

UNIVERSITY OF TORONTO STUDIES

PUBLICATIONS OF THE
ONTARIO FISHERIES RESEARCH LABORATORY

No. 5

RATES OF GROWTH OF THE BLUE AND YELLOW
PIKE PERCH

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UNIVERSITY OF TORONTO

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1922

RATES OF GROWTH OF THE BLUE AND YELLOW
PIKE PERCH (*STIZOSTEDION VITREUM*)
IN LAKE ERIE

From material obtained during the summer of 1920, at Merlin, Ontario, on Lake Erie, a study has been made, under the direction of Dr. W. A. Clemens, of the rates of growth of the blue and yellow pike perch. These fish, together with the gray pike perch, are described as colour varieties of one species, *Stizostedion vitreum* Mitchell (Jordan and Evermann, 1898, American Fish Manual, 1903). This species is also known as the wall-eyed pike perch, pickerel or doré, the latter being sometimes restricted to the yellow variety.

Apart from their difference in colour, these varieties are also distinguished by their great diversity in size. The blue is apparently the smallest, averaging less than one pound in weight, and occasionally attaining as much as five pounds. The yellow may reach 20 pounds and is often taken weighing from 5 to 10 pounds, and the gray, which is the largest, attains a maximum of 40 pounds, 10 to 20 being common.

The specimens of blue and yellow pike perch obtained at Merlin agree in this divergence in size, but apparently none of the gray variety are caught there by fishermen. Measurements of length, girth, etc., were taken on the specimens of the blue and yellow varieties with a view to the later determination of their respective rates of growth. For this purpose scales from each fish were preserved for the determination of age. The scales were mostly taken from the middle of the sides of the body below the lateral line. In most cases the ear stones were also preserved for use in estimating age.

By microscopic examination of the scales from a fish a fairly accurate estimate of the age can be made. Typical scales of both blue and yellow pike perch are shown in

Figs. 1, 2, 3. From the illustrations it will be seen that the scales are ctenoid; that is, the exposed posterior portion is covered with a number of small spines or teeth. The anterior margin, which is embedded in a pocket of the epidermis and is protected by the overlapping borders of those in front of it, has an entirely different appearance. Instead of being spiny it is fluted and the surface is marked by a large number of fine concentric lines, broken at intervals by radial lines, which pass inward towards the centre from the notches of the scalloped edge. The fine concentric lines are lines of growth, and each represents the addition of a ring

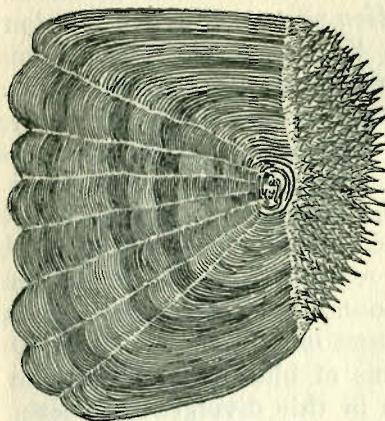


Fig. 1. Scale from a blue pike perch in its fourth summer.

of material to the scale at the border where it is attached to the epidermis.

At regular intervals on the scale the fine lines are laid down alternately closely set and more widely separated. The spacing is wide apart or close together according as the lines were added at a favourable or unfavourable season of the year. This arrangement of lines gives the scale the appearance of having wide light and dark bands when it is examined under the microscope. As shown in Fig. 1 the outer margin is marked by a light band and in the other scales examined a similar area was almost invariably present

in this position. This apparently marks a summer's growth since all the specimens were obtained in summer. The central portion of each scale is surrounded by a dark area which must necessarily represent a late summer's growth and the first winter period, since the fish hatch in spring and the central portion of the scale would be formed during the first summer. This is shown by the illustration of the scale of the smallest blue pike perch in Fig. 2.

By counting the number of dark bands present on a scale the age of the fish can be estimated. Thus, if there are three, as shown in Fig. 1, the fish must have lived three years and some fraction of the fourth summer. However,

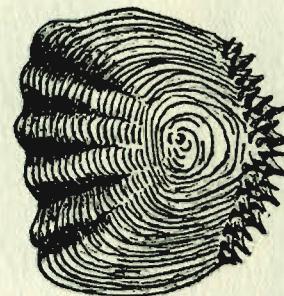


Fig. 2. Scale from a blue pike perch in its first summer.

it is impossible to estimate the fraction of a year with any great degree of accuracy. Accordingly, in the present instance, the number of whole years has been determined and an average fraction added to each. Thus, assuming that in general these fish hatch in May, then fish caught in June of the following year would have completed, on the average, a growth period of one year and one month. Similarly, fish caught in July would have completed one year and two months, and fish caught in August, one year and three months. Therefore, the average growth periods of fish caught in June, July and August would be one year and two months. All the fish considered in this study were obtained during the months of June, July and August, and

hence an average of two months has been added to the number of whole years indicated by the scale of any particular fish. Thus the estimated age of the fish whose scale is figured in Fig. 1 is 3 1-6 years and that of the yellow pike perch in Fig. 3 is 2 1-6 years. This arrangement, though quite arbitrary, is justifiable since the measurements of length, weights, etc., must also be averaged in the determination of the rate of growth.

In a great many cases the ear stones of the fish were examined as well as the scales. These also show increase in

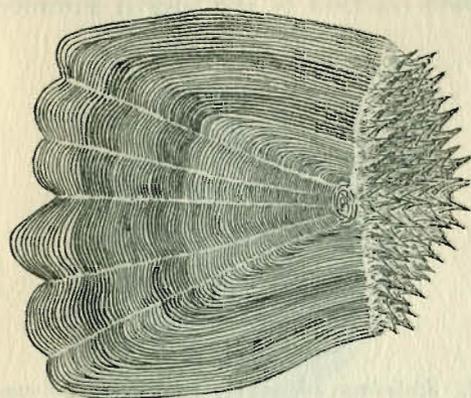


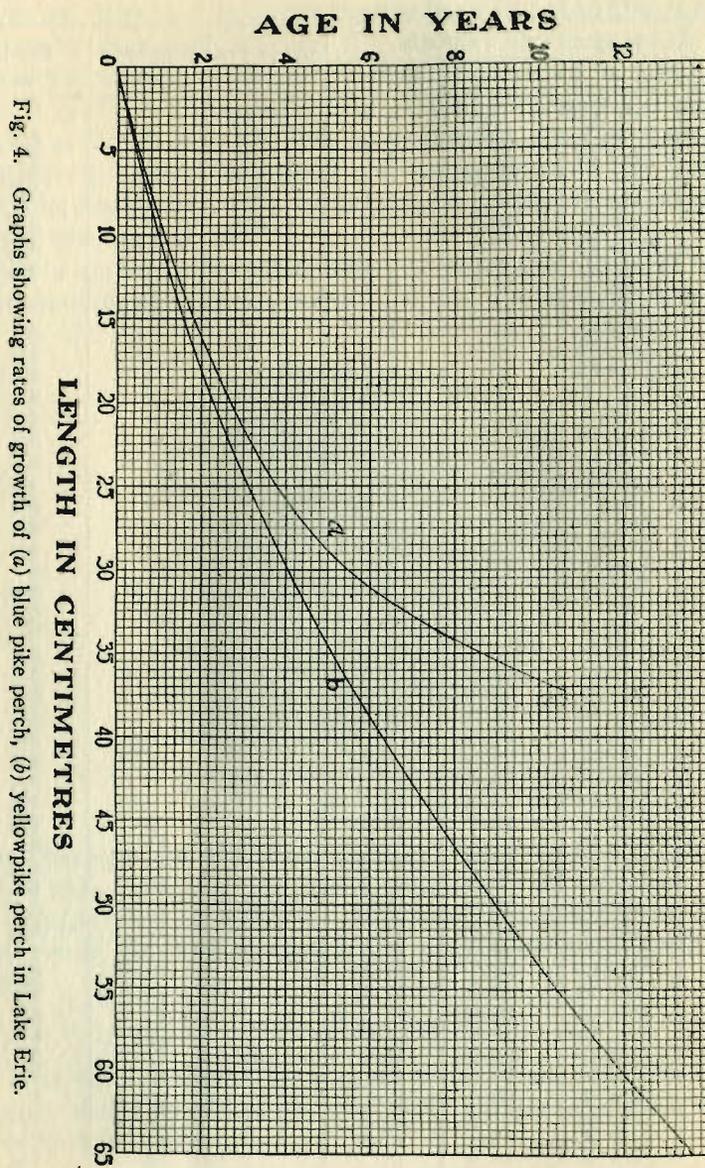
Fig. 3. Scale from a yellow pike perch in its third summer.

size with age and alternate light and dark bands, much like the scales, but they are much more difficult to work with on account of their opacity. However, in a great many cases they could be used to check the results obtained with the scales.

Blue Pike Perch

The data obtained by measurements, and determination of age, of the specimens of the blue pike perch are given in the following table:

No.	Date	Length		Age in yrs.	Weight in oz.	Girth in.
		cm.	inches			
52	Oct. 1920	7.4	2.9	½		
11	July 7	15	5.9	2½	2	3½
10	June 25	17	6.7	2½	3	3¾
1	June 24	17.2	6.8	2½	2½	3¾
17	July 7	18.1	7.1	2½	2½	
28	July 28	19.2	7.5	3¼	3	4½
48	Aug. 16	19.6	7.7	"	3½	4¾
12	July 7	19.6	7.7	"	3	4½
15	July 7	19.7	7.7	"	3	
16	July 7	20.4	8	"	3½	
27	July 28	20.4	8	"	4	5
2	June 24	20.6	8.1	"	4	4¾
8	June 25	20.7	8.1	"	4	4½
18	July 7	20.7	8.1	"	4	4½
13	July 7	21.0	8.3	"	4	4½
44	Aug. 16	21.0	8.3	"	4	4¾
38	Aug. 13	21.0	8.3	"	5	4¾
32	July 30	22.0	8.7	"	4	4¾
30	July 28	22.1	8.7	"	5	5½
45	Aug. 16	22.2	8.7	"	5	4¾
46	Aug. 16	22.3	8.8	"	5	4¾
37	Aug. 13	22.5	8.8	"	6	5
34	July 30	22.8	9	"	5½	5½
19	July 7	22.8	9	"	6	5½
14	July 7	23.2	9.1	"	6	5½
39	Aug. 14	23.2	9.1	"	7	5½
33	July 30	23.8	9.4	"	6½	5½
29	July 28	23.8	9.1	"	6	5½
27	Aug. 16	24.5	9.6	"	7	5½
43	Aug. 16	24.6	9.6	"	8	5¾
26	July 28	25.2	9.9	"	8	5¾
31	July 28	25.5	10	4¾	8	5¾
40	Aug. 14	25.5	10	"	9	5¾
20	July 7	26.7	10.5	"	9	5¾
49	Aug. 16	27.1	10.7	"	11	6½
26	Aug. 13	27.7	10.9	"	12	6½
41	Aug. 14	27.6	10.9	"	11	6¼
25	July 28	28.0	11	5¾	12	6½
21	July 7	28.0	11	"	12	6½
9	June 25	28.6	11.3	"	17	7½
42	Aug. 16	28.7	11.3	"	10	6¾
4	June 24	29.0	11.4	"	17	7½
51	Aug. 16	29.6	11.7	"	15	6¾
50	Aug. 16	29.8	11.7	"	14	6¾
6	June 25	30.2	11.9	6¾	17	7¾
5	June 24	30.5	12	"	17	7¾
22	July 7	30.5	12	"	15	7
3	June 24	31.9	12.5	7¾	17	7½
7	June 25	31.9	12.5	"	17	7½
23	July 7	33.0	13	"	16	7½



From the results given above the average length and weight, for each age, have been worked out and are given in the following table:

AGE IN YEARS	LENGTH		WEIGHT IN OZ.
	CENTIMETERS	INCHES	
½	7.4	2.9	
2½	16.8	6.6	2½
3½	21.9	8.6	5
4½	26.4	10.4	10
5½	28.8	11.4	14
6½	30.4	12.0	16½
7½	31.9	12.6	16¾

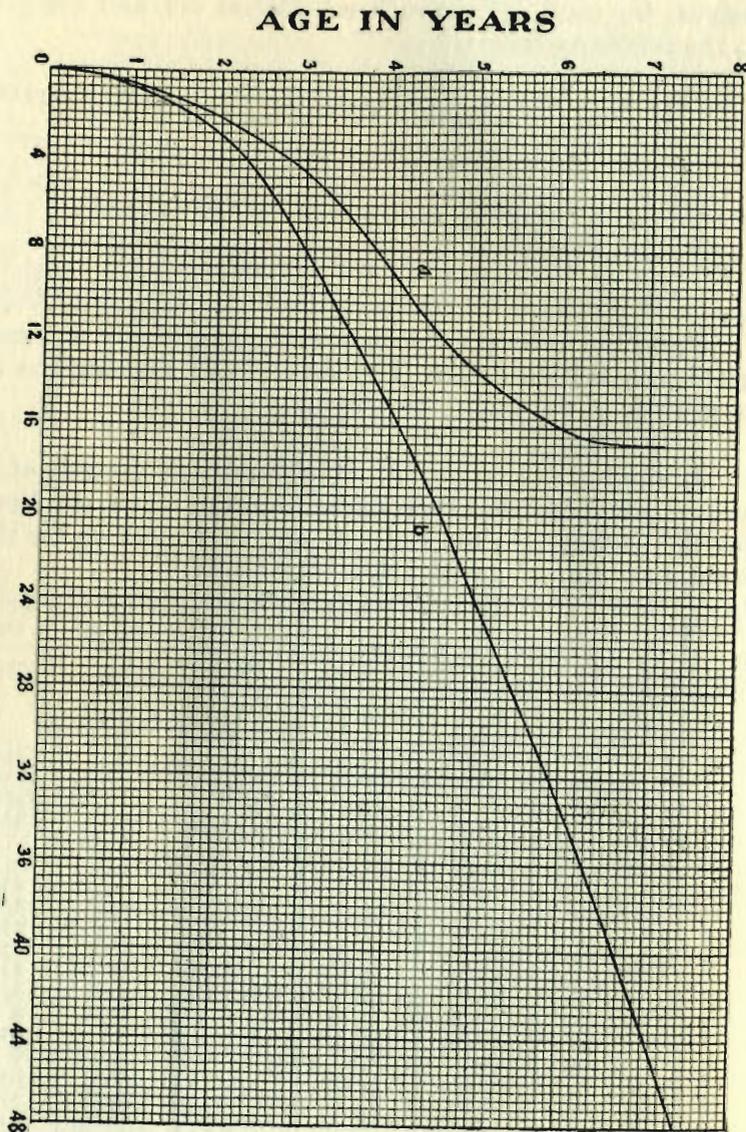
Using the averages of length and age given in this table, graphs have been drawn (Fig. 4a and 5a) showing the rate of growth of the blue pike perch.

Yellow Pike Perch

A similar determination of the rate of growth of the yellow pike perch has been made from the material collected for the purpose. The results of age determination for these specimens are tabulated below:

No.	Date	Length cm.	Length in.	Age years	Weight oz.	Girth in.
24	Aug. 16	14.7	5.8	2½	2	3½
20	July 9	15.1	5.9	"	2	
21	" 9	15.1	5.9	"	2	
13	June 25	15.6	6.2	"	2	
12	" 25	16.3	6.4	"	2	3½
1	" 24	16.8	6.6	"	2½	3½
11	" 25	17.8	7.0	"	3	3¾
2	" 24	18.2	7.3	"	3	3¾
19	July 9	18.8	7.4	"	3	
18	" 9	18.8	7.4	"	3	
23	Aug. 16	21.0	8.3	"	5	4¾
14	June 25	21.0	8.3	"	4½	4¾
9	" 25	21.0	8.3	"	4½	4½
5	" 24	21.0	8.3	"	4½	4½
3	" 24	21.1	8.3	"	4½	4¾
22	Aug. 16	25.0	9.8	3½	9½	5¾
4	June 24	28.6	11.2	"	11	6
7	" 24	30.0	11.8	4½	16	6¾
10	" 25	30.5	12.0	"	14	6½
6	" 24	30.7	12.0	"	14	6½
25	Aug. 18	33.5	13.2	"	1 lb. 6	7¾
8	June 25	38.7	15.2	6½	2 lb. 3	9½
16	" 30	51.5	20.2	9½	4 lb. 14	12½
17	July 5	60.5	23.8	12½	8 lb. 14	15½
15	June 30	63.5	25	13½	10 lb. 12	16½

Fig. 5. Graphs showing relation of weight to age, (a) blue pike perch, (b) yellow pike perch in Lake Erie.



The results given in the preceding table have been used to compute the following table of averages, from which curves illustrating the rate of growth of the yellow pike perch have been drawn in Figs. 4b and 5b.

AGE YEARS	LENGTH CM.	LENGTH INCHES	WEIGHT
2½	18.2	7.4	3½ oz.
3½	26.8	10.6	10¼ "
4½	31.2	12.3	16½ "
6½	38.7	15.3	2 lb. 3 oz.
9½	51.5	20.3	4 " 14 "
12½	60.5	24.1	8 " 14 "
13½	63.5	25.1	10 " 12 "

A comparison of the two curves obtained brings out the fact that the rate of growth of the yellow pike perch is fairly uniform, whereas, in the case of the blue variety, there is a decided slowing up of the rate of growth at about the end of the fifth year. In both cases, however, there is a falling off in growth with age. In order to show this the lengths at the ages of 1, 2, 3 years, etc., have been obtained by interpolation on the curves, and from these figures the yearly increase in length is obtained.

Age Years	Blue Pike Perch		Yellow Pike Perch	
	Length cm.	Yearly Increment cm.	Length cm.	Yearly Increment cm.
1	9.3		10.3	
2	16.2	6.9	18	7.7
3	21.7	4.5	24.4	6.4
4	25.8	4.1	29.7	5.3
5	28.8	3.0	34.4	4.7
6	31.2	2.4	38.7	4.3
7	32.7	1.5	42.7	4.0
8			46.5	3.8
9			50.2	3.7
10			53.5	3.3
11			56.9	3.4
12			60.2	3.3
13			62.5	2.3

In the case of the blue pike perch the decrease in rate of growth after the fifth year is not compensated by large

increase in weight, as in the case of the yellow variety. Thus, in the fifth summer, the average weight of the blue is 10 oz., which increases to 16 1-3 oz., by the seventh summer, but this increase in weight is accompanied by a very small increase in length.

In the case of the yellow pike perch, on the other hand, the slowing up of growth occurs about the end of the fifth year but the slow growth is more than compensated by the large increase in weight which then begins.

From a consideration of the curves obtained, it would appear that the best time to take the blue pike perch is after the fifth year when they have obtained a length of about 28 to 30 cm. (11 to 12 inches) and weigh 14 to 16 ounces. Since the girth measurement posterior to the gill cover at this age is about 6 inches, this is approximately the size which would be taken in a 3-inch gill net.

With the yellow pike perch, since they increase so rapidly in weight after the sixth year, it would appear that they should not be taken until they have reached a length of at least 15 inches and weigh approximately 2 lbs.

The study of the rates of growth of the blue and yellow pike perch shows that the former do not reach nearly so great a size as the latter, and amply confirms the opinion of fishermen that the blue are much smaller. Moreover, after the fourth year the rate of growth of the blue variety falls off very rapidly, whereas the yellow continue to grow uniformly up to a considerable age. This peculiar difference in the rates of growth possibly indicates some basic physiological distinction between the two varieties which also possibly finds expression in their difference in colour.

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No. 6

THE RATE OF GROWTH OF THE YELLOW PERCH
(*PERCA FLAVESCENS*) IN LAKE ERIE

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