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REPORT OF SIXTH ANNUAL CREEL CENSUS,  
PIGEON RIVER TROUT RESEARCH STATION,

1954

By

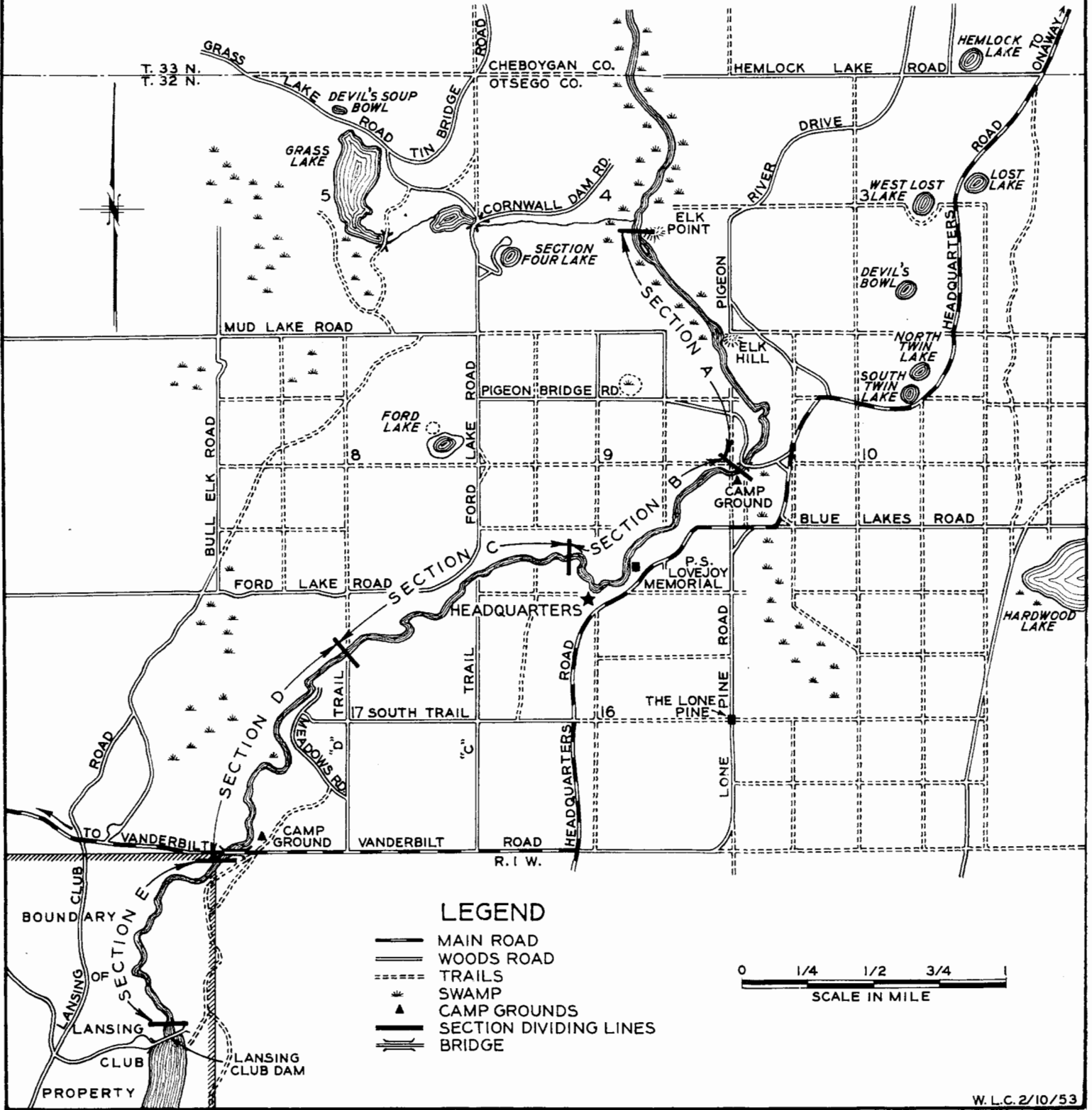
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JUN 11 1957  
FISH DIVISION

The Pigeon River Trout Research Station was established in 1949 on the site of the former Pigeon River Forest Headquarters, 13 miles east of Vanderbilt in Otsego County. The experimental trout waters of the station include seven small pot-hole lakes (Ford, Section 4, Hemlock, Lost, West Lost, North Twin, and South Twin) and, at the time of the station's establishment, included 4.8 miles of the Pigeon River; the stream included in the station was divided into four experimental sections (Sections A, B, C, and D), each one approximately 1.2 miles in length. In 1953, a fifth experimental section (Section E) was added at the upstream end of the controlled area, which was also approximately 1.2 miles long, increasing the total length of experimental stream to about 6 miles (see Figure 1). Table 1 presents the physical features of the experimental stream sections.

Since 1949 a compulsory permit system of fishing has been in effect on the experimental waters. Each angler visiting the area was required to obtain a free, one-day permit before proceeding to his selected

MICHIGAN DEPARTMENT OF CONSERVATION  
 FISH DIVISION  
**PIGEON RIVER TROUT RESEARCH AREA**  
 OTSEGO AND CHEBOYGAN COUNTIES



W. L. C. 2/10/53

Fig. 1

## THE PIGEON RIVER TROUT RESEARCH AREA

This research and experimental area is located in the northeastern corner of Otsego County and a small portion of Cheboygan County in the Pigeon River State Forest. Here five and one-half miles of the Pigeon River and seven trout lakes have been designated as experimental waters for studies on brook, brown, and rainbow trout. This program, as is also true with other functions of the Fish Division, is financed solely from the sale of fishing licenses and trout stamps. Its success depends to a large extent on the cooperation of the fishing public in supplying the information needed to maintain and improve trout fishing.

The Pigeon River in this experimental area is divided into five convenient fishing sections as indicated on the reverse side of this sheet. Seven trout lakes of unusual character are included in the trout research program. These lakes are believed to have been formed geologically through the solution of underlying limestone by ground water, and a settling of the surface layer of sand and gravel, producing cone-shaped pot holes, some with nearly vertical banks 50 to 60 feet high.

In order to obtain a complete record of the fishing in this area, each fisherman is required to register daily at the checking station, obtain a free permit to fish in any lake or portion of the stream and report back to the checking station before fishing in another lake or stream section or before leaving the area. Some experimental changes in the usual regulations governing trout fishing in Michigan are made from time to time in order to learn how necessary such restrictions are and whether changes may improve the angling quality. The special regulations will be stated on the fishing permit.

In addition to the information on fishing success collected from persons in the area, many other research projects are being followed by department personnel. Periodic estimates are made of the trout populations and information on rate of growth of the fish and their success in spawning is obtained. Studies of the returns from hatchery plantings are being made to determine their value and need.

The correct stocking programs for lakes of the type found in the Pigeon River Research Area, which lack natural spawning facilities, are being determined by plantings of different species of varying size and at different seasons of the year.

Table 1.--Morphometry of experimental stream sections, Pigeon River Trout Research Station\*

| Item                | Section |      |      |      |      |
|---------------------|---------|------|------|------|------|
|                     | A       | B    | C    | D    | E    |
| Length, miles       | 1.31    | 1.19 | 1.13 | 1.18 | 1.17 |
| Average width, feet | 45      | 41   | 40   | 40   | 40   |
| Area, acres         | 7.16    | 5.90 | 5.39 | 5.65 | 5.67 |

\*Data for sections A, B, C, and D from Cooper, 1952a. Length of Section E from E. H. Bacon, unpublished; average width of Section E was estimated.

water, whether experimental section of the stream or individual lake, and was also required to return for a report on his success and an examination of his catch by station personnel.

The creel census serves as a tool in evaluation of experimental methods of trout management, such as changed regulations, methods of planting, etc. Because a compulsory permit system was in effect, insuring a complete, or nearly complete, census, information could be secured which could not otherwise be obtained. Previous annual reports of creel census have appeared as Institute for Fisheries Research Reports Numbers 1250 and 1288 (Cooper, 1950, 1951).

It is the primary purpose of this report to record certain features of special interest concerning the trout fishing in the research area so that the recorded data may serve, with limitations, as indices of general trout fishing success in Michigan. These features of interest are: fishing success according to experimental section of the stream and to individual lake, according to lure used, according to time of season, and according to the frequency of trips of individual anglers; the various classes of anglers using the area; the residence of anglers; the age composition of the catch; and fishing success through the years since the establishment of the research station. In addition to the above purpose, data are herein recorded regarding the annual post-season fall population estimate made in the experimental area of the stream in order that the degree of exploitation by anglers may be noted.

The activities of the research station personnel are concerned, in addition to the creel census, with research projects of special interest, some of which may not utilize the creel census as a research tool, and some of which are conducted entirely off the experimental

waters. The results of these special projects will be given in separate reports, inasmuch as the projects often continue over a number of years. Since the results of experimental plantings of hatchery fish in the stream fall into the category of special projects, the data recorded in this report for the creel census do not include records of hatchery fish but rather wild trout only. Likewise, since the entire fisheries in the experimental lakes are the result of hatchery plantings involved in special projects, the results of the lake fishing have been, in general, reserved for separate reports, except for certain features of general interest which are included in this report.

During 1954, the research station was under the supervision of Edward H. Bacon, while the rest of the permanent staff consisted of Gerald F. Myers, Earl L. Wolf, and Harold H. Brado. During the post-season fall population study, additional assistance was received from Kenneth E. Christensen, Gaylord R. Alexander, and Alfred R. Grzenda. Supervisory assistance was provided by Albert S. Hazzard and David S. Shetter.

#### Creel census

Since the establishment of the research station certain special regulations have been in effect. The evaluation of such special regulations will be made in separate reports; however, a summary of these special regulations are given in Table 2, so that a more proper interpretation of the general creel census results may be made by the reader.

Table 3 presents the catch statistics for 1954 for the stream sections and individual lakes. Average catch-per-hour, which is

Table 2.--Experimental regulations, Pigeon River and Pigeon River lakes

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|      |   |
|------|---|
| 1949 | Sections A and B: 5 trout per day, 7-inch minimum, no bait restriction<br>Sections C and D: 15 trout per day, 7-inch minimum, no bait restriction (State-wide regulations)<br>Lakes: 5 trout per day, 7-inch minimum, no minnows (State-wide regulations)   |
| 1950 | Same as 1949  |
| 1951 | Sections A and B: 5 trout per day, 7-inch minimum, no bait restriction<br>Sections C and D: 2 trout per day, 9-inch minimum, no bait restriction<br>Lakes: Same as 1949 (State-wide regulations)  |
| 1952 | Same as 1951  |
| 1953 | Sections A and B: 5 trout per day, 7-inch minimum, no bait restriction<br>Sections C and D: 2 trout per day, 9-inch minimum, no bait restriction<br>Section E (added this year): 10 trout per day, 7-inch minimum, no bait restriction (State-wide regulations)<br>Lakes: Same as 1949 (State-wide regulations) |
| 1954 | Same as 1953  |

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Table 3.--Results of creel census for 1954, according to stream section and lake, Pigeon River Trout Research Station

| Water          | Number trips | Percentage successful | Catch |       |         | Total | Hours fished | Average catch-per-hour |      |
|----------------|--------------|-----------------------|-------|-------|---------|-------|--------------|------------------------|------|
|                |              |                       | Brook | Brown | Rainbow |       |              |                        |      |
| Stream section | A            | 461                   | 29.9  | 240   | 45      | 6     | 291          | 1,119.5                | 0.26 |
|                | B            | 737                   | 29.0  | 284   | 121     | 16    | 421          | 1,756.0                | 0.26 |
|                | C            | 325                   | 28.9  | 28    | 78      | 18    | 124          | 934.5                  | 0.16 |
|                | D            | 459                   | 21.8  | 55    | 63      | 12    | 130          | 1,304.5                | 0.15 |
|                | E            | 445                   | 56.4  | 828   | 130     | 14    | 972          | 1,470.0                | 0.67 |
| Total          |              | 2,427                 | 32.8  | 1,435 | 437     | 66    | 1,938        | 6,584.5                | 0.30 |
| Lake           | Ford         | 435                   | 62.8  | 986   | ✧       |       |              | 1,176.0                | 0.94 |
|                | Section 4    | 158                   | 54.4  | 249   |         |       |              | 380.5                  | 0.77 |
|                | Hemlock      | 265                   | 51.3  | 435   |         |       |              | 846.5                  | 0.49 |
|                | Lost         | 62                    | 37.1  | 49    |         |       |              | 115.0                  | 0.48 |
|                | West Lost    | 265                   | 51.3  | 470   |         |       |              | 739.5                  | 0.87 |
|                | North Twin   | 73                    | 42.5  | 87    |         |       |              | 163.0                  | 0.70 |
|                | South Twin   | 430                   | 43.5  | 577   |         |       |              | 1,109.0                | 0.53 |
| Total          |              | 1,688                 | 51.7  | 2,853 | ✧       |       |              | 4,529.5                | 0.63 |

✧ Includes one rainbow trout.



determined by taking a simple average of the catch-per-hour for all fishermen, was computed so that, for evaluation of special projects, statistical tests may be made.

In Table 3, it will be readily observed that over half of the total catch was from Section E and that in this section brook trout made up the bulk of the catch. It will also be noted that fishing success, as measured by average catch-per-hour, was less in sections C and D than in the other sections, due probably to the higher minimum size in effect in these two sections; the total catch, also, was less in these two sections, as particularly was the catch of brook trout. Of special interest also is the consistently higher degree of fishing success in the lakes, as compared with the experimental stream sections.

When fishing success is compared as to type of lure used, it may be noted from Table 4 that those anglers using flies enjoyed a higher degree of success than those using other lures; likewise, anglers using flies were responsible for a greater total catch than all other lures combined. Conclusions drawn from these data, however, should be viewed with caution, since the greater degree of success may be only indirectly related to the type of lure. Table 4 also lists the catch statistics for the lakes; the relative success among the various types of lures was the reverse from that in the stream, since worm fishermen fared the best in the lakes.

Table 5 shows the catch statistics by weekly period through the trout season in the stream only, while Table 6 presents the variation in average and total weight, by species, among weekly periods. It can be noted that fishing success generally decreased after about the middle of July.

Table 4.--Fishing success according to lure used, Pigeon River Trout Research Station, 1954

| Lure                     | Number trips | Percentage successful | Catch   |       |         | Total | Hours fished | Average Catch-per-hour |
|--------------------------|--------------|-----------------------|---------|-------|---------|-------|--------------|------------------------|
|                          |              |                       | Brook   | Brown | Rainbow |       |              |                        |
| Worms                    | 701          | 25.5                  | 288     | 64    | 16      | 368   | 1,821.5      | 0.17                   |
| Flies                    | 995          | 41.0                  | 698     | 308   | 40      | 1,046 | 2,622.5      | 0.43                   |
| Stream Worms and spinner | 423          | 28.8                  | 261     | 34    | 8       | 303   | 1,226.5      | 0.22                   |
| Other✓                   | 308          | 28.6                  | 188     | 31    | 2       | 221   | 914.0        | 0.25                   |
| Total                    | 2,427        | 32.8                  | 1,435   | 437   | 66      | 1,938 | 6,584.5      | 0.30                   |
| Worms                    | 1,083        | 53.8                  | 1,896** |       |         |       | 2,900.5      | 0.70                   |
| Flies                    | 73           | 32.9                  | 76      |       |         |       | 157.0        | 0.47                   |
| Lakes Worms and spinner  | 354          | 55.4                  | 654     |       |         |       | 1,042.5      | 0.85                   |
| Other✓                   | 178          | 38.8                  | 227     |       |         |       | 429.5        | 0.56                   |
| Total                    | 1,688        | 51.7                  | 2,853** |       |         |       | 4,529.5      | 0.71                   |

\*Other--refers to (1) baits other than worms, flies, or worms and spinner, (2) combinations of worms and flies, (3) combinations of worms or flies with other lures, and (4) two or more lures used successively on same trip.

\*\*Includes one rainbow trout.

Table 5.--Fishing success by weekly period, Pigeon River, 1954

| Week          | Number trips | Percentage successful | Total catch | Hours fished | Average catch-per-hour |
|---------------|--------------|-----------------------|-------------|--------------|------------------------|
| Apr 24-Apr 30 | 117          | 25.6                  | 81          | 294.5        | 0.23                   |
| May 1-May 7   | 41           | 63.4                  | 83          | 131.5        | 0.61                   |
| May 8-May 14  | 65           | 38.5                  | 73          | 193.5        | 0.37                   |
| May 15-May 21 | 114          | 41.2                  | 111         | 362.0        | 0.37                   |
| May 22-May 28 | 112          | 61.6                  | 205         | 299.0        | 0.71                   |
| May 29-Jun 4  | 141          | 15.6                  | 38          | 283.5        | 0.12                   |
| Jun 5-Jun 11  | 107          | 44.9                  | 124         | 338.0        | 0.40                   |
| Jun 12-Jun 18 | 120          | 41.7                  | 93          | 323.0        | 0.34                   |
| Jun 19-Jun 25 | 86           | 25.6                  | 91          | 202.0        | 0.42                   |
| Jun 26-Jul 2  | 176          | 57.4                  | 315         | 488.5        | 0.69                   |
| Jul 3-Jul 9   | 273          | 39.2                  | 231         | 756.0        | 0.33                   |
| Jul 10-Jul 16 | 193          | 29.0                  | 113         | 488.0        | 0.27                   |
| Jul 17-Jul 23 | 124          | 17.7                  | 40          | 394.5        | 0.12                   |
| Jul 24-Jul 30 | 118          | 15.3                  | 27          | 235.0        | 0.09                   |
| Jul 31-Aug 6  | 95           | 17.9                  | 32          | 246.5        | 0.14                   |
| Aug 7-Aug 13  | 93           | 23.7                  | 33          | 264.5        | 0.14                   |
| Aug 14-Aug 20 | 108          | 23.1                  | 55          | 281.5        | 0.17                   |
| Aug 21-Aug 27 | 109          | 19.3                  | 41          | 334.0        | 0.11                   |
| Aug 28-Sep 3  | 84           | 17.9                  | 22          | 220.0        | 0.09                   |
| Sep 4-Sep 10  | 118          | 34.7                  | 107         | 352.0        | 0.26                   |
| Sep 11-Sep 12 | 33           | 39.4                  | 23          | 97.0         | 0.20                   |
| Total         | 2,427        | 32.8                  | 1,938       | 6,584.5      | 0.30                   |

Table 6.--Average and total weight of anglers' catch by weekly period, Pigeon River, 1954

| Week          | Brook  |                      |                        | Brown  |                      |                        | Rainbow |                      |                        |
|---------------|--------|----------------------|------------------------|--------|----------------------|------------------------|---------|----------------------|------------------------|
|               | Number | Total weight, pounds | Average weight, pounds | Number | Total weight, pounds | Average weight, pounds | Number  | Total weight, pounds | Average weight, pounds |
| Apr 24-Apr 30 | 69     | 18.32                | 0.27                   | 10     | 2.47                 | 0.25                   | 2       | 0.53                 | 0.27                   |
| May 1-May 7   | 69     | 10.27                | 0.15                   | 12     | 2.96                 | 0.25                   | 2       | 0.53                 | 0.27                   |
| May 8-May 14  | 56     | 10.48                | 0.19                   | 17     | 5.85                 | 0.34                   | 0       | ...                  | ...                    |
| May 15-May 21 | 86     | 15.31                | 0.18                   | 17     | 6.07                 | 0.36                   | 8       | 2.66                 | 0.33                   |
| May 22-May 28 | 146    | 24.17                | 0.17                   | 52     | 14.79                | 0.28                   | 7       | 1.95                 | 0.28                   |
| May 29-Jun 4  | 17     | 3.03                 | 0.18                   | 19     | 10.68                | 0.56                   | 2       | 0.74                 | 0.37                   |
| Jun 5-Jun 11  | 82     | 15.03                | 0.18                   | 35     | 11.60                | 0.33                   | 7       | 2.39                 | 0.34                   |
| Jun 12-Jun 18 | 50     | 9.50                 | 0.19                   | 36     | 13.70                | 0.38                   | 7       | 2.61                 | 0.37                   |
| Jun 19-Jun 25 | 72     | 20.62                | 0.29                   | 18     | 9.27                 | 0.52                   | 1       | 0.31                 | 0.31                   |
| Jun 26-Jul 2  | 232    | 54.32                | 0.23                   | 77     | 37.76                | 0.49                   | 6       | 2.19                 | 0.37                   |
| Jul 3-Jul 9   | 169    | 41.62                | 0.24                   | 50     | 24.17                | 0.48                   | 12      | 5.91                 | 0.49                   |
| Jul 10-Jul 16 | 84     | 18.28                | 0.22                   | 28     | 14.07                | 0.50                   | 1       | 0.28                 | 0.28                   |
| Jul 17-Jul 23 | 30     | 6.27                 | 0.21                   | 9      | 4.81                 | 0.53                   | 1       | 0.47                 | 0.47                   |
| Jul 24-Jul 30 | 14     | 3.34                 | 0.24                   | 13     | 4.21                 | 0.32                   | 0       | ...                  | ...                    |
| Jul 31-Aug 6  | 26     | 6.06                 | 0.24                   | 5      | 2.01                 | 0.40                   | 1       | 0.41                 | 0.41                   |
| Aug 7-Aug 13  | 26     | 5.67                 | 0.22                   | 3      | 1.09                 | 0.36                   | 4       | 1.34                 | 0.34                   |
| Aug 14-Aug 20 | 44     | 9.91                 | 0.22                   | 9      | 2.71                 | 0.30                   | 2       | 0.49                 | 0.24                   |
| Aug 21-Aug 27 | 36     | 5.59                 | 0.15                   | 5      | 1.23                 | 0.25                   | 0       | ...                  | ...                    |
| Aug 28-Sep 3  | 15     | 3.31                 | 0.22                   | 7      | 2.05                 | 0.29                   | 0       | ...                  | ...                    |
| Sep 4-Sep 10  | 91     | 21.11                | 0.23                   | 13     | 6.08                 | 0.47                   | 3       | 1.01                 | 0.34                   |
| Sep 11-Sep 12 | 21     | 3.45                 | 0.17                   | 2      | 0.97                 | 0.48                   | 0       | ...                  | ...                    |
| Total         | 1,435  | 305.66               | 0.21                   | 437    | 178.55               | 0.41                   | 66      | 23.82                | 0.36                   |

Table 7 shows the fishing success according to the number of times fished by individual anglers. The hypothesis that the anglers fishing the area the most often are the most skilled and therefore enjoy a greater fishing success is not completely borne out, particularly among those fishermen fishing two or more times; for example, the angler who fished the most often, 75 times, had an average catch-per-hour of less than the average of all anglers. Certain anglers, no doubt well skilled in angling ability, accounted for very high degrees of fishing success (note the anglers who respectively fished 33, 19, 16, 11, and 10 times). The average catch-per-hour for those anglers fishing only one time was low, due in part to the inclusion of many unsuccessful trips. From the data included in this table it was possible to compute the following: Approximately one-third of the anglers caught 90 percent of the catch; and approximately 6 percent of the anglers caught 50 percent of the catch.

Table 8 shows the age composition of the anglers' catch, and also the average length and weight of each age group. Table 8 does not include the total catch of wild trout since some fish were impossible to age due to regenerated scales, insufficient samples, etc. For all three species, two-year-old fish made up the major proportion of the anglers' catch, with one-year-olds placing second among the brook trout and three-year-olds among the browns. Cooper's (1952a) appraisal of the age composition of brook and brown trout in the Pigeon River is herein supported, in that very few individuals live to be four years old. The first one-year-old brook trout appeared in the catch on June 19 and the first one-year-old brown on June 8, but one-year-old fish began to appear in the anglers' catch in significant numbers about the second week of July. From the length and weight data

Table 7.--Fishing success according to frequency of fishing trips,  
Pigeon River, 1954

| Frequency | Number anglers | Number trips | Total catch | Average catch-per-hour |
|-----------|----------------|--------------|-------------|------------------------|
| 75        | 1              | 75           | 59          | 0.28                   |
| 51        | 1              | 51           | 73          | 0.63                   |
| 33        | 1              | 33           | 74          | 1.50                   |
| 32        | 1              | 32           | 28          | 0.33                   |
| 23        | 2              | 46           | 9           | 0.13                   |
| 21        | 1              | 21           | 19          | 0.38                   |
| 20        | 1              | 20           | 16          | 0.43                   |
| 19        | 1              | 19           | 149         | 2.25                   |
| 18        | 1              | 18           | 10          | 0.21                   |
| 16        | 3              | 48           | 67          | 0.67                   |
| 14        | 2              | 28           | 15          | 0.27                   |
| 13        | 3              | 39           | 22          | 0.18                   |
| 12        | 3              | 36           | 21          | 0.26                   |
| 11        | 1              | 11           | 8           | 0.77                   |
| 10        | 5              | 50           | 45          | 0.30                   |
| 9         | 10             | 90           | 187         | 0.72                   |
| 8         | 7              | 56           | 45          | 0.30                   |
| 7         | 20             | 140          | 103         | 0.34                   |
| 6         | 12             | 72           | 84          | 0.46                   |
| 5         | 17             | 85           | 72          | 0.30                   |
| 4         | 34             | 136          | 145         | 0.33                   |
| 3         | 79             | 237          | 205         | 0.28                   |
| 2         | 171            | 342          | 259         | 0.23                   |
| 1         | 742            | 742          | 223         | 0.11                   |
| Total     | 1,119          | 2,427        | 1,938       | 0.30                   |

Table 8.--Age composition of anglers' catch and average length and weight of age groups, Pigeon River, 1954

| Species | Age group | Number | Average length, inches | Average weight, pounds |
|---------|-----------|--------|------------------------|------------------------|
| Brook   | I         | 103    | 7.3                    | 0.13                   |
|         | II        | 1,212  | 8.3                    | 0.20                   |
|         | III       | 94     | 9.6                    | 0.34                   |
|         | IV        | 7      | 12.6                   | 0.77                   |
|         | V         | 3      | 14.2                   | 1.12                   |
|         | VI        | 1      | 14.3                   | 0.97                   |
| Brown   | I         | 16     | 7.5                    | 0.15                   |
|         | II        | 356    | 9.8                    | 0.35                   |
|         | III       | 49     | 11.8                   | 0.67                   |
|         | IV        | 11     | 15.5                   | 1.48                   |
| Rainbow | I         | 2      | 7.8                    | 0.16                   |
|         | II        | 59     | 9.8                    | 0.34                   |
|         | III       | 3      | 12.1                   | 0.79                   |
|         | IV        | 1      | 11.7                   | 0.49                   |

appearing in Table 8, it would appear that the growth of brown and rainbow trout was somewhat more rapid than that of the brooks; the differential, in fact, may be even greater than indicated by the data in Table 8 since Cooper (1952a) has indicated that a bias in favor of the faster-growing individuals is exerted by angling, to a greater extent in the case of brook trout than with browns. The differential in size between one-year-old fish and two-year-old fish is also probably greater than indicated in Table 8 since the one-year-old fish were taken during the later part of the year after most of the season's growth had been attained, while the two-year-old fish were collected during the entire trout season.

Cooper (1952b) determined the rates of exploitation of brook and brown trout in the Pigeon River by comparing the catch with the legal fish remaining in the stream at the end of the trout season as determined by the post-season fall population estimate. He stated that, for brook trout, three fish were caught for each one remaining in the stream after the season, and for brown trout, one fish was caught for each three remaining in the stream after the fishing season. In two previous annual reports (Cooper, 1950, 1951) data were given in support of these conclusions; a similar presentation is offered in Table 9 where the rates of exploitation have been calculated for all three species, separating the experimental sections into two groups with different size minimum regulations. For the seven-inch minimum sections, Cooper's rates of exploitation appear generally to be confirmed, although the rates were somewhat higher in 1954 for both brook and brown trout than in the years 1949 and 1950; increased fishing pressure upon wild trout and conditions favorable for exploitation are offered as suggestions to explain the increase. Where a nine-inch minimum has been in force,



Table 9.--Exploitation of wild trout, Pigeon River, 1954

| Sections A, B, and E<br>(7-inch minimum)          | Brook | Brown | Rainbow |
|---|-------|-------|---------|
| Number caught (over 7 inches)                     | 1,633 | 296   | 36      |
| Population estimate, September<br>(over 7 inches) | 273   | 398   | 35      |
| Percent exploitation                              | 85.68 | 42.65 | 50.70   |

| Sections C and D<br>(9-inch minimum)              | Brook | Brown | Rainbow |
|---|-------|-------|---------|
| Number caught (over 9 inches)                     | 83    | 141   | 30      |
| Population estimate, September<br>(over 9 inches) | 67    | 281   | 3       |
| Percent exploitation                              | 55.33 | 33.41 | 90.91   |

the rates of exploitation were lower than under a seven-inch minimum for both brook and brown trout, while too few data regarding rainbows were obtained to justify a conclusion.

The classes of angler visiting the area are shown in Table 10. The figures given are in terms of angler-trips, rather than individual anglers, since this means of expression lends greater accuracy to the interpretation of results in terms of fishing pressure. Considering both lakes and stream, approximately 70 percent of the angler-trips were made by licensed males; other classes, of course, were represented by much smaller percentages. Among the stream fishermen, 84 percent were residents of Michigan, while among lake fishermen, 94 percent were Michigan residents.

Table 11 presents a breakdown of the angler-trips in the Pigeon River by place of residence. The greatest amount of fishing pressure was supplied by the Detroit-Lansing area, with local fishermen (Otsego and adjoining counties) placing second; few fishermen came from other parts of the state. This predominance of eastern-Michigan anglers (and also the predominance of Ohio residents among out-of-state anglers) is probably, as noted by Cooper (1951), the result of major highways in the Pigeon River area coursing most directly from these areas. Only one angler from the upper peninsula (Marquette County) was registered during 1954, and in relation to other areas of the state, very few fishermen from counties immediately adjacent to Otsego fished Pigeon River. Table 12 shows the place of residence for angler-trips on the lakes. The distribution is similar to that on the stream, except that Otsego County residents were most numerous.

Table 10.--Class of angler using the Pigeon River experimental waters

|                     | Licensed<br>males | Licensed<br>females | Wives         | Minor<br>males | Minor<br>females | Total            |
|---------------------|-------------------|---------------------|---------------|----------------|------------------|------------------|
| Resident            | 1,527             | 5                   | 255           | 222            | 29               | 2,038<br>(84.0)✓ |
| Stream Non-resident | 296               | 45                  | ...           | 20             | 28               | 389<br>(16.0)    |
| Stream total        | 1,823<br>(75.1)   | 50<br>(2.1)         | 255<br>(10.5) | 242<br>(10.0)  | 57<br>(2.3)      | 2,427            |
| Resident            | 1,084             | 8                   | 276           | 182            | 39               | 1,589<br>(94.1)  |
| Lakes Non-resident  | 83                | 7                   | ...           | 8              | 1                | 99<br>(5.9)      |
| Lake total          | 1,167<br>(69.1)   | 15<br>(0.9)         | 276<br>(16.3) | 190<br>(11.3)  | 40<br>(2.4)      | 1,688            |

✓Percentages in parentheses.

Table 11.--Residence of anglers fishing Pigeon River, 1954

| County     | Angler trips | County       | Angler trips | County               | Angler trips | State          | Angler trips |
|------------|--------------|--------------|--------------|----------------------|--------------|----------------|--------------|
| Wayne      | 420          | Cheboygan    | 17           | Emmet                | 2            | Michigan       | 2,038        |
| Otsego     | 283          | Montcalm     | 17           | Iosco                | 2            | Ohio           | 257          |
| Ingham     | 167          | Kalamazoo    | 15           | St. Joseph           | 2            | Indiana        | 64           |
| St. Clair  | 138          | Jackson      | 13           | Sanilac              | 2            | Pennsylvania   | 19           |
| Genesee    | 113          | Monroe       | 13           | Wexford              | 2            | New York       | 15           |
| Bay        | 107          | Eaton        | 11           | Alcona               | 1            | Illinois       | 12           |
| Oakland    | 95           | Berrien      | 10           | Allegan              | 1            | Missouri       | 10           |
| Muskegon   | 68           | Livingston   | 9            | Crawford             | 1            | New Jersey     | 5            |
| Saginaw    | 59           | Presque Isle | 9            | Marquette            | 1            | Virginia       | 3            |
| Washtenaw  | 55           | Osceola      | 8            |                      |              | Arkansas       | 1            |
| Shiawassee | 47           | Arenac       | 7            | Total resident 2,038 |              | Colorado       | 1            |
| Macomb     | 40           | Lapeer       | 7            |                      |              | North Carolina | 1            |
| Kent       | 34           | Gd. Traverse | 5            |                      |              | Oregon         | 1            |
| Calhoun    | 33           | Ionia        | 4            |                      |              |                |              |
| Gratiot    | 32           | Roscommon    | 4            |                      |              | Total          | 2,427        |
| Isabella   | 26           | Branch       | 3            |                      |              |                |              |
| Midland    | 23           | Cass         | 3            |                      |              |                |              |
| Alpena     | 21           | Clare        | 3            |                      |              |                |              |
| Huron      | 19           | Clinton      | 3            |                      |              |                |              |
| Manistee   | 19           | Lenawee      | 3            |                      |              |                |              |
| Charlevoix | 18           | Montmorency  | 3            |                      |              |                |              |
| Tuscola    | 18           | Ottawa       | 3            |                      |              |                |              |
| Barry      | 17           | Antrim       | 2            |                      |              |                |              |

Table 12.--Residence of anglers fishing Pigeon River lakes, 1954

| County       | Angler trips | County    | Angler trips | County         | Angler trips | State         | Angler trips |
|--------------|--------------|-----------|--------------|----------------|--------------|---------------|--------------|
| Otsego       | 318          | Macomb    | 16           | Gladwin        | 1            | Michigan      | 1,589        |
| Wayne        | 207          | Saginaw   | 16           | Mason          | 1            | Ohio          | 62           |
| Ingham       | 120          | Emmet     | 13           | Montmorency    | 1            | Indiana       | 28           |
| Shiawassee   | 120          | Hillsdale | 12           | Ottawa         | 1            | Pennsylvania  | 3            |
| Oakland      | 69           | Branch    | 11           | Roscommon      | 1            | Kansas        | 2            |
| Genesee      | 63           | Jackson   | 11           | St. Joseph     | 1            | Illinois      | 1            |
| Bay          | 53           | Berrien   | 10           |                |              | New York      | 1            |
| St. Clair    | 53           | Tuscola   | 8            | Total resident |              | West Virginia | 1            |
| Kalamazoo    | 46           | Cass      | 6            |                |              | Wisconsin     | 1            |
| Muskegon     | 39           | Alpena    | 5            |                |              | Total 1,688   |              |
| Cheboygan    | 36           | Manistee  | 5            |                |              |               |              |
| Washtenaw    | 36           | Monroe    | 5            |                |              |               |              |
| Eaton        | 34           | Montcalm  | 5            |                |              |               |              |
| Kent         | 33           | Lenawee   | 4            |                |              |               |              |
| Gratiot      | 32           | Ogemaw    | 4            |                |              |               |              |
| Charlevoix   | 28           | Van Buren | 4            |                |              |               |              |
| Presque Isle | 24           | Huron     | 3            |                |              |               |              |
| Allegan      | 23           | Isabella  | 3            |                |              |               |              |
| Calhoun      | 21           | Lapeer    | 3            |                |              |               |              |
| Midland      | 21           | Missaukee | 3            |                |              |               |              |
| Barry        | 19           | Osceola   | 2            |                |              |               |              |
| Livingston   | 19           | Oscoda    | 2            |                |              |               |              |
| Clinton      | 17           | Clare     | 1            |                |              |               |              |

Table 13 is offered to show year-by-year trends in fishing pressure and fishing success. Since various experimental management methods have been tested through these years, it would be difficult to interpret the data in Table 13 per se. However, it would appear that 1954 was an exceptionally favorable year for the trout angler.

#### Post-season fall population estimate

##### Method

The method used for estimating the trout population in the experimental stream area of the Pigeon River Trout Research Station is basically the Petersen method of mark-and-recapture. Using a D. C. generator as a source of power, a boat to carry the generator and other smaller equipment, and a crew of five men, electro-fishing was begun at the downstream end of the section farthest downstream (Section A) and continued upstream, shocking as many trout as possible. As the trout were captured they were measured in one-inch size groups (e.g., trout measuring between 4.0 and 4.9 inches ~~were~~ tabulated as "four"), given a mark (the mark used was the removal of the upper corner of the caudal fin), recorded as to species and inch-group, and released. The duties of the five-man crew were as follows: one man towed the boat and handled the lines leading to the electrodes; two men, each with an electrode and scap net, shocked and captured the trout; one man measured and marked the fish; and one man kept records. In this manner shocking was continued upstream through all five sections (A through E), each section being covered in one day's working time; this constituted the "first run". The second run was conducted in a similar manner, except that the mark used was the removal of the

Table 13.--Results of creel census, Pigeon River, 1949-1954

| Year     | Number trips | Percentage successful | Legal trout creeled |       |         | Total catch | Hours fished | Total catch-per-hour |
|----------|--------------|-----------------------|---------------------|-------|---------|-------------|--------------|----------------------|
|          |              |                       | Brook               | Brown | Rainbow |             |              |                      |
| 1949     | 2,233        | 26.3                  | 793                 | 198   | 57      | 1,048       | 6,817        | 0.15                 |
| 1950     | 2,160        | 27.3                  | 917                 | 255   | 18      | 1,190       | 6,195.0      | 0.19                 |
| 1951*    | 2,850        | 15.4                  | 453                 | 228   | 10      | 691         | 7,066.0      | 0.10                 |
| 1952*    | 1,453        | 24.5                  | 463                 | 128   | 47      | 638         | 3,957.5      | 0.16                 |
| 1953* ** | 1,943        | 25.0                  | 742                 | 203   | 88      | 1,033       | 5,689.5      | 0.18                 |
| 1954**   | 2,427        | 32.8                  | 1,435               | 437   | 66      | 1,938       | 6,584.5      | 0.29                 |

\* Annual reports on the Pigeon River creel census were not completed in 1951-1953, years when a senior biologist was not assigned to the Pigeon River Station. Data presented here are tentative, pending the completion of the more detailed reports for these years (currently being prepared).

\*\* Section E added in 1953.

lower corner of the caudal fin; in the event that a fish was captured the second time during the same run it was disregarded. All recaptures during the second run were recorded as such.

Since there appears to be a differential efficiency of capture related to size of fish, it is necessary that separate estimates of several size categories be made. For this purpose, all fish were separated into four size categories: (1) 0 to 3.9 inches, (2) 4.0 to 6.9 inches, (3) 7.0 to 9.9 inches, and (4) 10.0 inches and larger. Group (1) covers the young-of-the-year trout rather nicely, while (2) includes the remaining sub-legal trout (mostly yearlings); group (3) includes the majority of the legal fish (mostly two-year-olds), and group (4) includes the larger, but much less abundant, trout. Thus, four basic estimates were made, while the total estimate of the five sections (all species, all sizes, wild and hatchery) is the sum of the four individual estimates.

The formula used in the basic estimates is as follows:

$$P = m \frac{(x + y)}{x}$$

where

P = population estimate

m = number captured and marked during 1st run

x = number of recaptures during 2nd run

y = number unmarked during 2nd run

Using the 1954 data these computations are illustrated in the following table.

|         | m     | x   | y     | P      |
|---------|-------|-----|-------|--------|
| 0-3.9   | 2,872 | 572 | 1,997 | 12,899 |
| 4.0-6.9 | 2,067 | 606 | 1,357 | 6,696  |



|           |     |     |           |               |
|-----------|-----|-----|-----------|---------------|
| 7.0-9.9   | 506 | 204 | 385       | 1,461         |
| 10.0 & up | 164 | 67  | 118       | 453           |
|           |     |     | Total P = | <u>21,509</u> |

Each estimate for the various size classifications includes all species, all sections, and both wild and hatchery trout. Consequently, the total estimate includes all species, all sections, wild and hatchery fish, and all sizes. By making the basic estimates in this manner, rather than making separate estimates for each species in each section, etc., greater numbers are available for the computations and it is felt that because of the greater numbers, greater accuracy is attained for the total estimate.

Proceeding from each basic estimate of a size classification, estimates of the wild and hatchery trout, respectively, were obtained by proportioning the total estimate for a size classification between wild and hatchery according to the proportions of wild and hatchery fish appearing in the total sampling including recaptures. This apportionment is illustrated in the following table for the 4.0 to 6.9-inch classification.

| Total fish handled<br>(m + x + y) | Hatchery fish<br>handled |         | Wild fish<br>handled |         | Population estimate<br>(percent times total<br>estimate, 6,696) |       |
|-----------------------------------|--------------------------|---------|----------------------|---------|---|-------|
|                                   | Number                   | Percent | Number               | Percent | Hatchery  | Wild  |
| 4,030                             | 140                      | 3.47    | 3,890                | 96.53   | 232   | 6,464 |

Thus, 6,464 is the estimate of the wild trout of all species, in all sections, in the 4.0 to 6.9-inch classification.

Proceeding further, this estimate is divided into estimates for each section by proportioning 6,464 among the five sections according to the numbers of wild fish captured in each section during all of the

sampling including the recaptures. This apportionment is illustrated in the following table, again for the 4.0 to 6.9-inch classification.

|              | Wild fish<br>handled | Percent       | Estimate (percent<br>times 6,464) |
|--------------|----------------------|---------------|-----------------------------------|
| All sections | 3,890                |               |                                   |
| Section A    | 327                  | 8.41          | 544                               |
| Section B    | 650                  | 16.71         | 1,080                             |
| Section C    | 923                  | 23.73         | 1,534                             |
| Section D    | 914                  | 23.49         | 1,518                             |
| Section E    | 1,076                | 27.66         | 1,788                             |
|              | <u>3,890</u>         | <u>100.00</u> | <u>6,464</u>                      |

Thus, for example, 1,534 is the estimate of wild trout in Section C in the 4.0 to 6.9-inch classification.

Proceeding further, these estimates may be apportioned among the three species in a similar manner. The following table illustrates the computation of the estimates for each species, in Section C, for wild trout in the 4.0 to 6.9-inch classification.

|             | Fish<br>handled | Percent       | Estimate (percent<br>times 1,534) |
|-------------|-----------------|---------------|-----------------------------------|
| All species | 923             |               |                                   |
| Brook       | 794             | 86.02         | 1,319                             |
| Brown       | 125             | 13.54         | 208                               |
| Rainbow     | 4               | 0.44          | 7                                 |
|             | <u>923</u>      | <u>100.00</u> | <u>1,534</u>                      |

Thus, for example, 1,319 is the estimate of wild brook trout in Section C, in the 4.0 to 6.9-inch classification.

Proceeding still further, these estimates may be apportioned among the one-inch size groups in a similar manner. The following table illustrates the computation of the estimates for each one-inch size group, in Section C, for wild brook trout in the 4.0 to 6.9-inch classification.

|   | Fish handled | Percent       | Estimate (percent time 1,319) |
|---|--------------|---------------|-------------------------------|
| All sizes (in 4.0 to 6.9-inch classification) | 794          |               |                               |
| 4 (4.0 to 4.9)                                | 337          | 42.45         | 560                           |
| 5 (5.0 to 5.9)                                | 221          | 27.83         | 367                           |
| 6 (6.0 to 6.9)                                | 236          | 29.72         | 392                           |
|   | <u>794</u>   | <u>100.00</u> | <u>1,319</u>                  |

Thus, for example, 367 is the estimate of the wild brook trout in Section C in the 5.0 to 5.9-inch group.

Using the above method, estimates were obtained for wild trout of all three species in all five sections, by one-inch groups. Table 14 presents these estimates grouped into the four basic size classifications; it was necessary to obtain estimates of the one-inch groups in order to compute the population estimate on a weight basis.

Estimates on a weight basis were obtained by assigning an average weight to each one-inch size group, for each species, and subsequently multiplying by the estimated numbers. Assigned average weights for the one-inch size groups were obtained from length-weight data gathered at the Pigeon River station from the experimental sections.

### Results

Table 14 presents the results of the fall population estimate. The data are grouped into the original size classifications in which the four basic computations were made. In Table 15 are presented the population estimates for each year since 1949; it is interesting to note that the post-season population appears to be increasing through these years, with a maximum in numbers occurring in 1954. Although an increase in numbers occurred from 1953 to 1954, the total weight decreased, suggesting that the increase in numbers was due to an increased stock of young-of-the-year trout, with the number of larger trout decreasing from 1953 to 1954; since the anglers' catch was larger during 1954, there is some indication that 1954, in addition to being an excellent year for reproduction, was an exceptionally favorable year for the exploitation of available legal stocks (also see Table 9).

Table 14.--Results of post-season population estimate (wild trout only), Pigeon River, 1954

| Size classification |         | 0-3.9<br>inches |                  | 4.0-6.9<br>inches |                  | 7.0-9.9<br>inches |                  | 10.0<br>inches |                  | All sizes |                  | Pounds per<br>acre |
|---------------------|---------|-----------------|------------------|-------------------|------------------|-------------------|------------------|----------------|------------------|-----------|------------------|--------------------|
|                     |         | Number          | Weight<br>pounds | Number            | Weight<br>pounds | Number            | Weight<br>pounds | Number         | Weight<br>pounds | Number    | Weight<br>pounds |                    |
| Section A           | Brook   | 1,443           | 17.73            | 446               | 29.43            | 32                | 5.82             | 4              | 1.71             | 1,925     | 54.69            | 7.64               |
|                     | Brown   | 180             | 2.59             | 90                | 5.38             | 51                | 10.01            | 23             | 16.63            | 344       | 34.61            | 4.83               |
|                     | Rainbow | 7               | 0.04             | 8                 | 0.80             | 1                 | 0.15             | 0              | 0                | 16        | 0.99             | 0.14               |
|                     | Total   | 1,630           | 20.36            | 544               | 35.61            | 84                | 15.98            | 27             | 18.34            | 2,285     | 90.29            | 12.61              |
| Section B           | Brook   | 2,200           | 29.57            | 896               | 54.83            | 94                | 15.69            | 4              | 1.60             | 3,194     | 101.69           | 17.24              |
|                     | Brown   | 365             | 5.29             | 164               | 8.84             | 128               | 24.95            | 92             | 74.64            | 749       | 113.72           | 19.27              |
|                     | Rainbow | 38              | 0.39             | 20                | 1.58             | 4                 | 0.81             | 0              | 0                | 62        | 2.78             | 0.47               |
|                     | Total   | 2,603           | 35.25            | 1,080             | 65.25            | 226               | 41.45            | 96             | 76.24            | 4,005     | 218.19           | 36.98              |
| Section C           | Brook   | 2,486           | 35.24            | 1,319             | 78.02            | 275               | 47.40            | 7              | 3.07             | 4,087     | 163.73           | 30.38              |
|                     | Brown   | 344             | 4.94             | 208               | 7.58             | 197               | 38.60            | 142            | 89.68            | 891       | 140.80           | 26.12              |
|                     | Rainbow | 16              | 0.22             | 7                 | 0.70             | 9                 | 1.71             | 1              | 0.53             | 33        | 3.16             | 0.59               |
|                     | Total   | 2,846           | 40.40            | 1,534             | 86.30            | 481               | 87.71            | 150            | 93.28            | 5,011     | 307.69           | 57.09              |
| Section D           | Brook   | 2,287           | 31.01            | 1,393             | 90.19            | 263               | 47.29            | 9              | 4.91             | 3,952     | 173.40           | 30.69              |
|                     | Brown   | 254             | 3.77             | 123               | 4.13             | 73                | 14.50            | 90             | 88.49            | 540       | 110.89           | 19.63              |
|                     | Rainbow | 0               | 0                | 2                 | 0.12             | 8                 | 1.48             | 1              | 0.41             | 11        | 2.01             | 0.36               |
|                     | Total   | 2,541           | 34.78            | 1,518             | 94.44            | 344               | 63.27            | 100            | 93.81            | 4,503     | 286.30           | 50.68              |
| Section E           | Brook   | 3,004           | 41.62            | 1,570             | 92.18            | 136               | 22.98            | 3              | 1.20             | 4,713     | 157.98           | 27.86              |
|                     | Brown   | 275             | 4.04             | 218               | 6.78             | 54                | 10.70            | 50             | 46.16            | 597       | 67.68            | 11.94              |
|                     | Rainbow | 0               | 0                | 0                 | 0                | 3                 | 0.45             | 0              | 0                | 3         | 0.45             | 0.08               |
|                     | Total   | 3,279           | 45.66            | 1,788             | 98.96            | 193               | 34.13            | 53             | 47.36            | 5,313     | 226.11           | 39.88              |
| All<br>sections     | Brook   | 11,420          | 155.17           | 5,624             | 344.65           | 800               | 139.18           | 27             | 12.49            | 17,871    | 651.49           | 21.88              |
|                     | Brown   | 1,418           | 20.63            | 803               | 32.71            | 503               | 98.76            | 397            | 315.60           | 3,121     | 467.70           | 15.71              |
|                     | Rainbow | 61              | 0.65             | 37                | 3.20             | 25                | 4.60             | 2              | 0.94             | 125       | 9.39             | 0.32               |
|                     | Total   | 12,899          | 176.45           | 6,464             | 380.56           | 1,328             | 242.54           | 426            | 329.03           | 21,117    | 1,128.58         | 37.91              |

Table 15.--Post-season population estimate of wild trout, Pigeon River, 1949-1954

| Year              | Number | Weight,<br>pounds | Pounds<br>per acre | Number | Weight,<br>pounds | Pounds<br>per acre | Number | Weight,<br>pounds | Pounds<br>per acre |
|-------------------|--------|-------------------|--------------------|--------|-------------------|--------------------|--------|-------------------|--------------------|
|                   |        | Section A         |                    |        | Section B         |                    |        | Section C         |                    |
| 1949              | 585    | 48.18             | 6.73               | 1,373  | 91.66             | 15.54              | 3,287  | 148.37            | 27.53              |
| 1950              | 930    | 61.15             | 8.54               | 2,334  | 140.93            | 23.89              | 2,460  | 141.21            | 26.20              |
| 1951              | 1,380  | 74.7              | 10.43              | 3,063  | 134.8             | 22.85              | 4,322  | 180.7             | 33.53              |
| 1952              | 1,454  | 85.29             | 11.91              | 3,714  | 117.84            | 19.97              | 6,406  | 234.11            | 43.43              |
| 1953              | 2,249  | 127.28            | 17.78              | 3,287  | 173.19            | 29.35              | 5,022  | 354.88            | 65.84              |
| 1954              | 2,285  | 90.29             | 12.61              | 4,005  | 218.19            | 36.98              | 5,011  | 307.69            | 57.09              |
|                   |        | Section D         |                    |        | Section E         |                    |        | All Sections      |                    |
| 1949              | 2,491  | 135.59            | 24.00              | ...    | ...               | ...                | 7,736  | 423.80            | 17.59              |
| 1950              | 4,525  | 231.24            | 40.93              | ...    | ...               | ...                | 10,249 | 574.53            | 23.84              |
| 1951              | 5,746  | 336.8             | 59.61              | ...    | ...               | ...                | 14,511 | 727.0             | 30.17              |
| 1952              | 5,348  | 265.96            | 47.07              | ...    | ...               | ...                | 16,922 | 703.20            | 29.18              |
| 1953 <sup>*</sup> | 4,080  | 304.02            | 53.81              | 3,681  | 229.20            | <b>40.42</b>       | 18,319 | 1,188.57          | <b>39.93</b>       |
| 1954              | 4,503  | 286.30            | 50.68              | 5,313  | 226.11            | <b>39.88</b>       | 21,117 | 1,128.58          | <b>37.91</b>       |

\* Section E added in 1953.

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INSTITUTE FOR FISHERIES RESEARCH

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Appendix

Special research projects in progress

Since detailed treatment of all special research projects will be made in separate reports, no experimental data or conclusions will be given here. However, a brief description of those special projects in progress at the Pigeon River station during 1954 follows:

1. Testing of a higher size minimum in the Pigeon River. A nine-inch minimum has been in effect in Section C and D since 1951. The effects of the changed regulations will be evaluated through the complete creel census and fall population studies. Scheduled date of completion: not definite.

2. Testing of Psychological Research Services-trained trout. Plantings of trained trout were begun in the Pigeon River experimental area in 1953, with plantings being made in both the stream and lakes. In 1954, 800 brook trout were planted in the Pigeon River, 200 from each of the four levels of training; in the lakes, half of the regular fall plantings of brook trout fingerlings consisted of trained trout and half regular hatchery stock (control). Effects of the training upon the anglers' catch and natural mortality will be determined through creel census and fall population studies. Scheduled date of completion: 1956.

3. Studies on the disappearance of dead trout in the Pigeon River. Experiments were conducted during August and September to determine the length of time for rainbow trout to disintegrate in a stream environment. An Institute for Fisheries Research report (title as above), Number 1442, was prepared by Edward H. Bacon. A previous report, Number 1392, was submitted in 1953, on similar studies.

4. Fingerling trout planting--Pigeon River Lakes (project 30f). This project was initiated in 1952 to determine the survival to the



creel of fingerling brook trout planted in the lakes in the fall. This project included South Twin, North Twin, Lost, West Lost, Ford, and Hemlock lakes; Section 4 Lake, although originally included in the project, received an initial planting of brook trout fry, rather than fingerlings, and has continued to receive fry plantings through 1954. The fingerling plantings in the fall of 1954 consisted of half Psychological Research Services-trained trout and half regular hatchery stock (control). Scheduled date of completion: not definite.

5. Planting of sub-legal brook and brown trout to compensate for lack of natural spawning (project 27k). This project was initiated in 1952 with the plantings of fingerling brook and brown trout in Section A of the experimental area where natural reproduction had been extremely low. Plantings have been made each fall since 1952 consisting of 2,500 brook and 500 brown trout. Evaluation of these plantings will be made by creel census and fall population estimates. Scheduled date of completion: fall, 1956.

6. Effects of stream improvement on density of trout populations (project 26b). Stream improvement structures were constructed in the approximate lower half of Section A of the experimental area in 1953; this section of stream had previously been of a wide, shallow nature with shifting sand and little natural cover. Evaluation of the structures will be made by comparisons of anglers' catch and population estimates before and after the construction of the stream improvement structures. Scheduled date of completion: fall, 1956.

7. Pool construction as a tool for trout management (project 26c). A series of pools was dredged in 1953 in the Pigeon River immediately upstream from the Red Bridge (Cheboygan County, east of Wolverine) in

an area of stream that previously had few pools and little natural cover. Evaluation of the method will be made by population estimates made in that section of stream before and after the dredging to determine the effects of pool construction upon the density of trout populations. Scheduled date of completion: fall, 1956.

8. Spring plantings of sub-legal trout in streams (project 27n). This project, designed to determine if sub-legal trout planted in the spring would contribute to the anglers' catch during the same or succeeding seasons, was initiated on Gamble Creek (Rifle River area), and Hunt and Fuller creeks (Hunt Creek station) as well as on Section E of the Pigeon River, in the spring of 1953. In Section E of the Pigeon River, equal numbers of brook and rainbow trout, half fin-clipped and half with numbered jaw tags, were planted in the spring of 1953 as well as in the spring of 1954. Evaluation of the method will be made through creel census and fall population estimates. Scheduled date of completion: last planting, spring, 1955.