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MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
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THE THIRTEENTH ANNUAL CREEL CENSUS
AND PROGRESS REPORT,
PIGEON RIVER TROUT RESEARCH STATION, 1961

By William C. Latta

The Pigeon River Trout Research Station, 13 miles east of Vanderbilt in Otsego County, was established in 1949 on the site of the former Pigeon River Forest Headquarters. The experimental waters of the station include seven small limestone sinks or 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. This portion of the Pigeon River was divided into four experimental sections (A, B, C and D), each approximately 1.2 miles long (Fig. 1). In 1953, a fifth experimental section (E), of about equal length, was added at the upstream end of the controlled area, increasing the length of the experimental area to about 6 miles. The physical features of the experimental stream sections are presented in Table 1.

Since 1949, fishing on the experimental waters has been by permit. Each angler is required to obtain a free, one-day permit before proceeding to his selected water, whether experimental section of the stream or

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

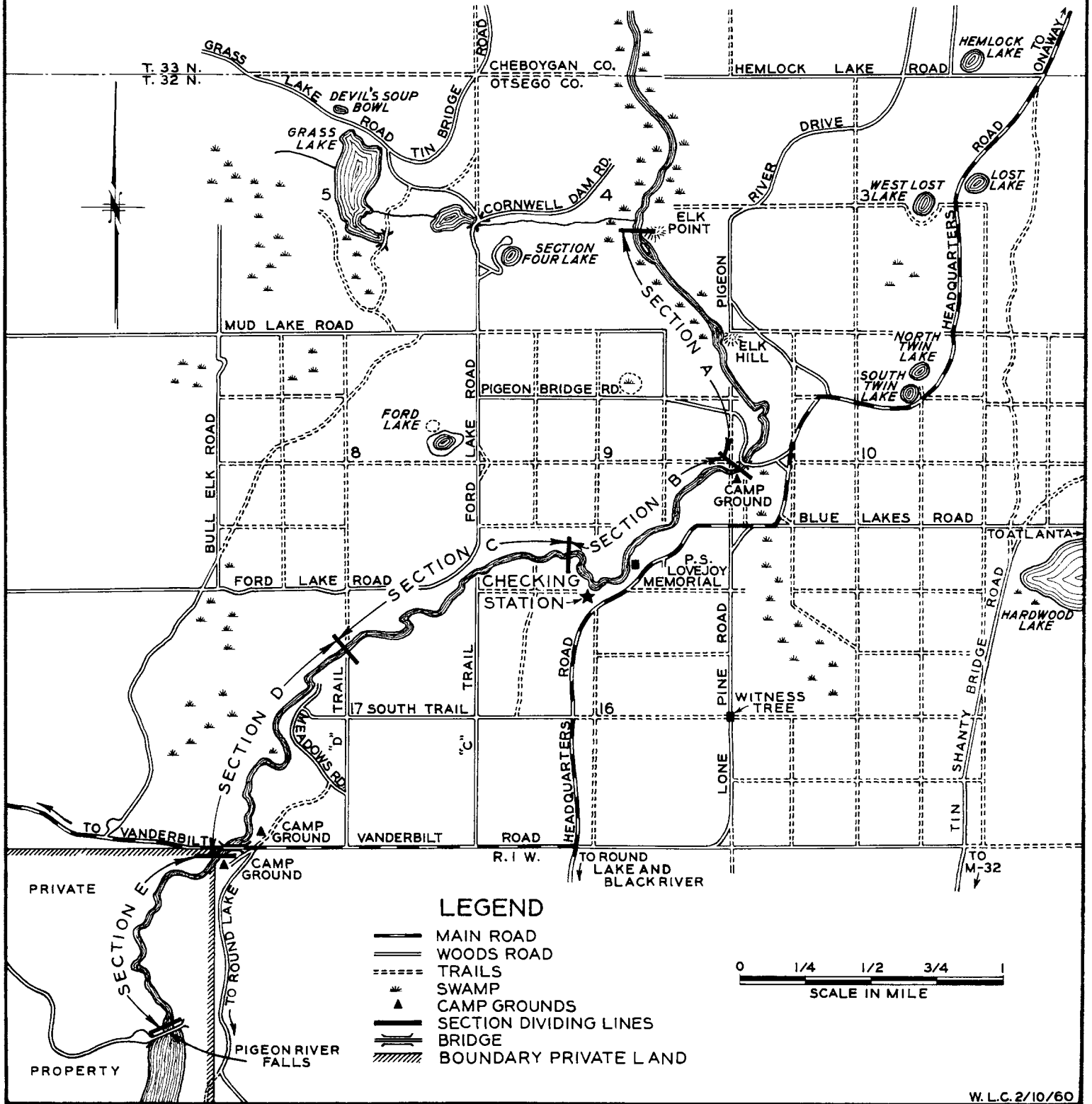


Figure 1

THE PIGEON RIVER TROUT RESEARCH AREA

This research and experimental area is located in the northeastern corner of Otsego County and in a small portion of Cheboygan County in the Pigeon River State Forest. Here six 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 are stated on the fishing permit.

In addition to the information on fishing success collected from anglers using the area, periodic estimates are made of the size of the trout populations and the rates of growth and mortality of the fish are determined. All of these factors—fishing success, total catch, population size, growth, mortality and any others that are pertinent—are used in the evaluation of research projects.

Research projects include the evaluation of various changes in the fishing regulations, the correct stocking programs for the lakes and stream, and the effects of stream improvement, as well as studies of the basic biology of trout.

The research station also provides a base for studies on waters outside of the experimental area.

Table 1.--Morphometry of experimental stream sections,
Pigeon River Trout Research Station¹

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

¹Data for Sections A, B, C and D from Cooper, 1953.
Length of Section E from Bacon, Shetter and Cooper,
1958. Width of Section E was measured July 28, 1961.

particular lake, and is also required to report on his trip and to allow examination of his catch by station personnel. On any day, he may fish in as many sections of the river or in as many lakes as he desires, so long as he reports back to the checking station after fishing in each separate water.

The creel census is used to evaluate experimental methods of trout management, such as special regulations, methods of planting, manipulation of the environment, as well as providing information concerning the basic biology of trout. The compulsory permit system assured a complete, or nearly complete, census and information was secured which could not be obtained otherwise. Previous annual creel census reports have appeared in the Institute report series.↓

No trout have been planted in the experimental sections of the stream since 1957; the data for the stream fishing are for wild trout only. Trout do not reproduce in the lakes, so for lakes all data are derived from plants of hatchery trout.

During 1961, the station was under the supervision of the author. The rest of the permanent staff included Gerald F. Myers, Harold H. Brado and Doyle E. Edson. Mr. Kiyoshi G. Fukano and Donald F. Thomas assisted during the pre-season population estimate. Mr. Fukano and Gayle D. Betts helped with the creel census during the first two days of the fishing season.

↓ For report numbers, refer to "Literature cited."

Mr. Theodore H. Turppa helped during the postseason population estimate. Supervisory assistance was provided by Gerald P. Cooper and David S. Shetter.

Since July 1, 1960, the station has been under the Federal Aid in Fish Restoration Act. The name of the project (F-17-R-2) is: Development and Evaluation of Trout Management Techniques. The primary purposes in previous reports were to record creel census data which might have significant bearing on trout fisheries in other Michigan waters and, from pre- and postseason population estimates, ascertain the degree of exploitation by anglers. The present report includes data on creel census and exploitation rates and also indicates progress on all "jobs" considered under the Federal Aid Project.

Job No. 1.--Station clerical work, record keeping and library maintenance.

The routine clerical work included bookkeeping on supplies purchased, utilities, time and attendance, and so forth. Daily weather readings were taken; weekly and monthly reports were submitted to the U. S. Weather Bureau. A stream gauge was checked weekly for U. S. Geological Survey. Progress was made on assembling and maintaining station library.

Job No. 2.--Complete creel census of six miles of stream.

Certain special fishing regulations have been in effect since the establishment of the research station. They have been, or will be, evaluated

in separate reports but to aid in an interpretation of the creel census results, the regulations are summarized in Table 2.

Catch statistics for 1961 for the stream sections are presented in Table 3.^{2/} The catch of 941 trout was slightly better than the 915 recorded in 1960 and approached the average catch (since 1953) of about 1,000 fish per year. Section E produced the most fish, 436 of the 941 trout caught. Sections C and D, with the higher size limit and flies-only regulation, produced the fewest fish, 37 and 49 trout, respectively. Total number of fishing trips increased from 1,236, in 1960, to 1,543, in 1961, and total hours fished increased from 3,197.0 to 4,196.5 hours. The average number of trout caught per hour decreased slightly from 0.27 trout, in 1960, to 0.23 trout, in 1961.

Fishing success during weekly periods is given in Table 4; it was best in May and was poorest in early August.

Annual totals of fishing pressure and fishing success for the experimental waters of the Pigeon River since 1949 are given in Table 5. Fishing pressure (hours fished) and number of fishing trips increased in 1961 to continue an upward trend, after a steady decline from 1954 to 1959. Fishing success, as measured by percentage of successful fishing trips and average number of trout caught per trip, was lower than in 1960, but higher than any year since 1954.

Most of the anglers fishing the Pigeon River came from Wayne County, with local residents from Otsego County placing second (Table 6). Of the

^{2/} In Table 3 and subsequent tables, catch per hour per trip was determined by taking a simple average of the catch per hour for each fishing trip.

Table 2. --Experimental regulations, in waters of the Pigeon River Trout Research Station, 1949-1961

Years	Water and regulation ¹							
	Stream sections						Lakes	
	A, B		C, D		E ²		Creel	Mini-
	limit	Mini-	Creel	Mini-	Creel	Mini-	limit	mum
	mum	mum	limit	mum	limit	mum	limit	mum
	(trout	(trout	(trout	(trout	(trout	(trout	(trout	(trout
	legal	legal	legal	legal	legal	legal	legal	legal
	per	per	per	per	per	per	per	per
	length	length	length	length	length	length	length	length
	day)	day)	day)	day)	day)	day)	day)	day)
	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1949-50	5	7	15	7	..	..	5	7
1951-52	5	7	2	9	..	..	5	7
1953-54	5	7	2	9	10	7	5	7
1955-61	5	7	5	9	10	7	5	7

¹ Lure was restricted to artificial flies only in Section C and D in 1958-61 and in Ford Lake in 1955-61. The use of minnows was prohibited in the lakes (state-wide restriction on all designated trout lakes).

² Section E was added in 1953.

Table 3. --Results of creel census on experimental stream sections,
Pigeon River Trout Research Station, 1961

Stream sections	Fishing trips		Total hours fished	Average number of trout caught per hour per trip
	Number	Percentage successful		
A	307	22.8	767.5	0.21
B	479	28.4	1,165.0	0.22
C	201	13.4	609.5	0.06
D	217	16.1	618.5	0.09
E	339	45.1	1,036.0	0.45
Total	1,543	27.3	4,196.5	0.23

Stream sections	Anglers' catch					
	Brook trout		Brown trout		Total	
	Number	Weight (pounds)	Number	Weight (pounds)	Number	Weight (pounds)
A	126	23.36	30	12.14	156	35.50
B	208	36.32	55	23.90	263	60.22
C	23	7.60	14	7.37	37	14.97
D	30	9.72	19	14.34	49	24.06
E	397	82.86	39	22.76	436	105.62
Total	784	159.86	157	80.51	941	240.37

Table 4.--Fishing success, and total weight of anglers' catch during weekly periods, Pigeon River, 1961

Dates	Fishing trips		Trout caught						Hours fished	Average number of trout caught per hour per trip
	Num-ber	Percent- age success- ful	Brook		Brown		Total			
			Num-ber	Weight (pounds)	Num-ber	Weight (pounds)	Num-ber	Weight (pounds)		
April 29-May 5	119	32.8	97	25.53	13	5.30	110	30.83	290.0	0.38
May 6-May 12	65	32.3	64	11.02	7	2.20	71	13.22	154.0	0.42
May 13-May 19	46	52.2	39	9.46	11	5.00	50	14.46	115.5	0.51
May 20-May 26	95	45.3	114	23.00	9	4.14	123	27.14	339.5	0.39
May 27-June 2	109	33.9	70	12.64	6	2.98	76	15.62	348.0	0.23
June 3-June 9	43	53.5	32	7.30	7	3.42	39	10.72	127.0	0.31
June 10-June 16	107	18.7	24	4.92	7	2.66	31	7.58	268.5	0.14
June 17-June 23	63	30.2	31	5.61	3	1.42	34	7.03	155.5	0.22
June 24-June 30	107	41.1	77	15.83	28	24.40	105	40.23	311.0	0.34
July 1-July 7	130	26.2	40	8.28	24	13.72	64	22.00	354.0	0.20
July 8-July 14	91	31.9	50	8.84	6	1.66	56	10.50	256.5	0.26
July 15-July 21	87	27.6	35	6.48	11	4.62	46	11.10	244.5	0.19
July 22-July 28	58	17.2	14	2.58	2	0.64	16	3.22	195.0	0.11
July 29-Aug. 4	77	10.4	15	2.24	6	1.70	21	3.94	183.5	0.15
Aug. 5-Aug. 11	61	4.9	9	1.76	...	...	9	1.76	145.5	0.05
Aug. 12-Aug. 18	66	9.1	7	1.79	3	2.93	10	4.72	159.5	0.06
Aug. 19-Aug. 25	73	21.9	35	7.12	4	0.83	39	7.95	188.0	0.17
Aug. 26-Sept. 1	43	11.6	4	0.72	1	0.26	5	0.98	81.5	0.05
Sept. 2-Sept. 8	68	19.1	24	4.28	6	2.22	30	6.50	192.5	0.12
Sept. 9-Sept. 10	35	8.6	3	0.48	3	0.42	6	0.90	87.0	0.07
Total	1,543	27.3	784	159.88	157	80.52	941	240.40	4,196.5	0.23

Table 5. --Results of creel census in experimental waters of the Pigeon River,
1949-61

Year [↓]	Fishing trips		Trout caught				Hours fished	Average number of fish caught per hour per trip
	Number	Percentage successful	Brook	Brown	Rain-bow	Total		
1949	2,233	26.2	793	198	57	1,048	6,817	0.15
1950	2,160	27.3	917	255	18	1,190	6,195	0.18
1951	2,846	15.4	453	228	10	691	7,076	0.10
1952	1,450	24.5	464	127	47	638	3,957	0.16
1953	1,943	24.9	742	203	88	1,033	5,689	0.23
1954	2,427	32.8	1,435	437	66	1,938	6,584	0.30
1955	2,039	25.3	959	250	33	1,242	5,775	0.20
1956	1,979	24.8	869	266	15	1,150	5,527	0.19
1957	1,699	23.2	721	120	17	858	4,490	0.18
1958	1,599	25.8	894	116	11	1,021	4,205	0.22
1959	1,206	14.8	289	52	1	342	2,760	0.11
1960	1,236	29.2	692	220	3	915	3,197	0.27
1961	1,543	27.3	784	157	...	941	4,196	0.23

[↓] Section E was added to the experimental waters in 1953.

Table 6.--Residence of anglers who fished the experimental sections of the Pigeon River in 1961

County	Number of fishing trips	County	Number of fishing trips	County, state or country	Number of fishing trips
Wayne	282	Lenawee	8	Ogemaw	2
Otsego	167	Presque Isle	8	Roscommon	2
Oakland	144	Barry	7	Sanilac	2
Genesee	114	Ottawa	7	Clinton	1
Ingham	96	St. Clair	7	Kalkaska	1
Washtenaw	54	Emmet	6	Lapeer	1
Bay	42	Hillsdale	6	Osceola	1
Muskegon	36	Eaton	5	Van Buren	1
Branch	35	Iosco	5	Michigan	
Alpena	34	Montcalm	5	(total)	1,348
Macomb	31	Newaygo	4	Ohio	136
Kent	30	Berrien	3	Indiana	33
Calhoun	25	Gladwin	3	Pennsylvania	8
Saginaw	22	Arenac	2	Illinois	4
Gratiot	21	Crawford	2	Maine	4
Tuscola	19	Huron	2	Arizona	2
Cheboygan	14	Ionia	2	Iowa	2
Midland	14	Isabella	2	Massachusetts	2
Charlevoix	12	Livingston	2	Kentucky	1
Jackson	11	Manistee	2	Wisconsin	1
Kalamazoo	10	Mecosta	2	Wyoming	1
Montmorency	10	Missaukee	2	Australia	1
Grand Traverse	9	Monroe	2	Total	1,543
Shiawassee	9	Oceana	2		

83 counties in Michigan, 56 were represented by at least one angler; 11 other states and one country (Australia) were represented. Most of nonresident anglers came from Ohio.

Job No. 3. --Complete creel census of seven trout lakes.

Catch statistics for the lakes are presented in Table 7. The fishery consists entirely of hatchery brook trout planted as fingerlings (average total length 5.5 inches) in the fall, with the exception of Section 4 Lake where brook trout fry are planted in the spring. The planting rate approximates 100 fingerling per acre per year. Section 4 Lake receives about 1,000 fry per acre per year. Fishing success for all the lakes combined, as measured by the average number of fish caught per hour per trip, was 0.26 trout. In 1960, it was 0.35 trout. Total fishing trips and hours fished increased from 1,649 trips and 4,386.0 hours in 1960, to 1,864 trips and 5,316.5 hours in 1961.

On Ford Lake, under a flies-only regulation, the catch per hour decreased from a high of 1.15 trout in 1959, to 0.82 trout in 1960, to 0.54 trout in 1961.

Residence of anglers who fished the lakes in 1961 is given in Table 8. Otsego County contributed the most anglers; Wayne County was second. Fifty counties of Michigan and six states contributed at least one angler.

Data from the river and the lakes are combined in Tables 9, 10 and 11.

On the stream, anglers who used worms were more successful, in terms of percentage of successful trips and catch per hour per trip, than those

Table 7. --Results of creel census on lakes of the Pigeon River Trout
 Research Station, 1961
 (only brook trout were caught)

Lake	Fishing trips		Trout caught		Hours fished	Average number of fish caught per hour per trip
	Num-ber	Percent- age successful	Num-ber	Pounds		
Ford	224	56.2	314	83.44	592.5	0.54
Section 4	143	37.8	146	26.32	357.5	0.31
Hemlock	291	33.7	248	80.63	930.0	0.21
Lost	282	37.2	270	50.02	798.5	0.28
West Lost	375	31.7	248	87.68	1,066.5	0.20
North Twin	315	35.2	253	90.23	1,001.5	0.22
South Twin	234	21.4	109	29.52	570.0	0.16
Total	1,864	35.6	1,588	447.84	5,316.5	0.26

Table 8. --Residence of anglers who fished Pigeon River lakes in 1961

County	Number of fishing trips	County	Number of fishing trips	County or state	Number of fishing trips
Otsego	272	Kalamazoo	16	Barry	3
Wayne	170	Ottawa	14	Berrien	3
Muskegon	154	Livingston	12	Huron	3
Presque Isle	94	Allegan	9	Gladwin	2
Cheboygan	90	Arenac	9	Monroe	2
Ingham	87	Macomb	9	Roscommon	2
Shiawassee	87	Montmorency	9	Kalkaska	1
Bay	80	St. Clair	9	Newaygo	1
Kent	77	Isabella	8	Oscoda	1
Saginaw	73	Ogemaw	8	<u>Wexford</u>	<u>1</u>
Genesee	71	Grand Traverse	6	Michigan	
Oakland	70	St. Joseph	6	(total)	1,793
Gratiot	64	Sanilac	6	Ohio	43
Washtenaw	62	Antrim	5	Indiana	16
Midland	59	Branch	5	Pennsylvania	4
Emmet	33	Crawford	4	Florida	3
Charlevoix	23	Eaton	4	Illinois	3
Jackson	19	Hillsdale	4	<u>Arizona</u>	<u>2</u>
Lenawee	19	Tuscola	4	Total	1,864
Calhoun	18	Alpena	3		

Table 9.--Fishing success according to lure used, Pigeon River Trout Research Station, 1961

Lure	Fishing trips		Number of trout caught			Hours fished	Average number of trout caught per hour per trip
	Number	Percentage successful	Brook	Brown	Total		
<u>STREAM</u>							
Worms	483	28.8	296	37	333	1,263.0	0.25
Worms and spinner	133	29.3	89	3	92	356.5	0.23
Flies	706	24.4	247	87	334	1,930.5	0.19
Minnows	6	33.3	6	...	6	17.0	0.26
Insects	...	...	...	...	...	...	...
Artificial ¹	31	38.7	17	10	27	51.5	0.53
Natural ²	6	16.7	2	1	3	17.5	0.17
Other ³	178	31.5	127	19	146	560.5	0.27
Total for stream	1,543	27.3	784	157	941	4,196.5	0.23
<u>LAKES</u>							
Worms	1,045	35.4	873	...	...	3,036.0	0.24
Worms and spinner	235	29.4	189	...	...	611.0	0.25
Flies	28	17.9	10	...	...	71.0	0.08
Insects	22	40.9	21	...	...	50.5	0.31
Artificial ¹	33	15.2	6	...	...	62.0	0.05
Natural ²	9	44.4	7	...	...	29.0	0.22
Other ³	268	28.0	168	...	...	864.5	0.16
Ford Lake (flies only)	224	56.2	314	...	...	592.5	0.54
Total for lakes	1,864	35.6	1,588	...	...	5,316.5	0.26

¹ Artificial lures other than flies.

² Natural baits other than worms, minnows or insects.

³ Other refers to a combination of the above lures, two or more lures used successively on same trip or a lure other than listed above.

Table 10. --Number of anglers using each type of fishing rod, Pigeon River Trout Research Station, 1961[↓]

Stream section or lake	Type of rod						Total
	Fly	Spin-ning	Cast-ing	Other	Com-bina-tion	No record	
STREAM							
A	152	122	18	11	2	2	307
B	286	163	21	1	5	3	479
E	189	126	17	...	4	3	339
Total	627	411	56	12	11	8	1,125
Percentage	55.7	36.5	5.0	1.1	1.0	0.7	...
C	201	...	...	...	...	...	201
D	205	10	2	...	...	...	217
Total	406	10	2	...	...	...	418
Percentage	97.1	2.4	0.5	...	...	...	...
LAKES							
Ford	181	36	...	...	1	6	224
Percentage	80.8	16.1	...	...	0.4	2.7	...
Section 4	27	104	10	...	1	1	143
Hemlock	40	195	34	7	10	5	291
Lost	47	186	20	13	11	5	282
West Lost	64	257	32	9	6	7	375
North Twin	66	214	18	2	11	4	315
South Twin	33	158	21	1	19	2	234
Total	277	1,114	135	32	58	24	1,640
Percentage	16.8	67.9	8.2	2.0	3.5	1.5	...

[↓] Data for stream sections C and D and for Ford Lake are shown separately because lures were restricted to flies only in 1961.

Table 11. --Number of anglers of different classes who fished in
 experimental waters of the Pigeon River in 1961
 [Percentages in parentheses]

Residence	Licensed males	Licensed females	Wives	Minor males	Minor females	Total
<u>STREAM</u>						
Resident	1, 005	13	112	167	51	1, 348 (87.4)
Nonresident	136	25	...	26	8	195 (12.6)
Total	1, 141 (73.9)	38 (2.5)	112 (7.3)	193 (12.5)	59 (3.8)	1, 543 ...
<u>LAKES</u>						
Resident	1, 173	8	203	336	73	1, 793 (96.2)
Nonresident	48	10	...	12	1	71 (3.8)
Total	1, 221 (65.5)	18 (1.0)	203 (10.9)	348 (18.7)	74 (4.0)	1, 864 ...

who used flies (Table 9). In terms of total catch, the anglers using worms caught 333 trout, while the anglers using flies caught 334 trout. Flies were used most frequently with worms next in order. In the lakes, worms were used most frequently and accounted for most of the catch.

Types of fishing rods used by anglers are listed in Table 10. In the sections of the stream where there was a flies-only regulation (Section C and D), 97.1 percent of the anglers used a fly rod. In the other sections, only 55.7 percent of the anglers used a fly rod. On the lakes, a spinning rod was used more often than a fly rod (except at Ford Lake where there was a flies-only restriction).

Number of fishing trips made to the experimental waters by licensed and non-licensed anglers, i. e., wives and minors, are given in Table 11. Licensed anglers accounted for 76.4 percent of the fishing on the stream and 66.5 percent of the fishing on the lakes. Michigan residents did 87.4 percent of the stream fishing and 96.2 percent of the lake fishing.

Job No. 4.--Estimate number of trout in stream during spring and fall.

The mark-and-recapture (Petersen) method was used to estimate the number of trout present in each experimental section of the river. Two trips were made through each section using a direct-current shocker to take samples of trout (one trip to mark trout, and the second to recapture, with an interval of a week between trips). The number of fish in each 1-inch group of each species for each section was calculated.

In order to compute the pounds of trout in the population estimates, the average weight of each 1-inch group of each species (based on the calculated weight at each 0.1 inch) was found by referring to a graph of the length-weight relationships for Pigeon River trout (Cooper and Benson, 1951).

Results of the 1961 spring estimates, by stream section, species, and 1-inch groups of trout (fish 12 inches long and longer were grouped in the table but not in the estimates) are presented in Table 12. The total population for the six miles of river was 7,235 trout (6,220 brook and 1,015 brown trout) or 15.97 pounds of trout per acre.

Results of the 1961 fall population estimates are presented in Table 13. The total population was 22,828 trout (19,388 brook and 3,440 brown trout) or 30.35 pounds of trout per acre.

Job No. 5.--Estimate number of trout in two lakes during spring and fall.

Estimated numbers of brook trout present in Ford and Hemlock lakes in October, 1961 are presented in Table 14. The Bailey modification of the Petersen formula for mark-and-recapture estimates was used (Ricker, 1958). Confidence limits (95 percent) were calculated from Clopper and Pearson's (1934) chart. Samples of trout were taken by fishing with flies and shocking with a direct-current shocker and underwater lights at night. The estimates of population size for April, 1961, were presented in the 1960 annual report (Latta, 1961b).

Table 12.--Estimated numbers and weight of trout of different species and lengths in the experimental sections of the Pigeon River in the spring of 1961 (before opening of the trout fishing season)

Stream section	Inch groups↓	Brook trout		Brown trout		Total	
		Number	Weight (pounds)	Number	Weight (pounds)	Number	Weight (pounds)
A	2	...	...	...	...	...	...
	3	89	1.34	20	0.32	109	1.66
	4	232	7.42	113	3.84	345	11.26
	5	132	7.66	12	0.72	144	8.38
	6	65	6.24	1	0.10	66	6.34
	7	38	5.55	8	1.20	46	6.75
	8	14	2.95	14	3.04	28	5.99
	9	1	0.29	10	3.02	11	3.31
	10	1	0.39	6	2.44	7	2.83
	11	...	...	7	3.73	7	3.73
	12+	...	...	26	24.56	26	24.56
	Total		572	31.84	217	42.97	789	74.81
Pounds per acre			4.45		6.00		10.45
B	2	12	0.07	...	...	12	0.07
	3	259	3.88	54	0.86	313	4.74
	4	271	8.67	67	2.28	338	10.95
	5	122	7.08	7	0.42	129	7.50
	6	84	8.06	4	0.39	88	8.45
	7	84	12.26	10	1.50	94	13.76
	8	12	2.53	38	8.25	50	10.78
	9	2	0.59	15	4.53	17	5.12
	10	...	...	6	2.44	6	2.44
	11	...	...	12	6.40	12	6.40
	12+	...	...	9	8.40	9	8.40
	Total		846	43.14	222	35.47	1,068	78.61
Pounds per acre			7.31		6.01		13.32
C	2	9	0.05	...	...	9	0.05
	3	451	6.76	90	1.44	541	8.20
	4	564	18.05	86	2.92	650	20.97
	5	142	8.24	6	0.36	148	8.60
	6	120	11.52	1	0.10	121	11.62
	7	145	21.17	8	1.20	153	22.37
	8	22	4.64	23	4.99	45	9.63
	9	5	1.46	6	1.81	11	3.27
	10	...	...	1	0.41	1	0.41
	11	...	...	12	6.40	12	6.40
	12+	...	...	3	3.71	3	3.71
	Total		1,458	71.89	236	23.34	1,694	95.23
Pounds per acre			13.34		4.33		17.67

(continued)

Table 12.--continued

Stream section	Inch groups ¹ ↓	Brook trout		Brown trout		Total	
		Number	Weight (pounds)	Number	Weight (pounds)	Number	Weight (pounds)
D	2	3	0.02	...	...	3	0.02
	3	438	6.57	15	0.24	453	6.81
	4	718	22.98	94	3.20	812	26.18
	5	248	14.38	13	0.78	261	15.16
	6	157	15.07	3	0.29	160	15.36
	7	98	14.31	28	4.20	126	18.51
	8	40	8.44	47	10.20	87	18.64
	9	7	2.05	6	1.81	13	3.86
	10	1	0.39	5	2.04	6	2.43
	11	1	0.52	4	2.13	5	2.65
	12+	...	...	13	12.49	13	12.49
	Total		1,711	84.73	228	37.38	1,939	122.11
Pounds per acre			15.00		6.62		21.62
E	2	10	0.06	...	...	10	0.06
	3	444	6.66	11	0.18	455	6.84
	4	729	23.33	49	1.67	778	25.00
	5	190	11.02	11	0.66	201	11.68
	6	158	15.17	...	...	158	15.17
	7	74	10.80	1	0.15	75	10.95
	8	19	4.01	3	0.65	22	4.66
	9	6	1.76	4	1.21	10	2.97
	10	2	0.79	6	2.44	8	3.23
	11	...	...	4	2.13	4	2.13
	12+	1	0.83	23	21.09	24	21.92
	Total		1,633	74.43	112	30.18	1,745	104.61
Pounds per acre			13.13		5.32		18.45
All sections	2	34	0.20	...	...	34	0.20
	3	1,681	25.21	190	3.04	1,871	28.25
	4	2,514	80.45	409	13.91	2,923	94.36
	5	834	48.38	49	2.94	883	51.32
	6	584	56.06	9	0.88	593	56.94
	7	439	64.09	55	8.25	494	72.34
	8	107	22.57	125	27.13	232	49.70
	9	21	6.15	41	12.38	62	18.53
	10	4	1.57	24	9.77	28	11.34
	11	1	0.52	39	20.79	40	21.31
	12+	1	0.83	74	70.25	75	71.08
	Total		6,220	306.03	1,015	169.34	7,235	475.37
Pounds per acre			10.28		5.69		15.97

¹ Length groups range from 2.0-2.9 inches, 3.0-3.9, 4.0-4.9 inches, etc.

Table 13. --Estimated numbers and weight of trout of different species and lengths in the experimental sections of the Pigeon River in the fall of 1961 (after close of the trout fishing season)

Stream section	Inch groups ¹	Brook trout		Brown trout		Total	
		Number	Weight (pounds)	Number	Weight (pounds)	Number	Weight (pounds)
A	1	1	T ²	...	...	1	T
	2	330	1.98	336	2.02	666	4.00
	3	465	6.98	436	6.98	901	13.96
	4	78	2.50	21	0.71	99	3.21
	5	81	4.70	...	...	81	4.70
	6	94	9.02	20	1.96	114	10.98
	7	62	9.05	21	3.15	83	12.20
	8	20	4.22	3	0.65	23	4.87
	9	3	0.88	2	0.60	5	1.48
	10	2	0.79	4	1.63	6	2.42
	11	...	...	7	3.73	7	3.73
	12+	...	...	17	16.20	17	16.20
Total		1,136	40.12	867	37.63	2,003	77.75
Pounds per acre			5.60		5.26		10.86
B	1	8	0.02	...	...	8	0.02
	2	1,432	8.59	215	1.29	1,647	9.88
	3	1,464	21.96	567	9.07	2,031	31.03
	4	187	5.98	30	1.02	217	7.00
	5	144	8.35	8	0.48	152	8.83
	6	148	14.21	34	3.33	182	17.54
	7	58	8.47	46	6.90	104	15.37
	8	6	1.27	19	4.12	25	5.39
	9	1	0.29	5	1.51	6	1.80
	10	...	...	8	3.26	8	3.26
	11	1	0.39	9	4.64	10	5.03
	12+	...	...	18	19.66	18	19.66
Total		3,449	69.53	959	55.28	4,408	124.81
Pounds per acre			11.79		9.37		21.16
C	1	4	0.01	...	...	4	0.01
	2	1,840	11.04	121	0.73	1,961	11.77
	3	2,930	43.95	663	10.61	3,593	54.56
	4	354	11.33	89	3.03	443	14.36
	5	344	19.95	3	0.18	347	20.13
	6	393	37.73	15	1.47	408	39.20
	7	203	29.64	96	14.40	299	44.04
	8	87	18.36	17	3.69	104	22.05
	9	27	7.91	3	0.91	30	8.82
	10	5	1.97	11	4.48	16	6.45
	11	...	...	4	2.13	4	2.13
	12+	1	0.83	46	61.18	47	62.01
Total		6,188	182.72	1,068	102.81	7,256	285.53
Pounds per acre			33.89		19.07		52.96

(continued)

Table 13.--continued

Stream section	Inch groups ¹	Brook trout		Brown trout		Total	
		Number	Weight (pounds)	Number	Weight (pounds)	Number	Weight (pounds)
D	1	2	T	...	...	2	T
	2	1,301	7.81	7	0.04	1,308	7.85
	3	2,514	37.71	105	1.68	2,619	39.39
	4	319	10.21	39	1.33	358	11.54
	5	321	18.62	3	0.18	324	18.80
	6	472	45.31	13	1.27	485	46.58
	7	208	30.37	32	4.80	240	35.17
	8	85	17.94	12	2.60	97	20.54
	9	32	9.38	1	0.30	33	9.68
	10	11	4.33	4	1.63	15	5.96
	11	3	1.54	4	2.13	7	3.67
	12+	5	4.01	26	38.31	31	42.32
Total		5,273	187.23	246	54.27	5,519	241.50
Pounds per acre			33.14		9.61		42.75
E	1	5	0.01	...	...	5	0.01
	2	757	4.54	6	0.04	763	4.58
	3	1,512	22.68	80	1.28	1,592	23.96
	4	341	10.91	107	3.64	448	14.55
	5	212	12.30	2	0.12	214	12.42
	6	292	28.03	2	0.20	294	28.23
	7	160	23.36	18	2.70	178	26.06
	8	37	7.81	38	8.25	75	16.06
	9	17	4.98	7	2.11	24	7.09
	10	5	1.97	5	2.04	10	4.01
	11	3	1.54	2	1.07	5	2.61
	12+	1	0.83	33	33.36	34	34.19
Total		3,342	118.96	300	54.81	3,642	173.77
Pounds per acre			20.98		9.67		30.65
All sections	1	20	0.04	...	...	20	0.04
	2	5,660	33.96	685	4.12	6,345	38.08
	3	8,885	133.28	1,851	29.62	10,736	162.90
	4	1,279	40.93	286	9.73	1,565	50.66
	5	1,102	63.92	16	0.96	1,118	64.88
	6	1,399	134.30	84	8.23	1,483	142.53
	7	691	100.89	213	31.95	904	132.84
	8	235	49.60	89	19.31	324	68.91
	9	80	23.44	18	5.43	98	28.87
	10	23	9.06	32	13.04	55	22.10
	11	7	3.47	26	13.70	33	17.17
	12+	7	5.67	140	168.71	147	174.38
Total		19,388	598.56	3,440	304.80	22,828	903.36
Pounds per acre			20.11		10.24		30.35

¹ Length groups range from 1.0-1.9 inches, 2.0-2.9, 3.0-3.9 inches, etc.

² T indicates a weight of 0.005 pound or less.

Table 14. --Estimated number of brook trout in Ford and Hemlock lakes in
October, 1961

Lake	Date of population estimate	Method of		Year class	Popula- tion estimate	95 percent confidence limits
		Marking	Recapture			
Ford	Oct. 1961	Fishing ¹ ✓	Shocking 2T ² ✓	1960	276	234-349
	Oct. 1961	Fishing	Shocking 2T	1959	19	none
Hemlock	Oct. 1961	Fishing	Shocking 2T	1960	140	116-175
	Oct. 1961	Fishing	Shocking 2T	1959	5	none

¹✓ Station personnel fishing with flies.

²✓ Direct-current shocker used at night with underwater lights;
2T indicates two trips to the lake.

Job No. 6.--Calculate growth and mortality rates for the trout from the stream.

Age composition of the anglers' catch in 1961 and average total length and weight of each age group for each experimental section of the Pigeon River are given in Table 15. As in past years, two-year-olds predominated in the catch.

Annual expectation of death (mortality rates) for brook and brown trout in the experimental sections of the Pigeon River, from the fall of 1960 to the fall of 1961, are given in Table 16.

The age distributions of the spring and fall population estimates were determined from scale collections (15 scale samples were taken for each inch group of each species) taken at the time of the estimates. In general, there was good agreement between the estimates and the number of fish in the catch but in some instances it appeared that more fish were caught during the 1961 season than were estimated to be present at the start of the season. Some of the possible reasons for these discrepancies, e. g., movement between sections, recruitment from outside the experimental area, inaccurate estimates of population size because of high water and other physical difficulties, are being checked and will be corrected for in the future.

The estimated total mortality from the fall of 1960 to the spring of 1961 was not nearly so great as in the previous year. In 1960, the mean over-winter mortality for the brook trout from all sections was 0.76 and for the brown trout it was 0.79; in 1961, the mean over-winter mortality was 0.46 and 0.45, respectively.

Table 15. --Age composition of the anglers' catch and average length and weight of age groups for each experimental section, Pigeon River, 1961

Stream section	Species	Age group	Number	Average total length (inches)	Average weight (pounds)
A	Brook ¹ ↓	I	28	7.5	0.14
		II	93	8.1	0.19
		III	4	9.7	0.31
	Brown	I	8	7.9	0.17
		II	17	10.0	0.36
		III	5	13.5	0.92
B	Brook ¹ ↓	I	56	7.4	0.14
		II	141	7.9	0.18
		III	5	10.0	0.42
	Brown	I	7	7.5	0.14
		II	43	10.1	0.39
		III	5	14.9	1.26
C	Brook	II	16	9.7	0.33
		III	7	9.8	0.32
	Brown	II	11	9.7	0.33
		III	3	14.5	1.24
D	Brook	II	22	9.3	0.29
		III	8	10.4	0.41
	Brown	II	9	10.4	0.41
		III	10	14.0	1.06
E	Brook	I	92	7.4	0.14
		II	273	8.0	0.19
		III	29	10.9	0.51
		IV	3	15.2	1.26
	Brown	I	9	7.8	0.17
		II	16	10.4	0.41
		III	13	13.3	0.92
		IV	1	18.5	2.62

¹↓ No scales were taken from one brook trout from Section A and three from Section B, and the age was not determinable for three brook trout from Section B.

Table 16. --Annual expectation of death for brook and brown trout in the experimental sections of the Pigeon River, fall, 1960 to fall, 1961

Section	Total mortality, winter, 1960-61		Total mortality, summer, 1961		Rate of exploitation, summer, 1961		Natural mortality, summer, 1961	
	Age group		Age group		Age group		Age group	
	I	II+	I	II+	I	II+	I	II+
BROOK TROUT								
A	... ¹ ↓	0.22	0.42	0.82	0.06	0.70	0.36	0.12
B	0.57	0.41	0.46	0.92	0.09	0.72	0.37	0.20
C	0.53	0.58	0.17	0.31	... ² ↘	0.06	... ² ↘	0.25
D	0.22	0.60	0.25	0.55	... ² ↘	0.09	... ² ↘	0.46
E	... ¹ ↓	0.55	0.48	0.83	0.07	... ¹ ↓	0.41	... ¹ ↓
BROWN TROUT								
A	... ¹ ↓	0.36	0.70	0.58	0.06	0.31	0.64	0.27
B	0.64	0.49	0.18	0.57	0.06	0.50	0.12	0.07
C	0.51	0.63	0.27	... ¹ ↓	... ² ↘	... ¹ ↓	... ² ↘	... ¹ ↓
D	0.33	0.19	0.50	0.68	... ² ↘	0.18	... ² ↘	0.50
E	0.32	0.54	... ¹ ↓	... ¹ ↓	... ¹ ↓	... ¹ ↓	... ¹ ↓	... ¹ ↓

¹↓ No estimate made because of lack of agreement between size of populations and/or catch.

²↘ Under 9-inch minimum size regulation no fish from age group I are caught.

The rate of exploitation of brook trout in Sections C and D (9-inch minimum size and flies-only regulation) was only 0.08, whereas in Sections A and B. (7-inch minimum size and any lure regulation), it was 0.71.

Job No. 7.--Calculate growth and mortality rates for the trout from two lakes.

Average length and weight for each year class of brook trout in the anglers' catch from Ford and Hemlock lakes are given in Table 17.

Annual expectations of death (total mortality, rate of exploitation and natural mortality) for brook trout in Ford and Hemlock lakes, April to October, 1961, are presented in Table 18. These figures are based on estimates of population size calculated for Job 5. Rate of exploitation of the two-year-olds was 70 to 80 percent while for the one-year-olds, just entering the catch, it was about 22 percent. Natural mortality for the one-year-olds was greater in Hemlock Lake (0.52) than in Ford Lake (0.33).

A report on the semiannual estimates of natural mortality of hatchery brook trout in Ford and Hemlock lakes which includes data from April, 1957 through October, 1960 was completed (Latta, 1962). The largest natural loss of trout occurred during the first summer after planting. The rate of natural mortality during summer decreased with a decrease in numbers stocked. The loss over winter was negligible. The causes of the mortality are unknown. The rate of fishing mortality tended to increase as the number of fish in each lake declined during the several years of the study.

Table 17. --Average length and weight for each year class of brook trout in the anglers' catch from Ford and Hemlock lakes, 1961

Lake	Year class	Number of fish	Average total length (inches)	Average weight (pounds)
Ford	1958	6	9.5	0.32
	1959	157	9.9	0.35
	1960	151	7.8	0.18
Hemlock	1958	2	13.0	1.21
	1959	143	10.2	0.41
	1960	103	7.9	0.19

Table 18. -- Annual expectations of death for brook trout in
Ford and Hemlock lakes, April to October, 1961

Lake	Year class	Total mortality	Rate of exploitation	Natural mortality
Ford	1959	0.91	0.73	0.18
	1960	0.57	0.24	0.33
Hemlock	1959	0.97	0.81	0.16
	1960	0.73	0.21	0.52

Job No. 8. --Mark hatchery and native trout

to facilitate recognition.

The lakes were stocked with 3,610 marked (anal fin and left maxillary removed) brook trout in November, 1961. The planted trout were from 5 to 6 inches long (mean length 5.5 inches).

All of the trout taken during the first run with the direct-current shocker through the experimental sections of the river in the fall of 1959 were given a fin clip distinctive for each section. It was decided that marking another large group of fish in the fall of 1960 might cause some confusion in the identification of fin clips from both years and that it would be better to wait until most of the fish marked in 1959 were gone from the population, thus no native trout were marked in 1960. In the fall of 1961, however, all trout less than 4 inches long (young-of-year) taken during the first run with the shocker were given a fin clip distinctive for each section. No fish were marked in the first or last 200 yards of each section in order to eliminate minor movement at the section dividing lines. The movement of these fish will be followed in the population studies and the creel census.

In order to check upon the movement of fish into the experimental area, a run was made in the fall of 1960 with the direct-current shocker through 1.5 miles of the Pigeon River immediately below Section A; 339 brook trout and 338 brown trout were given a fin clip (adipose, left pectoral). In a 0.5 mile of stream above the dam and impoundment at the upstream end of the experimental area, 1,168 brook trout and 1 brown trout were collected and marked by clipping the adipose and left ventral fins. Of

those trout marked below the experimental sections, 2 brook trout and 1 brown trout were taken during the spring population study in 1961. Also, one brook trout from above the dam was recovered in Section E. Four brook trout from below and 2 brook trout from above the area were recorded in the catch from the experimental sections during 1961 fishing season. In the population study in the fall of 1961, 1 brook trout and 5 brown trout from below, and 1 brook trout from above, were recorded. Excluding the fish recorded during the spring population study, for these fish may have appeared in the catch, these movements were noted: upstream--5 brook trout and 5 brown trout; downstream--3 brook trout. There does not appear to be much recruitment to the population of the experimental area either from downstream or upstream, and the dam at the upper end of the experimental area does not prevent downstream migration.

Job No. 9.--Construction and maintenance
of research equipment.

Equipment used was built, modified or repaired as needed.

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