
An Estimate of the Fish Population of a 16 Acre Lake Based on Recovery During Draining¹

RONALD E. ELKIN, Oklahoma Fisheries Research Laboratory, Norman

The summer survey crew of the Fisheries Research Laboratory undertook a fish-population study of Rocket Plant Lake during the period July 30 to August 4, 1955. The purpose of the study was to estimate the number of fish in the lake by sampling with wire traps and to determine the reliability of the estimate by draining the lake and counting the fish.

DESCRIPTION

Rocket Plant Lake, located on the McAlester Naval Ammunition Depot, in Pittsburg County, Oklahoma, was used in the study. The lake was originally a one-acre farm pond constructed in 1890. In 1943 it was enlarged to 16 surface acres by enlarging the dam. The drainage area comprises about 2500 acres of "post oak-blackjack savannah" that had been partially cleared and cultivated. Many years of cotton production had reduced the fertility until the soil was nearly worthless for agriculture. Since 1943 the land has not been cultivated and is regaining its natural vegetation.

The water of Rocket Plant Lake was shallow and muddy, with an average depth of approximately 2 feet and a maximum depth of 10.5 feet. The timber was not cleared from the enlarged lake basin, and dead trees

¹Contribution No. 52 of the Oklahoma Fisheries Research Laboratory, a cooperative unit of the Oklahoma Game and Fish Department and the University of Oklahoma Biological Survey.

December 8, 1955.

stood and lay in profusion. Beds of *Chara* filled all the lake area that was less than 2 feet deep.

METHODS

Eighteen 3 by 6 feet wire traps were used, ten of them were placed in the lake on July 30 and eight more on August 1. The captured fish were removed from the traps daily, identified, counted, measured, fin-clipped and returned to the lake. Eight additional traps were placed in the lake on August 1, the traps were lifted during the next three days for a total of 46 trap lifts, and by the end of the period 323 fish had been marked and returned to the lake. The number of each species marked prior to draining is presented in Table I. The population estimate of white crappie obtained from the trapping data was 2,488. No individuals of other species were recaptured, precluding pre-draining estimates.

The dam was cut by the use of a dragline on the morning of August 3, and a screen of $\frac{1}{4}$ -inch mesh hardware cloth placed across the cut. The water level dropped quickly trapping many of the smaller centrarchids in the *Chara* beds. Most of the fish became concentrated in the borrow pit immediately above the dam, and were recovered from that area with dip nets and seines. Recovery of fishes was very difficult because of deep deposits of silt on the lake bed. The lake drained well, and with the exception of the former creek channel, there were few pot-holes where fish could escape recovery. The channel could not be seined because of silt and fallen timber. All fishes recovered were measured, checked for previous fin clip markings, and weights and scale samples were recorded for a representative sample of each species.

RESULTS

Population estimates of all species appear in Table II. These estimates were derived by use of the formula presented by Schnabel (+). As there were no fish less than 5 inches in length marked before draining, it was impossible to estimate their numbers. Average lengths of a random sample of the smaller fish recovered appear in Table II. The fishes over five inches in length were divided into two groups designated as catchable-size fish and non-catchable-size fish (Table I).

Largemouth bass outnumbered the other game fishes present in the catchable-size range. There were 22 bass over 10 inches marked during the trapping operation. During the draining, 211 legal bass were recovered, and of this number 17 were marked. These data resulted in a population estimate of 273 legal bass, representing 16.7 pounds per acre, and 20.6 percent of the total estimated population of catchable fish.

There were an estimated 755 largemouth bass present in the 6 to 10-inch range, giving a combined total of 1,028 bass greater than 6 inches in length. They comprised 23.5 percent of the estimated total population and weighed about 28 pounds per acre.

There were 288 crappie checked during the draining operation, of which 149 were white crappie and 139 black crappie. The estimated crappie population was 1,381 white crappie and 890 black crappie. These estimates placed the crappie population considerably higher than the largemouth bass population, but only 31 crappie of both species were recovered which exceeded 8 inches. Crappie comprised only 2.3 percent of the estimated catchable population.

Green sunfish 5 inches or more in length were considered to be of catchable-size and 288 fish in this category were recovered. The lake was estimated to have had a green sunfish population of 735 catchable-sized individuals, representing 54 percent of the estimated catchable

population, and 8.3 pounds per acre. The green sunfish was the second most important sport fish in the lake.

Two black bullheads out of 127 recovered in the draining operation were marked, resulting in an estimated population of 450 individuals. All specimens recovered were over 7 inches in length and averaged 10.8 inches. Ten channel catfish averaging 17.4 inches in length were recovered, and it was assumed that they represented the entire population of this species.

Eighty-six orangespotted sunfish and 549 longear sunfish were recovered. Because there were no marked specimens of these species, no population estimates were attempted. However, they undoubtedly constituted a major portion of the fish population in Rocket Plant Lake in both numbers and weight.

AGE AND GROWTH

The growth rates of fishes were determined by the standard methods of scale and spine analysis, assuming a direct proportion between scale radius and fish length.

The game species exhibited very fast growth, particularly during the second year of life (Table III). Since the population was composed predominantly of young fishes it is probable that natural mortality was keeping the population at a level which was advantageous for fast growth.

Largemouth bass were growing very rapidly in Rocket Plant Lake, and there were no bass past their fourth summer of life. There was a very wide length-range in yearling bass (4.7-12.8 inches). However, it was reported that a number of small bass were rescued from other ponds on the Ammunition Depot during a low water period in 1954, and their introduction into Rocket Plant Lake could possibly account for the wide range in the yearling age group. The largest bass recovered measured 18.8 inches in length and weighed 4.5 pounds.

Growth-histories reveal that white and black crappie in Rocket Plant Lake were well above state average growth (2). Both species reached the 8-inch catchable-size during the second year of life, and the maximum length was 14.1 inches and 13.6 inches, respectively. However, only an estimated 31 individuals were in this size range. At the time of draining, young of the year white crappie average 3.0 inches, as compared to a calculated first year growth of 5.9 inches for other year-classes. Only two individuals were more than four years of age, and the great majority were in age-groups O and I. The increased numbers of crappie in the 1954 and 1955 year-classes indicated that a reduced growth rate might have resulted had the lake not been drained.

The green sunfish, although below state average, were exhibiting satisfactory growth, (3). Calculated lengths at the end of the first four years of life were 3.6 inches, 5.4 inches, 6.5 inches, and 7.5 inches, respectively. The entire sample averaged 6.7 inches in length.

There were no black bullheads in the sample which were less than two years old, suggesting that there might have been a sharp decline in the population in the next few years. However, there was still an ample supply of catchable-sized black bullheads (est. 450). The population of channel catfish, although extremely low, had shown very fast growth. The ten individuals recovered ranged from 15.0-19.7 inches in length and averaged 5.8, 12.8, and 17.4 inches at the end of the first three years of life. Apparently channel catfish had not reproduced in Rocket Plant Lake.

The bluegill, longear, and orangespotted sunfishes closely approximated state average growth rates (3). The bluegill population was surprisingly low, but there were large numbers of longear and orangespotted sunfishes.

Although every effort was made to recover as many fishes as possible, a great percentage of the population escaped capture. Many fish undoubtedly were lost downstream while shifting the screen across the outlet. Still other fish were lost in the channel and other areas which were impossible to seine, or became embedded in the soft mud of the lake bottom. These losses reduced the recovery to 22 percent of the estimated population. Thirty-five percent of the largemouth bass more than 6 inches in length were recovered, and 77 percent of those over 10 inches in length were recovered. Only about 11 percent of the white crappie, 16 percent of the black crappie, 31 percent of the green sunfish, and 28 percent of the black bullheads were recovered during the draining operation.

A comparison of Rocket Plant Lake with a typical pond of that area points out some distinct variations in species composition, numbers, and growth. Crowley pond, located 16 miles south of Rocket Plant Lake, has an area of 5 surface acres. The estimated total population of this lake was 24, 896 fishes or about 5,000 individuals per acre, weighing approximately 144.5 pounds per acre (Table IV). Stunted white crappie, orangespotted sunfish, bluegill, redear, and green sunfish comprised an estimated 23,500 individuals, or 94 percent of the total, while in Rocket Plant Lake these species totaled only 56 percent. There were only 2 catchable-size fish per acre recovered from Crowley pond as compared to 34 percent from Rocket Plant Lake. Largemouth bass and green sunfish dominated the catchable population of Rocket Plant Lake, constituting 25 pounds of catchable fish per surface acre.

Although the fishes less than 5 inches in length constituted an unknown quantity in the Rocket Plant Lake fish population, the overall picture was one in which the population appeared to be at a very desirable level. The species composition indicated that the population was essentially a largemouth bass—green sunfish combination, as opposed to the typical situation in which bluegill is the dominant pan fish. There are few accounts of largemouth bass—green sunfish combinations, and that which has been published indicates that green sunfish have not been satisfactory for stocking with largemouth bass (5). However, in Rocket Plant Lake the combination had produced an adequate population of catchable-size bass. The standing crop of 28 pounds per acre of largemouth bass is higher than the mean standing crop listed by Carlander (1) of 24 pounds per acre of largemouth bass in 15 midwestern lakes. These data indicate that further experimentation with largemouth bass—green sunfish stocking combinations may establish this combination as one in which both predator and prey maintain desirable levels in southeastern Oklahoma lakes.

ACKNOWLEDGEMENTS

Appreciation is extended to Mr. C D. Johnson for his help and operation during the study, and to Dr. Homer Buck for initiating the study.

LITERATURE CITED

1. Carlander, Kenneth D. 1955. The standing crop of fish in lakes. *Jour. Fish. Res. Bd. of Canada*, 10(4): 543-570.
2. Hall, Gordon E., Robert M. Jenkins, and Joe C. Finnell. 1954. The influence of environmental conditions upon the growth of white crappie and black crappie in Oklahoma waters. *Okla. Fish. Res. Lab. Rep. No. 40.*
3. Jenkins, Robert M., Ronald Elkin, and Joe C. Finnell. 1955. Growth rates of six sunfishes in Oklahoma. *Okla. Fish. Res. Lab. Rep. No. 49.*
4. Schnabel, Zoe Emily. 1938. Estimation of total fish population of a lake. *Am. Math. Monthly*, 45(16): 348-52.
5. Swingle, H. S., 1950. Relationships and dynamics of balanced and unbalanced fish populations. *Ala. Agr. Expt. Sta. Bull. 274: 74 pp.*

TABLE I.
 Estimate of the fish population of Rocket Plant Lake. Based on fish trapped and marked July 30-August 3 and re-covered August 3-5, 1955.

SPECIES	Number marked	Number recovered	Re-captures	Estimated population	Average length inches	Average weight pounds	Total weight pounds	Pounds per acre	Number per acre	Percent total
Largemouth bass										
6.0" - 9.9"	10	151	2	755	8.0	0.24	181.2	11.3	47	16.7
over 10 "	22	211	17	273	12.4	.98	267.5	16.7	17	6.6
Total	32	362	19	1,028	11.1		448.7	28.0	64	23.3
White Crappie										
5.0" - 7.9"	188	138	19	1,305	5.9	0.09	122.9	7.7	85	30.3
over 8.0"	6	11	4	16	12.8	1.04	16.6	1.0	1	0.4
Total	194	149	23	1,321	6.2		139.5	8.7	86	30.7
Black Crappie										
5.0" - 7.9"	35	125	5	875	5.3	0.06	52.5	3.3	55	19.4
over 8.0"	1	14	0	15	12.6	1.2	18.0	1.1	1	0.3
Total	36	139	5	890	6.0		70.5	4.4	56	19.7
Green sunfish										
over 5.0"	29	228	9	735	6.7	0.2	147.0	8.3	46	16.3
Black bullhead										
7.0" - 9.9"	3	58	1	174	9.3	0.4	69.6	4.4	11	3.8
over 10 "	4	69	1	276	11.4	0.9	248.4	15.5	17	6.0
Total	7	127	2	450	10.8		318.0	19.9	28	9.8
Channel catfish										
over 10"	0	10	0	10	17.1	1.8	18.0	1.1	1	0.2
Total	298	1,015	58	4,495			1,141.7	70.4	281	100.0

TABLE II.
Number of fish less than catchable-size recovered from Rocket Plant Lake, August 3, 1955.

	Largemouth bass under 6" under 5"	White crapple under 5"	Black crapple under 5"	Green sunfish under 5"	Orange spotted sunfish	Bluegill	Total
Number recorded	133	325	36	196	86	3	1328
Percent of total	10.0	24.5	2.7	14.8	6.5	.2	100
Average length	2.7	2.9	3.7	2.7	2.5	3.1	4.2

TABLE III. Average calculated growth rates of fishes from Rocket Plant Lake

SPECIES	Number of fish	Calculated length at end of each year			
		(1)	(2)	(3)	(4)
Largemouth bass	35	6.4	14.3	15.1	
State average		5.0	9.0	11.6	
White crapple	9	5.9	11.4	13.6	
State average		2.9	5.7	8.0	
Black crapple	9	5.1	8.4	11.1	12.8
State average		3.0	6.2	8.1	9.5
Green sunfish	27	3.6	5.4	6.5	7.5
State average		3.8	5.9	7.2	7.5
Bluegill	3	3.2	4.0		
State average		3.2	4.9		
Orangespotted sunfish	8	2.4			
State average		2.0			
Longear sunfish	11	2.5	3.4	4.1	
State average		2.6	4.0	4.5	
Channel catfish	10	5.8	12.8	17.4	
State average		4.4	9.2	13.4	
Black bullhead	3	5.4	8.9	12.6	13.6

TABLE IV.

Estimate of the fish population in Crowley Pond. Based on marking
seined fish 8-9 July and recovery 12-13 July, 1954

SPECIES	Estimated population	Average total length	Length range	Average weight (pounds)	Estimated total weight	Pounds per acre
Redear sunfish	2,800	3.8	3.0-7.2	0.031	86.8	17.4
White crappie	6,700	4.7	3.5-13.8	0.041	274.7	54.9
Orangespotted sunfish	5,700	2.9	2.0-4.0	0.015	85.5	17.1
Longear sunfish	430	3.0	2.3-4.2	0.021	9.0	1.8
Bluegill	7,000	3.2	2.3-4.9	0.018	126.0	25.2
Golden shiner	900	5.6	4.2-7.1	0.062	55.8	11.2
Green sunfish	1,300	4.4	2.6-8.6	0.047	61.0	12.2
Warmouth	62	6.0	4.6-8.4	0.165	10.2	2.0
Largemouth bass	3		15.9-19.6		13.2	2.6
River carpsucker	1	12.0			0.5	0.1
Total	24,896				727.7	144.5