Age and Growth of the Channel Catfish, *Ictalurus punctatus*, in Lake Texoma[1]

KERMIT SNEED, University of Oklahoma Research Institute, Norman, Oklahoma and

EDGAR M. LEONARD,[2] Oklahoma Fisheries Research Laboratory, Norman, Oklahoma

Markings on scales and other bone structures such as otoliths, vertbrae, fin rays and spines, and opercular bones have been used to determine the age and rate of growth of many species of fishes. Collectively, the works of Appleget and Smith (1), Cuerrier (2), Sneed (9) and Marzolf (8) give a comprehensive summary of the literature concerned with the structures employed and the techniques used in age and growth determination.

Several studies have been made on the age and growth of catfishes. Growth rings on vertebrae were used by Lewis (7) to age bullheads. Appelget and Smith (1) used vertebrae to age channel catfish and gave the criteria for the determination of age when using these bones. Sneed (9) used cross sections of fin spines of channel catfish of known age for age determination, and proved the validity of this method. Hall and Jenkins (3), and Jenkins, Leonard, and Hall (4) stated that data obtained from the examination of dorsal spines of channel catfish were more uniform than those obtained from pectoral spines of the same individuals. Marzlof (8) compared growth calculations made from sections of pectoral fin spines and from vertebrae of the same channel catfish and concluded that pectoral spines were more convenient to use, but the data obtained from the vertebrae were more similar to empirical data from the same fish.

Collection of Materials: The 330 channel catfish used in this study were collected from Lake Texoma in 1949. This reservoir, a 95,000 acre impoundment of the Red and Washita rivers, has been described in several publications (10, 12). It is a popular and productive fishing lake, and the channel catfish is one of the most fished-for species present. Most of the fish were collected in gill nets and on trot-lines; about equal numbers were taken by each of the two methods. Pectoral spines were used for the age and growth determinations, and if available, the left spine was taken. It was grasped by pliers, pulled outward so that the joint would be loosened, then rotated in a clockwise direction. In this way the entire spine was usually removed. Spines were placed in scale envelopes on which length, weight, sex, and kind of collecting gear were recorded.

Preparation of Spines: Spines were prepared for age determination essentially as described by Sneed (9). A thin cross section was cut from the spine near the proximal end of the groove that runs along its posterior edge. A small rotary saw mounted on a sliding platform (Leonard and Sneed, 6) was used.

Examination of Spines and Designation of Year Marks: The spine cross sections were examined under water. Year markings or annuli were determined and measured by the aid of a low power microscope equipped with an ocular micrometer with a movable crosshair. Measurements in millimeters were made from the center of the lumen to the posterior edge of the ventral "lip" of the spine groove (Sneed, 9: fig. 3). These measurements were multiplied by 100 to facilitate computations. Certain discrepancies appear in the numbers of fish used in the tables, since some spines could not be read with confidence.

---

[1] Contribution of the Oklahoma Fisheries Research Laboratory, Norman, Oklahoma, a cooperative enterprise of the Oklahoma Game and Fish Department and the University of Oklahoma Biological Survey.

[2] Present address: Baylor College of Dentistry, Dallas, Texas.

Growth checks or false annuli were found, and in some cases it was difficult and occasionally impossible to determine whether an annulus was valid or false.

Body Length-Spine Relationship: A straight line was fitted to the body lengths and spine measurements by the method of least squares (Fig. 1). The line was fitted to data on individual spine and body length

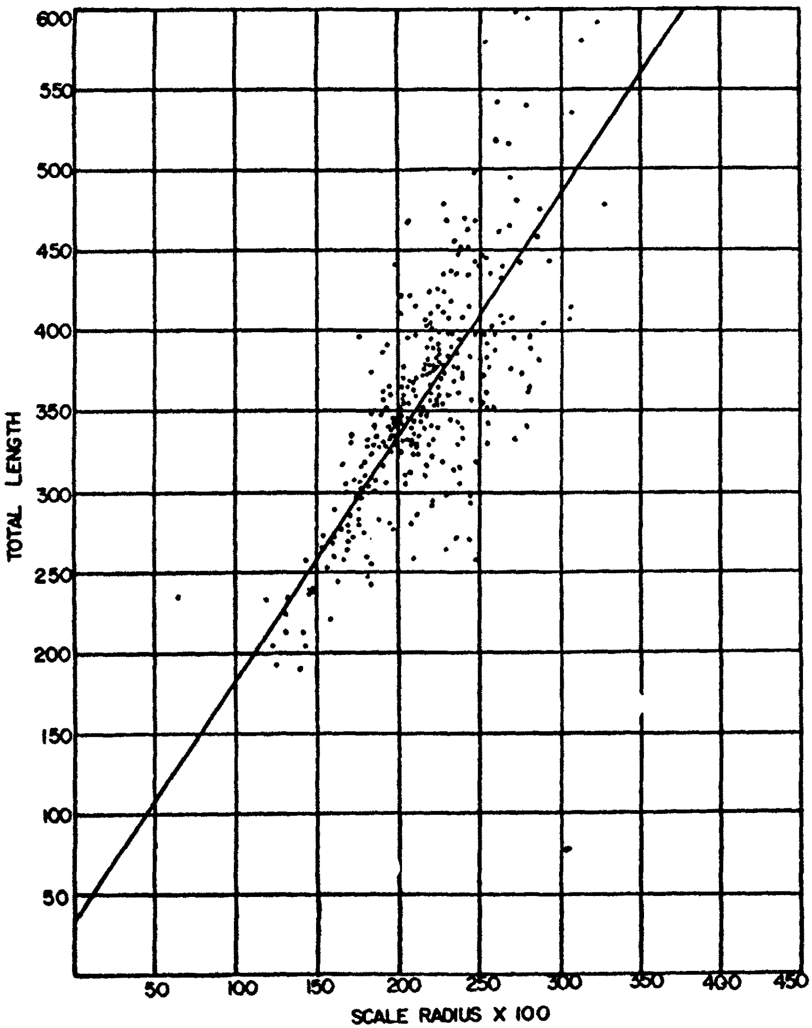

FIG. 1. Relationship between spine radius and total body length of channel catfish of Lake Texoma, Oklahoma, in 1949. The regression line was calculated from data for 329 fish.

measurements, not to mean values of lengths and spine radii. The equation thus computed is $L=34.1+1.5S$; i. e., the regression line has a slope (b) of 1.5, and the y-intercept is 34.1 millimeters of body length

The coefficient of correlation between spine radii and body lengths was found to be .0766. indicating considerable dispersion in the data.

Growth during successive years of life was calculated by use of the formula $L=a+b\ S$ where a and b have values as determined in the regression equation above. The use of this equation for growth calculations is statistically justified when *groups* of fish are being compared. However, when the growth of individual fish is to be compared, the formula $L_n=aS_n\frac{(Lt\text{-}a)}{St}$ should be employed, which in effect uses the same intercept but a different slope for each fish, as does the use of a nomograph.

Comparison of Calculated Growth with Empirical Length: Comparison of calculated growth with empirical lengths of Lake Texoma channel catfish (Table I) indicates that the calculated growth agrees fairly well with the empirical data. In each age group the calculated length at the time of the last annulus formation is less than the average empirical length at the time of capture. One would expect the calculated lengths for the fish to be less than empirical lengths unless the fish was captured at the time of annulus formation. The data indicate that the annual growth increment as determined by empirical measurements is approximately 50 millimeters for each succeeding age group. The calculated growth increment for each succeeding age group, with the exception of the increment between age groups I and II, is approximatly 40 millimeters. The increment of 99.3

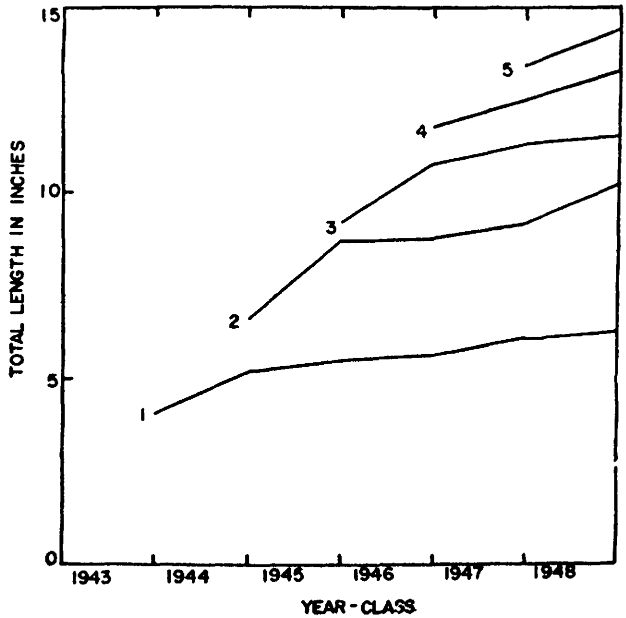

FIG. 2. Growth history of 329 channel catfish from Lake Texoma, Oklahoma, showing growth curves by year classes. Lines connect points representing lengths attained at end of year indicated by numeral at left.

millimeters between age-groups I and II cannot be satisfactorily explained from the data at hand because of the small number of fish in each year class.

Average Calculated Lengths at Successive Annuli: Growth increment in length (Fig. 2) was greatest during the first year of life. This is in accord with data on other species of fishes. Appleget and Smith (1) in their study of channel catfish from the Mississippi River found, however, that increment in length was greatest during the second year of life. Sneed's work (9) revealed a slightly greater increment of growth in channel catfish from Grand Lake, Oklahoma, during the first year of life; however, the difference between the first year's increment and those of succeeding years was slight.

There was a high degree of overlap in lengths between age groups and some indication that the length range within each group increases with age. Fish 240-259 millimeters in length may belong to age-groups I-IV, and fish 320-360 millimeters in length may belong to age-groups II-VI. The range of length in fish of the same age is not believed to be indicative of an error in age determination or in the use of selective fishing gear, but is probably a real difference in growth of the various year classes due to the great range of habitat conditions which exist in a body of water the size of Lake Texoma. A closer correlation might be obtained by grouping fish captured from the same type of habitat or at least from the same arm of the lake.

Lake Texoma catfish attained in their first year an average calculated total length for all year classes of 138 millimeters. Length increments after the first year were progressively smaller in succeeding years for all year classes of fish with more than one annulus. The average calculated growth increment (Table I) for age-groups II through VI was respectively 83; 51; 47; 34; and 21 millimeters. The annual calculated growth increments for all age groups are shown in Figure 2. It can be seen that the first year's growth gradually increased for the younger year classes; that is, fish spawned in 1943 reached a calculated length of 104 millimeters at the time the first annulus was formed; those of 1944, a length of 131 millimeters; 1945, 148 millimeters; 1946, 141 millimeters; 1947, 154 millimeters; and 1948, 158 millimeters. This growth rate is the opposite of the findings of Sneed and Thompson (10) concerning white crappie from Lake Texoma. The growth trend does show the characteristics of Lee's phenomenon, but since collections were made in only one calendar year (1949) no further statement can be made concerning this phenomenon. In all probability the changing ecological conditions weighed heavily in causing this growth pattern. It is quite possible that part of the 1943 year class fish was spawned in the Red River; this fact may account for the slow growth of this year class. The inundation of the lake bed with resultant decomposition of organic matter and the subsequent enrichment of the bottom may have accelerated the growth rate of bottom feeding fish.

Some workers have noted that water level fluctuations seem to have an effect on fish growth. Johnson (7) noted a retardation of crappie growth in Greenwood Lake, Indiana, due to extremely low water levels. Stroud's (13) data suggest good growth when water levels of the lake rise shortly after spawning time. Sneed and Thompson (10) stated that high water levels appeared to be correlated with successful spawning and good growth in Lake Texoma for white crappie and largemouth bass. The following lake level averages for three years were given by these last authors: May, 1946, 616 feet above sea level; May, 1947, 622 feet; and May, 1948, 616 feet. The data in Table 1 and Figure 2 do not indicate any significant influence of water levels on the growth of young-of-year fish, nor on growth increments of older fish during those three years, since the growth trend remains the same in the various year classes, regardless of high or low water levels during May. However, channel catfish do not spawn until June when the water levels are more stable, a fact which may account for the more uniform growth (as correlated to water levels) in age group O.

SUMMARY

1. This study was based on data from 330 channel catfish, *Ictalurus punctatus*, caught from Lake Texoma during the summer of 1949. The fish were taken with gill nets and trotlines.

2. Age groups were determined by examining cross sections of pectoral spines. It was found that an approximately linear relationship existed between total length of fish and the radius of the ventral lip of the spine plus 34.1 millimeters. Length was calculated using the formula $L = a + b\,S$, where a equals the incercept, b the slope of the regression line, and S the spine radius x 100.

3. Channel catfish in Lake Texoma (year-classes 1943-48) reached an average calculated total length of 138 millimeters the first year; 220 millimeters the second; 271 millimeters the third; 318 millimeters the fourth; 352 millimeters the fifth; and 373 millimeters the sixth year.

4. Each successive year class showed a greater growth for each year of life than had the preceding year class.

5. The legal limit of 10 inches for sport fishing was reached in the third year of life.

6. Water level fluctuation did not appreciably influence growth.

LITERATURE CITED

1. Appleget, John and Lloyd L. Smith Jr.
1951. The determination of age and rate of growth from vertebrae of the channel catfish, *Ictalurus lacustris punctatus*. Trans. Am. Fish. Soc., 80 (1950) :119-139.

2. Cuerrier, Jean-Paul
1951. The use of pectoral fin rays for determining age of sturgeon and other species of fish. Canadian Fish Cult. No. 11, pp. 1-9.

3. Hall, G. E. and R. M. Jenkins
1952. The rate of growth of channel catfish in Oklahoma waters. Okla. Fisheries Res. Lab. Rept. No. 27, 15 pp. (mimeo).

4. Jenkins, R. M., E. M. Leonard and G. E. Hall
1952. An investigation of the fisheries resources of the Illinois River and preimpoundment study of Tenkiller Reservoir, Oklahoma. Okla. Fisheries Res. Lab. Rept. No 26, 136 pp. (mimeo).

5. Johnson, Wendell L.
1945. Age and growth of the black crappie of Greenwood Lake. Invest. Indiana Lakes and Streams, II: 298-324.

6. Leonard, Edgar M., and Kermit E. Sneed
1951. Instrument to cut catfish spines. Prog. Fish-Cult. 13 (4) :232.

7. Lewis, William M.
1949. The use of vertebrae as indicators of the age of the northern black bullhead, *Ameiurus m. melas* (Rafinesque). Iowa State Coll. Jour. Sci., 23 (2) :209-218.

8. Marzolf, Richard C.
1955. Use of pectoral spines and vertebrae for determining age and rate of growth of the channel catfish. Jour. Wildlife Mgt. 19 (2) :243-249.

9. Sneed, Kermit E.
1951. A method of calculating the growth of channel catfish, *Ictalurus lacustris punctatus*. Trans. Am. Fish Soc., 80 (1950) :174-183.

10. Sneed, Kermit E., and W. H. Thompson
1950. The age and growth of white crappie and largemouth black bass in Lake Texoma, Oklahoma. Oklahoma Fisheries Res. Lab. Rept. No. 19, 82 pp. (mimeo).

11. Stroud, Rishard H.
1948. Growth of the basses and black crappie in Norris Reservoir, Tennessee Jour. Tennessee Acad. Sci., 23 (1) :31-99.

12. U. S. Army Corps of Engineers
1948. Denison Dam and Lake Texoma information pamphlet, Red River, Texas and Oklahoma, Tulsa District, Revision of March, 1948, 22 pp., 3 maps, (mimeo).

TABLE I

AVERAGE CALCULATED TOTAL LENGTH AT THE TIME OF ANNULUS FORMATION OF 329 CHANNEL CATFISH, LAKE TEXOMA, OKLAHOMA 1949

Age Group	Year Class	Number of Fish	Average total length (millimeters)	Calculated length at each annulus (millimeters)					
				1	2	3	4	5	6
O	1949	0		—	—	—	—	—	—
I	1948	3	207	158	—	—	—	—	—
II	1947	18	260	154	257	—	—	—	—
III	1946	57	303	141	233	293	—	—	—
IV	1945	144	351	138	222	287	337	—	—
V	1944	115	409	131	221	272	319	364	—
VI	1943	2	454	104	170	234	299	340	373
Total or Average		329	331	138	220	271	318	352	373
Total length (inches)				5.4	8.7	10.7	12.5	13.9	14.7
Average increment of growth (millimeters)				138	83	51	47	34	21