 45,000 fry on June 21 and each of the smaller lakes were stocked with 25,000 fry on June 20.

Ft. Greely #1 is the smallest of the lakes stocked, but is the deepest with 4.6 m (15'). Growth for the July and August samples is much lower than for the other three lakes (Table 9). Factors contributing to the slower growth rate are probably the higher rate of stocking/acre and colder water temperatures. No fall removal of fingerling was attempted in this lake. If they overwinter successfully removal is planned for the fall of 1978.

Big Lake is the largest of the lakes stocked in 1977; however, maximum depth is only 2.7 m (9'). Although grayling in West Pond and Left O.P. Pond had greater length and weight in the July sample, fish in the August Pond sample from Big Lake were the largest recorded in any of the lakes. Five grayling sampled had a mean length of 103 mm and mean weight of 11.6 g after only two months of pond rearing. No fall removal of fingerlings was conducted.

West Pond (3.6 hectares or 8.8 acres) has been utilized as a rearing pond for three consecutive years. The size of fish in each of the monthly samples shown in Table 9 was similar to that recorded in 1975 and 1976 (Peckham, 1977). However, the condition factor at the time of removal in late September was less than recorded the previous two years (Table 10). The condition factor for grayling removed in 1977 was 0.97 compared to 1.08 in 1976 and 1.02 in 1975. The lower condition factor was probably a result of competition from grayling from the previous year class which avoided removal in 1976 and survived the winter (dissolved oxygen recorded on March 23, 1977 was 5 ppm, although the maximum depth of the pond is only 1.5 m or 5'). The competition also resulted in reduced survival of the 1977 fry plant. Only 1,200 fingerlings were removed in September, 1977 compared to 4,200 in 1976 and 3,700 in 1975. A total of 334 age I+ grayling averaging 126 g (3.6/lb) from the 1976 fry plant was captured and removed.

Table 8. Summary of age, length, weight and scale circuli counts to the first annulus from 125 Arctic grayling less than 200 mm in length sampled from Mile One Slough, April 22 to May 5, 1977.

Circuli Count 10 or fewer							Circuli Count 11 or more						
		Length (mm)		Weight (g)		Circuli			Range (mm)		Weight (g)		Circuli
No.	Age	Range	Mean	Range	Mean	Mean	No.	Age	Range	Mean	Range	Mean	Mean
11	I	80-95	88	5.1-8.9	6.9	8.9	35	I	92-137	117	7.8-17.2	13.3	13.5
48	II	119-179	146	13.4-32	20.4	9.2	22	II	124-193	158			13.3
9	III	160-194	182			8.4	0						

Table 9. Mean fork lengths, weights and condition factors of pond reared Arctic grayling*, 1977.

Pond	Sample Date	N	Mean Length (mm)	Mean Weight (g)	Condition Factor**	Water Temp. (°C)
Ft. Greely #1	7/22	11	46	1.0	1.02	15.0
	8/24	7	67	2.9	0.96	15.0
Big Lake	7/22	5	54	1.7	1.07	19.5
	8/24	5	103	11.6	1.06	19.0
West Pond	7/22	9	63	2.6	1.03	17.0
	8/24	6	94	8.6	1.03	18.5
	9/28	10	107	11.9	0.97	5.0
Left O.P.	8/22	11	67	3.3	1.09	18.5
	8/26	10	97	9.1	0.99	16.0
	9/28	10	110	12.0	0.90	5.0

* Big Lake was stocked with 45,000 grayling fry on June 21, 1977. Each of the other lakes were stocked with 25,000 grayling fry on June 20, 1977.

** Condition factor = $K = \frac{\text{Weight}}{\text{Length}^3 \times 10^5}$

Table 10. Summary of estimated stocking survival* and removal of Arctic grayling from two rearing ponds, 1975-1977.

	Date	Age	Population Estimate	Estimated Percent Survival	Number Removed	Estimated Percent Removed	Fish/ lb	Condition Factor
Left O.P.	10/2/75	0	5,441	22	5,400	99	32	1.10
	9/22/76	0	8,385	34	7,900	94	36	1.13
	9/28/77	0	5,484	22	5,463	99	38	0.90
	9/28/77	I			37		3.6	
West Pond	10/2/75	0			3,700		33	1.02
	9/21/76	0	4,385	18	4,200	95	54	1.08
	9/28/77	0	795	5	1,200	100	38	0.97
	9/28/77	I	339		334	99	3.6	

* 25,000 grayling fry were stocked in each of the ponds in late June of each year.

Prior to the 1977 removal, 162 age 0+ and 145 age I+ grayling were captured with a fyke net, fin clipped and returned to the lake. During removal in the following 4 days, 545 age 0+ grayling were examined, of which 111 were marked recaptures. The Petersen population estimate of 795 is smaller than the actual removal of 1,200 fish. Examination of 271 age I+ grayling revealed 116 marked recaptures, which provides a Petersen estimate of 339. Actual removal was 334.

Left O.P. Pond (1.5 hectares or 3.6 acres) has also been utilized as a rearing pond for three consecutive years. Like West Pond, the grayling had a lower condition factor when removed in late September than recorded the previous two years. The lower condition factor was again probably a result of competition from age I+ grayling that avoided removal in 1976 and survived the winter (dissolved oxygen recorded on March 23, 1977 was 1.8 ppm and maximum depth is 3 m or 10'). Furthermore, the lake level in 1977 was about 0.5 m lower than in 1976, which reduced available habitat by about 20% by isolating a portion of the lake.

Despite the competition and reduced habitat a calculated total of 5,463 grayling averaging 12 g (38/lb) was removed with fyke nets during late September. Although less than the 7,900 removed in 1976, the number was essentially the same as removed the first year the lake was utilized for rearing in 1975. Estimated percent removal was 99% both years.

Prior to removal, 128 age 0+ grayling were captured by seine, fin clipped and returned to the lake. A sample of 1,071 fish examined from the total removal revealed 25 marked recaptures. This provides a Petersen population estimate of 5,484 or 22% survival from 25,000 fry stocked in June 1977. Removal by fyke nets was estimated to be 99% effective, with most of the fish captured in 2 days and nights.

An additional 37 age I+ grayling were removed with fyke nets.

Prior to transplanting all 6,663 age 0+ and 371 age I+ grayling were spray marked with fluorescent pigment. All age I+ grayling stocked were also marked with adipose fin clips.

The grayling were transported by riverboat and stocked in five spring areas of the Delta Clearwater River located in river sections 6-9. Water temperature in the spring areas was 3°C while the temperature of the rearing ponds was 5°C.

Round Whitefish Investigations

A continuing effort to monitor early spring fish movement into the Delta Clearwater River and to determine the feasibility of round whitefish removal was conducted in 1977. Estimates by Pearse (1974) indicated that round whitefish are six times more plentiful than grayling in the Delta Clearwater River.

As in the previous two years, a fyke net was fished at Mile One Slough. This slough is a side channel of the Tanana River that enters the Delta Clearwater River at Mile One. It is fed by spring upwelling during the

months that the Tanana River is non-glacial. In April, many of the fish entering the Delta Clearwater River from the Tanana River move into Mile One Slough prior to further upstream movement, probably because the slough is typically several degrees warmer during that period.

Round whitefish were first observed in the Delta Clearwater River on April 11, when five were counted. Significant numbers were not observed until April 18, when 180 were counted between miles 1 and 8. A summary of fish captured with a fyke net and electrofishing boat from April 21 to May 5 is presented in Table 11.

The total catch of round whitefish greater than 150 mm in length during the two week period was 1,287. A total of 486 was taken in a fyke net at the mouth of Mile One Slough, while 801 were captured in Mile One Slough and the first mile section of the Delta Clearwater River below the slough with an electrofishing boat.

In addition to this removal, the 354 round whitefish captured during the index sampling in July with the electrofishing boat were also removed, bringing the total removal for 1977 to 1,641.

In comparison 380 round whitefish greater than 150 mm in length were captured by fyke net in a two week period in 1976, while 1,200 were captured in two days in 1975.

Water temperature in the slough ranged from 4° to 8°C in 1977 while the Delta Clearwater River during the same period ranged from 3° to 5°C. The maximum temperature difference recorded was 3°C.

Sampling of the entire Delta Clearwater River with an electrofishing boat in July, as described earlier and summarized in Table 1, shows a continuing decline in the percentage of round whitefish. Round whitefish comprised 86.0%, 82.7% and 77.8% of the sample in 1975, 1976 and 1977, respectively.

Arctic Grayling Marking

During the sampling at Mile One Slough from April 21 to May 5 a total of 1,292 grayling was captured. Of this number 1,181 were caught in fyke nets and 111 were collected by electrofishing. As shown in Table 11, 856 were greater than 150 mm fork length and 436 were less than 150 mm. This compares to 401 grayling captured during a comparable period in 1976, of which 159 were 150 mm fork length or greater and 242 were less than 150 mm.

All grayling captured during the work at Mile One Slough in 1977 were marked. Grayling larger than 180 mm in length, totaling 578 fish were tagged with Floy FD 67 tags, while 714 grayling less than 180 mm in length were given a left pelvic fin clip. All were released into the Delta Clearwater River above Mile One Slough.

Length frequency of the 578 grayling tagged is presented in Table 12.

Table 11. Summary of fish* captured at Mile One Slough April 21-May 5, 1977.

Date	RWF <150 mm	RWF >150 mm	GR <150 mm	GR >150 mm	SS	Other Fish
4/21	3	13(50)**	33	13	96	3 LCI, 5 BB, 2 S, 3 SSC
4/22	3	7(86)	50	14	74	3 LCI, 2 BB, 2 SSC
4/25	0	(106)		(27)		
4/26	17	60(317)	102	175(31)	85	1 BB, 1 SSC, 1 HWF
4/27	22	295(69)	220	224	20	2 BB, 1 HWF
4/28	0	104(104)		248(47)	154	
4/29	1	7		52	100	2 SSC, 1 HWF
5/4		(69)		(6)		
5/5	6		31	19	152	1 BB
Totals	52	486(801)	436	745(111)	681	

* Fish Species
RWF - round whitefish, Coregonus cylindraceum (Pallas)
GR - grayling, Thymallus arcticus (Pallas)
SS - silver salmon, Oncorhynchus kisutch (Walbaum)
LCI - least cisco, Coregonus sardinella (Valenciennes)
SSC - slimy sculpin, Cottus cognatus Richardson
HWF - humpback whitefish, Coregonus pidschian (Gmelin)
BB - burbot, Lota lota (Linnaeus)
S - sucker, Catostomus catostomus (Forster)

** Numbers in parentheses indicate fish captured with electrofishing boat.

Table 12. Length frequency of 578 Arctic grayling greater than 180 mm in length captured at One Mile Slough and tagged with Floy FD 67 tags, April 21-May 5, 1977.

Length Class (mm)*	Number	Percent
180-214	190	33
215-264	320	55
265-314	65	11
315-364	3	1
	578	

* The table does not include 714 grayling less than 180 mm that were fin clipped.

A much higher percentage of smaller size and younger age classes is represented in grayling sampled in Mile One Slough than was collected in the Delta Clearwater River during a single downstream run with an electrofishing boat in July. Grayling smaller than 264 mm comprised 39% of the July electrofishing sample while the sampling at Mile One Slough, mostly by fyke net, resulted in 95% of the fish collected being under 264 mm.

Age composition of a sample of 97 grayling greater than 180 mm from Mile One Slough is as follows: age II (1%), age III (61%), age IV (19%), age V (13%), age VI (5%) and age VII (1%).

Of grayling greater than 180 mm in this sample, 61% were Age Class III. This year class strength may be a result of 100,000 grayling fry stocked in the north fork Delta Clearwater River and 150,000 grayling fry stocked in Clearwater Lake in 1974.

Tag Returns:

A total of 28 tag returns (4.8%) was reported from anglers during the four months following tagging. Eight tagged fish were caught in May, six in June, eight in July and six in August. Twenty-one (75%) were caught further upstream in the Delta Clearwater River while 5 were caught downstream in the Clearwater Lake outlet. One grayling caught in June in Dry Creek had traveled up the Tanana River a distance of approximately 60 miles, while another caught in August in Shaw Creek had traveled downstream about 35 miles.

DISCUSSION

Population Analysis

The primary purpose of the current study is to monitor population levels of Arctic grayling and round whitefish to reveal trends and for use in evaluating grayling enhancement efforts. As reported in past studies, little grayling and whitefish reproduction occurs in this spring-fed system. Sampling results and observations in recent years have revealed few grayling in age classes below age IV.

Sampling of fish in the Delta Clearwater River and spring tributaries along with sport fish harvest during 1977 is showing an increasing number of age I, II and III grayling in the population structure. Scale analysis shows a significant contribution to year class strength from stocking of pond reared grayling. Low circuli counts on age II and III grayling correspond with years when grayling fry were stocked suggesting contribution from these plants.

Index area sampling shows an increase in relative abundance of grayling in three consecutive years since grayling enhancement and round whitefish removal was initiated.

Grayling Stock Enhancement

The practice of utilizing small natural lakes for grayling rearing has provided about 28,000 fingerling over the past 3 years for stocking in the Delta Clearwater River. Stocked as fry in late June and removed as fingerlings after approximately 3 months of pond rearing, the fish exceed the back calculated length at age I of grayling found in the Delta Clearwater River prior to stocking efforts.

Grayling pond reared for two summers before removal averaged 3.6 fish/lb. This alternative would allow the stocking of fish that could immediately enter the sport fishery.

Round Whitefish Investigations

According to population estimates made in 1973, round whitefish are six times more plentiful than grayling in the Delta Clearwater River. Sport utilization is minimal and efforts to develop a sport fishery have been unsuccessful.

The goal of grayling enhancement through stocking of pond reared grayling is believed to have greater potential for success if combined with a reduction in whitefish numbers to lessen competition for food and space. Over the past 3 years about 3,500 whitefish have been removed. Index sampling for the period shows a continuing decline in the relative abundance of round whitefish. Continued reduction while monitoring spring movement of fish into the Delta Clearwater River would be desirable.

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