

SPAWNING HABITS OF GRAYLING IN INTERIOR ALASKA *

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ABSTRACT

Grayling enter the inlets of Fielding Lake and spawn as the ice begins to melt in the spring. Spawning occurs in moving water over a gravel bottom. There appears to be some spawning in the lake at the mouth of the inlet studied. Water temperatures, composition of spawning run, and actual spawning are discussed. Fecundity is expressed as a function of fork length of fish.

INTRODUCTION

Studies of the spawning habits of grayling by the Dingell-Johnson branch of the Fish and Wildlife Service were begun by Frank Wojcik at Fielding Lake in the spring of 1954 and were continued through the summer of 1955 by the present author. The objective of this work was to obtain a better understanding of the physical environment of spawning grayling and collect information on the actual spawning.

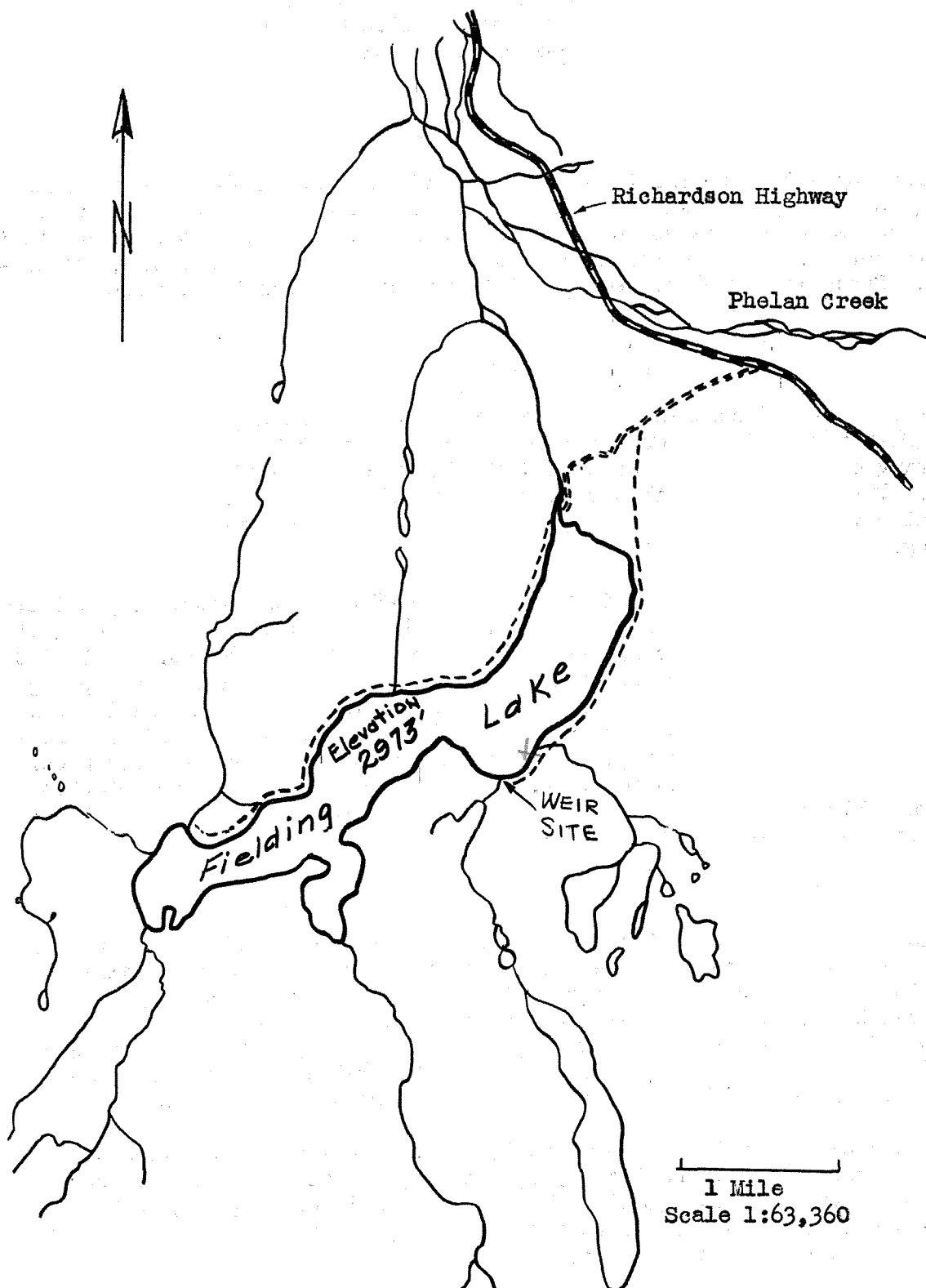
Fielding Lake is located just west of the Richardson Highway approximately 160 miles south of Fairbanks. It is a mountain lake at an elevation of just under 3,000 feet with a surface area of approximately 1400 acres. It is fed by several mountain streams which flow considerable water during the spring snow melt, but carry little water in the summer. The lake is normally frozen over from the end of October to the first of June. The species of fish known to be present include grayling, whitefish, lake trout, burbot and sculpins. Although grayling are known to ascend at least two of the lake tributaries to spawn, this study was confined to the second tributary above the outlet on the south-east side of the lake. (Figure 1)

Spawning Stream

The inlet studied is approximately 1-2/3 miles long and drains another small lake known to contain lake trout and grayling. This stream falls about 300 feet in its length, with most of the drop in the lower 3/4 mile. The stream bed in this lower section is composed of rock and gravel. On June 30, 1955, this stream was flowing a volume of 20.3 cubic feet per second. By this date, most of the ice and snow had melted and the flow was much lower than it had been during the previous weeks of break-up.

In the period of ice and snow melt, the daily fluctuations in water level were quite large. During daylight hours, the air temperatures were considerably above freezing and much snow would melt causing high water. The night temperatures dropped to below freezing and the water level would fall to a fraction of the daily high.

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Map of Fielding Lake area, taken from U.S.G.S. Mt. Hayes (A-4) Quadrangle map.

PROCEDURE

In the spring of both 1954 and 1955, an observation station was set up at the inlet. Both years, a weir was operated near the mouth of the inlet to obtain data on migration and composition of the spawning run. In 1954, the weir was constructed May 24 and operated until June 12. In 1955, the weir was constructed May 20 and was in operation until July 5. Because of the violent nature of this stream during break-up, the weirs operated both years were functional only intermittently. In 1955, considerable difficulty was encountered until June 16, after which, the water fluctuations and ice flow were not severe enough to prohibit continuous weir operation.

Afternoon water temperatures as well as a daily maximum and minimum were taken of the inlet from May 27 through the spawning period in 1955. Also, pH of the stream was recorded every three days.

Upstream Migration

The spawning migration of grayling from Fielding Lake into its inlets begins in the spring shortly after open water appears at the stream mouths. In 1955, a pool of water was ice free May 19 at the mouth of the inlet studied. Grayling were first observed in this pool on June 5 when five were taken in a set gill net. The following day the first fish were observed entering the stream. Grayling continued to migrate into the stream for the following two weeks with the peak of migration occurring about June 16.

In 1954, an earlier opening of this inlet brought an earlier spawning migration of grayling. This year the migration began about May 15 and continued until June 6. Thus, in 1954, grayling entered the stream at least two weeks earlier than in 1955.

The afternoon water temperatures and the daily maximum had begun to rise by the time grayling entered the stream in 1955. On June 5, the afternoon water temperature was 33°F. and June 6 it was two degrees higher. Also, the pH of the water had increased from 6.5 on May 21 to 6.8 on June 5.

In 1955, most of the grayling migration occurred at night between the hours of 8:00 p.m. and 4:00 a.m.

Spawning

In 1955, spawning was first observed June 18, which was fifteen days later than the first observed spawning in 1954. Both years it continued for about five days.

Both years, spawning occurred while much of the stream was covered with ice and snow. In 1955, approximately 200 yards of the stream just above its mouth was open and above this, open water occurred as large holes in rotting ice and melting snow.

Actual spawning was observed in several spots in the stream in 1954 and 1955. The following is a description of an instance observed June 19, 1955, between 1:20 p.m. and 1:55 p.m. This is believed to be typical of observations made.

The spawning site chosen was a pool of open water a little over fifty feet long and fifteen to twenty feet wide located about a quarter of a mile above the mouth of the stream. At either end, the pool was covered by ice and six to eight feet of snow. Almost everywhere the banks of the stream were covered by overhanging snow so the actual width of the stream was unknown. The water depth varied up to two feet in this open section with gravel bars covered with approximately six inches of water chosen as preferred spawning sites. The gravel in the spawning areas was predominantly quite fine--composed of rocks from $\frac{1}{4}$ to $\frac{3}{4}$ inches in diameter. The surface current velocity was checked at the time of spawning and found to be 3.9 feet per second. The water temperature was 42°F.

Aggressive males established "territorial rights" and each defended his area against intruding males. Females spent most of their time in quiet water or under the snow banks. Spawning occurred when a female left a resting spot and entered an area occupied by an aggressive male. At this time, the two fish pressed against each other side-by-side and vibrated quite violently. This period of vibration which is the period of egg deposition normally lasted from five to ten seconds. During this time, frequently an "outside" male rushed into the area and pressed against the spawning fish--presumably also spawning. After each period of egg deposition, the female would return to her resting spot and the "outside" male would depart, leaving the aggressive male in his own territory. This activity was observed three times in thirty-five minutes involving the same female and the same aggressive male. After this had been observed three times in the same spot, the gravel was dug up and found to contain over 200 grayling eggs.

There was no indication of spawning fish digging redds in the gravel and there was no attempt made to cover the spawn. The eggs were not found to adhere to rocks in the stream bed. They seemed to be slightly heavier than the water and settled among the rocks.

On the afternoon of June 18, 1955, which was the first day spawning was observed, a wire basket made of fine screen and with an opening two feet square was placed in various spots in the lower section of the stream to detect grayling eggs being washed downstream by the current. In this operation, spots were selected where the water was less than one foot deep. In no instance was this net fished in the immediate vicinity of spawning fish. This basket was fished four times for periods of two minutes and the number of grayling eggs captured each time recorded. The maximum catch for two minutes was fourteen eggs and the minimum catch was four eggs.

During this period, data were collected which would point to a certain amount of spawning in the lake at the mouth of the inlet. On June 18, 1955, a 60 foot beach seine haul in the lake at the mouth of the inlet yielded many grayling in various stages of spawning. Also in this seine haul were many whitefish. Stomach analyses of the whitefish disclosed the presence of grayling eggs. At no time were whitefish taken at the weir or observed in the stream.

A gill net was fished along the shore of the lake in a spring fed area shown by "X" in Figure 1, to ascertain if spawning grayling were present in this area. This net was fished before and during the time spawning occurred in the inlet. Only immature grayling and whitefish were taken in this net.

Downstream Migration

The downstream migration was first observed in 1955 on June 20, which was two weeks later than in 1954. In 1955, observations were continued for two weeks after the downstream migration began. During this period many fish returned to the lake, but at the end of the period, many remained in the stream. A size and age composition was obtained from a sample of 173 of the downstream migrants and is believed to be representative of the run. The per cent composition by size for 1954 and 1955 is given in Figures 2 and 3. The per cent composition by age is given for both years in Figure 4.

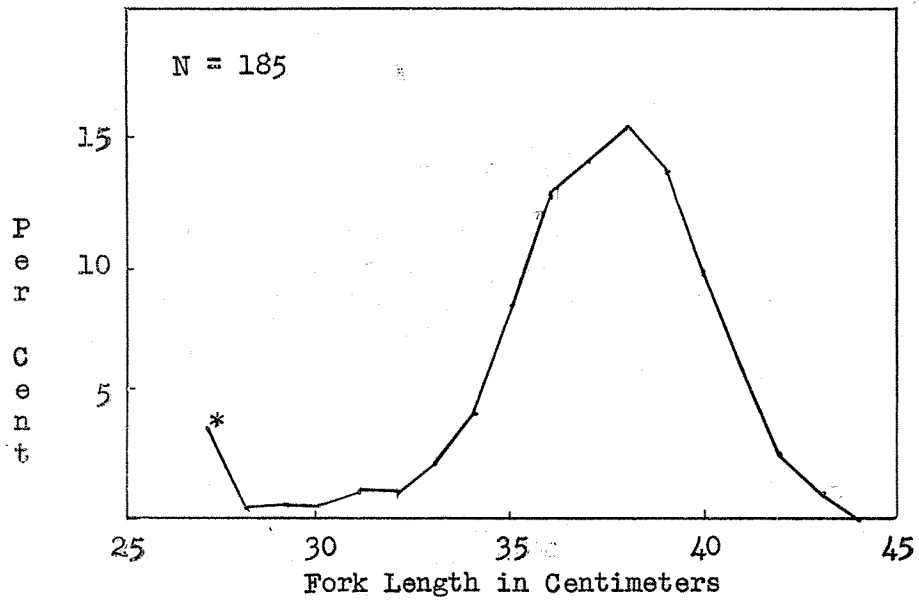
Fecundity

In 1955, ovaries were collected from eleven female grayling and used to calculate fecundity. In this work, the ovaries were collected, preserved in formalin, and later dried for egg counting. The actual calculations were made by weighing several samples of 100 eggs from each fish and weighing the complete ovaries of each fish. From this, the total number of eggs produced by individual fish was calculated. The fecundity is expressed as a function of fork length in Figure 5. Using the formula $N=FL^x$, a line was fitted to the points by the method of least squares. Solving the equation for F and x, it was found that the Number of Eggs produced = $0.0030 \times \text{Fork Length to the } 4.0224 \text{ power}$.

Tagging

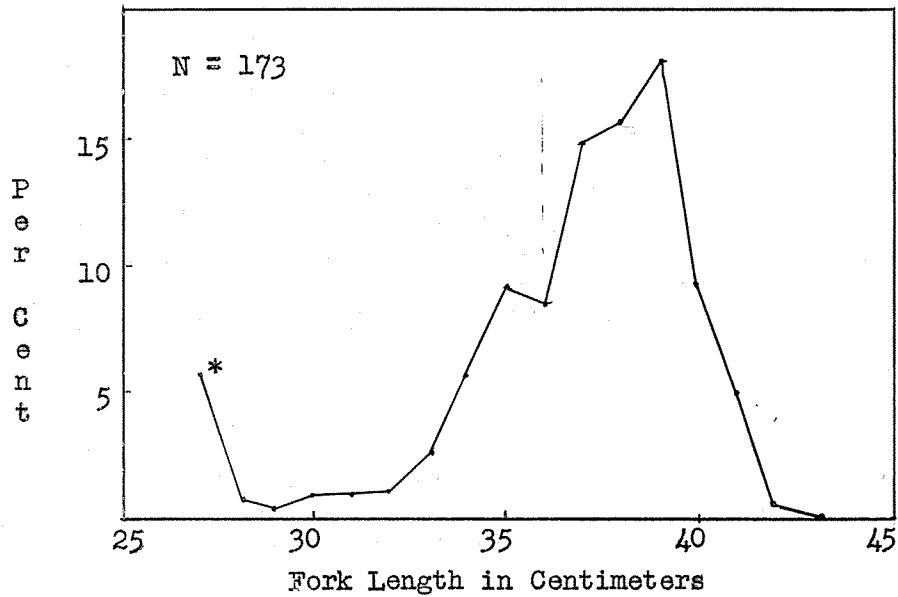
In 1954, 344 grayling in the spawning run into this inlet were captured, tagged, and released to trace migration. In this work a white, plastic, oval shaped, flutter tag measuring 9/16 inch by 1/4 inch was attached with cadmium wire through the flesh posterior of the dorsal fin.

Thirty of these fish were recaptured by anglers in 1954 leaving 314 believed to be at large in the spring of 1955. Sixty-eight of these were taken and released in the upstream migration in 1955. Fifty were



*All fish with fork length 27 cm. or smaller grouped in this class.

Fig. 2. Size composition of 1954 Fielding Lake Spawning run.



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Fig. 3. Size composition of 1955 Fielding Lake spawning run.

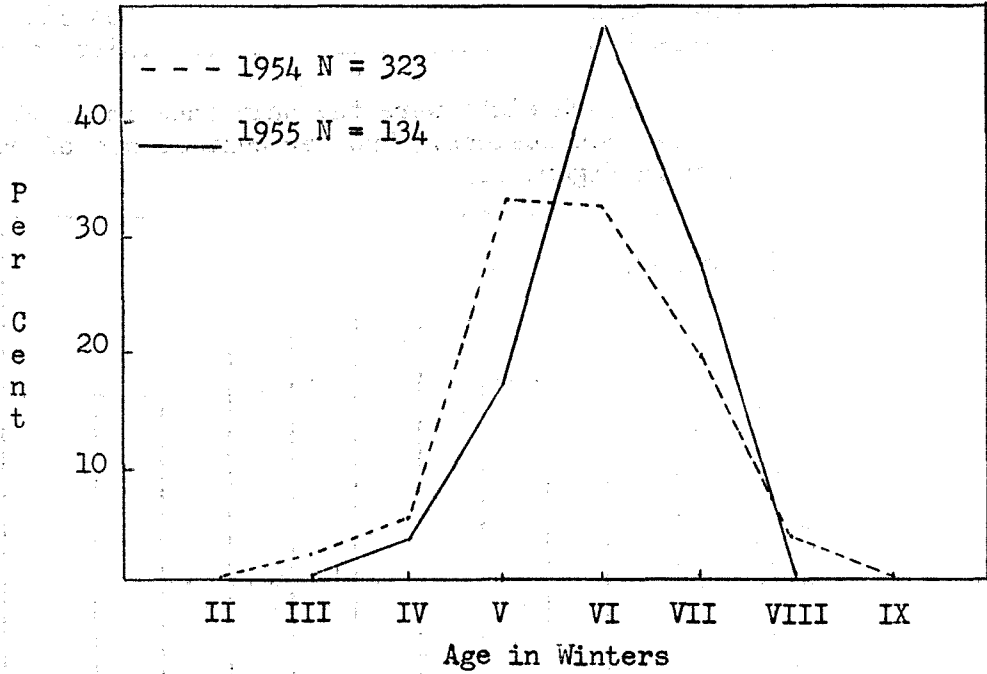


Fig. 4. Age composition of Fielding Lake grayling spawning run, 1954 and 1955.

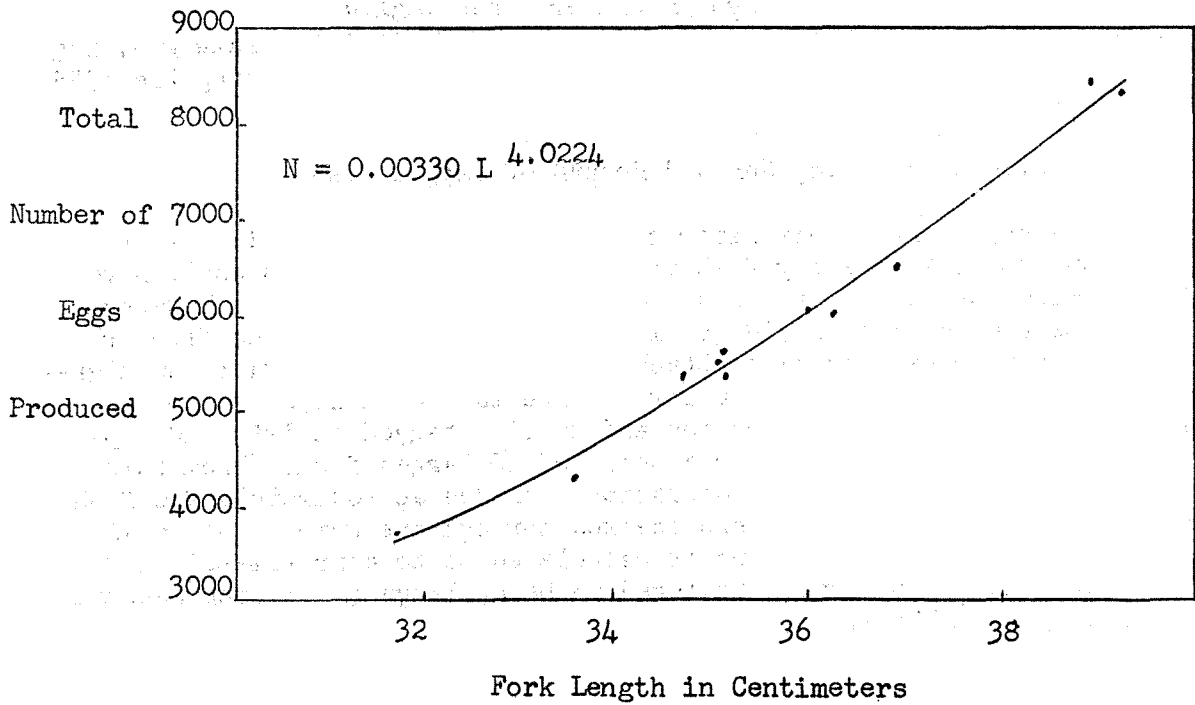


Fig. 5. Egg production of Fielding Lake grayling, 1955.

recaptured in the downstream migration including twenty previously taken in the upstream migration and thirty new recaptures. Thus 31.2 per cent of the tagged fish were known to have returned to the inlet to spawn.

Age classes four through eight were the only ones in which enough fish were tagged to draw conclusions. The per cent return of each age class tagged is shown in Figure 6.

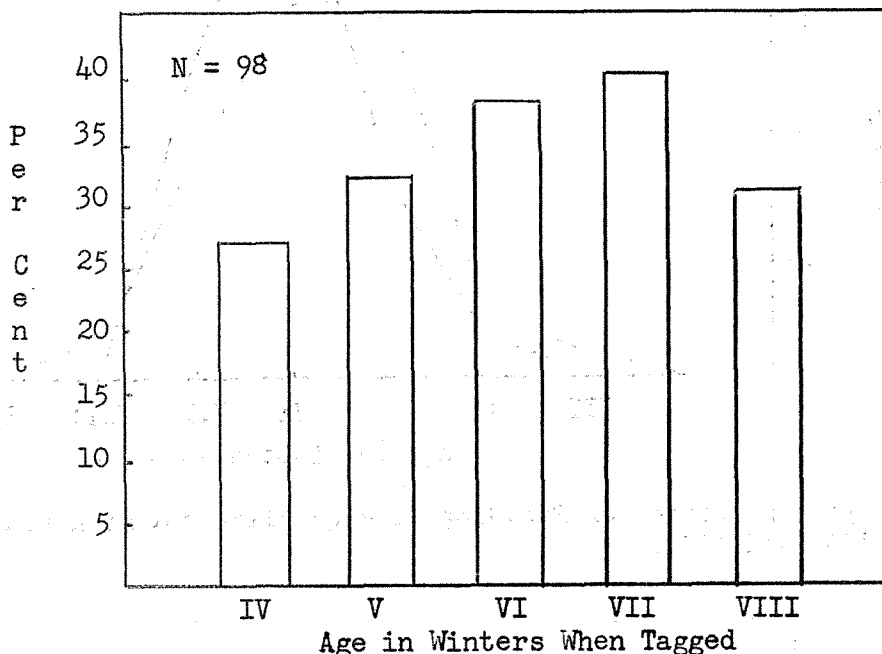


Fig. 6. Per cent tag return of each age class of Fielding Lake grayling tagged during the 1954 spawning run--recaptured during the 1955 spawning run.

Estimated Size of Spawning Run and Return of Tagged Fish

It is unfortunate that water conditions prevented the 1955 weir operation from taking every fish in the spawning run. This would have given a much more complete picture of return of tagged fish. However on the upstream migration 368 grayling were taken of which 68 fish or 18 per cent were bearing tags attached in 1954. In the downstream migration, 273 fish were taken including 30 fish tagged in 1954 and not captured on the upstream migration and 20 fish tagged in 1954 and captured on upstream migration for a total of 50 tagged fish. From this it is calculated the upstream migration included approximately 920 fish of which 530 or 58 per cent were checked through the weir. The total number of tagged fish returning is calculated to be approximately 170 or 54 per cent of the number believed to be at large (including natural and tagging mortality).

CONCLUSIONS

As soon as the water temperatures of the inlets of Fielding Lake begin to rise in the spring, the grayling start their spawning migration. This migration is to a large extent while much of the stream is covered by ice and snow.

Spawning occurs when the maximum daily water temperatures reach approximately 40°F. During this period, the stream is still slightly acidic but becoming more neutral.

Spawning takes place on shallow gravel bars at a high stage of water. It was observed in 1955 that many of these bars were dry when the water level dropped a few days after spawning. Doubtless, some egg mortality resulted.

Although grayling eggs have a slightly higher specific gravity than the water, many were being carried downstream by the current during the 1955 spawning.

It appeared in 1955 that grayling were spawning in the lake at the mouth of the inlet. This may be normal; it may have been caused by a late break-up in the tributary stream; or it may have been caused by the weir blocking the upstream migration. No grayling were found to be spawning in the spring-fed area of the lake shore.

A downstream migration into the lake begins as soon as the fish have spawned. Not all fish migrate downstream immediately after spawning.

Fecundity appears to have a direct relationship to length of the fish. The number of fish examined in this study was perhaps too few to give much significance to the line fitted to the points.

There seems to be a very definite tendency for grayling to return to the same spawning stream year after year.

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