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OBSERVATIONS ON THE AGE AND GROWTH OF THE NORTHERN PIKE, *ESOX LUCIUS* L., IN EAST HARBOR, OHIO

CLARENCE F. CLARK AND FRANK STEINBACH

Ohio Division of Wildlife, Columbus, Ohio and 2004 Sunrise Ave., Portsmouth, Ohio

INTRODUCTION

The recent interest in the northern pike, found along the Ohio shores of Lake Erie, has prompted a series of studies designed to obtain information on the best possible management and utilization of this species.

East Harbor is a sand-spit pond separated from Lake Erie by a large sand bar. A channel permits Lake Erie water conditions and fish populations to influence those of the harbor. East Harbor has a surface area of about 850 acres, of which the larger portion, under normal water conditions, is less than 8 ft in depth. The area contains an abundance of underwater vegetation, chiefly *Myriophyllum* spp., marshes of cattail, *Typha* spp., along the west and south shores, and an abundance of marginal vegetation which is inundated intermittently in accordance with the storms or strong winds on Lake Erie. A small ditch which drains a limited area of orchard is the only tributary stream; and its level is controlled by that of the harbor and the lake. The bottom in both the harbor and the stream is chiefly soft organic debris and silt.

MATERIALS AND METHODS

This study is based on scale samples taken from 688 pike during the month of March, in the years 1951 through 1953, as a part of a tagging program to provide information on the movements of these fish. The fish were taken in 6 ft modified fyke nets which are used as standard test net equipment in Ohio's fisheries operations. These nets are composed of 2 in. square mesh in the leads, 1 and $\frac{1}{2}$ in. in the hearts, and 1 in. in the cars.

Total length measurements are used in Ohio and measurements to the nearest one-half in. were recorded. Calculations were made to the nearest tenth-inch in calculating the lengths at each annulus.

Since the pike were taken in March, an annulus was assumed on the farthest edge of the scales. In a few instances, an annulus was present on the edge of scales of pike which were completing their first year of growth; but none were found on the scales of the older fish.

RESULTS AND DISCUSSION

Age

The histogram (fig. 1) portrays the percentage distribution of the 688 northern pike arranged according to the age groups. The range in the 1951 sample indicates a well distributed group of age classes in which the four year old fish represented 25 percent of the total sample. The 1952 catch reveals a large number of two year olds (21%) entering the population, and a reduction in the older four to six year age classes found in 1951. The 1953 sample further illustrates the

continued reduction of the older groups, found in 1951, and their replacement with younger ones, chiefly the three year olds.

The maximum ages of pike from East Harbor were 10 years for 4 females and 8 years for 4 males. Maximum ages of 15 years in Lake Waskesiu, Saskatchewan, was reported by Rawson (1932).

Growth

The growth rates of the individuals varied greatly (fig. 2). Calculated lengths at the formation of the first annulus ranged from 2.9 to 19 in. This age group averaged 15.8 in. at the time of capture as compared to the average calculated total length of 11.4 at the formation of the first annulus (table 1). These data and the data presented in figure 2 indicate that the information on the younger age groups may be a selected set of data resulting from the sizes of the net mesh. No pike under 12.5 in. were retained in the nets. Carlander (1953) lists a range from 4.1 to 21.1 in. in length for northern pike in age group one. Northern pike reared in the St. Marys Fish Farm, Ohio, have ranged from 3 to 23 in. in length at 5 months of age. Actual total lengths tend to vary when good or poor growth occurs in certain years, whereas it is our opinion that calculations tend to absorb or smooth out such deviations from the averages.

Since all scale samples were collected in March, the date of annulus formation was not ascertained. However, these samples were collected prior to the time that the annulus formation is suspected to occur. Thus, the total lengths exceeded considerably the calculated average lengths of the fish at the formation of the annuli. For example, those fish whose scales contained two annuli averaged 20.1 in. at the time of capture; but the calculated length at the formation of the second annulus was 17.2 in. If the annulus formation takes place shortly after the season during which these pike were taken, as was taken for granted in assuming an annulus on the edges of the scales, these fish were almost three years of age. Thus, their average total lengths at capture should closely approximate the average calculated lengths of pike at the formation of the third annulus. The 20.1 in. in length at capture compares favorably with the 21.2 in. average calculated length at the formation of the third annulus. This average length at capture is 94 percent of the calculated length at the formation of the next annulus. In all age groups but the first, the average total lengths at the time of capture represented from 92 to 98 percent of the total calculated length at the formation of the next annulus.

According to the data presented in table 1 and figure 3, the greatest growth of both sexes was made in the first year of life. The calculated length of the males slightly exceeded that of the females at the formation of the first annulus (table 1). The lack of an equal number of both sexes may account for this difference. The average calculated annual increment of males was about 106 percent that of the females during the first year of life, 94 percent the second, 70 percent the third, 71 percent the fourth, 63 percent the fifth, 73 percent the sixth, 66 percent the seventh, and 88 percent the eighth. Carbine (1942) and Solman (1945) reported that female pike grow more rapidly than males.

EXPLANATION OF FIGURES

FIGURE 1 (top, left). Age group distribution of the East Harbor northern pike taken in the years 1951, 1952 and 1953.

FIGURE 2 (top, right). Average maximum, average and minimum total lengths of East Harbor northern pike at the end of each year of life.

FIGURE 3 (bottom, left). Rate of growth and increment of East Harbor northern pike at the end of each year of growth.

FIGURE 4 (bottom, right). Growth histories of male and female northern pike from East Harbor. The lines connect points representing average lengths attained in ages indicated by the Roman numerals.

TABLE 1

Average calculated total length, in inches, attained by East Harbor northern pike, of age groups 1 through 10, at the end of each year of life

Age group	Number of specimens	Sex	Year of life										
			1	2	3	4	5	6	7	8	9	10	
10	4	Female	9.5	15.9	21.1	25.7	27.4	29.2	30.4	31.5	32.1	32.8	
9	8	"	8.8	16.7	21.7	24.8	26.8	28.5	29.4	30.1	30.7		
8	19	"	10.0	16.8	22.6	25.6	27.9	29.1	30.0	30.7			
	4	Male	10.4	16.1	21.8	24.1	25.3	26.1	26.8	27.5			
7	33	Female	10.2	17.9	23.1	26.0	27.8	28.9	29.7				
	18	Male	10.5	16.5	20.8	22.7	23.7	24.4	25.0				
6	45	Female	11.1	18.3	22.3	24.7	26.3	27.1					
	23	Male	10.4	17.5	20.7	22.3	23.5	24.3					
5	42	Female	10.8	18.5	22.1	24.3	25.6						
	32	Male	10.6	16.8	19.8	21.5	22.4						
4	64	Female	10.9	17.1	21.2	23.1							
	32	Male	10.9	17.0	19.8	21.3							
3	115	Female	11.7	16.7	21.6								
	74	Male	11.8	16.5	19.3								
2	64	Female	12.6	21.3									
	54	Male	11.7	18.7									
1	5	Female	16.4										
	52	Male	15.7										
Average calculated length			Female	11.3	18.0	21.8	24.4	26.7	27.4	29.8	30.4	31.2	32.8
			Male	12.0	17.2	19.8	21.8	23.2	24.1	25.3	27.5		
			Combined	11.4	17.6	21.2	23.6	25.5	26.4	28.6	30.1	31.2	32.8
Average annual increment			Female	11.3	6.4	4.5	2.4	1.6	1.1	.9	.8	.6	.7
			Male	12.0	6.0	3.1	1.7	1.0	.8	.6	.7	.6	.7
			Combined	11.6	6.3	4.0	2.1	1.4	1.0	.8	.7	.6	.7

TABLE 2

Average annual growth increment, in inches, of East Harbor northern pike by calendar years, 1941 through 1952

Year of life	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
8										.7		.4
7									.9	.6	.6	.5
6		Male northern pike						.7	.8	.9	.7	.5
5						1.5	2.0	1.8	2.1	1.4	1.5	1.7
4						6.5	5.9	3.8	3.0	2.3	2.0	3.0
3			4.6	7.0	7.1	6.5	7.5	7.0	5.1	4.9	6.0	
2			11.0	8.0	9.7	10.7	10.7	11.5	11.5	11.9	13.7	15.9
1												
Number of specimens			2	6	20	34	30	22	27	80	44	24
10										.6	.8	
9									.6	.6	.5	.4
8		Female northern pike						1.2	.7	.6	.4	.8
7							1.3	1.1	.7	1.0	.7	.7
6						1.8	1.6	1.2	.9	1.9	.6	.5
5					1.8	2.4	1.5	1.7	1.4	1.1	1.7	.8
4				3.9	3.8	3.0	3.4	2.6	2.8	2.3	2.3	1.8
3			5.3	5.5	6.2	5.3	4.2	3.4	4.2	5.9	4.1	5.1
2		6.3	7.9	5.8	7.5	8.4	7.2	7.4	7.9	6.0	5.9	8.4
1	9.9	7.8	9.4	9.9	10.7	10.8	11.0	10.7	11.1	11.2	12.9	16.4
Number of specimens	3	4	12	27	33	49	31	21	61	113	41	4

Annual growth increments of male and female northern pike of the various year classes (table 2 and fig. 4) illustrate that the annual growth of fishes of the same age varies from year to year, and for different age groups in the same calendar year. To illustrate this point, a comparison of the increments of the hatch of 1949 and 1950 can be made with that of the other year groups in table 2. The 1949 and 1950 hatches, in their first years of growth, closely approximate the average calculated increments listed in table 1 for both sexes. Yet, both sexes reveal increments which would indicate poor growth in their second year of life. If pike depend chiefly upon sight for feeding, the high and turbid waters in the early summers of 1950 and 1951 may have seriously affected the feeding and growth of the second year fish. Yet, these factors may have had little detrimental effect, and possibly a beneficial one, on the hatch of the year in the flooded and clearer backwaters of the marshes. As reported by Carbine (1945), slow growth in one year does not destroy the growth potential for other years. A seven year old male was calculated to have grown only 2.9 in. in its first year. However, it measured 27 in., or 1.7 in. over the average for others of its age when captured. This was one of the largest males taken during the study.

TABLE 3

Average total lengths at successive annuli of East Harbor, Ohio northern pike compared to that reported from other waters

Location of water area	Number of specimens	Annuli									
		1	2	3	4	5	6	7	8	9	10
Minnesota waters*	2,621	7.8	13.2	17.7	21.1	24.2	26.8	29.0	31.1	33.1	35.1
Illinois waters†	72	9.9	17.5	21.0	23.6						
Wisconsin waters†	528	10.0	18.0	23.0	27.0	30.1	33.0	36.0	38.0	40.0	44.0
Ohio waters, present work	688	11.4	17.6	21.2	23.6	25.5	26.4	28.6	30.1	31.2	32.8

*Kuehn 1949.

†Van Engle 1940.

Van Engle (1940) and Miller and Kennedy (1948) presented data which indicated that the increased growth rates in southern waters were associated with a decrease in the life span in northern pike. Table 3 reveals that growth of East Harbor northern pike and those of Illinois exceeded that reported from more northern waters, except for the Wisconsin data. Greeley (1940) reported from Lake Ontario growth of northern pike which closely paralleled that found for those from East Harbor, but reported his data for age groups, not at the end of each year's growth.

SUMMARY

Scale samples from 688 northern pike taken from East Harbor, Ohio, during the month of March in the years 1951 through 1953, were used in this study. Growth was calculated on the assumption of direct proportion between scale measurements and the lengths of the fish at the time of annulus formation. An annulus was assumed on the farthest edge of the scales.

Pike from age groups one through ten were taken; but numbers of the older groups were small.

Calculated growth for individuals of the same age varied greatly. The selectivity of the net mesh may have influenced the data for the younger fish.

The greatest annual increment was found in the first year of life and was followed by an annual decrease thereafter.

Sexual dimorphism, so far as females appearing to grow more rapidly than males in a given period of time, was evident.

Calculated annual increments for fish of the same age was found to vary from year to year, and for fish of different age groups in the same year.

The growth of East Harbor northern pike compares favorably with that reported from other waters. The more rapid growth in the younger fish and the suggested short life span for East Harbor pike are in keeping with reported data on the inverse variation of growth with latitude and the correlation of rapid growth and decreased life spans.

Maximum ages of ten years in females and eight years for males is suggested by this study.

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