Age and Growth of Four Centrarchid Species in Southeastern Kansas Streams

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ABSTRACT

Bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), and longear sunfish (*Lepomis megalotis*) were sampled from 14 streams in southeastern Kansas for age determination and growth analysis. Growth rates for all species were highly variable among streams and were consistently lower than rates reported for these species from Missouri and Oklahoma streams. The results of this study provide important information on growth of centrarchids in Kansas streams.

INTRODUCTION

Age and growth analysis is a commonly used tool to assess fish populations. Baseline growth data are needed if biologists are to make comparisons among populations and evaluate management activities. However, little information is available on the age and growth of centrarchids in Kansas streams. Therefore, the purpose of this study was to provide a summary of growth rates for bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), and longear sunfish (*Lepomis megalotis*) in several southeastern Kansas streams. We also wanted to determine how growth rates compared with published information from lotic ecosystems in Missouri and Oklahoma.

MATERIALS AND METHODS

Fish were collected using backpack or boat electrofishing (pulsed-DC) during June-August 1995 and May-August 1996 from fourteen streams in southeastern Kansas. See Tillma et al. (1998) for a detailed description of sampling methods and sample sites. Sampled fish were measured to the nearest mm total length (TL), and scales were collected below the lateral line near the tip of the pectoral fin for age determination and growth analysis (DeVries and Frie 1996). Scale impressions were made on acetate slides and aged using a microfiche projector. Scale annuli were measured using a digitizing pad and DISBCAL (Frie 1982). Back-calculated lengths were estimated using the Fraser-Lee equation assuming a direct proportion between body length and scale radius (Carlander 1982). Standard intercept values were used for bluegill (20 mm), green sunfish (10 mm), and largemouth bass (20 mm), as suggested by Carlander (1982). A standard intercept value has not been proposed for longear sunfish; therefore, the direct proportion method

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was used. Only populations with more than three individuals were used in the analyses. Mean back-calculated lengths at age were weighted by the proportion of fish within each year class.

The Walford plot was used to calculate ultimate length (L_∞) by stream (Everhart and Youngs 1981). Ultimate length is the point where a regression line of length at age t + 1 plotted against length at age t intersects the 45° line from the origin. The slope and intercept of the regression line was used to solve the equation:

$$L_\infty = \frac{\text{(intercept)}}{\text{(1 - slope)}}$$

Furthermore, growth of Kansas fishes was compared with published information from Missouri and Oklahoma streams (Carlander 1977).

RESULTS AND DISCUSSION

Age determination and growth analysis were conducted using 682 fishes (Table 1). Green sunfish dominated the centrarchid samples and composed 41% of the fishes aged. Growth rates for each species was highly variable among streams (Table 1) and likely results from different instream habitat and fish communities.

We sampled 140 bluegills (80 mm to 188 mm TL) for age determination and growth analysis (Table 1). Ultimate length was only estimable for the bluegill population from Otter Creek and equaled 188 mm. Bluegill growth was fastest in Oklahoma followed by Missouri and Kansas (Figure 1).

A total of 280 green sunfish was used in this analysis. Length at capture of green sunfish varied from 76 mm to 200 mm TL. Growth of green sunfish was variable among streams (Table 1). For example, mean back-calculated length at age 2 for green sunfish varied from 45 mm (SE = 4.8) to 78 mm (SE = 5.5) among streams. Ultimate length varied from 130 mm to 257 mm. Mean back-calculated lengths at all ages for green sunfish in Kansas streams were less than Missouri and Oklahoma streams (Figure 1).

One-hundred and twenty-six largemouth bass, varying in length from 54 mm to 502 mm TL were sampled. Similar to the other species used in our analysis, growth varied among streams. Mean back-calculated lengths at age for largemouth bass in Kansas streams were consistently lower than those reported for streams in Missouri and Oklahoma (Figure 1).

Longear sunfish varied from 59 mm to 134 mm TL. Ultimate length was only calculated for Cedar Creek and the Spring River and was greater than the attained length of any sampled fish. Similar to green sunfish and largemouth bass, mean back-calculated lengths were consistently lower in Kansas streams than in Missouri or Oklahoma streams (Figure 1).

Growth for all species was consistently lower in Kansas streams when compared to Missouri and Oklahoma streams. The observed differences may be due to zoogeography. Kansas is on the western edge of the native distribution for many of these species; thus instream conditions may not be as optimal for growth as in other states. Although the results of this study are descriptive, they provide essential baseline information regarding age and growth of centrarchids in Kansas streams.

Table 1. Species, location, sample size (N), mean back-calculated length at age, and ultimate length (L_∞) for 14 southeastern Kansas streams and rivers sampled during 1995 and 1996. Numbers in parenthesis represent one standard error.

			Mean back-calculated length at age					
Species	Location	N	1	2	3	4	5	L_∞
Bluegill	Caney River	14	40 (1.8)	71 (4.7)	102 (1.9)	131 (7.3)	156 (a)	
	Fall River	65	40 (1.4)	62 (1.1)	88 (2.3)	120 (6.1)	154 (a)	
	Fox Creek	16	35 (2.4)	58 (3.6)	79 (3.1)	110 (a)		
	Shoal Creek	8	45 (2.6)	68 (4.5)	86 (4.6)	104 (7.6)	130 (a)	
	S. F.[b] Cottonwood River	4	42 (2.7)	64 (0.4)	96 (a)			
	Spring River	14	32 (0.7)	55 (3.4)	86 (2.0)	105 (5.8)	140 (a)	
	Otter Creek	19	40 (2.3)	64 (5.3)	86 (9.3)	103 (a)		188
	Mean of means	7	39 (1.6)	63 (0.1)	89 (2.9)	112 (4.6)	145 (6.1)	188 (a)
Green sunfish	Caney River	27	33 (2.8)	59 (4.3)	81 (6.4)	105 (11.9)	123 (a)	
	Cedar Creek	30	43 (3.5)	78 (5.5)	100 (7.4)	133 (a)		
	Diamond Creek	4	35 (8.0)	66 (a)				
	Fall River	27	31 (0.9)	56 (0.3)	76 (1.8)	101 (4.7)	130 (a)	
	Fox Creek	29	32 (1.5)	56 (2.0)	85 (3.6)	120 (2.4)	156 (a)	
	Grouse Creek	11	36 (2.1)	64 (4.5)	82 (4.7)	97 (a)		130
	Otter Creek	37	29 (2.4)	51 (4.1)	73 (2.4)	93 (3.4)	109 (a)	257
	Rock Creek	30	47 (1.0)	78 (1.4)	143 (a)			
	S. F.[b] Cottonwood River	18	35 (2.4)	66 (5.6)	87 (4.2)	111 (9.0)	120 (a)	161
	Turkey Creek	34	31 (2.8)	54 (4.8)	76 (7.1)	89 (5.7)	120 (a)	
	Verdigris River	9	39 (3.6)	67 (2.4)	88 (a)			
	Walnut Creek	24	27 (1.8)	45 (3.0)	65 (4.7)	80 (6.1)	90 (a)	
	Mean of means	12	35 (1.7)	62 (2.9)	87 (6.2)	103 (5.4)	121 (7.6)	175 (28.0)
Largemouth bass	Caney River	7	61 (9.9)	130 (12.1)	223 (10.8)	287 (a)		
	Cedar Creek[c]	7	65 (11.2)	130 (26.6)	219 (31.8)	313 (29.9)	373 (33.4)	461
	Fall River	43	64 (6.1)	112 (16.7)	166 (31.6)	280 (12.1)	399 (a)	
	Fox Creek	7	89 (6.3)	195 (a)				
	Otter Creek	28	62 (5.8)	89 (7.2)	137 (6.3)	179 (16.9)	183 (a)	262
	Rock Creek	10	63 (4.2)	113 (a)				
	Shoal Creek[c]	8	80 (11.6)	126 (14.9)	184 (23.0)	253 (23.0)	303 (39.4)	
	S. F.[b] Cottonwood River	8	60 (3.6)	112 (9.9)	178 (8.7)	236 (a)		
	Spring River	4	50 (11.9)	83 (a)	120 (a)	169 (a)		
	Walnut Creek	5	48 (4.5)	70 (5.8)	88 (a)			
	Mean of means[c]	10	64 (3.9)	116 (10.9)	164 (16.7)	285 (20.6)	315 (48.3)	362 (99.5)
Longear sunfish	Cedar Creek	44	26 (5.0)	56 (6.4)	67 (4.2)	87 (3.6)	108 (a)	206
	Diamond Creek	14	25 (5.6)	54 (8.5)	75 (a)			
	Fox Creek	13	20 (3.9)	52 (8.3)	75 (a)			
	Grouse Creek	6	32 (5.7)	52 (11.3)	78 (a)			
	Rock Creek	4	25 (0.6)	62 (2.8)	87 (a)			
	Shoal Creek	10	24 (1.6)	47 (1.3)	67 (1.4)	90 (0.2)	107 (a)	
	S. F.[b] Cottonwood River	16	31 (2.2)	70 (8.8)	75 (a)			
	Spring River	7	22 (4.2)	42 (2.7)	71 (5.0)	85 (a)		174
	Turkey Creek	21	20 (1.2)	41 (3.8)	59 (4.1)	77 (2.3)	96 (a)	
	Mean of means	9	25 (1.4)	53 (3.1)	73 (2.6)	85 (2.8)	104 (3.8)	190 (16.0)

[a] Sample size insufficient to calculate standard error.
[b] S. F. = South Fork.
[c] Mean back-calculated length at age 6 (Cedar Creek, 355 [a] ; Shoal Creek, 392 [a]; Mean of means, 374 [18.5])

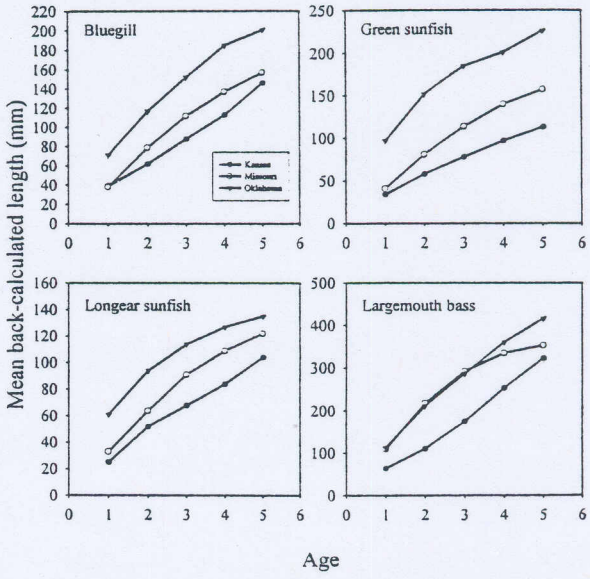

Figure 1. Mean back-calculated lengths at age of bluegill, green sunfish, largemouth bass, and longear sunfish from fourteen southeastern Kansas streams and rivers sampled during 1995 and 1996. Data for streams in Missouri and Oklahoma are from Carlander (1977).

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