
THE AGE AND GROWTH OF WHITE BASS, *LEPIBEMA CHRYSOPS* (RAFINESQUE), LAKE OVERHOLSER AND LAKE HEFNER, OKLAHOMA

WILLIAM H. THOMPSON, Fisheries Experiment Station*, Norman

Several workers have reported on the fresh water white bass from other states. Van Oosten (5) stated that "everywhere in Lake Erie the white bass population is composed of young fish. Apparently very few individuals survive beyond their third full year". Howell (2) states that "the white bass is one of the two chief game fish in TVA main stream reservoirs. The fish is unpredictable, both with reference to change in abundance from year to year and in location within the reservoir. The fish seems to be partial to running water, yet it has been greatly increased in number, apparently with the changing of the Tennessee River into a series of impoundments. Good white bass reproduction was apparent for the first year of impoundment of Watts Bar, Pickwick, and Gunterville Reservoirs. Its life span in TVA waters seems to be short; few white bass attain the age of 4 years. White bass travel in schools and are migratory. Growth and condition vary greatly from year to year. The species maintains itself without stocking." Sigler (4) observed in Spirit Lake, Iowa, that the white bass population has ranged from the most abundant species to what appeared to be near extinction.

In Oklahoma considerable attention has been given recently to the white bass. Kilpatrick (3) reported on the testicular development in relation to growth. Ward (6) found his white bass collections from Lake Duncan to consist principally of age groups II and III. Seven individuals of the 161 collected were in age group IV and none were found to be older. Weese and Thompson (unpublished) found white bass in their third year of growth to be common in a Lake Texoma collection, but fourth year fish were uncommon.

*Oklahoma Game and Fish Department and the University of Oklahoma.

LAKE OVERHOLSER. Lake Overholser lies just outside the city limits of Oklahoma City, Oklahoma. It was impounded in 1919 and is one of the oldest of Oklahoma's artificial lakes. A dam 1,200 feet in length across the North Canadian River in Sec. 30, Twp. 12 N., Range 4 W., of Oklahoma County originally impounded 17,000 acre feet of water covering a surface of 1,700 acres at spillway level. A canal routes the main flow of the river around the lake proper. The maximum depth of the lake is 28 feet. Large areas of the lake are now rendered shallow by siltation and these areas are subject to considerable agitation by prevailing winds. As a result the waters are turbid during many months of the year. Lake Overholser is a source of water for Oklahoma City and consequently it experiences an average draw-down of approximately 6 feet during the dry summer months. During extreme dry years, the draw-down is much greater. Although the North Canadian River is supplied by some 12,000 square miles of water shed, the low rainfall period during the summer results in a minimum of run-off.

As has been the case with other similar lakes of the area, good largemouth bass and crappie angling lasted only a few years. At the present time anglers depend heavily upon white bass, channel catfish, carp and drum. Perhaps more pounds of white bass are taken by the angler than of any other species. The majority of channel catfish and carp are taken by bank fishermen using surf casting rods and reels, but some channel catfish are taken from a drifting boat. Lake Overholser was stocked with 67 adult white bass during May of 1941. This species has evidently persisted in large numbers since that time, and at the present time is one of the dominant sports fish of that lake.

LAKE HEFNER. Lake Hefner lies within three or four miles of Oklahoma City, Oklahoma, and is the second of two impoundments created primarily as a municipal water supply and secondarily as a recreation area. The dam was completed in 1942 across a small creek area on the North Canadian River watershed, impounding 100,000 acre feet of water covering an area of 3,800 surface acres. The maximum depth of the water is approximately 110 feet. The lake is located in Sec. 2, Twp. 13 N., Range 4 W. (Oklahoma County). With exception of a small surrounding watershed, all the water reaches the lake via a man-made canal from the North Canadian River. Since silt has not become a major problem as yet, the bottom is more firm and, unlike Lake Overholser, clear water is the rule rather than the exception.

Lake Hefner was closed to fishermen from 1942 until May of 1946. A spot check on the first two or three opening days of fishing showed that the largemouth bass was the predominating species taken. This species was followed closely in order by carp and bullhead catfish. Only a very few white bass were reported during the first few days. A small number of larger white bass were taken during 1947. The harvest was good in 1948 and unusually good in 1949.

The specimens used in this study were collected from two Oklahoma lakes (Lake Overholser and Lake Hefner) during the period from August 9 to August 16, 1948, by a lake inventory party sponsored by the Oklahoma Game and Fish Department. A total of 368 fish were used from Lake Overholser for calculation of the coefficient of correlation and the scale radius-body length relationship (L/SC). Of this number, 365 specimens were used in the length-weight relationship calculations. Three hundred and seven individuals were taken from Overholser in gill nets and 58 were taken by trolling with artificial baits. Lake Hefner is represented by 131 specimens. All fish were used in the scale radius-body length relationship curve, coefficient of correlation and the length-weight relationship curve. Of these, 39 were taken in gill nets; the remaining 92 were taken by trolling. Gill nets of bar mesh 1 inch #60/3, 1½ inch #35/3, 2 inch #35/3, and 2½ inch #35/3, were used in both lakes. The 1½ inch mesh net was the most effective for this species (Tables I and II). No white bass were taken in the 2½ inch mesh net.

Standard lengths were recorded in millimeters from a measuring board and weights were taken from a gram balance. All records were taken from fresh specimens in the field.

Ages are expressed by roman numerals and represent the number of annuli found on the scales. Measurements of the projected images ($\times 28.0$) of the scales were taken along the anterior radii.

TABLE I

Distribution of Lake Hefner White Bass by Standard Length Intervals, Age Groups and Method of Capture

STANDARD LENGTH IN 5 MM INTERVALS	NUM- BER OF FISH	METHOD OF CAPTURE				HOOK AND LINE	NUMBER OF ANNULI	
		GILL NET 1" MESH	GILL NET 1½" MESH	GILL NET 2" MESH	GILL NET 2½" MESH		0	1
90-94	1					1	1	
110-114	2					2	2	
115-119	3					3	3	
120-124	1					1	1	
125-129	7					7	7	
130-134	2					2	2	
135-139	1					1	1	
140-144	4	1				3	4	
175-179	1					1		1
180-184	5	1	1			3		5
185-189	7	3				4		
190-194	30	5	6			19		30
195-199	20	2	6			12		20
200-204	8	1	2			5		8
205-209	9		3			6		9
210-214	1					1		1
220-224	2	1				1		2
225-229	2		1			1		2
230-234	2					2		2
235-239	9	1	1			7		9
240-244	7		1			6		7
245-249	4			1		3		4
265-269	1					1		1
275-279	2	1		1				2

The body length-scale length ratios and coefficient of correlations were determined for the fish of each lake. The two curves were calculated on the basis of individuals rather than five millimeter intervals. The averages of the five millimeter groups were then plotted along the calculated curves.

For the Lake Overholser fish, a line having an intercept of 29.7 and a slope of 1.62 was found. The coefficient of correlation was 0.924. For the Lake Hefner fish the intercept was calculated as 39.6 and the slope as 1.65. The coefficient of correlation for the latter group was 0.942.

The average weights and lengths of each five millimeter group were used in calculating the two length-weight relationship curves. The equation employed throughout was that of the general parabola, $W = cL^n$, where W = weight in grams, L = standard length in millimeters, and c and n are constants. This equation $W = cL^n$, expressed in logarithmic form becomes a straight line: $\log W = \log c + n \log L$.

TABLE II

Distribution of Lake Overholser White Bass by Standard Length Intervals, Age Groups and Method of Capture.

STANDARD LENGTH IN 5 MM INTERVALS OF FISH	NUM- BER OF FISH	METHOD OF CAPTURE				HOOK AND LINE	NUMBER OF ANNUI		
		GILL NET 1" MESH	GILL NET 1½" MESH	GILL NET 2" MESH	GILL NET 2½" MESH		0	1	2
95-99	1						1		
105-109	1					1	1		
115-119	4					4	4		
120-124	6					4	6		
125-129	19					16	19		
130-134	19	5				13	19		
135-139	1					1	1		
140-144	8	1				6	8		
145-149	1	1					1		
170-174	1	1						1	
180-184	1		1					1	
185-189	1		1					1	
190-194	7	2	5					7	
195-199	40	4	32			2		40	
200-204	141	10	126			3		141	
205-209	92	2	81			7		92	
210-214	6		6					6	
215-219	15		14			1		14	1
220-224	2		2					2	
245-249	1			1					1
265-269	1		1					1	

The values of $\log c$ and n are computed from the formulas:

$$\log c = \frac{\sum \log W \cdot \sum (\log L)^2 - \sum \log L \cdot \sum (\log L \cdot \log W)}{N \cdot \sum (\log L)^2 - (\sum \log L)^2}$$

and

$$N = \frac{\sum \log W - (N \log C)}{\sum \log L}$$

The values for $\log c$ and n are as follows:

Lake Overholser white bass $\log c = -4.5689$; $n = 3.0241$

Lake Hefner white bass $\log c = -5.2301$; $n = 3.2994$

The coefficient of condition K was determined by the equation $K = \frac{W \times 10^3}{L^3}$

where W = weight in grams and L = standard length in millimeters. The arithmetical mean of K for the Lake Hefner fish was 2.83, and the corresponding mean for those of Lake Overholser was 3.06.

Tables III and IV show average calculated weights and coefficient of condition K for 5 millimeter groups of the two lakes. The Overholser fish were in general more plump than those for Hefner (Figures 3 and 4). White bass of both lakes had an average better condition than those for Lake Erie (5).

TABLE III

Length-Weight Relationship of Lake Hefner White Bass, Based on Actual Lengths and Weights of 131 Individuals Taken in August 1948.

(The average standard lengths are based on five-millimeter intervals.)

AVERAGE STANDARD LENGTH IN MM.	AVERAGE STANDARD LENGTH IN INCHES	AVERAGE WEIGHT IN OUNCES	AVERAGE WEIGHT IN GRAMS	CALCULATED WEIGHT GRAMS*	DIF-FERENCE BETWEEN ACTUAL AND CALCULATED WEIGHT IN GRAMS	K	NUMBER OF FISH
95	3.8	0.5	15	20	5	1.75	1
112	4.4	1.2	35	34	- 1	2.49	2
115	4.5	1.4	40	37	- 3	2.63	3
121	4.8	1.6	45	44	- 1	2.54	1
125	4.9	1.8	50	49	- 1	2.54	7
130	5.1	2.1	61	56	- 5	2.68	2
137	5.4	2.3	65	66	1	2.53	1
140	5.5	2.9	82	71	-11	2.95	4
178	7.0	5.1	145	157	12	2.57	1
184	7.3	6.5	185	175	-10	2.98	5
188	7.4	6.7	189	185	- 4	2.84	7
192	7.5	7.1	202	201	- 1	2.85	30
197	7.8	7.7	217	219	2	2.84	20
203	8.0	8.6	243	242	- 1	2.91	8
209	8.3	9.3	263	266	3	2.88	9
213	8.4	9.7	275	283	8	2.85	1
222	8.8	11.8	333	325	- 8	3.04	2
229	9.0	12.4	353	359	6	2.94	2
232	9.1	12.4	353	376	23	2.02	2
235	9.3	13.6	384	392	8	2.91	9
242	9.5	13.8	392	432	40	2.77	7
248	9.8	16.0	456	467	11	3.04	4
267	10.5	19.9	565	597	32	2.97	1
277	10.9	24.0	680	674	- 6	3.17	2

The average calculated lengths of white bass from Lakes Overholser and Hefner for the first two years of life was shown to be slightly over 8 inches standard length. There was very little difference between the rates of growth of the fish of the two lakes. The 0 group of both lakes showed more rapid growth during their first year than did the I group during their first year of life. On the other hand, the second year growths of the I group were compensatory in that they were much better than those of the 1st year. The growth rates for the two lakes are comparable.

In comparison, the Lake Duncan white bass were growing at approximately the same rate eight years after initial stocking of that species (6). Spirit Lake, Iowa, white bass grew to an average calculated standard length of 9.7 inches at the end of their second year of life (4). Lake Erie two year olds averaged 7.7 inches calculated fork length (5). The calculated standard length at the end of two growing seasons for Wheeler Reservoir white bass averaged about 8.7 inches standard length (10.5 inches total length) (2). Two year old fish from Clinch River, Tennessee averaged 9.5 inches standard length (11.8 inches total length) at the end of their second growing season (1). The rate of growth of white bass from Lake Texoma, Oklahoma (Weese and Thompson-unpublished) has been observed to be on the average comparable to those of the TVA lakes.

*Calculated by means of the equation $W = 5.887 \times L^{2.86}/10^6$

TABLE IV

Length-Weight Relationship of Lake Overholser White Bass, Based on Actual Lengths and Weights of 365 Individuals Taken in

AVERAGE STANDARD LENGTH IN MM.	AVERAGE STANDARD LENGTH IN INCHES	AVERAGE WEIGHT OUNCES	AVERAGE WEIGHT IN GRAMS	CALCULATED WEIGHT IN GRAMS*	DIF-FERENCE BETWEEN ACTUAL AND CALCULATED WEIGHT IN GRAMS	K	NUMBER OF FISH
99	3.9	1.0	28	29	1	2.89	1
108	4.3	1.4	40	38	- 2	3.18	1
117	4.6	1.8	50	49	- 1	2.89	4
121	4.8	1.8	51	54	3	2.80	6
126	5.0	2.2	62	57	- 5	3.04	19
133	5.3	2.4	69	71	2	2.95	19
137	5.4	3.0	85	78	- 7	3.30	1
140	5.5	2.9	83	83	- 1	3.01	8
146	5.8	3.2	90	95	5	2.89	1
171	6.8	5.5	155	153	- 2	3.10	1
193	7.6	8.1	230	220	-10	3.22	7
197	7.8	8.4	238	234	- 4	3.11	40
202	8.0	9.0	256	253	- 3	3.10	140
208	8.3	9.6	272	276	4	3.03	93
213	8.4	10.3	291	297	6	3.01	6
217	8.5	10.7	303	314	11	2.99	15
222	8.8	11.5	326	336	10	2.98	2
248	9.8	12.9	465	470	5	3.05	1

*Calculated by means of the equation $W = 2.709 \times L^{3.04}/10^6$

The growth rates of this species from Lake Overholser and Lake Hefner were considerably more rapid than those of Lake Erie, but not as rapid as those from Spirit Lake, Iowa, TVA waters and Lake Texoma, Oklahoma.

TABLE V

Summary of Average Calculated Lengths and Increments of Length for Each Year of Life of the Lake Hefner White Bass Collected in August, 1948.

AGE GROUP	NUMBER OF FISH	AVERAGE LENGTH AT TIME OF CAPTURE		AVERAGE WEIGHT	CALCULATED LENGTH AT END OF YEAR OF LIFE				
					1		2		
		MM.	IN.		MM.	IN.	MM.	IN.	
0	21	125	4.9	53	1.9	132*	5.2*		
I	110	207	8.2	267	9.4	94	3.7	205*	8.1*
Grand Av. and Totals	131					100	4.0	205*	8.1*
Increments of Growth						100	4.0	105*	4.2*
Number of Fish						131		110	4.7

*Represents growth to August 10, 1948.

TABLE VI

Summary of Average Calculated Lengths and Increments of Length of Length for Each Year of Life of the Lake Overholser White Bass Collected in August, 1948.

AGE GROUP	NUMBER OF FISH AT CAPTURE	AVERAGE LENGTH		AVERAGE WEIGHT		CALCULATED LENGTH (MM) AT END OF YEAR OF LIFE								
						1		2		3				
		MM.	IN.	gm.	oz.	MM.	IN.	MM.	IN.	MM.	IN.			
0	30	129	5.1	65	23	137	5.4*							
I	306	205	8.1			84	3.4	203*	8.0*					
II	2	234	9.3			103	4.1	128	5.0	221*	8.8*			
Grand Avs. and Totals	368					93	3.8	203	8.0	221*	8.8*			
Increments of Growth						93	3.8	110	4.4	18*	0.9*			
Number of Fish						368		308		2				

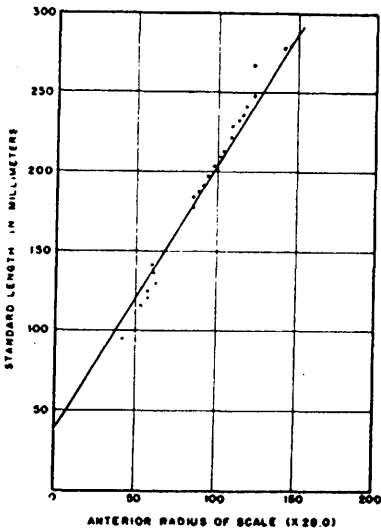


FIGURE 1. Body-scale Relationship (L/Sc) of Lake Hefner White Bass. The dots are based upon 5 mm averages. The scales were magnified 28 times.

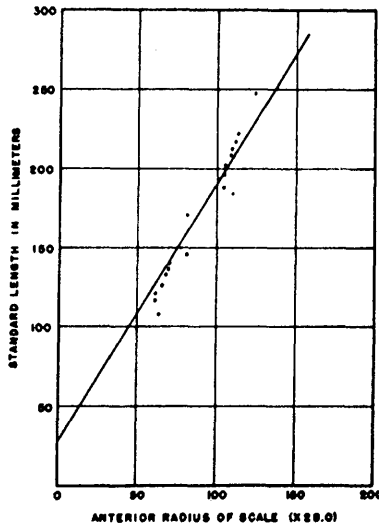


FIGURE 2. Body-scale Relationship (L/Sc) of Lake Overholser White Bass. The dots are based upon 5 mm averages. The scales were magnified 28 times.

*Represents growth to August 14, 1948.

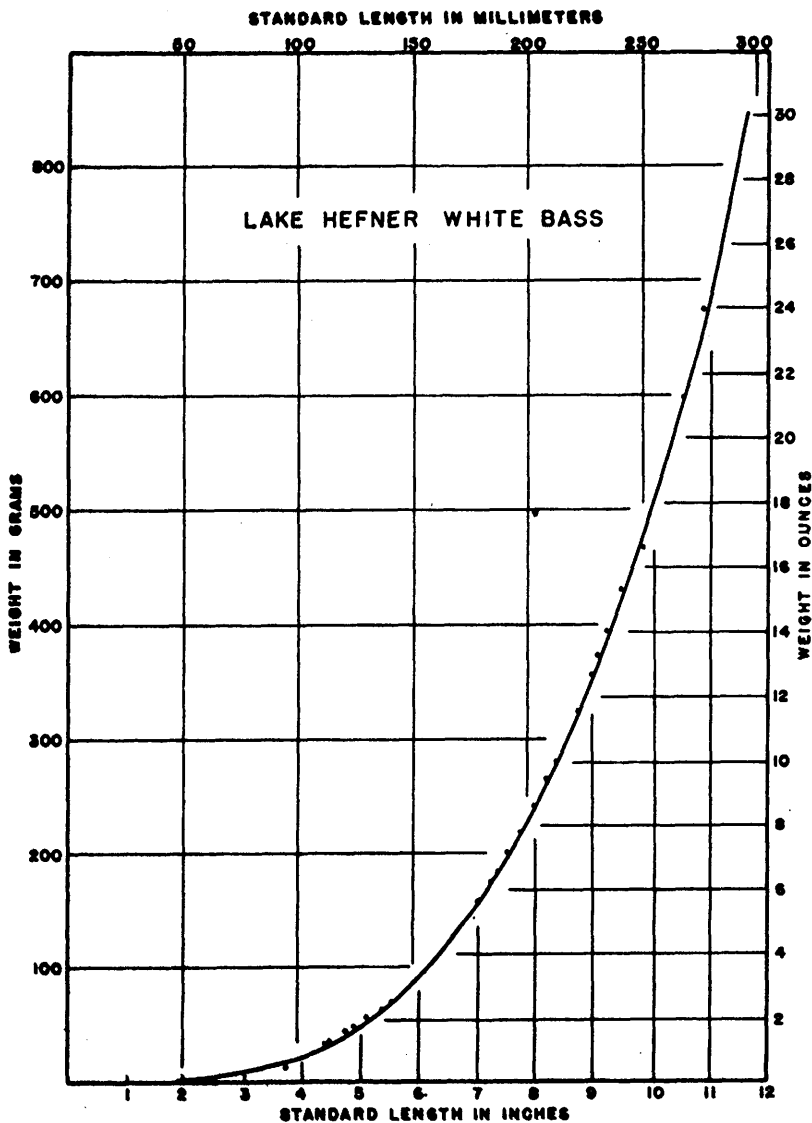


FIGURE 3. Length-weight Relationship of the Lake Hefner White Bass. The dots are based upon the average standard lengths and weights of Table III.

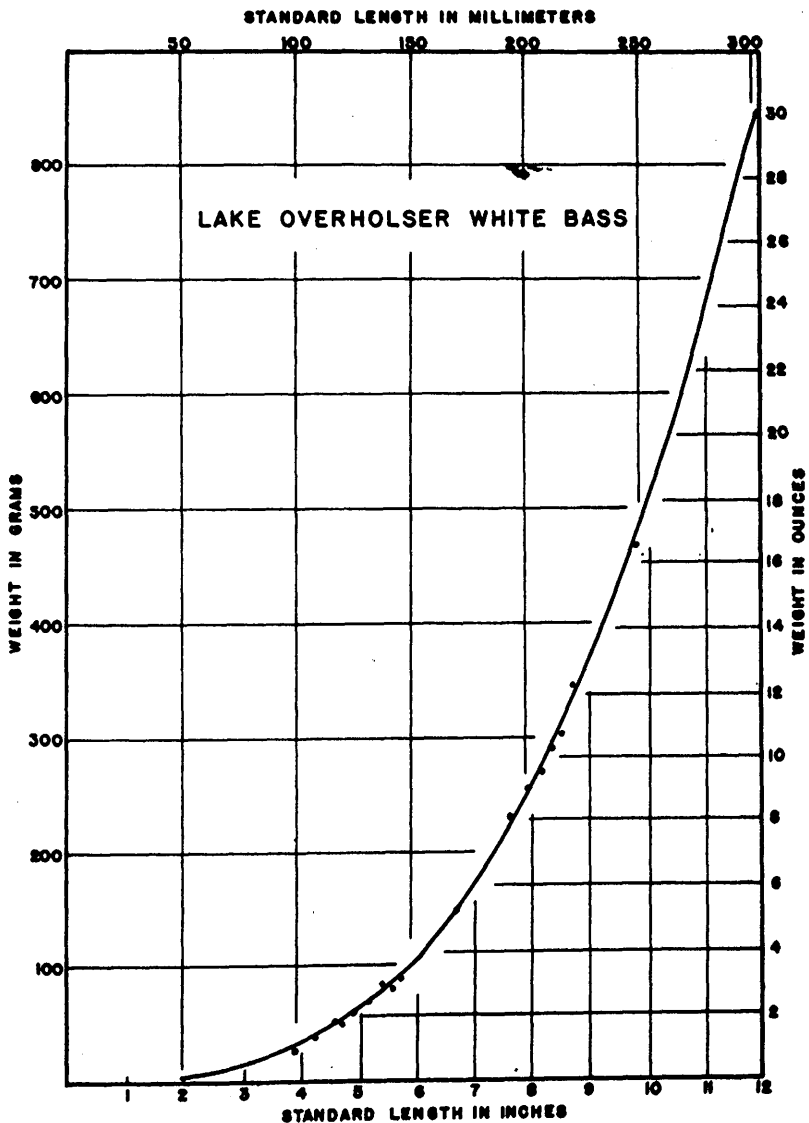


FIGURE 4. Length-weight Relationship of the Lake Overholser White Bass. The dots are based upon the average standard length and weights of Table IV.

SUMMARY AND CONCLUSIONS

1. The study on age and growth is based on 365 white bass from Lake Overholser and 131 white bass from Lake Hefner.
2. Thirty-eight per cent of the Lake Hefner fish varied between the 7.50 inch and 7.75 inch length interval. Forty-nine per cent of Lake Overholser fish varied between the 7.75 inch and 8.00 inch length interval.
3. Very little differential growth existed between the same year classes of the two lakes. Compensation in growth during the second year of life was suggested in the class I of both lakes.
4. Length-weight relationship studies show the Overholser fish to be in slightly better condition than the Hefner fish.

LITERATURE CITED

1. ESCHMEYER, R. W. and MANGES, D. E., 1945. Fish migrations into the Norris Dam tailwater in 1943. *J. Tennessee Acad. Sci.* 20 (1)
 2. HOWELL, HENRY H., 1945. The white bass in TVA waters. Rep. Reelfoot Lake Biol. Sta., *J. Tennessee Acad. Sci.* 9: 41-48.
 3. KILPATRICK, EARL B., 1948. Unpublished thesis. University of Oklahoma, Norman.
 4. SIGLER, WILLIAM FRANKLIN, 1947. The life history and management of the white bass, *Lepidema chrysops* (Rafinesque) in Spirit Lake, Iowa. Ph D. Thesis, Iowa State College, Ames.
 5. VAN OOSTEN, JOHN, 1942. The age and growth of the Lake Erie white bass, *Lepidema chrysops* (Rafinesque). *Pap. Michigan Acad. Sci., Arts, Letters.* 27: 307-334.
 6. WARD H. C., 1949. A study of fish populations, with special references to the white bass, *Lepidema chrysops*, (Rafinesque) in Lake Duncan, Oklahoma. *Proc. Oklahoma Acad. Sci.* 30:
-