A FISH POPULATION STUDY OF CLAREMORE CITY LAKE

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INTRODUCTION. This study of the fish population of Claremore City Lake by six fishery biologists of the Oklahoma Game and Fish Department was made in an attempt to determine the ratio of species present and the rates of growth as shown by fish scales with a view towards improved fishing. Fish populations are necessarily studied by the use of representative samples, as entire populations cannot be seen without destroying them. Spot poisoning with rotenone affords a representative sample and is the cheapest, most expedient and accurate means now available.

Claremore City Lake is located three miles northwest of Claremore, Oklahoma (Sec. 1, Twp. 21 N, 16 E, Rogers County), and serves as the municipal water supply. The lake was impounded in 1922 and has an area of 470 surface acres and a capacity of 3,070 acre-feet. The surrounding terrain is hilly and forested with blackjack and post oak. The drainage area is extensive and consists primarily of cultivated and pasture lands. Moderately heavy shoreline vegetation includes water willow (*Dianthera americana*) and smartweed (*Polygonum sp.*). The water is turbid throughout most of the year, clearing somewhat during August and September.

METHODS. On August 22, 1949, an application of powdered derris root (containing 5-per cent cube powder rotenone) in a concentration of 1 p.p.m. was made to two small coves on the west shore of the lake. The poison was mixed with lake water and applied with a stirrup pump which emitted a stream capable of covering shoal areas adequately from a boat. In applying the poison, a heavy concentration was sprayed along a line at the open end of the inlet initially, and followed by an even dosage over the entire area with proper allotment for variations in water depth. Means of determining the extent of ingress and egress of fishes in relation to the treated area were not available as a complete blocking-off of the cove was impractical, and water turbidity prohibited any observations of movement.

After poisoning, all of the fish which rose to the surface, and could be reached by hand or with a long-handled dip net were recovered for a population study. A large percentage of the total number of fishes were recovered on the second day, having risen from the bottom during the night and drifted into shore. Dead fishes floating on the surface were carried out of the area by the action of wind and waves on the second day. All dead and dying fishes recovered outside of the poisoned area were included in the total count, as there was little evidence of the diffusion of the poison into adjacent areas. Considerable difficulty was experienced in recovering fishes, especially smaller ones, from the dense vegetation along the shore. Others were covered with mud in the process of recovery, as wading was a necessary expedient and stirred the bottom considerably. Total recovery was estimated as 80% of the actual kill.

The first inlet poisoned (Station 1) is located on the west shore approxi-

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mately one-half mile north of the boathouse. The area treated was 2.5 surface acres in extent, and averaged 2 feet in depth, with a maximum depth of 5 feet. Extensive shallow areas exist at the head of the cove, and extend up the creek which empties into it. Exposed stumps and submerged brush piles are present, and the entire shoreline is weedy. The bottom is silt loam from 6 to 18 inches thick.

Rotenone was applied to a second cove (Station 2) near the boathouse at 3:00 p.m., 22 August. Approximately one surface acre at the head of the cove, with an average depth of eight feet, was treated. The banks are steep and rocky, with moderate shoreline vegetation and the bottom clean, with a two to six inch layer of silt over sandstone.

MATERIALS. Population density computations are based on 9,052 individuals, recovered after application of the poison (including both coves) on August 22-23, 1949. Age and growth studies are based on 229 scale samples and 895 length-weight measurements of fourteen species of fish. Fishes not actually aged were arbitrarily assigned to age-groups representative of their size.

TABLE I

Number and Weight of Fishes Recovered After Poisoning, 22-23 August 1949, Lake Claremore.

	Station 1 2.5 Acres (5 Acre-feet)		Station 2 1.0 Acres (8 Acre-feet)	
Species	Number	Pounds	Number	Pounds
Short-nose gar *Lepisosteus platostomus*	1	——	——	——
Gizzard shad *Dorosoma cepediainum*	3952	383.8	413	49.6
Big-mouth buffalo *Megastomatobus cyprinella*	——	——	1	16.5
Carp *Cyprinus carpio*	12	18.9	6	23.3
Red shiner *Notropis lutrensis*	5	0.1	——	——
Bluntnose minnow *Hyborhynchus notatus*	3	——	——	——
Channel catfish *Ictalurus lacustris punctatus*	299	43.0	179	25.1
Black bullhead *Ameiurus melas catulus*	1	0.1	1	——
Yellow bullhead *Ameiurus natalis*	2	0.5	1	0.2
Flathead catfish *Pilodictis olivaris*	17	12.0	2	1.4
Blackstripe topminnow *Fundulus notatus*	7	——	——	——
Logperch *Percina caprodes carbonaria*	10	0.2	——	——
Largemouth bass *Micropterus salmoides*	80	26.7	21	4.2
Sunfishes*	1728	50.7	1277	24.6
White crappie *Pomoxis annularis*	68	5.3	238	15.5
Brook silversides *Labidesthes s. sicculus*	16	——	——	——
Drum *Aplodinotus grunniens*	581	103.8	131	21.8
Total	6782	645.1	2270	182.2
Grand Total	9,052 individuals			827.3 pounds

*Includes Bluegill, *Lepomis macrochirus;* green sunfish, *Lepomis cyanellus;* longear sunfish, *Lepomis megalotis;* redear sunfish, *Lepomis microlophus.*

TABLE II

Comparison of Total Pounds and Pounds of Game Fishes[1], of Forage Fishes[2], and of Coarse Fishes[3], Per Acre in Two Coves of Lake Claremore.

	Total Pounds of Fish/Acre	Pounds of Game Fish/Acre
Station 1	258.0	50.3
Station 2	182.2	69.4
Average	236.4	55.7
	Pounds of Forage Fish/Acre	**Pounds of Coarse Fish/Acre**
Station 1	153.7	54.1
Station 2	49.6	63.2
Average	124.0	56.7

Considering the recovered amount as 80% of the actual population, there were approximately 300 pounds of fish per surface acre sampled. Of the total, 24 per cent were game fish, 52 per cent were forage fishes, and 24 per cent

TABLE III

Calculated Average Total Lengths of 73 Lake Claremore Large-mouth Bass.

I Age Group	I No. of Fish	Average Total Length (inches)	Average Weight (ounces)	Length Range	Weight Range (ounces)
0	38	3.7	0.4	3.1- 4.3	0.2- 0.7
I	24	7.8	3.7	5.4- 9.2	1.4- 5.8
II	3	10.4	8.8	9.7-10.9	7.4-10.1
III	4	13.2	19.1	11.6-14.7	12.0-24.0
IV	1	14.9	25.0	———	———
V	2	18.6	58.0	17.7-19.6	56.0-60.0
VI	1	20.7	74.0	———	———

	Average Calculated Total Lengths In Inches At End of Year						
	1	2	3	4	5	6	7
0							
I	3.5*						
II	5.2	7.7*					
III	6.2	9.3	10.7*				
IV	6.5	10.8	12.9	13.3*			
V	7.3	11.3	13.7	16.6	17.3*		
VI	7.8	10.7	13.3	15.7	16.8	17.9*	
VII	6.1	9.3	15.3	18.0	18.5	19.3	19.9*
Average Total Length	4.5	8.5	12.7	14.9	17.4	18.4	19.9
Average Growth per Year	4.5	4.0	4.2	2.2	2.5	1.0	1.5

*Growth completed by August 22, 1949.
Age-group 0 includes all fish hatched in the spring of 1949, age-group I includes all fish hatched in the spring of 1948, etc.
[1]Game fishes—channel catfish, largemouth bass, crappie and sunfishes.
[2]Forage fishes—gizzard shad, minnows and logperch.
[3]Coarse fishes—gar, carp, bullheads, flatheads and drum.

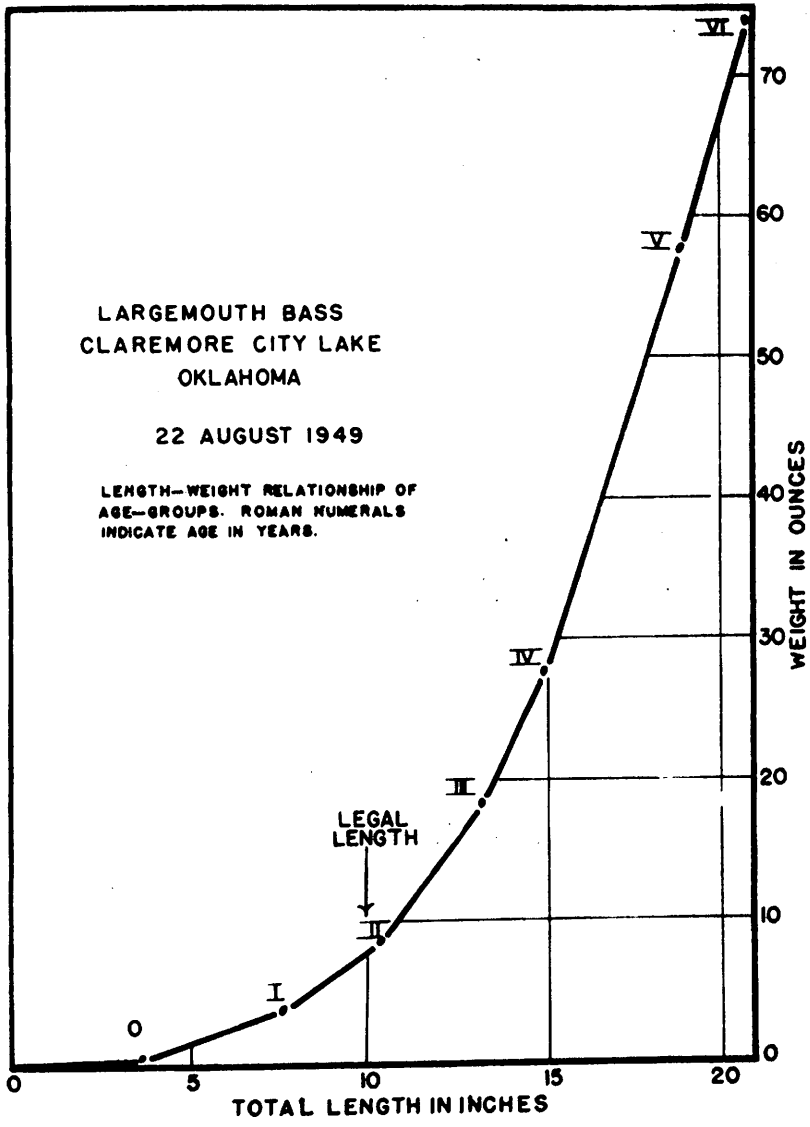

FIGURE 1.

were edible, coarse, or commercial fishes. The total number of individuals, 9,052, averaged 0.09 lb. (1.5 ounces) in weight. Eleven largemouth bass, 45 channel catfish, and 44 white crappie of legal length comprised the total of fishes from 3.5 acres with which the fisherman is immediately concerned. The gizzard shad, a valuable food fish for game fish during the first year of

its life, accounted for about one-half of the total, both in numbers and weight. Sunfishes represented 33% of the numerical total and 9% of the weight. A big-mouth buffalo weighing 16.5 pounds was the largest fish taken. (Station 2).

AGE AND GROWTH RATES

LARGEMOUTH BASS. Age and growth rate data for the largemouth bass are based on 73 of a total of 101 recovered. On the basis of total weight, this species was the second most important game fish in the lake. A total of 30.9 pounds comprised 3.7 per cent of the total weight of all fishes recovered.

From an examination of the calculated growth rates for years past, it appears that the growth of bass is becoming progressively slower. The average growth per year indicates an increase in length of about four inches for each of the first three years of life. Thereafter, this length increase drops sharply to two, and then to one inch growth per year. The early years of growth are of great importance in determining the ultimate size of comparatively short-lived largemouth bass in southern waters. Natural mortality is no doubt rapid from age four on, and depletes the population much faster than do fishermen's catches. If growth rates are accelerated during the critical first and second years of life, and bass reach legal length in their second summer, many more bass would appear in the angler's creel. Table III indicates that bass reached legal length late in their second summer of life in the years 1945-47, but not in 1948, and (in all probability), 1949. This de-acceleration of growth rate creates a condition unfavorable to the production of ten-inch bass and lowers the chance of fishermen seeking this most highly-prized Oklahoma game fish.

TABLE IV

Comparison of Growth of Largemouth Bass in Lake Claremore and in Other Waters (1).

BODY OF WATER	AVERAGE CALCULATED TOTAL LENGTHS IN INCHES AT END OF YEAR OF LIFE							
	1	2	3	4	5	6	7	8
Lake Claremore, Oklahoma*	4.5	8.5	12.7	14.9	17.4	18.4	19.9	—
Great Salt Plains Reservoir, Okla.**	9.5	12.1	14.1	15.3	—	—	—	—
Norris Reservoir, Tennessee	6.9	12.2	14.7	16.1	17.5	19.3	20.8	—
Louisiana Lakes***	7.6	11.3	14.5	18.8	—	—	—	—
Shawnee Lake, Oklahoma**	5.0	8.0	11.1	12.4	14.0	15.0	16.3	16.7

Slower growth is exhibited by Lake Claremore bass than in the other lakes cited, with the exception of Lake Shawnee. Largemouth bass reach legal length in their third summer of life in Lake Claremore.

WHITE CRAPPIE. Studies of age and growth rates of the white crappie are based on 251 of the 306 individuals recovered.

*Bass taken on 22 August 1949.
**Bass taken in June, 1949.
***Figures represent the average actual total lengths of the various year classes.

TABLE V

Calculated Average Total Lengths of Lake Claremore White Crappie.

Age Group	No. of Fish	Actual Average Total Length Inches	Actual Average Weight in Ounces	Total Length Range Inches	Weight Range Ounces
0	25	3.2	0.2	2.5-3.6	0.1-0.3
I	194	5.3	1.0	4.2-6.3	0.6-1.6
II	30	6.4	1.7	5.9-6.9	1.4-2.5
III	2	7.9	3.9	7.8-8.0	3.8-4.0

Age Group	Average Calculated Total Lengths in Inches at End of Year of Life			
	1	2	3	4
0	3.3*			
I	4.1	5.3*		
II	4.5	5.7	6.4*	
III	4.8	6.5	8.0	9.3*
Average Total Length	4.1	5.4	6.5	9.3
Average Growth per Year	4.1	1.3	1.1	2.8

The calculated growth of crappie in the last four years indicates a steady decline in the annual growth rate. Individuals hatched in 1946 grew approximately one inch longer during the first year of life than those that hatched this spring (1949).

TABLE VI

Comparison of Growth of White Crappie in Lake Claremore and in Other Waters. Total Length in Inches.

Body of Water	Year of Life				
	1	2	3	4	5
Lake Claremore, 8-22-49	3.2	5.3	6.4	7.9	—
Spiro City Lake, 9-15-49	—	5.9	7.2	—	—
Henryetta Country Club Lake, 9-13-49	4.7	6.9	7.6	8.3	9.2
Duncan City Lake, 1947-48	—	4.6	5.5	5.9	—
Foot's Pond, Indiana, 1942 (C)	2.8	5.8	8.6	—	—

(C) Average calculated total lengths.

The growth rate of Lake Claremore crappie compares favorably with the other lakes cited (Table VI), but is not as rapid as is considered desirable to afford satisfactory fishing. Crappie grow at twice this rate during early years in new impoundments under reduced population pressure, and with ideal available food. Although doubling the growth rate of crappie in a reservoir as old as Lake Claremore is hardly possible, it should be increased by a decrease in the existing crappie population. Lake Claremore crappie reach legal length in their third summer of life.

Channel Catfish. Age determinations of channel catfish are based on 348 of the 478 individuals recovered. This species represented 5.3 per cent of the numerical total and 8.2 per cent of the total weight of recovered fishes.

*Growth completed by August 22, 1949.

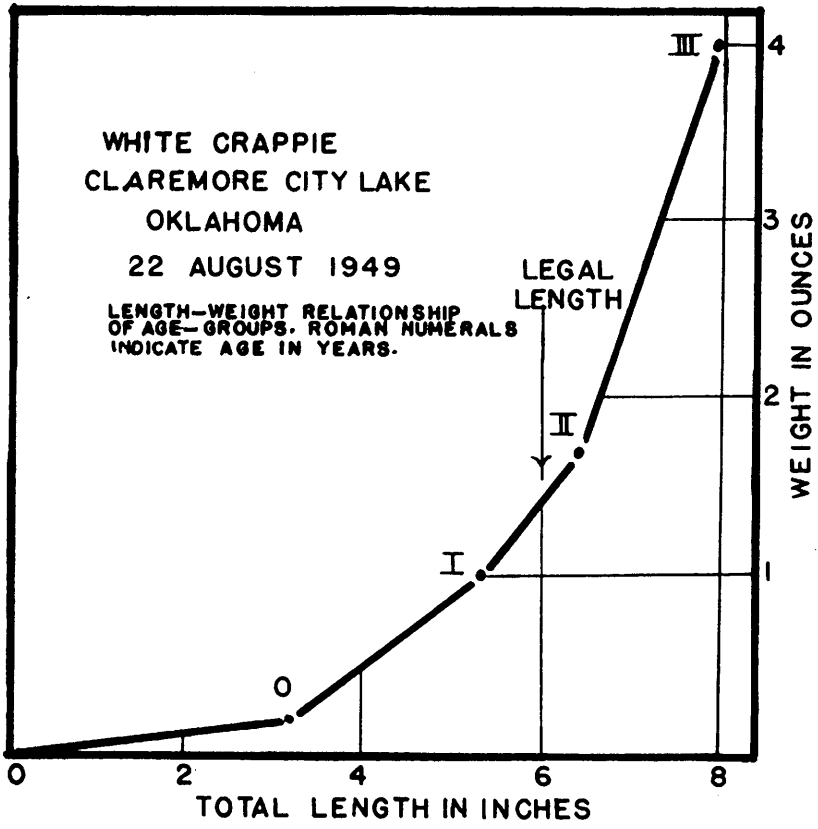

FIGURE 2

TABLE VII

Average Total Length and Weight of Age Groups of Channel Catfish from Lake Claremore, August 22, 1949

Age Group	No. of Fish	Total Length in Inches	Weight in Ounces	Total Length Range in Inches
0	67	2.7	0.1	1.5- 3.7
I	124	6.4	1.1	4.3- 7.5
II	86	8.4	2.6	7.4- 9.6
III	39	9.6	4.1	8.9-10.5
IV	16	11.2	5.7	10.4-11.8
V	14	12.3	8.8	11.8-13.0
VI	1	14.1	14.3	———
VIII	1	21.4	52.0	———
TOTAL	348			

TABLE VIII

Comparison of Growth of Channel Catfish in Lake Claremore and in Other Oklahoma Waters. Average Total Length in Inches.

Age Group	Claremore Lake	Pawhuska Lake	Shawnee Lake	Lake Overholser	Great Salt Plains Reservoir	Fairfax Lake	Comanche Lake
0	2.7	—	—	—	—	—	—
I	6.4	11.6	3.6	—	6.1	11.0	9.3
II	8.4	17.2	5.5	13.5	8.7	19.3	18.3
III	9.6	—	7.6	14.0	12.0	24.3	20.0
IV	11.2	23.9	9.0	15.4	16.4	—	24.4
V	12.3	29.7	11.1	19.9	19.1	—	—
VI	14.1	31.9	13.5	21.1	21.3	—	—
VII	—	—	18.0	29.8	23.0	—	—
VIII	21.4	—	—	—	—	—	—
IX	—	—	26.1	—	—	—	—

Legal length (ten inches) is attained in the fifth summer of growth. In comparison, Shawnee Lake catfish reach ten inches in their sixth summer, and the Great Salt Plains Reservoir channel cats in their fourth summer.

Growth is much more rapid in some lakes of Oklahoma (Table VIII). Channel catfish attained legal length during their first summer of growth in Lake Fairfax in 1948.

Sunfishes. Bluegill, warmouth, green, long-ear, orange-spot, and red-ear sunfishes. Thirty-one scale samples were taken from a total of 3,005 sunfishes recovered. The following table summarizes ages and growth rates of the various species.

TABLE IX

Average Total Lengths and Weights of Age-groups of Five Species of Sunfishes in Lake Claremore, August 22, 1949.

Age	Bluegill		Green Sunfish		Red-ear Sunfish		Long-ear Sunfish		Warmouth	
Group	TL*	Wt*	TL.	Wt.	TL.	Wt.	TL.	Wt.	TL.	Wt.
I	3.7	0.4	4.3	0.8	3.8	0.7	3.8	0.6	—	—
II	5.1	1.4	—	—	5.7	1.9	—	—	5.5	1.9
III	6.0	2.8	—	—	7.1	3.5	—	—	—	—
IV	—	—	—	—	—	—	—	—	7.4	4.8

The most rapid growth is evidenced in the red-ear sunfish, with green sunfish, warmouth, long-ear, and bluegill following in order. The growth rates exhibited are not extremely poor, but are below the regional average.

TABLE X

Comparison of the Growth of Bluegill in Lake Claremore and in Other Waters.

Body of Water	Actual Average Total Length in Inches Year of Life			
	1	2	3	4
Lake Claremore, 8-22-49	—	3.7	5.1	6.0
Spiro City Lake, 9-15-49	4.2	6.0	—	—
Henryetta Country Club Lake, 9-13-49	—	4.7	6.1	6.7
White's Pond, Muskogee, 9-16-49	—	4.2	5.9	6.3
Foot's Pond, Indiana*	1.6	4.1	—	—
Michigan Lakes (Lagler, 1949)	1.7	3.1	4.3	5.4

*TL—Total length in inches.
Wt. — Weight in ounces.
*Calculated growth.

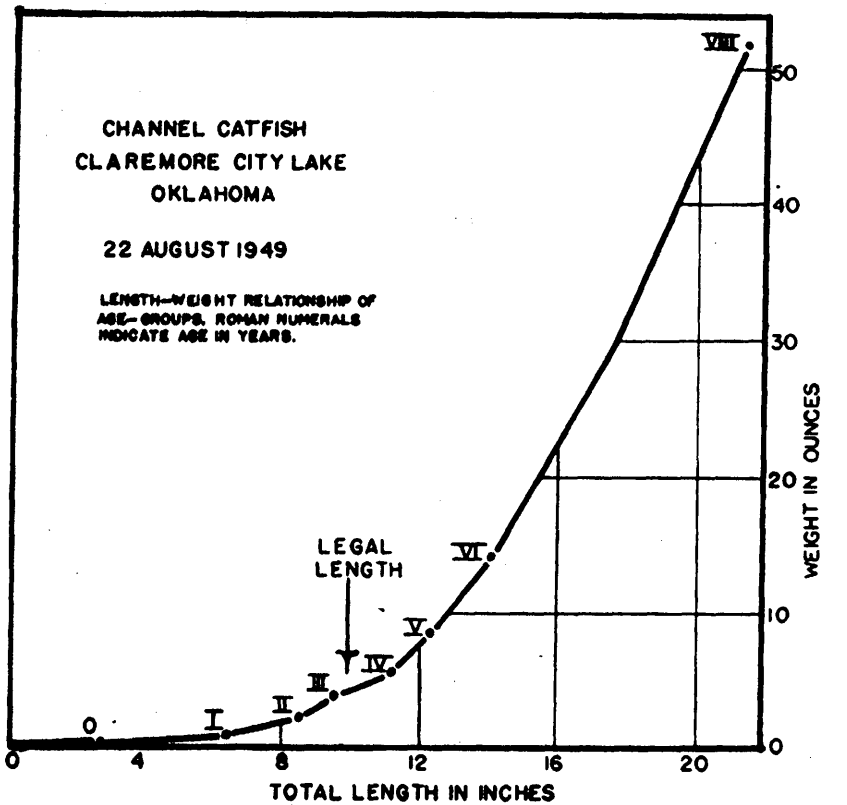

FIGURE 3

DRUM. Age determinations of drum are based on 84 of 721 individuals recovered.

TABLE XI

Average Total Length and Weight of Age-groups of Drum, Lake Claremore, August 22, 1949.

AGE GROUP	NO. OF FISH	TOTAL LENGTH IN INCHES	WEIGHT IN OUNCES	TOTAL LENGTH RANGE IN INCHES	WEIGHT RANGE IN OUNCES
0	5	3.6	0.3	3.4- 3.7	0.2-0.4
I	38	7.2	2.2	5.8- 8.0	1.6-2.9
II	38	9.1	4.4	8.1- 9.7	3.2-5.5
III	3	11.2	7.9	10.2-11.5	5.7-7.5

Similar surveys conducted at Grand Lake and in other reservoirs have revealed great numbers of drum in comparable size groups. A proportion of 721:4,365, or about one drum to six shad was found at Lake Claremore.

TABLE XII

Comparison of Growth of Drum in Lake Claremore and in Other Waters. Total Length in Inches, Weight in Ounces

	Lake Claremore		Reelfoot Lake, Tenn.		Lake Erie	
Age Group	Av. Length Inches	Av. Weight Ounces	Av. Length Inches	Av. Weight Ounces	Av. Length Inches	Av. Weight Ounces
0						
I	7.2	2.2	10.4	8.0	8.6	3.7
II	9.1	4.4	13.4	18.4	10.4	7.0
III	11.2	7.9	15.1	28.0	11.8	10.6

Table XII indicates that the growth rate and condition of Claremore drum is far below that of the other lakes cited. In both Lake Erie and Reelfoot Lake, drum are taken by commercial fishermen in significant numbers. The fact that this fish is not harvested in Lake Claremore, and does exist in great abundance, undoubtedly accounts in part for its poor growth rate.

Gizzard Shad. Age determinations of gizzard shad are based on 163 of 4,365 individuals recovered.

TABLE XIII

Average Total Length and Weight of Age-groups of Gizzard Shad, Lake Claremore, August 22, 1949

Age Group	No. of Fish	Av. Total Length in Inches	Length Range in Inches	Av. Weight in Ounces	Weight Range in Ounces
0	10	3.7	2.8-4.5	0.4	0.2-0.6
I	111	6.7	5.3-8.3	1.7	0.9-2.9
II	43	9.1	8.2-9.9	4.0	3.3-6.1

Comparison shows the growth rate to be near the average for lakes of about the same size and age in this area. The shad is by far the most abundant species in the lake, as is typical of all larger Oklahoma lakes, and assures an ample game fish food supply throughout the summer months.

LITERATURE CITED

1. Lagler, Karl F., 1949, Studies in Freshwater Fishery Biology. Third Revised Edition: 213-214.
2. Schoffman, R. J., 1941, Age and Growth of the Drum in Reelfoot Lake. Journ. Tenn. Acad. Sci., 16: 100-110.