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THE EFFECTS OF POOL DREDGING IN THE PIGEON RIVER ON FALL STANDING CROP OF FISH AND GROWTH RATE

by

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The dredging of pools in a trout stream where few pools originally exist has recently been proposed as a method of physical stream improvement. A section of the Pigeon River east of Wolverine in Cheboygan County, near the "Red Bridge" (T. 33 N., R. 1 W., Sec. 8), appeared to be well adapted for the evaluation of this method, since this area of stream contained few natural pools and the bottom was of well-compacted gravel and cobbles.

The project included (1) an evaluation of the trout and minnow populations during the summer of 1953, (2) dredging of pools in the fall of 1953, and (3) studies of fish population density and growth during the years 1954, 1955 and 1956. No creel census was conducted on this portion of the Pigeon River. A progress report was prepared following the 1955 population studies, giving a more detailed description of the stream, a list of all species of fish found in the area, a list of fish-food organisms present in the area with some limited quantitative data, and some mention of the higher aquatic plants found (Bacon, 1955).

The dredging was done by the Lake and Stream Improvement Section of the Fish Division. Evaluation of the method was made by the staff of

the Pigeon River Trout Research Station under the supervision of A. S. Hazzard and D. S. Shetter.

Dredging

Four pools were dredged in a 1,000-foot section of the Pigeon River immediately upstream from the Red Bridge. The pools were formed by digging the compacted gravel and cobbles from one side of the stream channel and piling them on the other side, thus narrowing the channel as well as deepening it in the pool area. In some cases, log deflectors were anchored at the upstream end of the rock piles thus formed, in an attempt toward stabilization of the piles. The dredging was completed in October, 1953. At this writing (August, 1957) the rock piles appear to be stabilized and the pools show few signs of filling in.

Population studies

A population estimate, using a 250-volt, D. C. shocker, was made in June, 1953 by the mark-and-recapture (Petersen) method, similar to that used at the Pigeon River Trout Research Station farther upstream (method outlined in detail by Waters, 1957a). This study was concerned with all species of fish captured, including trout, minnows, and other fishes. Population "checks," involving only one collection with the shocker, were made in July and August of 1953 to determine the extent to which trout were present in the area during the summer months. The mark-and-recapture method of population estimate was used again in September, 1953, just prior to dredging, to estimate the trout population only.

Trout population estimates were made also in April and September, 1954, in April and September, 1955, and in September, 1956.

The results of all population studies, with the exception of the last two, were reported by Bacon (1955), where it appeared that the spring (April) estimates for brown trout were considerably less than the fall (September) estimates. This marked seasonal variation in brown trout population may have been due to inactivity of a portion of the trout population in early season. Since this variation occurred, it was deemed advisable to restrict comparisons to the fall estimates only, particularly since comparable fall estimates had been made during all four years of the study (1953-1956). Trout data relative to only the fall estimates, therefore, are given in this report; data relating to other trout estimates and the population "checks" made in the summer of 1953 were given by Bacon (1955). Population estimates made in June, 1953 and September, 1956 of several species of minnows and suckers are also discussed in this report.

In electrofishing, the larger fish are captured at a greater rate of efficiency, so it is necessary to compute the population estimates in several size classifications (Cooper, 1952); consequently, estimates of the trout population were made separately for two size classifications: 0 to 6.9 inches, and 7.0 inches and larger. A certain amount of error is present among the data because of a different rate of capture within each of the two size classifications; the error, however, is probably not so great as would be present due to insufficient numbers if more size classifications were used. Furthermore, the error would be similar in each of the four population estimates, and would not invalidate direct comparisons.

Separate estimates were made for each species of fish. In the estimates of species other than trout, the fish were not separated into size classifications, because the size range for any one species was not great. Estimates were made for the blacknose dace (Rhinichthys atratulus) longnose dace (Rhinichthys cataractae), white sucker (Catostomus commersoni),

and creek chub (Semotilus atromaculatus). Other species, while represented in the catch, did not appear in significant numbers.

For some species, numbers caught were low and although fish were captured in both runs, no recaptures were made. In these cases, for the purpose of obtaining a practical estimate, it was assumed that one fish taken in the second run was a recapture, the result being the best estimate available for the population under study.

Table 1 presents the trout population estimates made in the fall of 1953 through 1956. The trout population (mostly brooks and browns, few rainbows) remained about the same in the fall of 1954 as in 1953, but dropped successively in 1955 and 1956. The smaller populations estimated in 1955 and 1956 may have been merely the result of a general downward trend in trout populations in the Pigeon River through these years; such a trend was observed in the controlled sections at the Pigeon River Trout Research Station (see Waters, 1957b, Table 16). At least, it would appear that no increase in fall standing crop resulted from the dredging of pools.

The possibility exists that the dredged pools may have raised the rate of exploitation by anglers, by providing fishing spots where the trout were easier to catch. However, since no creel census was available for this section of stream, rates of exploitation could not be determined.

Table 2 presents the population estimates of species other than trout made in June, 1953, and September, 1956. Some marked differences can be noted: the estimate for the blacknose dace was over 100 percent greater in 1956; longnose dace and creek chub estimates were smaller in 1956; and the estimate for white suckers was many times larger in 1956. It would be difficult to form any conclusions regarding rough fish population trends, however, since the two estimates were made at widely different times of the year, and the differences in population size may merely be due to natural factors related to spawning, presence or absence of young-of-the-year, etc.

Table 1.--Fall trout population estimates, Red Bridge area,

Pigeon River, 1953-1956

Date	Brook trout			Brown trout			Rainbow trout			All trout
	0-6.9 inches	>6.9 inches	All sizes	0-6.9 inches	>6.9 inches	All sizes	0-6.9 inches	>6.9 inches	All sizes	
1953	187	12	199	201	30	231	14	0	14	444
1954	187	8	195	115	112	227	1	0	1	423
1955	140	6	146	158	53	211	1	0	1	358
1956	87	6	93	35	28	63	2	1	3	159

Table 2.--Population estimates of species other than trout,

Red Bridge area, Pigeon River,

1953 and 1956

Date	Black-nose dace	Long-nose dace	Creek chub	White sucker
June, 1953	589	306	191	4
Sept., 1956	1,348	136	120	118

Growth of trout

To determine the effect of pool dredging on growth of trout, scale collections were made from the trout handled during the population studies of June, 1953, and September, 1956. Scales were obtained only from trout 4.0 inches long or larger, at both collection times. Since the two collections were made at different times of the year (June and September), and the average total length of any given age group would be expected to vary, it was necessary to compare the calculated lengths at previous annuli. For this purpose, a nomograph constructed by Edwin L. Cooper (unpublished) from trout collections made at the Pigeon River Trout Research Station farther upstream, was used.

Table 3 presents the average calculated lengths at previous annuli for brook and brown trout of Age Groups I and II; in addition to these groups, several rainbow trout, and brook and brown trout of other age groups, were collected, but they were too few to allow an analysis of growth rate.

In all cases, the average calculated lengths indicated slower growth following the pool dredging; however, no statistically significant differences were found except in the case of the Age-Group-I brown trout, where a significant decrease in growth during the first year of life was observed (t-test). If it is assumed that the dredging did not affect growth rate, several other factors may have been responsible: (1) A natural difference in growth may have been present between the years 1952 and 1955, due to differences in population density, weather, food conditions, etc.; however, a check on the first year's growth of Age-Group-I brown trout at the Pigeon River Trout Research Station during these same years showed no such natural difference. (2) The fact that the 1953 collection was made in June may mean that some of the faster-growing Age-Group-I brown trout

Table 3.--Average calculated total length (inches) at previous annuli and growth increment of trout collected in 1953 and 1956, Red Bridge area, Pigeon River (numbers of fish in parentheses)

Item	Brook trout		Brown trout	
	1953	1956	1953	1956
Age-group I				
First annulus	3.4 (18)	3.2 (28)	4.2 (16)	3.5 (12)
Age-group II				
First annulus	...	4.5 (2)	4.9 (2)	3.8 (4)
Second annulus	...	7.6 (2)	9.4 (2)	7.6 (4)
Average increment during second year	...	3.1 (2)	4.5 (2)	3.8 (4)

that would be removed by anglers before September were present in the sample, giving an average larger than would have been observed had the sample been collected in September as was the case with the 1956 collection. (3) Only trout 4.0 inches long and larger were included in the samples; in September it would be almost a certainty that all Age-Group-I brown trout collected would be over 4 inches long, but in June some of the slower-growing individuals may have been excluded from the sample by the 4-inch minimum limitation, thus producing an average larger than that of the stream population. Probably the slower growth observed in the 1956 collection was the effect of one or both of the last two factors, rather than of the dredging itself. At any rate, increased growth of trout was not apparent following the dredging.

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