Report No. 50

TROUT STREAM INVESTIGATIONS DURING 1930

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During July, August, and September of 1930, the Institute for Fisheries Research carried on a field investigation of trout streams in western Michigan. The work was done by a party of three, equipped with a truck for transportation. The streams which were visited and examined lie in the Pere Marquette and Little Manistee watersheds and are spread over a large area, comprising parts of four counties: Lake, Newaygo, Mason and Oceana.

The primary object of the investigation, as planned at the beginning of the work, was to survey streams of the Pere Marquette system in order to develop plans for stocking these waters. Each stream was to be classified on the basis of field studies so that recommendations could be made in regard to the species and number of fish which should be planted to the best utilization of the particular stream. In addition to supplying information about these waters, the work was expected to serve in the development of methods which could be applied to other Michigan trout streams. The latter purpose, a study of methods, will be here regarded as the more important of these two objectives.

Several associated lines of research were followed as a part of the field work. Attention was given to closed nursery streams with the purpose of learning to what extent trout migrate out of the closed areas into the streams in which fishing is permitted. Tagging of fish was the method of study and this was done in several closed streams as well as in some open ones, about two hundred fish being tagged during the summer.* Collecting of certain supposed predators of trout was carried on and a small collection of fish-eating bird and watersnake stomachs was made for a study of the food contained in them. Owing to a special appropriation made by the Conservation Department for experimental stream improvement it was possible to put a crew of men on re-snagging work on the Little Manistee River and all efforts were directed to this work during the last half of the field period. Thus, time was divided among several investigations, so that it was not possible to complete the survey of Pere Marquette streams and definite recommendations for stocking these waters will not at present be made.

Both the Pere Marquette and Little Manistee rivers drain an area which is predominantly sandy. Since lumbering days, when the pine was cut off, the land has gone through fires which made the deforestation practically complete. At present most of the barren areas have succeeded into scrub oak and jack pine. These stands are steadily increasing in size with the present good fire protection and this affects the streams in that shade conditions are improving. Shade is an important factor in keeping stream temperatures low. The flow of the streams is maintained by spring water, with very little surface drainage, so that fluctuations in stream level are comparatively slight and the streams also resist drought conditions very well. The stream bottoms are predominantly sand, which is known to be a comparatively unproductive type of bottom for trout food.** However, there are large gravel areas as well as swamp areas where black peaty muck is predominant.

* Tagging work was continued in the fall months by Gerald McCrimmon who marked about two thousand trout in headwater streams.

** Needham, Paul. A quantitative study of the fish food supply in selected areas. pp. 192-206, Supplement to 17th Ann. Report N. Y. State Conservation Dept. 1928.

Conditions for fishes are very similar in the Pere Marquette and Little Manistee. There are no natural falls in either stream and the barriers which can prevent Lake Michigan fishes from ascending into headwaters and inhabiting them are principally barriers of environmental conditions. Apparently temperature is one important factor in preventing some of the lake fishes from living in headwater trout streams. Temperature and other ecological factors are doubtless responsible for the succession of fish species from headwaters downward. The cold, headwater creeks have a fish association including trout, muddlers, several minnows, and the common sucker. Downstream there is a gradual transition to a fauna which is richer in species, and includes many lake fishes, such as perch and northern pike. In some cases, as in the Pere Marquette river, the lines of demarkation between the headwater fauna and the lower fauna are not sharp and it often happens that an occasional northern pike may be found well upstream in the trout waters.

Historical evidence (based on observations of residents of the region) shows that trout were not native to these streams. Grayling were natural inhabitants of some of these waters but are now extinct here. The establishment of brook trout, which took place well before 1900, was followed by stocking of the brown and rainbow trouts and all three species are now found within the Pere Marquette and Little Manistee systems. At present the brook trout is dominant only in certain headwaters, although a few individuals are taken in the main waters of both streams. The rainbow trout is decidedly predominant in the main waters of the Little Manistee, with both brook and brown trout being uncommon. In the case of the lower Pere Marquette, brown trout probably predominate but with rainbows a close second, while brook trout are scarce.

As a basis for recommendations regarding stocking of trout streams, certain information is needed. A rather large amount of data has been gathered and filed away on printed survey cards which are in use by the Institute for Fisheries Research. This information comprises geographic facts such as location of stream, economic points such as amount of use as a fishing stream, and ecological data having a bearing on suitability of the water for trout. Size and calculated flow of stream in cubic feet per second, comparative rating of food and pool conditions, species and abundance of fish present, and water temperatures are some of the points which are covered by routine examination cards. These cards form a satisfactory basis for making qualitative recommendations, however other methods must be devised before quantitative recommendations can be made.

There seem to be three fundamental questions to consider before we can rationally make recommendations for stocking trout waters. The first two of these are much easier to answer than the third one. The first question is whether the stream under consideration is suitable for trout, and the second question is for what species of trout is it most suitable. These two are of a qualitative nature and the field examination card will go a long way toward answering these. The third question is "What intensity of trout population will give the greatest return". This question is a fundamental one because, until we know the answer to it, any development of stocking policies must rest largely upon guesswork. We must know the optimum carrying capacity of each trout stream in order to understand how to proceed in regard to improvements involving stocking. The determination of this carrying capacity is difficult, since it involves quantitative work and research on growth rate. Special methods must be devised for these points, as they cannot be dealt with by routine survey methods.

By optimum carrying capacity of a stream, it is here meant that intensity of population which will give the largest returns in fish of legal size (seven inches). Perhaps many persons are of the opinion that the best use of a stream would be accomplished when the stream had as many trout as it could support. Such is not the case, however, because of the fact that trout (like many, if not all other fishes) are very adaptable in growth rate. Under crowded conditions in nature, as well as upon insufficient diet under experimental conditions, they will undergo more or less stunting.

It is an interesting fact that poor growth rate does not always imply poor condition. It is quite commonly the case that fish of more or less stunting are perfectly healthy, well-proportioned, and normal in every way except that they are smaller than they might have been under good growth conditions. Certain species may differ from others in respect to the visible evidences of stunting but in trout of poor growth rate there is very slight appearance of thinness. If growth rate is poor, due to crowding, the "turn-over" of trout into fish which may be caught is slow. On the other hand if growth rate is very good, it may also be true that fish are too scarce for good fishing and it would then be advisable to stock in order to bring up the population to a point of good numbers as well as good growth rate, taking care not to overstock. Somewhere between the two extremes lies the point, at present largely hypothetical, which is here called optimum carrying capacity.

As a start on the problem, population counts were made upon several streams, and some of the correlations between numbers and growth rate were investigated. At present, this work is in its preliminary stages, however some interesting results were obtained. The method which was used in determining the intensity of trout population in a stream is the simple method of counting individuals in a typical sample. A section is chosen which is representative of other parts of the stream while at the same time being well suited to counting work. One must be fairly sure that practically all trout can be caught so it is not wise to take an area full of logs, however it is necessary to select one having average good habitats for trout. The selected area, which is best kept less than two hundred feet for a two-man seining job, is screened both above and below with as little disturbance to trout as possible. It is then thoroughly seined, until no more trout can be found. Fish are removed as they are caught and are counted and measured.

As an alternative method of counting, when screening is impractical, an estimate method is devised. By taking the average of about twenty-five seine hauls in a screened area it is possible to get an average seine-haul figure which can be compared with a similar average figure taken in an unknown section (the same seine being used in the same manner). By using the total count figure in the screened area and the average seine haul there in a proportion involving the unknown count figure and the average seine haul in that area, it is possible to calculate a figure for the total count in the unknown section. This method promises good results as it is adaptable to most conditions, however, its accuracy should be tested in some detail.

For comparative purposes, computations based on trout counts in screened sections were figured in trout per mile and trout per acre. It is realized that there is a large source of error in applying such counts on a mile or acre basis. However, if the section chosen for the count is representative of average conditions, such errors would be small.

In analyzing trout stream counts it seemed advisable to make a graph of frequencies of the various size groups. Percentages of legal fish in relation to total population were figured in each case, for comparative purposes. In the case of rainbow trout, samples of scales were taken from fishes representative of the ones counted, so that the various year groups composing the population, and particularly the legal individuals, could be determined.

The trout counting which was done on the Little Manistee, is more significant than other counts made, as it is the only one of the counts which was thoroughly correlated with growth work. An area of predominantly gravel bottom was selected. Considerable random seining had been previously done in other parts of this stream, and it is rather certain that the point chosen for a count was representative of other areas of similar topography. In a stretch of stream 126 feet long and averaging 28 feet wide, we removed 534 trout. Of these, 480 were rainbow, 27 were brook, and 27 were brown trout. The total population calculates on a mile basis as about 22,000 and on an acre basis as about 6,500. For rainbows only the intensity of population would be 20,000 trout per mile.

The size-frequency groupings (chart 1) of this rainbow count of 480 fish has two clear peaks of abundance, which may be expected to represent two age groups. From a study of 119 rainbows taken near the place of counting and at about the same time of year (August), it is clear that this is the case. Age determinations of these trout were carried out by reading winter marks of the scales. On this basis, the conclusion is justified that of the 480 rainbows there were 454 fish in their first season, 25 fish in their second season, and one fish in the third season. Of the total, five fish or .8% were of legal size, four being over 7 inches and one being over 8 inches. This is at the rate of 160 legal fish to the mile or 52 per acre.

It is clear that the population of rainbow trout in the Little Manistee river is very dense. Is the intensity of population above the point of optimum carrying capacity? To determine this, it is necessary to study growth of rainbows under comparable conditions which vary only in regard to lesser density of population. It is hoped that this can be done in a thorough manner in the future. At present, the only comparisons which are at hand are based on a dozen rainbows from the Little South Branch of the Pere Marquette, and a very few from the Big South Branch and from the Pine River. All of these streams have a lesser population intensity than the Little Manistee (although comparable counts have not been made, estimates based on seining observations are the basis for this statement). In temperature and general conditions, all of the streams are similar except for the Big South Branch of the Pere Marquette, which is the warmest of the streams. Comparing the growth of second season rainbows of the various streams, we find that 102 Little Manistee fish (August) gave a range from 4 3/4 to 7 5/8 inches in total length with 23.5 % over the seven inch limit; 12 Little South Branch fish (early August) gave a range of 5 5/8 to 8 1/8 inches with

50% over the legal limit; 3 Big South Branch fish (July) were 8 3/8, 8 3/8, and nine inches in length or 100% legal; and two Pine River fish (late July) were 7 1/2 and 9 inches or 100% legal. Although comparative growth data here given is very scanty, it is supported by estimates of anglers during July and August. All agree that the majority of the Little Manistee rainbows which are hooked are illegal fish, while they do not estimate the percentage of illegal fish nearly so high in these other streams.

Since it is known that trout of the sizes involved in the Little Manistee count of 480 fish, fish mostly under 7 inches, feed upon the same type of food it seems probable that food competition of this heavy population is a large factor in the comparatively poor growth rate.

Taking food competition into account as a factor, it is interesting to study the comparative numbers of the two principal year groups represented in the Little Manistee count. According to the figures here, there are 18 times as many first year rainbows as there are second year ones. If the proportion of young rainbows was still greater, would the number of second year fish increase according to a proportionate better survival chance? Or would the number decrease because of greater food competition of a heavier population? The latter occurrence would seem to be the more probable.

The Little Manistee, which has an exceedingly heavy run of breeding steelhead rainbows from Lake Michigan has an unusually heavy trout population and conditions there may not be typical of the trout stream situation in general. The figure computed on the basis of the count, 22,000 fish per mile represents a count on gravel bottom. By a method of proportionate estimate of average seine hauls, the figure obtained for a predominantly sand bottom area was only one fourth of this, and if this represents a comparable saturation point of numbers we may judge that the sand bottom section is only one-fourth as productive as the gravel.

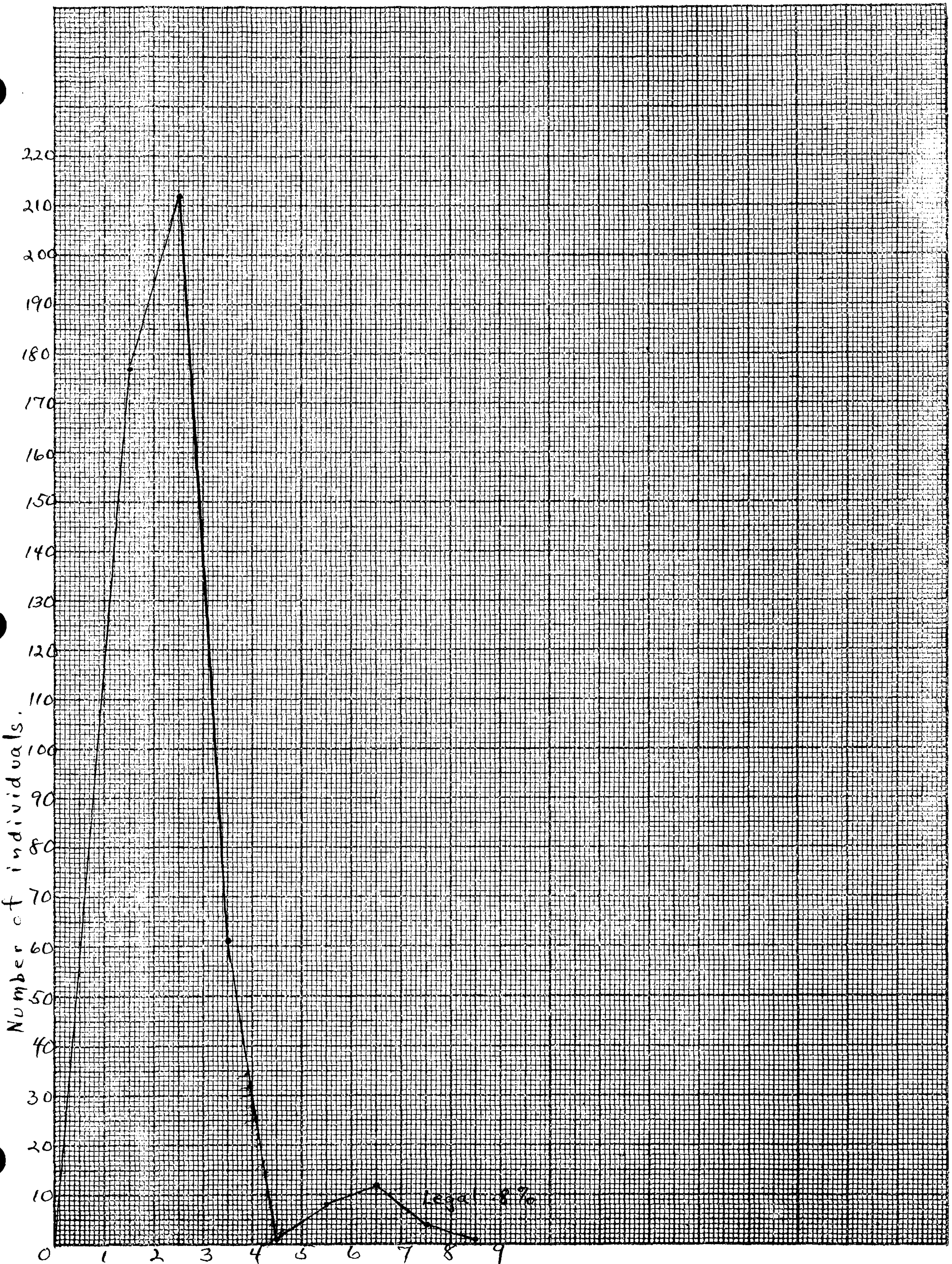
Two counts of brook trout populations in closed headwater streams are of interest for comparison with the rainbow count in regard to population. Both counts reflect the non-migratory habit of the brook trout as in both places a number of adult trout were taken, while all of the rainbows counted were juvenile fish. No age determinations of the brook trout were made and it is not certain what age-groups made up the populations counted.

A count on McDuffy Creek was made and 211 brook trout were removed. The calculated intensity of the population was about 5,000 trout to the mile or 3,500 per acre. The percent of legal fish was 3% or 150 legal fish per mile (105 per acre) (graph 2).

Another closed feeder stream, ~~McDuffy~~ Baker Creek, gave a much higher count of large trout. In this case, the section selected for counting was much deeper than in the case of McDuffy Creek and habitats for large trout were more suitable. The calculated intensity of the population, based on 53 brook trout, was 2,300 fish per mile or nearly 1300 per acre. There were more legal trout than illegal ones here, 57 percent of those taken being legal (graph 3). Obviously this count could not be representative of the stream as a whole since there were less young fish than older ones. For comparison with other counts, the figure of legal fish per mile would be 2850 (741 per acre). It is not claimed that this figure would be representative. However, the population count made on this stream furnishes an interesting extreme for comparison with the others. Between the one extreme represented here and the other extreme represented by the Little Manistee river, we may expect to find the point of optimum carrying capacity.

Graph 1.

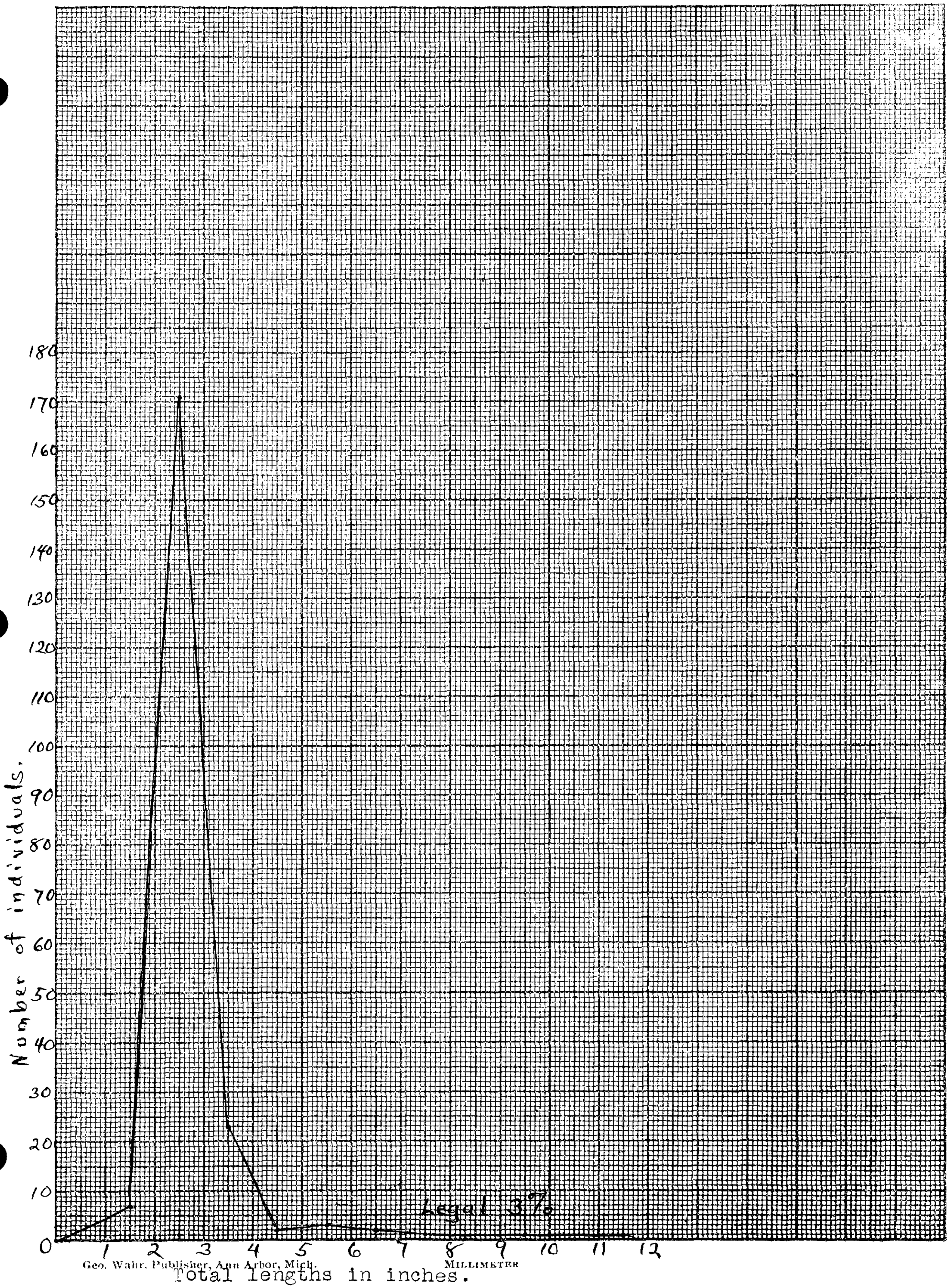
Size-frequency graph for Rainbow Trout. Little Manistee River. August 15, 1930. Based on 480 trout.



Total lengths in inches.

Graph 2.

Size-frequency graph for Brook Trout. McDuffy Creek.
July 30, 1930. Based on 211 trout.



Graph 3.

Size-frequency graph for Brook Trout. Baker Creek.
August 4, 1930. Based on 53 trout.