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AGE AND GROWTH OF LARGEMOUTH BASS IN DARBONNE PIT, ST. LANDRY PARRISH, LOUISIANA

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ABSTRACT

Measurements of total length, standard length, weight and scales were made on largemouth bass from Darbonne Pit, St. Landry Parish, Louisiana. The following determinations were derived: (1) Length-Weight relationship, Log W = —.7835 + 3.11 Log L; (2) Scale Length—Total length relationship, Y = .44 + 61.51 X, X = scale length (inches), Y = total length (inches); Coefficient of Condition, K = 2.36 and C = 49.3. The calculated growth increment for the first year was 6.6 inches, the measured total length of the young-of-the-year bass was 8.3 inches. These data were compared to data given by Brashier (1965) for bass of two oxbow lakes in Pointe Coupee Parish, Louisiana; and by Carver (1965) for the bass of the Delta National Wildlife Refuge, Plaquemines Parish, Louisiana.

INTRODUCTION

Largemouth Bass, *Micropterus salmoides* Lacepede, were collected from a pit in St. Landry Parish, Louisiana, from September 11, 1966, to May 16, 1967, to determine (a) age and growth relationship, (b) length and weight relationship, and (c) Coefficient of Condition.

The area surrounding the pit from which the bass were collected is in the alluvial flood plain of Louisiana and has the following characteristics (Buchanan, 1957): Elevation—15 feet; Mean temperature—January 51.3F, July 81.3F; Frost free period—March 15 to November 15; Rainfall—annual average 58 inches.

The study area is 4 miles west of Krotz Springs, Louisiana, and 8 miles east of Port Barre, Louisiana, at the intersection of U.S. Highways 190 and 71 (Fig. 1). The pit is approximately 2¼ miles long, east to west, ½ miles wide, north to south. It is a shallow pit, 10 feet deep at high water, and has numerous small islands. The old Darbonne Bayou channel crosses it from north to south on the east end. Digging of the pit began in 1957 and ended in 1962. The dirt was used for highway construction. The pit is identified as Darbonne Pit by U.S. Geological Survey Maps and Conservation Department records but it is known locally as North Two O'clock Pit.

Duckweed *(Lemma sp.),* coontail *(Ceratophyllm demersum)* and water hyacinth *(Eichornia crassipes)* are found throughout the pit. At times the wind-blown water hyacinth and duckweed make fishing and boating almost impossible and the coontail is extremely thick over the shallower areas. The Louisiana Conservation Department works each year to control the water hyacinth but there is no control at this time for the coontail and duckweed. Black willows, *Salix nigra,* are all around the banks of the pit and bald cypresses, *Taxodium distichum,* are along the old bayou channel through the pit.

1. Present address: 952 Rose Ann Street, Opelousas, Louisiana.

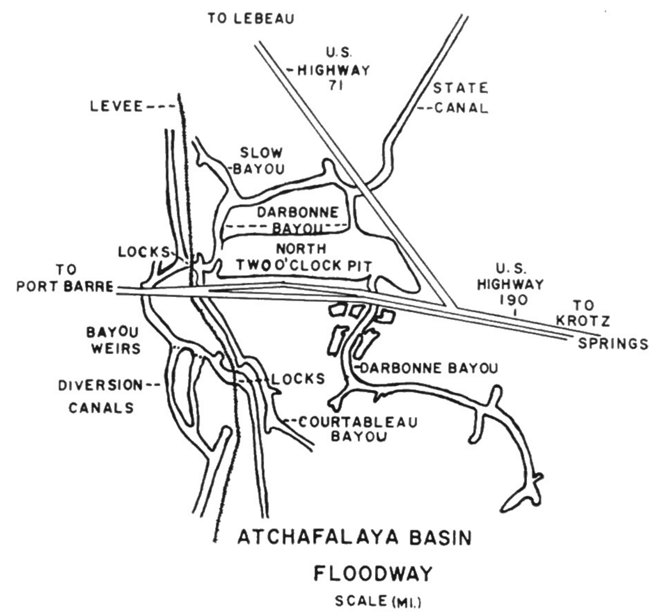

FIGURE 1. Location of Darbonne Pit (North Two O'Clock Pit) St. Landry Parish, Louisiana

The water level in the pit is unstable due to its connection with Darbonne Bayou. Darbonne Bayou connects to Bayou Courtableau to the south and to the State Canal to the north. These streams are used by the U.S. Corps of Engineers for flood control and receive much water from the watershed during the rainy season. The flood control streams rise and cause Darbonne Bayou to rise and empty much water into the pit. After the rains stop, the flood control streams drain off the water rapidly, thus causing Darbonne Bayou to drop and drain the water from the pit. It is not uncommon for the water level to rise several feet during rains and fall accordingly when the rains stop. In 1964 and 1965 Hurricanes Hilda and Betsy went through Louisiana. After each of these storms, fish were killed in the pit.

METHODS

The bass were taken on artificial baits by casting. The casting method was selective of yearling and older bass and few young-of-the-year bass were taken in this manner.

Once a bass was taken, it was placed on a measuring board and measured for standard length and total length. Length measurements were recorded to the nearest 1/16 of an inch. The bass were then weighed to the nearest ounce, using a spring balance which was checked periodically to insure accuracy. A dull knife was used to remove scales from an area immediately posterior to the depressed pectoral fin and below the lateral line. The collected scales were placed in envelopes on which were recorded the total length, standard length, weight, time of capture, date of capture, method of capture, and collector.

After cleaning, four scales from each fish were placed between two microscope slides which were bound together with scotch tape. The slides were inspected with a Bausch and Lomb microprojector, and all regenerated scales were replaced with normal scales. Each slide was examined at a magnification of 22 diameters. The number of annuli was determined by the following procedures (Lagler 1956): (a) By locating areas of discontinuous ridges and/or ridges which were not parallel to the focus (cutting over); (b) Noticing the pattern of the circuli, the ridges are closely packed on the inside of the annulus as compared to those on the outside of the annulus; (c) A clear, narrow streak found all around the scale at the annulus. Most scales displayed combinations of these three criteria but very few showed all three effects clearly. Scales which were difficult to interpret were re-examined at a magnification of 46 diameters. In addition to annular counts, distances from the focus to the outside edge of each annulus and to the outer edge of the scale at the anterior field were recorded.

Results

Scale-Length—Total-Length Regression Equation. To determine the length of bass at the time of annulus formation, it was assumed that a relationship existed between the body-length of a bass and its scale-length. The equation used to describe this relationship is the Lee Method regression equation (Lagler 1956).

$$Y = a + cX$$

Y = Total Length (inches)
X = Scale Length (inches)
a = y intercept (correction factor)
C = constant (slope)

To make a straight line "fit" of the data, when more than two pairs of values are used, it is necessary to use the method of least squares (Steel and Torrie 1960). Once the regression equation is determined, the length of the scale from the focus to an annulus can be measured, and from this value the length of the fish at annulus formation can be determined.

A regression equation was calculated for the bass of the Darbonne Pit using the total lengths and scale lengths from 50 bass. From these data *a* was found to be .44 inches and *c* was 61.51. Therefore the regression equation is, Y = .44 + 61.51 X.

Calculated Growth. In order to use the formation of annuli to calculate growth and to age bass, it must be shown that bass form only 1 annulus each year. Carver (1965) and Muncy (1965) have demonstrated that bass in Louisiana form a single annulus each year between March and early June. In my sample the mean growth-increment was least during the month of May thus indicating that annulus formation had occurred by this time.

Using the average distance from the scale focus to each annulus in the regression equation, Y = .44 + 61.51 X, the values for calculated growth were determined for each age group (Table 1). Bass in Darbonne Pit grew most rapidly the first year and growth increase was less each succeeding year as predicted by Thompson (1952).

A comparison of calculated total length increments was made with those derived by Brashier (1965) from False River and Old River and Carver (1965) from the Delta National Wildlife Refuge (Table 2). This comparison shows a close agreement in growth increments, especially the 2nd, 3rd, and 4th year increments. In addition to the data given, 13 young-of-the-year bass were caught and these had an average standard length of 7.7 inches.

Coefficient of Condition. The growth pattern of bass follows approximately the inverse cube law, where the weight in grams is divided by the cube of the standard length in millimeters. The derived value is called the Coefficient of Condition. This Coefficient is K in the Metric System and C in the English System. In actual practice, the weight is multiplied by a multiple of ten, to cause the Coefficient to increase enough to be expressed in scientific notation. The following equation is used to describe the average bass of the sample.

$$K = \frac{\text{Wt. (grams)} \times 10^5}{(L\text{s.l.})^3 \text{ mm}} \qquad C = \frac{\text{Wt. (lbs.)} \times 10^5}{(L\text{t.l.})^3 \text{ inches}}$$

This equation is used only to describe the average bass, or any bass in the sample, and is not used to predict the weight, when the length is known; or the length, when the weight is known. A more accurate method of predicting the length-weight relationship is the equation, $W = aL^n$, which will be discussed later in this text. To compare the robustness or plumpness of fish in Darbonne Pit to those of other areas, Coefficient of Condition were compared (Table 3). The values for Darbonne Pit are below those of the other Louisiana areas, indicating that these fish are not as plump as the fish found in False River, Old River or the Delta National Wildlife Refuge.

The bass of Darbonne Pit were in better condition in the spring than at any other time of the year. The K value for March was larger than the K value for the late summer and early fall (Table 4). Since no distinction was made between male and female bass, it is expected that a higher K value will be shown in the spring when the fish are ripe and spawning is about to occur.

In addition to the above data, 13 young-of-the-year bass were taken and their average total length was 8.3 inches and weight 118 grams. K was calculated for these bass and found to be 2.31.

Length-Weight Relationship. To express the true length-weight relationship of the Darbonne Pit bass, the following equation was used:

$$W = aL^n$$

W = weight in grams
L = total length in inches
a = constant
n = constant

TABLE I

Average Calculated Growth for Bass in Darbonne Pit

Age (yrs.)	Year Class	No. of Fish	Annuli 1	2	3	4	5	6
1	1966	43	7.1					
2	1965	64	7.3	10.5				
3	1964	35	6.5	9.85	12.1			
4	1963	24	7.1	10.0	12.1	14.2		
5	1962	9	6.2	9.5	11.5	12.8	14.9	
6	1961	6	5.4	8.5	11.6	13.4	14.0	15.2
Total no. of fish		181						
Average total length			6.6	9.7	11.9	13.6	14.5	15.2
Growth increment since last annulus			6.6	3.1	2.2	1.7	.9	.7

TABLE II

Total Length Increments since last annulus

	Years 1	2	3	4	5	6
Brashier:						
False River	6.8	3.8	2.1	1.8	1.5	1.3
Old River	8.0	3.7	2.3	1.8	1.5	1.3
Carver: Delta Nat.Wildl. R.	9.6	3.53	2.56	—	—	—
Shay:						
Darbonne Pit	6.6	3.1	2.2	1.7	.9	.7

TABLE III

Comparison of K and C

	Shay Darbonne Pit		*Carver* Delta National Wildlife Refuge	*Brashier* False River		Old River	
Age	K	C	K	K	C	K	C
1	2.31	44.7	2.81	2.53	51	2.78	55
2	2.28	46.8	2.86	2.59	52	2.91	58
3	2.36	49.3	3.06	2.72	54	2.91	60
4	2.30	48.7	—	2.72	55	2.83	59
5	2.54	55.0	—	2.73	56	2.73	57
6	2.34	51.6	—	2.65	55	2.97	—
Mean	2.36	49.3	2.91	2.67	55	2.86	58

TABLE IV

K of fall and spring for bass from 1 to 5 years

Age (years)	K (Sept.-Oct.-Nov.)	K (March)
1	2.23	2.39
2	2.23	2.35
3	2.38	2.39
4	2.35	2.37
5	2.02	2.36

This equation is a cubic equation which has a curved line as its locus when graphed arithmetically, but its locus is a straight line when plotted on double-log graph paper. The equation, $W = a\ L^n$, can be expressed in logarithmic form, Log W = Log a + n Log L. The equation can now be used as a linear equation when the observations are transformed into log form (Log W and Log L) before being used in the equation. Since it is in linear form, Log *a* is the intercept (correction factor) and *n* is the regression coefficient.

The value of the constant *a* was determined by taking paired values for total length and weight from 50 bass and using these values, in their log form, in the following equation:

$$\text{Log a} = \frac{\text{Log W} \times \sum (\text{Log L})^2 - \sum \text{Log L} \times \sum (\text{Log L} \times \text{Log W})}{N \times \sum (\text{Log L})^2 - (\sum \text{Log L})^2} = -.7835$$

N = number of bass

With Log a known, the value of n was determined using the equation:

$$n = \frac{\sum \text{Log W} - (N \times \text{Log a})}{\sum \text{Log L}} = 3.11$$

The logarithmic form of the regression equation, $W = a\ L^n$, was found to be:

$$\text{Log W} = -.7835 + 3.11 \text{ Log L}$$

The values for total length of the bass were grouped into 1 inch intervals, and the mean length values transformed into log values. These log values (Log L) were used in the regression equation to derive the logarithm of the weight values (Log W). The calculated weight values, corresponding to the mean total length values, were found by taking the antilog of the derived Log W values.

The paired mean weight and mean total length values were then plotted on the same graph on which the mean total length values and the calculated weight values had been plotted. This was done to determine the accuracy of the regression equation, Log W = −.7835 + 3.11 Log L, in predicting the weight when only the total length was known. The graph of this data (Fig. 2), indicates that the equation is extremely accurate in predicting weight when only the length is known. In addition, the length of a bass may be determined from the equation when only the weight is known by changing the equation to the form: $\text{Log L} = \frac{\text{Log W} + 7835.}{3.11}$

A comparison of the regression equation for length-weight of bass from the Darbonne Pit was made with those of the other areas of Louisiana.

Brashier:
False River . . . . Log W = − .8500 + 3.22 Log L
Old River . . . . . Log W = − .7688 + 3.15 Log L

Carver: Delta National
Wildlife Refuge . . Log W = − .648 + 3.059 Log L

Shay:
Darbonne Pit . . . Log W = − .7835 + 3.11 Log L

As shown, the correction factor and regression coefficient for my sample lies between the values for the samples from the other areas.

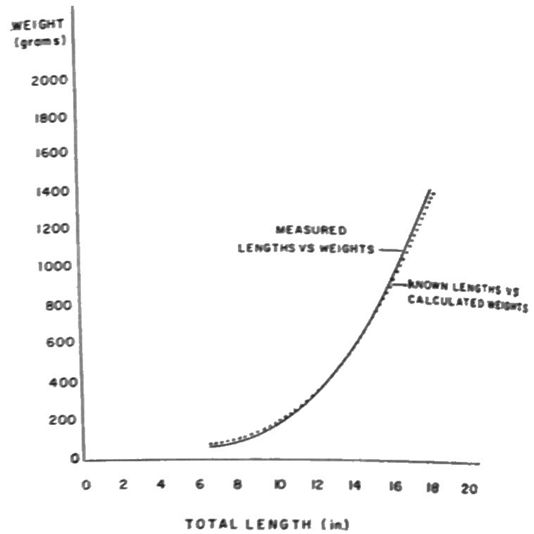

FIGURE 2. Comparison of Fit of the Predictive Weight-Length Equation with Actual Weight-Length Data.
Pit), St. Landry Parish, Louisiana.

Discussion

Thirty-four trips were made to the Darbonne Pit from September 11, 1966, to May 16, 1967. During these trips 206 bass were taken, for an average catch of 6 bass per trip. The average bass had a total length of 13.66 inches and an average weight of 19.75 ounces.

The log of the mean total length value was used in the regression equation, Log W = −.7835 + 3.11 Log L, to determine the accuracy of the equation in predicting the weight when only the total length was known. The antilog of the Log W value derived from the equation was 19.5 ounces. This value differed by .25 ounces from the actual average weight value of 19.75 ounces, indicating that the regression equation does describe very accurately the weight when only the total length is known. The predicted total length could be found as easily by using the log of the weight value in the equation, $\text{Log L} = \frac{\text{Log W} + .7835}{3.11}$, and then taking the antilog of the derived Log L value.

The regression equation, Y = .44 + 61.51 X, was checked by using scale lengths from bass, selected at random, in the equation and comparing the derived total lengths against the actual total lengths for these bass. This check showed that the equation was accurate in predicting the average total length of bass with a given scale length.

Calculated growth data for bass in Darbonne Pit were compared to that of other areas of Louisiana and close agreement was found for these data. Darbonne Pit bass grew approximately one inch less in total length the first year of life than did the bass from the other areas (Table 2).

Aging bass by the annuli formation method seemed to give valid results. However, this worker found that as the age of the bass increased beyond 3 years, the scales became increasingly difficult to read. This was due to the irregular pattern found on the scales and to their translucence. The scales with two or three annuli gave better results than any others, since the younger scales often had very irregular patterns and wide-spread circuli. The method of aging bass by the annuli number is subject to an age error of several months. A bass with one annulus, if caught in September after annulus formation, is about 3 to 4 months older than one growing season. Another bass with one annulus, if caught in May before annulus formation, has had two growing seasons. Both would be grouped as one-year-old bass by the procedures used in this paper. Other workers have aged bass by growing seasons. For example, a no-annulus bass would be considered one year old, and one annulus bass would be considered two years old. Either of these methods is subject to the error mentioned above.

The largest bass was taken in March, and weighed 94 ounces (5.9 lbs) with a total length of 22.13 inches. Sixty-nine bass were caught in March, 27 in October, 22 in April, and 21 in May.

Young-of-the-year bass, for the entire growing season of 1966-1967, had an average total length of 8.3 inches. When this growth rate is compared to the results obtained from other areas of Louisiana, (False River—4.7 in., Old River—7.7 in., Delta Nat. Wildl. Refuge—7.5 in., Springhill impoundment—12.5 in. (Oct., 1950), 10.6 in. (Oct., 1951), it is seen to be intermediate. Some of the variability of these results is due to the determinations being made at different times of the year.

It is concluded from results obtained in this investigation that Darbonne Pit is not quite as productive for bass as some other areas of Louisiana. This conclusion is supported by the slightly smaller annual growth increments and a generally smaller coefficient of condition.

We thank Kenneth Lantz of the Louisiana Wildlife and Fisheries Department in Opelousas, Louisiana, for securing material and helping at the beginning of my project. Thanks also go to the U.S. Geological Survey for their maps and the Louisiana Wildlife and Fisheries for permission to trap bass. Indebtedness goes to Jules Manuel for his many hours of help in cleaning scales and preparing slides.

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