AGE AND RATE OF GROWTH OF THE LARGEMOUTH BLACK BASS,

MICROPTERUS SALMOIDES (LACÉPÈDE), OF VARIOUS IMPOUNDMENTS

IN OKLAHOMA

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by

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AGE AND RATE OF GROWTH OF THE LARGEMOUTH BLACK BASS, MICROPTERUS SALMOIDES (LACÉPÈDE), OF VARIOUS IMPOUNDMENTS IN OKLAHOMA

INTRODUCTION

The age and growth rate data contained herein were obtained from the scales of 195 largemouth black bass (*Micropterus salmoides*) from Oklahoma waters. This species was chosen because: it is the primary Oklahoma game fish; no literature on the subject pertaining to Oklahoma were found; and it is generally agreed (Bennett, 1937) that the importance of scale analyses in fish management cannot be overemphasized.

Approximately 5,000 scale envelopes were distributed among fishermen, but only a few were returned with usable data. Most of the scales used were obtained by personal contact with the fishermen, and by collections made by members of the Zoology Department and their students. Although the number of scale samples obtained was small (195), they represented a relatively wide distribution over the state (fig. 1). All scale samples used were collected between the summers of 1942 and 1949. The number of fish sampled, dates collected, and various impoundments from which collections were made are shown in Table 1.

Several scales from a single individual were read to determine the number of annuli and to measure their respective distances from the foci. Difficulty was experienced in reading many of the scales for the following reasons: (1) false annuli resembling the "check marks" of Lagler and Applegate (1942) were frequently observed. (2) variation of growth rate in fishes from the same water (fig. 2) regarded as a natural phenomenon in agreement with Eddy and Carlander (1942). (3) a high incidence of regenerated scales necessitated the rejection of samples from 3 fish consisting of 25 to 30 scales each -- 2 samples

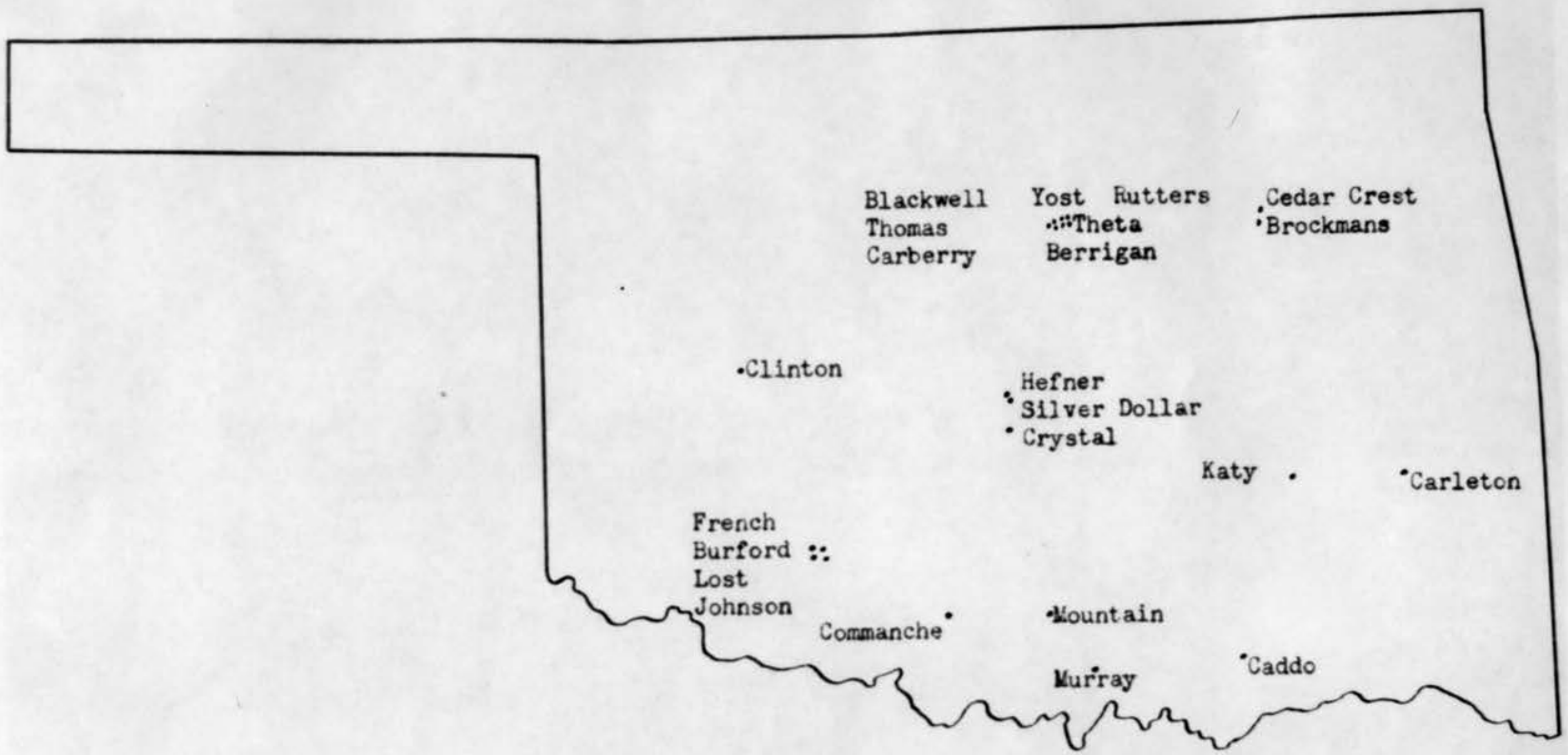

Fig. 1 Lakes from which scale samples were received.

TABLE I

COLLECTION DATA, NUMBERS AND SIZE RANGE OF SPECIMENS OBTAINED ON EACH DATE

Locality	Date	No. of Specimens	Size Range	Method Taken
Lake Carl Blackwell	5-6-48	1	20.5 inches	Hook and Line[1]
	5-13-48	1	20.5	
	5-20-48	2	15 - 17	
	5-21-48	2	12	
	5-22-48	3	12	
	5-23-48	1	11.5	
	5-29-48	5	13.5 - 24	
	6-1-48	4	17.5	
	6-2-48	4	14 - 21	
	6-3-48	3	14.5 - 21	
	6-4-48	10	11.5 - 22	
	6-6-48	4	12 - 15.5	
	6-11-48	1	14	
	6-26-48	1	13	
	6-27-48	1	12	
	4-8-49	1	19.3	
	4-14-49	1	22.5	
	5-8-49	1	21	
		TOTAL - 46		
Carberry's Pond	8-31-47	1	14	Hook and Line
	3-19-48	1	7.3	
	4-3-48	1	9.5	
	4-5-48	12	2.8 - 8.8	Seine
	5-5-48	1	17	Hook and Line
	5-28-48	1	10	
	5-29-48	1	10	
	7-7-48	5	6.3 - 8.5	
	9-13-48	1	10	
	5-2-49	2	8.8 - 9.3	
		TOTAL - 26		
Yost Lake	5-5-42	1	14.4	Trapping
	6-10-42	4	18 - 18.3	
	6-12-42	2	16.6 - 17.7	
	6-14-42	1	13.8	
	6-19-42	1	22.5	
	6-19-42	20	3.9 - 14.1	Seine
	12-3-48	15	5.6 - 19	Rotenone Poison
		TOTAL - 44		

[1] Method taken remains the same until a new method is listed.

TABLE I (Continued)

Locality	Date	No. of Specimens	Size Range	Method Taken
Rutter's Pond	4-20-48	3	12.5 - 13.8	Hook and Line
Katy Lake	7-13-48	2	10 - 20	
Cedar Crest	3-24-47	1	17.5	
	4-6-47	1	14.3	
	4-26-47	1	11.5	
	5-18-47	2	12 - 14.5	
	5-20-47	1	10.5	
	5-31-47	1	12	
	8-3-47	1	10	
	TOTAL -	8		
Berrigan's Pond	10-11-43	5	8.3 - 11.8	Seine
Clinton Lake	7-3-48	5	10.5 - 14	
Commanche Lake	7-5-48	2	8.4 - 9.5	
	7-8-48	6	7 - 7.9	
Brockman's Pond	4-2-47	1	14	Hook and Line
	5-2-47	1	14.8	
	5-4-47	3	13 - 15.5	
Theta Pond	4-3-48	1	14.5	Seine
Lake Murray	1-9-49	2	16 - 18	Hook and Line
	5-2-48	5	12 - 16.8	
Mountain Lake	5-9-48	3	18.5 - 21.5	
French Lake	5-10-47	1	20	
Lost Lake	5-10-47	1	13	
Lake Burford	5-10-47	1	14.5	
Crystal Lake	5-10-48	1	17	
	5-16-48	1	18	
	5-25-48	1	20	
Johnson Lake	10-42	1	23.5	
Lake Carleton	8-18-47	1	8	
Caddo Lake	7-5-48	1	19.5	
Thomas Lake	3-20-47	1	13.2	Rotenone Poison
	2-19-49	2	6.4 - 7.1	Seine
	5-17-49	16	7.2 - 11.5	
	6-3-49	2	11 - 12	Hook and Line
	TOTAL -	21		
Silver Dollar Lake	4-28-49	1	19	
Lake Hefner	4-16-49	1	7.4	

TOTAL NUMBER OF SPECIMENS ---------- 195 had only 1 usable scale each. (4) scale erosion in older fish rendered 1 sample useless and in 2 other samples only a single uneroded scale each could be found.

Scale samples for this investigation were taken from the side of the fish between the operculum and the dorsal fin. Key scales were not used because of the high incidence of regenerated scales. Their use was questioned by Frey (1942).

METHODS

Collections of fish used were made by the following methods: (1) seining, (2) rotenone poisoning, (3) trapping, and (4) hook and line fishing.

Since Oklahoma laws determine the legal size of bass as 10 inches and since some of Oklahoma's larger lakes have a local size limit of 12 inches, the specimens collected by the sportsmen are limited to the bass of this size or larger (fig. 3). One would expect, in natural populations, to find a larger number of 1 and 2 year fish than of the 3, 4, and 5 year fish. However, samples used in this study had a reversed condition with a greater number of the 3, 4, and 5 than of the 1 and 2 year age groups. It appears that these figures did not depict the populations in the waters, but rather show a selection of older fish by the sportsmen returns. Also, it is believed that the sportsmen tended to turn in only the larger specimens. This selection of the larger bass had a definite advantage in that more information concerning the yearly growths of Oklahoma bass could be gathered by use of a smaller number of specimens.

Seining seemed to select smaller bass, allowing the larger ones to escape. As shown in fig. 4, only a few of the larger bass were taken by this method.

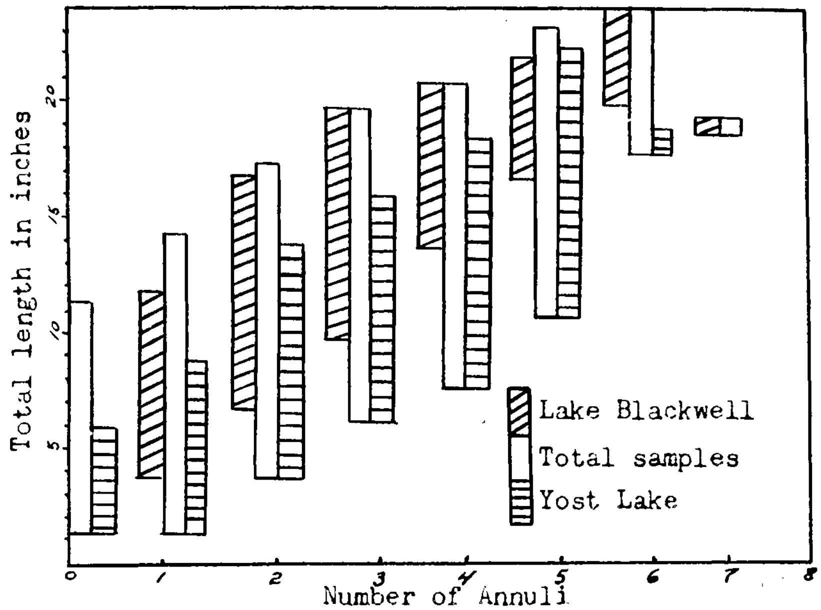

Fig. 2. Comparison in the variance of length of each age group for Lake Blackwell, Yost Lake, and the total samples taken.

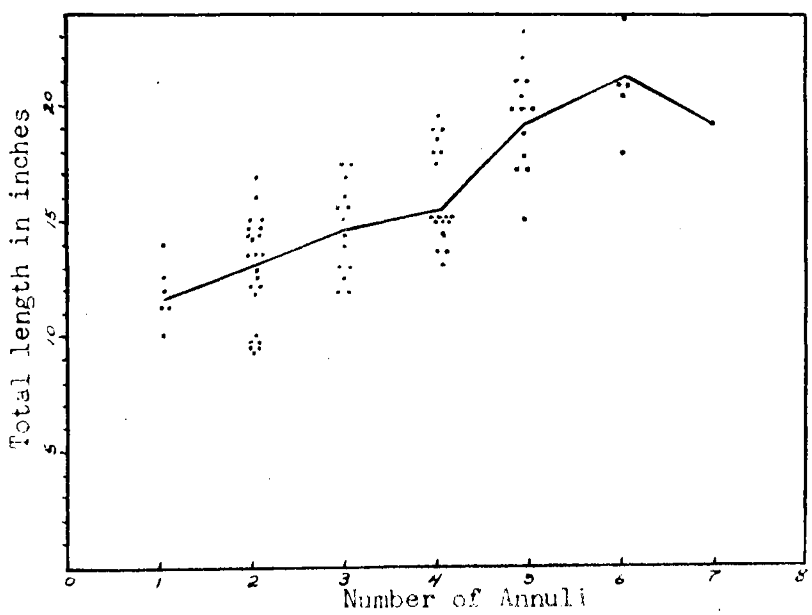

Fig. 3. Fish collected by hook and line fishing.

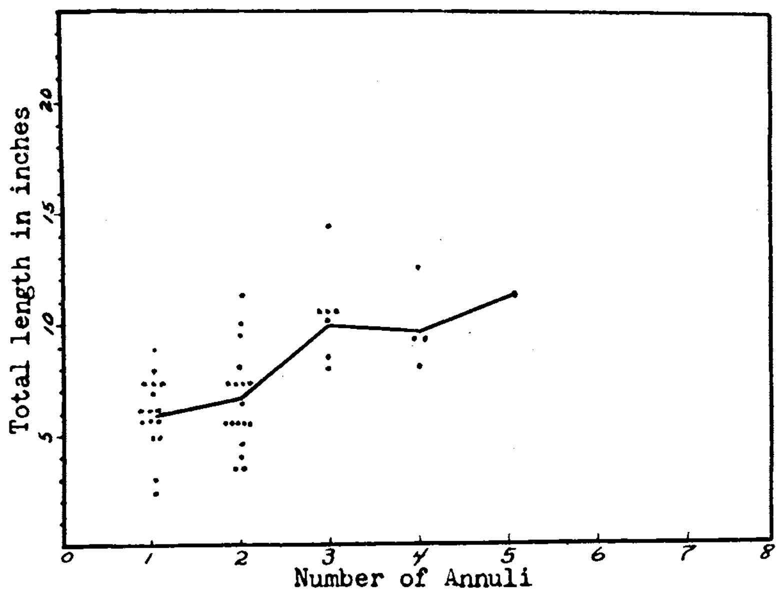

Fig. 4. Fish collected by seining.

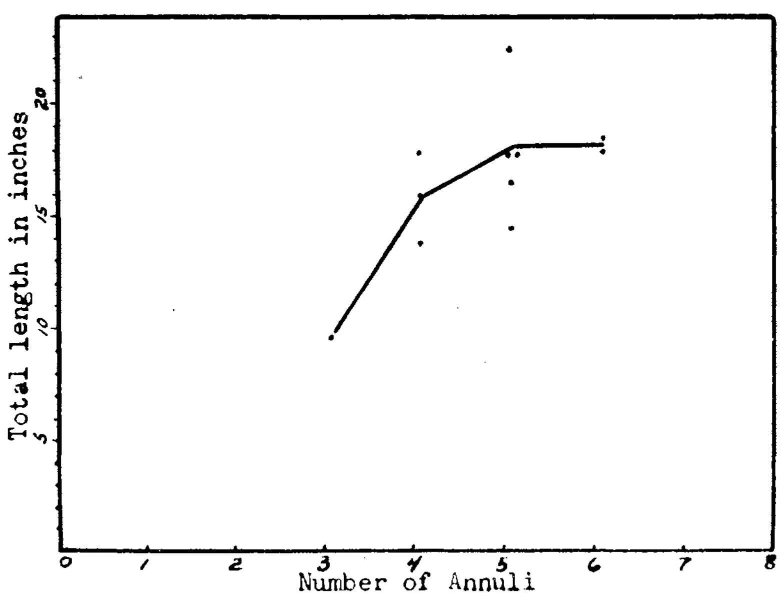

Fig. 5. Fish collected by trapping.

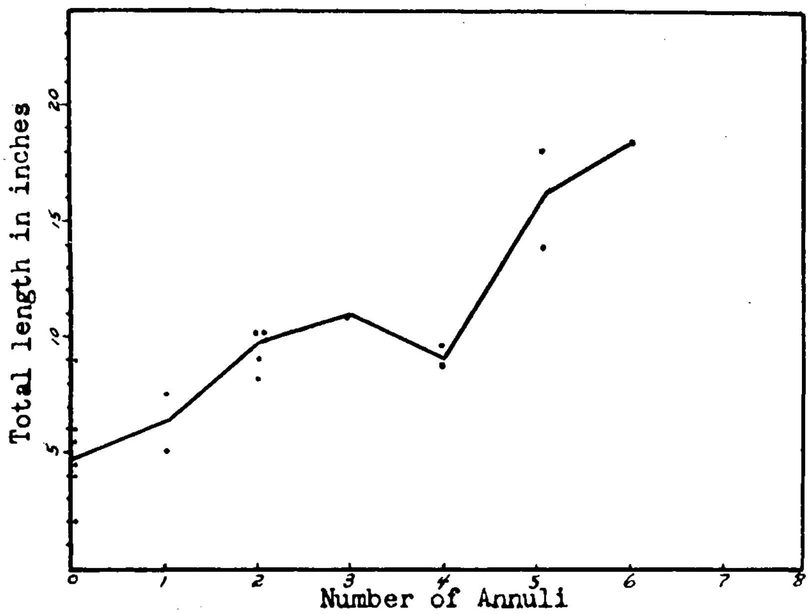

Fig. 6. Fish collected by poisoning.

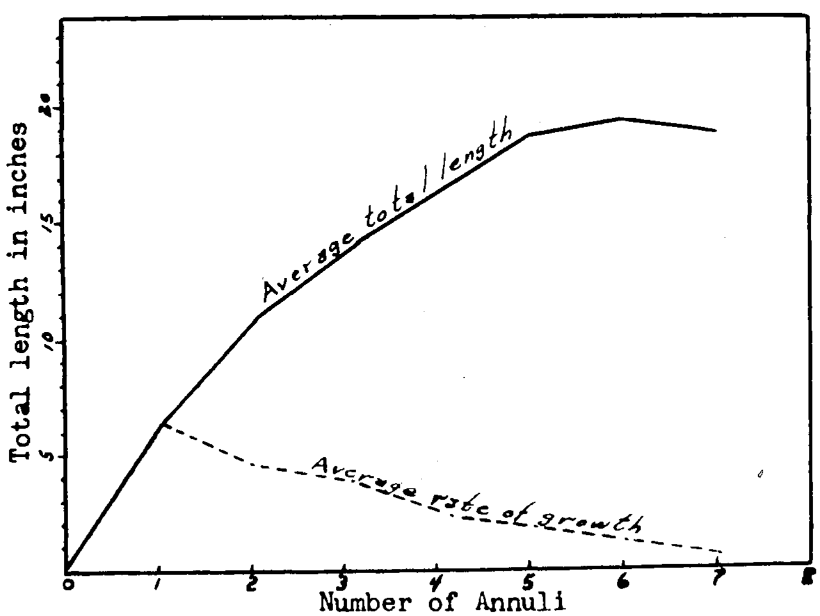

Fig. 7. Average total length and rate of growth for all impoundments studied.

The size of the traps used to collect specimens for this study selected only the larger bass and permitted the smaller bass to escape (fig. 5).

Rotenone poisoning was the only method used which did not show selectivity (fig. 6).

Total length (measured from the tip of the mandible with the mouth closed, to the tip of the longest caudal ray of the tail) in inches to the nearest tenth was used in order to facilitate measurement by the sportsmen.

Plastic impressions were made instead of mounting the scales in a glycerine-gelatin mixture as given by Van Oosten, (1929). Materials for the impression method are as follows: cellulose acetate plastic, 1/20th inch thick; a small tooth brush; a hydraulic press (Plate 1); and a hot plate wired with a thermostat and relay.

The cellulose acetate plastic of this thickness had the following advantages: it required little heat to make impressions and it was easily cut to desired size with the aid of an ordinary paper cutter. One disadvantage in making impressions, including the margins, of the large scales was experienced: it was necessary to press the large scales so deeply into this thin plastic that a bulge causing some distortion was often formed on the reverse side.

The tooth brush was used to clean the scales.

The hydraulic press was designed for field as well as laboratory use. The press was built around a seven-inch hydraulic car jack with a lift capacity of 1-1/2 tons, and had an overall height of 11-1/2 inches with a pressing surface of 3 square inches.

The hot plate, with a 115 volt-500 watt capacity, was used to soften the plastic and was attached to the upper pressing surface. Thus the impression side of the plastic received the desired heat. The thermostat was also

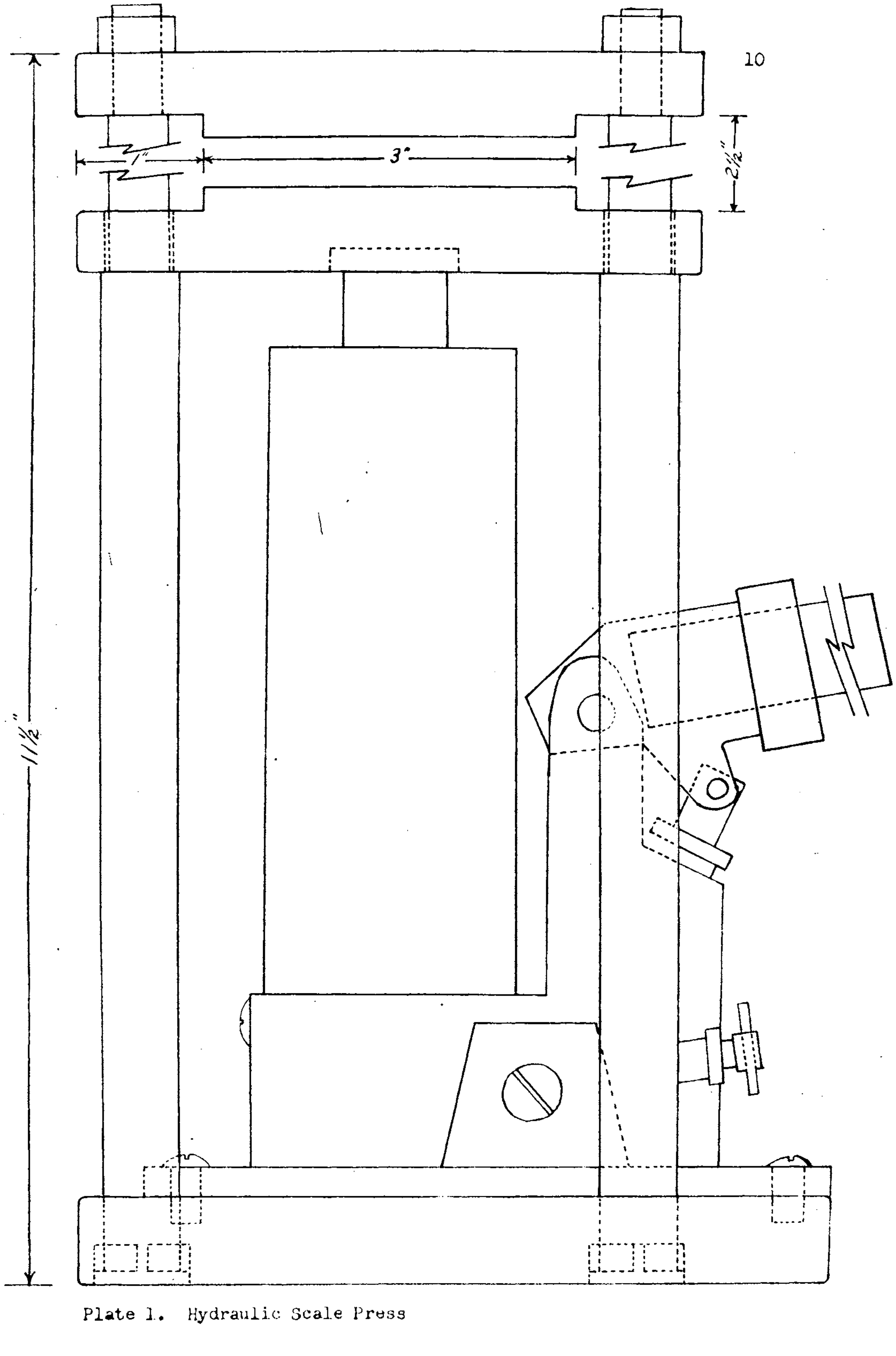

Plate 1. Hydraulic Scale Press

attached to the upper pressing surface to control the heat. It was found, even with the use of the thermostat, that continuous use for 3 or 4 hours increased the temperature above the desired amount. A more constant temperature was maintained by attaching in series a small 115 volt-60 cycle bell relay. When the points of the thermostat began to open, the bell relay broke the circuit completely.

Since thick scales had to be forced deeper into the plastic, they required more heat than thinner ones. A temperature of 150° F. was used for small scales and 165° F. for larger ones to produce good clear impressions including the margins. Such large scales as those of the carp would not only require higher temperatures but thicker plastic.

The scale impression method presents the following improvements over the permanent slides: (1) 3 to 12 scales can be placed on a plastic section the size of a microscope slide, (2) sections of plastic up to 3 by 3 inches can be used, (3) the impressions can be more clearly seen with a microscope and produce a better image on a scale reader, and (4) the impressions in plastic seem to be more permanent. This method is comparatively inexpensive and reasonably fast.

Age determinations were based on the reading of annuli with the use of a scale reader (Van Oosten, Deason, and Jobes, 1934).

The term "age group" as used in this paper indicates the number of annuli found on the scale. For example, young-of-the-year were placed in age group 0, until it had produced its first annulus. These fish may not be quite one year old at the time of the first annulus formation, but the second annulus would be formed about one year later.

AGE AND RATE OF GROWTH

Scales from 46 specimens ranging in length from 11.5 to 24 inches and in age from 1 to 7 years were available from Lake Carl Blackwell. All of these were caught on hook and line by sportsmen and, therefore, are selective and are not necessarily a true representation of the lake population. The fish exceeded the established average (tables 2 and 3) for length each year but fell below the average for rate of growth during their third, fourth, and fifth years. The analysis of these scale samples indicates that the lake provided good growing conditions for bass during their first two years and fair conditions for the remainder of their lives. The largest individual from this lake was a 24 inch 6-year-old whose growth at the end of the first year was 12 inches. The slowest growing individual was a 13.5 inch 4-year-old whose growth at the end of the first year was only 4.8 inches. Both of these fish were caught the same day in the same arm of the lake.

Scale samples from 26 fish were obtained from Carberry's Pond. This pond was stocked for the first time in March, 1946 with 119 fingerling bass (2.5 to 5.5 inches). Only one 3 year old fish was reported and it undoubtedly was one of the original plant. It was approximately 2.9 inches when planted, grew 8.5 inches its first year in this pond, and 5.6 inches its second year, to reach a total of 17 inches. The samples from this fertilized pond averaged higher than the established average each year (tables 2 and 3). The fastest growing fish taken grew 10 inches the first year while the slowest one grew only 2.8 inches. Analysis of these scale samples indicates that conditions were good for bass their first two years. The pond was not old enough to judge conditions for older bass.

Yost Lake was represented by scales from 44 specimens (3.9 to 22.5 inches) and from 1 to 6 years. The fastest growing individual from this lake made a growth of 9 inches the first year and reached a length of 22.5 inches the fifth year. The slowest growing fish grew only 1.8 inches the first year and was only 8.6 inches at the end of the fourth year. The fishes from this lake fell below the established average each year (tables 2 and 3). The study of these fish showed that this lake offered poor conditions for young bass and was improved only slightly for older bass. If these were representative of the lake, it appeared that the bass population was stunted. The bass from this lake reached legal size sometime between their third and fourth years.

Scale samples from 3 fish were received from Rutters Pond. All 3 made poor growths their first year but made tremendous growths reaching at least 12.5 inches by the end of their second year (table 2).

Scales from 2 fish were received from Katy Lake. These fell below the established average the first year but exceeded it thereafter (tables 2 and 3).

Cedar Crest Lake was represented by 8 fish and they exceeded the established average rate of growth each year except the third (table 3). One fish reached a length of 14.3 inches the first year.

The 5 fish obtained from Berrigan's Pond exceeded the established average growth rate their first year but fell below the second (table 3).

The 5 specimens from Clinton Lake grew slower than the established average the first two years, equaled the average the third and surpassed it in the fourth. However, their growths were so slow the first two years that they did not equal the average total length for 3 and 4 year old fish.

Commanche Lake, represented by 8 fish, fell far below the established average growth and length rates. Five of the fish were 2 years old, 2 were 3, and 1 was 4, but none attained the legal length of 10 inches.

TABLE 2

AVERAGE TOTAL LENGTH FOR EACH AGE GROUP

Locality	Number of Annuli							
	0	1	2	3	4	5	6	7
Lake Carl Blackwell		6.6	11.8	14.8	16.9	20.2	21.1	19.3[1]
Carberry's Pond	6.6[2]	7.9	10.8	17.0[1]				
Yost Lake	4.9[2]	4.2	7.9	10.6	13.0	18.3	18.0[1]	
Rutters Pond		3.7	13.0					
Katy Lake		5.9	12.0	17.3	19.5			
Cedar Crest Lake		8.3	11.1	11.5	14.7	17.5		
Berrigan's Pond		7.7	10.9					
Clinton Lake		4.7	8.3	10.9	14.0			
Commanche Lake		3.8	7.0	8.1				
Brockman's Pond		4.5	11.5	13.4	14.7			
Theta Pond [3]		8.7	12.3	14.5				
Lake Murray		6.2	14.0	15.8	18.0			
Mountain Lake		5.9	11.0	14.5	17.7	19.5	21.5	
French Lake [3]		6.7	14.0	18.1	20.0			
Lost Lake [3]		9.9	13.0					
Lake Burford[3]		4.7	8.5	14.5				
Crystal Lake		5.1	8.6	13.5	16.3	18.0	18.0[1]	
Johnson Lake[3]		10.1	15.8	18.8	21.1	23.5		
Lake Carleton[3]		6.6	8.0					
Caddo Lake [3]		7.6	12.4	15.2	17.8	19.5		
Thomas Lake[3,4]		1.6	5.3	10.1	13.2			
Thomas Lake[5]	8.1[2]	9.1						
Silver Dollar Lake[3]		9.6	13.2	17.4	18.6	19.0		
Lake Hefner[3]		7.4						
AVERAGE	6.5	6.5	10.9	14.2	16.8	19.4	19.6	19.3

[1] Only one fish this age was collected from this Lake.

[2] These fish were collected from December to April and, therefore, had lived through a growing season but had not formed a complete annulus.

[3] Only one fish was collected from this Lake.

[4] This fish was collected when the Lake was poisoned.

[5] These fish were collected after the Lake was restocked.

TABLE 3

AVERAGE RATE OF GROWTH FOR EACH YEAR

Locality	Number of Annuli							
	0	1	2	3	4	5	6	7
Lake Carl Blackwell		6.6	5.2	3.6	2.0	1.9	1.5	.6[1]
Carberry's Pond	6.6	6.9	4.6	5.6[1]				
Yost Lake	4.9	4.2	3.7	3.3	2.5	2.1	.6[1]	
Rutters Pond		3.7	9.3					
Katy Lake		5.9	6.1	3.3	2.2			
Cedar Crest Lake		8.3	5.5	2.5	3.2	2.8		
Berrigan's Pond		7.7	4.3					
Clinton Lake		4.7	3.6	3.5	3.0			
Commanche Lake		3.8	3.3	1.5				
Brockman's Lake		4.5	7.0	1.9	2.4			
Theta Pond [2]		8.7	3.6	2.2				
Lake Murray		6.2	8.0	2.9	1.6			
Mountain Lake		5.9	5.1	3.4	3.2	2.2	1.6	
French Lake [2]		6.7	7.2	4.1	1.9			
Lost Lake [2]		9.9	3.1					
Lake Burford[2]		4.7	3.8	6.0				
Crystal Lake		5.1	3.5	4.9	2.8	2.1	2.0[1]	
Lake Johnson[2]		10.1	5.7	3.0	2.3	2.4		
Lake Carleton[2]		6.6	1.4					
Caddo Lake [2]		7.6	4.8	2.8	2.6	1.7		
Thomas Lake[2,3]		1.6	3.7	4.8	3.2			
Thomas Lake [4]	8.1	9.1						
Silver Dollar Lake[2]		9.6	3.6	4.2	1.2	.4		
Lake Hefner [2]		7.4						
AVERAGE	6.5	6.5	4.8	3.8	2.4	2.0	1.4	.6

[1] Only one fish this age was collected from this Lake.

[2] Only one fish was collected from this Lake.

[3] This fish was collected when the Lake was poisoned.

[4] These fish were collected after the Lake was restocked.

Brockman's Lake, represented by 5 fish, exceeded the established average only during the second year (tables 2 and 3), and reached legal size by the second or third year.

Scales from 1 fish were obtained from Theta Pond. This fish reached legal size the second year, although it fell below the established average the second year (tables 2 and 3).

The 7 fish received from Lake Murray grew slower than the established average each year except the second when they almost doubled it (table 3). Because of this rapid second year growth, they exceeded the average length each year except the first (table 2).

Scales from 3 fish were collected from Mountain Lake. These showed a faster growth than the established average the second, fourth, and sixth years, and grew slower the first and third, and equaled it the fifth year.

The 1 fish received from French Lake exceeded the established average growth rate each year except the fourth. The length at the end of the second year was 14 inches.

Lost Lake was represented by 1 fish which grew 9.9 inches the first year and reached 13 inches by the end of the second year.

Scales from 1 fish were obtained from Lake Burford. This fish fell below the established average growth rate the first two years and made a rapid growth of 6 inches the third year to reach a total length of 14.5 inches (table 3).

The 3 fish obtained from Crystal Lake reached legal length during their third year. The fish grew slowly the first two years and made a more rapid growth the third year (table 3).

Johnson Lake was represented by 1 fish which made a good growth each year, especially the first two when it grew 10.1 inches the first and 5.7 inches the second year. It reached a length of 23.5 inches the fifth year.

The 1 fish received from Lake Carleton made a good growth of 6.6 inches the first year but only 1.4 inches the second year (table 3).

Caddo Lake was represented by 1 fish which was 5 years old and made good growths the first two years but did not grow well the last three (table 3).

Scale samples from 21 fish were received from Lake Thomas. Scales from 1 fish were received before the lake was poisoned and restocked. This fish had a poor growth the first year of only 1.6 inches. The growth rates for the next 3 years and total lengths are found in tables 2 and 3. The remaining samples were from fish stocked after poisoning. All of these fish had completed their first growing season and averaged 8.1 inches.

The 1 fish received from the Silver Dollar Lake grew rapidly the first year, fell below the established average the second, exceeded it the third, and dropped below the fourth and fifth years (tables 2 and 3).

Scales from 1 fish were received from Lake Hefner. This fish had just completed the first growing season and was 7.4 inches in length.

DISCUSSION

The average rate of growth and the average length of the samples studied are shown at the bottom of tables 2 and 3, and by graph in fig. 7. This average is based on 195 readable scale samples received from the various impoundments. Since the largemouth black bass exhibited pronounced variations in rate of growth within each age group, it seemed one should have many more specimens before declaring the average given herein to be a standard for Oklahoma. These scale samples were received from some of the lakes and ponds which sportsmen reported as poor and from some they reported as good, therefore, these figures do indicate a trend for the rate of growth of largemouth black bass. Forty-four of the 195 scale samples were obtained from Yost Lake where the fish made particularly poor growths. This lake had been treated with copper sulphate until it became a poor representative of Oklahoma waters. These specimens reduced the established average growth rate below what would be expected for a state average.

Since the writer could find no correlation between the size of impoundments and the rate of growth of the bass taken from them, the size of the impoundments was omitted. When only a few scale samples were received from an impoundment, they were not considered as representing an average for the lake, still they do show whether the particular individuals found a good or poor habitat, and contribute toward an average growth rate for largemouth black bass in Oklahoma.

The largemouth black bass in Oklahoma seemed to show growth compensation since fish which made a slow growth the first year showed a tendency to grow more rapidly the second year. However, bass which made a rapid growth the first year generally retained advantage in length throughout life.

Growth in Other States

Since 10 inches is the minimum legal length for most states which have a size limit, legal length provides a convenient comparison of Oklahoma bass with those of other States. Table 4 shows that Oklahoma bass generally reach legal length during their second year, while only Conchas Reservoir in New Mexico and Lake Mead in Nevada reached it during the first year. The bass in northern states reach a legal size sometime during their third or fourth year.

No report on bass growth studies was intentionally overlooked. When original figures were given in terms of standard or forked length, or in the metric system, they were changed to total length in inches. It would seem that errors introduced by so doing would be too small to change comparisons significantly.

Table 5 shows the comparison of the rate of growth of bass in Oklahoma with those given for other States. These figures were computed from table 4 and, therefore, are not completely accurate, but do show the comparison.

SUMMARY

1. This paper contains an investigation of the age and rate of growth of the largemouth black bass of various impoundments in Oklahoma.

2. The investigation was based upon the scales from 195 fish which represented 23 impoundments from various parts of the State.

3. An average was established for length and rate of growth in the 23 impoundments sampled.

4. A description is given for the materials used in making plastic impressions.

5. Variation is shown in the rate of growth found in different impoundments, and within the same lake or pond.

6. Evidence is shown of selectivity in the methods used in collecting these specimens.

7. A comparison is made between the age and rate of growth of the bass in Oklahoma and those of other States.

TABLE 4

COMPARISON OF GROWTH OF LARGEMOUTH BLACK BASS IN OKLAHOMA AND IN OTHER STATES. (Total lengths in inches) Numbers of fish not included (see original source).

Water and Source	Average Lengths at end of Year 1	2	3	4	5	6	7	8	9	10	11
OKLAHOMA	6.6	10.9	14.2	16.8	19.4	19.6	19.3[1]				
CONCHAS RESERVOIR, NEW MEX. (Mottley & Chamberlain, 1948)	10.7	13.4	16.2	18.1	20.6	21.3	23.0	23.5			
LAKE MEAD, NEV. (Moffett, 1943)[2]	10.3	12.6	13.4	14.6	15.2	16.4	20.1				
LOUISIANA (Bennett, 1937)	7.6	11.3	14.5	18.8	20.9	23.5	24.8				
NORRIS RESERVOIR, TENN. (Stroud, 1948)	6.9	12.2	14.7	16.1	17.5	19.3	20.8				
CHICKAMAUGA RESERVOIR, TENN. (Eschmeyer, Stroud & Jones, 1944)	6.9	10.5									
MICHIGAN (Beckman, 1946)	6.1	8.7	10.0	12.1	13.7	15.1	16.1	17.7	17.9		
ONTARIO, CANADA (Curran, Bardach, Bowman, Lawler, 1947)	5.5	9.1	11.7	13.5	15.5	16.5	17.2	18.0			
CONNECTICUT WATERS (Webster, 1942)[3]	5.1	8.3	10.7	12.9	14.7	16.2	17.5				
LAKE OF OZARK, MO. (Weyer, 1940)	4.8	7.7	10.5								
MASSACHUSETTS (Swartz, 1942)	4.6	7.0	9.3								
FOOTS POND, IND. (Ricker, Lagler, 1942)	4.0	7.2	9.4	14.6							
MINNESOTA WATERS (Smith & Moe, 1944)	3.9	6.2	11.5	13.8	15.3	16.3	16.9	18.0	19.8	21.7	23.3
SPORTSMEN LAKE, ILL. (Thompson & Bennett, 1939)	3.8	8.1	11.4	13.3	14.9	16.6	18.4				
NEBRASKA (Bennett, 1937)	3.6	7.6	10.9	13.5	15.8	17.6	18.9				
OHIO (Roach & Evans, 1948)	3.5	7.3	10.0	12.5	14.5	16.0	17.5	19.6			
ONIZED LAKE, ILL. (Bennett, 1945)	3.4	10.6	14.0	16.5	18.6						
WISCONSIN WATERS (Bennett, 1937)	3.3	7.4	10.5	12.5	14.0	15.1	16.3				
REELFOOT LAKE, TENN. (Schoffman, 1938)[4]			9.7	11.8	13.6	15.0	16.4				

[1] Only one fish this age was received from the 23 impoundments.

[2] These were selected according to a 10 inch legal limit. The actual average would probably be somewhat less.

[3] These values are approximate, having been computed in inches to the nearest tenth, from the growth curve given by Webster.

[4] Schoffman recorded age to the number of summers while these have been computed to the nearest year.

TABLE 5

COMPARISON OF THE RATE OF GROWTH OF OKLAHOMA LARGEMOUTH BLACK BASS AND THOSE OF OTHER STATES.
(Computed from Table 4)

Water and Source	Average Rate of Growth for Each Year										
	1	2	3	4	5	6	7	8	9	10	11
OKLAHOMA	6.6	4.8	3.8	2.4	2.0	1.4	.6[1]				
CONCHAS RESERVOIR, NEW MEX. (Mottley & Chamberlain, 1948)	10.7	2.7	2.8	1.9	2.5	.7	1.7	.5			
LAKE MEAD, NEV. (Moffett, 1943)[2]	10.3	2.3	.8	1.2	.6	1.2	3.7				
LOUISIANA (Bennett, 1937)	7.6	3.7	3.2	4.3	2.1	2.6	1.3				
NORRIS RESERVOIR, TENN. (Stroud, 1948)	6.9	5.3	2.5	1.4	1.4	1.8	1.5				
CHICKAMAUGA RESERVOIR, TENN. (Eschmeyer, Stroud, & Jones, 1944)	6.9	3.6									
MICHIGAN (Beckman, 1946)	6.1	2.6	1.3	2.1	1.6	1.4	1.0	1.6	.2		
ONTARIO, CANADA (Curran, Bardach, Bowman, Lawler, 1947)	5.5	3.6	2.6	1.8	2.0	1.0	.7	.8			
CONNECTICUT WATERS (Webster, 1942)[3]		3.2	2.4	2.2	1.8	1.5	1.3				
LAKE OF OZARK, MO. (Weyer, 1940)	4.8	2.9	2.8								
MASSACHUSETTS (Swartz, 1942)	4.6	2.4	2.3								
FOOTS POND, IND. (Ricker, Lagler, 1942)	4.0	3.2	2.2	5.2							
MINNESOTA WATERS (Smith & Moe, 1941)	3.9	2.3	5.3	2.3	1.5	1.0	.6	1.1	1.9	1.6	
SPORTSMEN LAKE, ILL. (Thompson & Bennett, 1939)	3.8	4.3	3.3	1.8	1.7	1.7	1.8				
NEBRASKA (Bennett, 1937)	3.6	4.0	3.3	2.6	2.3	1.8	1.3				
OHIO (Roach & Evans, 1948)	3.5	3.8	2.7	2.5	2.0	1.5	1.5	2.1			
ONIZED LAKE, ILL. (Bennett, 1945)	3.4	7.2	3.4	2.5	2.1						
WISCONSIN WATERS (Bennett, 1937)	3.3	4.1	3.1	2.0	1.5	1.1	1.2				
REELFOOT LAKE, TENN. (Schoffman, 1938)[4]				2.1	1.8	1.4	1.4				

[1] Only one fish this age was received from the 23 impoundments.

[2] These were selected according to a 10 inch legal limit. The actual average would probably be somewhat less.

[3] These values are approximate, having been computed in inches to the nearest tenth, from the growth curve given by Webster.

[4] Schoffman recorded age to the number of summers while these have been computed to the nearest year.

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