A STUDY OF FISH POPULATIONS, WITH SPECIAL REFERENCE TO THE WHITE BASS, LEPIBEMA CHRYSOPS (RAFINESQUE), IN LAKE DUNCAN, OKLAHOMA[1]

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There have been few fish population studies of Oklahoma waters. From time to time biologists of the Oklahoma Game and Fish Department have made brief age, growth, and population studies of species found in Oklahoma lakes; to date most of this work remains unpublished.

Attention has been given to the life history of white bass, *Lepibema chrysops* (Rafinesque), in the northern and eastern areas of their natural range (12, 16). Thompson (14) made an age and growth study of white bass of two Oklahoma City Municipal Reservoirs. Weese and Thompson (18) are, at the present time, making an age and growth study of white bass of Lake Texoma, Oklahoma. The results of these latter studies indicate that the over-all age average of this species is slightly less than the white bass reported on by Van Oosten (16), Howell (7), and Sigler (12).

The validity of the annulus as a year mark has been established by Creaser (2), Hile (4,5), Hansen (3), Van Oosten (16), Sigler (12), Beckman (1), and others. The section on white bass of known age to be presented later is further evidence in favor of the validity of the annulus as a year mark. It was assumed that the scale method was valid for this study.

Creaser (2) emphasized that cessation of growth in the winter and the resumption of growth following in the spring are the immediate factors involved in the formation of the annulus. According to Beckman (1), temperature appeared to be the primary factor in the time of annulus formation. He also stated that "Food is ordinarily of secondary importance as a factor in the time of annulus formation. A severe scarcity of food, or an abrupt change in its availability, may make it a primary factor."

Growth compensation has been mentioned by several investigators as a somewhat common occurrence in many species. Tiller (15), working on the yearling and two-year-old striped bass, *Roccus saxatilis* (Walbaum), found that complete compensation does not occur. Hile (5) concluded that the larger yearlings retained at least a part of their original length advantage through most of their life.

[1]A thesis submitted in partial fulfillment of requirements for Master of Science Degree at the University of Oklahoma.

Lagler (8) described four general methods employed for age and growth studies:

1. Sample of length-frequency data and graphic analysis.
2. Known age method.
3. Otolith and bone methods.
4. The scale method.

He described the last method as being the simplest and most accurate means of age and growth studies.

The calculations in this paper are based upon data obtained by the known age, scale, and bone methods of analysis.

MATERIALS AND METHODS. The species of fish collected for age and growth studies are listed as follows:

White Bass	*Lepibema chrysops* (Rafinesque)
Largemouth Black Bass	*Micropterus salmoides* (Lacèpède)
White Crappie	*Pomoxis annularis* (Rafinesque)
Black Crappie	*Pomoxis nigro-maculatus* (Le Sueur)
Bluegill	*Lepomis macrochirus* (Rafinesque)
Redear Sunfish	*Lepomis microlophus* (Gunther)
Longear Sunfish	*Lepomis megalotis* (Rafinesque)
Warmouth	*Chaenobryttus coronarius* (Bartram)
Green Sunfish	*Lepomis cyanellus* (Rafinesque)
Hybrid Sunfish (Warmouth and Redear Sunfish)	
Channel Catfish	*Ictalurus lacustris* (Rafinesque)
Flathead Catfish	*Pilodicti solivaris* (Rafinesque)
Carp	*Cyprinus carpio* (Linnaeus)
River Carpsucker	*Carpiodes carpio* (Rafinesque)
Gizzard Shad	*Dorosoma cepedianum* (Le Sueur)

The collections were made with four gill nets (one inch square mesh size was 10 by 125 feet; one and one-half, two, and two and one-half inch square mesh sizes were 8 by 150 to 210 feet) and with seines (minnow seine, 4 by 20 feet of one-quarter inch square mesh; and bobbinet seine, 3 by 10 feet). "Still" fishing with live bait and trolling with rod and artificial bait also were employed. The latter method was especially effective in collecting white bass.

Three netting stations were selected and all gill net sets were made at these locations. All net sets were made in the evening and allowed to remain overnight.

Scale samples were taken from the left side just below the dorsal fin, and each sample was placed inside a small envelope. Pertinent data were recorded on the face of the envelope. Standard length was recorded for most specimens. A pectoral spine was taken from only a small percentage of the catfish collected during the research. Weights taken in ounces were converted to grams, and lengths taken in inches were converted to millimeters.

Eleven fingerling white bass were collected from the 20 foot minnow seine and the 10 foot fry seine May 27, 1948. The fingerlings were preserved in 10 percent formalin, and at the laboratory the lengths and scale measurements were taken. A small amount of shrinkage probably occurred after the preservation, but the error was considered to be insignificant when standard lengths were taken (9).

TABLE I

Lake Duncan Species of Fish and the Method of Capture

Method of Capture	White Bass	Largemouth Black Bass	White Crappie	Black Crappie	Bluegill	Redear Sunfish	Longear Sunfish	Warmouth	Green Sunfish	Hybrid Sunfish	Channel Catfish	Flathead Catfish	Carp	River Carpsucker	Gizzard Shad	Total
Seining catch	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11
Total net catch	79	1	7	—	7	13	—	1	—	1	33	1	1	2	8	154
Rod and line catch*	87	33	38	5	6	2	1	4	1	2	—	—	—	—	—	179
Aggregate Total	177	34	45	5	13	15	1	5	1	3	33	1	1	2	8	344

In the laboratory, two scales from each envelope were immersed in warm water and cleaned with a stiff-haired brush. They were mounted on numbered glass slides in a glycerin-jelly medium. The scales were examined on a conventional scale machine with a magnification of 28.0 X. Measurements were made from the focus of the scale to the anterior margin. The positions of the annuli were marked on 1 x 8 inch tagboard strips. Measurements in millimeters for computations were taken from these strips.

Each catfish spine was severed, near the base, with a fine-toothed saw. The cross-section surface was smoothed with a rotating carborundum abrasive and then polished on a felt buffer. A microscope was used to determine the number of rings on the polished surface of the spine.

In this paper the ages 0, I, II, III, . . . refer to the number of winters through which the fish have lived. January 1 was designated as an automatic birthday for each fish. Thus, a fish collected in the summer following the spring in which it had been hatched belongs to the 0 age group. If this same fish had been collected on January 1 or after, it would belong to the I age group. A fish in its second summer of growth would belong also in the I age group; but a fish in its third summer of growth would belong in the II age group. The selection of January 1 as the birthday is permissible since this date occurs during the period of growth cessation, and new growth would not begin until spring. Fish spawned in the spring and collected the following January 1 or after were considered in the I age group in the data considered in this paper, even though the first annulus was not yet present. This plan was utilized also for designating the age of the older fish. Hile (6) employed this manner of age designation except that no date was set as the birthday. Ages I, II, III, . . . referred to the number of winters through which the fish had lived.

The coefficient of condition, K, was determined by the well-known equation $K = W \times 10^5/L^3$, where W = weight in grams and L = standard length in millimeters. A relatively large value of K represents a good condition of the fish.

The determination of the relationship between the body length of the white bass and the anterior radius of the scale was based on 171 samples. The

*Includes trolling

formula $L = a + bS$ (10) was used in fitting the regression line to the data, where L = standard length, a = a constant, b = a constant, and S = scale radius.

White Bass. The age composition of the Lake Duncan white bass is given in Table II. A greater number of individuals belonged to the age groups II and III. The selectivity of the gill nets in taking the older age groups is obvious. The smallest net size captured no young-of-the-year and the two other net sizes captured only II- and III-year-old fish. Trolling with rod and line and "still" fishing were the least selective. The data indicated that the II and III age groups are dominant, but this probably is not an absolute fact because of the selective methods of capture.

No V-year-old fish were captured, and apparently the average maximum life is four years. All of the IV-year-old white bass were collected in April and May, 1948. None of these had begun spring growth. Several of the individuals in age group II exhibited a change in pattern of the circuli at the anterior margin of the scales by May 5, 1948, but this could not be interpreted as a definite annulus.

TABLE II

Age Distribution of Lake Duncan White Bass

Method of Capture	Year Collected	Age Groups					
		0	I	II	III	IV	0-IV
1 Inch Gill Net	1948	—	1	3	1	1	6
1½ Inch Gill Net	1948	—	—	17	8	—	25
2 Inch Gill Net	1948	—	—	6	39	3	48
2½ Inch Gill Net	1948	—	—	—	—	—	—
Trolling	1947-1948	5	15	35	16	3	74
"Still" Fishing	1947-1948	5	1	5	2	—	13
Seining	1948	11	—	—	—	—	11
Grand Total		21	17	66	66	7	177

The length frequencies of the white bass are given in Table III. The standard length ranged from 24.0 millimeters for the 0 age group to 356.0 millimeters for the IV age group. There is considerable overlapping of the length intervals in age Groups I, II, III and IV, but a greater number of fish of age groups II and III belong in the length interval 210-229 millimeters and 260-279 millimeters respectively. The overlapping of the length intervals would have been decreased if all specimens had been collected during the same period. The white bass collected in August and October belonging in the same age group as those collected in April and May had the advantage of a summer growing season over the latter. All of the specimens belonging in age group IV were collected in April and at the beginning of May, 1948, but many of the specimens in age group III were collected in August and October, 1948. The latter had the advantage of the 1948 growing season. As can be seen in Table III, the standard lengths of a few individuals in age group III are as great as those in age group IV.

TABLE III

Length-frequency Distribution of the Lake Duncan White Bass, According to Age Grouns and Ten-millimeter Intervals of Standard Length

Standard Length in Millimeters	Age Groups					0-IV Number
	0	I	II	III	IV	
20- 29	11	—	—	—	—	11
60- 69	1	—	—	—	—	1
70- 79	2	—	—	—	—	2
80- 89	2	—	—	—	—	2
90- 99	2	—	—	—	—	2
100-109	1	—	—	—	—	1
110-119	1	—	—	—	—	1
120-129	1	—	—	—	—	1
130-139	—	—	—	—	—	—
140-149	—	—	—	—	—	—
150-159	—	1	—	—	—	1
160-169	—	2	—	—	—	2
170-179	—	3	—	—	—	3
180-189	—	1	—	—	—	1
190-199	—	4	—	—	—	4
200-209	—	1	4	—	—	5
210-219	—	1	16	1	—	18
220-229	—	3	16	2	—	21
230-239	—	—	4	4	—	8
240-249	—	—	6	7	—	13
250-259	—	—	4	6	—	10
260-269	—	—	1	16	—	17
270-279	—	—	8	11	—	19
280-289	—	—	—	5	—	5
290-299	—	—	2	3	1	6
300-309	—	—	—	5	—	5
310-319	—	—	—	2	2	4
320-329	—	—	—	2	1	3
330-339	—	—	—	1	—	1
340-349	—	—	—	—	2	2
350-359	—	—	—	1	1	2
Total	21	16	61	66	7	171

The average standard length in millimeters and the average weight in grams for each age group are given in Table IV. The average standard length of age group II was 269.4 mm, and of age group IV it was 327.0 mm. The difference was 57.6 mm. The average weight of age group IV was almost two times the average weight of age group III. The greatest difference in length occurred between age group 0 and age group I.

The average *K* values are given in Table V. The coefficient of condition was computed for the white bass collected during the months as indicated. Seasonal variation in *K* has been reported by Stroud (13) and others. The average *K* values during 1947 appeared to be higher than during 1948. The small number of specimens collected during 1947 might account for this difference. The average *K* was higher during August, 1948, then during March, April, May, and October, 1948. After August the value of *K* decreased. It was expected that the value of *K* would have been highest just prior to the spawning season, but this was not revealed by the data. The sexes were recorded for 103 individuals. The average *K* for the males was 2.32 and for the females it was 2.29. This difference is not significant.

TABLE IV

The Average Standard Length and Average Weight of Lake Duncan White Bass

	Age Groups				
	0	I	II	III	IV
Average Standard Length in Millimeters	91.5 (10)	190.7 (16)	234.3 (62)	269.4 (66)	327.0 (7)
Average Weight in Grams	19.0 (6)	185.6 (14)	335.0 (61)	483.6 (66)	882.9 (7)

(The numbers of the specimens employed are given in parentheses.)

TABLE V

Monthly Averages of the Coefficient of Condition (K) of the Lake Duncan White Bass Collected in 1947 and 1948, According to Ten-Millimeter Length Intervals

Length	1947			1948			
Interval	July	November	March	April	May	August	October
60- 69						2.54 (1)	
70- 79						2.58 (2)	
80- 89						2.59 (2)	
90- 99							
100-109							
110-119							
120-129		3.27 (1)					
130-139							
140-149							
150-159	2.92 (1)						
160-169	5.07*(1)			1.59 (1)			
170-179	4.04*(1)					2.48 (2)	
180-189						2.58 (1)	
190-199						2.69 (3)	2.32 (1)
200-209				2.32 (1)	2.31 (3)	2.99 (1)	
210-219				2.08 (8)	2.30 (7)	3.10 (2)	2.54 (1)
220-229	3.01 (5)			2.14 (6)	2.20 (6)	2.60 (1)	2.27 (3)
230-239	2.87 (1)		2.05 (1)	2.22 (5)	2.31 (1)		
240-249	2.95 (6)			2.19 (2)	2.30 (4)	2.53 (1)	
250-259	2.70 (2)			2.28 (4)		2.63 (3)	2.33 (1)
260-269				2.39 (8)	2.14 (5)	2.47 (4)	
270-279	2.64 (5)			2.39 (9)	2.48 (2)	2.49 (3)	
280-289				2.57 (3)	2.34 (2)		
290-299				2.27 (1)	2.35 (3)	3.00 (2)	
300-309				2.55 (3)	2.45 (2)		
310-319				2.63 (3)	2.51 (1)		
320-329				2.55 (2)	2.54 (1)		
330-339				2.16 (1)			
340-349				2.28 (1)	2.75 (1)		
350-359				2.33 (1)			2.58 (1)
60-359	2.86 (20)	3.27 (1)	2.05 (1)	2.31 (59)	2.31 (38)	2.64 (28)	2.37 (7)

(The numbers of specimens employed are given in parentheses.)

*Discrepancy in weight — not included in averages.

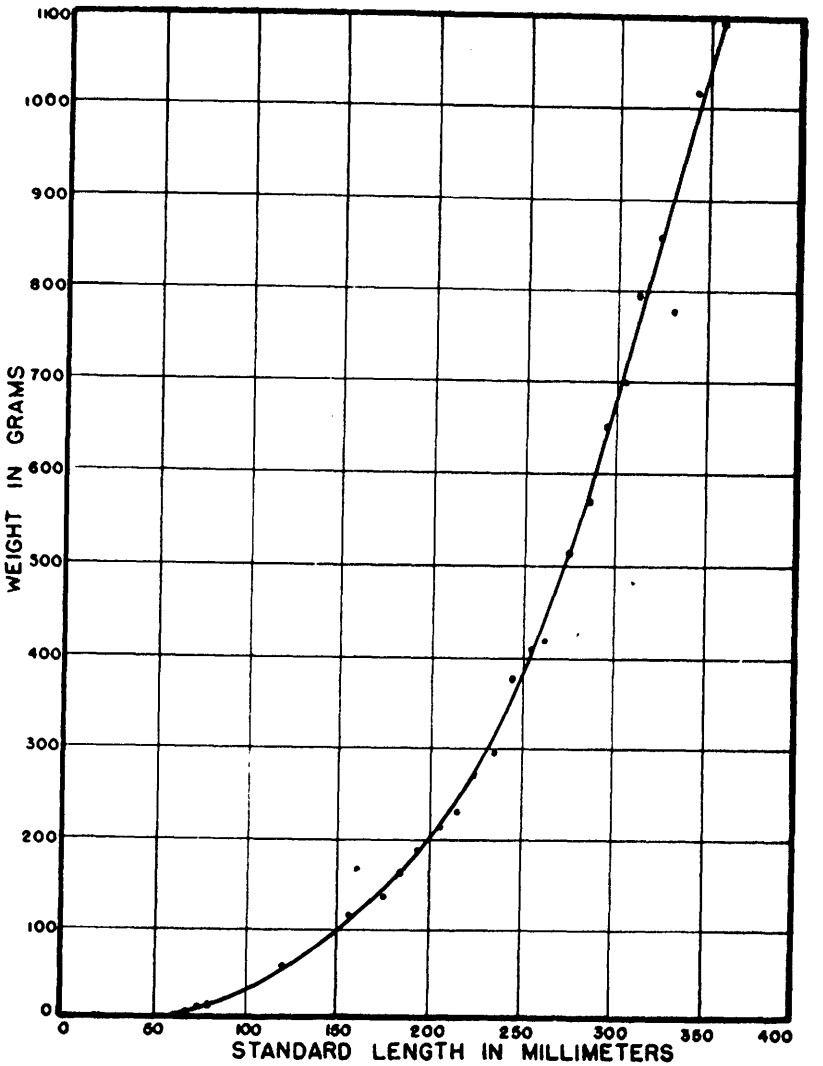

FIGURE 1. Length-weight (L/W) Relationship of Lake Duncan White Bass.

The fish had a wide range in condition; *K* varied from 1.59 for one fish in age group I to 3.57 for one fish in age group II. The grand average of *K*, based on 154 individuals, was 2.45.

The average standard lengths and average weights for Lake Duncan white bass are given in Table VII. The weight of the fish increased more rapidly than the length. The length-weight growth curve is shown in Figure 1.

The body-scale *(L/Sc)* relationship is shown in Table VIII, and the values are plotted in Fig. 2. The regression formula for length on scale length was calculated as $L = 21 + 1.82\ S$.

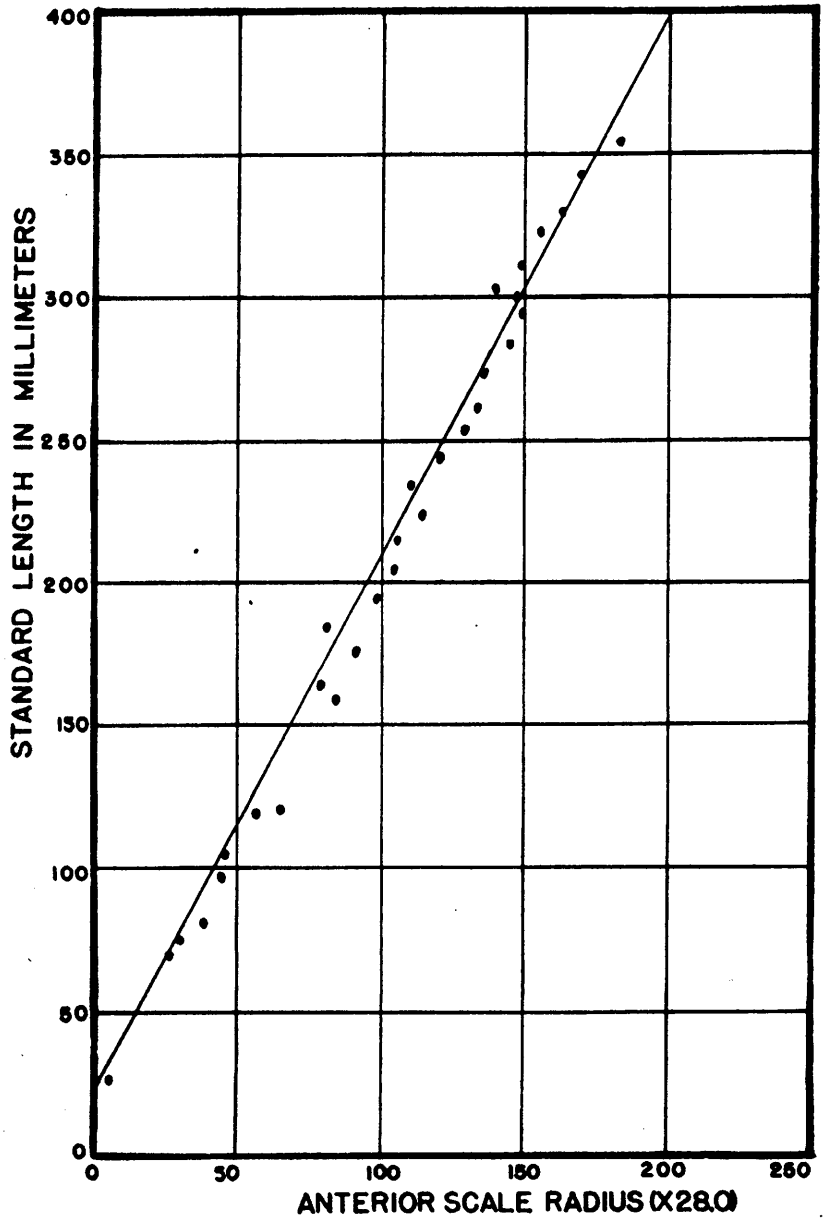

FIGURE 2. Length-scale (L/Sc) Relationship of Lake Duncan White Bass.

TABLE VI

The Average Coefficient of Condition (K) for Each Age Group of Lake Duncan White Bass

Standard Length Interval	Year	Number	Age Group 0	I	II	III	IV	0-IV
120-129	1947	1	3.27					3.27
150-159	1947	1		2.92				2.92
220-279	1947	19			2.85			2.85
60- 89	1948	5	2.57					2.57
160-229	1948	13		2.45				2.45
200-299	1948	42			2.31			2.31
210-359	1948	66				2.38		2.38
290-359	1948	7					2.50	2.50
60-359	1947-1948	154	2.69	2.48	2.48	2.38	2.50	2.45

TABLE VII

Length-Weight Relationship of Lake Duncan White Bass Ten-Millimeter Intervals

Average Standard Length in Millimeters	Average Weight in Grams	Number of Fish
68.0	8.0	1
74.0	10.5	2
80.5	13.5	2
97.0	——	2
105.0	——	1
118.0	——	1
121.0	58.0	1
——	——	—
——	——	—
158.0	115.0	1
160.0	65.0	1
174.5	132.0	2
184.0	161.0	1
193.0	187.0	4
205.4	212.0	5
214.6	228.4	18
223.5	269.3	21
233.8	293.4	8
243.5	375.0	13
254.1	405.8	10
261.1	417.4	17
274.1	511.0	19
284.0	568.0	5
293.8	647.8	6
303.0	698.0	5
312.0	790.0	4
323.0	858.3	3
330.0	775.0	1
343.0	1015.0	2
354.5	1092.5	2

TABLE VIII

Body-Scale Relationship (L/Sc) of 171 Lake Duncan White Bass

Average Standard Length (Millimeters)	Number of Fish	Average Scale Measurement (x 28.0) (Millimeters)
25.6	11	5.3
68.0	1	27.0
74.0	2	30.0
80.5	2	38.0
97.0	2	44.0
105.0	1	46.0
118.0	1	57.0
121.0	1	65.0
158.0	1	84.0
162.5	2	78.5
175.7	3	92.0
184.0	1	87.0
193.0	4	97.8
205.4	5	104.8
214.6	18	106.4
223.5	21	114.7
233.8	8	111.6
243.5	13	121.3
254.1	10	128.7
261.5	17	138.2
274.1	19	136.1
284.0	5	144.6
293.8	6	149.5
303.0	5	140.0
312.0	4	149.8
323.0	3	156.3
330.0	1	163.0
343.0	2	169.5
354.5	2	183.0

TABLE IX

Calculated Average Standard Length of 171 Lake Duncan White Bass

Age Group	No. of Fish	Average Standard Length (mm)	Average Weight (Grams)	Calculated Standard Length in Millimeters at End of Year of Life I	II	III	IV
0	21	57	19**	117	208*		
I	16	191	186***	63			
II	61	234	335	116	224	231*	
III	66	269	484	121	232	265	267*
IV	7	327	883	190	279	307	334
Average Standard Length				115	228	252	273
Average Growth per Year				115	113	24	21

The date of formation of the annulus could not be determined because no specimens were collected during late Spring of 1947 or 1948. None of the fish collected as late as May 5, 1948, showed the definite formation of a new annulus. Twenty-three white bass collected during July, 1947, had formed annuli. The amount of scale growth since the annulus formation was small.

*Incomplete growing season for some specimens

**Weight available on 6 fish only

***Weight available on 14 fish only

Either the annulus had been formed early in the spring with very little growth occuring since then, or the annulus had been formed sometime during late spring. Data obtained from the 1948 collections indicated the possibility of a late spring annulus formation.

There was evidence that growth compensation occurred. The first year growth of the group of fish spawned in 1944 was higher than the first year growth of the succeeding year classes. The 1945 and 1946-year classes grew more the second and third years of life than did the 1944-year class. The length advantage attained by the 1944-year class never was completely overcome by the 1945 and 1946 year classes.

The high reproductive potential of the white bass is demonstrated by the fact that since the 1941 stocking of eighty-seven individuals this species has become one of the most abundant in Lake Duncan. The egg counts made by Sigler (12) ranged from 650,000 to 970,000 per individual female.

LARGEMOUTH BLACK BASS. The number of this species collected was not sufficient to allow detailed growth calculations. The age groups, average lengths, and weights are presented in Table X.

TABLE X

Average Lengths and Weights of Lake Duncan Largemouth Black Bass Grouped According to Age

AGE GROUP	TOTAL NUMBER OF FISH	AVERAGE WEIGHT IN GRAMS	AVERAGE STANDARD LENGTH (mm)	AVERAGE TOTAL LENGTH (mm)
0	2	27.0 (2)	103.5 (2)	———
I	2	84.5 (2)	133.5 (2)	———
II	7	234.3 (6)	230.0 (6)	242.0 (1)
III	9	639.7 (9)	274.0 (6)	372.3 (3)
IV	4	839.8 (4)	296.5 (2)	368.5 (2)
V	8	1812.1 (8)	416.0 (2)	413.0 (6)
VI	2	1874.0 (2)	———	451.0 (2)

WHITE CRAPPIE. The age groups, average lengths and weights are presented in Table XI.

TABLE XI

Average Lengths and Weights of Lake Duncan White Crappie Grouped According to Age

AGE GROUP	TOTAL NUMBER OF FISH	AVERAGE WEIGHT IN GRAMS	AVERAGE STANDARD LENGTH (MM)	AVERAGE TOTAL LENGTH (MM)
I	7	38.4 (5)	116.1 (7)	———
II	14	76.1 (14)	138.6 (14)	———
III	10	72.9 (9)	149.0 (10)	———
IV	11	246.7 (10)	194.7 (10)	381.0 (1)
V	2	345.0 (2)	242.5 (2)	———
VI	—	———	———	———
VII	1	740.0 (1)	305.0 (1)	———

(The number of specimens employed is given in parentheses.)

CHANNEL CATFISH. The total collection of channel catfish consisted of thirty-three specimens. All of these were taken by means of gill nets during 1948. The pectoral spines were removed only from those specimens collected in August, 1948.

Very little data have been published on the determination of age of the channel catfish. Studies have been made on age of other fishes by using the ear stone, or otolith. Moore (11) found that the scale and otolith of the sand flounder show good correspondence in age determination. She assumed that the first clear ring outside of the core of the otolith represented the first winter growth and the other alternating white and dark rings register further periodicity of growth. Other workers have assumed a direct correlation between the number of rings or bands on the otolith and the length of the fish.

The pectoral spine of the channel catfish was found to be more convenient for study than the dorsal spine. Succeeding the core or lumen, were narrow translucent bands (appearing white) and wider opaque bands (appearing dark). It might be assumed that the narrow, clear bands represent the growth cessation period during the winter months and that the opaque bands represent the summer growth (Figure 4). A number of pectoral and dorsal spines have been collected from other Oklahoma lakes by Ward and Thompson (17). The study of these revealed that in most cases the number of translucent bands appearing on the spine could be correlated with the length of the fish.

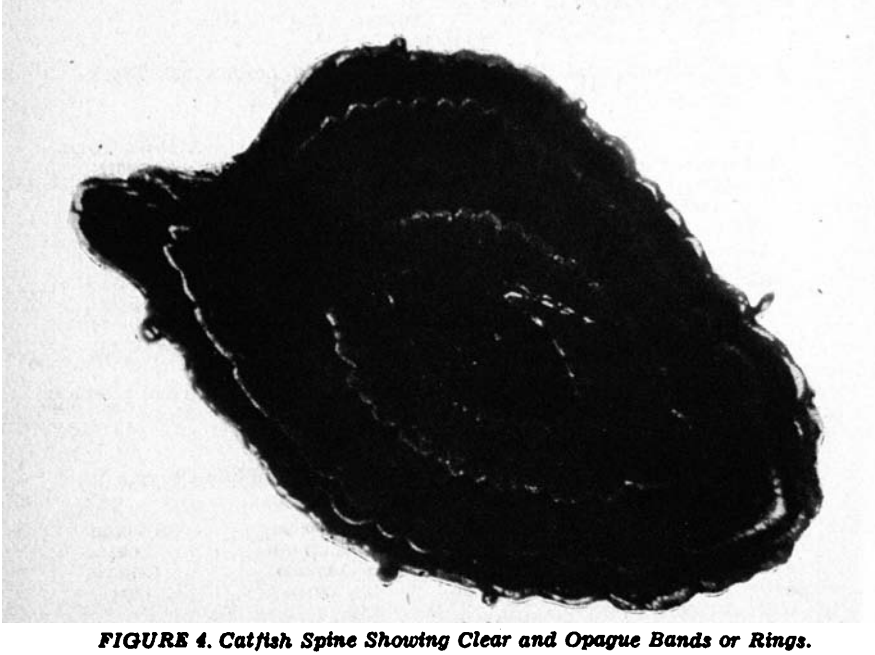

FIGURE 4. Catfish Spine Showing Clear and Opague Bands or Rings.

Since the number of spine samples collected from Lake Duncan catfish was small, the author does not attempt to validate the number of bands appearing on the spine as a method of age determination. The weights, lengths, and number of translucent bands appearing on the spine are listed in Table XII.

TABLE XII

Average Lengths and Weights of Eight Lake Duncan Channel Catfish, According to the Number of Rings Appearing on the Pectoral Spine

Number of Spine Rings	Number of Fish	Average Weight Grams	Average Standard Length Millimeters
2	1	152.0	216.0
5	4	1,023.5	386.0
7	1	1,080.0	406.0
8	2	1,520.0	450.5

(No information is given on other species collected because the number of specimens was insufficient.)

Growth of White Bass of Known Age. The fry of white bass in Lake Duncan are able to pass through a screened pipe, located approximately sixteen feet below the lake surface, into the number two hatchery pond below the lake dam.

Hatchery pond number two was heavily populated with white bass and other species at the time of draining, September 15, 1947. Approximately 562 white bass fingerlings, that ranged from 64.0 mm to 229.0 mm in length, were removed at that time. Scale samples were taken from 14 medium-sized individuals (Table XIII).

TABLE XIII

Average Weight in Grams, Standard Length in Millimeters, and Anterior Scale Radius in Millimeters of Fourteen Fingerling White Bass From Duncan Hatchery Pond Number Two

Number of Fingerlings	Average Weight	Average Standard Length	Average Anterior Scale Radius (28.0 X)
14	144.7*	144.9	71.5

*Does not include weights of three individuals whose average standard length was 67.0 millimeters.

Fifty fingerlings (approximately 76.0 mm in length) were placed in hatchery pond number five. This hatchery pond was 250 feet by 250 feet with a maximum depth of five feet. Seven of these white bass were removed from the experimental pond May 2, 1948. The data are presented in Table XIV.

TABLE XIV

Age Group, Average Weight in Grams, Standard Length in Millimeters, and Anterior Scale Radius in Millimeters of Seven White Bass from Duncan Hatchery Pond Number Five

					Anterior Scale Radius (28.0 X)	
Age Group	Number of Fish	Average Weight	Average Standard Length	September 15, 1947*	First Annulus	May 2, 1948
I	7	40.7	120.1	27.9	33.4	50.7

*As indicated by position of change in width of circuli (Fig. 5)

Analysis of scales from the seven individuals taken from pond number five revealed that an average of 5.6 mm of growth had occurred on the scales between September 15, 1947, and the time of annulus formation. A false annulus appeared at the time when these fish were removed from the highly populated pond number two to the less populated pond number five (Figure 5). The time of annulus formation of these individuals could not be compared

with the time of annulus formation of the same age individuals from the lake, since no fish of the latter were collected May 2, 1948.

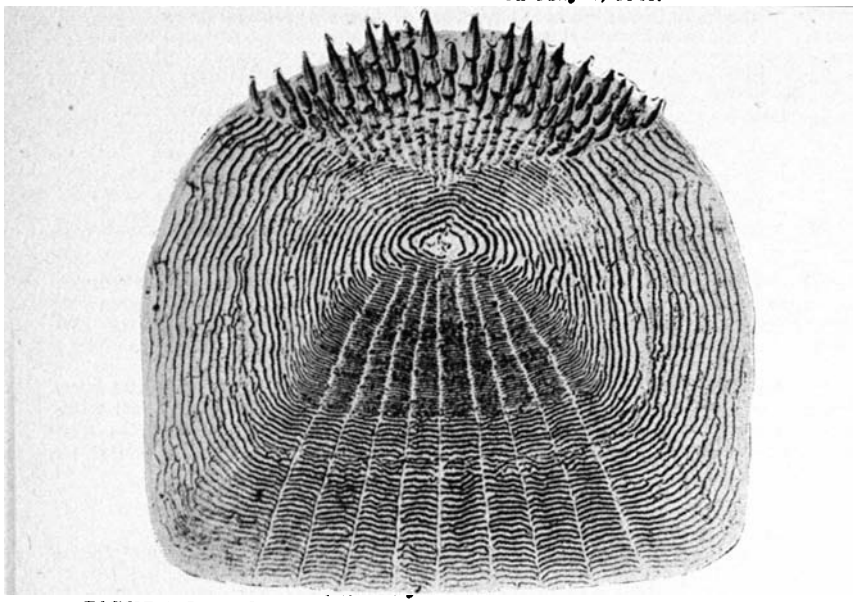

FIGURE 5. Scale of White Bass from Hatchery Pond Showing the False Annulus and First Annulus.

Fourteen white bass were removed from experimental pond number five October 11, 1948. The data are presented in Table XV.

TABLE XV

Age Group, Average Weight in Grams, Standard Length in Millimeters, and Anterior Scale Radius in Millimeters of Fourteen White Bass From Duncan Hatchery Pond Number Five

Age Group	Number of Fish	Average Weight Grams	Average Standard Length mm	Anterior Scale Radius (28.0 X) September 15, 1947*	First Annulus	Oct. 11 1948
I	14	182.4	190.8	32.1	39.9	120.3

The average scale growth from the date of annulus formation to October 11, 1948, was 80.4 mm. This second summer scale growth was more than twice the amount of the first summer scale growth. Rapid growth of the scales was indicated by the wide spacing between the circuli on the anterior margins.

MANAGEMENT. Management practices for Lake Duncan, since impoundment, have been very similar to those for other Oklahoma lakes. In most cases it has been assumed that heavy stocking programs year after year were the solution to better angling. At the present time, this has become questionable. Only eighty-seven white bass were planted in Lake Duncan, and no subsequent stocking of this species was accomplished. White bass appeared to be one of the dominant species in the lake during the course of this survey. On the other hand, 162,700 redear sunfish and 110,200 longear sunfish have been planted in the lake since 1939, but the harvest of these fishes has been negligible. Two hundred eighty-seven thousand five hundred seventy crappies have been planted in Lake Duncan since 1939, but crappie angling has not been outstanding. Further, it can be noted from the data that this species does

*As indicated by position of change in width of circuli.

not reach legal length until its fourth or fifth year of life. While these data are not sufficiently indicative of the previous stocking practices, they do indicate that slow growth occurred during the early years of life. These same results might have been applicable to other species if adequate samples had been available. From the available data, it appears logical that the primary management practice should be shifted from heavy stocking programs to the encouragement of a greater harvest.

Since the white bass is a relatively fast-growing, short-lived fish with a high reproductive potential, its rapid harvest is recommended. Methods of capture, other than "still" fishing along the shorelines, should be employed to increase the harvest. Many of the larger specimens are caught on artificial bait by trolling through a school of this species. This method has proved to be one of the favorite means for capturing white bass from other Oklahoma lakes.

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