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# AN INVESTIGATION OF THE BOARDMAN RIVER, GRAND TRAVERSE COUNTY, TO CHOOSE A SECTION OF THE STREAM SUITABLE FOR AN EXPERIMENT ON RESTRICTIVE FISHING REGULATIONS[1]

By

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## Introduction

Age-and-growth and creel census information obtained from a number of Michigan streams has indicated that a seven-inch minimum legal size limit for trout results in the removal of many trout before they can spawn (Cooper, 1951). The Boardman River in Grand Traverse County has been selected for further study of this problem. This is principally a brown trout stream at present, but in the early part of the century it produced excellent brook trout fishing. The study that is the subject of this report was made to find a suitable section for an experiment on restrictive fishing regulations and to obtain basic data for future evaluation of the

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[1] The biological study of this river, analysis of data and preparation of the report were undertaken with Federal Aid to Fish Restoration funds under Dingell-Johnson Project Number F-2-R-3.

[2] Assistants in the field were Alfred M. Beeton and James C. Wiese. The author was the field party leader.

effects of such regulations. Therefore, during July, 1954, fish were collected in the Boardman River from the head of Keystone Pond up to, and including, the North and South branches of the Boardman River.

## Methods

Eleven collections of fish were taken by a three-man crew using a 230-volt direct-current electric shocker. Three collections, numbered 9, 10 and 11, were taken in the Boardman River between Keystone Dam and Brown Bridge Dam. Six other collections, numbered 1, 3, 4, 5, 6, and 7, were taken between Brown Bridge Pond and The Forks. Collection Number 2 was taken in the South Branch and Number 8 in the North Branch, both above The Forks. Collection Number 6 was taken as a demonstration for Traverse City sportsmen.

Table 1 gives the locations, dates and summarized records of the physical data on the collecting stations and the length of time the shocker was in operation. In Table 2 the numbers of fish captured have been converted by direct proportion to the number of fish shocked per hour of effort. This procedure enables a direct comparison of the collections. Table 3 gives the size range of the important species of fish at each station.

The length and a sample of scales were taken from each trout captured, after which the fish was returned to the river. The scales were impressed in plastic with a roller press, and the ages were then determined from the plastic impressions by using a micro-projector. Except for young-of-the-year trout, the ages given are the number of annuli found. The averaged lengths for each age-group and the number of trout involved are given in Table 4.

Some of the collecting stations have been grouped together in tables 3, 4 and 5. The collections from the North Branch (No. 8) and the South Branch (No. 2) are listed as individual units. The three collections between Keystone Dam and Brown Bridge Dam (Nos. 9, 10, 11) are grouped together. The stations between Brown Bridge Pond and The Forks were divided into two groups in anticipation of the use of this part of the river for experimental purposes. The experimental water includes stations 3, 4 and 5. For comparison, two sections of the river under the usual regulations (a seven-inch minimum legal size and all legal types of tackle) were designated as controls. The first of these sections, below the experimental water, contains station Number 1. The second control section is upstream of the experimental area and includes station Number 7.

Collection Number 6 was taken above and below Scheck's Bridge. Because Scheck's Bridge is one of the boundaries between the experimental and the control waters, the information obtained from collection Number 6 cannot be included with that of these sections, and so is separated in the tables.

## Results

The physical and biological data are summarized in the five tables of this report. The data show that the brown trout is the principal game fish in the section of the Boardman River from Keystone Dam upstream to Brown Bridge Dam. No rainbow trout and only one brook trout was captured. The number of trout caught per hour of shocking probably illustrates the effect of Brown Bridge Dam on this section of the river relative to brown trout. One-half mile downstream from Brown Bridge Dam the yield was 7 trout per hour. Seven miles downstream from the dam the catch increased to 25 trout per hour, and eleven miles downstream it was 57 trout per hour. Two other common species of fish in this section were the slimy sculpin and the blacknose dace.

Two noticeable effects of Brown Bridge Dam on the river were the increase in temperature and the fluctuation of water flow. The temperature of the stream below the dam was eight degrees higher than that in the stream above the reservoir. This is obviously due to the impounding of the river and spreading it out over an area of about 180 acres where there is little movement of the water and no shade. The fluctuation of water volume below the dam is caused by the intermittent use of the turbines at the dam for generating electric power.

Of those portions of the Boardman checked in this study, the section from Brown Bridge Pond up to The Forks is apparently the best part of the stream for trout. Brown trout averaged over 100 captures per hour. Included in this catch were many large fish. The rate of growth of the brown trout was about the same as the state average for this species. Only 15 percent (114) of the trout captured were brook trout and only one of them was over seven inches long (8.8 inches). No rainbow trout were taken in this section of the stream. The slimy sculpin was the only other fish found in abundance, although moderate numbers of white suckers and yellow perch were captured.

One sample each was taken from the North and South branches of the Boardman River. Brown trout and slimy sculpins were the most abundant species in the collections from the North and South branches, with the brook trout third in number. No rainbow trout were captured except for four hatchery released fish in the South Branch. (All trout planted in the Boardman system in 1954 were fin-clipped.) The catch-per-hour figure for the South Branch was the highest obtained for any collection, but the trout were small and the growth rate slower than that of the trout in the other ten collections. The growth rate of trout from the North

Branch averaged the same as for those of the main stream below The Forks, but the catch per hour was less. All hatchery trout released in the Boardman River during 1954 had the left pectoral fin clipped to distinguish them from the native trout. Of 145 trout captured in the South Branch, four were hatchery rainbows. No hatchery fish were taken from the North Branch or from the Boardman River between Keystone Dam and Brown Bridge Dam. One hatchery brook trout was among the 781 trout captured between Brown Bridge Pond and The Forks. No hatchery fish have been included in the catch-per-hour figures or in the tables.

## Recommendations

It had been suggested that part of the Boardman River be used as an experimental stream to obtain further information on an increased legal size limit and fly fishing only. The results of this survey indicated that the section of stream most suitable for experimenting with trout regulations is that between the head of Brown Bridge Pond and The Forks. This part of the river has a good population of trout, is readily accessible, and is fished by many anglers. It is small enough to get a good sample of fish with an electric shocker, and large enough and open enough to permit fly fishing.

The growth rates of both brook trout and brown trout were similar to the state averages for these species. The collections indicated that most of the brook trout were removed by anglers soon after they had reached seven inches or were killed by fishermen before reaching this size. An increase in the size limit of ten inches should give both the brook and brown trout an opportunity to spawn at least once before they are removed. Also, it was thought that angling should be limited to flies only to prevent excessive hooking mortality among the sub-legal trout.

To afford an adequate check on results, plans called for the experimental regulations to remain in effect for at least five years. Also, a regular check was to be made at three stations each year during this five-year period, along with a similar check at three stations in the adjacent parts of the river not included under the special regulations.

The recommendations[3] drawn up for the experiment and control were as follows: A ten-inch minimum size limit, flies only, and five trout per day limit from Scheck's Bridge upstream 4.4 miles, more or less, to The Forks Forest Camp Ground. This includes the Boardman River in T. 26 N., R. 9 W., Sections 18 and 7 and most of Section 8. This recommendation was approved by a Conservation Commission order effective January 1, 1955. The control sections, with no change in regulations, are from The Forks Forest Camp Ground upstream to the bridge at The Forks, and that part of the stream from the head of Brown Bridge Pond up to Scheck's Bridge. This gives a total of approximately 2.3 miles of stream to compare with the experimental section.

The Boardman River between Keystone Dam and Brown Bridge Dam was not recommended for several reasons. Here the river varies widely in its volume of flow because the water coming from Brown Bridge Dam is being used for generating electric power for Traverse City. When the turbines are operating, the water is deep and swift and prohibits adequate sampling with the shocker. Large trout were present, but very few young-of-the-year fish were seen or captured. All of the land along this part of the Boardman River is privately owned and is inaccessible, except for one

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[3] These recommendations were the result of discussions with Dr. A. S. Hazzard and District Fisheries Supervisor Stanley Lievense while the summer field work was in progress.

public fishing site, making approach to the river difficult for both anglers and biologists.

## Literature Cited

Cooper, Edwin L.

1951. Brook trout management study North Branch Au Sable River progress report. Institute for Fisheries Research Report No. 1271, 14 pages (unpublished).

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Common and scientific[1] names of fishes found in the study area and referred to in this report.

| | |
|---|---|
| **Game fish** | |
| Brook trout | *Salvelinus fontinalis* |
| Brown trout | *Salmo trutta* |
| Rainbow trout | *Salmo gairdneri* |
| Yellow perch | *Perca flavescens* |
| Smallmouth bass | *Micropterus dolomieu* |
| **Coarse fish** | |
| White sucker | *Catostomus commersoni* |
| **Forage fish** | |
| Creek chub | *Semotilus atromaculatus* |
| Blacknose dace | *Rhinichthys atratulus* |
| Redbelly dace | *Chrosomus eos* |
| Finescale dace | *Chrosomus neogaeus* |
| Common shiner | *Notropis cornutus* |
| Blacknose shiner | *Notropis heterolepis* |
| Mudminnow | *Umbra limi* |
| Mottled sculpin | *Cottus bairdi* |
| Slimy sculpin | *Cottus cognatus* |
| American brook lamprey | *Lampetra lamottei* |

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[1] Names follow "Check List of the Fishes of Michigan", (unpublished), by Reeve M. Bailey, Curator of Fishes, Museums of Zoology, University of Michigan. Revised to March 4, 1955.

Table 1. Locations, physical features, and conditions affecting shocking at the collecting stations on the Boardman River, July, 1954.

| Stream unit | Below the dam | | | Control | Demon-stration | Experiment | | | Control | South Branch | North Branch |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Station number | 10 | 11 | 9 | 1 | 6 | 4 | 3 | 5 | 7 | 2 | 8 |
| Town N. | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 27 |
| Range W. | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Section | 3 | 14 | 21 | 13 | 18 | 18 | 7 | 8 | 4 | 3 | 34 |
| Width, feet | 40 | 45 | 40 | 37 | 45 | 45 | 33 | 25 | 30 | 20 | 18 |
| Depth, inches | 12 | 9 | 11 | 12 | 8 | 8 | 6 | 7 | 5 | 5 | 5 |
| Current | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid | Rapid |
| Trout cover | Fair | Poor | Good | Poor | Fair | Good | Good | Good | Good | Good | Poor |
| Vegetation | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse | Sparse |
| Bottom types (percent) | | | | | | | | | | | |
| Clay | --- | --- | 1 | 2 | --- | 5 | --- | 2 | 1 | --- | --- |
| Silt | --- | 5 | 5 | 5 | 2 | 5 | 5 | --- | --- | 5 | --- |
| Sand | 40 | 45 | 44 | 83 | 60 | 65 | 75 | 50 | 44 | 70 | 75 |
| Gravel | 40 | 45 | 50 | 10 | 28 | 20 | 20 | 38 | 50 | 25 | 20 |
| Rubble | 20 | 5 | --- | --- | 10 | 5 | --- | 10 | 5 | --- | 5 |
| Length shocked (feet) | 950 | 750 | 1,200 | 1,100 | 800 | 1,600 | 1,140 | 1,355 | 1,050 | 865 | 1,140 |
| Time shocked (minutes) | 53 | 46 | 64 | 80 | 40 | 70 | 65 | 66 | 63 | 44 | 47 |
| Efficiency | Poor | Low | Low | Fair | Fair | Fair | Fair | Fair | Fair | Good | Good |

Table 2. Number of fish caught by shocker, converted to catch per hour,

Boardman River, 1954.

| Stream unit | Below the dam | | | Control | Demon-stration | Experiment | | | Control | South Branch | North Branch |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Station number | 10 | 11 | 9 | 1 | 6 | 4 | 3 | 5 | 7 | 2 | 8 |
| Brook trout | 1 | ... | ... | 24 | 38 | 28 | 5 | 14 | 5 | 7 | 20 |
| Brown trout | 57 | 25 | 7 | 101 | 110 | 99 | 61 | 106 | 155 | 187 | 69 |
| Yellow perch | ... | ... | 1 | 10 | ... | 3 | 1 | ... | ... | ... | ... |
| Smallmouth bass | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| White sucker | 1 | ... | 7 | 15 | ... | 10 | 3 | 1 | 1 | ... | ... |
| Creek chub | ... | ... | 6 | 2 | ... | ... | ... | 1 | 3 | ... | ... |
| Blacknose dace | 19 | 55 | 1 | ... | ... | ... | ... | ... | 2 | ... | 1 |
| Redbelly dace | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... |
| Finescale dace | ... | ... | ... | ... | ... | ... | 1 | ... | ... | ... | ... |
| Common shiner | ... | ... | ... | 1 | ... | ... | 1 | ... | .... | ... | 1 |
| Blacknose shiner | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... |
| Mudminnow | ... | ... | ... | ... | ... | 1 | ... | 1 | ... | ... | ... |
| Mottled sculpin | ... | ... | 2 | 14 | ... | ... | 7 | 12 | ... | ... | ... |
| Slimy sculpin | 14 | 31 | 18 | 13 | ... | 30 | 29 | 45 | 33 | 44 | 28 |
| American brook lamprey | ... | ... | 1 | 2 | ... | 1 | 1 | 2 | ... | 1 | ... |

Table 3. Size ranges of some of the fish captured in the Boardman River, 1954.

(Total length in inches.)

| Stream unit | Below dam | Demonstration | Control | Experiment | South Branch | North Branch |
|---|---|---|---|---|---|---|
| Brook trout | 7.8 | 2.3- 6.9 | 1.9- 6.0 | 2.1- 8.8 | 2.0- 5.3 | 2.1- 6.3 |
| Brown trout | 2.1-14.6 | 2.1-12.4 | 1.8-14.6 | 2.0-13.5 | 1.7-11.8 | 2.2-11.3 |
| Yellow perch | 4.4 | ... | 3.4- 5.0 | 3.8- 4.5 | ... | ... |
| White sucker | 1.6- 4.5 | ... | 2.5-12.0 | 3.4- 7.1 | ... | ... |
| Creek chub | 3.5- 4.9 | ... | 1.8- 5.4 | 4.4 | ... | ... |
| Blacknose dace | 2.1- 3.9 | ... | 1.3- 2.7 | ... | ... | 1.9 |
| Mottled sculpin | 3.0- 3.4 | ... | 2.2- 3.2 | 1.8- 3.4 | ... | ... |
| Slimy sculpin | 2.0- 3.9 | ... | 1.7- 3.8 | 1.6- 3.6 | 1.8- 3.5 | 2.1- 3.6 |

Table 4. Age and average total lengths (inches) of trout collected from the Boardman River, 1954.

| Species and stream unit | AGE GROUP 0 | | I | | II | | III | |
|---|---|---|---|---|---|---|---|---|
| | Number of fish | Length | Number of fish | Length | Number of fish | Length | Number of fish | Length |
| Brook trout | | | | | | | | |
| State average | | 3.2 | | 6.5 | | 8.5 | | 11.4 |
| Below dam | ... | ... | 1 | 7.8 | ... | ... | | |
| Control | 33 | 2.6 | 4 | 5.7 | ... | ... | | |
| Experiment | 30 | 2.8 | 22 | 6.0 | 1 | 8.8 | | |
| Demonstration | 6 | 2.7 | 18 | 5.4 | ... | ... | | |
| Combined study[1] | 69 | 2.7 | 44 | 5.7 | 2[2] | 8.0 | | |
| South Branch | 3 | 2.3 | 2 | 5.2 | ... | ... | | |
| North Branch | 11 | 2.5 | 5 | 5.7 | ... | ... | | |
| Brown trout | | | | | | | | |
| State average | | 3.2 | | 7.2 | | 9.9 | | 12.3 |
| Below dam | 37 | 3.0 | 24 | 7.6 | 13 | 11.0 | 2 | 14.6 |
| Control | 207 | 2.6 | 61 | 6.5 | 20 | 9.9 | 8 | 11.6 |
| Experiment | 146 | 2.7 | 100 | 6.5 | 50 | 9.8 | 5 | 12.6 |
| Demonstration | 16 | 2.7 | 38 | 6.2 | 10 | 9.1 | 2 | 11.2 |
| Combined study[1] | 369 | 2.6 | 199 | 6.5 | 81[2] | 9.7 | 15 | 11.9 |
| South Branch | 70 | 2.4 | 28 | 5.8 | 27 | 8.5 | 11 | 10.2 |
| North Branch | 20 | 2.7 | 23 | 6.4 | 11 | 9.6 | ... | ... |

[1] Totals and averages for the control, experimental and demonstration sections.

[2] Including one angler-caught trout.

Table 5. Trout per hour of shocking in the Boardman River between Brown Bridge Pond and The Forks, 1954.

| Species | Size groups (total lengths, inches) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.0 to 6.9 | | | 7.0 to 9.9 | | | 10.0 and over | | | All sizes | | |
| | Control | Exper. | Both | Control | Exper. | Both | Control | Exper. | Both | Control | Exper. | Both |
| Brook trout | 15.6 | 14.8 | 15.1 | ... | 1.0 | 0.3 | ... | ... | ... | 15.5 | 15.4 | 15.4 |
| Brown trout | 105.0 | 63.8 | 80.5 | 13.4 | 15.9 | 14.9 | 6.7 | 7.3 | 7.0 | 125.1 | 87.0 | 102.5 |
| Both species | 120.4 | 78.5 | 95.6 | 13.4 | 16.5 | 15.3 | 6.7 | 7.3 | 7.0 | 140.7 | 102.3 | 118.0 |