GROWTH RATES OF THE WHITE CRAPPIE *Pomoxis annularis* IN KENTUCKY LAKE[1]

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[1]A contribution from Dingell-Johnson Project F-2-R, Kentucky

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Abstract

During a series of netting studies conducted on Kentucky Lake, scale samples were collected from the white crappie that were harvested. Age and growth data was computed for 925 individuals of this species. These data showed that the white crappie in this impoundment reached a length of 4.63 inches at the end of the first year, 7.87 inches at the end of the second, 10.44 inches at the completion of the third year's growth, and 11.86 inches at the end of the fourth. The oldest fishes examined during the study were in their sixth year, and had attained an average length of 12.76 inches at the completion of their fifth year's growth. The relationship of length to weight is expressed by the formula: $W = CL^n$, or in this instance:

$$\text{Log } W = 3.7664 + 3.4566 \text{ Log } L.$$

This formula was used in determining each of the calculated weights.

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INTRODUCTION

Kentucky Lake is a 260,000 acre impoundment created by a dam across the Tennessee River at a point 22 miles above its confluence with the Ohio River. The pool extends 184 miles through western Kentucky and Tennessee. This impoundment is relatively shallow, averaging only 23 feet in depth over its entirety. It is characterized by a sand and muck bottom with gradually sloping margins, and has many comparatively shallow shelf areas.

In 1951 a project was undertaken in this impoundment to determine what netting gear could be best utilized by commercial fishermen for the harvest of what was then considered to be an expanding rough fish population. The subsequent extensive experimental netting failed, however, to support the results of standard cove eradication procedures. An analysis of the latter suggested that the white crappie comprised only a small proportion of the population. This species, however, comprised 40.2% of the total weight of over 13,000 pounds of fish taken in eight types of commercial gear utilized during the study. An examination of creel census returns for this impoundment indicated that fishing success for this species had remained constantly high during the past three years.

Inasmuch as the management of this species has constituted a definite problem in other waters, an attempt was made to define those factors which help to support a successful population in this area. The growth rate study presented herein is one facet of that investigation.

METHODS

The 925 specimens used in this study were collected during routine netting operations in the spring and summer of 1952, and

from rotenone samples taken during the same period. The scarcity of fishes of younger age groups reflects the selectivity of the gear used, as well as the failure of extensive rotenone samples to reveal the extent of the crappie population present.

All weights and measurements were made on fresh fish in the field. Total lengths were determined to the nearest tenth of an inch on a standard measuring board. Weights of the larger fishes were taken on a spring scale and recorded to the nearest twentieth of a pound. Smaller fishes were weighed on a gram balance and later converted to decimal fractions of a pound.

Scales were collected from each fish at a point even with the anterior portion of the spiny dorsal fin and immediately under the lateral line. The plastic impression method was utilized in preparing the scales for reading, and scales were read on a standard scale machine at a magnification of 40 diameters. The anterior scale radius was determined to the nearest tenth of an inch and length of the fish at the end of each year of life was back-calculated by direct proportion.

Although sexes were determined at the time of scale collection, no data concerning differential growth rates between the species has been tabulated. All growth data presented in this paper is for both sexes combined.

An uncorrected straight-line relationship was assumed in determining direct-proportion calculated lengths for each individual. Since the greater number of scales were collected in April only a very small number had formed the current annulus. Hansen (1951) found that most of the white crappie from Lake Decatur, Illinois, did not form an annulus until the latter part of May.

Calculated lengths were determined by the following formula:

$$L_a = \frac{S_a \times L}{S_t}$$

where

L_a = total length of fish at each annulus

S_a = anterior scale radius at each annulus

L = total length of fish at capture

S_t = total scale radius

AGE-COMPOSITION AND LENGTH-FREQUENCY

The age-composition and length-frequency relationships of the 925 fish used in this study are shown in Table I. In this Kentucky Lake series 47.35% of the crappie were found to be in the third summer, and 46.80% of this number were in the 12.5 - to 13.5-inch group. No individuals over five years of age were found, and only 3.46% of the total number examined had reached Age Group V, even though over 30% of the crappie used ranged from 13 to 16 inches in total length. The selectivity of the gear used caused the preponderance of larger specimens, since no fish less than 4 inches in length were taken in this equipment. The group containing the largest number of individuals, as shown in Table I, is the 12.5 - to 12.9-inch class. This is the approximate size of the average fish in the sportsman's creel from this lake.

GROWTH

Calculated lengths for each year of life of the individuals in this study are given in Table II. Increments of growth for each age group are also given.

TABLE I

AGE COMPOSITION AND LENGTH-FREQUENCY DISTRIBUTION OF WHITE CRAPPIE FROM KENTUCKY LAKE

TOTAL LENGTHS IN INCHES	AGE GROUPS							
	0	I	II	III	IV	V	Total No.	%
2.0 - 2.4	4						4	00.31
2.5 - 2.9								
3.0 - 3.4								
3.5 - 3.9								
4.0 - 4.4	1						1	00.11
4.5 - 4.9								
5.0 - 5.4	2						2	00.22
5.5 - 5.9		1					1	00.11
6.0 - 6.4		1					1	00.11
6.5 - 6.9		5					5	00.42
7.0 - 7.4		7					7	00.76
7.5 - 7.9		8	1				9	00.97
8.0 - 8.4		6	7	1			14	01.50
8.5 - 8.9		3	16	8			27	02.81
9.0 - 9.4		1	8	5			14	01.51
9.5 - 9.9			11	3			14	01.51
10.0 - 10.4		1	6	6			13	01.40
10.5 - 10.9			2	13	1		16	01.63
11.0 - 11.4			29	9	1		39	04.22
11.5 - 11.9			34	30	8	1	73	07.79
12.0 - 12.4			27	55	14		96	10.37
12.5 - 12.9			28	103	26	2	159	17.19
13.0 - 13.4			7	102	41	3	153	16.44
13.5 - 13.9				67	64	10	141	15.24
14.0 - 14.4			2	31	50	7	90	09.72
14.5 - 14.9				4	23	3	30	03.24
15.0 - 15.4				1	7	3	11	01.89
15.5 - 15.9					2	3	5	00.53
TOTAL	7	33	178	438	237	32	925	
PERCENTAGE	0.76	3.57	19.24	47.35	25.62	3.46		100.00

Of special significance is the high rate of growth for the first year, showing a growth of 4.63 inches for the crappie investigated. Ricker (1942) noted a length of 2.8 inches at time of formation of the first annulus in a series of crappie from Foots Pond, Indiana. A length of 7.87 inches was attained by Kentucky Lake crappie at the end of the second year.

Growth rates of these crappie are well above figures given for similar populations in other areas. Johnson (1945) found a calculated length of 7.8 inches at completion of the third year in Greenwood Lake, Indiana, and Caldwell noted a series of crappie in Ohio which reached 12.1 inches at the end of the fifth year, combining several studies. The Kentucky Lake crappie reached a length of 10.44 inches at the end of the third year and were 12.76 inches long at the end of five years.

TABLE II

SUMMARY OF AVERAGE CALCULATED LENGTHS AND ANNUAL LENGTH INCREMENTS, IN INCHES, OF WHITE CRAPPIE FROM KENTUCKY LAKE

Year Class	Length at time of capture	Group I	Group II	Group III	Group IV	Group V	No. of fish
1953	3.41						7
1951	7.58	3.81					33
1950	11.20	4.90	8.04				178
1949	12.68	4.66	7.99	10.66			438
1948	13.56	4.57	7.66	10.16	11.93		237
1947	14.00	4.11	6.84	9.45	11.33	12.76	32
Grand final averages & total		4.63	7.87	10.44	11.86	12.76	925
Increments of growth		4.63	3.24	2.57	1.42	0.90	

SEX RATIO AND SIZE AT MATURITY

Of the 826 individuals sexed during this study, 636 were females and 190 were males. The ratio for those sexed is 335 females for each 100 males. The males mature earlier, the smallest mature specimen being only 7.5 inches in length. One female 9.3 inches in length was found to be mature. Only one mature female was found in Age Group I, along with three mature males.

LENGTH - WEIGHT RELATIONSHIP

The length-weight relationship of the Kentucky Lake white crappie is shown graphically in Figure I. The basic equation,

$$W = C\ L^n$$

yielded the equation:

$$\text{Log } W = 3.7664 \times 10^{-6} + 3.4566 \text{ Log } L.$$

when applied to this crappie population.

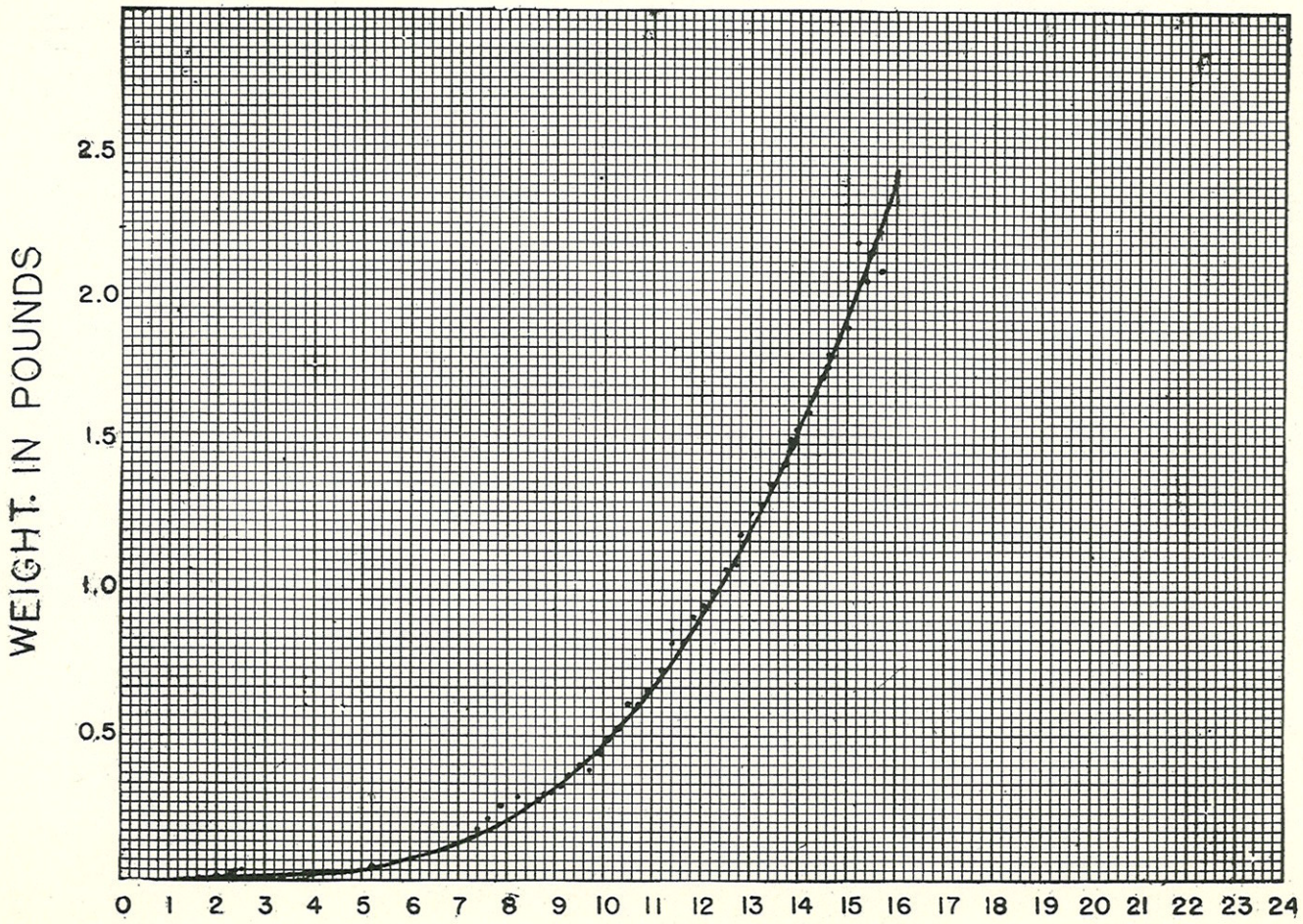
MANAGEMENT

Present regulations regarding the white and black crappie combined, provide for a creel limit of 30 with no minimum size required. This prevails throughout Kentucky and is believed satisfactory for the present, since only a few weeks during the year are conducive to limit catches.

No creel limit would be required, in view of the high rate of growth of the species in question, but is deemed advisable to prevent possible taking of crappie by the commercial fisherman in the area. Large-scale netting operations by the Division of Fisheries have shown that crappie are easily taken in large numbers by certain net types legal for commercial use.

FIGURE I

LENGTH-WEIGHT RELATIONSHIP OF KENTUCKY LAKE WHITE CRAPPIE



Rough fish do not seem to present a problem and no provision is believed necessary for their control. Crowding of the game fishes is of little or no significance.

A size limit seems unnecessary, since 97.19% of the Kentucky Lake white crappie over 9 inches in length were sexually mature. The prolific nature of this species provides it with adequate protection under almost any circumstances.

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