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SUMMARY OF THE INTENSIVE CREEL CENSUSES ON THE PIGEON RIVER FOREST TROUT LAKES FOR THE 1938 AND 1939 SEASONS, AND FOR THE PERIOD APRIL 27-MAY 5, 1940, WITH A BRIEF REVIEW OF MANAGEMENT PRACTICES AND SUGGESTIONS FOR FUTURE STOCKING

by

David S. Shetter

Since no report on the 1938 creel census of the Pigeon River Forest lakes has been prepared, it is felt that a summary of the information collected to date would be of interest, especially fishing results from the trout lakes where the angling is maintained solely by artificial means. Lakes which have been under intensive creel census for three or more trout seasons are Lost and West Lost, North and South Twin, and Hemlock. Records from the Devil's Soup Bowl and Section Four Lake are relatively few. Pickerel Lake was censused for the first time during the opening week of the 1940 season. Unfortunately the 1940 census on the entire Pigeon River Forest had to be discontinued at the end of the first week because of a general shortage of CCC enrollees for the camp projects. Information of value was nevertheless obtained from the short census of North and South Twin, Hemlock, and Pickerel Lakes.

The general results of the angling will be given briefly for each season, followed by a comparison of the trends in the catch with the records of the stocking. Previous to 1939, creel census records for the various lakes were kept separately but during 1939 and 1940 records for (1) Lost and West Lost and (2) North and South Twin were combined, as many fishermen would fish a short time in one lake, go over the hill to the other body of water for an hour, and then go back where they started. For purposes of comparison, the data from North-South Twin and Lost-West Lost lakes have been combined for each year that figures are available. A tabular summary of the fishing results on all lakes will be found in Table 1. This table includes all pertinent census data from the opening of the 1935 season to May 5, 1940.

Angling Results - Lost and West Lost Lakes (Total acreage - 8.6)

1938

A total of 283 anglers fished 960 hours catching 505 legal brook trout and 692 undersized fish, the latter were returned to the water. Fifty-nine (59) per cent of these anglers took no fish. The catch per hour was 0.53 brook trout. The angling pressure was 112 man-hours per season per acre. The catch per acre in legal trout was 58.7. The catch per acre of undersized fish was 80.5.

1939

During this season 367 fishermen fished 865.75 hours and caught 445 legal brook trout for a catch per hour of 0.51 trout, just slightly less than the previous year. Sixty-three (63) per cent of these anglers took no fish. The angling pressure was 100 man-hours per acre per season, also slightly less than in 1938. The catch per acre of legal trout was 51.7, and the catch per acre of undersized fish returned to the water was 62.7.

1940

No creel census.

Angling Results - North and South Twin Lakes (Total acreage - 10.0)

1938

These lakes were fished by 354 anglers for a total of 1,139 hours, and 60 per cent of the fishermen took no fish. A total of 181 rainbow trout and 518 yellow perch comprised the 699 legal fish removed. Sixty-one (61) undersized fish, mostly perch, were reported as caught and returned. The catch per hour of legal fish was 0.60 fish. Angling pressure on this lake was 114 man-hours per acre per season. The catch per acre of legal fish was 71 (19.2 trout, 51.3 perch), while the catch per acre of undersized fish was 6.1.

1939

North and South Twin lakes were fished by 457 anglers for a total of 1,441 hours, and 84 per cent of these anglers took no fish. A total of 735 legal fish were captured, 154 rainbow trout and 581 yellow perch. The number of undersized fish returned to the water was not given. The catch per hour of legal fish was 0.66. The catch per acre of legal fish was 73.5 (15.4 rainbow, 58.1 perch), and the angling pressure increased to 144 man-hours per acre for the season.

1940

In the period April 27-May 5 inclusive, a total of 96 anglers used North and South Twin lakes for 340.25 hours. Sixty-three (63) per cent took no fish. The total catch for these lakes was made up of 117 legal fish of which 111 were rainbow trout and 6 were perch. The total catch per hour was 0.53. The catch per acre of legal fish was 11.1 trout, 0.6 perch. No undersized fish were reported. The angling pressure to date

(May 5) was 34 man-hours per acre.

Angling Results - Hemlock Lake (Total acreage - 6.0)

1938

One hundred and seventeen (117) anglers spent 340.25 hours on this lake and 50 per cent of the fishermen took no fish. They caught 204 legal fish, of which 203 were brook trout and one was a perch. A total of 297 undersized brook trout were returned to the water. The catch per hour of legal fish was 0.60. The catch per acre of legal fish was 35.7; of illegal fish, 49.6. The angling pressure was 57 man-hours per acre for the season.

1939

In this season the number of anglers almost doubled over the preceding year, 206 individuals fished the lake for a total of 616.25 hours. Sixty-five (65) per cent of the anglers took no fish. The total legal catch was exactly doubled; 408 fish being captured. The total catch included 311 brook trout and 97 rainbow trout. The catch per hour of legal fish was 0.66. The catch per acre of legal trout was 68, while the catch per acre of undersized fish was slightly less than 4. The angling pressure also was slightly less than twice that of the previous year -- 103 man-hours per acre for the season.

1940

One hundred and twenty-one (121) anglers fished a total of 299.50 hours during the opening week of the 1940 trout season on Hemlock Lake but 74 per cent took no fish. The entire legal catch was 120 trout of which 113 were rainbow and 7 were brook trout. Two undersized brook trout were returned to the water. The catch per hour of legal fish was 0.40. The catch per acre

of legal trout was 20. The angling pressure was 50 man-hours per acre for the duration of the census.

Angling Results - Section Four Lake (3.3 acres)

1939

This lake was fished for a total of 502 hours by 190 anglers, eighty-eight per cent of whom took no fish. The legal catch was 74 fish, of which 41 were brook trout and 26 rainbow trout. Nine under-sized brook trout were returned to the water. Seven yellow perch were also taken. The catch per hour of legal fish was 0.15. The catch per acre of legal fish was 22.4. The angling pressure was 152 man-hours per acre for the season.

1940

Fishing in Section Four Lake was poor during the opening week of 1940; out of a total of 49 anglers, 88 per cent caught nothing. Eleven rainbow trout were caught in 133.75 hours of fishing, and one undersized rainbow was returned to the water. The catch per hour of legal trout was 0.08. The catch per acre of legal fish was 3.3, and the angling pressure during the opening week was 41 man-hours per acre.

Angling Results - Pickerel Lake (40.6 acres)

1940

No creel census has been operated on this lake since 1936, when 58 records (only about half the total angling, according to Eschmeyer) were secured. During the first week of the 1940 season 53 fishermen spent 214.50 hours on Pickerel Lake. Forty per cent of the anglers caught nothing. The total legal catch of these fishermen was 112 trout, of which 104 were rainbow and 8 were brown trout. The catch per hour of legal fish 0.52. No undersized fish were reported. The catch per acre of legal fish was 2.8. The angling pressure was 5 man-hours per acre.

Angling Results - Devil's Soup Bowl (1.3 acres)

Only incomplete records are available for any year on the Devil's Soup Bowl. In 1938 there were 6 trout taken there (4 rainbow, 2 brown). Eighteen anglers in 1939 fishing for 33.75 hours took no fish of any kind. Institute members have also heard unverified reports of several other brown trout being captured.

Angling Results - Grass Lake (28.3 acres)

1939

This lake is not a trout lake but was checked during 1939 from June 24 to Labor Day. It was fished a total of 343.50 hours by 131 anglers (59 per cent caught no fish) who caught a total of 306 legal fish for a catch per hour of 0.89 fish. The recorded legal catch consisted of 30 large-mouth bass (average 11.6 inches), 13 small-mouth bass (10.9 inches), 99 bluegills (6.7 inches), 101 sunfish (6.4 inches), 7 yellow perch (6.7 inches), 54 bullheads (8.1 inches), and 2 suckers (12 inches). Eighty-three illegal fish were returned to the water. The catch per acre of legal fish was 10.8 fish. The angling pressure was 12 man-hours per acre for the season. The period of best fishing was July 22-28, when the catch per hour of legal fish was 2.1 and the catch per fisherman was 5.2 fish.

Average Size of Trout Taken in Pigeon River Forest Lakes

The average total length of the anglers' catch from the various lakes is presented in Table 2. For all years except the short period in 1940, total lengths were estimated; during the latter period the fish were measured.

The average size of the brook trout in these lakes has run consistently between 8.2 and 8.6 inches, while the average length of the rainbow trout has never been less than 8.5 inches (Hemlock Lake) and has reached a high of 15.6 inches (Twin Lakes).

All trout taken during April 27-May 5, 1940, were weighed. The average weights of the trout are presented in Table 2. The longest and heaviest fish were from Pickerel Lake where the average weight was 1¼ pounds. Rainbow trout from Hemlock Lake averaged lightest (3.8 ounces), but this species was planted in this lake only last summer (July, 1939). In Section Four Lake, the average weight was almost 3/4 pound (11.3 ounces). In the Twin Lakes the average weight for all fish caught was 6 ounces.

The coefficients of condition (the relationship of the weight of the fish to its length) have been calculated for those fish from the various lakes where weights of fresh fish (not cleaned) were available. These calculations indicate that the fish from Pickerel Lake were improperly weighed, as a majority of the fish had coefficients of condition of almost impossible magnitude. Coefficients of condition on Hemlock, North and South Twin and Section Four Lakes were of a reasonable nature.

Only a very small amount of information on coefficients of condition of rainbow trout has been published. Embody (1937) calculated the average coefficient of condition at 1.583 for 7 inch rainbow trout in hatcheries of New York State. Such a fish would weigh only slightly more than two ounces.

By way of comparison, coefficients of condition for rainbow trout in the various Pigeon River Forest Lakes during the first week of the 1940

season were as follows:

North and South Twin	---- 1.617 (103 specimens)
Hemlock	---- 1.397 (79 specimens)
Section Four	---- 1.506 (5 specimens)
Average	---- 1.521 (187 specimens)

Comparing Embody's figure with the results obtained from the creel census, it can be seen that only the rainbow trout from North and South Twin Lakes were in better condition than the New York hatchery fish. The average for all lakes was below the New York State hatchery average. It is very possible that deferring the opening date of the trout season two weeks would result in capture of fish with a coefficient of condition at least equal to that obtained in the eastern hatcheries. It has been noted that rainbows taken in these lakes in the first two weeks of the season are generally rather thin and only partly spent. Presumably they are not in very good condition for eating and certainly do not yield the sport they would if taken after recovery from spawning.

Percentage of Fishermen Taking 0 to 15 Trout

The percentages of fishermen who have been successful in varying degrees on trout lakes and the Pigeon River have been listed in Table 3. It is noteworthy that even more fishermen were unsuccessful (caught no fish) on the lakes than were unsuccessful on the Pigeon River during 1938 and 1939. The percentages of anglers taking 1,2,3,4 and 5 fish from the lakes were usually about the same or less than the percentage of stream anglers taking the same number of fish. The percentage of anglers taking 6 to 15 fish from the trout lakes was on some lakes greater, and on some lakes less than the percentage of fishermen taking a similar number of fish from the Pigeon River.

Close study of the available data brings out the fact that most of the catches of 5 or more fish were made early in the season, usually within six weeks of the opening day, with a few good catches made during the last three weeks of the season.

Residence of Anglers

During the past two seasons (1938 and 1939) and for the first week of 1940, fishermen from 49 counties of the Lower Peninsula and from 8 other states have tried their luck in the lakes of the Pigeon River Forest.

Out-of-state anglers during 1938 and 1939 were mostly from Ohio, while Indiana was second in both years. Approximately 10 per cent of the anglers were non-residents in both years. Other states represented were New York, Wisconsin, Missouri, Nebraska, Pennsylvania and Illinois. Only 5 out-of-state fishermen were recorded during the first week of 1940, all from Indiana. This is to be expected, as the vacation season, when most non-residents would normally fish in the Pigeon River Forest, can hardly be considered in full swing the first week of May.

Among the resident anglers, Wayne and Cheboygan county fishermen were tied with 154 each in 1938, followed by Otsego and Genesee.

In 1939, Cheboygan county led with 302 fishermen, followed by Wayne, Presque Isle, and Genesee counties.

During the first week of 1940, Otsego county led with 66, followed by Wayne, Presque Isle, and Cheboygan counties.

Local anglers (Cheboygan, Presque Isle, and Otsego counties) constituted 36 per cent, 35 percent, and 45 per cent of the total fishermen in 1938, 1939 and 1940 respectively.

Table 4 gives the number of anglers from the various counties and states for the years 1938, 1939 and 1940 respectively.

Review of the Management Practices Effected on the Pigeon River Forest Trout Lakes, with Suggestions for Future Management

This section of the report is written with the intention of bringing up-to-date the management history of these lakes. It is now almost nine years since they were first inventoried, and over five years since management practices were inaugurated in the form of changes in classification, stocking, fertilation, removal of undesirable fish, et cetera. Each lake, or each pair of lakes, will be analyzed in the following pages, and the history of the management through the last five years briefly outlined along with the changes which have occurred in the angling results. Where data appear to justify certain management practices, further suggestions have been made for future use on the lakes of the Pigeon River Forest.

Lost and West Lost Lakes

Eschmeyer records in Report No. 438 (p. 30) that Lost Lake was first planted with brook trout in 1927 when Mr. William Horsell of the State Forest introduced 200 fingerlings. The lake was not fished until 1931, when 58 trout were reported to have been illegally removed before the opening day, which at that time was June 25. On June 25, 1931, a total of 104 more brook trout were also captured, according to creel census records obtained by the local conservation officer. Four more trout were netted by the Institute survey party in August. At least 166 trout or 83 per cent of the original planting in 1927 survived. No records of stocking other than that mentioned above can be found, so it may be assumed that these were survivors of the 1927 planting.

The total number of brook trout fingerlings which have been stocked since 1933, along with the total catch of legal and undersized brook trout recorded by the intensive creel census, are presented in Table 5. A total of 39,250 fingerlings, varying in age from 5 to 9 months old when released, have been introduced in these two lakes in the period 1934-1938 inclusive. A total of 2,313 legal brook trout have been removed, while 1,691 undersized fish were reported. The return to the angler therefore was 5.9 per cent of the total planting over this six-year period.

It should be noted that the fewest undersized fish (13) were reported in the 1936 trout season, after two years of extremely heavy plantings. Since the releases have been lowered to 6,250 or less for the two lakes, it seems safe to conclude that more fish have survived from fall to the succeeding summer since a larger number of undersized fish were reported in years following these plantings.

The best fishing, in terms of catch per hour, has been demonstrated for the years 1938 and 1939 by the creel census. The stocking for the preceding years (1937 and 1938) were the lowest for these lakes, 5,000 and 6,000 fingerling brook trout respectively. These latter two stockings were also older and presumably larger fingerlings (8 and 9 months old).

The following stocking procedure is recommended for the 1940 planting of these lakes (which are almost identical as far as trout habitat is concerned).

Lost Lake - 500 adult brook trout (clip right pelvic)

West Lost Lake - 2,000 8 to 9 months old fingerlings (clip left pelvic).

A creel census during 1941 will be necessary to determine the comparative survival to the angler of the plantings of different sizes of trout.

North and South Twin Lakes

The 1932 Institute survey showed these lakes to contain an abundance of stunted perch. As physical-chemical conditions were determined by survey to be for trout, both lakes were stocked with fingerling brook trout in 1933 (about 6,500 in each lake). In 1934, North Twin was treated with 250 pounds of Farm Bureau Fertilizer (4 per cent nitrogen, 16 per cent phosphoric acid, 8 per cent potash).

In 1934, gill net studies in South Twin demonstrated the perch in that lake to be both stunted and very abundant, and that very few trout had apparently survived (ratio of 263 perch to 21 trout in the gill nets despite the introduction of 6,300 fingerlings in the previous fall). Accordingly, South Twin was poisoned and dynamited in September, 1934.

South Twin remained dormant during the summer of 1935, but 5,000 blunt-nosed minnows (Hyborhynchus notatus) and 50 killifish (Fundulus d. menona) were introduced. In the fall of 1935, one hundred (100) adult rainbow trout were planted.

In 1936, the creel census of South Twin recorded 62 of the 100 fish planted in 1935 as taken by fishermen. Two additional specimens were taken by the Institute. There was no planting in this lake in 1936, but in 1937, nine (9) more rainbows were captured by fishermen, indicating a known survival of 73 per cent of the original planting in 1935.

In the fall of 1937, two hundred (200) adult rainbows were planted in South Twin and 100 were introduced into North Twin Lake. The recorded

rainbow trout catch in these lakes in 1938 was as follows:

North Twin	66
South Twin	115
Total	181

The rainbow catch from North Twin, where no rainbows were previously present, demonstrates a return to the angler of comparable magnitude to the 1935 stocking of South Twin Lake, -- a survival of at least 66 per cent from fall to the succeeding summer.

In the fall of 1938, further plantings were made in both North and South Twin Lakes consisting of 150 adult rainbow trout for each lake. Also on July 14, 1939, the same number (150) of fin-clipped rainbow adults were introduced. This summer planting was not entirely successful, as 16 marked fish were found dead on the shores, and only 5 marked trout were later retaken by anglers. Unfortunately the records for the two lakes have been combined (as explained on page 2) so the results cannot be given separately. The total catch of rainbow trout for the two lakes in 1939 was 154.

The 1939 fall planting for these lakes was 300 adult rainbows (half in each lake), also marked by removing a different fin than on the summer planting. During the first week of 1940 a total of 111 rainbow trout were taken; the catch was as follows:

Summer plant of 1939	3 fish
Fall plant of 1939	16 fish
Mark not described	24 fish
Unmarked	68 fish
Total	111 fish

It is to be regretted that over one-half the marked trout were not properly reported as to the mark, hence, the carry-over from the two plantings

of 1939 could not be more closely evaluated. However, it is apparent that not all of the summer planting of 1939 had died, and that the fall release had survived in fair numbers. It is also encouraging to note that 61 per cent of the first week's catch presumably came from rainbow trout plantings introduced previous to 1939.

The present rainbow trout population may be estimated by the process of continuously adding the number of fish stocked and the number removed by angling, assuming again that all fish have been recorded, and in the case of these lakes that the mortality was not greater than is already known for the July, 1939 planting. By this process the estimate reached for the population of adult rainbow in the two lakes was 763 on May 5, 1940 (see Table 6).

Mention should here be made of the perch fishing in the Twin Lakes. The population of South Twin Lake was killed off by poisoning in September, 1934. No perch were recorded in the creel census of this lake until 1938, when 191 yellow perch of an average size of 8.4 inches (estimated length) were recorded. Evidently the perch have been reintroduced by the anglers fishing the companion lake (North Twin) from which the perch were not removed, and which lies only about 100 yards over the hill.

If such a practice is continued by fishermen, perch may reach their former abundance in South Twin Lake, and will have to be again eliminated. When and if this is done, North Twin Lake should also be poisoned to eradicate the source of supply from which South Twin was probably re-stocked.

It may be said in favor of the perch in these lakes, however, that they do make up the bulk of the legal catch during that part of the fishing season when the rainbow trout are not biting, that is in late June, July and

early August, and in all years have outnumbered the catch of rainbow trout. Also, since the poisoning of South Twin and the fertilizing of North Twin, the average size of the species has been fairly good. The danger, as previously pointed out, lies in the re-establishment of the species in too great a number to obtain consistent growth to legal and above-legal size.

It would be desirable to make stomach examinations of the rainbow trout to determine if the smaller, younger perch are being utilized as food by the rainbow trout.

Each lake should be stocked with 150 adult rainbows in the fall and 100 about June 1-20 if the angling pressure remains at its present level.

Hemlock Lake

This lake was first stocked with brook trout in 1927 by William Green of Hillman; the number of fish and the approximate size is not recorded (Report 438, p. 28). Six of the surviving brook trout of this planting were taken by the Institute field party in 1932. As the lake has no spawning facilities, Eschmeyer recommended the introduction of fingerling brook trout. The stocking record, along with the known catch for the various years from 1933-1939 inclusive are presented in Table 7.

Although there was no creel census in 1933 or 1934, Eschmeyer reports (Report 438, p. 29) that fishing was excellent in 1934. Creel census records demonstrate that the total legal catch and the catch per hour fell off each year through 1937. Also, as in Lost and West Lost lakes, the number of undersized fish reported indicated a low survival of fingerling fish from fall to the following summer.

In the fall of 1937, eight-months old brook trout fingerlings (5,000) were stocked, instead of 5 and 7 months old fish (which had been previously used). The total legal catch in 1938 approached that of 1935, and the catch per hour was almost doubled. The number of undersized fish taken indicated that there had been a much better survival of this planting.

In the fall of 1938, adult brook trout (200) were planted and were evidently available during 1939, as the legal catch of brook trout was almost one-third greater than in 1938 or 1935. In the middle of the summer (July, 1939) 200 fin-clipped rainbow trout adults were introduced, and a total of 97 were captured from mid-August to Labor Day. However, the brook trout, not yet of legal size, appeared to be vanishing, as only 23 undersized brook trout were reported. The catch per hour of legal fish for 1939 was 0.36.

In October, 1939, rainbow trout adults were again planted (200). They were marked by clipping a different fin. During the first week of 1940, the total legal catch was made up of 7 brook trout and 113 rainbow trout. The catch per hour was 0.40 trout. Only 2 undersized brook trout were reported.

In the years for which stocking records and creel census are available, a total of 23,750 fingerling brook trout were released. Of these fish (which were 5-8 months old at planting) 516 were later taken by anglers as legal trout -- a return of 2.2 per cent of the total released as fingerlings. This calculation is based only on the 1934-1937 stockings and the 1935-1938 creel censuses when only fingerlings were planted. The actual total return was undoubtedly somewhat greater as a part of the 1939 legal catch was obviously originating from all or a part of the fingerling releases of 1934-1937.

Although all the rainbow are not recorded as marked fish, all those captured in 1939 and 1940 must have been from the two plantings listed, as there are no records of previous stocking of rainbow trout in this lake. The marked fish were recorded merely as marked fish and the missing fins were not described. On May 5, 1940, there should have been 190 rainbow trout left in the lake from previous plantings, assuming no mortality and also that all rainbow have been reported by fishermen and recorded properly. This figure is determined as follows:

Planted July 14, 1939	200
Caught from July 14-Labor Day	-97
Left on Labor Day	103
Planted October, 1939	200
Total available April 27, 1940	303
Number taken April 27-May 5	-113
Left in lake on May 5	190

The creel census data indicate that the fishermen have enjoyed better fishing after the introduction of a moderate number of advanced fingerling fish no less than 8 months old, or under the stocking of adult fish, particularly the latter, since the catch per hour was slightly better than under the fingerling program in spite almost twice the fishing pressure. The records from 1939 also indicate that planting this lake in late June will furnish some fishing in mid-August.

In view of the general results obtained to date, it is recommended that 300 adult rainbows be planted in the fall of each year and 200 adult fish of the same species be introduced some time in early June (depending on the season, these fish should be planted before the upper waters of the

lake become too warm for the fish to become successfully acclimated).

Pickerel Lake

This 40-acre lake was first surveyed by Metzelaar in 1925, who reported brook trout present. The Institute survey in August, 1932 found brook trout in the deeper part of the lake. Small-mouthed bass and perch also were taken in other collections, although the bass were apparently not abundant and the perch were found to be rather slow-growing individuals.

Management practices suggested by Eschmeyer (Report 438, pp. 20-23) and carried out by CCC camp Vanderbilt were as follows:

1935 - (a) Installation of numerous brush shelters because of a lack of rooted aquatic plants.

(b) Installation of spawning boxes for the small-mouthed bass.

1937 - Application of 2 tons of fertilizer high in phosphorus content to increase the food organisms thought by Eschmeyer to be rather scarce.

The stocking record since 1932 is presented in Table 8.

Unfortunately, there is not a single year of complete creel census on this lake. In 1936, Eschmeyer (Report 438, p. 58) estimated that only somewhat more than one-half of the anglers were contacted. One hundred and seventy hours of fishing by 58 anglers yielded 17 brook trout, 103 perch, 1 small-mouthed bass and 2 bullheads for a catch per hour of 0.7 legal fish. The trout were reported to be of good average size -- 11.7 inches.

An 400 fin-clipped rainbow trout adults were planted in the fall of 1939, a creel census was projected for the entire 1940 season, but was operated for the first week only because of a shortage of man power.

The results of the fishing during this short period were very encouraging; ninety-three (93) of the 112 rainbow trout captured were marked fish, a recovery of 23¾ per cent to May 5, 1940 of fish introduced during the previous fall. It is not unreasonable to assume that at least twice as many of these fin-clipped fish will be taken before the end of the trout season. During the first week hatchery reared adults, released during the previous fall, comprised 83 per cent of the total catch.

The population of adult rainbows on the opening day of the 1940 trout season (April 27) may be estimated through the use of Needham's formula (1937, p. 45), which is stated as follows:

$$y = (b + c)\frac{a}{b}$$

where y = total population

a = number of marked fish available

b = " " " " caught

c = " " unmarked fish caught.

It is assumed in this calculation that any mortality which has taken place among the rainbow trout in this lake occurred in equal proportions among the marked and unmarked fish. Application of the formula to the creel census results gives the following result.

y = 112 (total number of marked and unmarked rainbow caught)

times $\frac{400}{93}$ (total marked fish planted) / (total marked fish caught)

= 481 adult rainbow present on April 27.

Of these fish we know that 400 were planted in October, 1939, so 81 were holdovers from the releases of 1934 and 1935. On May 6, the total population was 112 less, and was probably made up as follows: 307 adults from the 1939 planting (marked), 62 hold-overs from previous stocking.

It is suggested that 500 adult rainbows be planted each fall and 300 each June.

Section Four Lake

In this body of water stunted perch were found to be abundant at the time of the original survey in 1932. In 1933, at Eschmeyer's recommendation, 300 brook trout 8-months old were planted. In August, 1934, gill nets yielded a total of 39 perch and 3 brook trout, the latter not of legal size. Casual reports by anglers during 1934 and 1935 indicated the trout fishing to be very poor.

On September 19, 1935, the lake was poisoned, and only perch were found to be present. After the poisoning, a release of 150 rainbow trout adults was made. In 1936 no planting was made. In 1937, 100 rainbow trout adults and 1,000 grayling adults were released. In 1938 and 1939, a total of 100 rainbow trout adults were planted in each year.

Accurate information on the quality of the angling is not available for any year except 1939. For that year, 41 brook trout, 1 brown trout, and 25 rainbow trout or a total of 67 trout were reported. Since there are no records of brown trout or brook trout introductions since the poisoning in 1935, it must be assumed that the fish have been (a) misidentified by the census clerks, or (b) that other unrecorded species of trout have been planted, or (c) that the poisoning was not complete. The most logical assumption is that the trout were all rainbow trout but were misidentified.

During the first week of the 1940 trout season, a total of 11 rainbow trout were taken from Section Four Lake. Although 100 fin-clipped adults of this species were planted in October, 1939, not one of the marked fish was among the 11 rainbows reported. This lake does not appear to have given the fishing that the others have under the program of stocking adult fish. The explanation may be in the chemical-physical conditions. It was found during the original survey that the deeper waters contained

no oxygen in late summer. This oxygen deficiency of the colder, deeper water or the fact that this is the deepest lake with the lowest percentage of shoal may be inhibiting factors to the supposed fish-carrying capacity of the lake. The presence of grayling may also have been a factor responsible for poor trout production. Both Section Four and Ford lakes should be re-investigated to determine what species of game fish will provide better fishing in those waters.

Since the experimental planting of 5,000 grayling made in October, 1936, is now apparently diminished to a point where it is difficult to obtain specimens by netting, and since it has been decided to discontinue grayling experiments in this lake, Ford Lake should be planted with adult brook trout, and re-opened to public use. This 11.7-acre lake should receive an experimental planting of 600 legal brook trout in the fall plantings. Such a release will provide us with an opportunity to determine whether or not brook trout can survive successfully in combination with a supposedly non-predaceous and slightly competitive species, the bluegill. The latter species was introduced into Ford Lake accidentally, and is now apparently present in fairly large numbers. The original planting and first progeny have grown quite rapidly. Some bluegills taken in 1938 reached legal size by the end of the second summer of life.

A planting of 100 adult rainbow trout should be made in Section Four Lake in the fall of each year and about June 1 of each year.

Grass Lake

Inventory data compiled by Eschmeyer (Report 438, p. 18) indicate that in earlier days this lake might have been a trout lake, as brook trout were captured in the original survey of 1931-32. However, the spreading of the water over shoals caused by beaver dams at the outlet and damming of tributary streams by beaver have since modified the aquatic habitat to that of a

warm-water fish lake. Eschmeyer also states that this lake was used to almost no extent by the fishing public up to and including 1937 (Report 483, p. 1). This may or may not have been the true situation, as this lake was not very closely observed by census takers until the 1939 fishing season.

The aquatic conditions present were suitable for bass and bluegills, and these were recommended by Eschmeyer. The stocking record to date (1940) is as follows:

1934 - 4,000 bluegills (4 mo.)

1935 - 1,000 bluegills (4 mo.)

1937 - 65 small-mouthed bass (adults)

The stocking and management program for this lake must be considered as successful to date since it has made fishing where, according to all reports, little or none existed in the past decade. Ninety-nine (99) bluegills (6.7 inches) and 101 sunfish (6.4 inches)(the latter may have been bluegills misidentified by the CCC enrollees) were the dominant species in the 1939 catch, and also 30 large-mouthed (11.6 inches) and 13 small-mouthed bass (10.9 inches). Large-mouthed bass were said to have been planted at the time bluegills were first stocked (1934) but the planting was not recorded. A 12 inch large-mouthed bass was taken by Hazzard May 18, 1937. This lake during the period June 24-September 4 furnished 345½ hours of angling to 131 fishermen at a rate of 0.89 legal fish per hour, which is fishing of better than average quality.

Also of interest is the fact that the period of best fishing in 1939 came during mid-summer when the fishing in the trout lakes of the Forest was at a low ebb.

Inasmuch as the angling pressure is relatively light (12 man-hours per acre for 1939), and both bass and bluegill appear to be reproducing successfully no further stocking is recommended.

Comparison of Number of Fish Stocked Per Acre with the Number Caught Per Acre

Table 9 was drawn up in an attempt to find some clue as to a more effective planting schedule for the use of the hatchery supervisors in servicing the fishing in the trout lakes of the Pigeon River Forest. Listed in this table are the number of trout stocked per acre each year and the number of legal and sub-legal trout caught per acre of water surface in the respective lakes. The percentage of the planting known to have been caught or returned is also given. The assumption is made that fingerling trout planted in the fall of one year supply the legal catch for the following summer, although this is not entirely a valid assumption, since there are undoubtedly present a small but unknown number of older fish entering the catch as hold-overs from the planting of two years or more previously. Certainly the great majority of fingerling trout could be assumed to enter the legal catch by the second summer after release. No matter which assumption is preferred, the general conclusions to be reached are similar.

In Lost and West Lost Lakes during 1934 and 1935, over 1100 fingerlings were planted per acre of water surface, yet the greatest return as legal trout was in 1935, when 5.5 per cent (76.7 legal trout per acre) were caught. The poorest results were obtained from the 1935 planting of 5 months old fingerling brook trout, when, during 1936 only 4.2 per cent of the planting (48.8 legal trout per acre) were recaptured as legal trout, and only 1.5 undersized fish were reported per acre.

When releases in these lakes in 1936, 1937 and 1938 were reduced from 1400 to 700 (approximately) fingerling trout per acre, these being older fish (7,8, and 9 months old brook trout), the percentage removed as legal fish in 1937, 1938, and 1939 increased (in 1938 to as high as 10.1 per cent), and the percentage of undersized fish returned to the water was also much higher in these years than previously.

Results of a similar nature were obtained on Hemlock Lake. Planting five-month old brook trout fingerlings at the rate of 1667 per acre did not give as good results as planting 833 eight-months-old fish per acre. Even better results were obtained by planting as few as 67 adult legal trout per acre[1] in 1938.

Plantings of 33 trout per acre in 1939 gave a return in 1940 of 20 trout per acre (60.6 per cent of the planting) by the end of the first week of the 1940 season.

Since fingerling trout have not been planted in this lake since 1937, and since a few have been reported in both 1939 and 1940 (but many fewer each year) it seems likely that most of the fingerlings which are going to enter the legal catch would do so in either the first or second summer after planting.

In North and South Twin Lakes there is no doubt but what the planting of the previous fall supplies the majority of the present summers angling, as all rainbow trout planted in these lakes have been of legal size. To date the best success, in terms of percentage of plant per acre recovered as legal fish per acre, has been obtained with releases of 30 fish per acre.

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[1] This anamalous situation of obtaining a return of 101 per cent on the number planted is caused by an unknown number of fingerlings from the 1937 planting entering the 1939 legal catch in addition to the legal fish planted. Since neither planting was marked it was impossible to determine the exact contribution from legal trout.

It is the author's belief, however, that if the angling pressure remains high (above 125 man-hours per acre per season), and if there are two plantings made (one in the fall, another in early June), these lakes will support plantings of up to 50 trout per acre per year. The comparatively poor success of the planting of 60 trout per acre in 1938 and summer of 1939 was at least partially due to too warm weather for the planting in July of 1939.

To sum up briefly, better angling has been made by comparatively small plantings of older trout; i.e. 600 - 750 eight or nine months-old fingerlings per acre or from 30 to 70 adult, legal-sized fish per acre.

General Management Suggestions for the Area

1. If possible, change the opening day to May 15 for the rainbow trout lakes (Twin Lakes, Hemlock, Section Four, Pickerel) of the Pigeon River Forest. There are several good reasons for such a limitation of the season. The last Saturday in April and the week immediately succeeding it are usually cold. This year (1940) the ice had barely left these lakes by April 27, and the fishing weather was rather uncomfortable. Because of the low water temperatures existing under such conditions the fish are usually sluggish in action when hooked. As these lakes are dependent on artificial means for their stock of fish, the catch is definitely limited by the number planted. If the majority of these fish are removed in the first few weeks of the season, they obviously will not be available to fishermen later. Dr. Hazzard reports opening-day catches of rainbow trout from these lakes to be very thin and generally in poor condition. It is very possible that delaying

the opening day for two weeks would result in the take of heavier, more gamey fish. Calculations on the coefficient of condition of the rainbow trout in Hemlock, North and South Twin and Section Four Lakes suggest that the fish are not up to standard at this early date.

2. Reduce the limit on rainbow trout, in the Pigeon River Forest Trout Lakes to 5 fish per angler per day. A limit of 5 fish is suggested so that more anglers, particularly out-of-state and southern Michigan anglers, may benefit from these hatchery plantings. As the opening day legislation and the legal limit now stands, almost all of the limit and near-limit catches of stocked rainbow trout are being taken by local anglers. Reduction of the limit from 15 to 5 fish would probably spread the total catch over more fishermen from more sections of the state. Reduction in number should be justifiable considering the large average size of the rainbows taken.

3. The placement of a competent fisheries biologist in the Pigeon River Forest during the trout season to supervise and instruct the creel census clerks is suggested. The duties of such a man would be to supervise the creel census work on the lakes and the streams, obtain a series of accurate weights and measurements, and scale samples, also physical and chemical data on the lakes and streams. To such an individual would be assigned the problem of re-designing the fisheries management policy for the Pigeon River Forest, using as his guide results obtained from plantings as shown by the intensive creel censuses on the various waters.

Summary of Stocking Suggestions for Trout Lakes in Pigeon River Forest

Lost and West Lost Lakes -- (Brook Trout)

If fingerling brook trout are used plant 4,000 eight or nine-months old fish.

If adults -- 200 fish in each lake in the fall.

North and South Twin Lakes -- (Rainbow Trout)

Stock 300 adult fish in the fall.

Stock 200 adult fish about June 1 of following year.

Pickerel Lake -- (Rainbow Trout)

Stock 500 adult fish in fall.

Stock 300 adult fish about June 1 of following year.

Ford Lake -- (Brook Trout - experimental)

Stock 600 adult fish in fall.

Section Four Lake -- (Rainbow Trout)

Stock 100 adults in the fall.

Stock 100 adults about June 1 of following year.

Hemlock Lake -- (Rainbow Trout)

Stock 300 adult fish in the fall.

Stock 200 adult fish about June 1 of following year.

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Fish Culture, Vol. 3, No. 2, Feb., 1937. pp. 19-38, 12 tables.

Eschmeyer, R. W. 1937

A Limnological and Fish Survey of the Lakes in the Pigeon River State Forest, Michigan, with Experiments in Fish Management, an Analysis of the Fish Yield and a Special Study of Stunted Perch Populations. Institute for Fisheries Research Report No. 438, pp. 1-108, 43 tables, 24 fig.

Table 1

General Summary of Creel Census Results on the Pigeon River Forest Trout Lakes from 1935 to May 5, 1940

Lake	Year	Number of Fishermen	Percentage Taking No Fish	Total Hours Fished	Legal Fish Caught					Catch Per Hour	Hours Per Fisherman Day	Angling Pressure[5]	Legal Fish Per Acre	Undersized Fish Returned	Undersized Fish Per Acre
					Brook Trout	Brown Trout	Rainbow Tr	Perch	Total						
Lost and West Lost (8.6 acres)	1935	551	62	1,740.00	660	--	--	--	660	0.38	3.2	202	76.7	187	21.7
	1936	364	67	1,158.25	420	--	--	--	420	0.36	3.2	135	48.8	13	1.5
	1937	331	69	1,382.50	283	--	--	--	283	0.20	4.2	161	32.9	259	30.1
	1938	283	59	960.00	505	--	--	--	505	0.53	3.4	112	58.7	692	80.5
	1939	367	63	865.75	445	--	--	--	445	0.51	2.4	100	51.7	540	62.7
	1940	No creel census		---	---	--	--	--	--	--	--	--	--	--	--
Hemlock (6.0 acres)	1935	212	42	622.00	215	--	--	--	215	0.35	2.9	104	35.8	344	57.6
	1936	75	67	241.50	52	--	--	--	52	0.22	3.2	40	8.7	21	3.5
	1937	54	74	244.00	47	--	--	--	47	0.19	4.5	41	7.3	57	9.6
	1938	117	50	348.25	203	--	--	1	204	0.60	2.9	57	35.7	297	49.6
	1939[1]	206	65	616.25	311	--	97	--	408	0.66	3.0	103	68.0	23	3.8
	1940[2]	121	74	299.50	7	--	113	--	120	0.40	2.5	50	20.0	2	Trace
North and South Twin (10.0 acres)	1936[3]	137	78	394.50	--	--	62	--	62	0.16	2.9	92	14.4	0	--
	1937	216	65	623.00	--	--	9	492	501	0.81	2.9	62	50.2	Not given	--
	1938	354	60	1,139.00	--	--	181	518	699	0.60	3.2	114	71.0	61	6.1
	1939	457	84	1,441.00	--	--	154	581	735	0.66	3.2	144	73.5	Not given	--
	1940[3]	96	63	340.25	--	--	111	6	117	0.53	3.5	34	11.7	0	--
Section Four (3.3 acres)	1939[1]	190	88	502.00	41	--	26	7	74	0.15	2.6	152	22.4	9	2.9
	1940[2]	49	88	133.75	--	--	11	--	11	0.06	2.7	41	3.3	1	Trace
Pickerel (40.6 acres)	1940[3]	53	40	214.50	--	8	104	--	112[4]	0.52	4.1	5	2.7	0	--
	1936[3]	58	45	170.75	17	--	--	103	123[4]	0.72	2.9	4	3.1	Not given	--

[1] Censused only from April 27 - May 5.
[2] Census only on South Twin this year.
[3] Census reported by Esclmeyer to be only about half complete.
[4] 1 small-mouthed bass, 2 bullheads also caught.
[5] Angling pressure = man-hours per acre per season.

Table 2

Summary of Average Sizes of Trout Recorded
in the Pigeon River Forest Trout Lakes Creel Censuses
(Figures in parentheses indicate number of specimens on which the average is based.)

Lake	Year	Average Length of Brook Trout	Rainbow Trout	Average Weight of Rainbow Trout (ounces)
Lost and West Lost	1935	9.3	--	--
		(660)	--	--
	1936	9.4	--	--
		(420)	--	--
	1937	9.4	--	--
		(283)	--	--
	1938	8.6	--	--
		(505)	--	--
	1939	8.2	--	--
		(445)	--	--
North and South Twin	1936	--	13.8	--
		--	(62)	--
	1937	--	16.3	--
		--	(9)	--
	1938	--	12.5	--
		--	(181)	--
	1939	--	15.6	--
		--	(154)	--
	1940 [1]	--	9.8	6.0
		--	(111)	(103)
Hemlock	1935	8.1	--	--
		(215)	--	--
	1936	10.6	--	--
		(52)	--	--
	1937	9.2	--	--
		(47)	--	--
	1938	8.2	--	--
		(204)	--	--
	1939	8.6	8.5	--
		(311)	(97)	--
	1940 [1]	8.3	9.3	3.8
		(7)	(113)	(79)
Section Four	1939	--	13.1	--
		--	(25)	--
	1940 [1]	--	10.5	11.3
			(11)	(5)
Pickerel	1940 [1]	--	12.9	19.5
			(104)	(49)

[1] All other years except April 27-May 5, 1940 lengths were estimated. The fish were measured in 1940, also weighed. Weights for Pickerel Lake, are not reliable, however.

Table 3

Percentage of Fisherman Days for which the Number of Trout Taken Varied from 0 to 15. Data from Rainbow Trout Lakes of the Pigeon River Forest Creel Census. (Where dashes (-) occur, 0.5 per cent or less were in that catagory.)

Lake	Year	Nos. of trout taken by percentage of fishermen																Number of Fisherman-Days
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Pickerel	1940 1/	40	17	9	4	9	9	2	7	2	0	0	0	0	0	0	0	53
Section Four	1940 1/	88	4	6	2	0	0	0	0	0	0	0	0	0	0	0	0	49
	1939	88	6	3	0	0	-	0	0	0	-	1	0	-	0	0	0	190
Hemlock	1940 1/	74	7	3	4	4	2	2	0	2	0	0	0	0	0	0	2	121
	1939	65	5	12	5	3	2	-	-	-	1	3	-	-	2	-	3	206
North and South Twin	1940 1/	63	16	8	1	4	2	1	1	2	0	0	0	1	1	0	0	96
	1939	84	8	3	2	-	0	-	0	0	0	0	-	1	0	0	0	457
	1938	73	9	7	4	2	2	1	-	0	-	0	0	-	0	0	0	354
Pigeon River	1939	56	14	11	6	3	2	1	1	1	1	1	1	-	-	-	1	2,213
	1938	51	14	12	7	6	3	2	1	1	1	1	-	-	0	0	-	1,139

1/ April 27 - May 5

Table 4

Residence of Anglers Using Pigeon River State Forest Lakes, 1938, 1939 Seasons, and April 27-May 5, 1940

County	Number of Anglers in Year 1938 [1]	1939 [2]	1940 [3]
Antrim	2	-	-
Alpena	2	16	3
Bay	6	25	4
Berrien	-	9	1
Calhoun	4	8	7
Charlevoix	14	38	3
Cheboygan	154	302	34
Clare	7	1	-
Clinton	-	-	2
Crawford	1	16	1
Eaton	2	-	-
Emmet	23	11	8
Genesee	68	116	19
Gladwin	--	-	3
Gratiot	4	3	-
Huron	4	-	-
Ingham	14	29	11
Iosco	-	2	-
Isabella	-	6	-
Jackson	16	7	9
Kalamazoo	-	13	5
Kalkaska	-	6	4
Kent	1	21	1
Lake	-	6	-
Macomb	1	4	-
Manistee	-	-	1
Mason	-	1	-
Mecosta	3	2	-
Midland	14	7	4
Montcalm	1	-	-
Montmorency	-	15	-
Muskegon	5	1	5
Oakland	8	45	3
Oceana	-	1	-
Otsego	79	64	66
Ottawa	-	6	-
Presque Isle	44	117	43
Roscommon	16	-	1
Saginaw	16	18	9
Sanilac	4	4	-
Shiawassee	2	4	-
St. Clair	-	6	-
St. Joseph	1	4	-
Tuscola	-	3	-
Washtenaw	7	-	-
Wayne	154	262	60
Lenawee	-	1	-
Gd. Traverse	1	-	-

State	Number of Anglers in Year 1938 [1]	1939 [2]	1940 [3]
Ohio	56	84	-
Indiana	13	32	5
New York	3	-	-
Wisconsin	3	-	-
Missouri	1	-	-
Nebraska	-	1	-
Pennsylvania	3	1	-
Illinois	1	13	-
Unknown	7	38	7
Total Anglers	765	1369	319

[1] Lakes under census: Lost, West Lost, North Twin, South Twin, Hemlock, Devil's Soup Bowl, for entire season.

[2] Lakes under census Lost, West Lost, North Twin, South Twin, Hemlock, Section Four, Grass, for entire season.

[3] Lakes under census North Twin, South Twin, Hemlock, Section Four, Pickerel, for the period April 27-May 5.

Table 5

Total Stocking and Total Catch, Lost and West Lost Lakes (8.6 acres)
(Figures in carets under "Number Stocked" indicate
age of fish in months at time of stocking.)

Year	Number Stocked (all brook trout)	Year	Brook Trout Caught Legal	Undersized	Catch per Hour of Legal Fish
1933	5,500[8 5]	1934	No Census		--
1934	12,000[6]	1935	660	187	0.38
1935	10,000[5]	1936	420	13	0.36
1936	6,250[7]	1937	283	259	0.20
1937	5,000[8]	1938	505	692	0.53
1938	6,000[9]	1939	445	540	0.51
Totals	39,250[X]		2,313	1,691	

[X] = Total stocking 1934-1938 under census.

Table 6

Population Estimates of Rainbow Trout
in North and South Twin Lakes on May 6, 1940

Stocking			Removal	
Plant	Fall 1935	100		
		-64	---------- Anglers and Institute	
	Available Labor Day '36	36		1936
Plant	Fall 1936	0		
	Available Opening Day '37	36		
		-9	---------- Anglers 1937	
	Available Labor Day '37	27		
Plant	Fall 1937	300		
	Available Opening Day '38	327		
		-181	---------- Anglers 1938	
	Available Labor Day '38	146		
Plant	Fall 1938 and Summer 1939	598		
	Available 1939 Season	744		
		-170	---------- Anglers (154); known mortality (16)	
	Available Labor Day '39	574		
Plant	Fall 1939	300		
	Available Opening Day '40	874		
		-111	---------- Anglers up to May 6, 1940	
		763	= Approximate Number of Adult Rainbow Trout Left in North and South Twin Lakes on May 6, 1940.	

Table 7

Total Stocking and Total Catch, Hemlock Lake
(Figures in carets under "Number Stocked" indicate age of fish in months at time of stocking.)

	Number Stocked			Number and Year Caught			Catch per Hour of
Year	Brook	Rainbow	Year	Brook	Rainbow	Undersized Brook	Legal Fish
1933	5,000[5]	-	1934	No census		-	-
1934	10,000[5]	-	1935	215	-	344	0.35
1935	5,000[5]	-	1936	52	-	21	0.22
1936	3,750[7]	-	1937	47	-	57	0.19
1937	5,000[8]	-	1938	202	-	297	0.60
1938	200[8a]	200[8a]	1939	311	97	23	0.66
1939	-	200[8a]	1940	7	113	2	0.40
Totals	23,950[x]	400		834	210	744	

x = Total stocking on which creel census has been operated.
z = April 27-May 5
a = Adults

Table 8

Stocking Record for Pickerel Lake,

1934-1939, Inclusive

Year	Brook Trout	Brown Trout	Rainbow Trout	Bluegill	Smallmouth Bass	Total
1934	7000 6"	600 8"	600 yr	3000 4"	500 4"	11,200
1935	900 6-ad	--	100 ad	1500 4"	--	2,500
1936	--	--	--	--	--	---
1937	--	--	--	20000 3"	--	20,000
1938	--	--	--	--	--	---
1939	--	--	400 ad	--	--	400

" = indicates age in months.

Table 9

Comparison of the Number of Fish Planted Per Acre of Water with the Catch of Legal Fish Per Acre of Water, also the Percentage of the Planting Per Acre Removed as Legal and Undersized Fish Per Acre (Figures above "√" indicate age of fish in months)

Lakes (acreage and species planted)	Year Planted	Number of Trout Planted Per Acre	Year Censused	Legal Trout Caught Per Acre	Under-sized Fish Caught Per Acre	Percentage of Preceding Years Plants Removed as Legal Fish	Percentage of Preceding Years Plants Returned as Under-sized Fish	Total
Lost and West Lost (8.6 acres) (Brook Trout)	1934	1395 6√	1935	76.7	21.7	5.5	1.5	7.0
	1935	1163 5√	1936	48.8	1.5	4.2	0.0x	4.2
	1936	727 7√	1937	32.9	30.1	4.5	4.1	8.6
	1937	581 8√	1938	58.7	80.5	10.1	13.9	24.0
	1938	698 9√	1939	51.7	62.7	7.4	9.0	16.4
Hemlock (6.0 acres) (All brook trout until summer '39, then all rainbow)	1934	1667 5√	1935	35.8	57.6	2.1	3.5	5.6
	1935	833 5√	1936	8.7	3.5	1.0	Trace	1.0
	1936	625 7√	1937	7.8	9.6	1.2	1.5	2.7
	1937	833 8√	1938	35.7	49.6	4.3	6.0	10.3
	1938	67 1ad√	1939	68.8	3.8	101.5	0.0x	101.5
	1939	33 1ad√	1940z	20.0	0.0x	60.6	0.0x	60.6
North and South Twin (10.0 acres) (All rainbow trout)	1935	20 1ad√	1936	12.8	--	64.0	--	64.0
	1936	0 1ad√	1937	0.9	--	25.0	--	25.0
	1937	30 1ad√	1938	18.1	--	60.3	--	60.3
	1938	60 1ad√	1939	15.4	--	25.7	--	25.7
	1939	30 1ad√	1940z	11.1	--	37.0	--	37.0

x = Less than 1 fish per acre or less than 1 per cent.

z = Censused from April 27 to May 5, 1940 only.

INSTITUTE FOR FISHERIES RESEARCH

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