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cc: Dr. Leonard
Dr. Shetter
Education-Game

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ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

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FISH MOVEMENTS IN TRIBUTARIES OF HUNT CREEK AS REVEALED BY COUNTING WEIRS

by

Justin W. Leonard
Hunt Creek Experiment Station

One of the first acts of Institute staff workers at the site of the proposed experiment station on Hunt Creek was the construction of a fish-counting trap or weir on each of the two tributaries entering the creek in the immediate vicinity of the building site. The weirs were designed and installed by Dr. D. S. Shetter, F. V. Ames and E. L. Cooper. The first trap has been in continuous operation since July 18, 1939, the second since August 15, 1939.

The first trap, designed primarily with a view to taking trout of fry size, was installed on Tributary No. 5, the small stream which has its origin in the spring behind the station and which, at its mouth, has a normal flow of approximately 200 gallons per minute. This stream is very small, seldom exceeding a foot in width. Throughout most of its length, however, the banks

are considerably undercut and deep holes are frequent, so that it offers places of retreat out of proportion to its apparent size. Slightly more than 600 feet above the mouth, the stream passes through a small road culvert; above this point, trout have never been found. The lower hundred feet of this section are densely shaded with cedar; the remainder of the stream flows through relatively open aspen and balm-of-gilead between high steep banks. The general design of the trap located near the mouth of Tributary No. 5 is shown in the appended photograph, Fig. 1.

Figure 1. Fry Trap on Tributary No. 5

The second weir was placed across Fuller Creek, a much larger tributary normally delivering nearly 5,000 gallons per minute. Fuller Creek originates from a small pond and from spring seepage at a point near the line between Sections 33 and 34, T. 29 N., R. 2 E., and empties into Hunt Creek about 1.75 miles nearly due east of its source. The upper mile-and-a-half of the stream flows almost entirely through dense cedar swamp, generally so dense as to allow little if any direct sunlight to penetrate to the water. For the most part, the rate of flow is swift, rising as high as 2.5 feet per second surface velocity. About half a mile below the source there is a large beaver dam which holds impounded about 10 acres of water. This dam, seven years old, has been deserted by beaver for three years, and is gradually falling into disrepair. A little over a quarter-mile above its mouth, Fuller Creek emerges from the dense swamp and for about 100 yards flows through cleared land paralleling the road. Through this stretch the current is swift and flows over a bottom composed chiefly of coarse gravel, with frequent riffles and small rapids. Its average width is about five feet. Then the gradient decreases and the channel skirts another dense swamp. Here the bottom is predominantly sandy. The south bank is firm and about three feet high, but with a flat, marshy, seepage area about 15 feet wide separating the high bank from the stream just above the weir. The opposite bank is low and marshy; such elevation as it possesses is due to hummocks of organic material consolidated by the roots of sedge clumps and a few alder bushes. A short distance below the weir the stream spreads out into a series of anastomosing silt-bottom pools and sandy channels produced by the influence of an old logging dam, built about 1890, which is still in good enough repair to prevent this part of the stream from digging down to its original channel level. Through the ponded section the

only cover is provided by considerable amounts of fallen, long-dead cedars and spruces. After crossing the dam, the creek splits into two main channels which flow through very dense cedar swamp for about 50 yards before entering Hunt Creek a short distance below the line separating Sections B and C. The logging dam mentioned above is not sufficiently steep to offer an obstacle to trout movements.

The design of the Fuller Creek weir (Fig. 2) follows the general plan of the two-way fish trap described by Shetter*, except that the transverse screen crosses the stream at an angle of about 15°, rather than 60° as described and figured by him. Instead of narrowly spaced vertical iron rods, galvanized wire mesh was employed for the screen. At first, an attempt was made to use screen of 1/4-inch mesh, but this clogged with debris so rapidly that 1/2-inch mesh screen had to be substituted. The walls and floors of the traps, however, were covered with 1/4-inch mesh successfully. A subsidiary trash-catcher of half-inch mesh screen, which only partially blocks fish movement, was placed a short distance above the weir.

While it was realized than half-inch mesh would not be completely effective in stopping trout fry, the exigencies of the situation precluded use of smaller mesh in a screen of the stationary type. As has been mentioned above, the banks adjacent to the weir are low and marshy, and allow the water to pass around the ends of the trap if lodged debris or sudden floods cause a rise in water-level of more than twelve inches. This is recognized as undesirable, but it is not planned to raise any dikes, since the retention of a much greater head of water

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*Shetter, David S. A two-way trap for use in studying stream-fish migrations. Trans. Third N. American Wildlife Conf., pp. 331-338. 1938.

would almost certainly undermine and destroy the weir as at present constructed. It is believed that, in actual practice, few fry pass through the screen, because the direction and velocity of the current is such as to make a head-on approach difficult.

Figure 2. The Fuller Creek Weir.

The most difficult feature of weir operation has been the problem of drift and trash accumulation. Although in fair weather there is little movement of debris, a short shower suffices to stir up a great quantity of screen-clogging materials; and, unlike Tributary No. 5 or Hunt Creek, the level of Fuller Creek is subject to considerable fluctuation, depending on rainfall. Weirs were generally checked early in the morning and late in the evening, but during rainy periods it was necessary to clean the screens several additional times

during day and night. On two occasions during the summer, heavy rains of cloudburst proportions raised the waters of Fuller Creek so high that the flow went over the screen, despite the fact that it was kept clean by constant attention during and after the rain.

Because of the time-consuming demands of screen cleaning, consideration is being given to the design of a rotary type, self-cleaning screen, in the hope that it may be possible to install such a device at reasonable cost. The results obtained from the operation of the two weirs here discussed clearly show the value of such structures in supplying information on the movements of trout and other fish of all sizes in the drainage, and on the size and age composition of the moving population. It appears desirable that at least three, possibly four, additional counting units be installed, to provide a complete picture of the movements of fish in the experimental area; and it is imperative, for reasons of economy, that they be so designed as to require a minimum of attention.

Fuller Creek Weir Records.- Movement of fish of all sizes through the Fuller Creek counting weir are shown, by two-week intervals, in Graphs 1 and 2, and on a day-to-day basis on the rolled graph supplied separately.* Table 1 shows the same numbers and includes all other species of fish. It is immediately apparent that the movement was very preponderantly downstream, with a sharp peak occurring during the last half of October, and another during the month of May. It is perplexing to note a heavy downstream movement in October, when an upstream movement would be expected, at least among fish of spawning age. However, it is true that spawning facilities in Hunt Creek are much more desirable and extensive than in Fuller Creek, a large part of which

*Filed at Hunt Creek Laboratory.

flows through dense swamp over a bottom of sand and silt.

The heavy downstream movement during May cannot be certainly interpreted, without previous records as an aid. It is strongly suggested, however, that the movement was a response to the planting, at this time, of a large number of Montana grayling fingerlings in Fuller Creek. During the late afternoon and evening of April 11, 1940, approximately 5,000 grayling were introduced at various points on Fuller Creek. Five hundred of these were placed in a stretch of about 300 yards of stream above the weir. By the following morning, considerable numbers of these fish were found in the weir, and throughout April and May they continued to appear, many of them dying against the screen. (See Report 598, and Table 1 of this report.) It is of particular interest, however, that almost immediately after their introduction, the movement of trout, especially fingerlings, was greatly stimulated, and continued active during the six weeks following. The sudden influx of large numbers of grayling into the territory of the trout may very well have induced them, through competition for food and shelter areas, to seek elsewhere for living space in less congested portions of the system. Data summarized through the month of September, 1940, indicate that again the autumnal movement is beginning and growing. No large planting is contemplated for Fuller Creek during the spring of 1941, so that records taken then should provide a dependable check on the extent to which movements in the spring of 1940 were induced by the introduction of grayling.

Examination of the day-by-day graphs of water temperatures and fish movements may possibly suggest, in the case of Fuller Creek, a tendency toward increased activity by the fish when water temperatures started to drop below

50° F., such activity persisting as long as the water temperature rose as high as 37° F. In the spring, some correlation again might be found between fish movements and the range of water temperatures lying between 37° and 55° F. When records are complete for the second year of operation, it should be possible to draw more definite conclusions as to the role of temperature in stimulating or inhibiting fish movements.

It is obvious that movement upstream through the Fuller Creek weir was of a very casual nature. Peaks in the curve show no correlation with season or temperature, and must, therefore, be considered as indicating mere aimless wandering on the part of a very few fish. The criticism might be made that something in the design of the weir makes downstream movement easier than upstream for the trout. This is very doubtful, however, because frequent observations have revealed that trout may frequently be seen lying above the screen, and almost never below it. If the screen were selective, and tended to block trout under strong impulsion to move upstream, numbers of fish would undoubtedly be seen congregated below the weir.

If the figures are accepted as giving a reasonably accurate record of up- and downstream movements, one is at once struck with their significance in pointing out the role played by Fuller Creek in the Hunt Creek system. In 13.5 months, a total of 1,099 trout of all sizes moved down, as against only 28 up. Of those moving down, 593 were of fingerling size, 79 were 7 inches or longer. Only five of those moving up were fingerlings, and none were legal size. It is probable that a great majority of the fish moving down continued into Hunt Creek, for stream conditions below the weir are not too well suited for trout, as may be seen from the previous description of this area (p. 3).

Trout have never been found here in numbers. Hence, it may be reasoned that Hunt Creek gained from Fuller Creek over 1,000 trout during the period covered by this report.

During the fall of 1938, a planting of 8,704 brook trout fingerlings seven months old was made in Fuller Creek in T. 29 N., R. 2 E., Sec. 34 and 35. Except for these fish and for 6,000 brook trout fingerlings, five months of age stocked in the same section in 1933, Fuller Creek had not been planted with trout prior to the installation of the weir. It is possible that some of the sublegal and legal trout taken in the downstream trap in 1939 and 1940 came from the later planting. However, it is probable that the majority of the downstream migrants were of natural origin.

Fry Trap Records.- Movements of trout through the fry trap situated on Tributary No. 5 are shown in Graph 3, and in a separate rolled chart*, the former summarizing movements on a two-week basis, the latter showing movements and morning and evening water temperatures of both Tributary No. 5 and Hunt Creek on a daily basis. Table 2 shows movements by two-week periods of trout, muddlers (Cottus) and mud minnows (Umbra).

Perhaps the most significant trend displayed by the graphs and table is the one which is the reverse of that found in Fuller Creek. In Tributary No. 5, roughly one-third more trout moved upstream than down. The bulk of the upstream movement took place in late summer and early fall. During October and November the upstream and downstream movements tended to balance. From mid-January to nearly the end of June, no trout moved up through the trap; and from early March to the middle of June there was a small but steady downstream movement, which, nevertheless, was not extensive enough to offset the

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*Filed at Hunt Creek Laboratory.

heavy upstream movement of the preceding late summer and early fall months. It is possible that a temperature reaction is displayed here, the trout tending to be attracted by the relatively stable temperatures of the spring-fed tributary in instinctive anticipation of the lower winter temperatures of Hunt Creek, and moving back when the waters of Hunt Creek commenced to rise in the spring. Or, the ample shelter and slower current of the tributary may have been attractive to fish of the year. It is also suggested that trout from Hunt Creek may have entered the upstream trap simply seeking shelter. Since it is the rule to pass fish on in their original direction of progress, some trout may have been directed upstream which had no intention of traveling further than the apparent shelter offered by the trap, but which, once in the tributary, found conditions more to their liking than those in Hunt Creek.

Fate of Montana Grayling in Fuller Creek.- In Report No. 598 the writer summarized some of the results, up to April 26, 1940, of the planting of Montana grayling made in Fuller Creek about two weeks earlier. At that time particular emphasis was laid on the heavy and rapid mortality of these fish which took place immediately following their introduction. Table 1 of the present report shows that a total of 161 grayling was recovered dead at the weir. After the first of June, only five live and three dead grayling were taken, all during the first half of July. Although attempts have been made, repeatedly, to recover additional grayling by seining throughout Fuller Creek, all have been uniformly unsuccessful. It is true that throughout the swamp sections of the stream, seining is rendered exceedingly difficult by natural obstructions. Repeated observation, too, has not certainly disclosed grayling in the stream since mid-summer. Most of the stomachs of trout taken by anglers

in the Fuller Creek beaver pond have been examined, but as yet no grayling have appeared in them. It is to be hoped that further observations may throw light on the fate of that part of the planting not already accounted for.

INSTITUTE FOR FISHERIES RESEARCH

By Justin W. Leonard

Report approved by: A. S. Hazzard

Report typed by: Alma Hartrick

Table 1

Fuller Creek Weir

Records by Two-week Intervals

Date	TROUT DOWN			TROUT UP			GRAYLING (All down)		MINNOWS*		SUCKERS	COTTUS
	Fry	Fingerlings	Legal	Fry	Fingerlings	Legal	Live	Dead	Down	Up	(Down)	(Down)
1939												
Aug.15-31	8	..	..	3	1	..	..	..	..	..	..	..
Sept.1-15	9	3	..	2	..	..	..	..	..	..	..	..
Sept.16-30	36	7	..	1	1	..	..	..	..	..	..	1
Oct. 1-15	68	10	15	1	1	..	..	..	1	..	..	..
Oct.16-31	99	36	21	1	1	..	..	..	2	..	..	2
Nov. 1-15	60	39	22	3	..	..	..	..	2	..	..	4
Nov.16-30	42	52	5	1	..	..	..	..	2	..	..	1
Dec. 1-15	35	35	6	1	..	..	..	..	1	..	..	..
Dec.16-31	16	29	1	3	..	..	..	..	2	..	..	1
1940												
Jan. 1-15	4	5	..	..	..	..	..	..	..	..	..	1
Jan.16-31	1	9	1	..	..	..	..	..	..	..	..	..
Feb. 1-15	..	2	..	..	..	..	..	..	1	..	..	..
Feb.16-29	2	2	..	..	..	..	..	..	..	..	..	..
March 1-15	..	..	..	..	..	..	..	..	1	..	..	..
March 16-31	..	2	1	..	..	..	..	..	..	..	..	..
April 1-15	..	8	..	..	..	..	68	83	3	..	..	..
April 16-30	..	47	..	..	..	..	25	29	14	..	..	..
May 1-15	..	109	1	..	..	..	25	33	11	..	1	1
May 16-31	..	100	2	..	..	..	23	13	4	..	6	..
June 1-15	2	53	1	1	..	..	1	1	..	..	..	..
June 16-30	7	18	..	..	..	..	2	1	1	..	..	..
July 1-15	6	4	..	2	..	..	1	..	..	..	..	..
July 16-31	4	1	..	1	..	..	1	1	24	7	..	..
Aug. 1-15	..	3	..	..	..	..	..	..	18	1	..	..
Aug. 16-31	12	5	..	1	..	..	..	..	3	1	..	..
Sept. 1-15	4	6	..	2	..	..	..	..	3	..	..	..
Sept.16-30	8	8	3	..	1	..	..	..	..	..	2	..
Totals	427	593	79	23	5	..	146	161	93	9	9	11

Trout

Total down . . 1,099
Total up. . . 28

All species combined

Total down . . . 1,358 (does not count dead grayling)
Total up 37

* Minnows include blunt-nose, mud minnow and common shiner.

Table 2

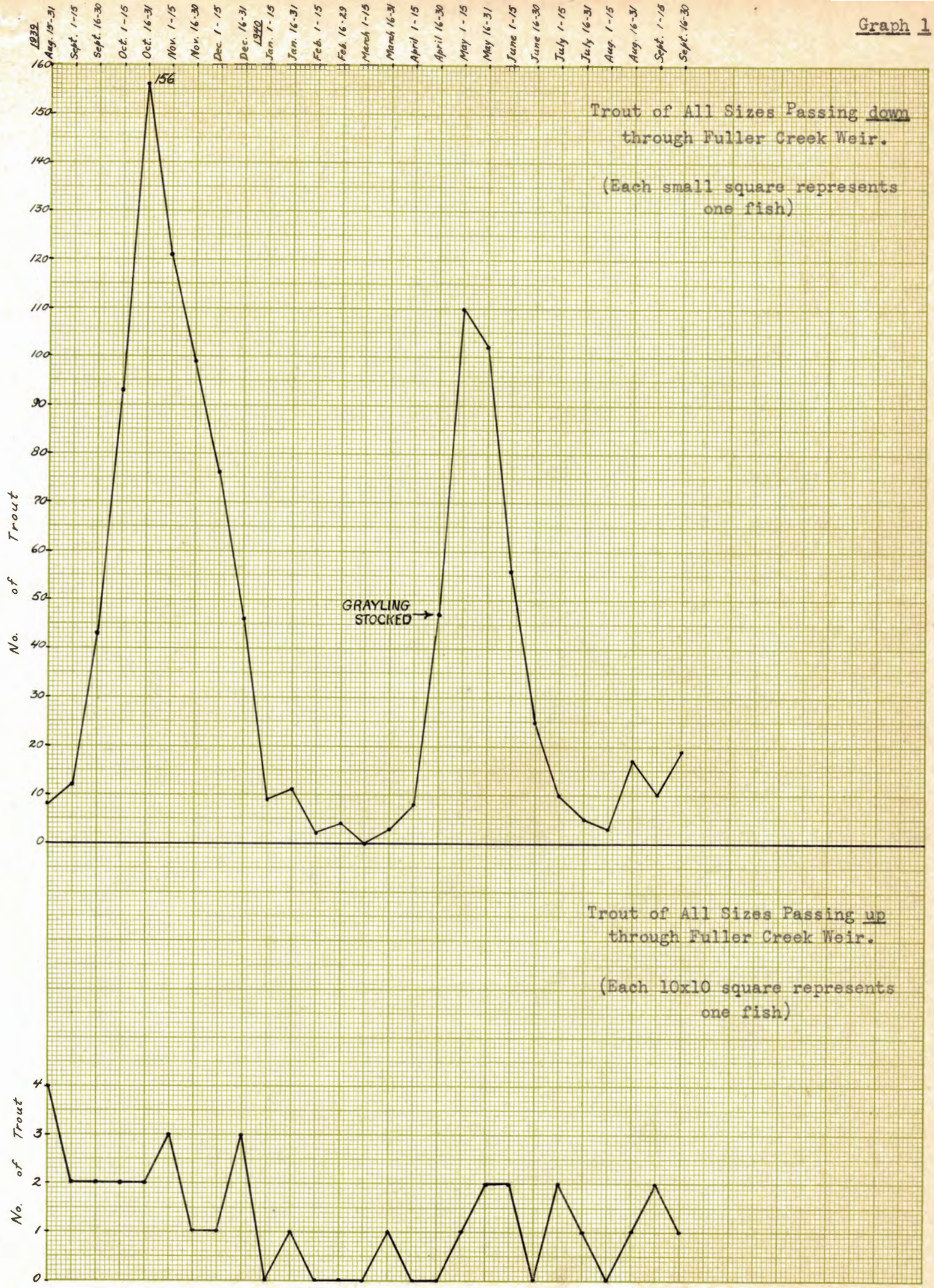
Fry Trap, Tributary No. 5

Records by Two-week Intervals

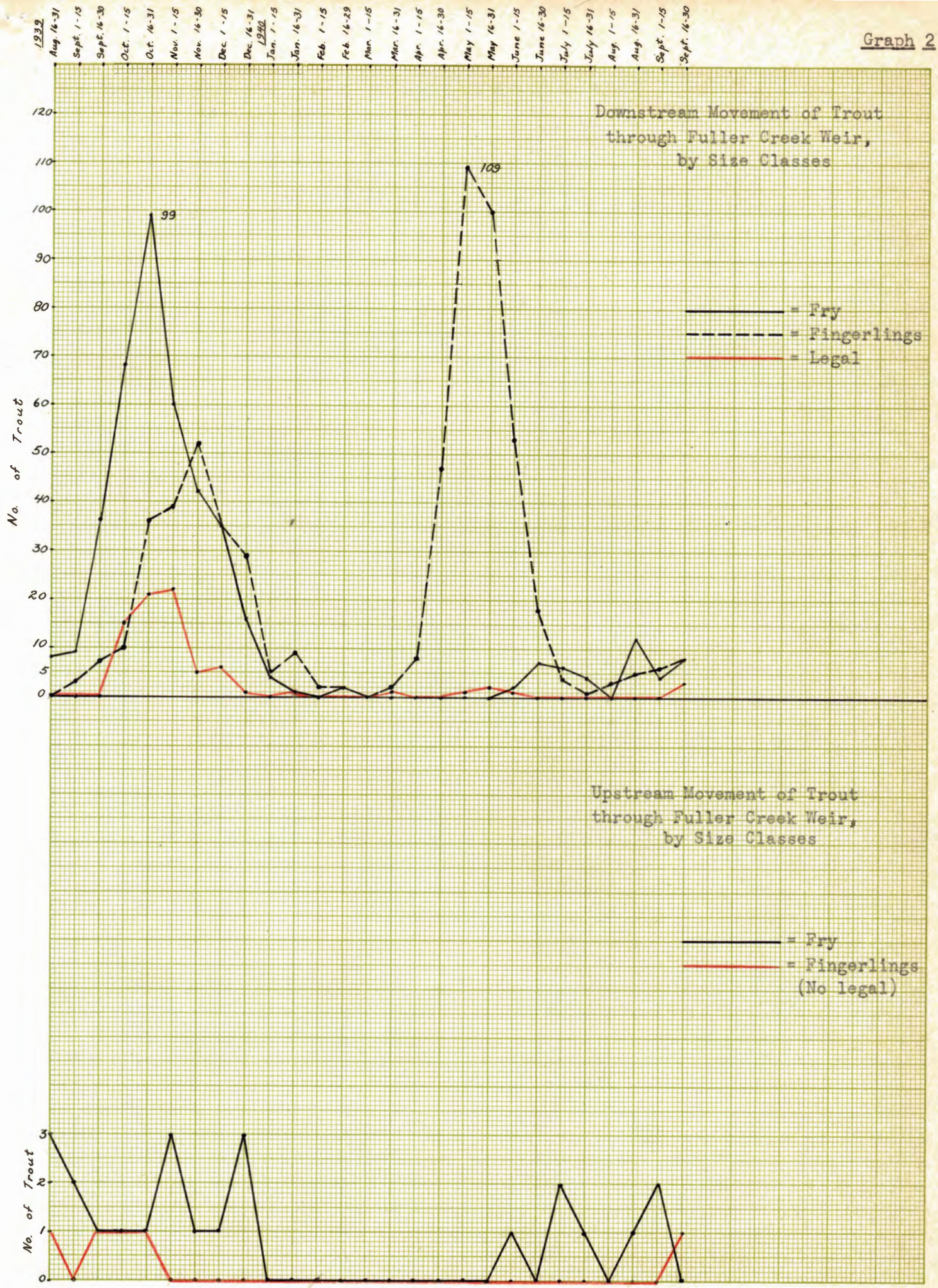
Date	TROUT DOWN			TROUT UP			COTTUS		UMBRA	
	Fry	Finger-lings	Legal	Fry	Finger-lings	Legal	Up	Down	Up	Down
1939										
July 18-31	5	1	..	18	..	..	1	1	..	..
Aug. 1-15	8	2	..	27	..	..	..	..	..	..
Aug. 16-31	7	1	..	31	..	..	2	..	..	..
Sept. 1-15	7	..	..	58	..	..	2	..	..	..
Sept. 16-30	9	2	1	28	2	..	..	..	..	..
Oct. 1-15	6	5	..	22	1	..	..	..	..	..
Oct. 16-31	17	1	1	23	..	..	1	..	..	..
Nov. 1-15	14	1	2	7	..	2	..	..	..	..
Nov. 16-30	7	2	..	10	..	..	2	..	..	..
Dec. 1-15	5	1	..	7	..	1	..	..	..	..
Dec. 16-31	2	..	..	1	..	..	..	..	..	..
1940										
Jan. 1-15	1	..	..	6	1	..	..	..	..	..
Jan. 16-31	4	..	..	1	..	..	..	..	..	..
Feb. 1-15	3	..	..	..	..	..	..	..	..	..
Feb. 16-29	..	..	..	..	..	..	..	..	..	..
March 1-15	8	..	..	..	..	..	..	..	..	..
March 16-31	13	3	..	..	..	..	..	..	..	..
April 1-15	8	1	..	..	..	..	..	..	..	..
April 16-30	14	2	..	..	..	..	..	..	..	..
May 1-15	7	3	..	..	..	..	..	..	..	..
May 16-31	2	4	1	..	..	..	..	..	..	..
June 1-15	..	4	..	..	..	..	..	..	..	..
June 16-30	..	..	..	3	..	..	..	..	..	..
July 1-15	3	2	..	3	..	..	..	..	..	..
July 16-31	4	1	..	1	..	..	..	..	..	1
Aug. 1-15	2	..	..	7	1	..	..	..	..	..
Aug. 16-31	..	1	..	14	..	..	..	..	..	..
Sept. 1-15	..	1	..	17	..	..	..	..	..	..
Sept. 16-30	..	..	..	16	..	..	..	..	..	..
Totals	156	38	5	300	5	3	8	1	..	1

Trout
Total down . . 199
Total up . . . 308

Graph 1



Graph 2



Downstream Movement of Trout through Fuller Creek Weir, by Size Classes

Upstream Movement of Trout through Fuller Creek Weir, by Size Classes

Graph 3