LIFE HISTORY STUDIES OF YELLOW BASS IN NORTH TWIN LAKE, IOWA

by

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TABLE OF CONTENTS

INTRODUCTION

The yellow bass, Roccus mississippiensis (Jordan and Eigenmann), was the most abundant game fish in North Twin Lake from 1953 to 1958. Although this fish does not reach much over 12 inches in length it is much sought by anglers of the region. Yellow bass were caught mainly in April, May and June by use of both natural and artificial bait. Minnows were most widely used as bait during the early spring with flies and small plugs used later in the season.

North Twin Lake is approximately 2.5 miles long and 0.25 miles wide. It has a surface area, when full, of 569 acres (Harlan and Speaker, 1956, p. 4). The lake is located 5 miles north of Rockwell City, Iowa, in Calhoun County, Township 89 North, Range 32 West, Sections 27, 28, 32 and 33, and Township 88 North, Range 33 West and Section 1. The State Conservation Commission dredged 135 acres of the southern end of the lake during 1939-40 (Owen, 1958). The greatest depth of the dredged area during 1956-58 was found to be 8 feet. Because of the heavy bloom of algae on the lake almost no emergent vegetation is found except near a tile outlet on the west side of the lake across from the public access near the south end of the lake. Some cattails, Typha spp., and bullrushes, Scirpus spp., were the only emergent vegetation in the area.

Table 1. Field collections at North Twin Lake by the Iowa Cooperative Fishery Research Unit

Year	Dates	Collectors
1951	June 21 to September 10	Leonidas Tebo and John B. Owen
1952	June and July	John B. Owen
1953	July 1 to August 31	Joe Kutkuhn and John B. Owen
1954	June 24 to August 30	Joe Kutkuhn and John B. Owen
1955	June to August	Joe Kutkuhn
1956	August 28 to September 15	Calvin Fremling and Joe E. Collier
1957	June thru August	Joe E. Collier and John Hart
1958	July 14-16	Joe E. Collier
1959	August 4-6	Joe E. Collier
1960[a]	July 5-6	Joe E. Collier
1961[a]	July 7-8	Joe E. Collier

[a]The work during 1960-61 was done with the help of the Algona High School summer biology class (Collier, 1961).

Research was started on the lake by the Iowa Cooperative Fisheries Research Unit in the summer of 1951 (Table 1). The last four summers (1958-61) showed a great decline in the number of yellow bass with no yellow bass taken in the research work in 1959, 1960 and 1961.

This study was undertaken to determine some aspects of the life history of yellow bass in North Twin Lake and to determine how these have changed over the years. The aspects which were studied were age and growth, abundance of year classes, condition or relative plumpness, and food habits of the yellow bass.

MATERIALS AND METHODS

Collection of Specimens

Specimens were collected in two ways. Shore-line seining was done using a 30-foot bag seine, mostly to obtain young-of-the-year fish. A few adults were also captured by this method. The second method was by use of the nylon experimental gill net. This net is made up of five 25-foot sections with stretch measure mesh sizes of 1 1/2, 2, 2 1/2, 3 and 4 inches. The average catches per gill-net hour for the years 1953-58 (Table 2) show a decline in yellow perch, gizzard shad, walleye and yellow bass populations; an increase in carp; and a fairly steady population of bullheads. There was a fairly extensive winter kill in 1955-56.

The gill nets were set at various positions in the lake and usually left for 48 hours. The nets were lifted every 2 hours during that time and all fish were removed and examined. Total lengths, weights and scale samples were taken on all fish. Some of the fish were kept for stomach sample analyses. All of the remaining fish were released. Twenty-two of the 1957 catch were taken by the State Conservation Commission Lake Survey Crew by bag seine.

Table 2. Catches per gill net hour--North Twin Lake, Iowa, 1953-58[a]

Type of fish	1953	1954	1955	1956	1957	1958
Carp, *Cyprinus carpio*	.1	.2	.1	*	1.4	1.1
Buffalo, *Ictiobus* spp.	*	*	*	.1	*	*
Common white sucker, *Castostomus commersoni*	*	*	*	*	*	0
Gizzard shad, *Dorosoma cepediaum*	.4	4.6	3.5	.2	*	0
Black crappie, *Pomoxis nigromaculatus*	*	*	*	.1	*	0
Bullheads, *Ictalurus* spp.	2.0	1.8	1.2	1.5	1.6	1.4
Yellow perch, *Perca flavescens*	3.0	.6	*	.1	.1	0
Walleye, *Stizostedion vitreum*	.5	1.3	1.2	.4	.7	*
Northern pike, *Esox lucus*	*	*	*	*	*	*
Yellow bass, *Roccus mississippiensis*	3.1	4.1	2.7	.6	2.2	1.7
Total	9.2	13.0	9.3	3.2	6.1	3.4
Total gill net hours	196	128	114	264	265	36

[a]Modified from Collier, 1959.

*Less than one fish per 10 gill net hours.

Individual Records

Records were kept on each yellow bass taken. The date, hour, net location, total length and weight of the fish were recorded on each scale envelope and a sample of the fish scales was taken above the lateral line and anterior to the dorsal fin. Stomach contents were taken of some fish and these contents placed in a 10 per cent formalin solution for later study.

Determinations of Age and Growth

Scales were taken from a total of 2,591 yellow bass during the 1950-58 study of North Twin Lake, Iowa (Table 3). There were 905 bass used for aging from this group (Table 4). The scale envelopes were selected at random from each year of collection to represent some of the fish in most of the size groups. Since only 60 fish were taken in 1958, all of these fish were aged.

Scale impressions were made of 4 or 5 scales from a fish on an acetate strip with a roller press similar to that described by Smith (1954). The impressions were examined with a scale projector at 49 magnifications. Strips of paper were placed on the ground glass projector plate along the center part of the scale. A mark was made on the paper at

Table 3. Yellow bass collected from North Twin Lake, Iowa, by size groups

Total length in inches	1950	1951	1952	1953	1954	1955	1956	1957	1958	
1.0 - 1.9						1				
2.0 - 2.9	2					3	1			
3.0 - 3.9					34	12				
4.0 - 4.9		51			164	42	12			
5.0 - 5.9	1	8		14	31	36	2	11	1	
6.0 - 6.9		1	8	6	4	143	11	161	1	
7.0 - 7.9	3		27	38	19	3	4	143	25	
8.0 - 8.9			3	440	200	28	22	7	23	
9.0 - 9.9				97	172	129	33	80		
10.0 - 10.9				15	16	33	77	130	5	
11.0 - 11.9						1	21	27	5	
12.0 - 12.9								4		
Total	6	60	38	610	640	431	183	563	60	2591

Table 4. Number of yellow bass aged each year by size group, North Twin Lake, Iowa

Total length in inches	1950	1951	1952	1953	1954	1955	1956	1957	1958	
1.0 - 1.9										
2.0 - 2.9	2									
3.0 - 3.9					5					
4.0 - 4.9		1			4		12			
5.0 - 5.9		1		13	2	17		2	1	
6.0 - 6.9			2	6	1	44		36	1	
7.0 - 7.9			2	35	4	1	1	22	25	
8.0 - 8.9				139	42	2	21	2	23	
9.0 - 9.9				85	15	22	20	50		
10.0 - 10.9				15	2	11	61	104	5	
11.0 - 11.9						1	14	25	5	
12.0 - 12.9								3		
Total	2	2	4	293	73	98	129	244	60	905

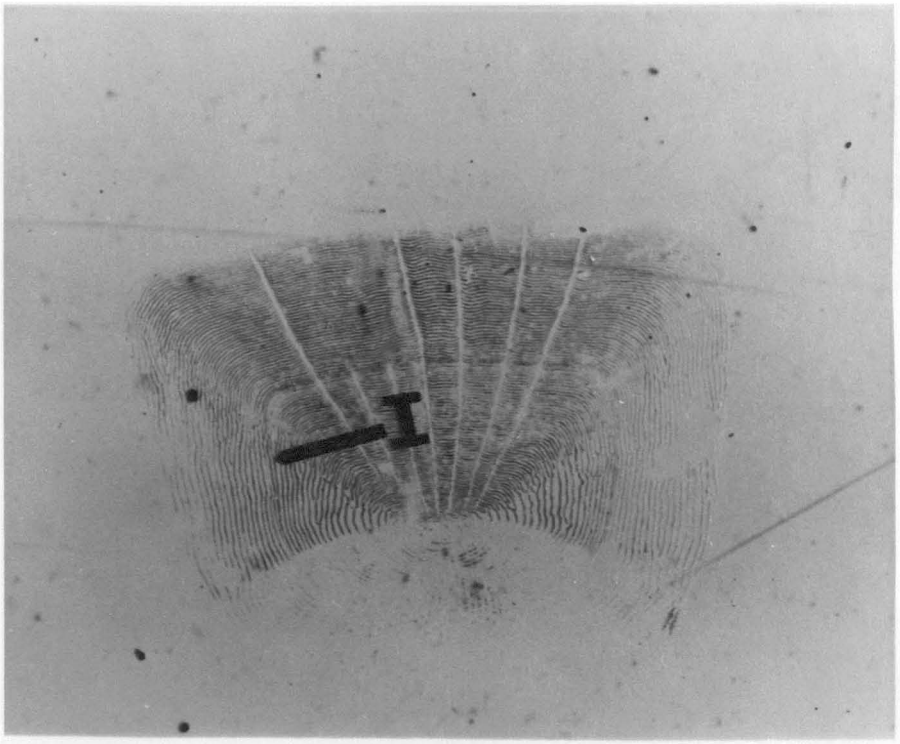
the center part of the scale and other marks made at each annulus of the scale. A final mark was made at the outer edge of the scale.

The annuli of the yellow bass are usually very clear, especially in the lateral fields, because of the anastomosing of the circuli at this point. The circuli are very distinct and evenly spaced except where an annulus is indicated by their being crowded together along the anterior field and anastomosing on the lateral fields (Figure 1). What was interpreted as false annuli appear in some scales but they were distinguished from true annuli by lack of anastomosis of the circuli in the lateral fields (Figure 2). Near the center of many of the yellow bass scales it was noticed that the annuli seem to be close together. It is possible that this is due to a change in the feeding habits of the fish during the first year of life. On the scale in Figure 3 the growth was slight the first year, much better the second year and slight again during the third year. The fish was taken on July 28, 1954, and the scale growth beyond the third annulus represents its fourth summer. Figures 1 and 2 show good growth during the first and second years.

There appeared to be no evidence of missing annuli or resorption of scale material as was reported in Clear Lake (Buchholz, 1960). A comparison of scales indicated that annuli were much easier to identify on the relatively fast

Figure 1. Photograph of scale impression of a North Twin Lake yellow bass collected July 30, 1957. The specimen measured 5.7 inches (total length). Point "I" indicates the first annulus.

Figure 2. Photograph of scale impression of a North Twin Lake yellow bass collected July 12, 1951. The specimen measured 5.1 inches (total length). Point "A" indicates possible change in feeding habits. Point "I" indicates first annulus and point "F" indicates a false annulus.


I

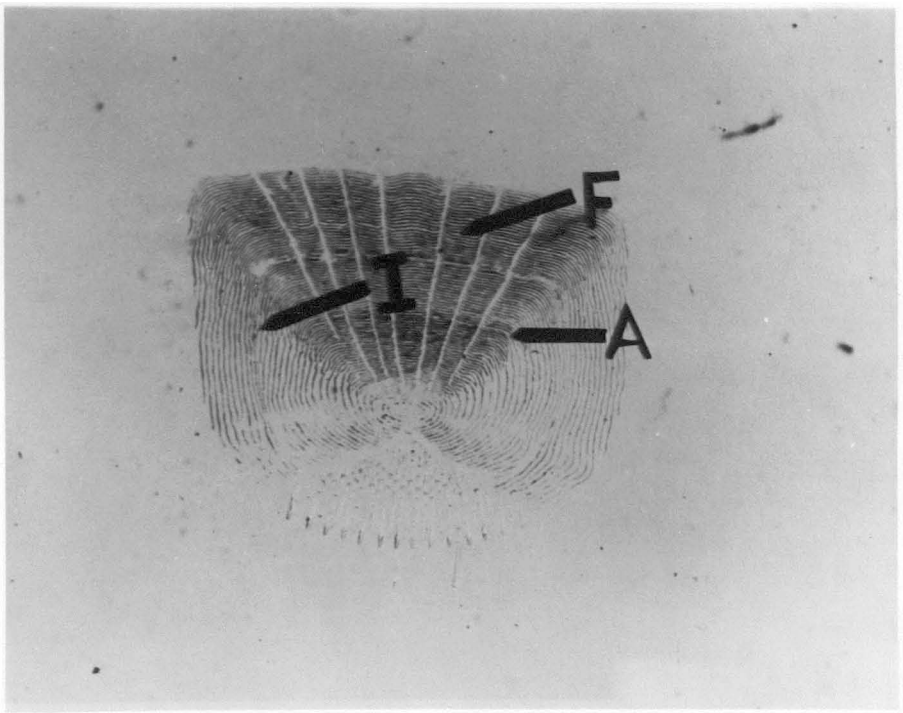
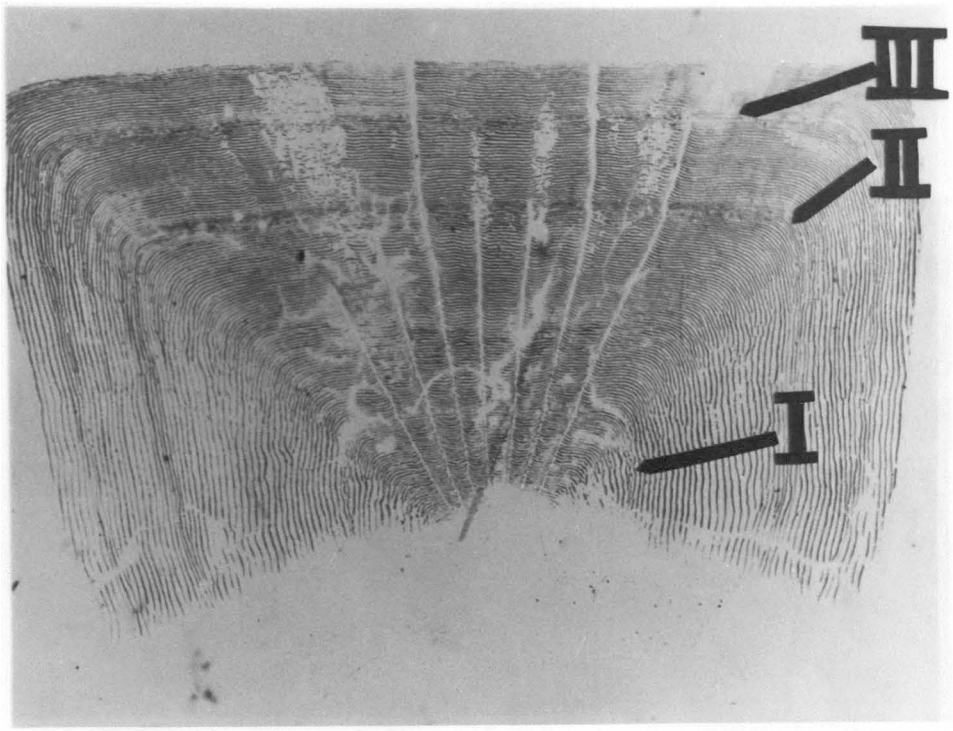

F
I
A

Figure 3. Photograph of a scale impression of a North Twin Lake yellow bass collected July 28, 1954. The specimen measured 8.9 inches (total length). Points "I", "II" and "III" indicate the first, second and third annulus respectively.

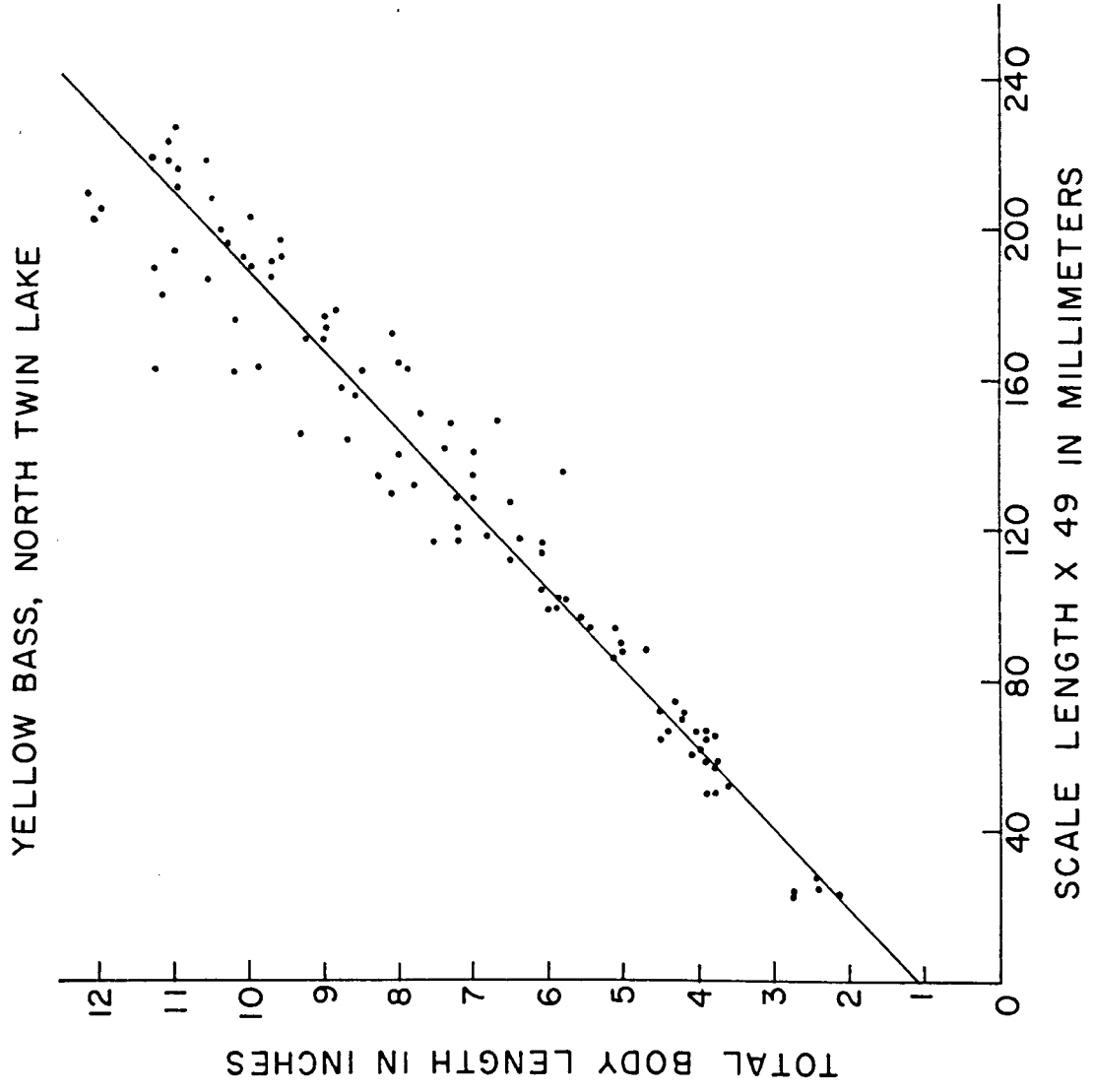

III
II
I

growing North Twin yellow bass than the Clear Lake yellow bass.

Body-Scale Relationship

The lengths of the yellow bass at previous years were computed from the scale measurements assuming proportional growth of the length of the fish and its scales. It was necessary, however, to make a correction for the fact that scales are not formed until sometime after the fish hatches. This correction factor was determined by fitting the regression of the body length on the scale measurements. One hundred pairs of data were collected from fish of all size groups and almost all years of collection. Data were not used from more than 10 fish in any 1-inch interval of length. These fish were selected at random from the total population of fish collected during the entire study. The straight line regression equation gave an intercept of 1.03 inches and a slope of 0.0479 (Figure 4). A nomograph, as described by Carlander and Smith (1944), was used for back calculations of growth with 1.0 inch as the intercept.

Figure 4. Body-scale relationship of 100 yellow bass from North Twin Lake, Iowa, 1950-58.


YELLOW BASS, NORTH TWIN LAKE
TOTAL BODY LENGTH IN INCHES
SCALE LENGTH X 49 IN MILLIMETERS
0
40
80
120
160
200
240
1
2
3
4
5
6
7
8
9
10
11
12

AGE AND GROWTH

The oldest yellow bass examined were age group VI (Table 5). The yellow bass is apparently a relatively short lived fish for in most of the lakes studied age V bass are the oldest reported (Ricker and Lagler, 1942; Bennett, 1945; Stroud, 1947; and Schoffman, 1958). Carlander and others (1953), however, found some age VII yellow bass and Buchholz (1960) found some age VIII bass in Clear Lake, Iowa, although those scales examined by Buchholz showed only five annuli.

The growth data computed for fish of the same year class but in different years do not show Lee's phenomenon of apparent change of growth as reported in some studies (see Van Oosten, 1928, and Hile, 1936, for reviews). There is thus no evidence that faster growing individuals are shorter lived than the slow growing ones. Furthermore, there appears to be no consistent bias in the growth calculations.

The yellow bass were from 3.8 to 6.7 inches when taken in the second summer, (Age I) except for the 1956 and 1957 year classes which were 5.7 to 8.5 inches long. In the third summer, they were from 5.5 to 8.5 inches long when taken. They were from 7.1 to 9.7 inches when taken in the fourth summer except for the 1954 year class that was from 8.7 to 10.5 inches long. During the fifth summer they were from 9.0 to 11.1 inches long and in the sixth summer from 9.9 to

11.8 inches in length. The seventh summer of life was represented by 5 fish of the 1951 year class and 3 fish of the 1952 year class with lengths from 10.8 to 12.2 inches.

The average growth of the various year classes (Table 5) does not show much difference except for a slowing of growth for the first two years of the 1953 and 1954 year classes and for rapid growth of the 1956 and 1957 year classes, after the winter kill.

The average annual increments (Table 6) show the increased growth in 1956 and 1957, all age groups showing greater growth in these years than in the years before the winter kill.

Growth of the North Twin Lake yellow bass was quite rapid compared to those taken from the Tennessee Valley Authority waters as reported by Stroud (1947) and those taken from Clear Lake, Iowa, as reported by Carlander and others (1953) and Buchholz (1960). The yellow bass of Reelfoot Lake, Tennessee, of 1939 showed faster growth and those of 1955 and 1957 slower growth than the bass of North Twin Lake (Schoffman, 1956, 1958).

Table 5. Means and ranges of total length in inches at each annulus of North Twin Lake yellow bass in the 1948-57 year classes, by year of collection

Year	Number of fish	Calculated total lengths at each annulus						Total length at capture
		1	2	3	4	5	6	
				1948 year class				
1953	2	3.6= 9.15 cm	6.2=15.75	7.3=18.55	8.8=22.38	9.5=24.14		10.2
		3.5 - 3.6	6.1 - 6.3	7.0 - 7.6	8.8 - 8.8	9.5 - 9.5		10.0 -10.3
				1949 year class				
1953	57	3.7 = 9.4	5.8=14.72	8.3 21.1	9.1=23.13			9.7
		3.1 - 4.1	5.3 - 7.0	7.6 - 9.0	8.4 - 9.7			9.0 -10.4
				1950 year class				
1951	3	3.3						4.8
		3.0 - 3.6						4.4 - 5.1
1952	4	3.0	6.0					6.9
		2.7 - 3.3	5.7 - 6.4					6.4 - 7.3
1953	227	3.1	6.0	7.7				8.5
		2.4 - 4.8	4.9 - 6.9	7.1 - 8.6				7.1 - 9.5
1954	2	3.8	5.8	8.6	9.5			10.2
		3.7 - 3.8	5.8 - 5.9	8.6 - 8.7	9.3 - 9.7			10.1 -10.3
1955	3	3.7	7.0	8.8	9.6	10.4		10.8
		3.2 - 4.3	6.4 - 7.3	8.3 - 9.1	9.4 - 9.8	10.2 -10.6		10.6 -11.0
	239	3.1=7.88	6.0=15.24	7.7=19.57	9.6=24.4	10.4=26.41		
				1951 year class				
1954	58	3.0	6.0	7.7				8.8
		2.5 - 4.5	5.1 - 6.9	7.2 - 8.4				7.9 - 9.7
1955	30	3.1	6.2	7.9	9.0			9.8
		2.8 - 3.4	5.5 - 6.7	7.3 - 8.3	8.3 - 9.4			9.1 -10.2
1956	33	3.1	6.2	8.0	9.3	10.2		10.9
		2.7 - 3.7	5.8 - 7.8	7.6 - 8.8	8.6 -10.2	9.5 -10.7		10.3 -11.8
1957	5	2.9	5.3	7.5	9.1	10.2	11.2	11.9
		2.5 - 3.3	4.0 - 6.3	5.7 - 8.2	8.0 - 9.9	9.2 -10.6	10.5 -11.5	11.5 -12.2
	126	3.0=7.62	6.1=15.50	7.8=19.82	9.1=23.13	10.2=25.90	11.2 28.45	

Table 5. (Continued)

Year	Number of fish	Calculated total lengths at each annulus						Total length at capture
		1	2	3	4	5	6	
				1952 year class				
1953	20	3.8						5.8
		3.4 - 4.1						5.3 - 6.7
1954	4	3.7	6.0					7.2
		2.8 - 4.2	5.0 - 6.6					6.8 - 7.2
1955	4	3.9	6.6	8.1				8.9
		3.8 - 4.0	6.3 - 6.9	7.7 - 8.5				8.4 - 9.2
1956	50	3.3	6.2	7.9	9.0			10.2
		2.6 - 4.4	5.7 - 7.0	7.2 - 8.6	8.5 - 9.5			9.5 -10.6
1957	78	3.1	5.6	7.6	8.8	9.9		10.4
		2.6 - 3.9	3.7 - 6.7	5.6 - 8.8	7.7 - 9.7	8.8 -11.0		9.9 -11.6
1958	3	3.6	5.6	7.8	9.0	9.9	10.5	10.9
		3.4 - 3.8	5.4 - 6.0	7.6 - 8.0	8.7 - 9.3	9.7 -10.2	10.3 -10.8	10.8 -11.0
	159	3.3=8.38	5.9=15.0	7.7=19.57	8.9=22.61	9.9=25.16	10.5=26.6	
				1953 year class				
1954	11	2.7						4.2
		2.5 - 3.1						3.8 - 5.1
1955	63	2.7	4.4					6.1
		2.4 - 3.1	3.7 - 5.1					5.5 - 7.0
1956	29	3.1	4.7	6.6				8.8
		3.0 - 3.5	3.9 - 5.6	5.5 - 7.7				8.5 - 9.3
1957	79	2.9	5.2	7.3	9.3			10.2
		2.5 - 3.3	3.7 - 6.5	5.6 - 8.4	8.2 - 9.9			9.0 -11.1
1958	4	3.4	6.5	8.4	9.4	10.5		11.2
		3.0 - 3.8	6.2 - 6.7	7.9 - 8.7	9.0 - 9.8	10.0 -10.8		10.8 -11.4
	186	2.9=7.37	4.9=12.45	7.2=18.3	9.3=23.62	10.5=26.6		

Table 5. (Continued)

Year	Number of fish	Calculated total lengths at each annulus 1	2	3	4	5	6	Total length at capture
				1954 year class				
1955	13	2.3						4.0
		2.0 - 2.5						3.6 - 4.5
1956	5	2.7	4.6					8.1
		2.4 - 3.0	4.0 - 5.3					7.8 - 8.4
1957	23	3.0	4.9	8.0				9.4
		2.5 - 3.4	3.9 - 6.4	6.0 - 9.0				8.7 -10.5
1958	2	2.8	5.3	7.4	9.5			10.7
		2.6 - 2.9	5.1 - 5.4	7.0 - 7.7	9.4 - 9.5			10.5 -10.8
	43	2.7 = 6.86 cm	4.9 = 12.45	8.0 = 20.32	9.5 = 24.14			
				1955 year class				
		No adult fish of this year class were found during the study						
				1956 year class				
1957	75	4.2						6.7
		3.3 - 5.5						5.7 - 7.5
1958	9	3.9	6.9					7.8
		3.0 - 4.3	6.1 - 7.1					7.3 - 8.5
	84	4.2 = 10.6	6.9 = 17.53					
				1957 year class				
1958	41	4.4 = 11.18						7.9
		4.1 - 5.0						5.9 - 8.5

Table 6. Average annual increments in inches total length of North Twin Lake yellow bass in 1948-57 year classes in each calendar year

	Year Class									
Annulus	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
6									1.0=2.54	0.6=1.52
5					0.7=1.78	-	0.8=2.03	0.9=2.29	1.1=2.78	1.1=2.78 cm
4				1.5=3.8	0.8=2.03	0.8=2.03	1.3=3.29	1.2=3.04	2.0=5.08	2.1=5.32
3			1.1=2.78	2.5=6.33	1.7=4.31	1.7=4.31	1.9=4.82	2.0=5.08	3.1=7.85	-
2		2.6=6.58	2.1=5.32	2.9=7.35	3.1=7.85	2.6=6.58	2.0=5.08	1.9=4.82	-	3.0=7.62
1	3.6=9.12	3.7=9.37	3.1=7.85	3.0=7.62	3.2=8.1	2.9=7.35	2.7=6.86	-	4.2=10.67	4.4=11.17

ABUNDANCE OF YEAR CLASSES

Critical analysis of the relative abundance of the yellow bass in various year classes will take a more detailed analysis of the sampling because of the differences in effort each year and of the subsampling which was done. It is obvious, however, that the 1950 and 1953 year classes were much more abundant than any of the others. No fish of the 1955 year class were found after 1955 probably as the result of the 1955-56 winter kill. That some yellow bass of the older year classes survived is evident however. After the 1955-56 winter kill there was successful reproduction in 1956 and 1957 which is difficult to evaluate (Table 5).

During the summer of 1955 relatively large numbers of large yellow bass were found dead along the shoreline. These fish were of the V and VI age groups and many of them may have reached the end of their normal life span (Kutkuhn, 1955a). Seining results revealed that a reasonably good hatch of yellow bass occurred during the spring of 1955 in North Twin Lake.

A one-day trip to the lake on March 27, 1955, (by Kutkuhn) showed the water level of the lake to be quite low due to drought conditions of the area. Tests showed that the dissolved oxygen supply was low. Large numbers of large gizzard shad and 2- to 5-year-old yellow bass were found dead

along the shoreline (Kutkuhn, 1956). The following summer's work showed no yellow bass of the 1955 year class and greatly reduced numbers of all fish, except bullheads, taken per gill net hour (Table 2).

CONDITION FACTORS

The condition factor, C, is used as an indication of the plumpness of the fish, where $C = (W\ 10^5) / L^3$, where W = weight in pounds and L = total length in inches.

During this study, no attempt was made to study the condition of the sexes separately since sex data were available for only a few of the fish. Since almost all research was conducted during the months of June to September no study was made of seasonal variation in condition factor.

The bass caught in 1953 and 1955 showed an increase of the condition factor as the size of the fish increased (Table 7). This seems to show that there was more competition for food among the smaller size fish and less competition among the larger fish. The bass caught in 1957 showed a decrease in the condition factor as the size of the fish increased. This may indicate a greater competition among the larger fish. The fish caught during the other years of study showed no marked difference in the condition factor as the fish increased in size.

The mean condition factors for the years 1953-58 are shown in Figure 5. Since only 2 fish were studied in 1951 and 4 fish in 1952, these years were not included. The 1953-55 catches show a low condition factor as compared to the 1956 catch. This was probably due to the heavy winter kill

during the winter of 1955. More food should have been available to the fish remaining in the lake. No reason was found for the decrease in the mean condition factors for the years of 1957 and 1958 but competition may have been more than in the first year after the winter kill.

Since these data included fish of all sizes they may not be directly comparable from year to year. Mean condition factors for the 7 and 8 inch fish were plotted as a broken line on Figure 5. These factors agreed with or were just slightly higher than the total mean condition factors for the years 1953-58, and indicate that the noted change in condition were not due to differences in length.

Table 7. Condition factors for yellow bass of North Twin Lake, Iowa, 1953-58 by one inch intervals

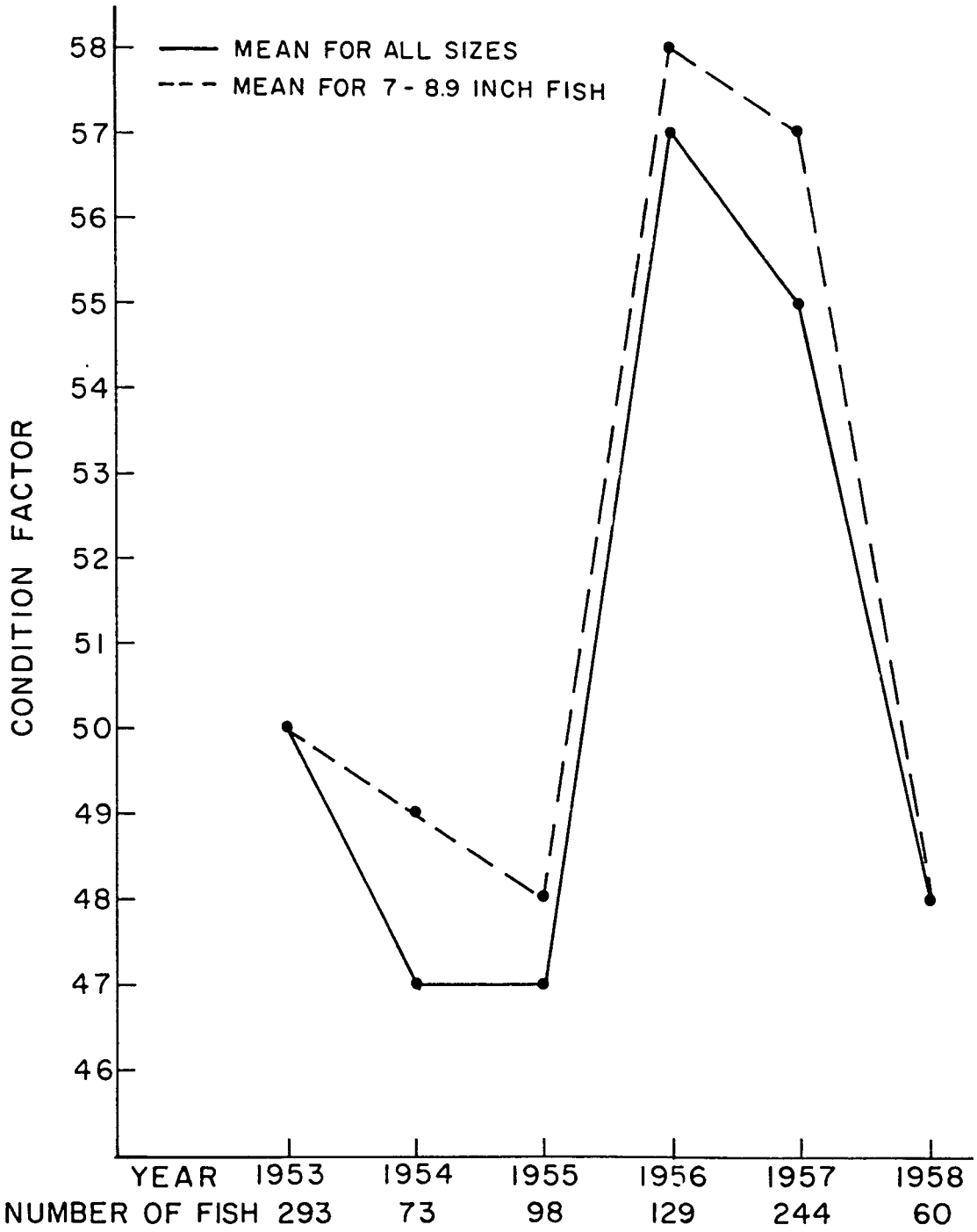
Year	Mean total length in inches	Mean weight in pounds	Mean C	Number of specimens
1953	5.6	.08	45	13
	6.3	.12	47	6
	7.8	.23	48	35
	8.4	.30	50	139
	9.4	.41	50	85
	10.2	.60	52	15
			50	
1954	3.8	.02	41	5
	4.3	.03	40	4
	5.1	.05	39	2
	6.8	.15	50	1
	7.5	.20	48	4
	8.7	.32	49	40
	9.2	.36	48	15
	10.2	.50	47	2
			47	
1955	5.7	.09	47	17
	6.3	.11	45	44
	7.0	.15	44	1
	8.7	.33	50	2
	9.6	.45	51	22
	10.2	.54	50	11
	11.0	.72	54	1
			47	

Table 7. (Continued)

Year	Mean total length in inches	Mean weight in pounds	Mean C	Number of specimens
1956	4.4	.06	62	12
	7.8	.26	55	1
	8.6	.37	58	21
	9.5	.47	55	20
	10.4	.63	56	61
	11.3	.80	55	14
			57	
1957	5.8	.12	59	2
	6.4	.15	56	36
	7.2	.22	57	22
	8.7	.38	57	2
	9.6	.50	56	50
	10.4	.62	55	104
	11.2	.77	54	25
	12.1	1.24	53	3
			55	
1958	5.9	.10	48	1
	6.0	.09	42	1
	7.7	.22	48	25
	8.2	.27	49	23
	10.6	.55	46	5
	11.2	.60	43	5
			48	

Figure 5. Mean condition factors of yellow bass, North Twin Lake, 1953-58.

YELLOW BASS, NORTH TWIN LAKE



FOOD OF THE YELLOW BASS

The principal foods of the yellow bass have been found to be crustaceans, insects and their larvae and small fish (Harlan and Speaker, 1956). It was found that the food habits of the yellow bass of North Twin Lake changed during the study.

During 1953-54 young-of-the-year bass fed largely on microcrustacea and insects. The bass started to feed on forage fish as yearlings of 5.0-5.9 inches. The adult yellow bass depended mostly on forage fish but continued to eat insects at times (Kutkuhn, 1955b). Young yellow bass were the principal forage in 1953 and young gizzard shad in 1954.

During the summers of 1956-57 the stomachs of 120 yellow bass were collected for study (Collier, 1959). These fish fed mainly upon immature insects and microcrustacea as young-of-the-year, yearlings and as adults. Only 5 of the stomachs taken contained fish remains of undetermined types.

SUMMARY

1. The yellow bass was the most abundant game fish in North Twin Lake from 1953 to 1958.

2. Data for the study were collected during the summers of 1951 to 1961, but no yellow bass were collected after 1958.

3. Yellow bass were collected by experimental gill nets and bag seines.

4. The body-scale relationship was computed as a straight line with an intercept of 1.03 inches and a slope of 0.0479.

5. There was no evidence that faster growing individuals are shorter lived than the slow growing ones.

6. The 1956 and 1957 year classes showed faster growth when taken in the second summer than other year classes. This was probably due to the lack of competition for food after the 1955-56 winter kill.

7. The growth of yellow bass in North Twin Lake was good when compared to that in other lakes containing this fish.

8. The 1955 year class was completely lacking after the summer of 1955. This was due, no doubt, to the 1955-56 winter kill.

9. The 1953-55 catches showed a low condition factor

as compared to the 1956 catch. The improved condition was probably related to the lowered population density.

10. The analysis of stomach contents showed that the food habits of the yellow bass of North Twin Lake changed during the period of study. Kutkuhn reported that adult bass depended mostly on forage fish, but in 1956-57 only 5 stomachs taken contained fish remains.

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