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ANALYSIS OF FACTORS CONTROLLING THE PRODUCTIVITY OF THE MAINE LOBSTER FISHERY

The years since 1940 have witnessed a tremendous increase in the production of the Maine lobster fishery, which is startling in its magnitude and perhaps far-reaching in its significance. After approximately forty years of irregular but persistent decline, the catch in the five years since 1940 has more than doubled, to reach the highest level since 1890 and about 3-1/2 (?) times the low level prevailing in the early 1920's. Table 1, Fig. 1. (Total annual catch and number of pots). If the factors responsible for this increase can be identified and evaluated, and if these factors are in any degree controllable by man, then it is conceivable that by formulation of suitable management measures, it may be possible to create such favorable conditions that the yield may be maintained at a level far above that existing during the past forty years.

POSSIBLE CONTRIBUTING FACTORS

Fortunately, study of the lobster fishery was begun by the Fish and Wildlife Service in 1939, two years before the phenomenal increase began, so that there is some record of conditions just before and during the increase. Tagging experiments and length-frequency data indicated that in 1939-40, the commercial fishery and natural mortality were removing annually about 70 percent of the legal-sized lobsters present at the beginning of the "lobster year" (August of one year to July of the next). Thus it appeared certain that the increased catch in 1941-1945 could not be the result of increased fishing intensity or efficiency. It became necessary to assume that there had been a major increase in numbers or weights of the lobster population of legal size. Since tagging results show that lobsters do not

carry out extensive migrations, the increase in the population along the Maine coast must have come from a much greater annual recruitment (recruitment is the number of lobsters reaching legal size each year) or from the increased size of the lobsters taken.

Two measures have been adopted in Maine during the past eight years, which should have some effect on recruitment and size. These are the increase in size limit from 3-1/16 inches in 1941 to 3-1/8 inches in 1942, and the hatching and rearing program begun in 1938.

Artificial propagation and rearing

In 1938, the U.S. Fish and Wildlife Service began a program of artificial hatching and rearing of young lobsters to the fourth stage. This is the stage at which most of them change from pelagic to bottom habits, and it is thought that the natural mortality rate from that stage on, is much reduced. In 1939, the Maine Department of Sea and Shore Fisheries began cooperating with the Fish and Wildlife Service in this program, and the work since then has been continued by the two cooperating agencies. As the result of this rearing program, about 40,000 fourth stage lobsters were reported liberated in 1938, 160,000 in 1939, 597,200 in 1940, 689,600 in 1941, 222,000 in 1942, 121,000 in 1943, 180,500 in 1944, and 205,000 in 1945. In addition, large numbers of first stage lobsters were liberated, but in this analysis, no account is taken of these liberations, since hatchery procedure to this stage is about the same as that found in nature (the females carrying the eggs are held in troughs in the hatchery while the eggs hatch out naturally), and there appears to be no good reason to believe that results from planting first-stage larvae are much, if any, better than would have been achieved had the females been left on the lobster grounds to spawn.

According to the best information available, in Maine waters it takes fourth stage lobsters about six years to reach legal size. Consequently, the hatchery plants in 1938 and later years, would begin contributing to the commercial catch in 1944. If we make the very optimistic assumption that 25 percent survived to reach legal size and that 70 percent of these were taken by the lobstermen each year after they reached legal size, then the increase in catch from this source would begin in 1944 with about 7,000 pounds, and be continued with 30,000 pounds in 1945, 113,000 pounds in 1946, and 155,000 pounds in 1947. In view of the fact that the actual increase in catch began in 1941 (instead of 1944) and in 1944 and 1945 showed increases of 5,700,000 and 10,300,000 pounds respectively over the 1940 catch, it is clear that the contribution from artificial propagation, even under the most optimistic assumptions, was a negligible factor in the observed increase.

Increase in size limit in 1942

The approximate effect of the 1942 increase in the size limit, on the catch in 1942 and later years, can be determined using known growth and calculated fishing mortality rates. The results indicate that the change in size limit by itself (assuming other factors to remain constant) would have caused a decrease in the 1942 catch of about 12 percent or 1,000,000 pounds (the actual decrease was only 500,000 pounds), and an increase in the 1943 catch of about 1,000,000 pounds (the actual increase was 3,100,000 pounds). It is further apparent that the change in size limit could account for no part of the increase in catch from the 7,600,000 pound average in 1939 and 1940 to the 8,900,000 pounds in 1941, nor could it account for the major part of the large increases in 1943 and subsequent years. (The figures for effect of size limit were obtained from the theoretical size and weight distribution. They should be checked against actual distributions.)

Improved environmental conditions

A third possible explanation for the recent increase in the lobster catch can be developed if it is assumed that natural conditions in the ocean in recent years were particularly favorable for the survival of young lobsters.

The long record of progressive decrease in the catch and catch-per-pot, does not suggest that this species is subject to the wide variations in recruitment resulting from environmental changes, which have been observed in herring, mackerel, and some other species. Furthermore, such information as is now available does not indicate that an increase similar to that observed in Maine waters, has occurred in the lobster fishery of Massachusetts and other New England states. However, the lobster catch in the Bay of Fundy and Western Nova Scotia waters has increased markedly in recent years. Thus, there is a possibility that there have been environmental changes in the coastal waters extending from Western Nova Scotia, through the Bay of Fundy and along the Maine Coast, which made it possible for a much larger percentage of lobster larvae to survive to legal size, than during past years. No evidence of changes in hydrographic or biological conditions, which might account for such favorable changes in lobster survival, has come to our attention. Before reconciling ourselves to such a completely speculative explanation of the increase in the lobster catch, there is one other promising avenue to explore.

Decrease in minimum size limit in 1935

In January 1935, Maine changed the minimum legal size limit on lobsters from the 3-1/2-inch minimum carapace measure, which had been in force since _____, to a 3-1/16-inch minimum. By making use of our accumulated knowledge of the biology of Maine lobsters, it is possible to estimate the effects of this change in size limit on the lobster population and on the spawning stock.

It will be shown that these changes appear to be the primary factors responsible for the recent increase in catch.

In 1933, Commissioner Crie of Maine arranged to obtain an extensive series of length samples from the lobster catch through the wardens of his department. Beginning in 1939, Fish and Wildlife Service biologists have obtained extensive length samples of the lobster catch, except during the war years when sampling was much reduced.

From the records of catch and catch-per-pot, it appears reasonable to assume that the average catch and recruitment during 1929-1934, were in approximate equilibrium. The catch per pot remained at about the same level throughout these years, and although the catch experienced some variations, they appear to be the result of changes in fishing effort or perhaps of errors arising from differences in the methods used in collecting the data in the surveys conducted during those years. Fig. 1.

If we accept the assumption that recruitment and catch were in approximate equilibrium during the period mentioned, then by making use of the length-frequency data collected in 1933, and of our knowledge of growth rate, it is possible to calculate the total mortality rate experienced by that portion of the lobster population over 3-1/2 inches, eye-socket measure, during the years just prior to the reduction in the size limit. The calculated rate is about 65 percent and results in a spawning stock amounting (in numbers) to between 20 and 25 percent of the total stock above 3-1/2 inches. Thus of every 100 lobsters reaching the minimum legal size of 3-1/2 inches, between 20 and 25 survived to spawn. Fig.2, Table 2.

Since lobsters of this size shed in midsummer and make no further growth until they again shed the following summer, it follows that the full recruitment to the legal stock occurs at the time of shedding (July - September). For the balance of the year there is no change in the size composition of the

stock except for that resulting from selective fishing. Consequently in analysis we have adopted a lobster year extending from August of one year to July of the following year. In Figure 2 each size group is represented by a rectangular bar with a width equal to one year's average growth. This size grouping was adopted, since each year's recruitment would first appear in the fishery as a size class of this dimension, as a result of the increase in size through shedding from the unfished sizes below the legal minimum. Thenceforth the members of this group decreased in numbers at a comparable rate, under the fishery, and advanced together to the next size group when shedding occurred. This is an oversimplification of course, because the effect of the minimum size limit is not perfectly sharp (particularly in view of some use of short lobsters), and there is some variability in growth which tends to smooth out the step-like appearance of the length frequencies as the lobsters grow older. However, this method provides a reasonable accurate approximation, as is shown by comparison between the calculated curve using a 65 percent mortality rate and 5/16-inch annual growth rate, and the actual length composition obtained in 1933. (To be tested).

The 65 percent total mortality (M_r) rate is made up of fishing mortality (M_f) plus natural mortality (M_n). We have no specific information indicating the proper division of M_r between M_f and M_n. However there are a number of lines of reasoning which indicate that under present conditions about 5 to 10 percent is the most reasonable figure for M_n. Lobsters are long lived creatures and such long life is possible only when adult mortality rates are low. A rate as high as 20 percent would reduce the stock about 90 percent in ten years. At such rates few would survive to maturity, even without commercial fishing.

A rate of 10 percent is more likely but even this may be too high, particularly in view of the fact that a rate of 10 percent to 15 percent is considered to be most probable for mature haddock, a much shorter lived fish. Conclusions reached in the following analysis are much the same regardless of whether a M_n rate of 5 percent or 10 percent is used.

The succeeding analysis is based on these assumptions:

1. Recruitment was in approximate equilibrium with average catch plus natural mortality during 1929-1934, and the population and fishery were stabilized during those years. (see discussion on page).
2. Growth of lobsters from 3-1/16 inches up averaged 5/16 inch annually (actual growth rate to be substituted when available).
3. The average weight of lobsters between 3-1/16 and 3-5/16 inches is .875 pounds, and it increases thereafter as the cube of the length. (actual length-weight data to be substituted when available).
4. Annual natural mortality equals 5 percent of the stock over 3-1/16 inches, present at the beginning of the lobster year. (Calculations should also be made for 10 percent M_n.)
5. Total annual mortality during 1929-1934 equalled 65 percent of the stock over 3-1/2 inches, present at the beginning of the lobster year. (See discussion on page).
6. Selective fishing by sizes was inconsiderable (supporting data from tagging experiments,etc.)

7. With respect to M_f, the lobster year August - July is equivalent to the calendar year January - December; for the bulk of the catch is taken during the months August - December. (Adjust annual catch to the lobster year by assigning the average spring catch to the proper lobster year. Substitute in calculations for calendar year data.)

If 500 units is adopted to represent the annual recruitment to the stock of lobsters over 3-1/16 inches during 1929-1934, and we use the mortality and growth rates given above, it is possible to calculate the size composition of the lobster stock over 3-1/16 inches in 1933-1935, (the size composition in 1935 would be the same as in 1933 in spite of the change in size limit, except for the limited quantity of 3-1/16 to 3-1/2-inch lobsters taken during January-June of 1935). Figure 2, Table 2. The results show that the number of mature lobsters (4" +) made up 21.1 percent of the stock over 3-1/2 inches and 10.7 percent of the stock over 3-1/16 inches. This agrees with the length-frequency data obtained in 1933. (?) (To be checked from Table 3, Fig.2-B data).

The natural mortality, in abstract units, can be obtained by taking 5 percent of the population over 3-1/16 inches. This equals 70.3 units. The catch mortality in abstract units can be obtained by taking 60 percent of the population over 3-1/2 inches. This equals 429.7 units. The combined mortality from natural causes and the catch then is 70.3 U plus 429.7 U or 500 U, which is equal to the annual recruitment adopted above.

According to our basic assumption that recruitment during 1929-1934 was in approximate equilibrium with average catch and natural mortality, we can equate the 429.7 units representing catch mortality to the average catch during these years (6,600,000 lbs.) One unit therefore equalled 15,360 lbs.

Since the average size of the lobsters over 3-1/2 inches was 1.47 lbs. (from the 1933 length-frequency distribution and length weight curve), the 15,360 pounds per unit equalled 10,450 lobsters per unit. Using this conversion figure, the M_n and total population data in abstract units can be converted into numbers of lobsters. Thus, the natural mortality of 70.3 units equalled 734,000 lobsters, the total stock over 3-1/16 inches at the beginning of the lobster year, equalled 1406 units, or 14,700,000 lobsters, the stock above 3-1/2 inches equalled 716 units or 7,480,000 lobsters, and the mature stock (above 4") equalled 151 units, or 1,580,000 lobsters.

The calculated size distribution at the end of the lobster year (June) was obtained by applying the 5 percent natural mortality rate to the length frequencies between 3-1/16 and 3-1/2 inches, and the 65 percent total mortality rate to the length frequencies of 3-1/2 inches and over. Table 2, Fig.2.

The calculated size distribution in August of 1935, 1936, etc., was obtained by advancing each of the June size groups by 5/16 inch (the result of shedding and growth) and adding the 500 units annual recruitment to the smallest size class (3-1/16 to 3-6/16 inches). Tables 2 and 4.

Beginning in 1935, it no longer was possible to obtain the June (1936) distribution by applying the 60 percent catch mortality rate for, although the lowered size limit in 1935 about doubled the number of lobsters available to the fishery, the catch increased only a relatively small amount (17 percent above the 1929-1934 average). Thus, although the total catch had become greater, the rate of fishing mortality decreased. (A lower rate applied to a greater range of sizes produced a greater total catch.) To determine the new rate the total 1935 catch in pounds was converted to number of lobsters through dividing by the average size, as shown by the calculated

1935 length-frequency distribution for 3-1/16 inches and over lobsters. This number was divided by 10,450 to convert to Units, and the number of units plus the 5 percent M_n (70.3 Units), was subtracted from the 3-1/16 inches plus stock present in August 1935, to give the stock in units at the end of the lobster year. This yielded a survival of 721.7 units or 51.4 percent, compared to the 35 percent survival for the legal stock during the previous years.

The August 1936 distribution was obtained by advancing each of the June size groups 5/16 inch as before, and adding the 500 Units recruitment. The 1936 catch of 7,500,000 pounds was converted to Units through dividing by the average size of 1.26 lbs., as shown by the August 1936 distribution, and then by 10,450. This figure plus 5 percent M_n was subtracted from the stock present in August 1936 to obtain the June 1937 stock. Survival in this case equalled 48.4 percent.

The same procedure was followed for 1937, 1938, and 1939, giving calculated survival rates of 44.4 percent, 33.8 percent, and 17.8 percent respectively. Fig. 4.

The validity of this reconstruction of developments between August 1935 and June 1940 can be examined by the following propositions.

1. The calculated size composition of the stock in 1939 and 1940 must agree with the observed size composition in those years.
2. The difference in the size of the stock of 3-1/16 inches plus lobsters in August 1935 and August 1940 must be accounted for.
3. The calculated mortality rates in 1939 and 1940 from this reconstruction must be consistent with the results of tagging experiments in these years.

Taking these up in order

1. The calculated size composition in 1939 shows a greater proportion of large than does the observed distribution, but the 1940 distribution approximately agrees. Figures 3 and 4. In order to obtain a smaller calculated value, it would be necessary to assume a lower recruitment or much higher M_n than that used in the calculations. However, if these were changed enough to reduce the proportion of the larger sizes to the observed level in 1939, survival to 1940 would be negligible or negative. This does not check with the observed 1940 size composition. Therefore, a more probable explanation is that recruitment in 1940 and possibly 1939 was greater than during the preceding years. (An increase of 30 percent in 1939 and 60 percent in 1940 would about account for the difference?).

2. According to the calculated values, in August 1935 the lobster stock consisted of 7,500,000 lobsters over 3-1/2 inches and 14,700,000 lobsters over 3-1/16 inches. Therefore the drop in the size limit from 3-1/2 to 3-1/16 inches made 7,200,000 more lobsters available to the fishery.

   In August 1940 the calculations indicate that the lobster stock consisted of 6,800,000 lobsters over 3-1/16 inches. This was a decline of 7,900,000 lobsters from the 1935 population.

   The total catch from 1935-1939 was 31,200,000 lobsters (from the records of landings and calculated average size). Additions to the stock during these years equalled recruitment minus natural mortality. This equalled 5 x 500 units - 277 units natural mortality X 10,450 = 23,500,000 lobsters. Thus additions to the

stock were 7,700,000 lobsters less than the number taken by the fishery. This decrease is about equal to the 7,900,000 decline in the stock between 1935 and 1940.

These results indicate that the additional lobsters made available to the fishery by the reduction in the size limit in 1935, were not caught up immediately, but were taken gradually over the next five years.

3. According to the calculated data the survival from August 1939 to June 1940 was only about 18 perdent. Table 4, Fig.4. This is considerably lower than any overall rates indicated by tagging. If recruitment in 1939 were increased some 30 percent above the preceding years, the calculated survival rate would have been increased to about 30 percent, which is more in line with the results of tagging experiments. It would have required an increase of 60 percent or more in 1940 to keep the survival rate up to 30 percent in that year.

Conclusions:

This examination of the results obtained from the calculated reconstruction of the developments in the lobster fishery and population from 1935 to 1940, indicates that the reconstruction fits all of the available facts. According to these results annual recruitment averaged about 5,200,000 lobsters in 1935-1938, increasing to about 6,800,000 lobsters in 1939 and 8,500,000 lobsters in 1940. The numbers of lobsters of legal size (3-1/16 inches plus) and berried females were as shown in Table 5.

Table 5

	Legal[1]	Berried[2] [3]
	(in 1,000)	(in 1,000)
1934	12,090	183
1935	11,130	183
1936	9,480	271
1937	8,240	374
1938	6,890	349
1939	5,120 ?	184
1940	-	55

1/ Average stock 3-1/16" + August and June of following year. Table 2

2/ Equals 1/5 of the 4" + lobsters in June, before shedding.

3/ If these figures are even approximately correct, then the overall survival from egg to legal size for 1939-1945, must be around 0.5 to 1 percent.

The number of legal size is the average of the calculated number in August and in the following June. For the reasons given above it is probable that the 1939 figure is somewhat too low. The figures for berried lobsters are based on the following reasoning: The sex ratio for immature lobsters is 1/1. After maturing, the males shed annually. The females after maturing are subject to the same mortality as the males during the first year, then the eggs are spawned and carried by the female for another year, during which she is protected by law. Consequently the number of mature females present two years after shedding is about the same as the number of males one year after shedding (except for M_n). Furthermore, since at the end of the year they mature, the males shed and advance to the next size, while the females produce eggs but do not shed. The male stock of the size class just above maturity will consist of newly recruited males, while the female stock will consist of the new recruits plus the berried survivors from the previous recruitment. By the end of the lobster year the new recruits of both males and females will be reduced to about the same number as the berried females, so that about 2/3 of the stock will be females and 1/2 of these will be berried. (Check by field observations).

Using the above data it is now possible to examine certain factors bearing on changes in the catch. We have plotted in figure 5 the total Maine lobster catch from 1938-1945, and the catch per pot for the same years. If catch per pot could be relied upon it would provide the best measure of the lobster population size. However, in view of known defects in method of obtaining catch per pot, it will be safer to use both total catch and catch per pot as rough indices of abundances.

From growth studies of Maine lobsters we are fairly sure that it takes 5 - 7 years for them to grow from newly hatched larvae to 3-1/16 inches carapace measure. Furthermore since the females mature a year before the eggs appear, and the eggs are carried for one year before hatching, it will be about 8 years before a newly matured female can contribute to the stock of legal sized lobsters, and 7 years before newly berried females will contribute to the legal stock.

In order to show the relationship between the size of the spawning stock and thepopulation or catch, the number of newly berried lobsters can obtained from our calculations has been plotted against the lobster catch seven years later. The comparison shows that the population began to increase in 1941 and continued in 1942. According to our interpretation of growth rate increased recruitment resulting from a larger spawning stock was not possible until 1943, unless we assume that a considerable proportion of young from the increased number of 1936 and 1937 berried lobsters reached legal size in 5-6 years. An alternative explanation is discussed below. The large 1943 and 1944 catch increases are associated with major increases in the spawning stock, but the continued rise in the 1945 catch must be the result of accumulated stock (Check from L-F) and increased fishing intensity, or of other factors discussed below.

The other major population characteristic bearing upon recruitment, is competition within the population, which affects the survival from newly hatched larvae to legal size. Competition between legal sized and smaller lobsters might be concentrated on the youngest bottom stages (less than one year old) or it might be distributed through the young lobsters in the II, III, and older age groups. This can be examined by comparing the legal size stock with the lobster population 3, 4, 5, 6, etc. years later (since 50 - 70 percent of the population is made up of the new growth class, and

the fishery removes 50 to 70 percent of the stock during the year, total catch roughly represents recruitment). The comparisons for a 4 and 6-year lag are given in Figure 6. The close agreement between decrease in legal population and increase in recruitment six years later (Figure 6 B) suggests that competition is greatest for the 0 group of lobsters. The increases in 1941 and 1942, which cannot be explained by increase in the spawning stock, can be accounted for in this way. The accelerated increase in 1943 and 1944 probably is the combined effect of increased spawning stock and decreased competition. The probable increase in recruitment in 1939 and 1940 (page) can be accounted for if we assume that competition between legal size lobsters and 2 - 3-year olds, also is appreciable, for the effect of the reduced 1935 and 1936 legal stocks on two and three-year lobsters, would appear in 1939 and 1940.

On the basis of these data, the relative effect on recruitment of spawning stock size and the size of the total population over 3-1/16 inches, cannot be evaluated at present. The continued increase of the catch in 1945 (if it cannot be explained by increased effort and accumulated stock) indicates that competition is a very important factor, for there was a major increase in recruitment ? (to be evaluated), in spite of the fact that the spawning stock had levelled off and begun to decline. If our calculations are correct, then 1946 should do much to settle the question of the relative importance of spawning stock and competition. According to our data (calculated stock and L-F) the berried stock in 1939 (7 year lag) was at about the same level as those in 1934 and 1935, which were responsible for the 1941 and 1942 catches. The competing stock in 1940 (6 year lag) also was at a much lower level than in previous years. If 1946 recruitment (showing up in August to December) increases or remains at the high level which held in 1944 and 1945, it must

indicate that at this population level, competition is the dominant factor. If spawning stock rather than competition is dominant at this population level, then we can expect perhaps (Depends upon whether spawning stock increased during war because of increased recruitment and limited fishing operations) a drastic decline in yield beginning in 1946, to production levels considerably below those prevailing during 1935-1940.

There is one further item of circumstantial evidence bearing on the question of spawning stock vs intra-species competition, as a probable explanation of the recent increase in catch. If the course of the declining lobster catch and stock is traced backwards toward the 1890 peak, it must cross some level at which the spawning stock was equal to that which existed in 1936-1938. If the spawning stock is the dominant factor, then why did not the stock at that time produce an upswing in the catch comparable to that which recently has appeared? The most probable explanation is that at that time the competitive stock of large lobsters was much greater than in 1935-1940 and at such population levels the magnitude of the spawning stock is much less important than the magnitude of the competitive stock. This line of reasoning suggests the tentative conclusion that the increase in recruitment in 1941-1945, was made possible by the decrease in competition resulting from the decline in number of lobsters over 3-1/16 inches from 1934 on, more than by the increase in the spawning stock from 1936-1938. Thus the reduced competition resulting from the reduced stock, made possible an increase in survival from the same egg production which prevailed in 1935 and 1939, and from the increased egg production brought about by the larger spawning stock in 1936-1938.

If this interpretation of the conditions which resulted in a great increase in recruitment of lobsters is valid, then in order to develop and maintain production at the maximum level , the major problems are to reduce the

competitive stock to the lowest practical level while maintaining an adequate spawning stock. The first objective can be achieved by encouraging the fishermen to catch off the annual recruitment as rapidly as possible while the lobsters are as small as market demands permit. However such a procedure will cause a reduction in the spawning stock below levels which even now appear to be inadequate.

We may presently find that the relatively high spawning stock level reached in 1937 and 1938 is needed to produce lobster yields of the size recently attained. The most recent data available indicate that the present spawning stock is only about 50 percent (purely hypothetical, substitute a realistic value when available) as great as that in 1937. To restore the spawning stock to the 1937 level, with the present fishing intensity, and using a minimum size limit, will require raising the minimum to about 3-1/2 inches. (Confirm this). However, even if such an increase were economically and politically practical, it would result in an increase in the competitive stock (3-1/16 inches plus) by about 2½ times, and past experience indicates that such an increase would cause competition between these lobsters and the young to increase to such an extent that it would cancel (perhaps more than cancel) the beneficial effect of the increased spawning stock. Consequently the size of the optimum catch possible, using management measures based on minimum size limits, is problematical, but it seems certain that it is far less than the catch level in 1944-45.

Our present understanding of the factors controlling the productivity of the lobster population indicates that to obtain the maximum recruitment we should keep the competitive population at the lowest practical level, meanwhile maintaining an adequate spawning stock. This sounds like a paradox but there is a good possibility of achieving it if a new approach to the problem is adopted.

First of all it will be necessary to discard the minimum size limit as a conservation measure for lobsters. It should be completely discarded in order to encourage fishermen to take the lobsters at as small a size as possible. If it becomes economically undesirable to catch and market the smallest sizes available, because of the effect on price, efficiency of utilization, demand, etc., a minimum size could be adopted based entirely on economic considerations. Elimination of the minimum size limit would encourage our first objective, reduction of the competitive stock to the lowest level practicable.

In order to maintain an adequate spawning stock the idea of a maximum size limit should be resurrected and adjusted downward, so that instead of being a relatively impotent symbol of protection, as the Maine 5-inch maximum limit is at present, it can be made effective.

The 5-inch maximum limit is ineffectual in protecting an adequate spawning stock since the high mortality rate allows only negligible numbers of lobsters to reach that size. Out of each ten thousand lobsters reaching the present minimum size, on the average not more than about five will reach the 5-inch size where they are protected.

To make the maximum size limit useful as a conservation measure it will be necessary to pull it down from its present size to an effective level. 1/

1/ The values for increase in spawning stock,etc., in the remainder of this paragraph are assumed. To be revised when data from 1945-1946 L-F are available.

In order to achieve the 500 percent increase in the spawning stock discussed on page , under present conditions a maximum size limit of about 3-3/4 inches would be required. Such a limit would provide the needed spawning stock without causing any great increase in competition, for the total stock of

3-1/16 inches and over would be increased less than 25 percent.

Use of the maximum size limit, adjusted to fit the particular conditions of growth and fishing intensity prevailing for any given lobster stock, appears to be the conservation measure most in line with the principles of lobster population dynamics developed in this report. However, it must be remembered that most of the conclusions reached here are deductive and based on circumstantial evidence. Consequently it seems premature to discard present lobster conservation measures in favor of those proposed, pending further verification of these conclusions. Such verifications may be developed in two ways. First: continue and intensify observation and measurement of the population characteristics involved and hope that in the course of the next several years, developments will be sufficiently clear cut to establish or disprove present theories. Second: design experiments which can be carried out during the next year or two, which will satisfactorily establish whether or not competition between young lobsters and lobsters over 3-1/16 inches, is an important factor in the survival to commercial size.

Of the two approaches outlined above, it seems desirable that the second should be attempted regardless of the action taken in respect to the first. The experimental approach offers the possibility of concrete information within one or two years time. Furthermore direct experimental evidence is urgently needed to bolster up the theoretical structure erected by deductive reasoning and indirect evidence. If the proposed explanation of the great increase in the Maine lobster catch can be confirmed, it should revolutionize our approach to the conservation of this valuable resource and perhaps double the sustained yield of the fishery. However, if we expect the lobster fishermen to accept such a drastic change in point of view and support a program which he cannot check by direct observation for a long period of years, we must be able to show him some direct evidence supporting the change in our methods.

PROPOSED EXPERIMENT FOR MEASURING
INTRA-SPECIES COMPETITION

Objective: To determine whether the survival rates of young lobsters (0-1 yr, and 1-2 yr) are significantly influenced by the abundance of lobsters over 3-1/16 inches.

Design - (preliminary suggestions)

Construction of tank.

Reinforced concrete tank 60 feet X 20 feet X 15 feet deep, located in tidewater with bottom at about low tide and top above high tide. Tank divided into 6 compartments each 10 feet X 20 feet with screened openings in sides, extending from top to 2-1/2 feet of bottom. The bottom to be level, finished with rough concrete. Rocks, shells, and seaweed to be distributed over the bottoms of all compartments in a comparable manner.

Equal numbers of fourth stage lobsters to be planted in all compartments (Possibly 1000 each. Explore this question by attempting to calculate the number of 4th stage lobsters in some good lobster area).

Using random distribution plant 0 to 5 lobsters (lengths from 3-1/16 to 3-1/4 inches) in the various compartments. Feed all compartments regularly, using some fragmented and some unopened mussels. Quantity and frequency to be determined.

Check survivors every 3 months.

Subsidiary problems - to be explored if time permits.

1. Effect of density of young lobsters on survival.

   Beginning as early as possible in the rearing season plant 50, 100, 200, 400, 800, 1600 fourth stage lobsters distributed at random in the six compartments. Feed regularly using fragmented mussels.

Terminate experiment in time to permit setting up the primary experiment.

2. Effect of feeding on survival

Place the same number of fourth stage lobsters in each compartment, number to be determined by results of density experiments. Feed the several compartments at different rates. Continue experiment as long as possible and determine survival.

3. Effect of season

Standardize number and feeding. Determine survival every 3 months.

Table 2

Calculated Survival to Maturity

Annual Recruitment = 500
Natural Mortality " = 5%
Catch " Aug 34-June 35 = 60% of 3½" + stock
" " Aug 35+ calculated from catch Table 4.

	Aug '34		June '35		Aug '35		June '36		Aug '36		June '37	
3 1/16 - 3 4/16	500.0		475.0		500.0		257.0		500.0		242.0	
3 4/16 - 3 8/16	190.0	690.0	180.5	655.5	190.0	690.0	97.7	354.7	102.7	602.7		
						475.0		244.7		257.0	124.3	
3 8/16 - 3 11/16	285.0		99.8		285.0		146.7		154.3			
3 11/16 - 3 13/16	180.5		63.2		180.5		92.8		97.7	344.4	118.2	
3 13/16 - 4 0	99.8	565.3	34.9	197.9	99.8	565.3	51.4	290.9	146.7	398.7		
		1255.3		853.4		1255.3		645.6		1001.4		484.5
4 - 4 2/16	63.2		22.1		63.2		32.5		92.8		44.9	
4 2/16 - 4 5/16	34.9		12.2		34.9		17.9		51.4		24.9	
4 5/16 - 4 7/16	22.1		7.7		22.1		11.4		32.5		15.7	
4 7/16 - 4 10/16	12.2		4.3		12.2		6.3		17.9		8.7	
4 10/ - 4 12	7.7		2.7		7.7		4.0		11.4	48.4	5.5	
4 12/ - 4 15	4.3	144.4	1.5	50.5	4.3	54.4	2.2		6.3		3.1	
4 15/ - 5 1/	2.7		.9		2.7		1.4		4.0		1.9	
	1.5		.5		1.5		.8		2.2		1.1	
	.9		.3		.9		.5		1.4		.7	
	.5		.2		.5		.3		.8		.4	
	.3		.1		.3		.1		.5		.2	
	.2		.1		.2		.1		.3		.1	
	.1				.1		.05		.1		1	
	.1	6.3		2.1	.1		.05		.1		0	
		150.7		52.6		150.7		77.6			0	
										221.8		107.3
Total 3 1/16 +		1406.0		906.0		1406.0		723.2		1223.2		591.8
3 1/2 +		716.0		250.5		716.0						
Survival to 4" from 3 1/16		10.7		5.8		10.7				18.1		
" 3 1/2		21.0		21.0		21.0						

	Aug '37		June '38		Aug '38		June '39		Aug '39		June '40	
3 1/16 - 3 6/16	500.0		222.0		500.0		169.0		500.0		89.0	
3 6/16 - 3 11/16	242.0		107.4		222.0		75.0		169.0		30.0	
3 11/16 - 4	124.3		55.2		107.4		36.3		75.0		13.4	
		866.3		384.6		829.4		280.3		744.0		132.4
4 - 4 5/16	118.2		52.5		55.2		18.7		36.3		6.5	
4 5/16 - 4 7/	44.9		20.0	4 5-4 11	52.5		17.7		18.7		3.3	
4 7/ - 4 10/	24.9		11.1	4 10-4 12	20.0		6.8	4 12-4 15	17.7		3.2	
4 10/ - 4 12/	15.7		7.0					4 15-5 1	6.8	79.5	1.2	
4 12/ - 4 15/	8.7	44.4	3.9		11.1	33.8	3.8			17.8		
4 15/ - 5 1/	5.5		2.4		7.0		2.4					
5 1/ - 5 4/	3.1		1.4		3.9		1.3		3.9		.7	
5 4/ - 5 6/	1.9		.8		2.4		.8		2.4		.4	
5 6/ - 5 9/	1.1		.5		1.4		.5		1.3		.2	
	.7		.3		.8		.3		.8		.1	
	.4		.2		.5		.2		.5		.1	
	.2		.1		.3		.1		.2		.1	
	.1		.1		.2		.1		.1			
	.1		.0		.2							
		225.5		100.3		155.5		52.7		88.7		15.8
Total		1091.8		484.9		984.9		333.0		832.7		148.2
Survival to 4"		20.7				15.8				10.7		

	Avg.	'40
3 1/16 - 3 6/16	500.0	
3 6/16 - 3 11/16	89.0	
3 11/16 - 4	30.0	
		619.0
4 - 4 5/16	13.4	
4 5/16 - 4 9/16	6.5	
4 9/16 - 4 15/16	3.3	
4 15/16 - 5 4/16	3.2	
5 4/16 - +	2.8	
		29.2
Total		648.2
% over 4"		4.5

Table 3

1933 - Maine Lobster Measurements (8th Biennial Rpt Comm. S & SF 1934)

Total length	Carapace length in hundredths	in sixteenths	No.		No. per 1/16" length	% of 9"-10¼" group	Carapace Lg.	Allowing 100 units for each length.	100 units 1/16" of carapace
							3 1/16-3 7/16	100	
9"-10¼	3.13"-3.07" 44	3 7/16-3 9/16	966		137.0	100.0		700	
10¼-11	3.57-3.83 26	3 9/16-3 11/16	483		116.0	84.5		338	
11-12	3.83-4.18 .35	3 11/16-4 3/16	388		70.0	51.1	180/129	307	Division above or below 4"
12-13	4.18-4.52 .34	4 3/16-4 7/16	155		27.9	20.3		102	
13-14	4.52-4.87 .35	4 7/16-4 11/16	79		14.2	10.4		62	
14-15	4.87-5.22 .35	4 11/16-5 3/16	22		4.0	2.9		17	
15-16	5.22-5.57 .35	5 3/16-5 9/16	7		1.3	.9		4	
16-17	5.57-5.91 .34	5 9/16-5 15/16 5 15/16-6 4	2		.4	.3 .1		2 .5	
Sub total							3 1/16-4	1318	80.8
Sub total							4 +	314	19.2
Total			2102				Total	1632	100

Carapace length taken as 34.806% of total length

Males - 35.14% of total length

Females - 34.44% of total length

Table 4

Calculated Survival Rates from Year to Year
Size limit 3½" in 1934, 3 1/16" in 1935 +
Natural Mortality = 5% (M_N)
Catch " in 1928-34 = 60%, Av. catch = 6,600,000 lb. (1934)
Annual Recruitment = 500 Units

	3 1/16 - 3½	3½+			
Aug '34	690.0	716.0	1406.0		Total stock over 3 1/16
	-34.6	-35.7	-70.3	=	M_N
		-429.7	-429.7	=	Catch of 6,600,000 lb ÷ 1.47 ¹ = 4,485,000 L. IU = 10,450
June '35	655.4	250.6	906.0	(64.5)	
			+500.0	=	Recruitment = $M_N + M_F$
Aug '35			1406.0		Total stock
			-70.3		M_N
			-614.0	=	M_F = 7,700,000 lb ÷ 1.20 = 6,415,000 L ÷ 10,450
June '36			721.7	(51.4)	
			+500		
Aug. '36			1221.7		T. S
			-61.1	=	M_N
			-569.0		M_F = 7,500,000 lb ÷ 1.26 = 5,950,000 L ÷ 10,450
June '37			591.6	(48.4)	
			500		Rec.
Aug. '37			1091.6		T. S
			-54.6		M_N
			-552.0		M_F = 7,300,000 lb ÷ 1.265 = 5,770,000 L ÷ 10,450
June '38			485.0	(44.4)	
			500.0		
Aug '38			985.0		T. S
			-49.2		M_N
			-603.0		M_F = 7,700,000 lb ÷ 1.22 = 6,310,000 ÷ 10,450
June '39			332.8	(33.8)	
			500.		
Aug '39			832.8		T. S
			-41.6		M_N
			-643.0		M_F = 7,600,000 lb ÷ 1.13 = 6,720,000 ÷ 10,450
June '40			148.2	(17.8)	
			500.0		
Aug. '40			648.2		T. S
			32.4		M_N
			735.0		M_F = 7,600,000 lb ÷ .99 = 7,680,000 ÷ 10,450

¹ Average weight calculated from Table 2 length frequencies and length weight data (check these)

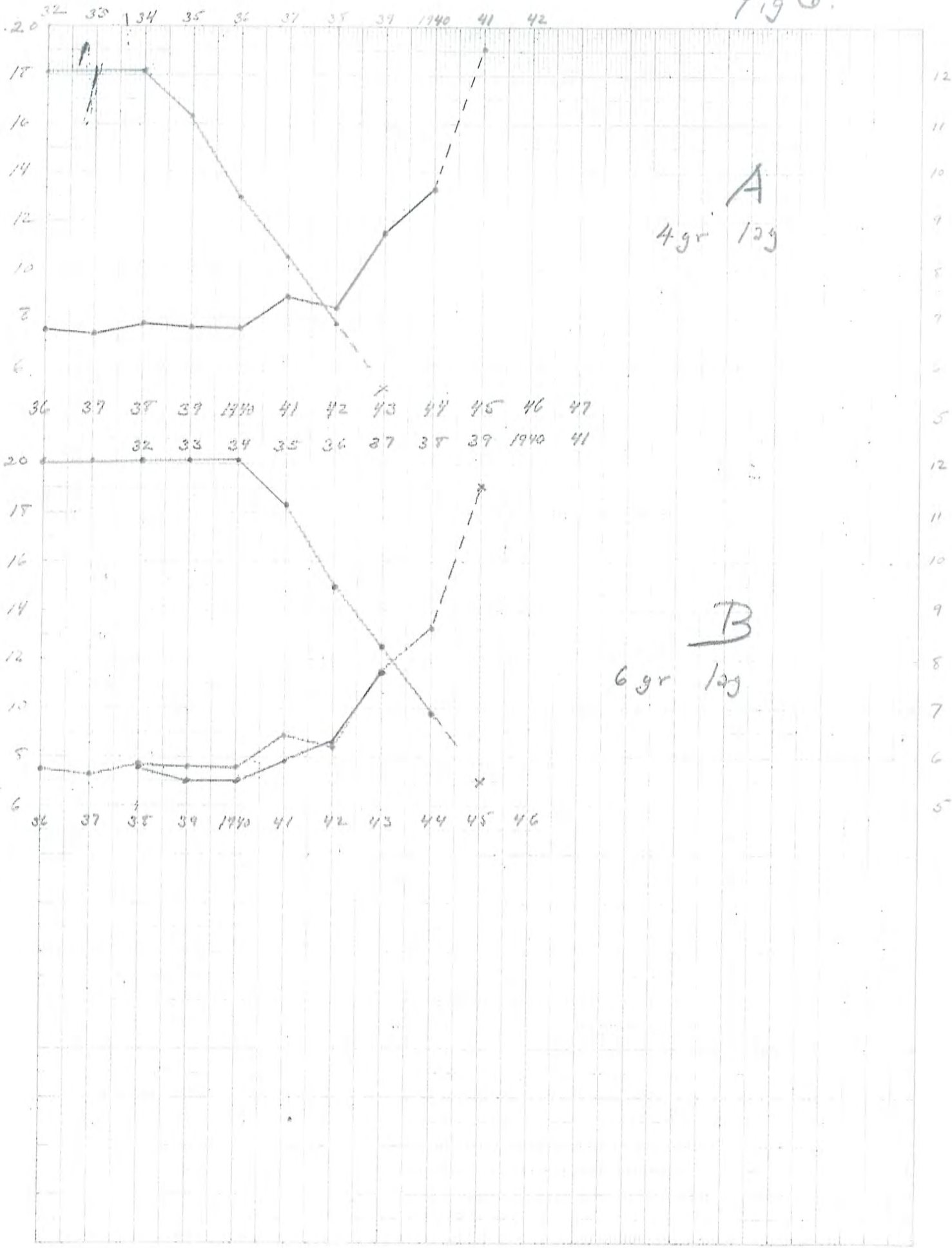
Results Obtained from Going with the Fishermen When They Were Hauling Their Traps - 1933

	9" - 10¼"		10¼ - 11"		11" - 12"		12" - 13"		13" - 14"		14" - 15"		15" - 16"		16" - 17"		Number	
	No	Lbs	No	Lbs	No	Lbs	No	Lbs.									Males	Female.
Casco Bay	110	72¼	63	75	69	108½	30	71¾	20	31	1	3¾	—	—	—	—	131	162
Duck Island	295	218¾	56	78½	71	111¼	36	73¼	11	11½	2	6¾	1	3¼	—	—	222	250
Portland	176	155	160	267½	105	188¼	29	75¾	9	30¼	—	—	—	—	—	—	239	240
Orr's + Bailey's Ids	91	80¼	33	56½	32	66¾	6	13½	3	38½	—	—	—	—	—	—	62	103
Boothbay Hbr.	48	53⅝	16	23¼	14	23½	7	15¼	2	5¾	3	10	1	4½	—	—	54	37
Cosco	177	144½	108	143	68	119	28	63¾	26	70	13	44½	4	23¼	2	14¼	232	194
Tenant's Harbor	55	55	40	56½	29	44¼	14	28¼	8	22	3	8¾	—	—	—	—	70	79
Westhill Bay	14	17½	7	11½	—	—	5	20	—	—	—	—	1	3¼	—	—	13	14
Totals	966	796⅞	483	711¾	388	661½	150	361½	79	209	22	74¾	7	34¼	2	14¼	1023	1079

Grand Total: 2102 - 2863⅞ Lbs.

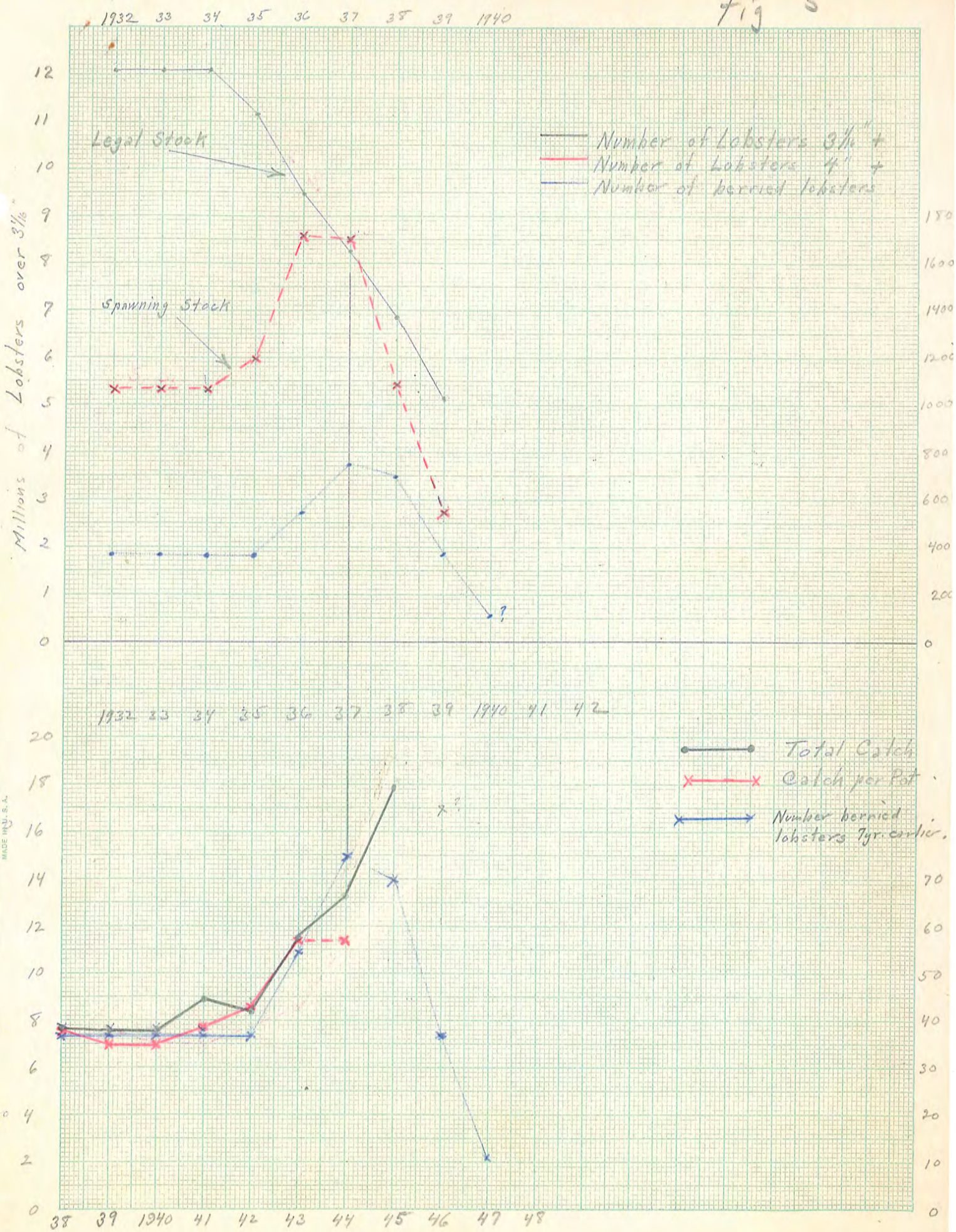
Do not copy

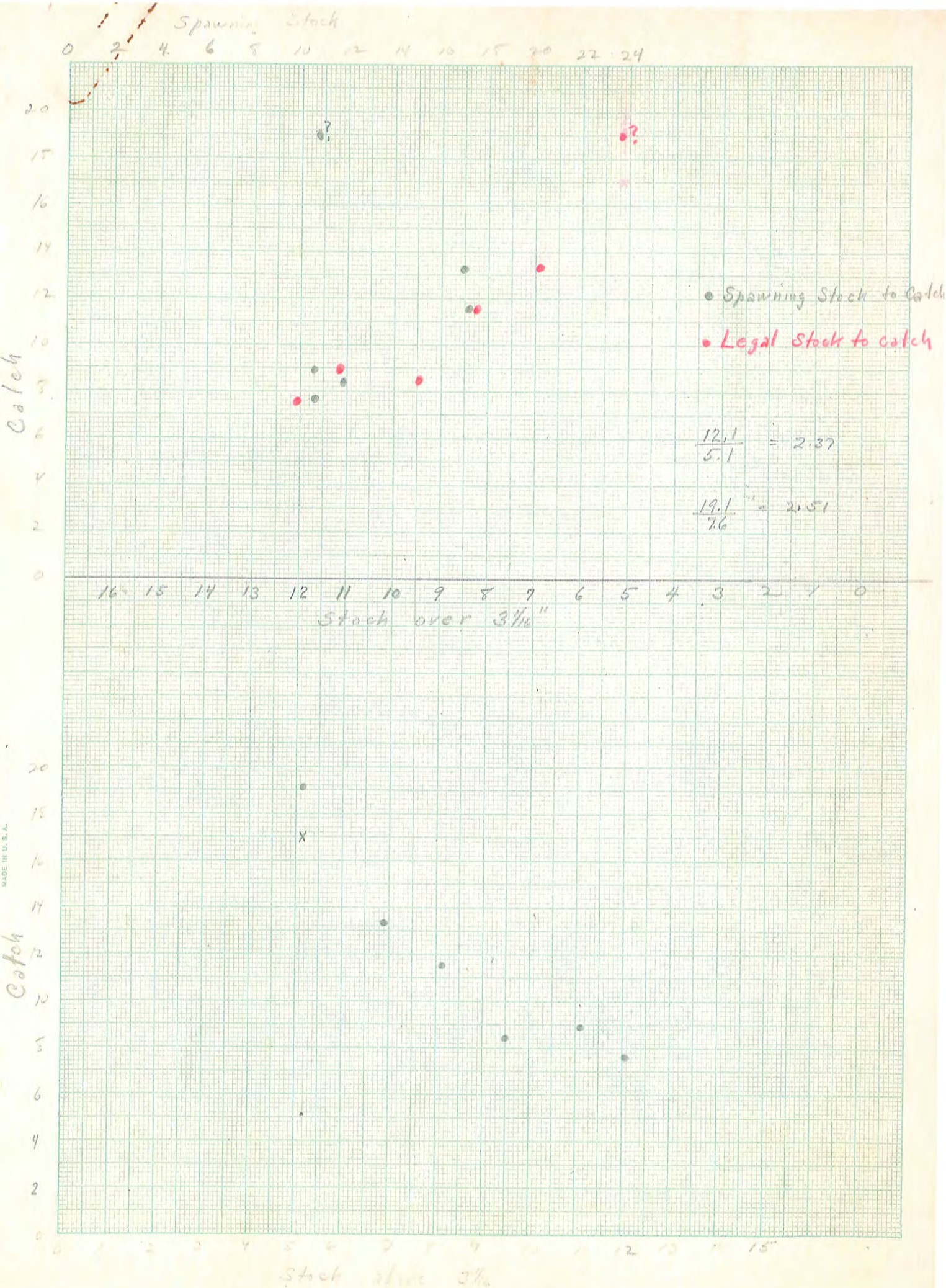
Fig 6.



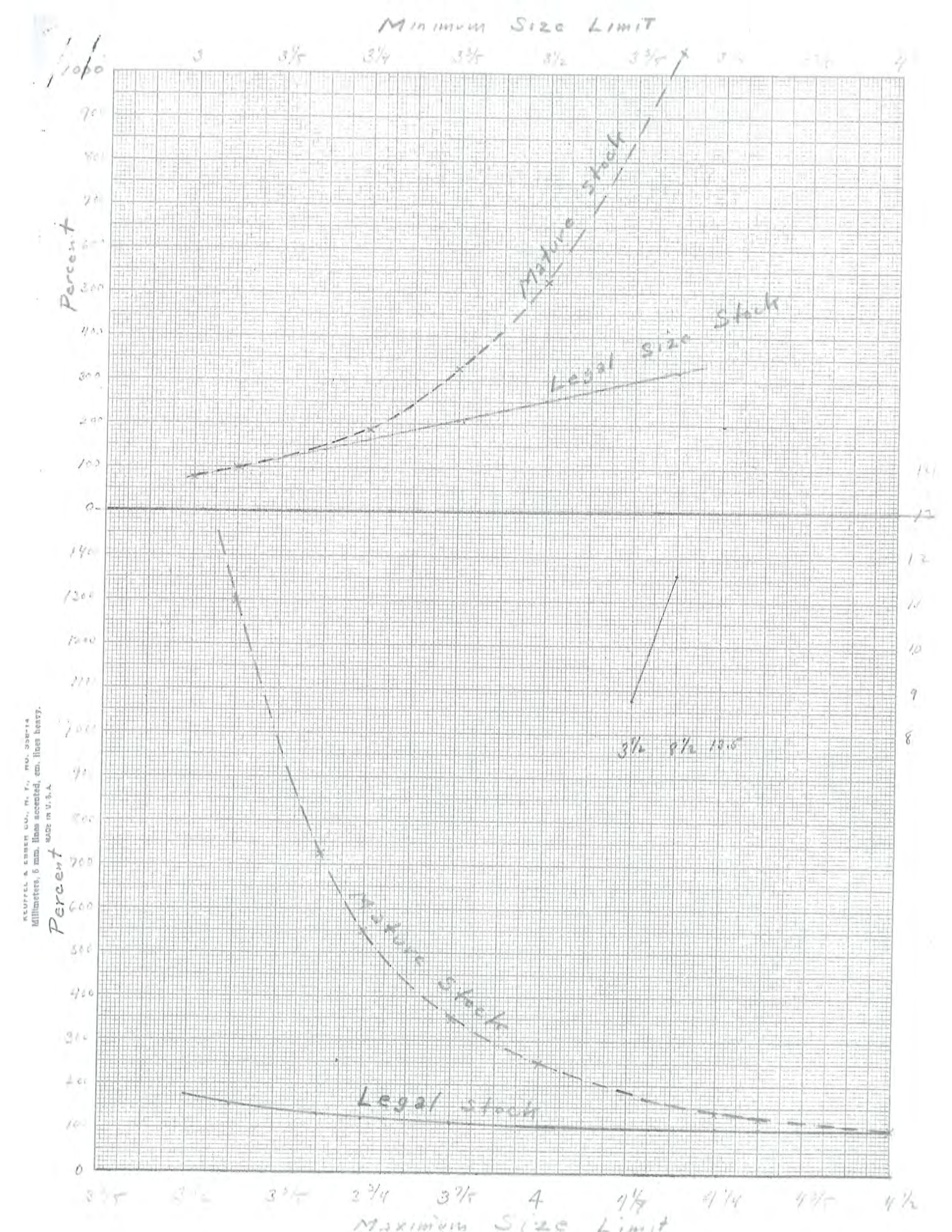
KEUFFEL & ESSER CO., N.Y. NO. 358-14B
Millimeters, 3 form. lines accented, cm. lines heavy.
MADE IN U.S.A.

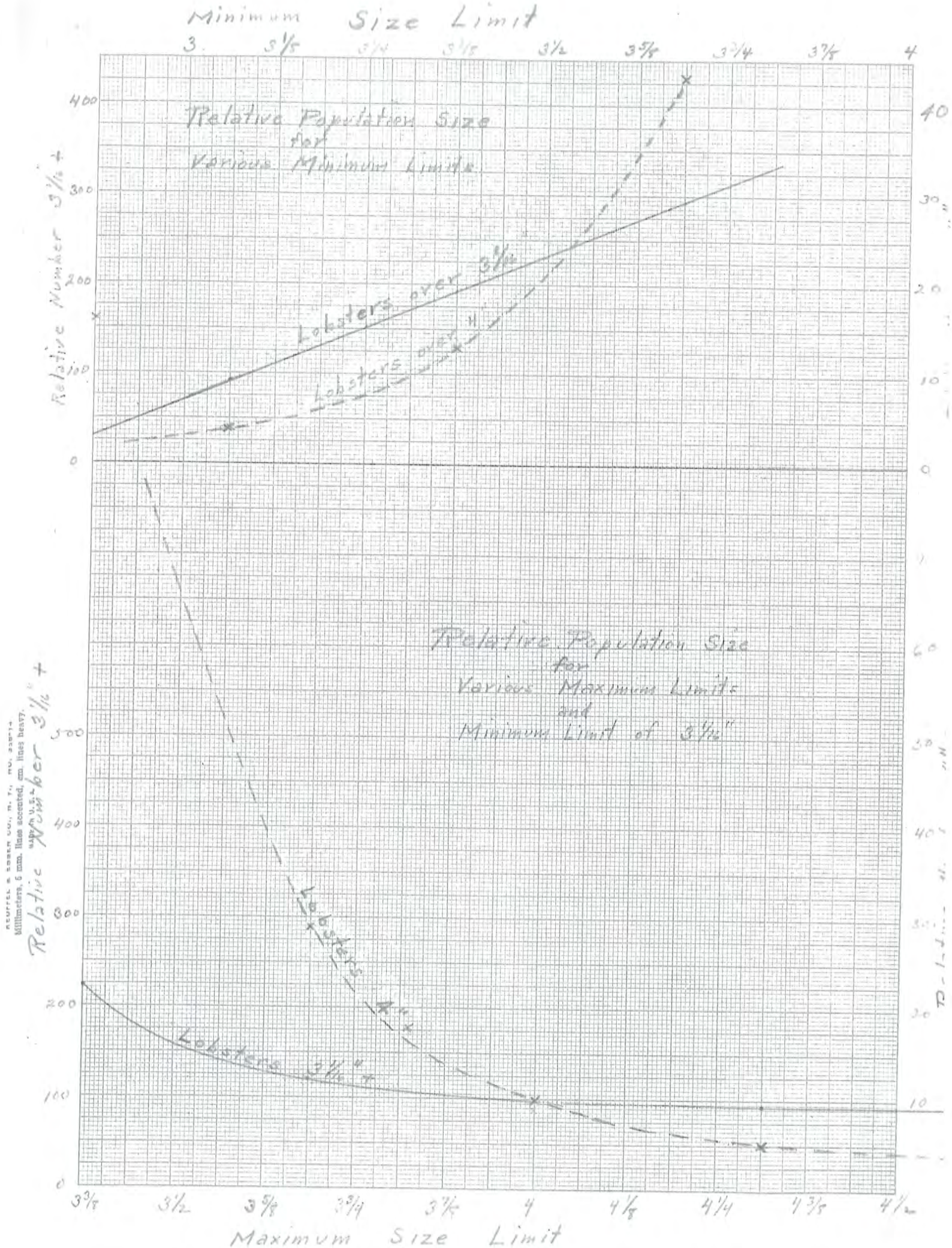
Fig 5


1932 33 34 35 36 37 38 39 1940
Legal Stock
Spawning Stock
Number of Lobsters 3 1/16" +
Number of Lobsters 4" +
Number of berried lobsters
Millions of Lobsters over 3 1/16"
1932 33 34 35 36 37 38 39 1940 41 42
Total Catch
Catch per Pot
Number berried lobsters 7yr. earlier.
38 39 1940 41 42 43 44 45 46 47 48



KEUFFEL & ESSER CO., N.Y. NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U.S.A.

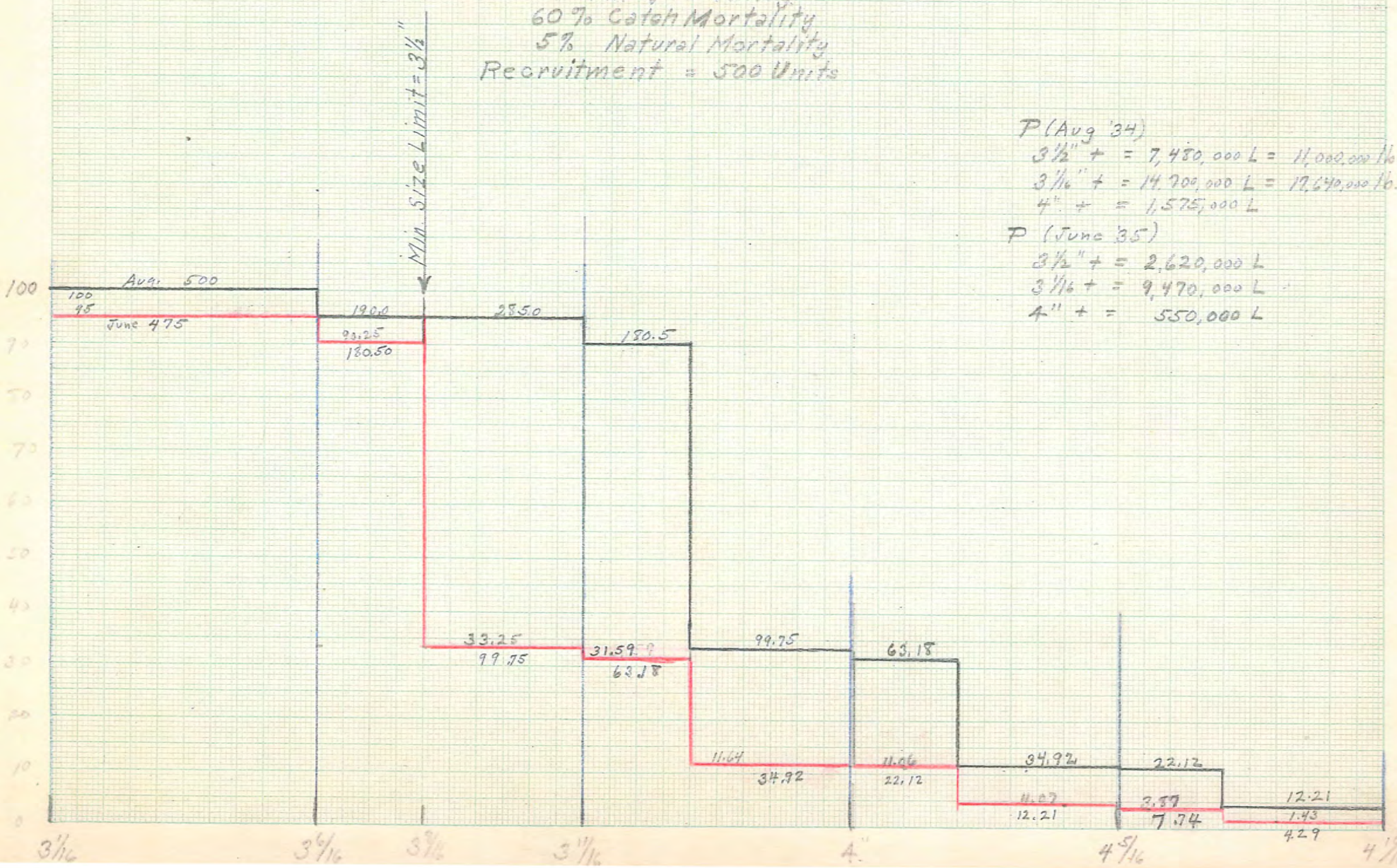

Minimum Size Limit
Percent
Mature Stock
Legal Size Stock
3½ 8½ 13.5
Mature Stock
Legal Stock
Maximum Size Limit


Minimum Size Limit
3
3 1/8
3 1/4
3 3/8
3 1/2
3 5/8
3 3/4
3 7/8
4
Relative Population Size for Various Minimum Limits
Lobsters over 3 5/16"
Lobsters over 3 1/4"
Relative Number 3 1/16" +
400
300
200
100
0
40
30
20
10
Relative Population Size for Various Maximum Limits and Minimum Limit of 3 1/16"
Lobsters 3 1/16" +
Relative Number 3 1/16" +
500
400
300
200
100
0
60
50
40
30
20
10
3 3/8
3 1/2
3 5/8
3 3/4
3 7/8
4
4 1/8
4 1/4
4 3/8
4 1/2
Maximum Size Limit

KEUFFEL & ESSER CO., N. Y. NO. 359-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U. S. A.

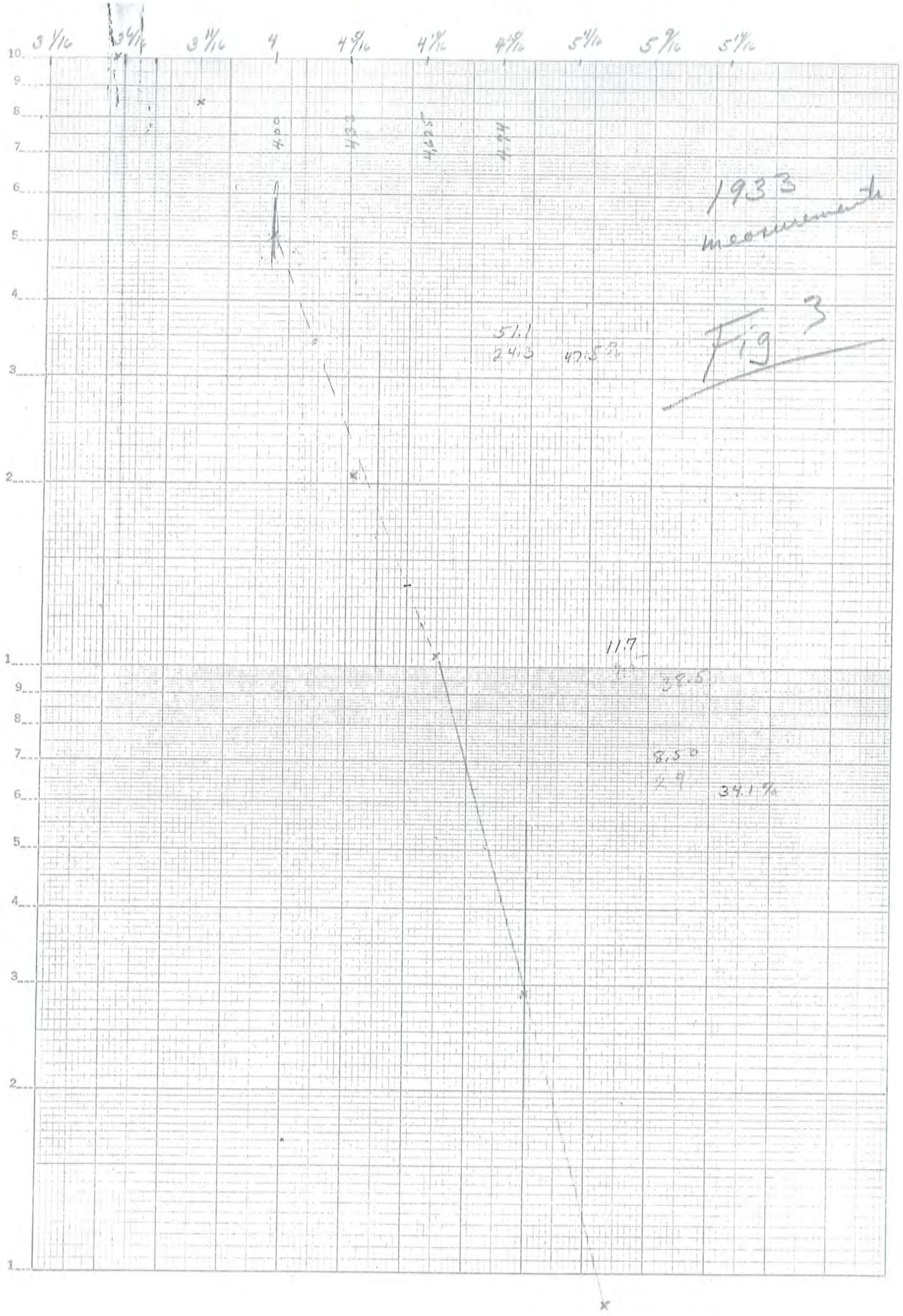
Survival from 3 1/16" 1934

3½" size limit
65% Total Mortality
60% Catch Mortality
5% Natural Mortality
Recruitment = 500 Units



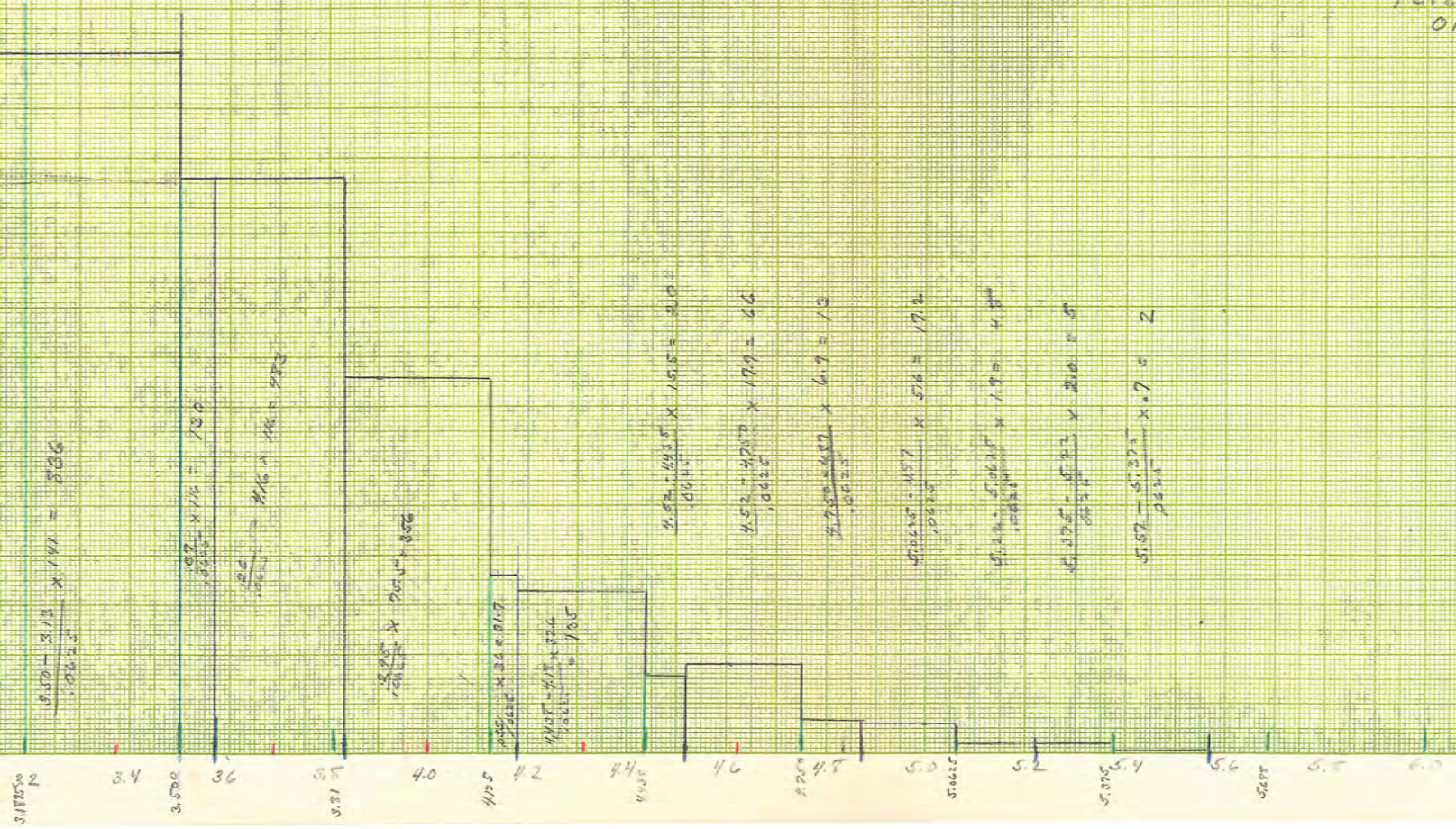
P (Aug '34)
3½" + = 7,480,000 L = 11,000,000 lb (716.00
3 1/16" + = 14,700,000 L = 17,640,000 lb. (690.00
4" + = 1,575,000 L

P (June '35)
3½" + = 2,620,000 L
3 1/16 + = 9,470,000 L
4" + = 550,000 L



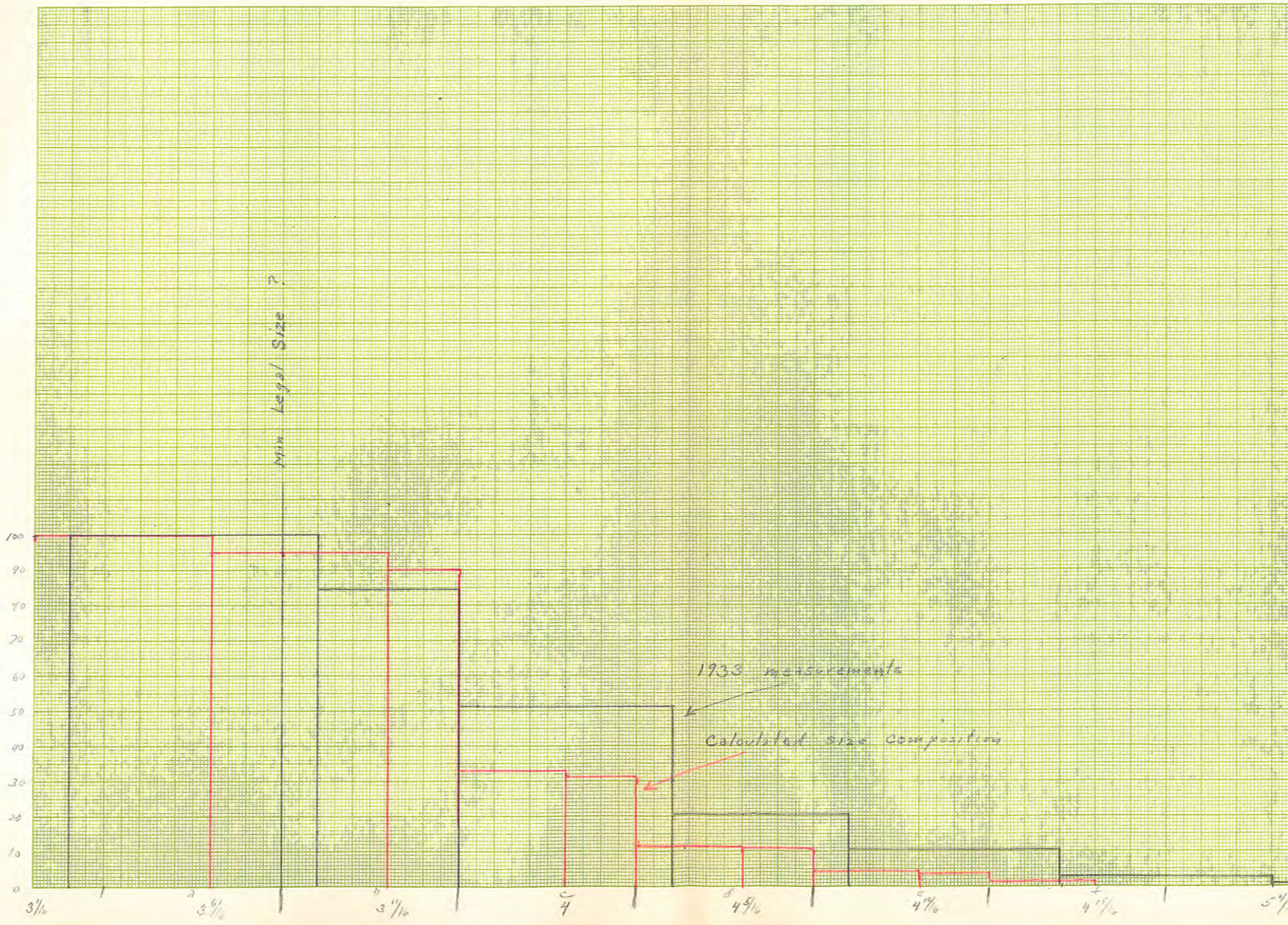
KEUFFEL & ESSER CO., N. Y. NO. 359-63
Semi-Logarithmic, 2 cycles × 10 to the ½ inch, 5th lines accented
MADE IN U. S. A.

1933 Lobster Measurements



3 7/16 - 3 9/16 (3.0625 - 3.187)	= 282.0	
3 5/16 - 3 7/16 (3.1875 - 3.30)	= 705.0	987.0
3 3/16 - 3 5/16 (3.30 - 3.31)	= 613.0	
3 1/16 - 4 (3.31 - 4.00)	265.0	878.0
		1865.0
4 - 4 1/16 (4.00 - 4.125)	= 151.0	
4 1/16 - 4 3/16 (4.125 - 4.438)	= 166.7	
4 3/16 - 4 5/16 (4.438 - 4.750)	= 96.0	
4 5/16 - 5 1/16 (4.750 - 5.0625)	= 30.2	
5 1/16 - 5 3/16 (5.0625 - 5.375)	= 9.5	
5 3/16 - 5 1/2	3.5	
	1.2	448.4

Total	2253.4
" 3 1/2 +	1266.4
Percent 4 +	
OF 3 1/16 +	19.9
3 1/2 +	35.4



KEUFFEL & ESSER CO., N. Y. NO. 359-14L
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U.S.A.

SPECULATIONS ON LOBSTER SURVIVAL RATES

	Legal	Berried [1]		No. Eggs	4th St.	4th St.	4th St.	Catch 1945	Overall Survival from egg	From 4th to legal		
		No	%							1st to 4th Surv.		
	~~1,550~~			@ 10,000 1,000	(1% surv.) 1000	(10% surv.) 1000	(5% surv.) 1000	1,000		1%	5%	10%
1939	5,120	184	3.6	1,840,000	18,400	184,000	92,000	18,000	1%	100	20	10
	5,120	184		@ 20,000 3,680,000	36,800	368,000	184,000	18,000	0.5%	49	10	5

[1] Table —

Calculated Average Weight

3/16 - 3 6/16 Av. = 7/8 lb.
1928-34 Av. catch = 6,600,000 lb.
1934 N.M. = 5%, CM = 60%

	Avg 1934 + 1935 No	Av. Wt.	Tot. Wt.		Avg '36 No				Avg 37 No				Avg 38 No.		
3 1/16 - 3 6/16	500.0	.875	438		500.0	.875	438		500.0	.875	438		500.0	.875	438
3 6/16 - 3 8/16	190.0	1.07	203	3 7/16-3 11/16	257.0	1.157	297		242.0	1.157	280		219.0	1.157	253
				3 11/16-3 13/16	97.7	1.37	134	3 7/16-4	124.3	1.494	186		106.0	1.494	158
3 8/16 - 3 13/16	465.5	1.27	591					4-4 5/16	118.2	1.884	221		55.5	1.884	105
3 13/16 - 4 2/16	163.0	1.63	266		239.5	1.63	391					4 5/16-4 10/16	51.8	2.345	122
4 2/16 - 4 7/16	57.0	2.05	117		83.9	2.05	172	4 5/16-4 7/16	44.9	2.20	99				
4 7/16 - 4 12/16	19.9	2.54	51		29.3	2.54	74		40.6	2.54	103	4 10/16-4 15/16	19.7	2.70	53
4 12/16 - 5 1/16	7.0	3.10	22		10.3	3.10	32		14.2	3.10	44		17.8	310	55
Total															
3 1/16 - 5 1/16	1402.4		1688		1217.7		1538		1084.2		1371		969.8		1184
3 8/16 - 5 1/16	712.4		1047.												
Av.															
3 1/16 - 5 1/16		1.203				1.26					1.265				1.22
3 8/16 - 5 1/16		1.47													

	Avg '39			Avg '40	
3 1/16 - 3 6/16	500.0	.875	438	500.0	438
3 6/16 - 3 11/16	169.0	1.157	176	89.0	103
3 11/16 - 4	25.0	1.494	112	30.0	45
4 - 4 5/16	36.3	1.884	68	13.4	25
4 5/16 - 4 10/16	18.7	2.345	44	6.5	15
4 10/16 - 4 15/16	17.7	287	51	3.3	9
4 15/16 - 5 1/16	6.8	3.27	22	1.3	4
	823.5		931	643.5	639
			1.13		.99

Effect of Planting 4th Stage Lobsters

Assuming 25% survival to legal size and 70% Catch Mortality

	1938		1939		1940		1941		1942					
	40,000		160,000		597,200		690,000		222,000					
1944	10,000	7,000											7,000	
45	3,000	2,100	40,000	28,000									30,000	
46	900	630	12,000	8,400	148,300	104,000							113,000	
47	270	190	3600	2520	44,800	31,300	172,500	121					155	
48	81	57	1,086	756	13,300	9,300	51,800	36	55,500	39			85	
49	24	17	324	227	4,000	2,800	15,500	11	16,650	12				
1950	7	5	97		1,200	840	4,650	3	5,000	4				

Effect of Increasing the Size Limit to 3 1/8"

Assuming 7/8 lb. for 3 1/16 - 3 4/16, and increase as L^3 and 70% mortality

	1941	42	43	44	45		1941	42	43	44	45
3 1/16 - 3 4/16	500.0	400.0	400.0	400.0	400.0	.875	438	360	360	360	360
3 4/16 - 3 7/16	150.0	150.0	215.0	215.0	215.0	1.157	174	174	249	249	249
3 7/16 - 4	45.0	45.0	45.0	64.5	64.5	1.494	67	67	67	96	96
							679	591	666	695	
4 - 4 5/	13.5	13.5	13.5	13.5	19.35	1.894	25	25	25	25	36
4 5/ - 4 9/	4.0	4.0	4.0	4.0	4.0	2.345	9	9	9	9	9
4 9/ - 4 13/	1.2	1.2	1.2	1.2	1.2	2.87	3	3	3	3	3
	713.7	613.7	678.7		704.0		716	638	713	742	751
							100	89	100	104	105
							8,900	7,920	8,900	9,250	9,340
			400.0	400							
			220.0	220							
			45.0								

U

Comparison of Lobster Stocks in 1935 and 1940, Recruitment + Catch

1934 70.3 U., N.M + 429.7 C.M. = 500 U. recruitment

429.7 C.M. = 6,600,000 lb (av. production 1929-34) ÷ 1.47 = 4,485,000 L

1 U = 10,450 L 500 U = 5,225,000 L = recruitment

Aug 1935	3 1/16" +	= 1406 U.	= 14,700,000 L	× 1.20 = 17,640,000 lb.	1.20
	3 1/2" +	= 716 U	= 7,480,000 L	× 1.47 = 11,000,000 lb.	1.47
	3 1/16 - 3 1/2	= 690 U	= 7,220,000 L	= 6,640,000 lb	0.92

Aug. '35	3 1/16" +	1406 U	= 14,700,000 L	× 1.20 = 17,640,000 lb	1.20
Aug '40	3 1/16 +	648.2 U	= 6,770,000 L	× .99 = 6,710,000 lb	.99
Decline =			7,930,000 L	= 10,930,000 lb	1.38

Total catch 1935-1939 31,165,000 L = 37,800,000 lb.

Increment '35-'39 = 5 × 500 U - NM[#]
= 2500 - 276.8 = 2223 × 10,450 = 23,500,000 L.

Deficit of increment below catch 7,665,000 L

From table showing Calculated Survival Rates.

Speculations on Mortality + Survival Rates

Lobsters

Rate of Decline in Stock

Age		5%	10%	15%	20%
		at Given Mortality Rates			
IV		100	100	100	100
V		95	90		80
VI	3 1/16	90	81		64
VII		86	73		51
VIII		82	66		41
IX	4"	78	59		33
X	4"	74	53		26
XI	4"	70	48		21
XII	4"	67	43		17
XIII	5"	64	39		14
XIV	5"	61	35		11
XV	5"	58	31		9

Estimated Survival Rates for Various Periods of Lobster Life Cycle

Age or Size	No.	1/ Annual Survival	Age Size	No.	2/ Annual Survival
Total 3 1/16"+	100	%	3 1/2+	100	
4"+	4	30	4"+	21	30
eggs	3/ 13,000			3/ 70,000	
1st st.	11,700	90		63,000	90
4th stage	341	3		630	1
1 yr	170	50		189	30
2"	136	80		132	70
4"	110	90		107	90
6"	100	95		97	95

3/ 1/3 of mature lobsters would be berried females, production 10,000 eggs each.

1/ Assumes Mortality and Recruitment in equilibrium with 3 1/16" min. size and 70% total Mortality for legal sizes.

2/ Assumes Mortality and Recruitment in equilibrium with 3 1/2" min. size and 65% T. M. for legal sizes

KEUFFEL & ESSER CO., N. Y. NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U. S. A.

Fig 4 (Add observed Length frequencies for 1940)

Add

Survival from 3 1/16", 1940

3 1/16" size limit
Total Mortality varying as calculated

P(Aug. 40)
3 1/16" + = 6,770,000 L = 6,710,000 lb. (64.2%)
4" + = 305,000 L (29.2%)

KEUFFEL & ESSER CO., N. Y. NO. 358-14
Millimeters, 5 mm. lines accented, cm. lines heavy.
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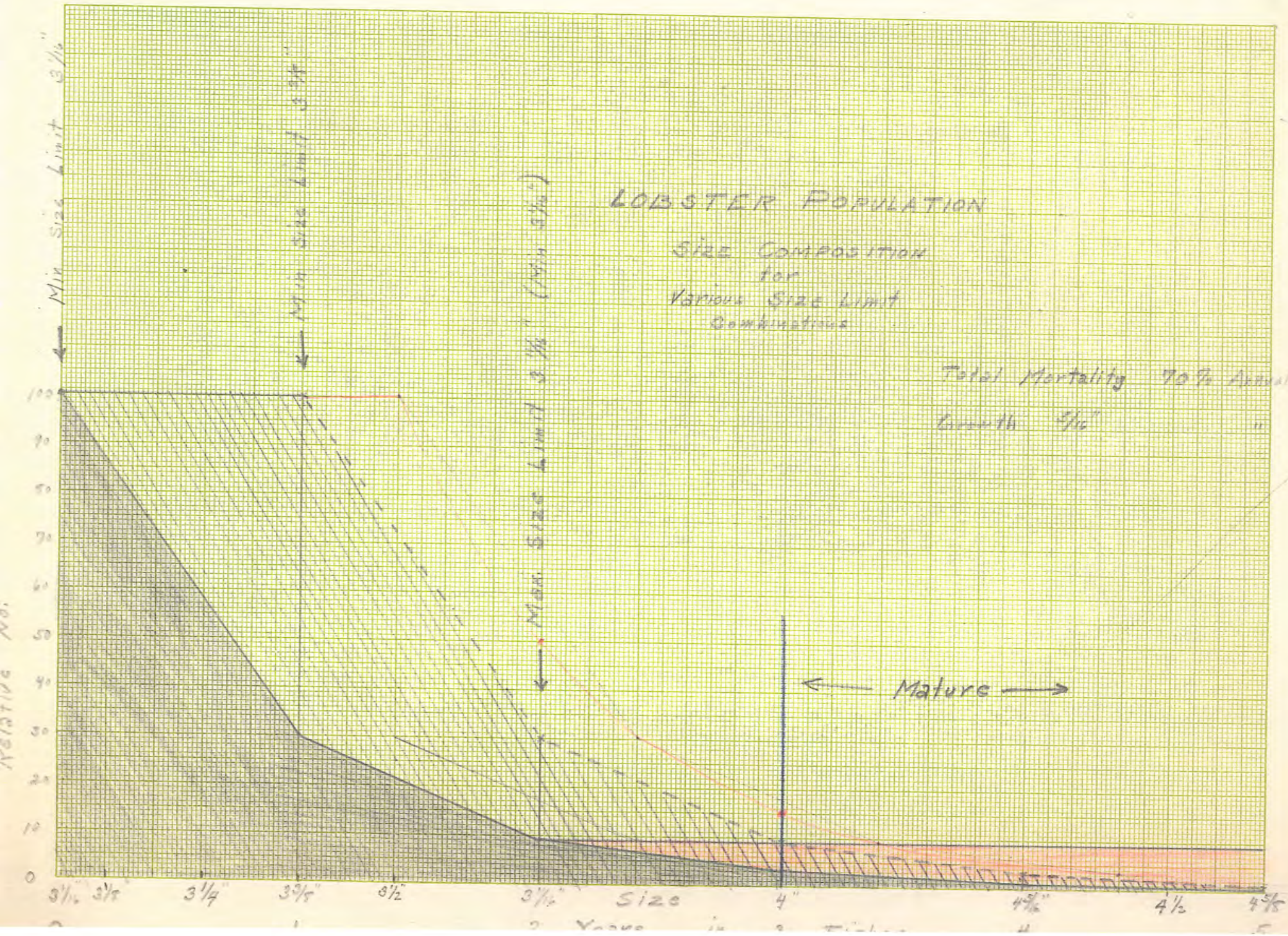

KEUFFEL & ESSER CO., N.Y. NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
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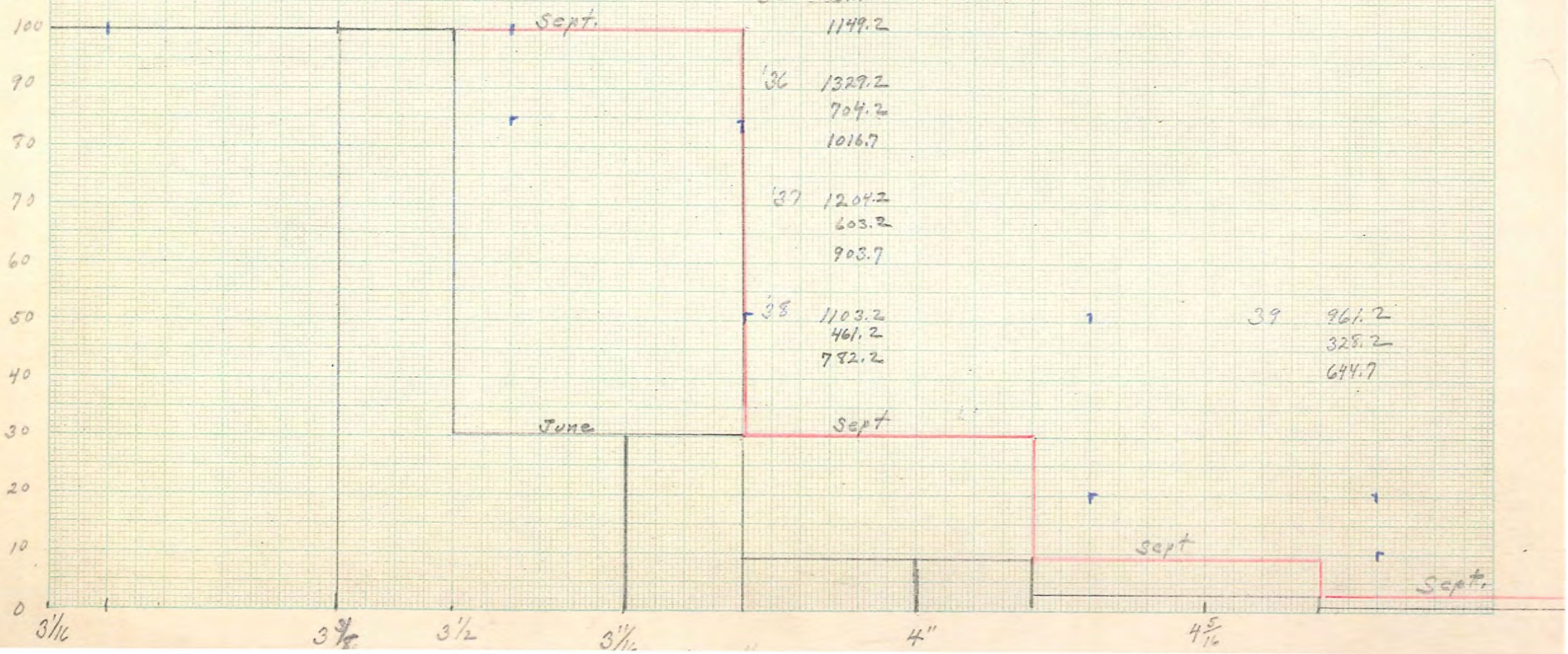
Fig —

Calculated Size Composition of Lobster Stock in 1935

Survival from 3 1/16"
3 1/2" Size limit
No Natural mortality
70 % Catch "

		3 1/2" min Size				3 1/16" min Size		
70%		Over 3 1/16"	3 1/2"	4"	%	3 1/16"	4"	%
	Sept	1414	714	124	17.4	714	19.1	2.7
	June	914	214	37	17.3	214	5.6	2.6
	Av.	1164	464	80.5		464	12.4	
65%	Sept	1469.2	769.2	164.2	21.3	769.2	32.9	4.3
	June	969.2	269.2	57.4	21.3	269.2	11.4	4.2
	Av	1219.2	519.2	111.8		519.2	22.2	
60%	Sept.	1533.1	833.1	213.1	25.5			
	June	1033.1	333.1	85.1	25.6			
	Av.							

	Over 65%	3 1/16" 70%
	1469.2	1414
'35	829.2	
	1149.2	
'36	1329.2	
	704.2	
	1016.7	
'37	1204.2	
	603.2	
	903.7	
'38	1103.2	
	461.2	
	782.2	
'39	961.2	
	328.2	
	644.7	



Effect of Various Size Limits

Lobsters

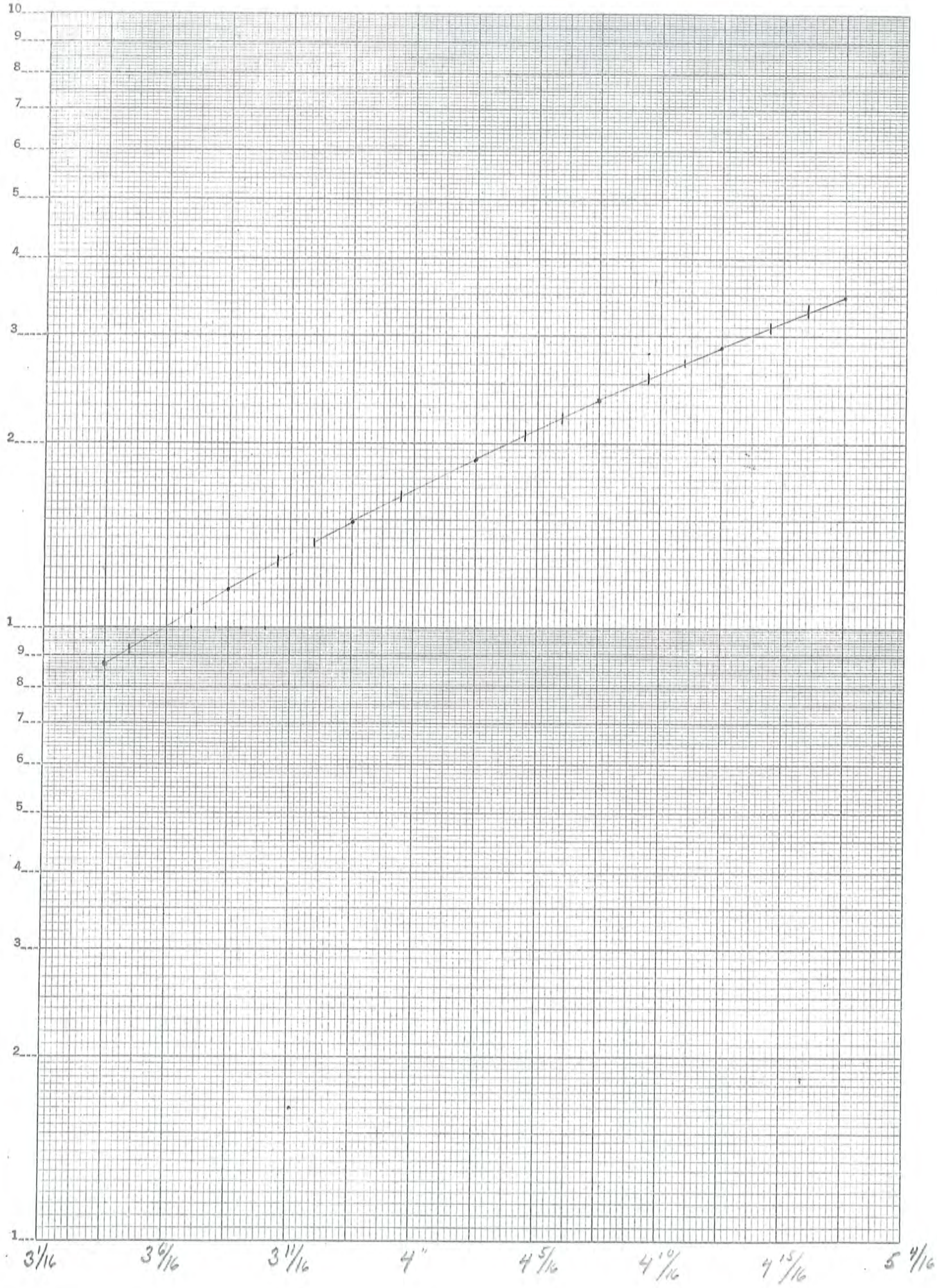
Size Limit	Relative Av. Population 3 1/16" + No.	%	Relative Adult Stock (sp. season) 4" + No.	%
Min 3"	70	76	3	75
3 1/16	92	100	4	100
3 1/4	152	165	7.5	188
3 3/8	192	209	13	325
3 1/2	232	252	21	525
3 11/16	292	318	43	1075
Min 3 1/16				
Max 4 5/8	92	100	4	100
" 4 5/16	94	102	5	125
4 1/4	95	103	5.5	138
4	99	108	10	250
	104	113	14	350
3 3/4	112	122	22	550
3 11/16	120	130	29	725
3 9/16	140	152	52	1300
3 1/2	158	172	65	1625
3 3/8	221	203	96	2400

Total mortality legal sizes 70% annually

Mortality non-legal sizes disregarded

Growth 5/16" annually

Size at maturity 4"



KEUFFEL & ESSER CO., N. Y. NO. 359-63
Semi-Logarithmic, 2 cycles × 10 to the ½ inch, 5th lines accented
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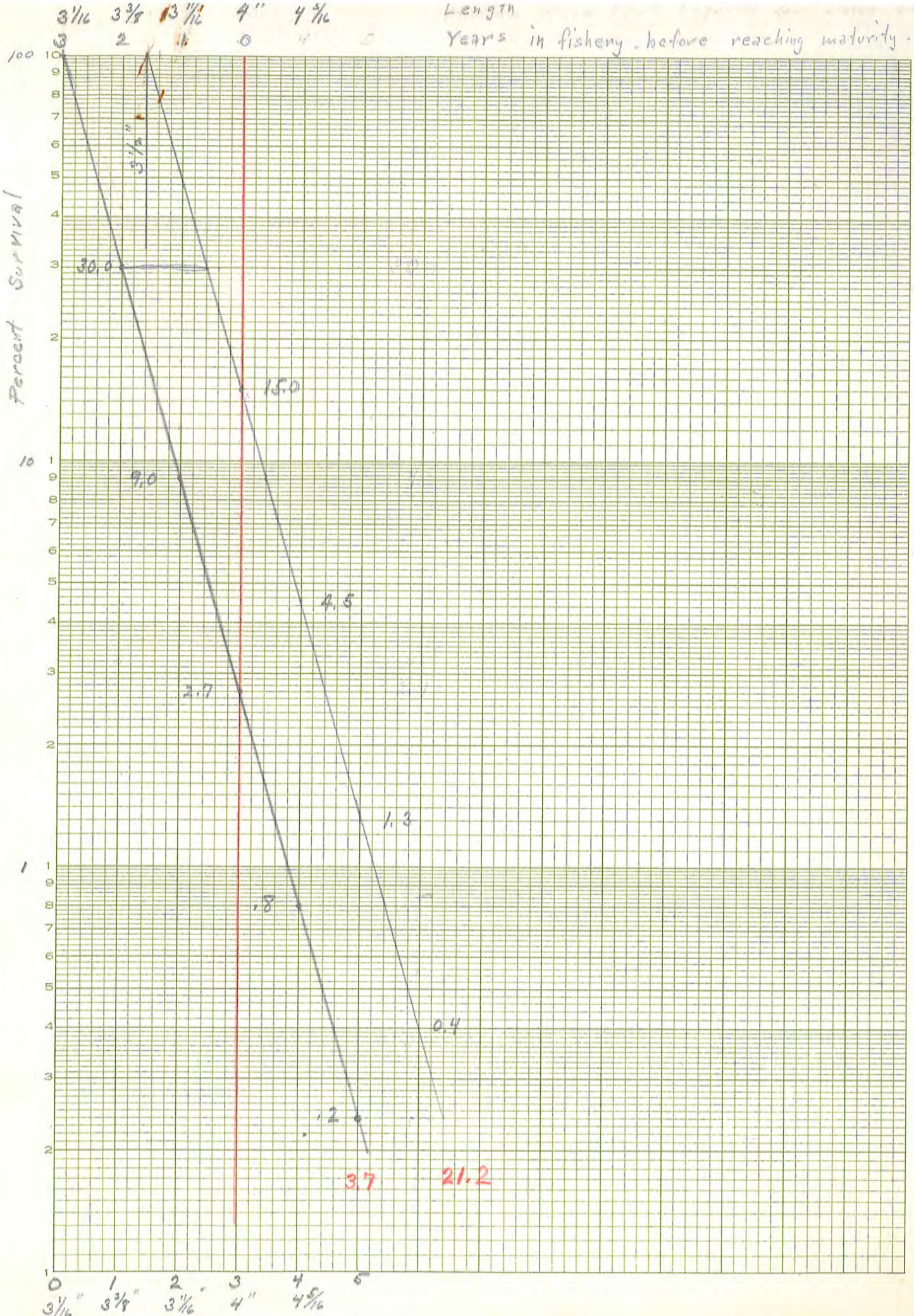
Possibilities from maintaining adequate spawning stock but reducing legal size stock

Need of experiments to determine competition between young and legal size
At what size of young is competition greatest



EUGENE DIETZGEN CO.
PRINTED IN U.S.A.
SEMI-LOGARITHMIC—3 CYCLES X 70 DIVISIONS

Table I

Survival Rates with Various min sizes + Mortality Rates

	3½" Min Size Sept		June		3 1/16" Min Size			
	70%				70%			
3 1/16 - 3½	700		700		3 1/16 - 3 5/8	500	150	
					3 5/8 - 3 1/16	150	45	
3½ - 4	500		150		3 1/16 - 4	45	13.5	
	90	590	27	177		695	208.5	
4 +	60		18			13.5	4.0	
	45		14			4.0	1.2	
	14		4	37 17.3		1.2	.4	
	4	124 17.4	1			1.4	268 5.6	2.61
	1					17.1		
Total 3½ +		714		214		714.1	214.1	
		1414		914				

	65%				65%			
3 1/16 - 3½	700		700		3 1/16 - 3 5/8	500	175	
					3 5/8 - 3 1/16	175	61.3	
3½ - 4	500		175		3 1/16 - 4.0	61.3 736.3	21.5	257.8
	105	605	36.8	211.8				
4 +	700		24.5		4 +	21.5	7.5	
	61.3		21.5			7.5	2.6	
	21.5		7.5			2.6	0.9	
	7.5		2.6			0.9	.3	
	2.6		0.9			0.3	.1	11.4 4.23
	0.9		0.3			0.1 32.9 4.25		
	0.3		0.1	57.4				
	0.1	164.2				769.2		269.2
		769.2		269.2				
		1469.2		969.2				
	60%							
3 1/16 - 3½	700		700					
3½ - 4	500		200					
	120	620	48	248				
4 +	80.0		32.0					
	80.0		32.0					
	32.0		12.8					
	12.8		5.1					
	5.1		2.0					
	2.0		.8					
	.8		.3					
	.3		.1	85.1 25.6				
	.1	213.1 25.5						
		833.1		333.1				

Lobsters

Table 2

Calculated Survival to Maturity

with 70% total Mortality in 1934-35 and
Calculated Survival Rate from Table 3

	Aug. '34		June '35		Aug '35		June '36		Aug '36		June '37
3 1/16 - 3 3/8	500		500		500		273.		3 1/16 - 3 3/8 500		254.0
3 3/8 - 3 1/2	200	700	200	700	200	700	109.		3 3/8 - 3 11/16 273		138.9
3 1/2 - 3 11/16	300		90		300		164.		3 11/16 - 4 273		138.9
3 11/16 - 3 13/16	200		60		200		109.				
3 13/16 - 4	90	590	27	177	90	590	49.1	704.1		1046	531.8
		1290				1290					
4" - 4 1/8	60.0		18.0		60.0					158.1	
4 1/8 - 4 7/16	45.0		13.5		27.0						
4 7/16 - 4 13/16	13.5		4.0								
4 13/16 - 5 1/16	4.0		1.2								
	1.2		.4		37.2						
	.4		.1								
	.1	124.2		37.2		124.2		67.8		67.8	2259	114.8
Total		1414.2		914.2		1414.2		771.9		1271.9	646.6
Total over 3 1/2		714.2		214.2		714.2					
% Survival to 4" of 3 1/16" +		8.8		4.1		8.8		8.8		17.8	17.8
of 3 1/2" +		17.4		17.4		17.4					

	Aug. '37		June '38		Aug. '38		June '39		Aug '39		June 40
3 1/16 - 3 3/8	500.0		235.0		500.0		191.0		500.0		147.0
3 3/8 - 3 11/16	254.0		119.4		235.0		89.8		191.0		56.2
3 11/16 - 4	138.9		65.3		119.4		45.7		89.8		26.4
		892.9		419.7		854.4		326.5		780.8	229.6
4 - 4 5/16	138.9				65.3				45.7		
4 5/16 +	114.8	253.7		119.2	119.2	184.5		70.5	70.5	116.2	34.2
Total		1146.6		538.9		1038.9		397.0		897.0	263.8
% over 4".		22.1		22.1		17.8		17.8		13.0	13.0

	Aug '40		June '41		Aug. '41
3 1/16 - 3 3/8	500.0		147.0		500.0
3 3/8 - 3 11/16	147.0		43.2		147.0
3 11/16 - 4"	56.2	703.2	16.5	206.7	43.2 690.2
4 - 4 5/16	26.4				16.5
4 5/16 +	34.2	60.6		17.8	17.8 34.3
Total		763.8		224.5	724.5
%		7.9		7.9	4.7

Table 3.

Calculated Survival Rates

Lobsters

1934 - 1940

No Natural Mortality

65% Total "

No adjustment for change in wt. of lobsters

Aug. '34	1414	
'34 catch	500	
June '35	914	(64.7%)
Aug. '35	1414	
'35 catch	642	
June '36	772	(54.6)
Aug. '36	1272	
'36 catch	625	
June '37	647	(50.8)
Aug. '37	1147	
'37 catch	608	
June '38	539	(47.0)
Aug. '38	1039	
'38 catch	642	
June '39	397	(38.2)
Aug. '39	897	
'39 catch	633	
June '40	264	(29.4)
Aug. '40	897	
'40 catch	633	
June '41	264	(29.4)

No. units over 3 1/16" = 16,970,000 lb.

500 units equals 6,000,000 lb + 500,000 lb. N.M (5%)

No. units surviving with 70% mortality of lobsters over 3 1/16"

Assuming a stabilized fishery prior to 1935, recruitment = 1934 catch = 50

1935 catch = 7,700,000 lb.

	1934+35 No.	1934+35 Weight Av.	1934+35 Weight Total	1936 No.	1936 Av.	1936 Total	1937 No.	1937 Av.	1937 Tot.	1938 No.	1938 Av.	1938 Tot.	1939 No.	1939 Av.	1939 Tot.
3 1/16 - 3 4/16	500	1.00	500	500		500	500.0			500.0			500.0		
3 4/16 - 3 1/16		1.32		273		360	254.0			235.0			191.0		
3 4/16 - 3 1/2	200	1.22	244												
3 1/2 - 3 11/16	300	1.39	417												
3 11/16 - 4	290	1.71	496	273		467	138.9		237	119.4	20	204	89.8		15
4" - 4 5/16	87	2.15	187	158.1		340	138.9		299	65.3		140	46.6		1
4 5/16 - 4 5/8	26	2.67	69	47.5		127	80.4			65.3			24.9		
4 5/8 - 4 15/16	8	3.28	26	14.2		47	24.1			37.8			24.9		
4 15/16 - 5 4/16	2	3.96	8	4.4		17	7.2			11.3			14.5		
5 4/16 - 5 9/16	1	4.73	5	1.1		5	2.2			3.4			4.3		
				.5			0.6			1.0			1.3		
													.4		
1934	714		1208	1271.8		1863	1146.3			1038.5			897.7		
1935	1414		1952												
Av. 1934			1.69			1.46									
35			1.38												

Table 4/ Calculated Survival to Maturity
With 5% Natural Mortality
and 65% Total Mortality in 1934-35

Lobsters

	Aug. '34		June '35		Aug '35		June '36			Aug. 36		June 37
3 1/16 - 3 3/8	500		475.0		500.0		235.0		3 1/16 - 3 3/8	500.0		202.1
3 3/8 - 3 1/2	190	690	180.7	655.7	190.0	690.0	89.4		3 3/8 - 3 1/2	235.0		95.0
3 1/2 - 3 11/16	285.0		99.8		285.0		134.1		3 1/2 - 4	223.5		90.5
3 11/16 - 3 13/16	180.7		63.2		180.7		85.0					
3 13/16 - 4	99.8	565.5	35.0	198.0	99.8	565.5	47.0	590.5			958.5	387.6
						1255.5						
4 - 4 1/8	63.2		22.1		63.2		29.7		4-4 5/16	132.0		53.3
4 1/8 - 4 7/16	57.1		20.0		57.1		26.9		4 5/16 - 4 7/16	29.7		12.0
4 7/16 - 4 12/16	20.0		7.0		20.0		9.4		4 7/16 - 4 12/16	26.9		10.9
4 12/16 - 5 1/16	7.0	147.3	2.4	51.5	7.0	147.3	3.3		4 12/16 - 5 1/16	9.4		3.8
5 1/16 - 5 4/16	2.4		.9		2.4		1.1			3.3		1.3
5 4/16 - 5 7/16	.9		.3		.9		.4			1.1		.4
5 7/16 - 6	.3		.1	1.3	.3		.1			.4		.2
6 - 6 5/16	.1				.1					.1		
		3.7				3.7		70.9			202.9	81.9
		151.0		52.8		151.0						
Total 3 1/16 - +		1406.5		906.5		1406.5		661.4			1161.4	469.5
Total over 3 1/2 +		716.5		250.8		716.5						
Survival to 4" of 3 1/16 +		10.7		5.8		10.7		10.7			17.5	
of 3 1/2" +		21.1		21.1		21.1						

	Aug '37		June '38		Aug '38		June '39
3 1/16 - 3 9/16	500.0		145.0		500.0		
3 9/16 - 3 11/16	202.1		58.7		145.0		
3 11/16 - 4	95.0	797.1	27.5	231.2	58.7	703.7	
4 - 4 5/16	90.5		26.3		27.5		
4 5/16 - 4 10/16	53.3		15.5		26.3		
4 10/16 - 4 12/16	12.0		3.5	4 10/16 - 4 15/16	15.5		
4 12/16 - 5 1/16	10.9		3.2	4 15/16 - 5 1/16	3.5		
5 1/16 - 5 6/16	3.8		1.1	5 1/16 - 5 6/16	3.2		
	1.3		.4	5 6/16 - 5 11/16	1.1		
	.4		.1		.4		
	.2		.1		.1		
		172.4		50.2	.1	77.7	
		969.5				781.4	
		17.8				9.9	

Weight Increase with Length

Lobsters

Assuming Weight of 3 1/16"-3 4/16" = Unity
and
W varies as L^3

	L_g	L_g^3	Ratio to 3 1/16-3 4/16	
3 1/16 - 3 4/16	3.219	33.35	1.00	.875
3 4/16 - 3 8/16	3.437	40.7	1.22	1.07
3 8/16 - 3 11/16	3.594	46.5	139	1.22
3 11/16 - 4	3.843	56.9	1.71	1.50
4 - 4 5/16	4.156	71.7	2.15	1.88
4 5/16 - 4 10/16	4.468	89.3	2.67	2.34
4 10/16 - 4 15/16	4.781	109.3	3.28	2.87
4 15/16 - 5 4/16	5.094	132.1	3.96	3.47
5 4/16 - 5 9/16	5.406	158.0	4.73	4.14
5 9/16 - 5 14/16	5.718	187.0	5.61	4.91
3 4/16 - 3 11/16	3.531	44.1	1.32	1.15
3 11/16 - 3 13/16	3.750	52.8	1.58	1.38
3 13/16 - 4	3.906	59.6	1.79	1.57
4 - 4 3/16	4.062	67.0	2.01	
4 3/16 - 4 7/16	4.281	78.5	2.35	
4 7/16 - 4 12/16	4.594	99.1	2.97	
4 12/16 - 5 1/16	4.906	118.1	3.54	
5 1/16 - 5 6/16	5.219	142.4	4.27	
5 6/16 - 5 11/16	5.531	169.1	5.07	
5 11/16 - 6	5.843	199.0	5.97	
4 5/16 - 4 7/16	4.375	83.8	2.51	
4 9/16 - 4 13/16	4.687	103.1	3.09	
4 15/16 - 5 1/16	5.000	125.0	3.75	

		✓		
3 1/16 - 3 4/16	3.219	33.35	.875	
3 4/16 - 3 11/16	3.531	44.1	1.157	
3 11/16 - 4	3.843	56.9	1.494	
4 - 4 5/16	4.156	71.7	1.884	
4 5/16 - 4 10/16	4.468	89.3	2.345	
4 10/16 - 4 15/16	4.781	109.3	2.87	
4 15/16 - 5 4/16	5.094	132.1	3.47	

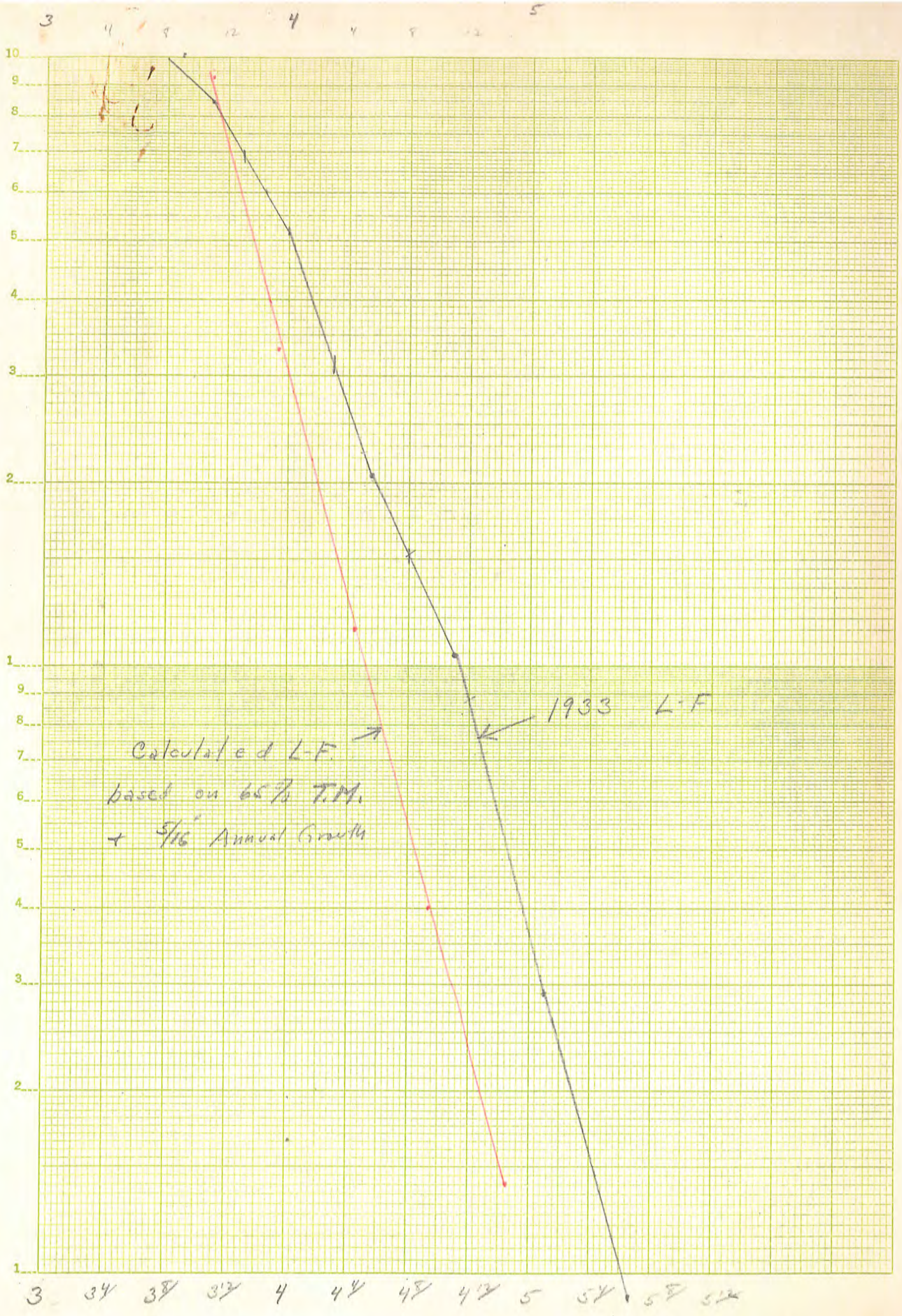
Table 6

Calculated Annual Survival

Lobsters

5% Natural Mortality
60% Comm. M in 1934
C.M. in other years from catch adjusted for change in wt.

	3 1/16 3 1/2	3 1/2	+	Total		
Aug. '34	690.0	716.5		1406.5		No. units over 3 1/16" (proportional to no. lobsters)
	-34.3	-35.8		-70.1		Natural Mortality = 5%
		-429.9		-429.9		Catch " = 60% = 6,000,000 lb ÷ 1.70 = 3,530,000 lobsters
June '35	655.7	250.8		906.5	(64.5)	1 unit = 5,210 lobsters
				500.0		Recruitment = N.M. + C.M.
Aug. '35				1406.5		
				-70.1		N.M.
				-675.0		C.M. = 7,700,000 lb. ÷ 1.39 = 5,540,000 L =
June '36				661.4	(47.1)	
				500.0		Recruitment
Aug 36				1161.4		
				-58.1		N.M.
				-634.0		Catch M = 7,500,000 lb ÷ 1.44 = 5,210,000 L. =
June 37				469.3	(40.4)	
				500		Recruitment
Aug '37				969.3		
				-48.5		N.M.
				-640.0		Catch M 7,300,000 lb ÷ 1.39 = 5,250,000 L =
June '38				280.8	(29.0)	
				500.0		Recruitment
Aug. '38				780.8		
				-39.0		N.M.
				-739.0		Catch M. 7,700,000 ÷ 1.27 = 6,070,000 L
June '39						



KEUFFEL & ESSER CO., N. Y. NO. 358-63
Semi-Logarithmic, 2 cycles X 10 to the ½ inch, 5th lines accented
MADE IN U.S.A.

Lobsters

Recent lobster work

Some data collected in Mass, R.I. Conn., more in Maine.

Maine has statistical records needed to interpret data.

Maine catch increase

	Tot. Catch	c/pot				
1919 & 1924	5.5	35	1941	8.9	39	
			42	8.4	43	
1939	7.5	35	43	11.5	57	Highest
1940	7.6	35	44	13.3	57±	since 1902

Increase 1939-1944 5,800,000 lb about 6,000,000 lobsters

Possible causes

1. Propagation and rearing

a. Rearing program started in 1938, 40,000 4th stages liberated

Annual liberation since from 40,000 to 600,000

b. Effect on catch

Growth - takes 5-7 yr to reach comm size from 4

1938 + 6 = 1944 Max. effect 60% of 40,000 = 24,00

2. Change in size limit

Effect	Theor.	Actual change
1942 catch	- 800,000 below 1941	- 500,000
1943 "	+ 1,100,000 above 1941	+ 2,600,000

Does not explain increase of 1941 over 1939-40

3. Environmental changes

Favorable conditions

a. Other species - herring etc

b. Past records of lobster fishery indicate no such fluctuations

c. Reports indicate no great increase in other lobste states or Nova Scotia.

4. Relationship stock of large lobsters and survival of young.

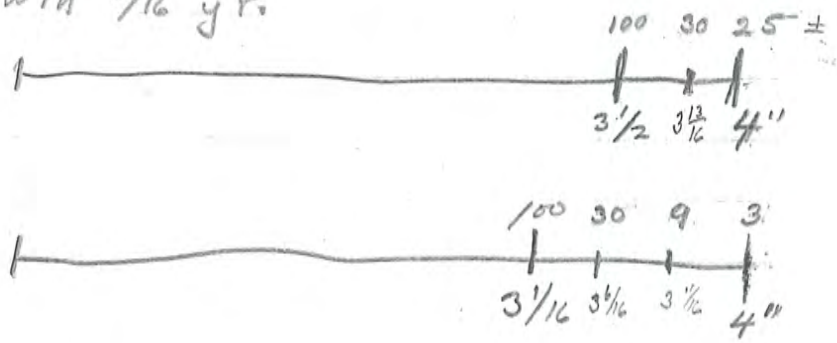
a. Survival from min. comm. size to maturity

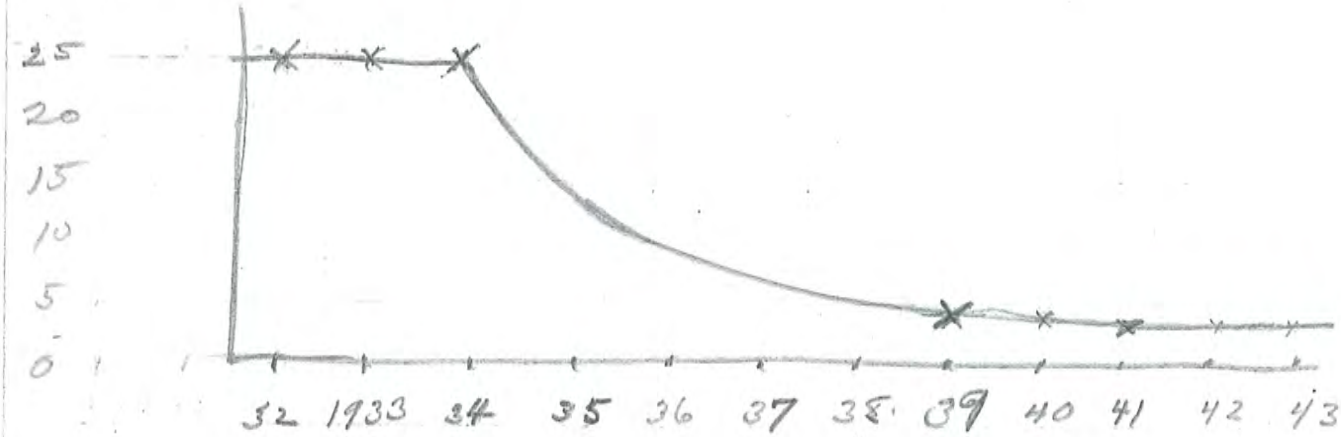
1934	3½"	25%	4"
1939	3 1/16"	4%	4"
1941	3 1/16	3%	

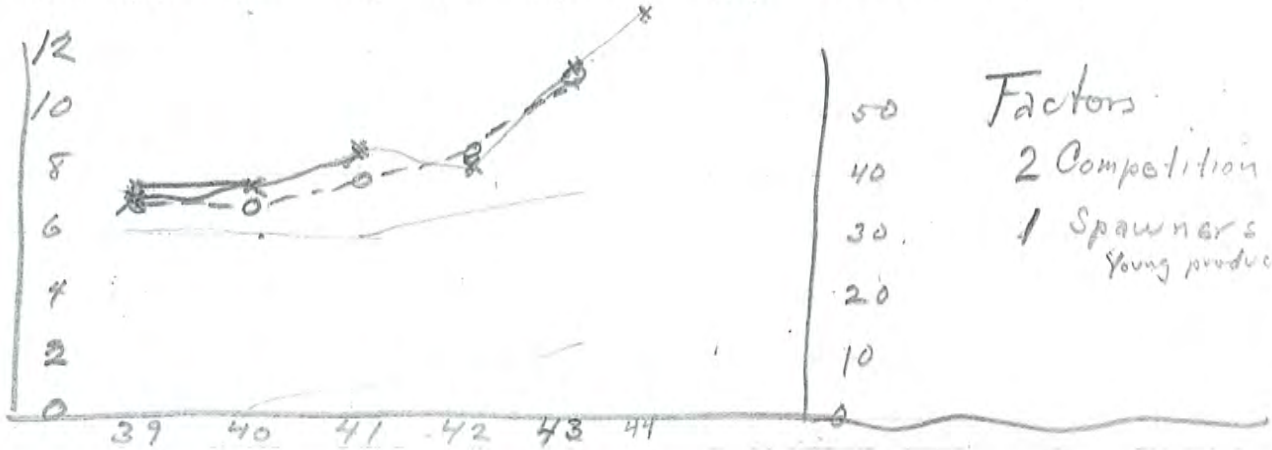
b. Tagging experiments
30-55% rec in 2-3 mo.

c. Total mortality about 70% yr.

d. Growth 5/16" yr.



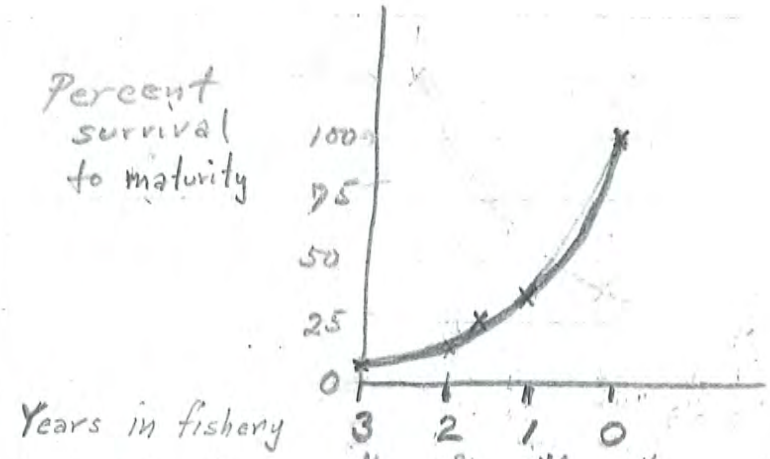


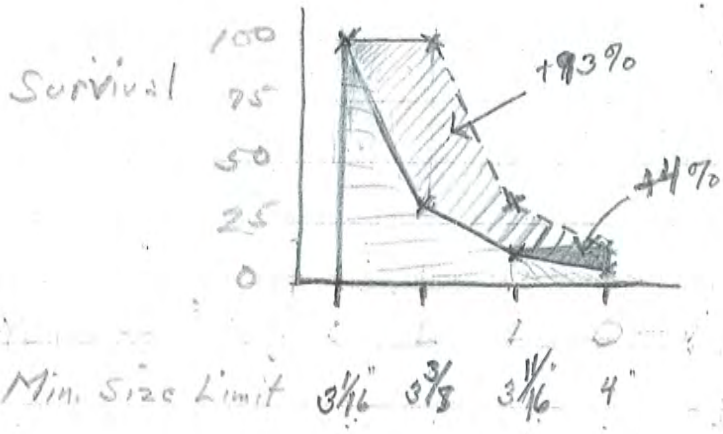


Factors
2 Competition
1 Spawners
Young produced

Management measures indicated
Adequate spawning stock
Less than 25% survival, more than 4%
between 6 to 15%
Minimum competition
Young
Commercial size

High size limit means more competition
Low " " " inadequate spawners.





Min. limit
3 1/8" subtracts 1/5 of a year
Results in about 5% survi
3 1/4" subtracts 3/5 of a year
Results in about 8 %
3 3/8" subtracts 1 year
Results in about 12% "

Max. limit
3 3/4" subtracts 4/5 yr.
Results in about 12% "

Tables

Calculated Relative Average Weight

from

Assuming W varies as L^3

	Avg. 1934 + 1935				1934				1937				1938		
	No.		Wt.												
3 1/16 - 3 6/16	500	1.00	500		500	1.00	500		500.0	1.00	500		500.0	1.00	500
3 6/16 - 3 11/16					235	1.32	311		202.1	1.32	267		145.0	1.32	191
3 6/16 - 3 8/16	190	1.22	232												
3 8/16 - 3 11/16	285.0	1.39	396												
3 11/16 - 3 13/16	190.0	1.58	300		223.5	1.71	383		95.0	1.71	162		58.7	1.71	100
3 13/16 - 4	99.8	1.79	179												
4 - 4 2/16	66.5	2.01	134	4-4 5/16	132.0	2.15	284	4-4 5	90.5	2.15	195		27.5	2.15	59
4 2/16 - 4 7/16	58.2	2.35	137	4 5-4 7	29.7	2.51	75	4 5-4 10	53.5	2.67	143		26.3	2.67	70
4 7/16 - 4 12/16	20.4	2.97	61	4 7-4 12	26.9	2.97	80	4 12-4 12	12.0	3.09	37	4 12-4 15	15.5	3.28	51
4 12/16 - 5 1/16	7.1	3.54	25		9.4	3.54	33	4 12-5 1	10.9	3.54	38	4 15-5 1	3.5	3.75	13
5 1/16 - 5 6/16	6.4	4.27			3.3	4.27	14	5-5 6	[illegible]						
5 6/16 - 5 11/16	5.8	5.07			1.1	5.07	6		[illegible]						
5 11/16 - 6	5.2	5.97			.4	5.97	2		[illegible]						
					.1		1		.2						
Total															
3 1/16 - 5 1/16	1417.0		1964		1156.5		1666		964.0		1342		776.5		984
3 1/2 - 5 1/16	727.0		1232												
4 - 5 1/16	152.2		957												
Av.															
3 1/16 - 5 1/16			1.39				1.44				1.39				1.27
3 1/2 - 5 1/16			1.70												

NEW BRUNSWICK

Date	Grand Manan Cwt.	Grand Manan Traps	Rest of Charlotte Cwt.	Rest of Charlotte Traps	St. John Cwt.	St. John Traps	Albert Cwt.	Albert Traps
1897			19,716	24,192	3,800	10,900		
98			17,269	23,059	6,390	10,700		
99			15,529	17,702	5,980	13,200		
1900			13,687	19,461	6,080	10,000		
1			13,292	20,620	2,115	10,000	100	
2			11,516	18,189	2,114	5,250		
3			11,339	17,179	2,310	5,090		
4			8,916	18,900	1,848	5,050		
5			13,535	6,476	2,285	19,450	200	200
6			10,423	18,586	884	5,125	300	300
7			9,344	19,746	1,424	4,605	400	300
8			6,694	19,615	1,818	4,900	250	500
9			8,591	21,144	3,015	3,955	300	500
10			6,456	20,672	1,330	4,968	100	600
11			6,969	20,975	1,570	4,545	120	800
12			10,298	20,100	2,112	6,510	125	200
13			9,808	22,944	1,943	6,577	90	150
14			7,724	25,458	1,613	5,955	90	150
15			6,591	27,688	2,641	6,895	54	200
16			4,580	28,085	1,960	5,430	51	250
17	3,122	23,800	1,632		2,880	6,900	51	200
18	1,685	16,000	1,387	5,149	1,459	6,060	36	300
19	2,487	16,500	1,733	7,002	2,324	6,368	5	130
20	4,530 21.3	22,000	2,025 30.5	6,650	2,080 37.8	5,500		
21	5,734 22.7	25,225	1,120 20.7	5,400	2,150 34.7	6,200	8	14
22	4,659 15.5	30,000	1,086 13.6	8,000	1,425 26.4	5,400	8	14
23	3,484 11.6	30,000	939 13.8	6,800	1,380 28.7	4,800	10	11
24	3,399 11.3	30,000	1,203 12.1	9,925	1,420 33.0	4,300		
25	2,758 9.2	30,000	1,409 19.6	7,175	1,525 33.1	4,600	9	27
26	3,963 13.2	30,000	952 10.3	9,260	1,200 26.7	4,500	15	24
27	4,222 10.5	40,000	1,194 14.7	8,140	1,300 26.0	5,000	19	67
28	4,838 12.1	40,000	1,187 15.1	7,880	1,145 19.4	5,900	7	72
29	5,183 13.0	40,000	689 8.5	8,150	895 16.9	5,300	7	60
30	6,209 14.4	43,000	667 8.4	7,910	1,034 21.3	4,850	8	48
31	6,167 14.3	43,000	1,048 16.2	6,560	1,283 28.1	4,561	8	74
32	4,543 10.5	43,000	807 13.8	5,830	1,113 20.3	5,475	9	38
33	3,645 12.1	30,016	528 10.2	5,160	579 10.5	5,494	3	42
34	3,753 12.5	30,016	646 14.5	4,460	606 12.6	4,808	1	5
35	4,973 16.6	30,012	597 14.1	4,230	756 17.0	4,450	3	5
36	3,114 9.9	35,000	741 14.7	5,030	677 15.5	4,361	3	5
37	3,629 10.4	35,000	705 12.8	5,520	802 17.1	4,692	6	28
38	2,406 8.0	30,036	613 17.8	3,436	826 18.4	4,492	29	116
39	3,712 11.6	32,000	1,188 30.9	3,845	1,424 27.5	5,008	38	267
40	2,866 9.2	31,000	1,422 31.2	4,560	1,461 27.9	5,240	49	264
41	2,753 16.2	17,000	1,471 26.9	5,470	1,673 30.5	5,486	54	119
42	2,941 26.7	11,000	1,963 29.0	6,775	1,785 36.3	4,901	108	256
43	3,807 36.3	10,500	5,678 81.9	6,945	2,037 37.5	5,436	61	266

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NEW BRUNSWICK

	Westmorland Strait		Kent		Northumberland		Gloucester	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	18,087	46,100	17,560	48,400	4,655	12,200	56,882	76,860
98	22,085	58,000	19,526	55,000	5,047	13,000	38,086	80,700
99	34,976	61,800	18,964	48,500	4,667	14,000	29,264	82,300
1900	35,265	60,000	17,893	52,700	4,170	15,300	26,407	85,300
1	35,244	58,000	13,900	54,900	3,426	14,500	24,316	89,400
2	35,335	59,000	16,821	37,000	4,413	14,700	30,340	91,400
3	34,344	66,500	15,867	38,000	5,546	15,000	34,154	94,000
4	30,143	68,000	15,235	43,500	6,233	15,000	37,291	101,000
5	27,910	75,000	20,984	41,500	8,217	15,000	37,694	105,000
6	37,929	79,200	18,884	39,000	8,378	16,500	34,757	101,800
7	43,149	95,000	20,795	34,700	8,584	17,000	40,586	113,500
8	40,670	95,700	22,599	54,500	9,022	18,500	40,604	111,500
9	32,648	97,000	18,309	53,800	9,456	21,000	31,084	110,300
10	24,259	97,400	17,484	56,500	8,120	22,500	26,134	108,900
11	22,929	65,300	16,387	51,460	9,334	21,700	28,458	84,620
12	13,492	78,210	14,575	52,050	6,974	24,880	21,941	100,270
13	19,817	63,000	12,549	48,960	6,510	28,500	14,617	78,750
14	17,846	73,200	16,521	47,600	8,163	27,900	16,272	70,070
15	13,331	63,025	18,283	42,295	10,196	18,925	20,139	53,338
16	15,605	53,750	29,939	55,680	15,015	27,191	31,209	62,320
17	13,502	53,900	27,608	60,400	21,888	29,775	34,387	74,774
18	4,697	25,015	13,036	59,490	6,945	30,100	12,736	59,091
19	9,753	42,850	10,943	56,260	7,201	31,500	21,157	55,286
20	11,517	34,500	15,846	58,800	10,017	24,550	17,581	82,300
21	15,096	26,400	17,616	93,800	8,968	27,765	16,752	70,200
22	18,951	35,852	12,767	102,600	11,862	33,300	17,835	64,000
23	14,032	33,400	20,333	109,270	14,066	34,130	18,268	88,649
24	11,100	40,800	18,699	123,650	15,158	33,050	16,162	91,525
25	9,740	38,325	17,155	130,800	10,458	40,025	21,185	96,235
26	8,556	38,325	13,771	125,800	9,088	42,500	20,702	101,752
27	7,903	38,325	10,863	132,500	6,209	43,325	16,956	101,250
28	15,057	38,325	12,793	95,450	8,247	43,900	13,661	90,100
29	20,783	38,525	24,187	91,125	11,924	46,450	17,957	95,940
30	23,622	41,525	29,052	103,220	11,412	45,710	17,521	82,840
31	21,852	29,068	31,741	114,537	12,498	45,800	19,473	86,140
32	27,367	35,468	29,662	131,470	14,582	72,900	19,112	92,500
33	18,827	49,475	21,631	130,510	13,976	70,050	14,669	97,700
34	12,186	69,000	20,461	124,500	10,580	75,500	15,858	97,500
35	9,775	60,100	16,543	134,000	7,864	80,300	13,790	102,000
36	11,118	54,900	17,895	129,634	7,535	95,550	14,817	105,500
37	17,774	53,000	24,739	131,925	9,291	86,900	15,070	106,025
38	23,207	54,148	20,759	135,085	8,393	83,100	11,787	115,025
39	25,954	69,485	26,292	130,705	10,262	81,900	11,883	115,125
40	16,022	69,185	17,216	110,390	10,588	77,100	11,045	106,725
41	14,022	69,185	18,447	83,885	8,759	45,100	10,997	103,225
42	17,644	65,000	20,553	83,426	9,767	38,725	13,751	97,041
43	11,852	53,000	21,531	85,384	9,728	42,612	13,190	98,741

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NEW BRUNSWICK

Date	Restigouche Cwt.	Traps
1897	1,918	2,260
98	1,429	3,260
99	1,303	3,500
1900	1,176	4,100
1	1,980	4,200
2	2,205	4,200
3	3,019	4,680
4	2,850	5,100
5	1,426	6,650
6	1,500	5,650
7	1,893	5,100
8	1,875	6,600
9	2,443	5,200
10	719	4,200
11	746	4,000
12	514	3,000
13	556	3,800
14	830	3,350
15	876	3,800
16	1,092	3,800
17	1,631	3,700
18	923	4,000
19	877	4,000
20	750	3,600
21	1,021	3,825
22	961	3,500
23	1,176	3,900
24	1,162	3,900
25	1,655	3,900
26	1,364	5,100
27	1,086	5,900
28	1,035	5,600
29	237	5,350
30	1,042	5,750
31	918	8,405
32	1,527	8,710
33	1,082	8,350
34	982	8,470
35	530	8,390
36	599	8,500
37	570	8,000
38	454	6,000
39	509	6,000
40	556	4,000
41	674	4,500
42	1,018	4,500
43	661	4,000

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NOVA SCOTIA

	Cumberland B.of F.		Cumberland Straits		Colchester		Kings	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897			20,458	31,500	862	1,200	20	
98			21,089	39,450	600	1,200	187	
99			20,383	45,265	842	1,500		
1900			16,698	46,630	1,530	4,600		
01			20,389	47,250	1,630	4,400	248	947
2			18,197	54,390	2,078	4,400	500	991
3			18,968	49,250	1,606	4,000	641	1,064
4			16,890	52,295	1,552	4,000	810	1,192
5			16,070	48,500	1,520	3,000	760	1,252
6			15,359	47,120	1,386	4,000	854	1,722
7			19,459	47,804	1,624	4,300	678	1,875
8			21,660	54,330	2,244	4,400	679	1,785
9			21,529	60,835			493	1,725
10			19,636	47,945	1,178	2,000	244	1,177
11			21,594	52,073	976	2,500	219	1,177
12			15,233	61,093	630	2,500	128	600
13			16,962	59,093	824	4,625	136	630
14			19,313	59,257	508	2,700	196	665
15			20,264	56,423	346	2,000	262	955
16			16,475	56,655	506	3,050	217	1,125
17	35		15,153	51,290	68	2,900	195	1,400
18	165	400	4,229	29,900	32	350	147	1,200
19	76	1,380	5,769	31,400			190	1,250
20	102	183	8,043	29,800			218	1,075
21	190	185	9,424	28,133			203	1,125
22	202	398	15,388	41,433	60	100?	180	1,100
23	122	867	11,168	44,065	918	4,965	145	1,100
24	181	741	6,923	43,500	680	4,800	174	950
25	111	510	7,841	47,200	638	6,000	150	950
26	64	487	6,694	39,260	330	6,000	69	589
27	86	503	4,726	42,325	176	6,000	79	580
28	94	641	6,881	33,975	231	6,000	95	455
29	66	386	13,936	34,625	375	6,000	114	420
30	101	438	18,033	36,250	1,048	6,000	67	320
31	104	437	24,093	47,575	1,398	6,000	74	240
32	122	615	23,429	63,000	1,914	5,700	82	350
33	88	558	16,031	64,000	1,547	5,700	38	320
34	31	291	17,877	65,650	1,418	7,000	42	350
35	46	278	14,009	68,450	1,169	8,000	48	360
36	84	266	9,001	61,575	582	8,000	45	345
37	95	434	9,944	63,050	517	8,000	75	825
38	66	451	9,806	63,050	468	10,000	86	850
39	105	453	8,560	62,300	597	10,000	122	1,000
40	173	418	6,048	47,800	591	7,200	234	1,200
41	252	459	7,071	34,900	447	5,600	382	1,000
42	378	767	7,161	45,700	654	6,400	585	1,400
43	244	722	9,395	48,800	658	6,000	428	1,600

NOVA SCOTIA

	Annapolis		Digby		Yarmouth		Shelburne	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	1,553	7,925	15,649	24,700	47,466	30,250	73,405	82,085
98	1,535	6,500	16,548	31,110	45,351	30,250	73,484	101,620
99	1,515	3,550	21,936	28,885	44,859	23,150	61,166	101,320
1900	1,838	7,900	53,185	30,274	45,495	32,500	66,586	108,210
1	895	4,525	72,497	35,111	43,394	37,200	35,927	109,200
2	1,545	9,100	23,839	29,120	77,123	38,035	67,204	112,500
3	2,448	7,800	25,149	34,376	71,117	40,810	35,778	109,400
4	362	5,500	26,798	34,029	78,678	40,848	38,480	113,450
5	485		26,876	35,470	57,835	40,855	57,345	42,700
6	1,560	9,400	18,024	35,210	55,749	44,930	49,988	52,600
7	6,004	11,755	14,233	34,105	59,938	45,180	37,943	74,500
8	5,533	12,950	15,099	36,548	58,798	47,000	47,753	93,000
9	7,170	15,850	13,551	33,820	48,580	47,000	47,572	100,000
10	2,985	17,900	15,647	57,900	61,970	49,500	35,874	106,500
11	2,934	12,420	15,938	40,950	79,610	68,955	44,264	113,800
12	1,146	8,915	21,524	45,550	43,707	80,350	35,669	105,055
13	1,824	9,500	17,634	44,450	55,567	88,545	42,626	111,512
14	1,767	8,500	20,599	44,450	51,521	88,682	36,288	111,115
15	1,386	9,875	20,247	44,050	58,278	91,800	39,322	118,390
16	1,104	10,170	21,734	44,550	52,833	91,540	29,393	121,698
17	1,079	10,550	14,757	43,950	44,572	87,300	26,543	108,844
18	1,174	8,190	9,021	45,805	30,607	84,000	22,691	78,930
19	1,253	8,325	6,721	28,705	38,341	78,000	28,497	91,030
20	2,117	8,975	11,476	20,693	41,730	90,200	30,497	106,000
21	1,596	15,000	21,389	37,375	63,549	92,352	46,283	125,300
22	1,175	15,000	8,922	42,550	29,671	93,432	18,766	116,000
23	1,358	15,000	12,003	42,600	32,340	95,714	16,242	117,400
24	695	16,000	5,658	36,700	23,591	81,260	15,785	99,600
25	1,043	16,000	11,941	39,815	39,977	75,411	24,811	103,200
26	706	16,000	11,937	38,475	37,024	83,977	23,289	103,850
27	609	16,000	9,683	43,600	34,542	85,775	21,708	106,550
28	737	15,950	9,442	52,475	31,408	87,290	16,170	118,875
29	624	15,500	6,820	55,295	26,332	86,067	19,452	126,760
30	880	16,000	7,295	52,025	26,935	100,445	26,443	146,500
31	607	15,600	5,507	51,225	26,578	95,945	22,708	165,000
32	958	15,000	4,537	44,125	25,551	89,750	19,885	172,000
33	422	12,000	3,355	41,000	16,922	70,316	14,953	35,500
34	329	11,000	3,606	38,000	17,370	65,817	18,862	27,000
35	334	8,075	4,210	34,550	18,763	63,318	20,888	30,500
36	434	8,525	3,912	34,550	14,994	72,708	15,783	97,500
37	513	9,000	5,171	37,000	22,740	85,221	19,473	171,000
38	408	8,000	5,160	38,495	22,018	90,560	14,143	145,000
39	709	10,000	6,405	38,495	20,689	85,445	14,096	143,000
40	820	5,000	8,359	38,400	24,118	94,768	16,480	137,000
41	1,410	5,000	8,428	22,941	22,161	94,578	13,355	126,000
42	2,179	5,400	6,575	35,200	19,783	82,457	14,181	104,000
43	1,997	5,640	9,895	35,200	26,667	74,236	19,740	100,000

APR 1 1946

NOVA SCOTIA

	Queens		Lunenburg		Halifax		Guysborough	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	9,850	12,478	6,925	14,230	34,597	64,675	40,042	85,800
98	10,302	12,767	7,225	14,850	42,663	64,210	38,979	118,100
99	9,377	12,700	6,098	12,000	32,799	62,680	36,699	111,850
1900	6,730	11,080	6,989	13,200	29,245	89,650	41,476	125,575
1	8,803	15,231	5,452	15,220	31,209	80,630	31,180	117,600
2	4,160	17,085	6,301	15,295	29,675	76,625	26,915	97,800
3	9,392	19,345	6,207	16,910	27,590	70,786	25,308	88,900
4	9,704	18,900	6,054	20,220	32,712	77,783	24,254	85,160
5	9,087	19,000	5,800	20,870	38,516	79,000	30,501	88,100
6	7,075	15,800	7,092	15,030	22,960	74,050	22,853	70,700
7	9,525	17,800	8,019	19,000	24,735	85,620	20,174	88,600
8	9,268	22,600	6,947	18,650	18,850	91,140	20,356	102,100
9	10,031	23,200	5,670	25,100	15,110	92,785	15,418	93,150
10	8,452	21,200	4,835	34,700	17,135	77,378	18,018	100,305
11	8,684	27,100	7,344	33,300	19,242	71,325	21,167	100,535
12	6,964	40,500	5,544	28,810	20,383	73,065	18,830	104,900
13	8,415	42,200	13,787	31,635	25,774	80,935	17,280	75,350
14	5,734	42,200	4,592	51,250	19,674	62,685	13,938	79,500
15	12,346	43,300	11,114	63,800	17,627	69,865	16,524	63,380
16	6,560	43,500	3,908	64,950	16,283	75,417	17,412	64,795
17	4,911	42,000	4,962	64,950	14,206	73,317	13,082	71,795
18	3,495	43,500	3,453	59,500	7,506	69,317	10,979	72,000
19	6,463	23,870	4,878	41,871	13,569	71,617	15,023	65,515
20	5,249	14,380	5,697	33,167	8,452	70,000	15,380	39,700
21	8,219	13,720	5,151	36,200	7,226	69,000	9,854	48,850
22	2,165	11,625	1,220	25,090	6,590	67,000	9,770	50,250
23	2,000	11,800	1,552	25,440	5,892	71,500	9,717	50,250
24	2,727	12,100	1,224	26,000	3,112	85,000	7,272	49,600
25	5,751	21,980	2,327	26,850	5,176	87,000	11,650	50,000
26	4,737	28,300	3,313	30,000	8,217	90,800	17,952	50,500
27	3,818	31,400	3,724	31,800	13,207	89,800	20,364	54,856
28	2,922	31,400	3,468	35,300	15,034	88,000	21,842	84,085
29	2,781	31,300	3,288	34,500	16,400	76,804	27,863	93,950
30	3,600	25,000	3,365	35,500	17,994	76,120	26,608	97,550
31	4,921	32,000	3,396	39,000	21,995	76,720	29,400	103,000
32	5,112	34,700	3,062	40,000	20,318	85,500	31,253	108,648
33	2,952	34,200	2,215	39,000	12,693	92,400	23,535	122,617
34	5,827	35,500	2,659	45,000	11,163	94,500	19,694	126,370
35	3,242	36,700	3,432	46,600	11,709	123,000	19,325	128,000
36	2,624	25,600	2,750	53,000	8,051	121,000	16,947	127,875
37	2,528	29,800	3,755	58,500	10,553	117,700	16,263	126,575
38	1,703	12,000	2,995	58,000	9,375	115,000	16,475	136,260
39	2,449	15,000	3,700	58,500	10,848	121,500	15,974	130,235
40	2,314	15,500	4,220	58,000	9,152	115,150	14,154	121,050
41	1,928	8,000	3,350	58,100	9,963	104,750	16,020	100,775
42	2,567	8,000	2,975	55,000	8,251	96,500	12,300	98,125
43	3,599	8,000	3,000	54,000	9,130	93,100	11,863	82,905

APR 1946

NOVA SCOTIA

	Richmond		Cape Breton		Victoria		Inverness	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	17,022	68,544	20,525	42,400	7,361	26,215	12,486	49,960
98	15,909	40,670	21,222	43,700	5,605	18,175	10,803	54,000
99	18,168	79,050	22,945	61,199	5,169	13,699	10,740	55,000
1900	20,232	51,980	26,957	46,351	6,099	13,217	11,140	49,305
1	14,415	72,895	18,907	38,270	5,118	13,983	11,477	41,100
2	10,799	41,080	9,251	39,050	3,765	15,550	10,014	41,450
3	11,976	38,450	19,498	31,588	7,457	14,553	14,222	37,320
4	12,540	39,900	19,137	29,890	9,084	14,256	12,292	40,400
5	12,065	36,250	24,400	39,200	6,839	14,064	13,682	47,400
6	8,495	46,050	20,198	33,360	5,727	16,553	16,805	55,400
7	5,574	32,100	11,492	32,365	4,470	13,886	12,150	47,900
8	7,366	40,715	13,479	31,686	3,917	14,224	9,874	47,950
9	5,962	32,425	10,660	29,860	4,504	17,114	7,587	35,651
10	7,816	42,938	12,103	24,092	6,204	14,350	8,571	46,075
11	7,326	46,485	14,541	34,940	5,568	15,292	11,700	39,540
12	8,590	54,500	13,880	35,890	5,796	15,695	14,453	42,590
13	7,221	37,750	15,842	42,740	6,091	20,305	12,587	30,142
14	4,298	27,400	11,094	40,080	4,682	19,900	12,719	52,810
15	7,406	28,900	14,884	36,880	3,699	11,480	13,955	46,415
16	9,237	27,700	11,814	39,805	6,466	16,210	13,235	52,690
17	5,784	25,400	18,737	40,400	7,217	17,820	12,266	54,515
18	3,990	20,000	14,620	30,769	3,823	14,460	11,239	45,305
19	8,883	16,500	20,371	27,505	5,226	10,870	13,604	47,406
20	11,369	24,425	20,865	33,450	7,474	12,750	16,182	48,674
21	5,462	37,600	12,713	31,320	6,832	14,000	11,208	45,245
22	5,665	38,926	16,615	24,977	8,419	15,100	17,199	56,880
23	6,464	30,740	14,602	26,395	8,300	16,900	17,366	66,472
24	4,097	18,735	10,295	31,790	5,471	18,820	8,675	62,855
25	6,721	27,845	10,875	32,895	5,026	18,330	11,156	69,735
26	8,338	29,555	12,975	33,365	6,958	20,150	14,603	66,180
27	8,575	37,150	12,111	33,580	7,248	21,450	14,590	66,714
28	8,380	36,735	13,524	33,470	5,490	18,900	13,009	69,247
29	8,700	37,020	14,710	33,680	5,760	20,190	12,613	70,130
30	7,624	39,000	12,309	29,880	6,964	20,170	14,356	72,295
31	8,473	40,660	13,814	31,655	7,344	21,000	14,081	70,815
32	11,038	43,180	19,303	39,290	10,043	25,100	15,147	70,826
33	8,795	49,920	17,353	52,560	8,363	31,300	12,406	73,571
34	7,977	54,180	15,527	56,093	7,610	32,630	13,203	73,710
35	6,567	56,000	13,496	56,893	7,226	33,900	13,175	73,791
36	6,266	61,000	14,419	57,960	6,931	36,100	12,013	77,480
37	6,521	63,200	14,378	60,660	6,251	34,700	11,810	75,532
38	6,486	63,800	15,172	64,300	8,414	35,900	13,144	71,524
39	6,985	68,800	12,552	64,200	6,855	35,800	9,756	67,482
40	4,587	68,600	9,136	57,200	5,006	33,100	6,684	48,572
41	5,328	65,300	11,649	51,576	5,312	23,000	10,124	47,305
42	4,545	62,110	10,262	39,980	6,156	21,600	9,057	44,689
43	3,922	53,400	11,824	38,700	6,173	26,200	9,662	49,790

APR 1 1946

NOVA SCOTIA

	Antigonish		Pictou	
Date	Cwt.	Traps	Cwt.	Traps
1897	8,661	16,100	20,825	44,550
98	6,844	22,150	17,386	46,415
99	5,452	26,160	17,885	43,175
1900	6,585	20,800	21,019	47,700
1	5,672	19,250	20,073	49,480
2	5,344	17,400	17,407	47,660
3	6,918	16,800	19,269	43,700
4	7,326	21,300	20,748	44,429
5	7,599	21,150	21,365	54,959
6	5,722	18,400	19,611	59,800
7	7,162	18,060	18,039	61,550
8	6,632	21,847	22,191	64,675
9	6,534	21,750	19,701	62,200
10	6,062	20,052	22,142	66,555
11	7,672	22,800	22,886	72,875
12	8,692	25,600	20,114	75,654
13	8,984	27,000	14,500	80,975
14	9,550	27,700	19,509	77,780
15	9,146	35,300	17,832	55,706
16	10,852	38,772	21,741	70,045
17	9,944	36,800	25,762	80,761
18	10,168	36,930	11,532	61,650
19	10,627	36,930	13,054	49,600
20	10,160	42,750	18,916	54,910
21	6,768	45,500	14,966	65,090
22	10,309	56,250	21,390	69,730
23	10,956	62,500	21,575	86,729
24	6,413	65,000	12,302	86,729
25	8,664	65,000	16,840	72,729
26	9,816	70,000	17,294	73,929
27	10,425	68,000	14,002	74,679
28	10,390	69,000	13,292	74,380
29	10,725	67,500	19,476	71,650
30	12,208	65,000	22,371	60,100
31	11,940	64,000	27,216	58,900
32	14,972	63,000	31,004	80,200
33	11,610	75,000	23,580	85,260
34	13,863	86,000	27,532	91,555
35	14,432	95,000	24,765	124,025
36	11,581	100,000	18,674	135,650
37	10,760	92,000	17,614	137,750
38	10,948	90,000	18,518	126,700
39	7,861	80,000	16,647	109,600
40	6,110	60,000	13,748	98,800
41	6,936	60,000	16,618	89,500
42	6,826	55,000	14,036	78,000
43	7,861	60,000	17,685	81,600

APR 1 1946

PRINCE EDWARD ISLAND

	Kings		Queens		Prince	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	32,304	75,880	21,168	49,800	49,314	90,453
98	26,791	96,500	22,823	59,290	47,968	128,495
99	32,430	90,680	22,751	67,000	45,743	125,434
1900	29,854	87,595	20,901	77,550	42,040	136,972
1	31,323	95,310	21,709	72,500	46,426	113,070
2	31,434	98,576	20,297	54,930	33,482	88,390
3	37,629	101,775	23,534	57,680	36,552	93,740
4	42,697	117,675	26,761	74,240	36,294	104,060
5	38,805	111,050	30,995	78,880	21,499	94,030
6	38,107	122,900	20,437	74,825	37,289	115,220
7	42,795	118,500	28,408	64,500	47,837	122,970
8	46,687	130,000	26,494	83,960	55,460	136,339
9	37,701	129,700	19,103	78,080	39,148	152,725
10	34,288	127,000	23,693	77,340	33,240	155,530
11	35,326	118,000	26,059	82,140	42,641	139,200
12	43,267	133,600	33,148	88,475	33,188	168,470
13	28,962	145,600	16,639	94,027	28,720	177,120
14	37,202	156,800	19,974	85,251	31,168	146,700
15	33,832	135,400	19,129	61,254	31,937	98,250
16	43,013	142,300	24,288	70,640	43,995	141,727
17	46,761	134,400	21,893	70,280	55,449	144,443
18	18,589	100,000	12,243	57,824	18,475	109,150
19	29,976	113,700	11,945	58,070	23,015	115,731
20	33,695	118,350	16,009	60,525	33,490	115,061
21	23,401	97,109	11,997	48,865	28,418	93,581
22	32,690	112,600	16,847	59,525	38,046	136,826
23	38,001	145,175	19,761	75,925	39,694	164,040
24	23,224	135,140	12,492	74,045	30,177	170,435
25	29,025	141,410	17,217	81,195	32,328	162,114
26	25,630	137,650	13,794	75,245	26,874	151,028
27	25,347	126,529	13,067	78,325	24,386	141,069
28	27,641	99,150	11,096	50,525	26,876	133,370
29	29,111	106,575	11,789	53,010	32,690	118,754
30	28,269	94,450	17,213	52,710	35,338	120,062
31	29,222	103,050	19,176	45,160	45,752	118,189
32	34,979	114,325	25,628	66,120	53,963	167,527
33	28,105	115,960	25,965	75,985	37,477	183,205
34	26,778	126,205	21,759	97,215	28,045	165,500
35	24,782	139,400	17,408	102,365	21,686	160,800
36	23,200	157,810	13,785	102,875	22,301	171,270
37	21,851	170,590	12,465	95,250	23,922	160,670
38	28,093	168,770	12,902	82,600	30,218	139,675
39	23,661	169,580	11,383	75,540	34,933	151,430
40	18,083	136,820	9,100	55,940	28,416	135,525
41	23,687	118,600	10,105	48,505	26,159	127,650
42	21,451	112,600	11,859	43,225	31,144	119,925
43	23,883	110,100	11,333	46,100	24,503	131,415

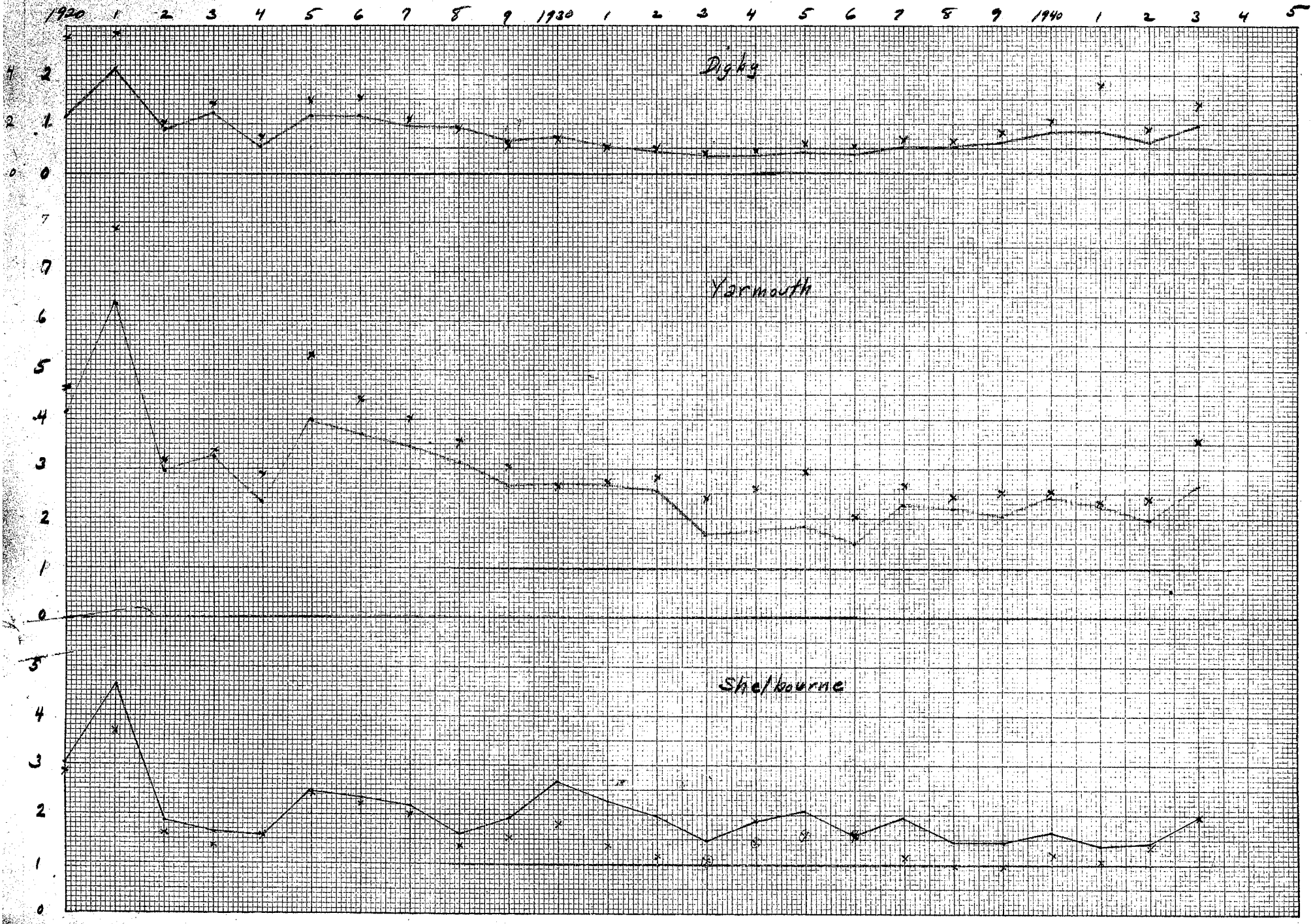
APR 1 1946

QUEBEC

	Magdalen		Gaspé		Bonaventure		Saguenay	
Date	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps	Cwt.	Traps
1897	29,321	76,370	9,440	29,665	2,788	9,895	1,722	775
98	25,514	99,385	8,427	35,230	3,846	14,395	6,877	13,460
99	26,647	90,135	7,952	41,450	3,984	15,750	5,695	12,010
1900	24,817	85,065	5,525	26,350	3,910	16,600	8,417	6,970
1	18,731	78,520	3,856	19,500	3,109	13,600	8,757	17,100
2	17,910	56,500	2,801	7,950	2,720	11,170	6,125	16,450
3	27,760	51,110	4,351	15,350	2,602	10,600	6,163	9,250
4	24,525	58,200	3,595	15,500	2,068	11,600	5,292	7,620
5	36,904	50,645	4,071	24,200	3,198	11,000	3,778	8,800
6	22,796	61,650	4,472	7,500	2,361	13,720	3,741	6,765
7	24,506	82,712	4,372	8,064	2,698	9,150	2,670	8,464
8	21,377	74,230	3,222	16,160	1,977	13,050	2,650	6,449
9	28,593	71,250	4,657	12,560	2,853	11,830	4,181	7,080
10		74,800	34,053	15,100	3,642	12,100	3,806	6,685
11	34,544	86,550	4,995	18,200	2,337	8,595	3,740	7,040
12	28,922	76,855	5,619	19,499	2,092	8,600	3,792	8,980
13	25,652	120,250	2,460	21,110	1,710	9,000	3,250	10,020
14	18,437	120,250	1,658	21,110	1,144	9,000	1,572	7,020
15	18,475	62,725	2,368	9,965	1,255	3,600	1,491	5,895
16	22,597	65,225	3,158	7,724	1,700	2,500	1,300	3,863
17	19,658	63,125	2,877	9,710	895	4,470	1,364	3,310
18	18,644	52,110	2,860	10,550	826	3,750	684	2,620
19	28,060	51,000	2,859	8,800	752	3,800	174	801
20	33,114	100,000	3,160	21,395	1,247	4,610	989	1,666
21	24,356	80,945	3,551	10,000	1,342	3,000	1,062	2,597
22	26,258	94,975	3,740	8,370	1,730	3,400	1,354	3,058
23	29,981	123,100	3,205	18,910	3,136	6,850	1,442	4,851
24	17,605	96,900	2,670	8,700	1,259	9,700	1,208	4,678
25	20,601	94,725	2,661	15,700	1,816	10,075	598	3,202
26	25,375	82,900	2,128	15,275	1,263	10,618	592	2,580
27	20,463	98,720	2,269	15,810	1,162	11,073	712	2,989
28	22,227	90,875	2,176	15,135	1,141	11,060	901	3,056
29	22,564	128,550	2,161	11,460	2,117	4,784	491	2,969
30	24,625	92,500	1,317	11,300	1,332	6,904	403	2,212
31	20,241	80,300	986	10,825	1,053	5,600	423	2,254
32	27,499	89,500	2,414	11,150	2,011	5,900	542	2,792
33	26,776	89,300	2,435	11,740	1,884	6,800	476	2,912
34	30,343	133,925	2,971	12,950	1,962	6,850	471	3,200
35	21,707	177,725	1,501	13,140	740	6,350	478	3,262
36	19,696	159,900	1,215	13,100	1,078	8,438	408	3,755
37	17,304	157,750	1,159	12,925	1,336	7,585	366	3,710
38	17,181	122,300	1,141	12,750	971	6,647		
39	17,101	106,470	652	12,750	763	6,467		
40	17,320	95,330	1,212	6,240	697	3,700		
41	17,535	95,450	608	4,400	345	3,300		
42	15,808	100,400	360	5,025	631	3,850	996	2,871
43	16,693	62,958	1,383	4,960	675	4,126	334	4,470

APR 1948

KEUFFEL & ESSER CO., N. Y NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U. S. A.



KEUFFEL & ESSER CO., N. Y NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
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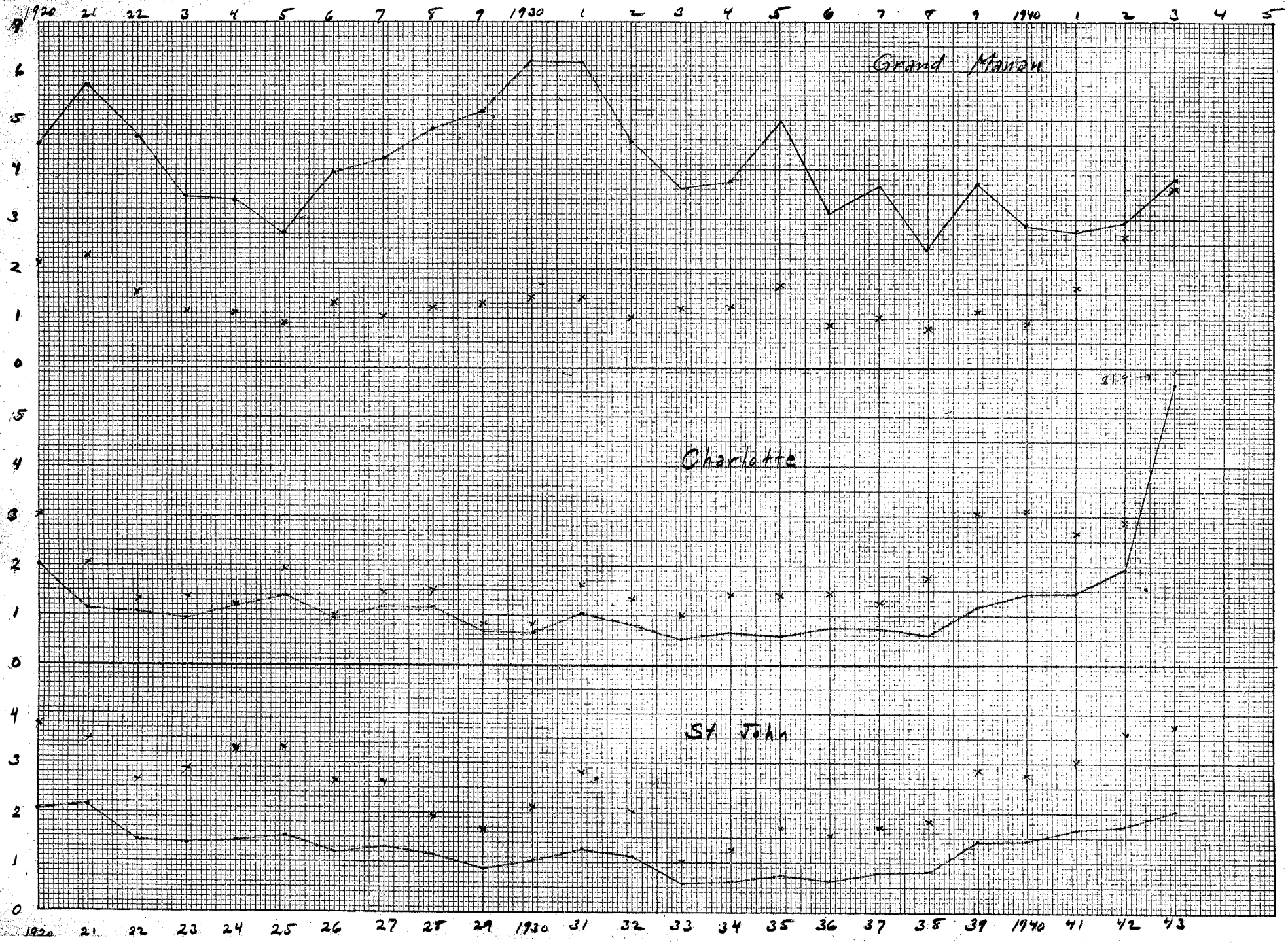
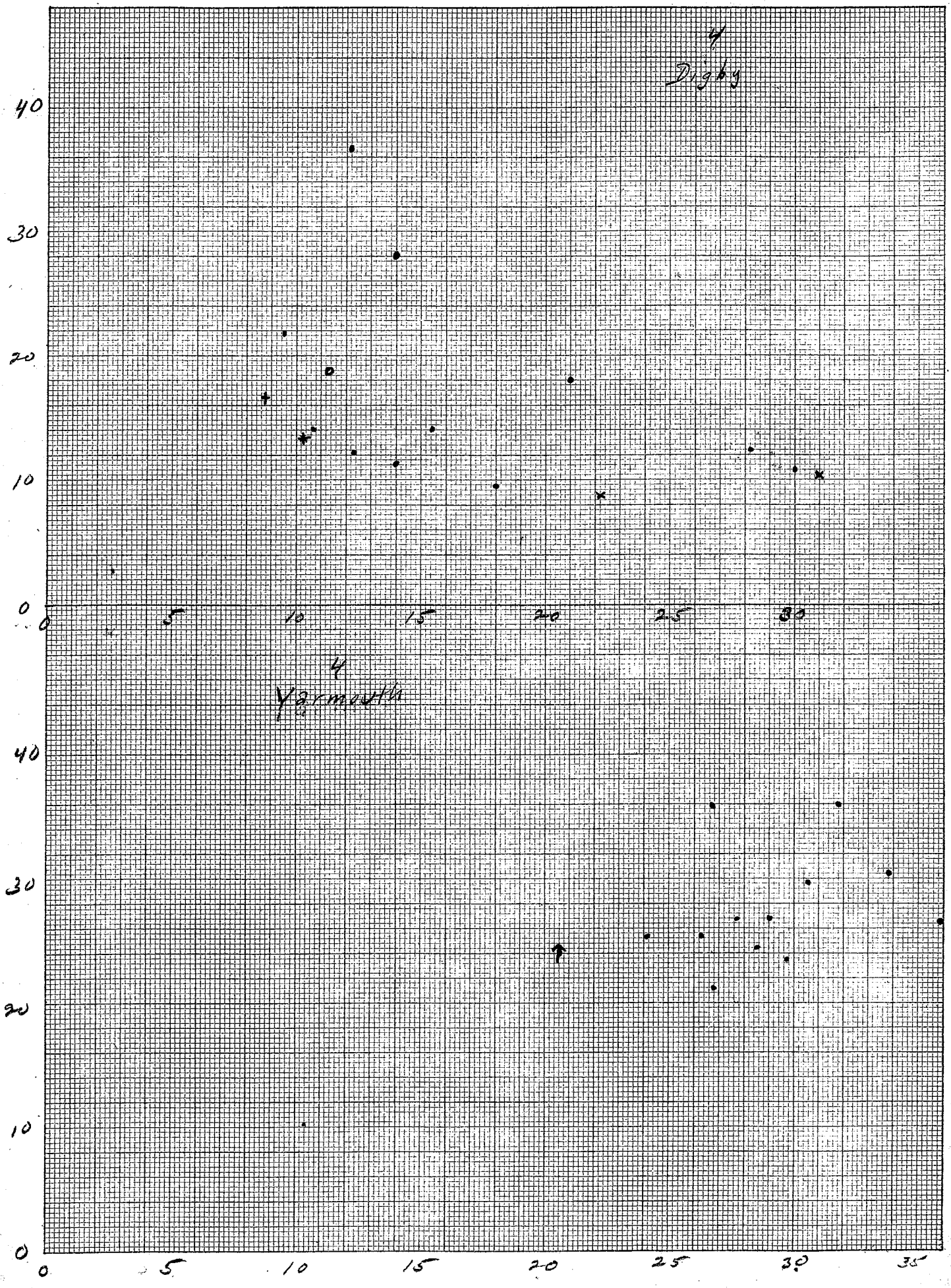
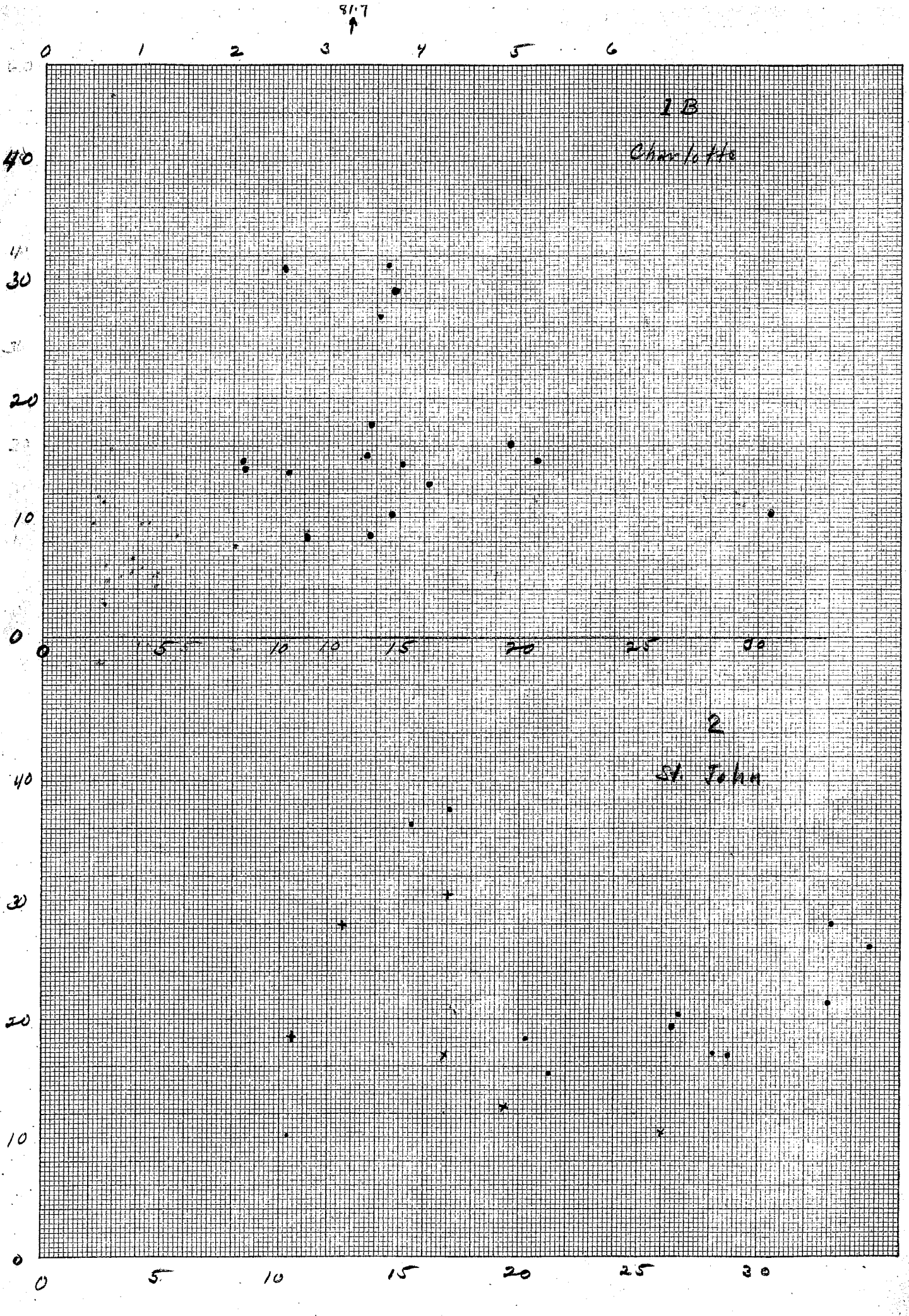




KEUFFEL & ESSER CO., N.Y. NO. 358-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U. S. A.



KEUFFEL & ESSER CO., N.Y. NO. 359-14B
Millimeters, 5 mm. lines accented, cm. lines heavy.
MADE IN U.S.A.

Total Lobster Catch - Canada

Date	Cwt.	Traps	Lbs. Per Trap
1869	2,546		
1870	24,648		
71	47,087		
72	148,590		
73	202,724		
74	338,244		
75	271,454		
76	223,896		
77	336,978		
78	446,478		
79	426,881		
1880	546,088		
81	739,690		
82	740,311		
83	594,079		
84	725,240		
85	820,977		
86	858,062		
87	580,778		
88	525,699		
89	548,193		
1890			
91	721,512		
92	642,146	767,479	83.7
93	716,770	892,680	80.5
94	706,915	976,385	72.4
95	661,921	983,454	67.3
96	634,240	1,106,889	57.6
97	616,641	1,156,352	53.4
98	587,608	1,335,641	44.0
99	591,938	1,364,644	43.4
1900	628,687	1,382,935	45.5
1	583,254	1,363,512	42.8
2	531,654	1,221,236	43.5
3	548,517	1,205,006	45.5
4	559,512	1,288,997	43.3
5	591,360	1,239,651	47.6
6	522,436	1,268,866	41.1
7	541,715	1,340,711	40.4
8	553,055	1,477,623	37.4
9	481,960	1,458,585	33.0
1910	476,229	1,504,872	31.6
11	527,820	1,469,192	36.0
12	460,611	1,590,966	29.0
13	433,904	1,617,195	26.8
14	408,816	1,596,538	25.6
15	445,277	1,371,774	32.4
1916	480,898	1,493,157	32.2
17	474,871	1,497,179	31.7
18	264,096	1,243,415	21.2
19	345,806	1,203,571	28.8
1920	399,985	1,290,639	31.0
21	393,625	1,300,921	30.3
22	363,925	1,427,261	25.5
23	381,628	1,620,248	23.5
24	272,213	1,576,928	17.3
25	340,838	1,620,958	21.0
26	339,583	1,613,974	21.0
27	316,831	1,659,784	19.1
28	322,437	1,586,576	20.9
29	372,820	1,618,779	23.0
1930	407,265	1,593,584	25.6
31	435,490	1,623,295	26.8
32	483,488	1,833,689	26.4
33	374,916	1,767,937	21.2
34	361,992	1,870,750	19.4
35	319,969	2,013,969	15.9
36	283,273	2,134,762	13.3
37	309,950	2,210,517	14.0
38	314,385	2,094,070	15.0
39	314,665	2,068,382	15.2
1940	267,991	1,849,777	14.5
41	278,023	1,630,659	17.1
42	280,250	1,539,848	18.2
43	301,092	1,490,906	20.2
44			
45			

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Lobster districts, seasons and size limits - 1945.

District	Season	Size limit
1A	May 1 - June 24 and November 15 - January 15	$3\frac{1}{4}$" carapace
1B	" "	3 1/8" "
2	" "	3 1/8" "
3	January 15 - June 29	3 1/8" "
4	December 1 - May 31	3 1/8" "
5	April 20 - June 20	7" total length
6A	May 20 - July 15	3 1/8" carapace
6B	May 15 - July 15	7" total length
7	May 1 - June 30	7" " "
8	August 10 - October 5	7" " "
9	May 10 - July 20	7" " "
10	May 20 - July 31	7" " "

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Size limit changes since 1910.

1910	Charlotte and Saint John Counties	$4\frac{3}{4}$"
Sept. 30,1918	Charlotte Co.	$4\frac{3}{4}$"
"	District 2	9"
"	District 3	9"
Jan. 23,1925	Charlotte Co.	$3\frac{1}{2}$"
Jan. 12,1932	Charlotte Co.	9"
Oct. 13,1932	District 4	9"
Mar. 26,1934	Districts 2,3,4 and 6A	3 1/16"
Oct. 18,1934	1A	$3\frac{1}{2}$" min. and $4\frac{3}{4}$" max.
" " "	1B	3 1/16" min. and $4\frac{3}{4}$"max.
Nov. 7, 1935	1A	$3\frac{1}{2}$" min.
Nov. 23,1938	1A	$3\frac{1}{4}$" min. and 5" max.
Apr. 11,1940	Districts 5,6B,7,8,9,10	$6\frac{1}{2}$"
Nov. 11,1941	1B	3 1/8" - $4\frac{3}{4}$"
" " "	2,3,4,6A	3 1/8"
Mar. 27,1942	1A	$3\frac{1}{4}$"
" " "	5,6B,7,8,9,10	7"

Feb. 10,1938 That portion of Quebec from Seven Is. to Blanc Sablon (Saguenay Co.) closed to fishing from May 19, 1938, to May 19, 1942.

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	1932	1934	1935	1935	1941	1942
1A		3 1/2 - 4 3/4	3 1/2 -	3 1/4 - 5"		3 1/4
1B	9"	3 1/16 - 4 3/4			3 1/2 - 4 3/4	
2		3 1/16			3 1/8"	
4	9"	3 1/16			3 1/8	

		3 2	3 4/1 3 5	3 [illegible]	[illegible]	[illegible]
1 A	Grand Manan		3 1/2	3 1/4	3 1/4	3 1/4
1 B	Charlotte	9"/16	3 1/16		3 1/8	
2	St John		3 1/16		3 1/8	
3	Annapolis, Kings --					
4	Digby, Yarmouth, Shelbourne, Queens, Lunenburg.	9"	3 1/16		3 1/8	