

STATE OF ALASKA

William A. Egan, Governor



Annual Progress Report for

DISTRIBUTION, ABUNDANCE AND NATURAL
HISTORY OF THE ARCTIC GRAYLING IN
THE TANANA RIVER DRAINAGE

by

Stephen L. Tack

ALASKA DEPARTMENT OF FISH AND GAME

Wallace H. Noerenberg, Commissioner

DIVISION OF SPORT FISH

Rupert E. Andrews, Director

Howard E. Metsker, Coordinator

Objectives

1. To obtain information on the spawning behavior of the Arctic grayling in the Chena, Mineral Lake outlet, and other systems known to contain spawning populations.
2. To obtain fecundity, feeding, and mortality information on fish near and on the spawning grounds.

Spawning Observations at Mineral Lake Outlet

Spawning activity began May 18 in Mineral Lake outlet located about 40 miles south of Tok. Spawning began on the same day at this location in 1969 (Roguski and Tack, 1970). Water temperature reached 45°F (7.2°C) and was clearer than on the two preceding days. The water temperatures on May 16 and 17 reached 43° and 44°F (6.1° and 6.7°C), respectively.

Many mature and immature grayling were caught on hook and line during the two days preceding the onset of spawning. Some of the mature fish taken were running sex products freely. Since ripe fish were present for at least two days before spawning began, spawning behavior apparently started in response to a cue. Three cues are suggested: (1) the date was almost the same in 1969 and 1970. This suggests day length was a cue. (2) There may be a threshold temperature. (3) The clearing of the water following spring run-off may be a significant cue.

Sixty-nine grayling ranging in age from 2 - 9 years, were caught on hook and line on May 16 to 18 (Table 6). The male-to-female sex ratio was 1:1.2.

A small percent of both males and females mature at 4 years. Most females are mature at 5 years. All grayling 6 years old or having reached a length of 270 mm were mature. Only three of the 69 fish (all females) matured before reaching a length of 270 mm.

Ovaries were collected from five of the ripe females. The number of eggs per ovary was determined volumetrically and ranged from 4,208 - 7,363 (Table 7). A 371 mm female had an ovary volume of 98 ml. The fecundity as well as egg size seem to increase with the size of the fish.

TABLE 6 Length and Maturity of 69 Grayling Caught on Hook and Line, Mineral Lake Outlet Spawning Grounds, May, 1970.

Age Group	No. in Sample	Length (mm)		Sex	No. Mature
		Range	Mean		
II	2	144 - 179	162	1 ♀ 1 ♂	0 0
III	11	177 - 202	192	5 ♀ 6 ♂	0 0
IV	32	199 - 279	226	15 ♀ 17 ♂	1 2
V	11	248 - 299	269	5 ♀ 6 ♂	4 3
VI	5	278 - 359	309	3 ♀ 2 ♂	3 2
VII	6	324 - 358	341	1 ♀ 5 ♂	1 5
VIII	1	---	363	1 ♂	1
IX	1	---	371	1 ♀	1

TABLE 7 Fecundity Counts on Mineral Lake Grayling, 1970.

Fork Length (mm)	No. Eggs Per ml	Total Vol. of Ovary	Total No. of Eggs
248	155	47.5 ml	7,363
257	155	29.0 ml	4,495
278	187	22.5 ml	4,208
282	146	47.0 ml	6,862
324	124	58.5 ml	7,254

Observations of spawning behavior and physical parameters of the spawning grounds were made over a one-mile stretch of stream immediately below Mineral Lake. Males, judged to be mature by their size and color, took up territories in riffles which they defended against all other males and immature grayling. Females remained in deep pools and only entered the riffles for two- to three-minute periods during which they were usually courted by more than one male, but usually completed only a single spawning act. On several occasions, a female completed two acts and on one occasion a female spawned four times before leaving the riffle.

The spawning act is intense. When a female comes into the riffle, males from territories near her erect their dorsal fins and move laterally toward her. The female may pass up several males before responding to a male display. A female responds by erecting her dorsal fin and moving laterally toward the displaying male. The undulations intensify as the fish come closer. As their bodies come in contact, the undulations become more intense, the male leans toward the female so his dorsal fin covers her back, and the male's caudal peduncle crosses over that of the female. The force of the male's caudal fin, working now in a vertical direction because of his body tilt and slight axial twist, drives the posterior portion of the female's body down into the gravel. After a spawning act the posterior third of the female's body is usually buried in the gravel. About half way through the spawning act, the female opens her mouth widely, displaying the dark slash on her throat. The male also gapes, starting a second or two after the female.

It was common for males from nearby territories to move within a foot or two of a spawning pair and undulate as if spawning, but less intensely. On one occasion, two males spawned with a female simultaneously. Eleven spawning acts averaged 13 seconds in duration (range, 9 - 18 seconds).

The male territory is of particular interest because in it are to be found the conditions sought by grayling for spawning.

Measurements were made on 22 territories, 8 of which were in the same riffle. All territories observed were generally oval, 6 - 8 feet wide, and 8 - 10 feet long. No territories were observed with common borders. Often a gravel bar lay between territories. The bottom topography appeared important in determining location and distribution of territories. All territories were over bottoms of pea size gravel. The average depth of 22 territories was 1.0 foot (range, 0.6 - 2.4 feet) and the average water velocity was 2.6 fps (range, 1.1 - 4.8 fps).

Spawning, Early Growth, and Distribution in the Chena River

On May 14, two ripe females were taken near Pike's Landing in the lower Chena. The water temperature was 44°F (6.7°C). A sample of 123 grayling were captured on May 21 and 22 between mile 60 and mile 70 in the Chena River. All mature females were spawned out and retained 2 - 10 eggs. The water temperature was again 44°F.

The first grayling fry were found on June 18, at river mile 28 and averaged 19 mm in length. Subsequent fry samples are recorded in Table 8. A large difference in growth rate is evident among the samples and within some samples. Fry from the Little Chena show widely varying growth rates. It is not apparent from these samples that fry grew faster in one portion of the river than in another. The differences could be attributed to several factors, including different spawning times, strong competition for food at this stage, water temperature, or egg size.

TABLE 8 Date, Location, and Composition of Grayling Fry Samples, Chena River System, 1970.

Date	Location (River Mi.)	No. in Sample	Length (mm)		No. of Circuli* on Scales
			Range	Mean	
6/18	28	11	16 - 20	19.0	No scales
7/17	11	1	---	39.0	Focus only
7/27	In Little Chena River	5	27 - 51	34.0	No scales to 4
8/ 5	In Little Chena River	9	31 - 75	57.4	No scales to 7
8/ 5	108	1	---	48.0	2
8/ 8	24	4	35 - 38	36.0	Focus only
8/16	In East Fork	11	37 - 53	43.7	Focus only to 4

*Does not include margin.

The development of scales during the first summer is shown in Table 9. A close relationship exists between length and circuli formation. The smallest specimen on which scales were found was 35 mm long.

TABLE 9 Length at Various Stages of Early Scale Development, Chena River Grayling, 1970.

No. of Circuli*	No. in Sample	Length (mm)	
		Range	Mean
No scales	16	16 - 31	22.0
Focus only	6	35 - 38	36.5
1	3	40 - 44	42.0
2	6	41 - 48	44.5
3	2	46 - 50	48.0
4	2	51 - 53	52.0
5	4	61 - 67	63.5
6	1	---	70.0
7	1	---	75.0

*Does not include margin.

Fry seem to be distributed throughout the lower Chena and up into the East Fork. However, systematic seining during a float trip from mile 113 to mile 92 on August 3, revealed no grayling in this area. This indicates they may have drifted downstream by this time.

