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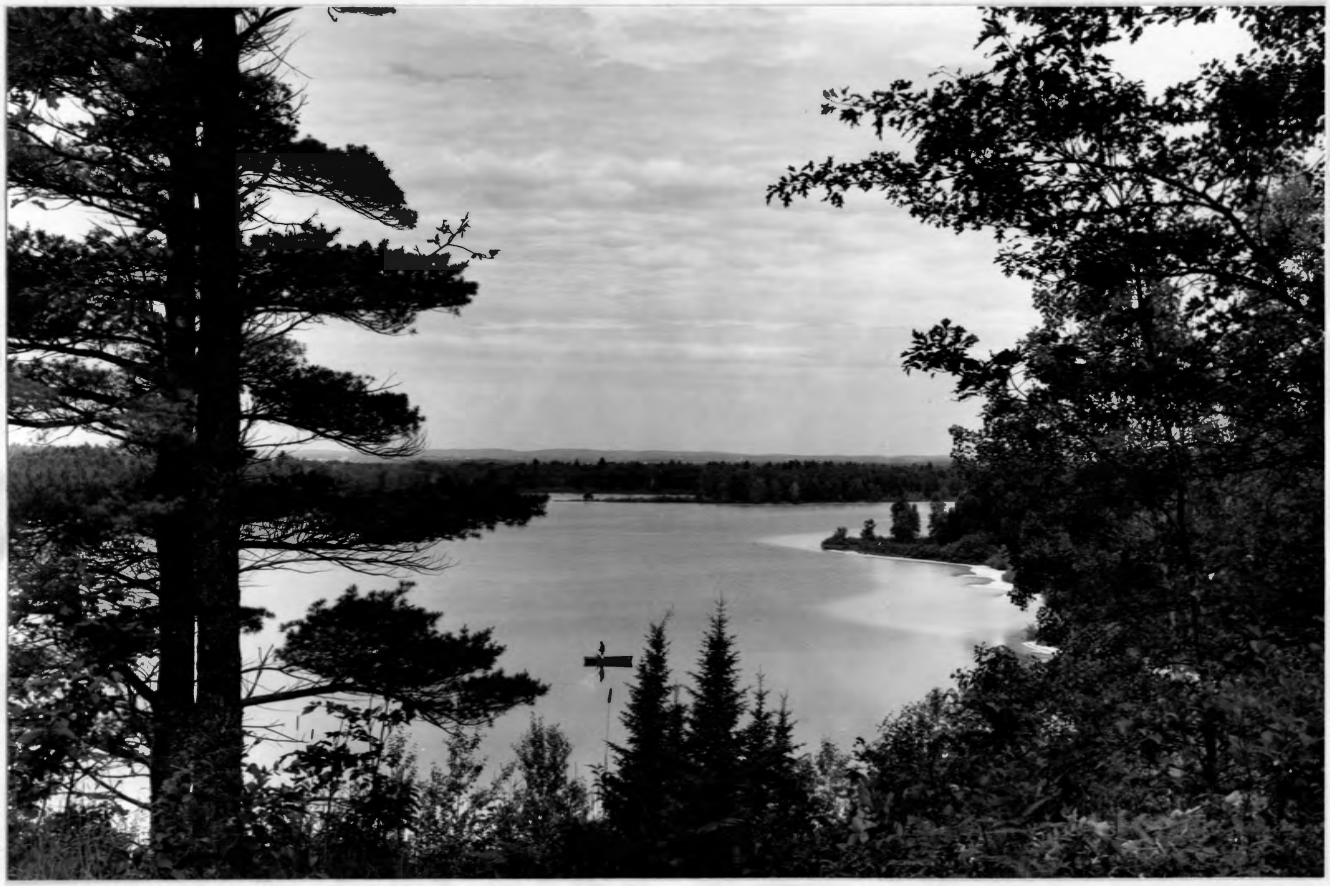
A Twelve-Year History of Fishing in the Lakes of the Rifle River Area, Ogemaw County, Michigan, 1945-1956

By

Mercer H. Patriarche



North Lake, Rifle River Area

Contents

Original: To printer
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Education - Game
Inst. for Fish. Res.
Hunt Creek Sta.
Rifle River Sta.
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A TWELVE-YEAR HISTORY OF FISHING ON THE LAKES OF THE RIFLE RIVER AREA, OGEMAW COUNTY, MICHIGAN, 1945-1956

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Introduction

In 1944 the Michigan Department of Conservation purchased the private estate of the late Harry M. Jewett, pioneer auto maker, for use as a research station and for public fishing, hunting, trapping, and sightseeing. This attractive estate, formerly known as "Grousehaven," covers an area of 4,318 acres. It is located 4 miles east of Rose City and about 1/2 mile south of Lupton, in northeastern Ogemaw County. Six lakes which range in size from 5.8 to 130 acres, a number of ponds, about 4 miles of the upper Rifle River, and portions of several smaller trout streams lie within the boundaries of this tract, which is known as the "Rifle River Area" (Fig. 1).

The Area was opened to the public in 1945. All persons register upon passing through the only entrance (Fig. 4), and report the results of their fishing, hunting, or trapping activities upon leaving. Overnight camping is not permitted. Under this permit-type creel census a virtually complete record of fishing has been obtained since 1945. The present report summarizes the fishing results in the six lakes and two of the ponds for the 12-year period 1945-1956. The other ponds are very shallow and seldom fished; statistics on their fisheries are therefore omitted. A few general characteristics of the eight lakes and ponds are presented in Table 1.

Only the owner and his guests fished in these lakes in 1925-1944. It is assumed that the fishing pressure was very light and the yields comparatively small. Many people were attracted to the Area in 1945, no doubt with the

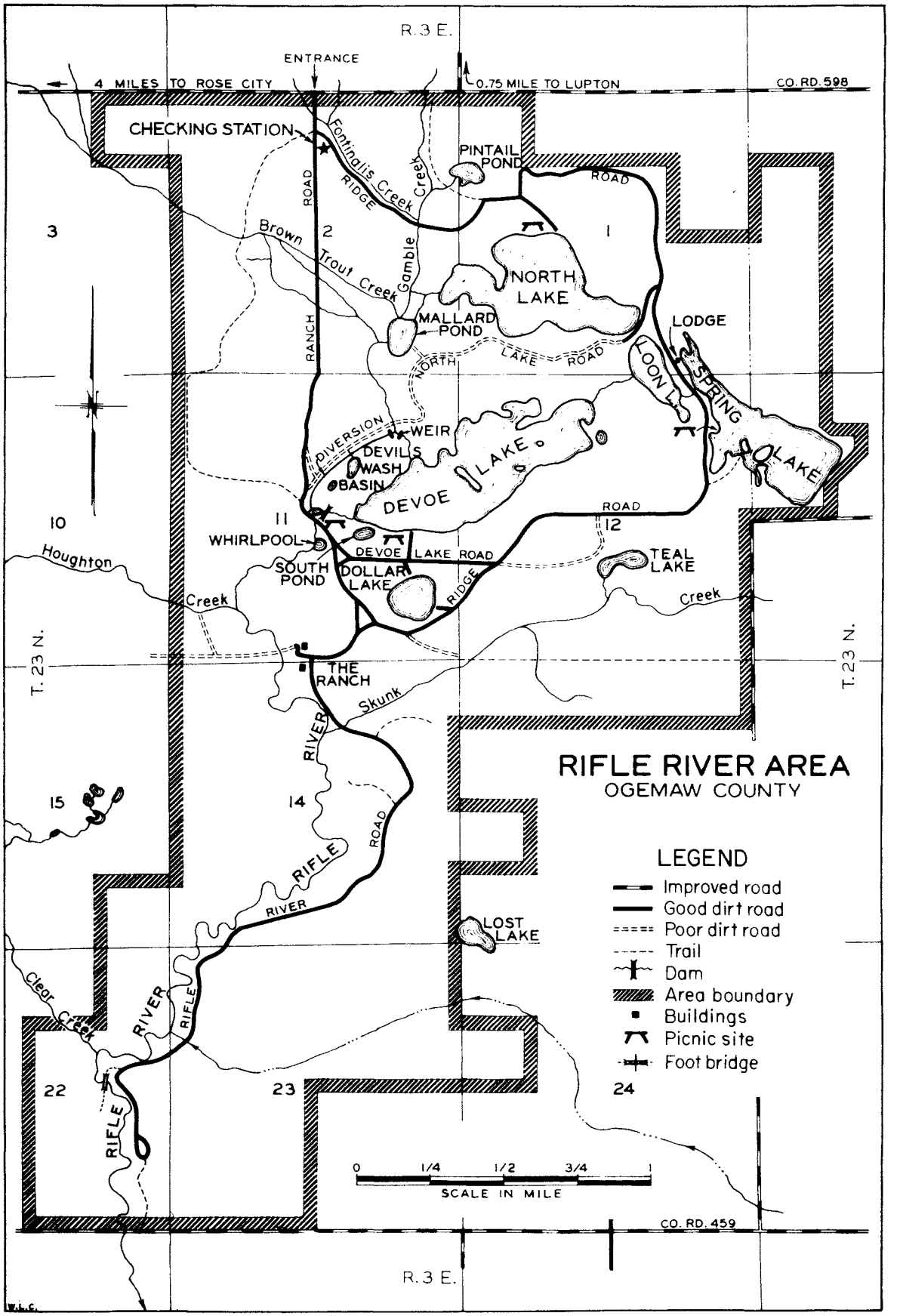

Figure 1.--The Rifle River Area, Ogemaw County.

Figure 2.--Checking station near the entrance of the Rifle River Area.

Table 1.--Some characteristics of eight lakes and ponds on the Rifle River Area

Lake or pond	Area (acres)	Maximum depth (feet)	Principal bottom soil types	Vegetation	Total alkalinity[1]	Maximum annual catch by anglers 1945-1956[2]
Devoe	130.0	53	Pulpy peat; marl	Scarce	166-198	6.2
North	95.0	54	Pulpy peat; marl	Scarce	157-181	3.9
Dollar	12.9	17	Pulpy and fibrous peat	Abundant	31-33	82.8
Loon	17.2	40	Pulpy peat	Abundant	92-97	58.8
Spring	72.5	18	Pulpy and fibrous peat	Abundant	73-95	11.4
Teal	5.8	15	Pulpy and fibrous peat	Abundant	120-121	10.5
South Pond	1.3	19	Fibrous peat	Scarce	122-160	28.5
Devils Wash Basin	1.3	15	Pulpy and fibrous peat	Scarce	126	20.8

[1] Values represent p.p.m. methyl orange alkalinity near the top and bottom of the lake in the summer. Total alkalinity (in natural waters) is a measure of the amount of carbonates, chiefly calcium, which influence the production of plant and animal life.

[2] Pounds of wild fish per acre.

thought that a fishing paradise awaited them. At that time Devoe, North, and Dollar lakes, and South Pond, which are not subject to winterkill, probably contained their full natural carrying capacity of fish. The yields in 1945, from these lakes that previously had been relatively unexploited, are compared here with subsequent harvests.

In making comparisons one should keep in mind that certain regulations governing the taking of pan fish were liberalized during the 12-year period of creel census (Christensen, 1953). From 1945 to 1948 a minimum-size limit of 6 inches was in effect for all pan fish, and fishing for bluegills and pumpkinseeds was prohibited between March 1 and June 24. The size limit was removed in 1949, and the closed season was gradually reduced during the next 6 years until it was eliminated in 1955.

Pertinent creel census data collected since 1945 include number of fish, total weights, hours fished, method of fishing, and type of lure. Base lengths were measured individually and enough scale samples were taken to provide information on year-class strength. Few fish of other species were measured in 1945-1955. In 1956 a large proportion of the fish were measured and many were scale-sampled, so that reasonably good estimates could be made of the age composition of the catch.

The common and scientific names of the species of fish to which reference is made in the text and tables are as follows:

Brown trout, Salmo trutta

Rainbow trout, Salmo gairdneri

American smelt, Osmerus mordax

Northern pike, Esox lucius

White sucker, Catostomus commersoni

Carp, Cyprinus carpio

Golden shiner, Notemigonus crysoleucas

Bullhead, Ictalurus spp.

Smallmouth bass, Micropterus dolomieui

Largemouth bass, Micropterus salmoides

Bluegill, Lepomis macrochirus

Pumpkinseed, Lepomis gibbosus

Longear sunfish, Lepomis megalotis

Rock bass, Ambloplites rupestris

Black crappie, Pomoxis nigromaculatus

Yellow perch, Perca flavescens

The species of bullheads were not identified in the creel census but probably were the brown bullhead, Ictalurus nebulosus, and the black bullhead, Ictalurus melas. The term "hybrid sunfish" as used in this paper refers to crosses of bluegill x pumpkinseed.

Devoe Lake

Devoe Lake (background, Fig. 10) is a marl lake of 130 acres with a maximum depth of 53 feet. The littoral area is confined to a narrow shelf around most of the lake, and around its three small islands (Fig. 3). Vegetation is sparse except in the vicinity of the Gamble Creek inlet. A small inlet also enters the lake from Loon Lake, and the outlet is the source of the Rifle River. A small dam in the outlet affords some control of the lake water level, and it is possible to hold a 3-foot head of water.

Fishing pressure and yields.--Among the Area lakes, Devoe Lake had the largest number of fishermen each year in 1945-1956, perhaps because it is the largest lake and is scenically attractive. The presence of stocked rainbow trout also apparently drew many anglers to this lake. Over the 12-year period, 11,380 anglers fished Devoe Lake and caught 14,270 fish.

The greatest angling activity on Devoe Lake was in 1945, the first year of public fishing, when 1,497 anglers fished for 5,800 hours (Table 2). On the average, only 914 anglers fished the lake each year in 1946-1956. Fishing pressure ranged from a high of 44.6 hours per acre in 1945 to a low of 15.5 hours in 1946; it averaged only 24.2 hours in the 11 years following 1945.

By far the largest number of fish caught, the highest catch per hour, and the greatest percentage of successful fishermen[1] in Devoe Lake were recorded in 1953, when 3,960 fish were taken at the rate of 0.9 fish per

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[1] A "successful" angler is one who caught at least one fish.

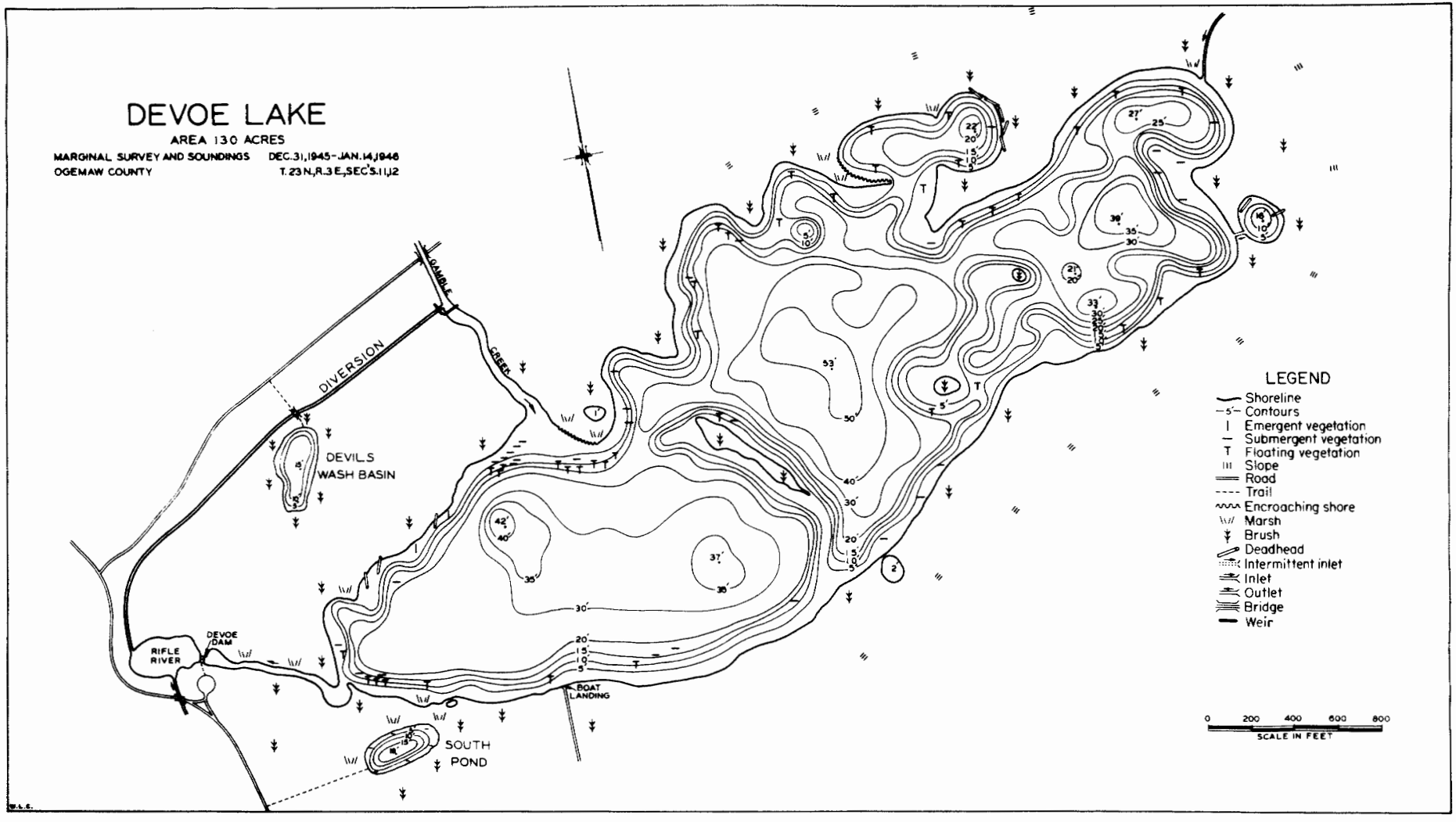

Figure 3.--Hydrographic map of Devoe Lake, Devils Wash Basin, and South Pond, Rifle River Area.

Table 2.--A comparison of fishing pressure, total yield, and fishing quality for Devoe Lake in 1945 with the years 1946-1956

Year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful[1]
1945	1,497	5,800	44.6	755	810	6.2	0.13	19
1946	575	2,020	15.5	144	118	0.9	0.07	11
1947	671	2,431	18.7	560	263	2.0	0.23	25
1948	680	2,230	17.2	293	262	2.0	0.13	24
1949	1,426	4,730	36.4	789	675	5.2	0.17	28
1950	961	3,157	24.3	532	320	2.5	0.17	19
1951	698	2,472	19.0	1,380	341	2.6	0.56	33
1952	728	2,380	18.4	1,780	403	3.1	0.75	36
1953	1,253	4,401	33.9	3,960	882	6.8	0.90	49
1954	1,159	4,389	33.8	1,989	423	3.3	0.45	30
1955	858	2,697	20.7	1,068	338	2.6	0.40	27
1956	1,044	3,762	28.9	1,020	372	2.9	0.27	29
Mean, 1946-1956	914	3,152	24.2	1,229	400	3.1	0.37	28

[1] A "successful" angler caught at least one fish.

hour and 49 percent of the fishermen creeled one or more fish. The largest poundage of native fish was caught in 1945, however, when 810 pounds were taken, as compared to an average of only 336 pounds in 1946-1956.[2]

Most of the fishing in Devoe Lake was in the summer (this also was generally true for other Area lakes).[3] Little winter fishing was done and fall fishing pressure was generally light, but Devoe Lake had more spring fishing than other lakes on the Area.

Devoe Lake is a relatively unproductive lake, due to extensive deposits of marl and limited shoal area. Aside from the contributions made by planted rainbow trout, the annual harvest in 1945-1956 ranged from only 0.9 to 6.2 pounds per acre.

Species composition of the catch.--At least 16 species of fish were caught in Devoe Lake, of which 11 may be considered numerically important (Table 3). Yellow perch contributed more than 60 percent of the catch in 1945-1956, and rock bass and rainbow trout were next in importance. Of particular interest are the fishing records for 1945, when large fish were the rule rather than the exception. Pike, smallmouth and largemouth bass, and brown trout dominated the catch by weight. Although the catch per hour was poor (0.13) and only 19 percent of the anglers were successful, more pike and bass were caught than in any later year.

Fish caught in Devoe Lake in 1956 were markedly smaller than in 1945 (the first year of public fishing) and five of seven species were smaller

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[2]Although 882 pounds of fish were caught in 1953, this catch included 441 hatchery-reared rainbow trout weighing 214 pounds (24 percent of the total weight of the catch). In 1949, stocked rainbow trout comprised an even greater proportion (43 percent) of the total weight.

[3]Seasonal fishing periods referred to in this paper are as follows: spring--open-water angling prior to opening date of bass season; summer--opening day of bass season through Labor Day; fall--open-water angling after Labor Day; winter--ice fishing.

Table 3.--Numbers of fish of different species caught in Devoe Lake, 1945-1956

Species	Year												Total 1945-1956
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
Brown trout	25	9	30	49	81	32	6	3	4	18	17	36	310
Rainbow trout	...	...	1	28	334	18	26	2	441	95	53	85	1,083
Northern pike	67	7	8	7	4	15	16	14	4	1	...	2	145
Smallmouth bass	88	19	50	30	74	50	46	55	83	35	40	80	650
Largemouth bass	70	5	16	14	8	18	22	24	14	14	6	19	230
Bluegill	92	3	49	15	13	72	61	75	85	84	103	28	680
Pumpkinseed	48	...	9	2	1	5	24	7	27	5	3	72	205
Rock bass	123	24	72	31	54	106	169	58	193	75	158	149	1,212
Black crappie	2	2	5	...	2	...	22	9	56	16	47	87	248
Yellow perch	415	72	182	98	155	181	942	1,508	2,996	1,619	573	426	8,970
White sucker	25	3	15	18	62	35	38	21	51	26	62	21	377
Bullheads	...	...	...	1	1	...	1	3	6	4	4	5	25
Miscellaneous[1]	...	...	123	...	...	...	1	1	...	...	...	10	135
Total	755	144	560	293	789	532	1,380	1,780	3,960	1,989	1,066	1,020	14,270

[1] Includes 91 smelt and 32 golden shiners in 1947; 1 hybrid sunfish in 1951; 1 carp in 1952 and 2 in 1956; and 6 longear sunfish in 1956.

than in 1949 (Table 4). The mean weights of pan fish caught in 1945 (when the minimum-size regulation was in effect) would be expected to exceed those in 1949 (when this restriction was removed) and in subsequent years. However, the weights of bluegills and rock bass caught in 1949 were also greater than the weights of fish caught in 1956. The data indicated a progressive decrease in the average size of fish caught during the 12 years of public fishing.

Largemouth bass and northern pike never recovered from the initial exploitation in 1945 even though angling pressure was light. Seventy largemouth bass were caught in 1945, 81 percent of which were 13 to 17 inches long; but in the subsequent 11 years only about half of the mean catch of 15 fish was in this size range. The decline in numbers of northern pike was even greater. Sixty-seven were caught in 1945 (of which about half were 23 to 27 inches long), but an average of only nine pike were caught annually between 1946 and 1953, and a total of only three in 1954-1956. The reduction in numbers of large predatory fish occurred rather quickly. Three-fourths of the pike and 40 percent of the brown trout caught in 1945 were taken before June 24, the opening date of the bass season; 42 percent of the largemouth bass and 31 percent of the smallmouth bass were caught during the first week of the bass season.

The recruitment of largemouth bass and pike was unquestionably retarded by the poor environment afforded by Devoe Lake for these species. Shallow, weedy areas desirable for spawning and cover for small fish were scarce. Scarcity of spawning areas, cover, and food organisms for young fish, and perhaps the abundance of small perch (which may have a deleterious effect on the survival of young bass through competition for food and perhaps predation) probably are among the factors which limited production of largemouth bass. The decline of northern pike must be associated principally with poor reproduction facilities. Local residents are probably correct in claiming that

Table 4.--The average weight in ounces of eight species of fish caught in Devoe Lake in 1945, 1949, and 1956 (Total number of fish in parentheses)

Species	Year		
	1945	1949	1956
Brown trout	63.4 (25)	29.9 (81)	17.5 (36)
Northern pike	72.0 (67)	73.5 (4)	24.5 (2)
Smallmouth bass	24.5 (88)	16.3 (74)	18.7 (80)
Largemouth bass	26.0 (70)	36.3 (8)	20.3 (19)
Bluegill	4.2 (92)	3.1 (13)	2.8 (28)
Pumpkinseed	4.2 (48)	....	2.3 (72)
Rock bass	4.9 (123)	4.7 (54)	2.7 (149)
Yellow perch	3.0 (215)	1.6 (155)	2.0 (426)

the lake once had a large pike population. Years ago, when logs were floated out of the lake and down the Rifle River, the lake level was raised before sending the logs down, thereby flooding adjacent lowland and potholes in the early spring. (The dam used was larger than the structure now in the outlet.) Good spawning areas for pike probably were created and the species could maintain itself easily since there was little angling pressure. The former owner objected to the presence of pike, however, and carried out a netting program (of unknown intensity) to remove as many pike as possible. The pike population was heavily exploited in 1945 and, in addition, 11 pike trapped in weirs in Gamble Creek in 1953-1956 have been removed, with the objective of improving the survival of planted rainbow trout. Spawning facilities are no longer available in the lake. In order to spawn, pike must either migrate up Gamble Creek to Mallard Pond, or else move downstream to the 'whirlpool' area just off the main channel of the Rifle River (Fig. 1). Possibly the species could be re-established by the manipulation of water levels in early spring.

In contrast to the poor recruitment of largemouth bass and pike, reproduction of smallmouth bass was adequate to sustain a small fishery for the species. The largest catches (74 to 88 fish) were in 1945, 1949, 1953, and 1956.

Age composition of the catch.--Scale samples were obtained from 95 percent of the smallmouth bass caught in Devoe Lake between 1951 and 1956; all bass were measured in other years and a few scale samples were collected. Scale samples also were collected from perch during some years and from all species in 1956.

Ages were assigned to most smallmouth bass caught before 1951 from a table of age-length frequencies prepared from the 1951-1956 data, and the

age-composition of the catches was estimated for all years (Table 5). Bass caught in Devoe Lake ranged from 1 to 10 years old; 3-year-old fish predominated in 8 of the 12 years and 2-year-olds occurred most frequently during the other four seasons. Smallmouth bass older than 4 years were more strongly represented in the catch in 1945 than during any subsequent year; this suggests that (as might be expected) the mortality rate was less during the years of lower exploitation before 1945 than during the subsequent 11 years.

The estimated total numbers of smallmouth bass of several year classes caught by anglers in the 12-year period are shown in Figure 4. Fishermen caught a mean of 50 bass from the hatches between 1943 and 1952. The 1947 year class contributed the largest number (86) because of both a strong year class and heavy fishing pressure in 1949 (Table 2). Fishing pressure and the catch of smallmouth bass were also high in 1953, but even though 49 percent of the catch was from the 1950 year class (3-year-old fish), there is no indication that this year class was much stronger than average.

Ninety-one percent of 115 scale samples of perch collected in 1952 and 75 percent of 92 samples in 1953 were from either the 1948 or 1949 year classes, indicating that these groups probably were largely responsible for the large catches of perch in 1951-1954. In 1956, when 47 percent of the perch caught were either scale-sampled or measured, 75 percent were estimated to be either 2 or 3 years old. No perch older than 7 years were caught.

Few black crappies were caught in Devoe Lake prior to 1951, but this species appeared in the catches more frequently in later years. Forty percent of the 87 crappies taken in 1956 were 2-year-old fish; crappies as old as 8 years were caught. Of 149 rock bass caught in 1956, 61 percent were 3 years old.

Rainbow trout plantings.--Between 1948 and 1955 Devoe Lake was stocked with 12,977 rainbow trout of legal size and 7,565 fingerlings (Table 6). Of

Table 5.--The estimated numbers of smallmouth bass of different ages caught by fishermen in Devoe Lake, 1945-1956

Age group	Year												Total 1946-1956
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
I	...	...	...	...	...	...	...	...	...	...	3	4	7
II	21	3	9	3	38	6	4	1	8	14	7	35	128
III	40	10	22	43	22	28	26	25	41	12	26	20	255
IV	20	4	11	2	11	11	13	21	18	7	2	15	115
V	6	1	2	1	...	...	3	4	8	2	2	1	24
VI	9	1	1	1	3	4	...	3	3	...	...	2	18
VII	7	...	1	...	...	...	...	1	3	...	...	2	7
VIII	1	...	...	...	...	...	...	...	1	...	...	1	2
IX	...	...	...	...	...	1	...	...	...	...	...	...	1
X	...	...	...	...	...	...	...	...	1	...	...	...	1
Total[1]	84	19	46	30	74	50	46	55	83	35	40	80	558

[1] The totals for 1945 and 1947 do not agree with totals in Table 3 because four fish in each year were not measured.

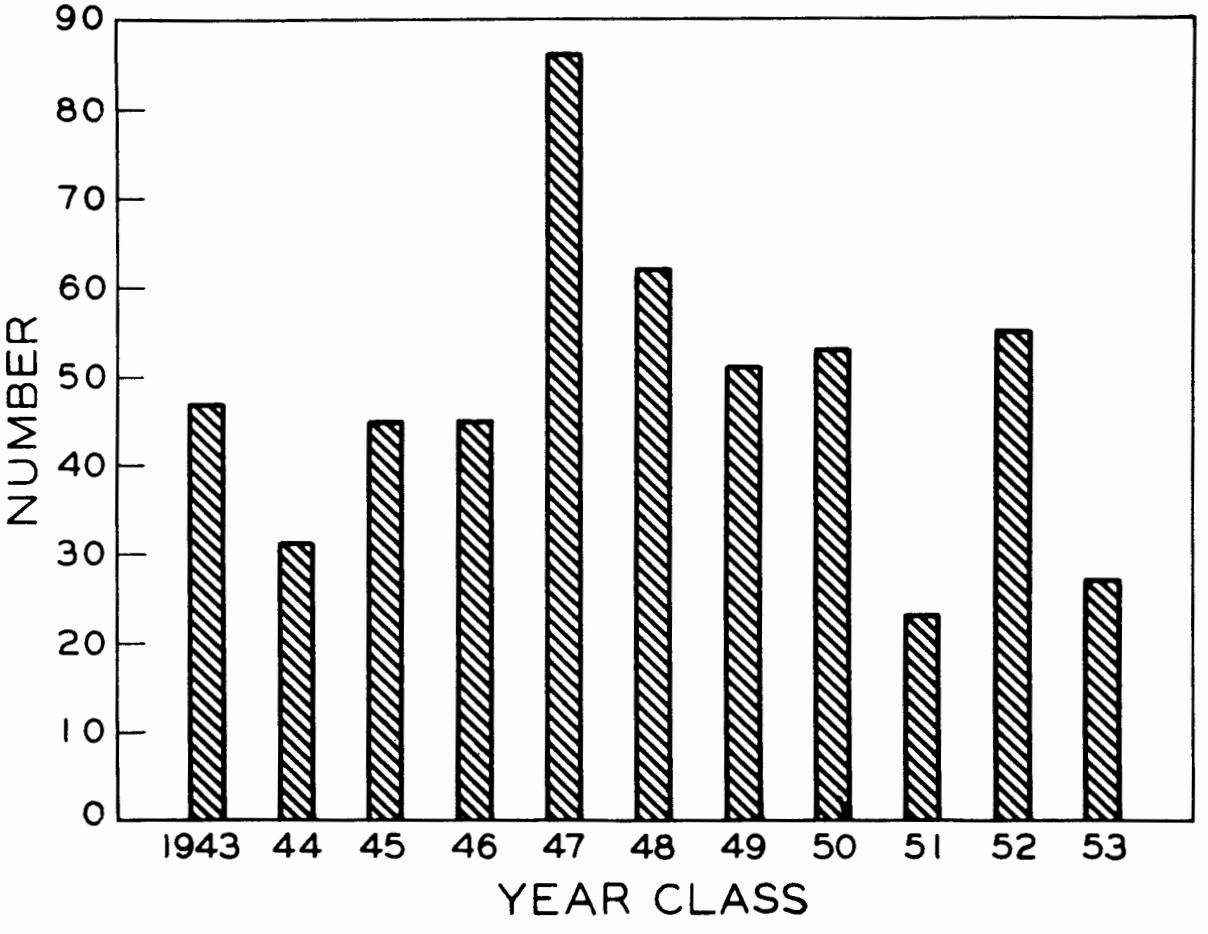

Figure 4.--Estimated total numbers of several year classes of smallmouth bass caught by anglers in Devoe Lake, 1945-1956.

Table 6.--Numbers of hatchery-reared rainbow trout stocked in Devoe Lake and recovered by anglers in the Lake (L) or in Area streams (S), 1948-1956

Size of fish, and season and date of planting	Number of fish stocked	Trout season of recapture[1] 1 L	1 S	2 L	2 S	3 L	3 S	4 L	4 S	Total recovery Number L	Total recovery Number S	Total recovery Percentage (L + S)
Legal size												
Spring												
April 30, 1948	1,983	28	14	334	44	16	12	3	0	382[2]	70	22.8
April 13, 1951	1,000	18	183	0	1	0	0	0	0	18	184	20.2
May 5, 1953	4,000	429	0	93	8	13	8	2	3	537	19	27.8
May 17, 1955	1,000	0	0	4	0	..	..	..	..	4	0	0.4
1948-1956	5,983	475	197	431	53	29	20	5	3	941	273	20.3
Fall												
Nov. 28, 1949	1,000	1	8	0	3	1	7	0	0	2	18	2.0
Nov. 3, 1950	1,000	5	84	1	2	1	0	0	0	7	86	9.3
Oct. 31, 1951	2,992	0	47	6	0	1	0	0	0	7	47	1.8
Dec. 3, 1954	1,000	30	96	6	2	..	..	..	..	36	98	13.4
Oct. 26, 1955	1,002	62	55	..	..	..	..	..	..	62	55	11.7
1949-1956	6,992	98	290	13	7	3	7	0	0	114	304	6.0
Fingerling												
Fall												
Oct. 15, 1954	7,565	0	46	0	14	..	..	..	..	0	60	0.8

[1] First season is the first trout season following the planting; other seasons (2,3,4) refer to subsequent trout seasons.

[2] Total includes one fish recaptured during the sixth season after planting.

the legal-size plantings, 1,632 trout (12.6 percent) were caught in Area waters (1,055 in Devoe Lake and 577 in streams). Only the spring plantings of legal-size fish in 1948-1953 provided a reasonably good return to the angler (24.3 percent); most were caught in the spring soon after the opening of the trout season. The extremely poor returns from the May 1955 planting are unexplained. Of the total recoveries from spring plantings, 78 percent were from Devoe Lake, although more than 90 percent of the recaptures of fish planted in 1951 were recovered from Area streams. Returns from fall stocking were generally poor (6.0 percent, with a range of 1.8 to 13.4 percent for different plantings); only 27 percent of the recoveries were from the lake. Returns from the planting of fingerling fish in 1954 were especially poor (only 0.8 percent by the end of 1956); all recoveries were from Area streams. The stocking of rainbow trout in Devoe Lake not only added to the anglers' catches, but also attracted many anglers who otherwise would not have fished there.

Fishing methods.--The preferred method of angling in Devoe Lake was still-fishing from a boat. From 1945 to 1950, minnows (Cyprinidae) were used most frequently for bait. In 1951 there was an abrupt change from minnows to earthworms, and this bait gained in popularity each year; by 1956 the ratio of 'worm' fishermen to 'minnow' fishermen was 12 to 1.

Some trolling was done each year with a variety of lures but with only limited success until 1953, when many trollers used a worm and spinner combination to catch 225 rainbow trout (mostly from a spring planting of 2,000 legal-sized trout). This lure combination also was used extensively in 1954 (525 hours), but only 26 trout were caught (no planting in the spring of 1954).

Anglers who trolled or cast artificial lures in Devoe Lake had poor fishing. In 1945, 352 fishermen caught 56 fish (including 23 pike and 27 bass) by casting artificial lures. An average of only 84 anglers per year

have fished in this manner since 1945, and they have taken an average of 19 fish (including 10 bass) each year. The few fishermen who trolled with plugs and spoons also were generally unsuccessful.

North Lake

North Lake, the second largest lake on the Rifle River Area, is a marl lake with an area of 95 acres and a maximum depth of 54 feet (Fig. 5). The shoal area is narrow, very shallow, and almost devoid of aquatic plants. The white shoreline of nearly pure marl is bounded by an abrupt drop-off into deep, blue-green water. The lake has four submerged marl islands, and two long, submerged, shallow bars of marl extend out into the open water. The outlet of North Lake runs from a small bay at the southwest end of the lake into Gamble Creek and Mallard Pond, but when the streams are high the current reverses and water flows into the lake; there is no other inlet. This is the most scenic lake on the Area, and probably one of the most attractive in Michigan (see frontispiece), but it is a poor producer of fish.

Fishing pressure and yields.--Fishing pressure on North Lake was light in 1945-1956 (Table 7). In 1945, 572 anglers fished for a total of 1,696 hours, or at the rate of 17.9 hours per acre. Fishing intensity in the following 11 years averaged only 10.5 hours per acre, a drop of 42 percent. The catch per hour varied between 0.08 (1950) and 0.57 (1948). One-third of the fishermen were successful in 1945, but in other years an average of only 20 percent of the anglers caught one or more fish.

The maximum annual yield (in 1945) was 370 pounds of fish (3.9 pounds per acre). In 1946-1957, the mean annual yield was a meager 1.3 pounds per acre. Only 3,211 fish, with a total weight of 1,696 pounds, were caught in 12 years of public fishing.

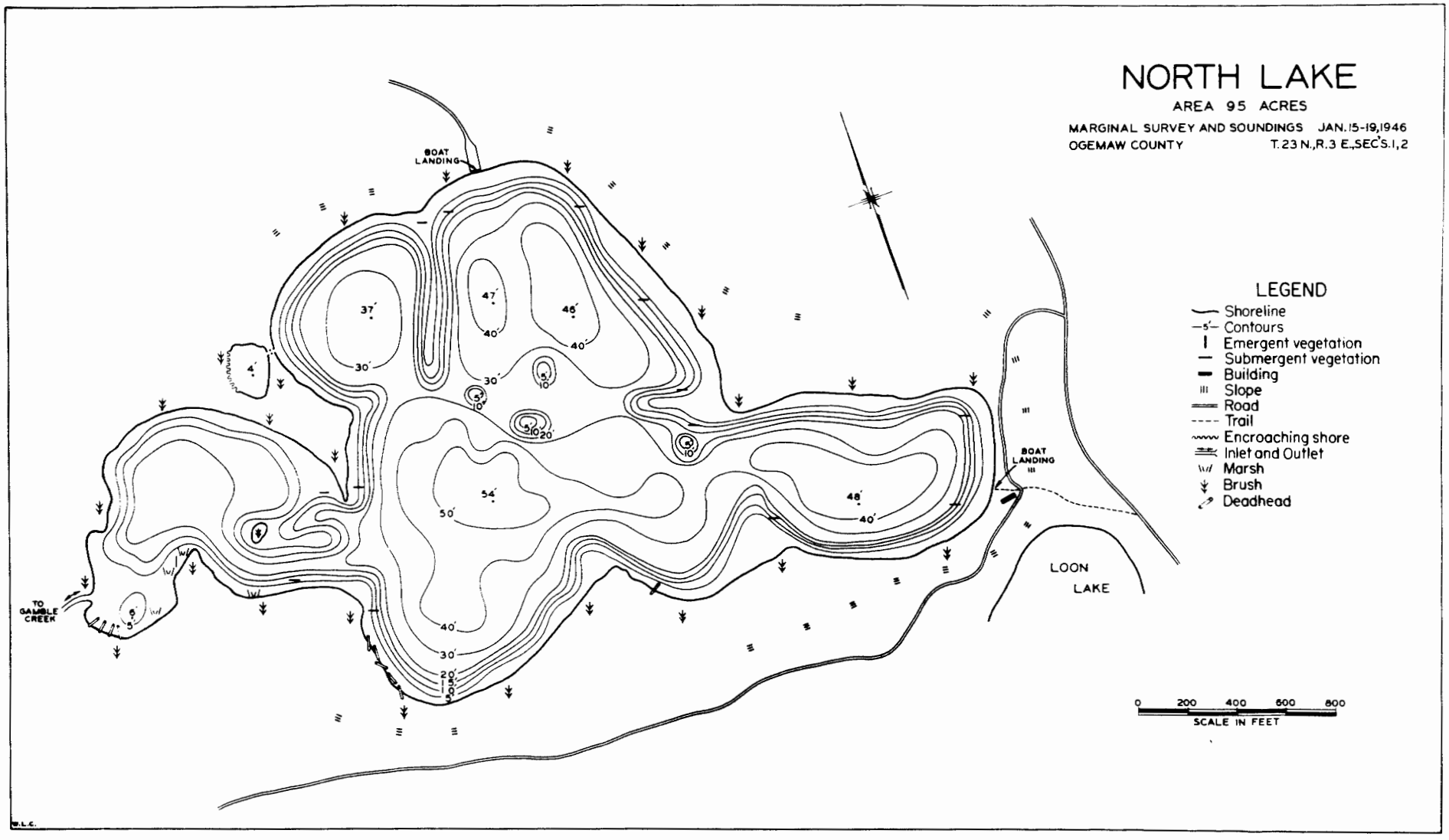

Figure 5.--Hydrographic map of North Lake, Rifle River Area.

Table 7.--A comparison of the fishing pressure, total yield, and fishing quality for North Lake in 1945 with the years 1946-1956

Year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful
1945	572	1,696	17.9	603	370	3.9	0.36	34
1946	216	611	6.4	226	100	1.1	0.37	27
1947	185	414	4.4	88	49	0.5	0.21	16
1948	451	1,368	14.6	605	339	3.6	0.57	30
1949	284	795	8.4	160	97	1.0	0.20	23
1950	321	1,003	10.6	89	86	0.9	0.08	13
1951	273	946	10.0	209	111	1.2	0.22	20
1952	234	669	7.0	117	67	0.7	0.17	21
1953	322	992	10.4	269	147	1.5	0.27	20
1954	396	1,299	13.7	134	108	1.1	0.11	15
1955	395	1,367	14.4	202	87	0.9	0.15	17
1956	403	1,434	15.1	292	135	1.4	0.20	19
Mean, 1946-1956	316	993	10.5	437	140	1.3	0.23	20

The annual harvest from both North and Devoe lakes was very poor, but low productivity is a well-known characteristic of marl lakes. Gerking (1950), for example, reported a total catch by anglers of only 1.02 pounds per acre for Oliver Lake, a marl lake in northern Indiana.

Species and age composition of the catch.--Thirteen species of fish were recorded in the catches from North Lake in 1945-1956 (Table 8). Yellow perch predominated in 11 of the 12 years and contributed an average of 58 percent of the annual catch (range, 38-76 percent). More smallmouth bass, largemouth bass, and bluegills were caught in 1945 than in any subsequent year. Fifty-nine percent of the largemouth bass were caught during the first week of the bass season, and 96 percent of the smallmouth bass were caught within the first 3 weeks.[4] The largest yields of perch and rock bass were in 1948.

Natural recruitment of largemouth bass failed to replenish the stocks in North Lake. Seventy-six largemouth bass with a mean weight of 33 ounces were caught in 1945, but an average of only 12 per year were taken in 1946-1956. Bluegills and pumpkinseeds showed a similar low level in the sport fishery in subsequent years. However, like Devoe Lake, North Lake cannot be considered a largemouth bass or sunfish lake because of the nature of the environment.

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[4] Smallmouth bass were not caught as rapidly in North (and Devoe) Lake in subsequent seasons. An average of 33 percent of the season's total was caught before July 1 in North Lake in 1946-1956, although high percentages were taken in 1954 (87 percent) and 1956 (64 percent). In Devoe Lake an average of 20 percent of the smallmouth bass were caught before July 1 in 1946-1956 (with a high of 50 percent in 1956). The higher percentages of bass caught before July 1 in both lakes in 1956 is ascribed at least in part to the presence of bass on their nests at the time of the opening of the season, because of a late spring.

Table 8.--Numbers of fish of different species caught in North Lake, 1945-1956

Species	Year												
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	Total
Northern pike	2	1	1	5	1	2	5	...	3	4	...	6	30
Smallmouth bass	50	13	17	29	30	22	25	29	39	16	24	37	331
Largemouth bass	76	13	1	45	7	9	6	3	5	12	20	10	207
Bluegill	66	37	1	9	1	1	1	9	23	14	19	5	186
Pumpkinseed	12	2	...	...	...	...	...	...	...	...	5	1	20
Rock bass	22	52	34	88	...	6	23	12	46	2	38	21	342
Yellow perch	366	106	33	613	119	49	147	62	135	96	92	199	2,017
White sucker	5	2	1	3	...	2	...	...	...	4	...	4	21
Bullheads	4	...	...	3	1	...	2	2	13	1	3	3	32
Miscellaneous[1]	...	...	...	10	1	...	...	...	3	5	1	6	28
Total	603	226	88	805	160	89	209	117	269	154	202	292	3,214

[1] Includes 6 brown trout in 1948, 1 in 1949, and 1 in 1954; 4 rainbow trout in 1948, 1 in 1955, and 1 in 1956; 5 black crappies in 1953, 1 in 1954, and 5 in 1956; and 3 carp in 1954.

The total catches of smallmouth bass were somewhat better than catches of largemouth bass, but inconsistent. Fifty were caught in 1945, but an average of only 25 were caught in 1946-1956. The estimated age compositions of the yearly catches of smallmouth bass (derived in the same manner as described for Devoe Lake) are shown in Table 9. The distribution of ages of fish in the 1945 catch generally resembles that from Devoe Lake, but seems to have shifted less toward a predominance of young fish in 1946-1956.

More smallmouth bass from the 1949 year class were caught in North Lake in 1945-1956 than from any other year class (Fig. 6). The 1947 year class also was well represented, and the 1953 year class probably will prove to be the strongest produced during the 12-year period. The latter class contributed 84 percent of the 37 smallmouth bass caught in 1956; by the end of the year it had been exploited for only two fishing seasons, whereas the previous strong year classes contributed to the fishery over a span of 6 to 8 years. The 1949 year class, for example, made its largest contribution to the catch as age-group IV. As judged by total numbers caught by anglers, the 1945, 1946, 1948, 1950, and 1952 year classes were extremely weak. Reproduction and/or survival of young bass obviously has been poor in North Lake.

Fish plantings.--Of 1,000 9-inch rainbow and 1,000 9-inch brown trout planted in North Lake in April 1948, only 4 rainbow and 6 brown trout were later recaptured. In May 1955, 1,000 7-inch rainbow trout were stocked in the lake but only 1 of these fish was recovered. No other attempts were made to provide a trout fishery in this lake. In October 1954, the lake was stocked with 15,000 fingerling bluegills and 8,000 fingerling largemouth bass.

Fishing methods.--A variety of fishing methods were used in North Lake, including trolling, casting, and still-fishing. Still-fishing and trolling

Table 9.--The estimated numbers of smallmouth bass of different ages caught by fishermen in North Lake, 1945-1956

Age group	Year												Total 1946-1956
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
I	...	...	...	...	...	1	...	...	...	...	...	...	1
II	10	4	...	...	20	...	14	4	7	1	20	2	72
III	16	2	2	1	1	17	8	20	8	13	1	31	104
IV	7	...	12	18	3	...	1	...	22	...	2	1	59
V	13	6	3	7	3	2	...	5	...	...	1	2	29
VI	2	...	...	1	3	2	...	...	2	...	...	...	8
VII	2	1	...	2	...	...	...	...	...	1	...	1	5
VIII	...	...	...	...	...	...	2	...	...	1	...	...	3
Total	50	13	17	29	30	22	25	29	39	16	24	37	281

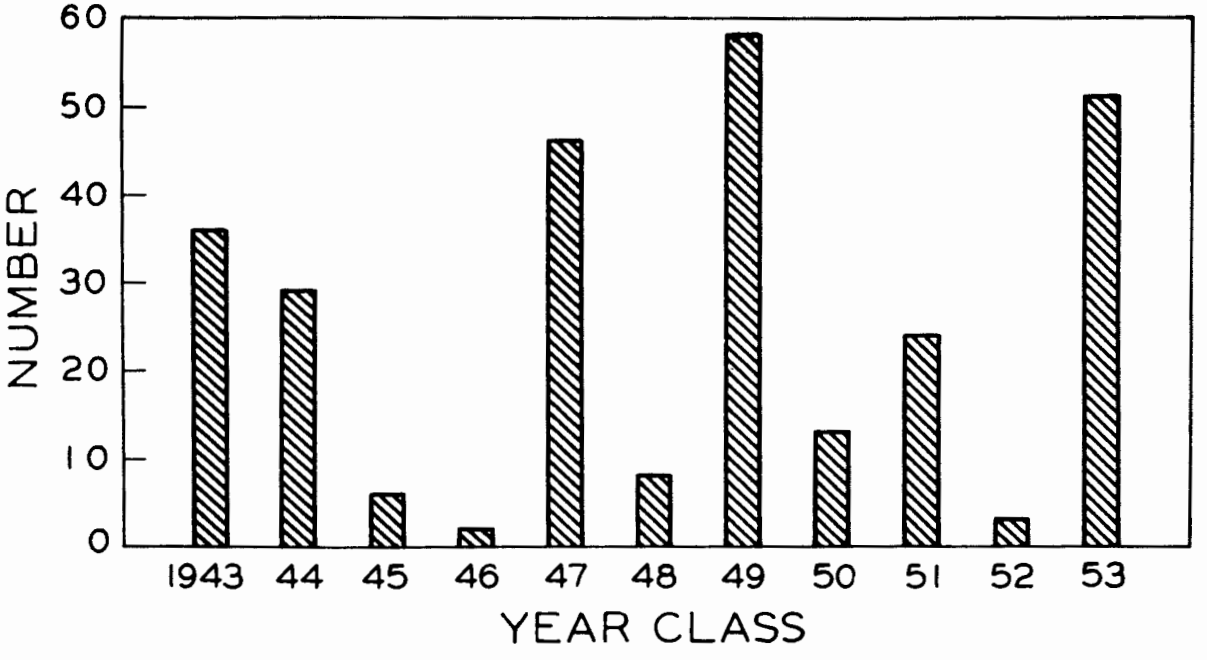

Figure 6.--The estimated total numbers of several year classes of smallmouth bass caught by anglers in North Lake, 1945-1956.

were methods used most frequently, and most of the angling was done during the summer season. The catches were so small that no further analysis was attempted.

Dollar Lake

Dollar Lake is a small, circular body of water with an area of 12.9 acres (Figs. 7 and 8). More than half of the lake is less than 10 feet deep, and the maximum depth is 17 feet. The fibrous and pulpy peat bottom materials support stands of floating vegetation around the periphery of the lake and submerged plants in the deeper parts. The lake has no outlet or inlet.

Fishing pressure and yields.--For its size, this lake had more fishing pressure during most of the 1945-1956 period than any other lake on the Rifle River Area. In these 12 years, 4,789 fishermen fished a total of 14,113 hours and caught 24,951 fish. Fishing pressure ranged from 52.5 hours per acre in 1949 to 145.2 hours in 1954 (Table 10).

More anglers fished Dollar Lake in 1945 than in any other year. They caught 4,804 fish at the rate of 2.58 fish per hour, and 70 percent of the fishermen were successful. More than 1,000 pounds of fish were caught (82.8 pounds per acre)--a much larger catch than in any later year. The 1945 fishing pressure of 144.4 hours per acre was only 60 percent greater than the average for 1946-1956, but the harvest of fish was three times as great. Although Dollar Lake again was fished more than 140 hours per acre in 1954, the catch was only about half that of 1945. The initial heavy fishing pressure and yields of 1945 definitely affected the abundance of fish and fishing quality in Dollar Lake in subsequent years.

Species and size composition of the catch.--Seven species were numerically important in the Dollar Lake fishery (Table 11). Bluegills comprised 56 percent

Figure 7.--Dollar Lake, Rifle River Area.

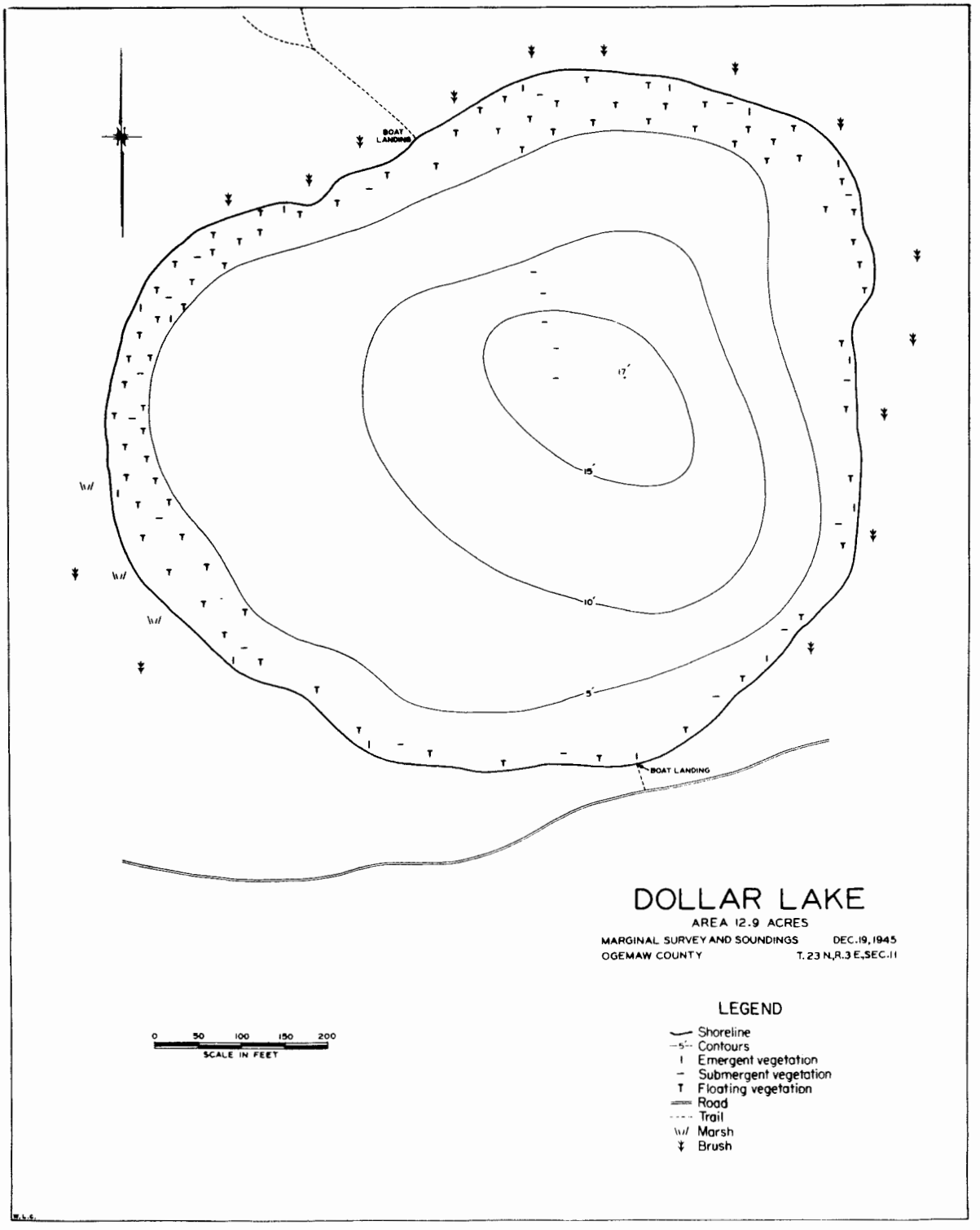

Figure 8.--Hydrographic map of Dollar Lake, Rifle River Area.

Table 10.--A comparison of the fishing pressure, total yield, and fishing quality for Dollar Lake in 1945 with the years 1946-1956

Year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful
1945	629	1,863	144.4	4,804	1,068	82.8	2.58	70
1946	385	1,141	88.4	1,482	346	26.8	1.30	57
1947	460	1,373	106.4	1,611	365	28.3	1.17	66
1948	335	994	77.1	1,025	205	15.9	1.03	70
1949	239	677	52.5	1,481	287	22.2	2.19	81
1950	244	703	54.5	1,544	285	22.1	2.20	77
1951	370	1,035	80.2	2,499	430	33.3	2.41	87
1952	445	1,313	101.8	2,322	453	35.1	1.77	76
1953	333	977	75.7	2,256	333	25.8	2.31	78
1954	580	1,873	145.2	3,103	553	42.9	1.66	70
1955	363	1,089	84.4	1,322	276	21.4	1.22	58
1956	406	1,075	83.3	1,502	250	19.4	1.40	57
Mean, 1946-1956	378	1,114	86.4	1,831	350	27.1	1.70	71

Table 11.--Numbers of fish of different species caught in Doller Lake, 1945-1956

Species	Year												Total
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
Largemouth bass	99	31	45	15	23	32	84	40	28	60	61	37	555
Bluegill	2,688	909	1,113	649	960	982	1,816	1,740	1,627	2,314	910	1,104	16,812
Pumpkinseed	1,013	150	136	95	220	177	82	143	151	117	83	161	2,528
Hybrid sunfish	...	...	...	16	10	21	37	20	...	...	...	...	104
Rock bass	41	41	47	43	47	46	61	74	42	62	39	28	571
Black crappie	595	115	92	49	41	47	159	151	157	299	48	71	1,824
Yellow perch	315	184	111	94	90	175	190	119	204	202	146	87	1,917
White sucker	3	...	...	...	...	...	...	1	...	...	...	...	4
Bullheads	50	52	67	64	90	64	70	33	49	48	35	14	636
Total	4,804	1,482	1,611	1,025	1,481	1,544	2,499	2,322	2,256	3,103	1,322	1,502	24,951

of the catch in 1945, and were even more prominent in the catches in later years (61-75 percent of the catch). The 1,013 pumpkinseeds caught in 1945 made up 21 percent of the catch, but this heavy exploitation apparently depleted the stock. An average of only 139 pumpkinseeds per year were caught during the 11 subsequent years. Similarly, many more largemouth bass, crappies, and perch were caught in 1945 than in the following years, but there was less variation in the annual harvest of rock bass and bullheads. Forty-five percent of the bass caught in 1945 were taken before July 1.[5]

The mean catches per hour of the seven species of fish taken by still-fishing with worms from a boat (the method employed by 64 percent of all fishermen in Dollar Lake) are in fairly good agreement (Table 12) with total catch figures (Table 11) in showing the relative abundance of various species in Dollar Lake from year to year. Judging by average catches per hour (only returns from summer and fall angling were used because spring fishing was prohibited from 1945 to 1952), the populations of crappies and pumpkinseeds were largest in 1945 and never recovered their original abundance. The catch of bluegills per hour declined for 3 years after 1945 but began to improve in 1949 (the year in which the 6-inch size limit was removed) and reached a peak in 1951. The catch rate of pumpkinseeds also improved briefly in 1949 and 1950, but the elimination of the size limit had no appreciable effect on the catch of crappies or perch. (Most Area anglers did not keep crappies and perch less than 6 inches long.) The removal of large numbers of fish in 1945 may have upset the population balance achieved through the years so that the bluegill, which probably

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[5] Largemouth bass were not as readily caught in Dollar Lake by early season fishermen in subsequent years. An average of only 15 percent of the season's catch was taken before July 1 in 1946-1956. Apparently largemouth bass did not lose their vulnerability to angling soon after the opening of the season (in contrast to Bennett's [1954] findings in Ridge Lake, Illinois).

Table 12.--The mean catches per hour of six species of fish by anglers who still-fished with worms from a boat during the summer and fall seasons, Dollar Lake, 1945-1956

(Total number of fish in parentheses)

Year	Hours of fishing	Species					
		Blue-gill	Pumpkin-seed	Rock bass	Black crappie	Yellow perch	Bull-heads
1945	1,672	1.46 (2,448)	0.54 (905)	0.02 (41)	0.29 (489)	0.18 (301)	0.03 (44)
1946	761	0.91 (693)	0.17 (131)	0.04 (31)	0.05 (44)	0.20 (158)	0.06 (45)
1947	905	0.92 (835)	0.11 (103)	0.03 (25)	0.03 (36)	0.08 (77)	0.06 (54)
1948	646	0.78 (504)	0.13 (89)	0.05 (30)	0.06 (42)	0.13 (91)	0.07 (47)
1949	569	1.52 (864)	0.32 (186)	0.06 (36)	0.06 (39)	0.14 (84)	0.14 (78)
1950	365	1.76 (644)	0.33 (122)	0.09 (34)	0.09 (33)	0.33 (121)	0.15 (54)
1951	631	2.09 (1,316)	0.09 (58)	0.05 (34)	0.12 (82)	0.19 (122)	0.08 (53)
1952	682	1.55 (1,060)	0.10 (69)	0.06 (40)	0.13 (90)	0.11 (81)	0.04 (26)
1953	557	1.95 (1,085)	0.17 (95)	0.03 (18)	0.11 (66)	0.29 (163)	0.05 (29)
1954	1,074	1.48 (1,590)	0.05 (64)	0.04 (45)	0.11 (119)	0.14 (155)	0.04 (39)
1955	495	1.06 (524)	0.11 (59)	0.06 (28)	0.04 (21)	0.20 (99)	0.06 (31)
1956	536	1.40 (780)	0.15 (87)	0.03 (14)	0.03 (21)	0.13 (75)	0.02 (13)

has a greater reproductive potential than other centrarchids, was able to assume an even more dominant position in the lake community and to suppress the other species.

The average weights of seven species of fish caught in Dollar Lake in 1945, 1949, and 1956 are compared in Table 13. The mean weights of all species except bass were lighter in 1956 than in 1945 when anglers were not permitted to keep pan fish less than 6 inches long. However, no crappies, perch, or rock bass under 6 inches were observed in the creel census in 1956, and the size limitation would not, of course, affect the bullhead weights. More than half of the bluegills and about one-third of the pumpkinseeds taken in 1956 were less than 6 inches long, and the mean weights of fish of these two species were less in 1956 than in 1949 (the year when size limits were discarded). It is apparent that the population of pan fish in Dollar Lake in 1945 contained many more larger (probably older) individuals than were present after 12 years of more or less intensive exploitation.

Age composition of the catch.--The measurement of all largemouth bass caught in Dollar Lake in 1945-1956 and the collection of scales from 80 percent of the bass caught between 1948 and 1956 permitted estimates of the age composition of fish in the annual catches (Table 14). (Unless scale samples were available, all bass caught before 1948 were assigned ages on the basis of a table of age-length frequencies of bass caught in 1948 or later.) Bass from 2 to 12 years of age were caught, but most were 3- and 4-year-old fish. Although small bass dominated the catches in most years, the average age and size of fish caught increased gradually during the 12-year period. The 190 bass caught during the first 4 years of public fishing averaged 3.8 years in age and 11.4 inches in length; in contrast, 158 bass caught in 1954-1956 averaged 12.8 inches in length and 5.0 years in age.

Table 13.--The average weight in ounces of seven species of fish caught in Dollar Lake in 1945, 1949, and 1956

(Total number of fish in parentheses)

Species	Year		
	1945	1949	1956
Largemouth bass	8.1 (99)	13.6 (23)	15.8 (37)
Bluegill	3.3 (2,688)	2.7 (960)	2.1 (1,104)
Pumpkinseed	3.8 (1,013)	3.2 (220)	2.8 (161)
Rock bass	3.5 (41)	4.3 (47)	3.3 (28)
Black crappie	3.7 (595)	3.0 (41)	3.2 (71)
Yellow perch	3.1 (315)	2.3 (90)	2.3 (87)
Bullheads	9.7 (50)	4.8 (90)	7.2 (14)

Table 14.--The estimated numbers of largemouth bass of different ages caught by fishermen in Dollar Lake, 1945-1956

Age group	Year												Total 1946-1956
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
II	...	...	...	1	1	1	...	1	...	...	...	2	6
III	43	13	16	3	6	16	33	6	1	9	16	6	125
IV	41	14	24	8	9	8	44	18	18	5	9	16	173
V	11	3	5	1	4	1	1	13	9	34	9	1	79
VI	4	1	...	4	5	4	4	...	...	6	17	2	37
VII	...	...	...	...	...	4	1	1	...	3	3	6	20
VIII	...	...	...	...	...	...	4	...	...	1	5	2	10
IX	...	...	...	...	...	...	1	1	...	...	1	1	4
XI	...	...	...	...	...	...	...	...	...	...	1	...	1
XII	...	...	...	...	...	...	...	...	...	...	...	1	1
Total	99	31	45	15	23	32	84	40	28	60	61	37	456

The contributions made by various year classes of largemouth bass to the sport fishery of Dollar Lake are shown in Figure 9. The 1947, 1948, and 1949 year classes were strong and those of 1945, 1946, 1950, and 1951 were weak. Although the data are less dependable, the 1942 year class probably was of above-average strength. The relatively weak 1944 year class contributed to the fishery over a span of 10 years. Interpretation of the changing age composition of largemouth bass in Dollar Lake since 1945 is obscured by the three strong year classes. As noted above, more older fish were caught in recent years than in 1945; possibly the mortality rate has decreased during the period of study.

Between 1946 and 1955, 1,063 scale samples were taken from bluegills caught in Dollar Lake. However, the collections not only were small for five of those years but there is a strong possibility that the age composition of all collections was biased in favor of the larger (and older) fish. Proportionately fewer small fish (5 to 7 inches long) were scale-sampled than were caught. In general, however, the collections indicated that bluegills were at least 3 years old before they entered the catch; most were probably 4 years old; and few bluegills older than 7 years were caught.

In 1956, 95 percent of the pumpkinseeds taken in Dollar Lake were 3- and 4-year-old fish. All rock bass and crappies were at least 4 years of age. An estimated 57 percent of the perch were 3 years old and 29 percent were 2 years of age.

Loon Lake

Loon Lake (area, 17.2 acres) has an inlet from Spring Lake and an outlet into Devoe Lake (Figs. 10 and 11). A two-way movement of small fish is possible through the outlet but the height of the outfall from Spring Lake prevents upstream movement of fish out of Loon Lake. This lake contains

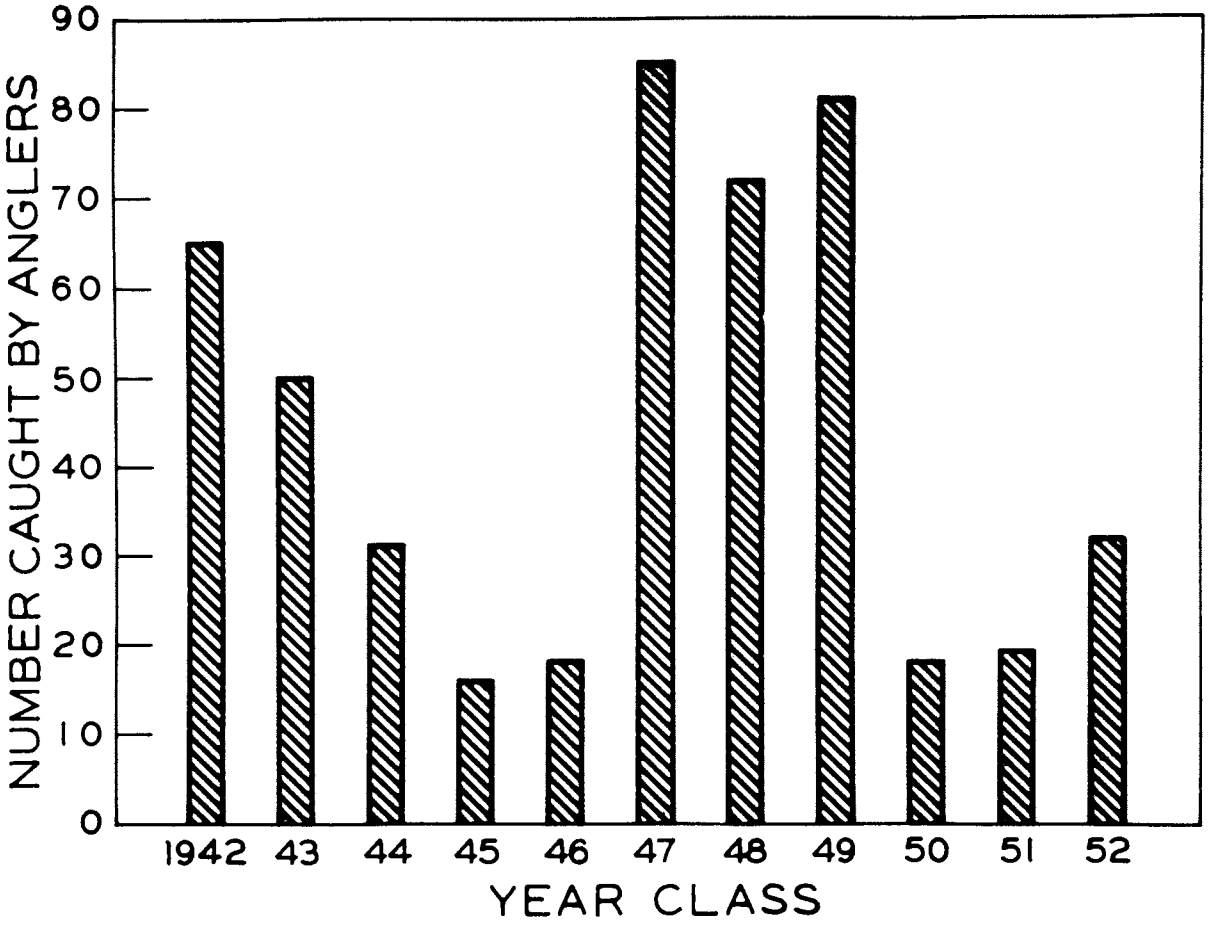

Figure 9.--The estimated total numbers of several year classes of largemouth bass caught by anglers in Dollar Lake, 1945-1956.

Figure 10.--Loon Lake, Rifle River Area, as seen from the Lodge. Devoe Lake is in the background.

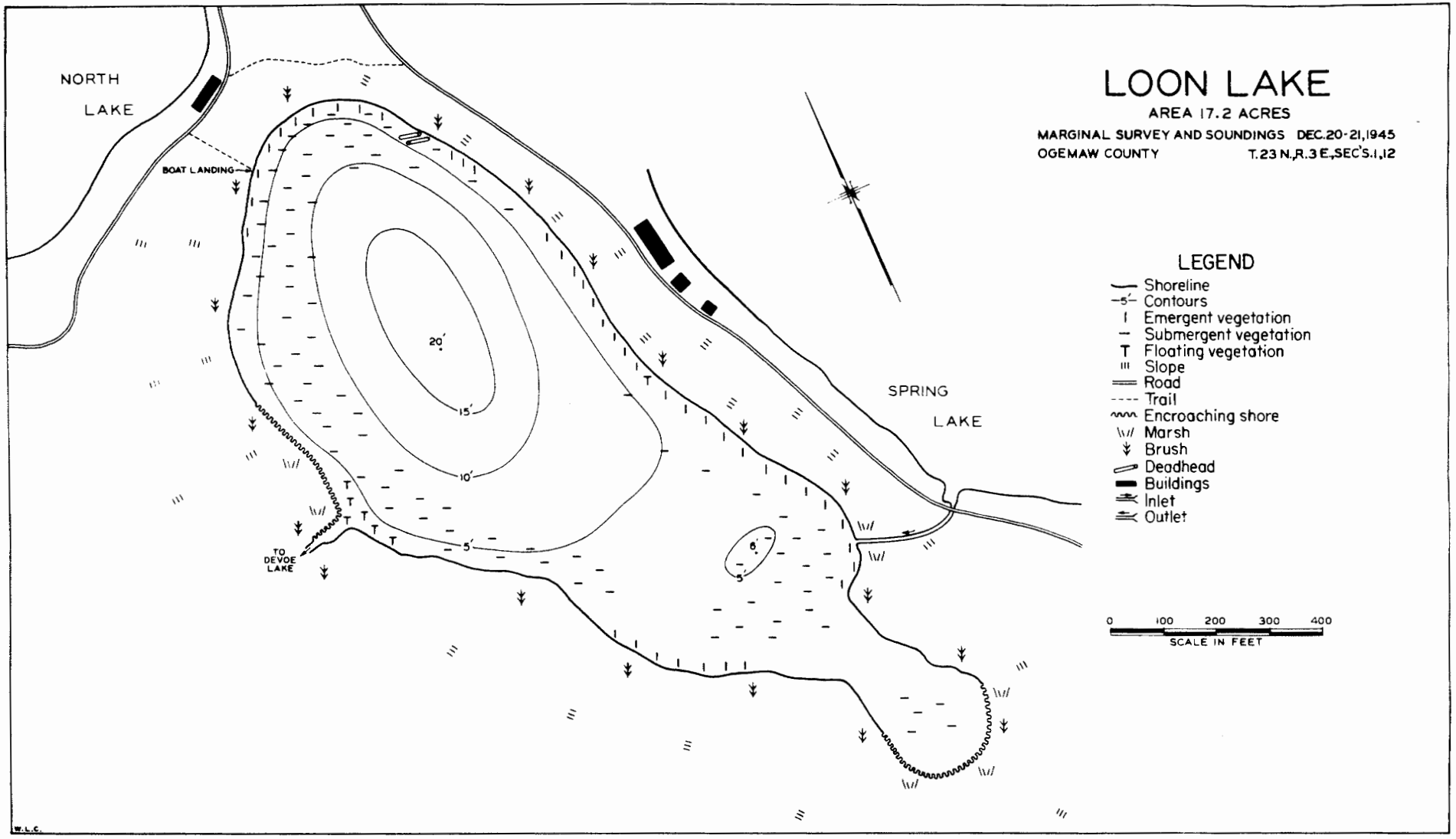

Figure 11.--Hydrographic map of Loon Lake, Rifle River Area.

much natural cover in the form of fallen trees lying in the shallow water and extensive beds of submerged vegetation. The bottom material consists mostly of pulpy peat, but some marl is mixed with it in the shallow east end of the lake. The fish fauna is similar to that in Dollar Lake.

Fishing pressure and yields.--Only 13 anglers fished in Loon Lake during the first 2 years after the Rifle River Area was opened to the public. Anglers at first favored Devoe and North lakes, presumably because of their size, and Dollar Lake because it was reputedly a favorite fishing spot of the former owners. The creel census clerks recommended these lakes to inquiring anglers because little was known about the fishing potential of the others. Consequently Loon Lake received scant attention until 1947, when a few anglers fished there and caught 37 largemouth bass. Fishing intensity then increased in subsequent seasons to a maximum in 1950, when 481 anglers fished nearly 1,500 hours and caught 4,483 fish, at the rate of 3 fish per hour; 80 percent of the fishermen caught one or more fish and the total harvest was 1,011 pounds, or 58.8 pounds per acre (Table 15). In 1951-1956, the average annual fishing pressure was 660 hours, and the mean annual yield was 77 percent below that of 1950.

Species composition of the catch.--The species of fish caught in Loon Lake were nearly identical to those caught in Dollar Lake, one exception being the three northern pike caught in Loon Lake prior to 1951 (Table 16).[6] Pumpkinseeds, bluegills, bullheads and perch dominated the fishery in 1950, when angling pressure was greatest. The peak catches of crappies and largemouth bass were in 1954 and 1955, respectively.

The catches per hour of four species of fish by fishermen who used worms for bait are compared in Table 17. Nearly all fishing was done from a boat in

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[6] Carp are known to occur in Loon Lake, but none were caught.

Table 15.--The annual fishing pressure, total yield, and fishing quality for Loon Lake, 1945-1956

Year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful
1945	3	12	0.7	...	...	...	....	..
1946	10	14	0.8	8	7	0.4	0.57	40
1947	55	169	9.8	126	42	2.4	0.75	67
1948	81	230	13.4	214	63	3.7	0.93	68
1949	200	524	30.5	849	262	15.2	1.62	62
1950	481	1,496	87.1	4,483	1,011	58.8	2.99	80
1951	401	638	37.1	2,028	390	22.7	3.17	76
1952	126	492	17.0	556	129	7.5	1.90	62
1953	185	514	29.9	740	163	9.5	1.40	63
1954	230	829	48.2	939	229	13.3	1.13	62
1955	308	976	56.7	637	280	16.3	0.65	51
1956	239	714	41.5	1,256	217	12.6	1.76	67

Table 16.--Numbers of fish of different species caught in Loon Lake, 1946-1956[1]

Species	Year											Total
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
Largemouth bass	8	37	20	82	76	11	5	6	15	117	4	381
Bluegill	...	7	99	99	1,288	579	197	325	360	294	632	3,880
Pumpkinseed	...	1	15	34	1,363	339	36	39	28	25	122	2,002
Rock bass	...	...	...	...	1	1	...	3	9	...	5	19
Black crappie	...	2	11	87	163	127	89	63	260	87	129	1,018
Yellow perch	...	75	64	124	457	289	48	96	101	22	290	1,566
Bullheads	...	4	4	423	1,132	680	180	188	165	91	70	2,937
Miscellaneous[2]	...	...	1	...	3	2	1	...	1	1	4	13
Total	8	126	214	849	4,483	2,028	556	720	939	637	1,256	11,816

[1] No fish were caught in 1945.

[2] Includes 1 northern pike in 1948 and 2 in 1950; 2 white suckers in 1951, 1 in 1954 and 1 in 1955; and 1 hybrid sunfish in 1950, 1 in 1952, and 4 in 1956.

Table 17.--The mean catches per hour of four species of fish by anglers who still-fished with worms from a boat during the summer and fall seasons, Loon Lake, 1947-1956

(Total number of fish in parentheses)

Year	Hours of fishing	Species			
		Bluegill	Pumpkinseed	Black crappie	Yellow perch
1947	38	0.13 (5)	0.08 (3)	0.03 (1)	0.71 (27)
1948	24	0.45 (11)	0.25 (6)	....	0.91 (22)
1949	119	0.18 (22)	0.09 (11)	0.04 (5)	0.69 (83)
1950	540	1.27 (686)	1.25 (679)	0.05 (28)	0.41 (226)
1951	401	0.97 (397)	0.63 (253)	0.11 (49)	0.63 (261)
1952	101	0.56 (57)	0.21 (21)	0.03 (3)	0.03 (3)
1953	304	0.73 (223)	0.05 (16)	0.13 (38)	0.22 (68)
1954	340	0.75 (254)	0.03 (10)	0.09 (31)	0.20 (68)
1955	257	0.74 (190)	0.09 (22)	0.08 (20)	0.04 (11)
1956	458	1.02 (465)	0.21 (96)	0.11 (52)	0.37 (168)

the summer months, and more anglers fished with worms than with any other bait. As judged by catch per hour, angling for bluegills and pumpkinseeds was best in 1950. The catch of perch per hour ranged from 0.41 to 0.91 between 1947 and 1951 but declined noticeably thereafter. Fishing quality for crappies remained uniformly poor. (Although the crappie catch per hour by anglers using worms in 1952 was low, fishermen who used artificial lures caught more than twice as many crappies in that year than in any other.) In Loon Lake, as in Dollar Lake, pumpkinseeds failed to recover fully after the year of peak exploitation.[1] Bluegills, on the other hand, made satisfactory recoveries in both lakes.

The mean weights of pan fish caught in 1949 or 1950, the first years of substantial harvests from Loon Lake, were compared with weights of fish caught in 1956 to determine whether exploitation had affected the average sizes of fish caught (Table 18). Crappies, perch, bluegills, and pumpkinseeds (but not bullheads) caught in 1949 or 1950 were larger than in 1956. (In contrast to most species of pan fish, the average weight of 117 largemouth bass caught in 1955 was about the same as that of 32 caught in 1949 [24 ounces].)

The heavy fishing pressure and catch of 1950 probably had a pronounced effect on fishing quality in subsequent years, but kills in the winters of 1950-1951 and 1955-1956 also undoubtedly affected later fishing success--particularly for largemouth bass.

Age composition of the catch.--The age composition of the largemouth bass caught in Loon Lake in 1946-1956 is presented in Table 19. Age-groups III or IV dominated the bass catches nearly every year, and no bass older than 4 years were caught before 1950. In 1955, however, 37 bass 5 to 8 years old were taken.

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[1] Numerous pumpkinseeds 4 to 6 inches long were caught in nets in Loon Lake in 1957, but few were taken in Dollar Lake.

Table 18.--The average weight in ounces of five species of pan fish caught in Loon Lake in 1949 or 1950, compared with weights of fish caught in 1956

(Total number of fish in parentheses)

Species	Year		
	1949	1950	1956
Black crappie	7.0 (87)	...	3.1 (129)
Yellow perch	2.9 (124)	...	1.9 (290)
Bullheads	3.6 (423)	...	5.7 (70)
Bluegill	...	3.3 (1,288)	4.9 (634)
Pumpkinseed	...	2.9 (1,363)	2.3 (122)

Table 19.--The estimated numbers of largemouth bass of different ages caught by fishermen in Loon Lake, 1946-1956

Age group	Year											Total
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
I	2	6	...	...	...	...	...	...	...	...	...	8
II	1	21	5	...	10	1	...	...	6	5	2	51
III	5	9	13	14	14	6	...	...	2	61	...	124
IV	...	1	2	68	42	3	4	2	...	14	...	136
V	...	...	...	...	10	1	...	2	3	9	1	26
VI	...	...	...	...	...	...	1	2	4	15	...	22
VII	...	...	...	...	...	...	...	...	...	11	1	12
VIII	...	...	...	...	...	...	...	...	...	2	...	2
Total	8	37	20	82	76	11	5	6	15	117	4	381

Repeated winterkills probably reduced the numbers of largemouth bass in Loon Lake. A heavy mortality occurred in the winter of 1955-1956 (only four bass were caught in 1956) and the paucity of bass in catches from 1951 to 1954 suggests that another winterkill may have occurred in 1950-1951--although the later occurrence of these missing year classes may mean that catchability had changed radically. Still earlier winterkills are suggested by the scarcity of large bass in the catches prior to 1950.

As shown in Figure 12, the 1945 year class contributed far more fish than any other to the catch in Loon Lake. The 1946 and 1952 year classes were also well represented; the 1952 hatch provided 33 percent of the big catch in 1955. Bass of the weak 1950 year class were caught only in 1955, when 9 were taken.

In 1956, a large number of fish caught in Loon Lake by anglers were measured and scale-sampled, and estimates of the age composition of the catches were made for most species. Age-groups IV, V, and VI dominated the crappie catch (94 percent); age-group III was best represented among the pumpkinseeds (46 percent); 4-year-old fish comprised 55 percent of the catch of perch; and 93 percent of the bluegills were either 3 or 4 years old.

Spring Lake

Most of the 72.5-acre area of Spring Lake is less than 10 feet deep and contains an abundance of vegetation (Fig. 13). Winterkills have occurred frequently, but the lake has provided some excellent perch fishing. The lake also contains large numbers of small black bullheads and some minnows, pumpkinseeds, and bluegills, but few of these have appeared in the fishery.

A total of 2,921 anglers fished for 8,464 hours in Spring Lake in 1945-1956 (Table 20). Perch contributed over 95 percent of the 11,021 fish

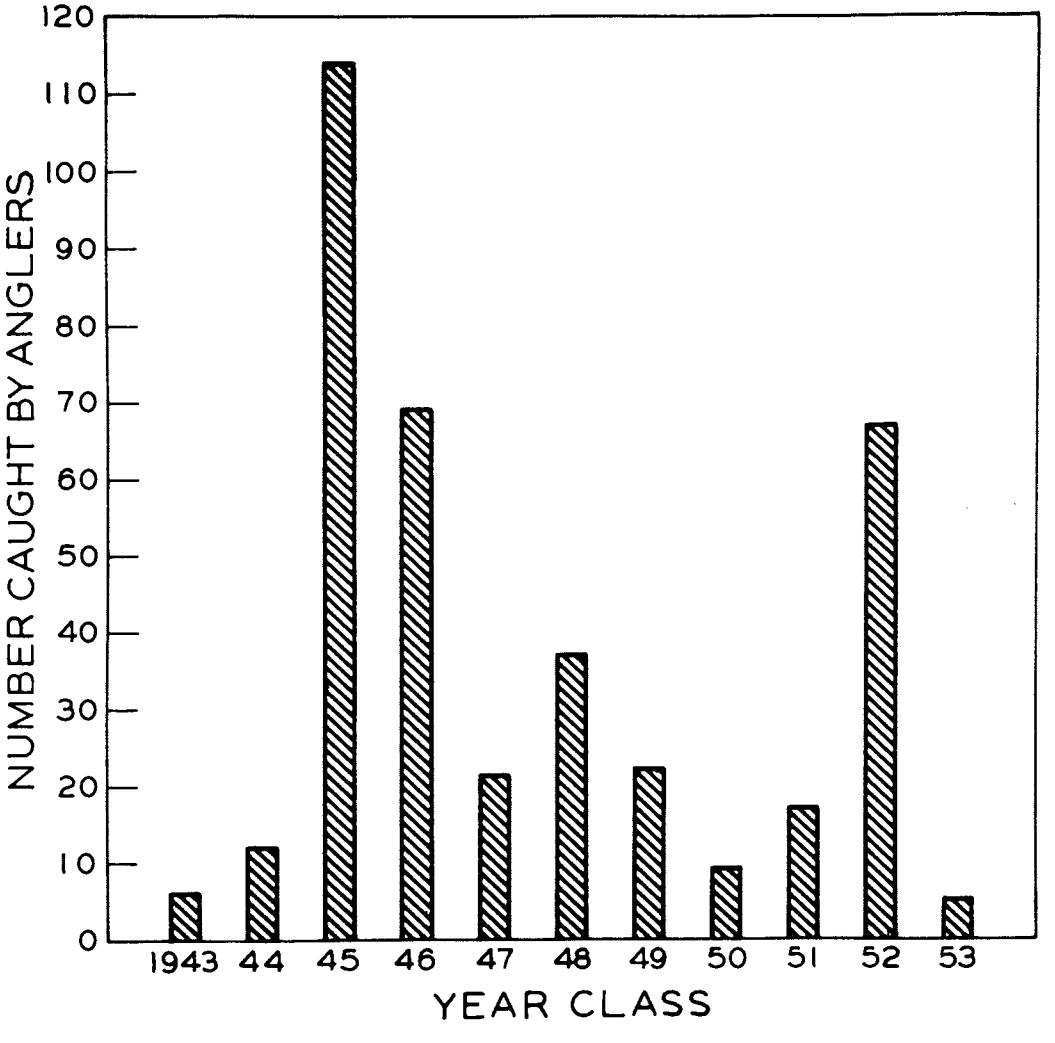

Figure 12.--Estimated total numbers of several year classes of largemouth bass caught by anglers in Loon Lake, 1946-1956.

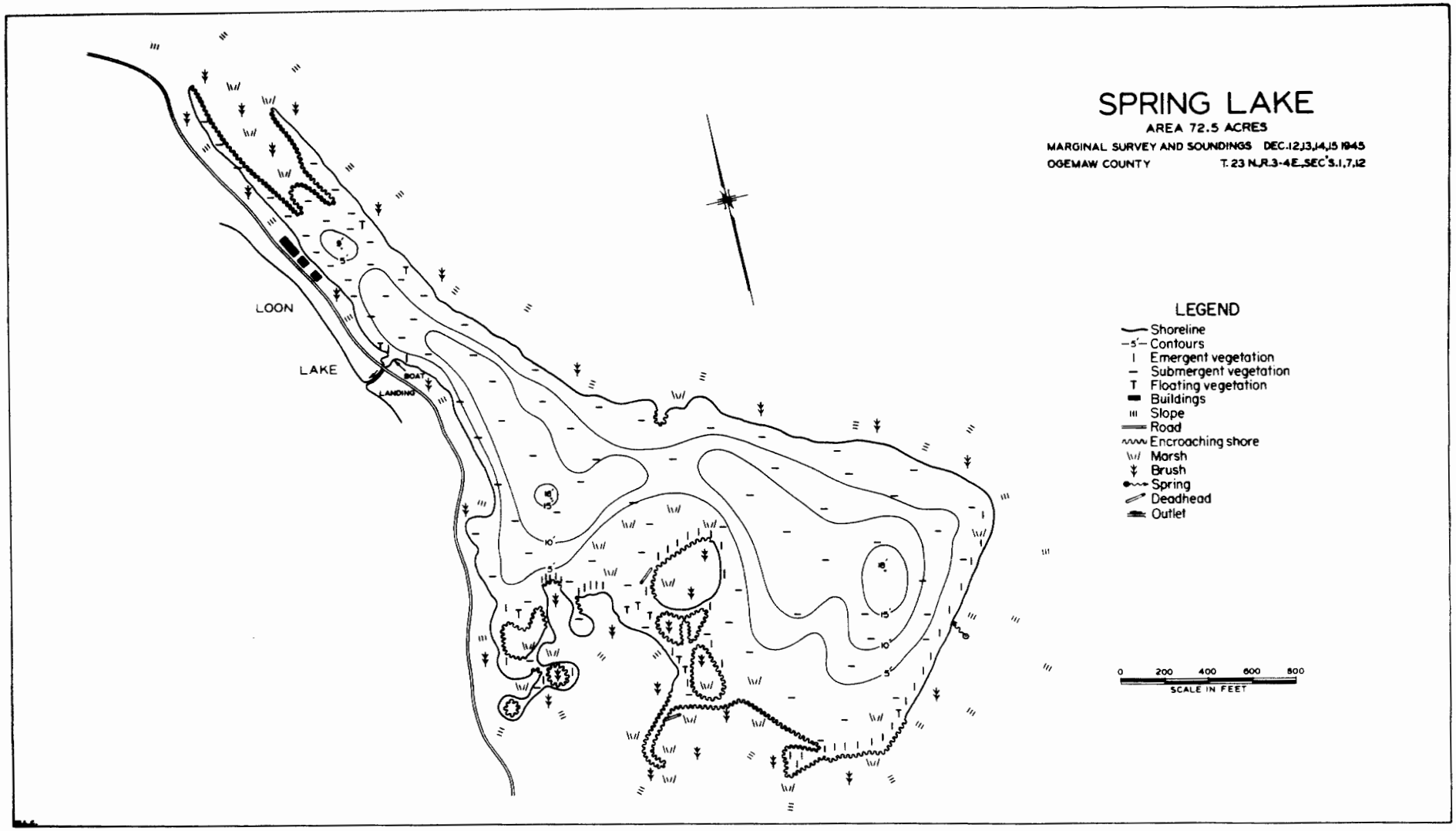

Figure 13.--Hydrographic map of Spring Lake, Rifle River Area.

Table 20.--The annual fishing pressure, total yield, fishing quality, and species composition of the catch in Spring Lake, 1945-1956

Item	Year											
	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Fishing pressure												
Number of fishermen	7	601	489	335	257	338	33	310	74	59	291	127
Total hours of fishing	8	1,841	1,600	960	742	1,029	82	1,002	144	110	725	221
Hours per acre	0.1	25.4	22.1	13.2	10.2	14.2	1.1	13.8	2.0	1.5	10.0	3.0
Yield of fish												
Total number caught[1]	...	2,961	1,875	1,312	911	1,301	6	1,776	17[2]	...	862	...
Yellow perch	...	2,919	1,815	1,306	866	1,090	3	1,681	15	...	806	...
Bullheads	...	40	59	6	45	173	3	94	2	...	25	...
Total pounds	...	826	450	233	186	335	1	415	5	...	321	...
Pounds per acre	...	11.4	6.2	3.2	2.6	4.6	0.01	5.7	0.07	...	4.4	...
Fishing quality												
Catch per hour	...	1.60	1.17	1.36	1.23	1.23	0.07	1.77	0.12	...	1.19	...
Percentage of fishermen successful	...	54	58	47	61	70	9	78	9	...	46	...

[1] Totals include 2 pumpkinseeds caught in 1946, 1 in 1947, 38 in 1950, 11 in 1952, and 23 in 1955; and 1 bluegill caught in 1946 and 8 in 1955.

[2] An additional 131 perch weighing 39 pounds were picked up in the outlet at the time of a winterkill in late February.

caught. The lake received its heaviest fishing pressure in 1946, the year in which anglers first discovered the large perch population. In 1,841 hours of fishing, 2,919 perch (average weight, 4.5 ounces) and 42 other fish were caught, for an average yield of 11.4 pounds per acre. Winterkills in 1950-1951, 1952-1953, and 1955-1956 resulted in extremely poor fishing in 1951, 1953, 1954, and 1956.

Information on age composition of the catches is lacking for most years. Eighty-nine percent of 102 perch that were caught in gill nets (74) or by hook and line (28) in 1946 were 2 years old (range in length, 6.1-12.7 inches); the rest were 3 years of age. As judged by the average weights of perch caught in the succeeding 4 years (1.3, 2.9, 3.4, and 4.7 ounces, respectively), it is quite possible that the 1946 year class supported most of the sport fishery in 1947-1950. In 1952, 64 percent of 221 perch examined were 4 years old, proving that many fish of the 1948 year class survived the winterkill of 1950-1951 (even though their presence in the lake was not revealed by the limited fishing effort in 1951). In 1955, 2 years after the winterkill of 1953, perch fishing improved markedly. The fast-growing fish of age-group I provided an estimated 70 percent of the catch, and age-group III contributed most or all of the remainder (no other age groups were detected in the samples). The perch caught were even larger than in 1946 and 1950, averaging 6.2 ounces in weight.

Excellent perch fishing in a lake without predators (other than the perch themselves) is unusual. Eschmeyer (1937, 1938) studied the perch populations in three small lakes in the Pigeon River State Forest, Otsego County, which contained no other species of fish. Young perch in these lakes were abundant but grew slowly and provided very poor fishing. There was some evidence of starvation at an early age. The fish obviously had

overpopulated these lakes, outstripped their food supply, and become severely stunted. In Spring Lake, frequent winterkills (coupled, perhaps, with the sizeable harvest in 1946) probably served as the controls which kept the perch population within bounds commensurate with the food supply. This resulted in rapid growth, and good fishing was available in 7 of the 12 years.

The principal method of angling in Spring Lake was still-fishing with either worms or minnows. Anglers who used minnows for bait had a much higher rate of success (Fig. 14). Their catch per hour was highest in 1946 and 1952. In the 7 years in which fishermen took large numbers of perch, fishing quality in the fall was superior to that in other seasons. The average catch per hour in the fall was 1.85 as compared to 0.98 in the summer and 1.31 in the spring.

Teal Lake, South Pond, and Devils Wash Basin

A summary of the fishing pressures and yields for Teal Lake, South Pond, and Devils Wash Basin is shown in Table 21. Few fishermen fished these smaller bodies of water, which, besides being small, are not as accessible as the other lakes on the Area.

Teal Lake is a 5.8-acre lake surrounded by a small marsh (Figs. 15 and 16). The larger of its two basins has a maximum depth of 15 feet, and the other is 12 feet deep. The outlet flows from the smaller basin into Skunk Creek, a tributary of the Rifle River. Submerged and floating vegetation is abundant in the shallow water, and the bottom consists entirely of soft, organic material--mostly pulpy peat. In 1945 the lake level was raised 1 1/2 feet by a beaver dam in the outlet but the dam is no longer functional. A winterkill in 1944 was reported by a local resident. The poor fishing quality in 1956 might have been caused by a winterkill in 1955-1956, when

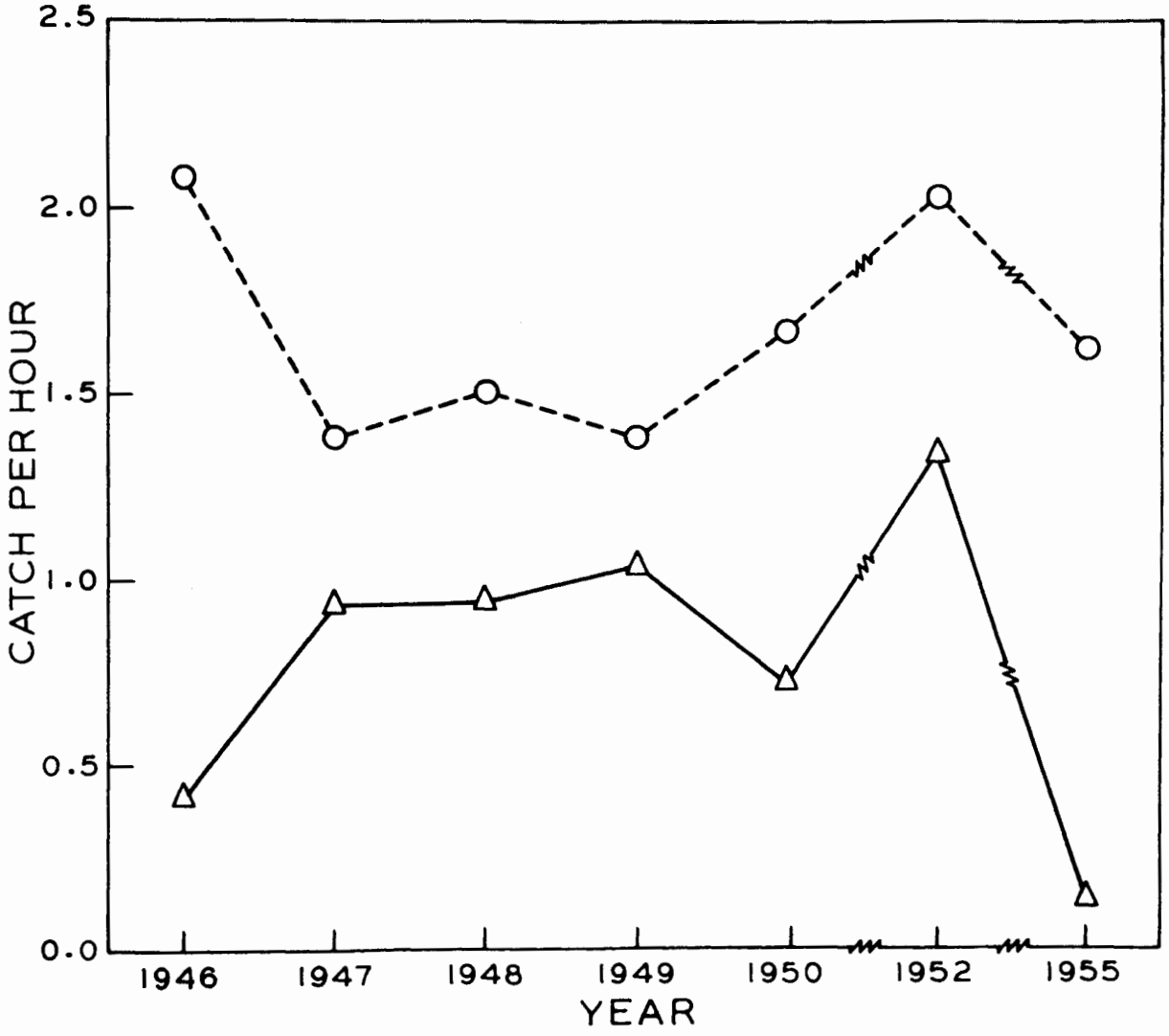

Figure 14.--A comparison of the mean catches per hour of perch in Spring Lake by anglers using minnows (broken line) or earthworms (solid line).

Table 21.--The annual fishing pressure, total yield, and fishing quality for Teal Lake, South Pond, and Devils Wash Basin, 1945-1956

Water, and year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful
Teal Lake								
1945	4	5	0.9	2	2	0.3	0.40	25
1946	38	139	24.0	275	52	9.0	1.98	74
1947	38	91	15.7	157	43	7.4	1.70	61
1948	47	158	27.2	133	19	3.3	0.84	45
1949	63	192	33.1	168	61	10.5	0.88	57
1950	36	65	11.2	33	7	1.2	0.51	25
1951	23	76	13.1	126	24	4.1	1.66	61
1952	37	77	13.3	69	14	2.4	0.90	41
1953	17	49	8.4	69	16	2.8	1.40	47
1954	27	73	12.6	23	9	1.6	0.32	33
1955	9	27	4.7	3	1	0.2	0.11	1
1956	49	99	17.1	4	1	0.2	0.04	0
South Pond								
1945	4	32	24.6	13	6	4.6	0.41	100
1946	14	18	13.8	12	5	3.8	0.67	36
1947	11	40	30.8	65	14	10.8	1.62	100
1948	33	66	50.8	25	5	3.8	0.38	24
1949	49	115	88.5	94	23	17.7	0.81	43
1950	23	68	52.3	65	13	10.0	0.96	35
1951	52	88	67.7	186	36	27.7	2.13	56
1952	79	160	123.1	185	37	28.5	1.16	60
1953	38	98	75.0	96	22	16.9	0.98	55
1954	45	160	123.1	86	25	19.2	0.54	59
1955	24	56	43.1	58	11	8.5	1.04	33
1956	53	117	90.0	181	27	20.8	1.55	73
Devils Wash Basin								
1945	15	22	16.9	50	8	6.2	1.92	41
1946	27	48	36.9	14	3	2.3	0.29	15
1947	12	20	15.4	1	1	0.8	0.05	8
1948	33	56	43.1	45	7	5.4	0.81	36
1949	11	18	13.8	...	..	...	....	...
1950	16	39	30.0	111	12	9.2	2.85	81
1951	5	11	8.5	34	6	4.6	3.09	60
1952	18	32	24.6	225	27	20.8	7.14	72
1953	24	52	40.0	88	15	11.5	1.69	52
1954	21	48	36.9	24	6	4.6	0.50	38
1955	8	18	13.8	20	3	2.3	1.11	50
1956	6	7	5.4	...	..	...	....	...

Figure 15.--Teal Lake, Rifle River Area.

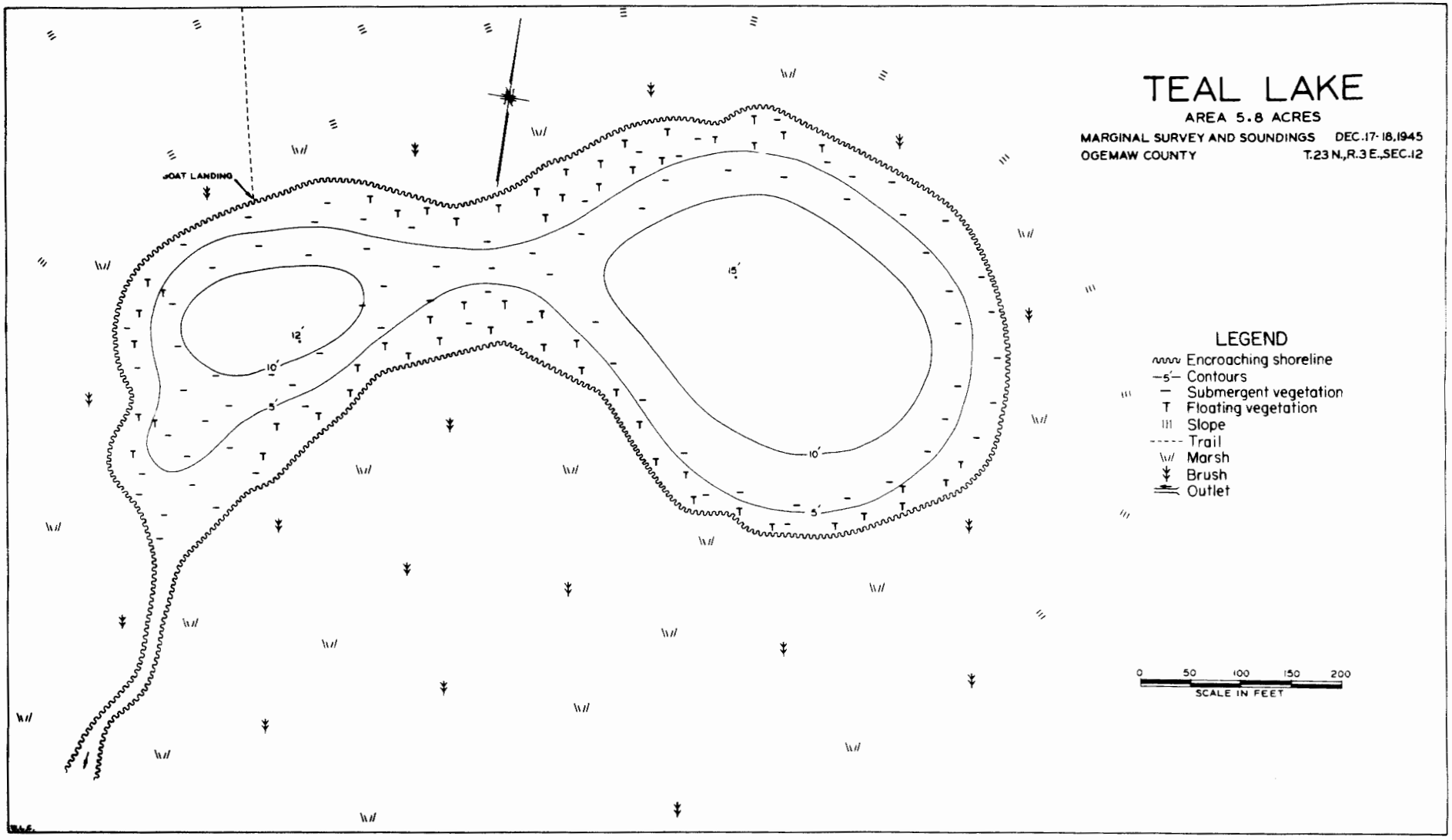

Figure 16.--Hydrographic map of Teal Lake, Rifle River Area.

kills occurred in Spring and Loon lakes. (Teal Lake is inaccessible in early spring, and has not been checked routinely for the occurrence of winterkill.[8])

An average of 32 fishermen per year fished Teal Lake in 1945-1956. Fishing quality was best in 1946, when 38 fishermen caught 275 fish (of which 270 were perch) at the rate of nearly 2 fish per hour (Table 21). Thirty largemouth bass (mostly 3 and 5 years old) were taken in 1949, but a total of only 3 were taken in 11 other years (Table 22). Although 37 northern pike were stocked in Teal Lake in 1953-1956 after being trapped in other Area waters, only 1 of the transferred fish was later recaptured.

Both South Pond and Devils Wash Basin[9] are 1.3-acre ponds, with maximum depths of 19 and 15 feet, respectively. The bottom material in both ponds is fibrous peat; aquatic vegetation is scarce. A few large tree trunks are submerged in Devils Wash Basin.

Over the 12-year span of 1945-1956, 425 anglers fished South Pond for 1,018 hours and caught 1,066 fish (including 681 bluegills). Maximum annual fishing pressures of 123.1 hours per acre occurred in both 1952 and 1954, but there was a wide difference in fishing quality in the two years (185 fish were caught in 1952, but only 86 in 1954).

In 12 years, 196 fishermen caught a total of 612 fish in Devils Wash Basin. The largest harvest was in 1952, when 225 fish (more than half of which were perch) were caught at the exceptionally high rate of 7.1 fish per hour. No fish were caught in 1949 and 1956, and only one in 1947.

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[8] Estimates of the fish population in the fall of 1957 indicated fewer than 400 game fish (and brown bullheads) of a size acceptable to anglers.

[9] Maps of South Pond and Devils Wash Basin are shown with the map of Devoe Lake in Figure 3.

Table 22.--Numbers of fish of different species caught in Teal Lake (T), South Pond (S), and Devils Wash Basin (D), 1945-1956

Species	Lake or pond	Year												Total
		1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	
Largemouth bass	T	2	...	...	1	30	...	...	...	...	...	...	...	33
	S	...	1	...	...	8	1	2	1	1	9	3	2	28
Bluegill	T	...	1	1	2	1	...	...	1	2	3	2	1	14
	S	1	3	21	2	61	22	104	155	66	50	49	147	681
	D	...	...	...	...	...	...	...	...	...	1	...	...	1
Pumpkinseed	T	...	4	3	...	...	...	...	...	...	...	...	3	10
	S	4	2	3	...	...	15	20	6	3	3	...	8	64
	D	...	2	...	...	...	1	1	30	5	...	...	...	39
Rock bass	S	...	3	14	2	7	6	35	18	18	19	5	6	133
	D	...	2	...	...	...	7	...	39	21	10	2	...	81
Black crappie	D	5	7	...	43	...	...	...	...	1	3	...	...	59
Yellow perch	T	...	270	150	127	136	33	126	68	67	17	1	...	995
	S	6	2	27	20	18	18	20	3	7	1	...	3	125
	D	44	3	1	2	...	94	14	114	32	2	18	...	324
Bullheads	T	...	...	2	1	...	...	...	...	...	...	...	...	3
	S	...	1	...	1	...	1	3	1	1	4	1	3	16
	D	1	...	...	...	...	9	19	42	28	8	...	...	107
Miscellaneous[1]	T	...	...	1	2	1	...	...	...	...	3	...	...	7
	S	2	...	...	...	...	2	2	1	...	...	...	12	19
	D	...	...	...	...	...	...	...	...	1	...	...	...	1
Total	T	2	275	157	133	168	33	126	69	69	23	3	4	1,062
	S	13	12	65	25	94	65	186	185	96	86	58	181	1,066
	D	50	14	1	45	...	111	34	225	88	24	20	...	612

[1] In Teal Lake this includes 1 northern pike in 1947, 2 in 1948, 1 in 1949, and 2 in 1954; and 1 white sucker in 1954. In South Pond this includes 2 smallmouth bass in 1945; 1 hybrid sunfish in 1951; 12 longear sunfish in 1956; and 2 white suckers in 1950, 1 in 1951, and 1 in 1954. In Devils Wash Basin 1 white sucker was caught in 1953.

All lakes and ponds

More than 68,000 fish weighing 17,882 pounds were caught by the 26,270 anglers who fished in the lakes and ponds of the Rifle River Area in 1945-1956 (Table 23). The fish were caught at an average over-all rate of 0.81 fish per hour (range, 0.57 to 1.21 in the different years) and 42 percent of the fishermen (range 34 to 53 percent) caught one or more fish. The average annual yield was 4.4 pounds of fish per acre of water and the mean annual fishing pressure was 20.8 hours per acre.

Summary

The Rifle River Area, formerly a private estate, was purchased by the Department of Conservation in 1944 and opened to the public in 1945. Six lakes, a number of ponds, and 9 miles of trout stream are located on the Area. All persons register upon passing through the only entrance and report the results of their fishing trips upon leaving. Overnight camping is not allowed. Under this permit-type creel census, a virtually complete record of fishing was obtained for the 12-year period, 1945-1956.

Prior to exploitation by the public, all Area lakes except Spring Lake (which is subject to winterkill) and possibly Loon and Teal lakes had a proportionately greater number of larger and/or older fish than during later years and probably contained their full natural carrying capacity. This resulted in the harvest of a greater poundage of fish in 1945 than subsequently, although both the catch of fish per hour and the percentage of successful fishermen were lower than in most later years. Northern pike in Devoe Lake, largemouth bass in Devoe and North lakes, and, to a lesser degree, pumpkinseeds in Doller and Loon lakes and black crappies in Doller Lake were markedly reduced in numbers during the first year of public fishing and failed to recover by natural recruitment during later years. In most of the lakes, the average size of some species in the catch became progressively

Table 23.--A summary of the annual fishing pressure, total yield, and fishing quality for eight lakes and ponds on the Rifle River Area, 1945-1956

Year	Fishing pressure			Yield of fish			Fishing quality	
	Number of fishermen	Total hours of fishing	Hours per acre	Number caught	Total pounds	Pounds per acre	Catch per hour	Percentage of fishermen successful
1945	2,731	9,428	28.1	6,227	2,264	6.7	0.66	34
1946	1,866	5,832	17.4	5,122	1,457	4.3	0.88	38
1947	1,921	6,138	18.3	4,483	1,227	3.7	0.73	43
1948	1,995	6,082	18.1	3,852	1,033	3.1	0.63	39
1949	2,529	7,793	23.2	4,452	1,591	4.7	0.57	40
1950	2,420	7,562	22.5	8,158	2,069	6.2	1.08	44
1951	1,655	5,348	15.9	6,480	1,339	4.0	1.21	49
1952	1,977	5,931	17.7	7,030	1,547	4.6	1.19	53
1953	2,246	7,227	21.5	7,475	1,583	4.7	1.03	49
1954	2,517	8,781	26.1	8,318	1,353	4.0	0.72	40
1955	2,092	6,451	19.2	4,172	1,317	3.9	0.65	39
1956	2,327	7,429	22.1	4,255	1,002	3.0	0.57	35
1945-1956	26,276	84,002	20.8	68,012	17,882	4.4	0.81	42

smaller after 1945. It is unlikely that these lakes will again produce yields equal to those of the first year of public fishing unless management procedures are devised to improve the present fish populations.

Devoe and North lakes, the largest on the Area, are relatively unproductive marl lakes which yielded only 6.2 and 3.9 pounds of fish per acre, respectively, in 1945. The mean harvests for the succeeding 11 years were down 60 percent in Devoe Lake and 67 percent in North Lake. Yellow perch predominated in the catches. Among the larger game fishes, only smallmouth bass reproduced adequately to sustain a small sport fishery for the species in these lakes. In Devoe Lake, a mean of 50 bass were taken by anglers from each of the year classes 1943-1952 (86 were caught from the exceptionally strong 1947 year class); in North Lake an average of only 23 bass were caught from the 1943-1952 year classes (58 from the strong 1949 class). Rainbow trout were stocked in both lakes, but the numbers stocked and the percentage of returns were both much greater in Devoe than in North Lake. Of 12,977 legal-size trout planted in Devoe Lake in 1948-1955, 12.6 percent were caught in Area waters. Spring plantings gave much better returns than fall plants.

Dollar and Loon lakes are small lakes with similar fish populations (largemouth bass and bluegills, and several other species of pan fish). Dollar Lake generally provided better fishing (1.8 fish per hour and 71 percent of the fishermen successful as an average for 1945-1956) and received more angling pressure in relation to its size (more than 140 hours per acre in both 1945 and 1954) than any other Area lake. It produced by far the largest yield of fish recorded for the Area--82.8 pounds per acre--in 1945. (Loon Lake was second highest with a production of 58.8 pounds per acre in 1950.) More than half of the fish caught in Dollar Lake each year were bluegills. Loon Lake received scant attention from Area anglers prior to 1949

and has been subjected to winterkills. Considerably larger numbers of bluegills, pumpkinseeds, and bullheads were caught in 1950 than in any other year.

Spring Lake had a relatively simple fish population, composed of perch, bullheads, minnows, and a few bluegills and pumpkinseeds. Although winterkills occurred on several occasions, this lake provided some excellent perch fishing. The maximum yield of 11.4 pounds per acre was in 1946 when 4,919 perch were caught (average weight 4.5 ounces). Anglers who used minnows were considerably more successful than those who fished with worms.

Fishing pressure in South Pond, Teal Lake, and Devils Wash Basin has been relatively light. Perch dominated the catches from the latter two lakes and bluegills were predominant in catches from South Pond.

Combining the data for the eight lakes and ponds on the Rifle River Area, 26,476 anglers caught 68,012 fish (17,852 pounds) in 1945-1956. The fish were caught at an average rate of 0.61 fish per hour, and 42 percent of the fishermen caught at least one fish.

Acknowledgments

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