THE AGE AND GROWTH OF THE WHITE BASS, *LEPIBEMA CHRYSOPS*, OF HERRINGTON LAKE, KENTUCKY

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Herrington Lake is a 2,940 acre reservoir located in the southern portion of the blue grass region of Central Kentucky. It was created by power interests in 1925 through the construction of a dam on the Dix River, a tributary of the Kentucky River. Because of the deep river gorge the lake averages 73 feet in depth, and is characterized by rocky precipitous banks and a notable lack of shoal area and aquatic plants. Since its impoundment it has almost continually furnished an abundance of fishing.

Since 1948 the Kentucky Division of Game and Fish has conducted routine population studies each year on this body of water. With the exception of 1949 the white bass has been the most abundant of the game fishes present, making up an average of 7.6 percent of the total weight of the population. Black basses have been second in importance with a weight equal to 3.8 percent of the total. All species of sunfishes present make up less than 7 percent of the total weight. The most important forage fish present, and the fish which provides the white bass with almost 90 percent of the total volume of its food, is the gizzard shad, *Dorosoma cepedianum*. This species comprised an average of 53 percent of the total weight of fishes present in 20 acres of water in which rotenone studies were undertaken.

The history of the white bass in Herrington Lake is rather hazy, and based on the reports of local fishermen. From 1925 until 1928 no white bass were taken in the lake proper, even though they were present in the Kentucky River. At this time, according to reports, large numbers of small white bass suddenly began to appear in the tail waters of the dam. Eschmeyer (1944) noted the migration of yearling white bass into the Clinch River below Norris Dam in 1942, and although his reasons for the migrations would not be applicable to this situation it none the less lends credulance to the reports. Enthusiastic white bass fishermen then placed "a few hundred" of these fish in the reservoir. From 1930 on the the white bass has become increasingly popular as game fish, and threatens to displace the black basses as the most sought-after species. The fame of its annual spawning runs up the Dix River is wide-spread, and during the month of April a large sports fishery develops along several miles of the river and the head waters of Herrington Lake.

MATERIALS AND METHODS

The specimens used in this study were collected by anglers during the 1951 spring spawning run in the head waters, and by seines and rotenone in the main body of the lake.

All length measurements were taken on a standard measuring board marked in inches and tenths, and recorded to the nearest tenth of an inch. All fish heavier then 0.3 pounds were weighed on a circular spring balance scale calibrated by 0.1 pound intervals and estimated to the nearest 0.05 pound. Smaller fish were weighed on a gram balance and converted to the nearest 0.01 pound. All measurements were taken in the field on fresh specimens.

Age, sex, and state of maturity determinations were made on 1,978 fish taken by anglers between April 18 and April 28, 1951. Age and growth studies were made by the scale method in the conventional manner. Scales were taken from an area on the left side immediately below the lateral line and even with the anterior dorsal fin.

The scales of all fish aged were used in the determination of the body-scale relationship, as well as those of 191 young fish collected during June, 1951 and August, 1951. Of these latter 131 were used to supplement length-weight data of the April, 1951 collection.

RESULTS

Body-Scale Relationship

The relationship between the total length of the body and the anterior scale radius (X33) was determined in order to find the necessary correction for the direct-proportion calculated lenghts. The data (Table 1) were grouped into 0.2 intervals and a line fitted to these data over their entire range. A regression line having a Y intercept of 1.12 and a slope of 1.74 was found to fit the plotted data (Fig. 1). Van Oosten (1942), working with Lake Erie white bass, used 1.18 (converted to total length) as a correction factor and Sigler (1949), working with the white bass of Spirit Lake, Iowa found a Y intercept of 1.21 (converted to total length).

The direct proportion calculated lengths of the white bass aged were corrected by the following formula:

$$L_x = 1.1 + \frac{S_x\ (L - 1.1)}{S_t}$$

where

L_x = total length of fish at annulus x
S_x = scale radius at annulus x
L = total length of fish
S_t = total scale of radius

Age Composition and Length Frequency

The age composition and length frequencies of the samples collected from April 18 to April 28 is given in Table 2. Van Oosten (1942) noted that in Lake Erie the white bass population is composed primarily of young fish, with only 4.7 percent of those he studied being older than three years. The same condition is apparent in the white bass of Herrington Lake. Only 7.1 percent of the sample belonged to Age Groups II - IV, and no fish was found that had reached its fifth summer. It must be noted, however, that this age composition was plotted at a

Table 1. Body-scale relationship (L/Sc) of 2,169 Herrington Lake white bass arranged by average total lengths based on 0.2 inch intervals with all age groups combined.

Avg. Total Length	Avg. Scale (x33) Measurement	Avg. L/Sc Ratio	Number of Fish	Avg. Total Length	Avg. Scale (x33) Measurement	Avg. L/Sc Ratio	Number of Fish
1.5	0.4	3.75	13	10.6	5.1	2.08	2
1.7	0.4	4.25	17	10.8	5.5	1.97	3
1.8	0.5	3.70	6	11.1	5.6	1.98	2
2.0	0.5	4.00	1	11.3	5.9	1.92	4
2.3	0.7	3.29	1	11.5	5.8	1.98	5
4.1	1.8	2.28	1	11.7	6.4	1.83	3
4.3	2.1	2.05	4	11.8	6.3	1.88	8
4.4	1.9	2.31	3	12.1	6.3	1.92	7
4.7	2.2	2.14	4	12.3	6.2	1.99	9
4.9	2.3	2.13	9	12.5	6.7	1.87	20
5.1	2.4	2.12	19	12.7	6.7	1.90	35
5.3	2.4	2.21	16	12.8	6.8	1.88	56
5.5	2.5	2.20	28	13.0	7.1	1.83	123
5.7	2.6	2.19	15	13.3	7.2	1.85	147
5.9	2.8	2.10	19	13.5	7.3	1.85	173
6.0	2.8	2.14	10	13.6	7.4	1.84	143
6.3	2.9	2.17	8	13.8	7.5	1.84	110
6.5	3.1	2.09	8	14.1	7.7	1.83	98
6.7	3.1	2.16	13	14.2	7.6	1.87	84
6.8	3.3	2.16	13	14.4	7.7	1.87	37
7.0	3.5	2.00	23	14.6	8.0	1.83	17
7.3	3.5	2.08	16	14.8	8.1	1.83	18
7.5	3.6	2.08	26	15.1	8.2	1.84	15
7.6	3.6	2.11	32	15.3	8.4	1.82	22
7.9	3.9	2.02	25	15.5	8.5	1.82	25
8.0	3.9	2.05	34	15.6	8.5	1.84	17
8.3	4.1	2.02	24	15.9	8.6	1.85	17
8.5	4.2	2.02	34	16.0	8.4	1.91	7
8.7	4.3	2.02	38	16.2	8.7	1.86	9
8.9	4.4	2.02	41	16.4	8.8	1.86	1
9.0	4.6	1.96	71	16.6	8.0	2.08	1
9.2	4.6	2.00	81	16.9	9.2	1.84	9
9.5	4.8	1.98	81	17.0	8.9	1.91	3
9.6	4.9	1.96	90	17.3	7.4	2.34	1
9.8	5.0	1.96	58	17.5	9.2	1.90	2
10.1	5.0	2.02	36	17.6	9.5	1.85	1
10.2	5.2	1.96	10	18.0	9.7	1.85	1
10.4	5.1	2.04	5	18.4	10.3	1.79	1

time when 0 age Group fish were all exactly one calendar year old, all Age Group I fish were two full years old, etc. Had the age composition been plotted at the end of June, when empirical observations showed that most fish had finished laying

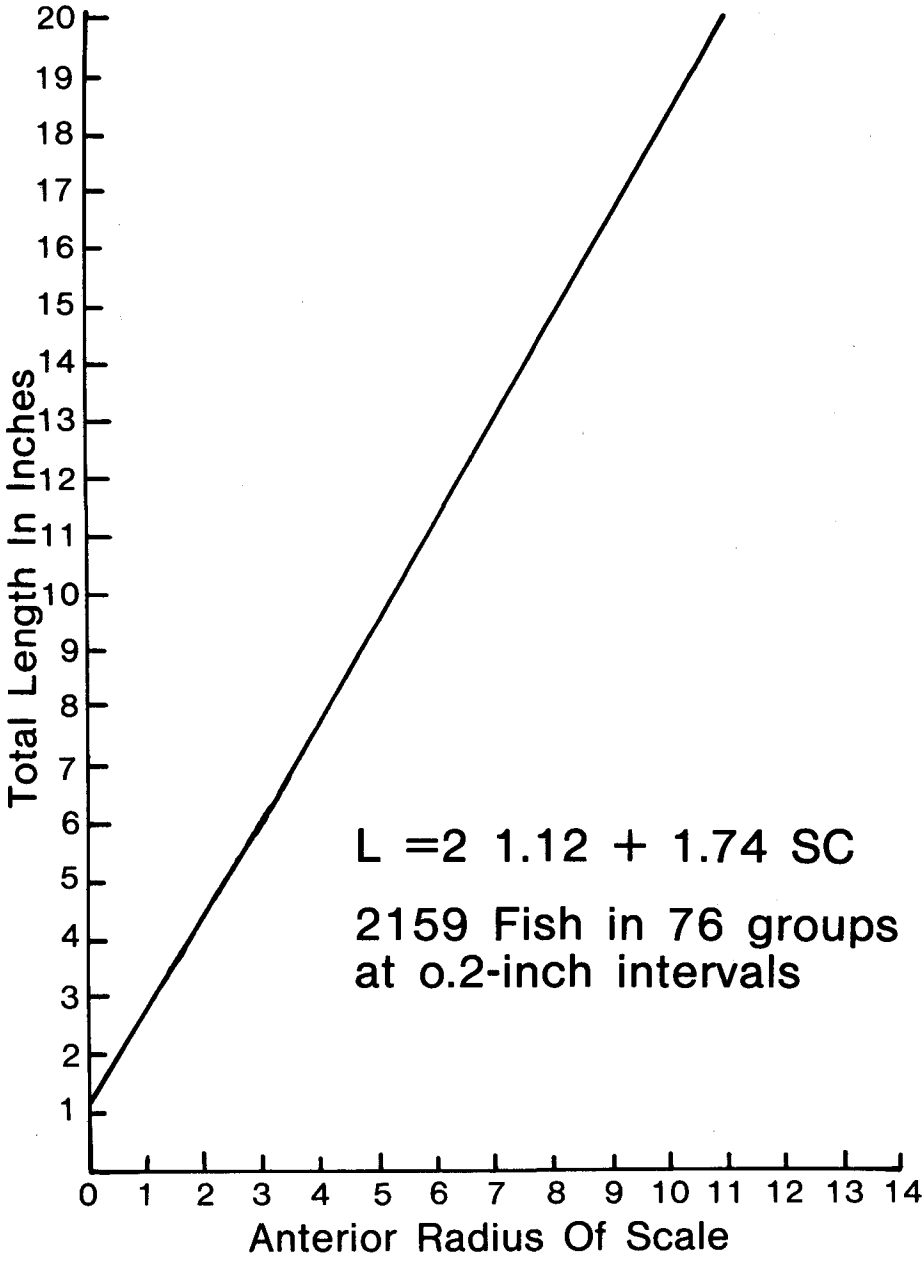

Fig. 1. Body-scale relationship of Herrington Lake white bass.

down the current annulus, the percentage of Age Group II fish would have been increased. There is no doubt, however, that the majority of mortalities occur in the third year of life, with few fish surviving much over this time.

Table 2. Age composition and length-frequency distribution of Herrington Lake white bass collected in April, 1951.

Total Length in Inches	Age Group 0	I	II	III	IV	No.	%
6.0 - 6.4	3					3	00.1
6.5 - 6.9	4					4	00.2
7.0 - 7.4	19					19	01.0
7.5 - 7.9	35					35	01.8
8.0 - 8.4	50					50	02.5
8.5 - 8.9	91					91	04.6
9.0 - 9.4	216					216	10.9
9.5 - 9.9	235	1				236	11.9
10.0 - 10.4	54	1				55	02.8
10.5 - 10.9	12	3				15	00.8
11.0 - 11.4	10	3				13	00.7
11.5 - 11.9	15	3				18	00.9
12.0 - 12.4	3	19				22	01.1
12.5 - 12.9	4	114				118	06.0
13.0 - 13.4		356				356	18.0
13.5 - 13.9		339	1			340	17.1
14.0 - 14.4		200	4			204	10.3
14.5 - 14.9		41	18			59	03.0
15.0 - 15.4		3	43	1		47	02.4
15.5 - 15.9		3	24	7		44	02.2
16.0 - 16.4			8	9	1	18	00.9
16.5 - 16.9			1	7		8	00.4
17.0 - 17.4				4		4	00.2
17.5 - 17.9					2	2	00.1
18.0 - 18.4					1	1	00.1
Total	751	1086	109	28	4	1978	100.0
Percent	38.0	54.9	5.5	1.4	0.2		

Growth

The calculated lengths for each year of life of the male and female white bass were recorded separately (Tables 3 and 4). The calculated lengths of the females exceeded those of the males for every year, as did the increment of growth. The white bass of Herrington Lake make quite rapid growth in comparison with that reported for other localities (Table 5). Very little information is available on the growth rates of the white bass in other Kentucky waters. Thirteen specimens aged from Kentucky Lake (Tompkins 1951) had an average calculated total length of 8.7 inches at the end of the second year. Data originally given in direct proportion calculated lengths, have been adjusted to a 1.1 inch origin.

Age and Size at Sexual Maturity

Inasmuch as all of the fish examined were taken during the spawning run no difficulty was encountered in determining the sex or state of maturity. Most fish

Table 3. Summary of the average calculated lengths and annual length increment in inches for the male Herrington Lake white bass collected in April, 1951.

Age Group	Number of Fish	Total Length at Capture	Calculated Length at End of Year of Life			
			1	2	3	4
0	658	9.2				
I	599	13.2	8.3			
II	74	15.2	8.2	13.3		
III	10	16.0	8.2	13.0	14.9	
IV	1	16.0	6.4	12.1	14.1	15.3
Grand Averages and Total = 684			8.3	13.3	14.8	15.3
Increments of Growth			8.3	5.0	1.5	0.5
Number of Fish			684	85	11	1

Table 4. Summary of the average calculated lengths and annual length increment in inches for the female Herrington Lake white bass collected in April, 1951.

Age Group	Number of Fish	Total Length at Capture	Calculated Length at End of Year of Life			
			1	2	3	4
0	93	8.6				
I	487	13.8	8.6			
II	35	15.8	8.1	13.7		
III	18	16.6	7.8	13.2	15.6	
IV	3	17.8	9.1	14.2	15.9	17.1
Grand Averages and Total = 543			8.5	13.6	15.6	17.1
Increments of Growth			8.5	5.1	2.0	1.5
Number of Fish			543	56	21	3

Table 5. Comparison of reported growth rates of white bass from various localities.

Locality	Number of Specimens	Calculated Total Length in Inches at End of Each Year of Life								
		1	2	3	4	5	6	7	8	9
Lake Erie (5)	1853	4.7	8.2	10.9	12.4	13.2	13.6	14.0		
Spirit Lake, Iowa (3)	1059	5.1	9.7	12.7	14.3	14.8	15.2	15.4	15.8	16.2
Clear Lake, Iowa (2)	118	6.0	10.5	12.9	14.0	14.8	15.5			
Herrington Lake[a]	1978	8.4	13.4	15.1	16.6					

[a] Both sexes combined.

could be stripped quite easily, and only with the smallest individuals was it necessary to examine the gonads.

Of 658 group 0 males examined, 526, or 80 percent, were mature. No mature males less than 8.1 inches were found, as were no immature males over 8.9 inches. The male white bass in Herrington Lake attains maturity at an average length of 8.5 inches.

The smallest ripe female examined was 8.2 inches in length. All fish over 11.4 inches were mature. Of 93 group 0 females examined, 14 or 15 percent, were ripe. The average size at which the females become mature is 10.4 inches.

There is no doubt that the high percentages of mature individuals in group 0 does not represent the group as a whole, inasmuch as the fish were taken at a time when the faster growing individuals were taking part in the spawning run. This is obvious when one compares the average length of the captured group 0 males with the calculated lengths of the other year classes (Table 3). This is not apparent in the case of the females because of the relatively small number of fish attaining the larger size coinciding with maturity in this sex.

Length-Weight Relationship

The length-weight relationship of the Herrington Lake white bass is plotted in Fig. 2. The standard equation, $W = cL^n$, gave the following equation: $W = 3.172 \times 10^{-6} L^{3.077}$. The logarithmic equation is Log W = -3.4304 + 3.077 log L. No condition factors were calculated, but comparison with the data given by Van Oosten (1942) and Sigler (1949) showed that the Herrington Lake white bass do not have the same degree of plumpness as the fish used in these studies.

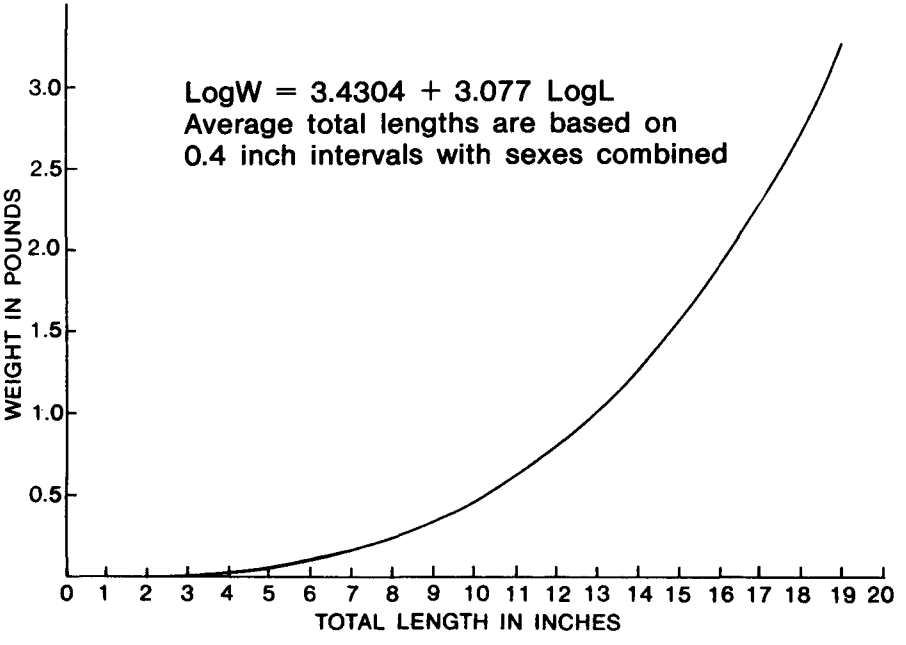

Fig. 2. Length-weight relationship of Herrington Lake white bass.

MANAGEMENT

Present Kentucky fishing regulations call for a creel limit of fifteen white bass with no size limit. Because of its rapid growth, short life, and early maturity the white bass should be harvested as rapidly as possible. It was noted during the field work, however, that only a small percentage of Herrington Lake fishermen attained limit catches. The amount of fishing pressure on the white bass, under existing regulations, is heavy enough to provide a sufficient harvest. Even though an abolishment of the creel limit would have little effect on the white population it is doubtful if this step would be wise, in view of the law enforcement problems that it would entail. The present creel limit sharply reduces the possibilities of large-scale poaching and marketing of this species, which is an important factor in view of the ease with which this fish can be taken in commercial fishing gear.

No size limit is necessary on the white bass in this impoundment at the present time. If the need arises for such a step in the future a limit of no less than eleven inches would be necessary for almost complete protection of this species.

SUMMARY

The study on the age and growth of the Herrington Lake white bass was based on 1987 fish taken in April, 1951. The body-scale relationship was determined from 2169 fish and an origin of 1.1 inches was found to fit the data. No fish older than Age Group IV were found, and 54.9 percent of the fish were in Age Group I, with group 0 fish representing 38 percent of the total. The females grow faster than the males, and attain the larger sizes. The average white bass in Herrington Lake reaches 8.4 inches at the end of its first year, 13.4 at the end of the second, 15.1 at the third, and 16.6 at the fourth. Males mature at a length of 8.5 inches, and females at 10.4 inches. The length-weight relationship is expressed by the equation $W = 3.712 \times 10^{-6} L^{3.077}$. No changes in the present fishing regulations are believed necessary.

LITERATURE CITED

Eschmeyer, R. William. 1844. Fish migration into the Clinch River below Norris Dam, Tennessee. Jour. Tenn. Acad. Sci. 19: 31-41.

Lewis, William M. 1950. Growth of the white bass, *Lepibema chrysops* (Rafinesque), in Clear Lake, Iowa. Iowa State Coll. Jour. Sci. 24: 273-277.

Sigler, William F. 1949. Life history of the white bass, *Lepibema chrysops* (Rafinesque), of Spirit Lake, Iowa. Iowa Agr. Exp. Sta. Res. Bull. 366: 203-204.

Tompkins, William A., and Bernard T. Carter. 1951. The growth rates of some Kentucky fishes. Ky. Fish. Bull. 6. 12 pp.

Van Oosten, John. 1942. The age and growth of the Lake Erie white bass, *Lepibema chrysops* (Rafinesque). Papers Mich. Acad. Sci., Arts, and Letters. 27: 307-333.