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GROWTH OF PIKE-PERCH (LUCIOPERCA LUCIOPERCA L.) IN THE TISZA STRETCH AT TISZAFÜRED

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Abstract

The author is investigating the growth of pike-perch, taken as a function of time. The mathematical model of the growth of pike-perch population is given by Bertalanffy's equation deduced for the single age-groups form the body proportions recalculated on the basis of squamae. Growth is demonstrated satisfactorily by the equation in interval 1⟨t⟩7.

Comparing the data of growth with BÍRÓ's data (1970) concerning the Balaton, it is to be seen that the initially smaller individuals in the Tisza, in the second Summer overtake the size of the individuals in the Balaton, and from their second year of age they exceed it.

Introduction

From among the fish of the river stretch, one of the most valuable and most considerable useful fish is pike-perch. As we have no data in respect of its growth in the Tisza, and as the Hungarian national Line-Fishing Association is at present introducing young fish bred previously, and plans to do it in the future, as well, it became necessary to study the growth, and that is the cause of the present investigation (HARKA 1974).

The up-to-date methods of growth-investigation, resting upon the activity of BRÓDY (1945) and BERTALANFFY (1957), are applied by some of the researchers in the ichthyological investigation (TUSNÁDI—VANGER 1962, SZÉKY 1962, BERINKEY 1966). To the present investigations BÍRÓ's research (1970) into the pike-perch population in the Balaton has served as a guide.

Materiels and Methods

For this investigation, 220 pike-perch individuals were caught in the river-stretch at Tiszafüred, mostly with fish-traps of wicker, between March 15, 1973 and October 22, 1975. The trunk-length of the individuals changed between 27 and 77 cm, and their body weight between 21 and 642 dg.

The age of life was determined on the basis of the growth-rings of squamae. In case of eleven individuals, however, we could not determine the age, therefore hereinafter only the data of 209 individuals will take place.

6 to 10 of the squamae taken from the fish were put in a slide-carrier and projected by means of a slide projector on an intercepting screen of transparent paper. On the screen, I measured with a mm-calibrated scale the complete oral radius of squamae (s) and the distance of the single growth-

rings from the focus (s_n), magnified ten times. As the relation of the complete oral radius to the trunk-length is expressed practically by the straight line going through the origo ($s=-0{,}0147+0{,}9857\ L_c$), I calculated backward from the data, according to Lea (1910), the body length that had existed in the time of the development of growth-rings, by means of the connection:

$$l_n = \frac{s_n}{s}\, l$$

in which l is the body-length of the fish in the time of sampling (cf. Tesch 1968).

For describing the growth of the pike-perch population, I have used BERTALANFFY's mathematical growth model (1957), suggested by DICKIE (1968), according to which the body weight (l_t) can be expressed in any t time (year) by the following equation :

$$l_t = L_\infty (1 - e^{-K(t-t_0)})$$

L_∞ = maximum (assymptotic) body length; K = measure of the speed of growing with which the body length approaches L_∞ : t_0 = the hypothetical point of time at which body length is equal to zero; e = basic number of the natural logarithm.

Results

The distribution of the 209 individuals used for the investigation according to age-groups was as follows: (2+): 82 individuals, (3+): 47 individuals, (4+): 46 individuals, (5+): 28 individuals, (6+): 4 individuals, (7+): 2 individuals. The notation of age-groups is the usual one: (2+)=in the third Summer, and so on. The recalculated body-sizes of the single age-groups are indicated in Table 1. The

Table 1. *Body length of the pike-perch in the Tisza recalculated on the basis of squamae*
(Body length given in cm, body weight in g)

Age-group		2+	3+	4+	5+	6+	7+	Mean	Weight
	min.	12,8	13,9	10,7	13,8	18,8	15,3		
1	max.	21,6	19,5	20,5	20,4	21,0	16,4		
	mean	16,96	16,88	16,96	16,51	19,55	15,85	17,12	50,6
	min.	23,8	22,3	18,7	21,3	26,5	24,3		
1	max.	31,7	29,5	30,0	34,2	30,8	25,8		
	mean	27,59	26,35	25,84	25,93	29,32	25,05	26,68	217
	min.		30,5	25,3	27,5	33,9	33,2		
1	max.		36,5	38,0	40,8	39,0	33,6		
	mean		33,18	32,89	33,34	37,22	33,40	34,01	482
	min.			30,7	32,5	40,3	40,5		
1	max.			43,5	45,9	47,0	40,9		
	mean			37,84	39,36	44,40	40,70	40,58	861
	min.				36,5	45,6	46,5		
1	max.				49,0	53,0	47,2		
	mean				43,37	50,32	46,85	46,85	1379
	min.					49,8	50,8		
1	max.					58,0	53,6		
	mean					53,82	52,20	53,01	2069
	min.						54,3		
1	max.						57,4		
	mean						55,85	55,85	2455

body weight corresponding to the average length was calculated from the allometric equation established on the basis of the same research material:

$$\lg W = -5{,}6303 + 3{,}2837 \lg L_c$$

where the weight (W) is given in g, the body length (L_c) in mm (HARKA 1975).

With the average values obtained on the basis of squamae I described Walford's (1946) transformed straight of growing, with the data $y=l_t$, belonging to $x=l_{t-1}$ (Fig. 1). The equation of the straight line, obtained by regression analysis (Sváb 1973) is:

$$l_t = 11{,}97 + 0{,}8484 l_{t-1},$$

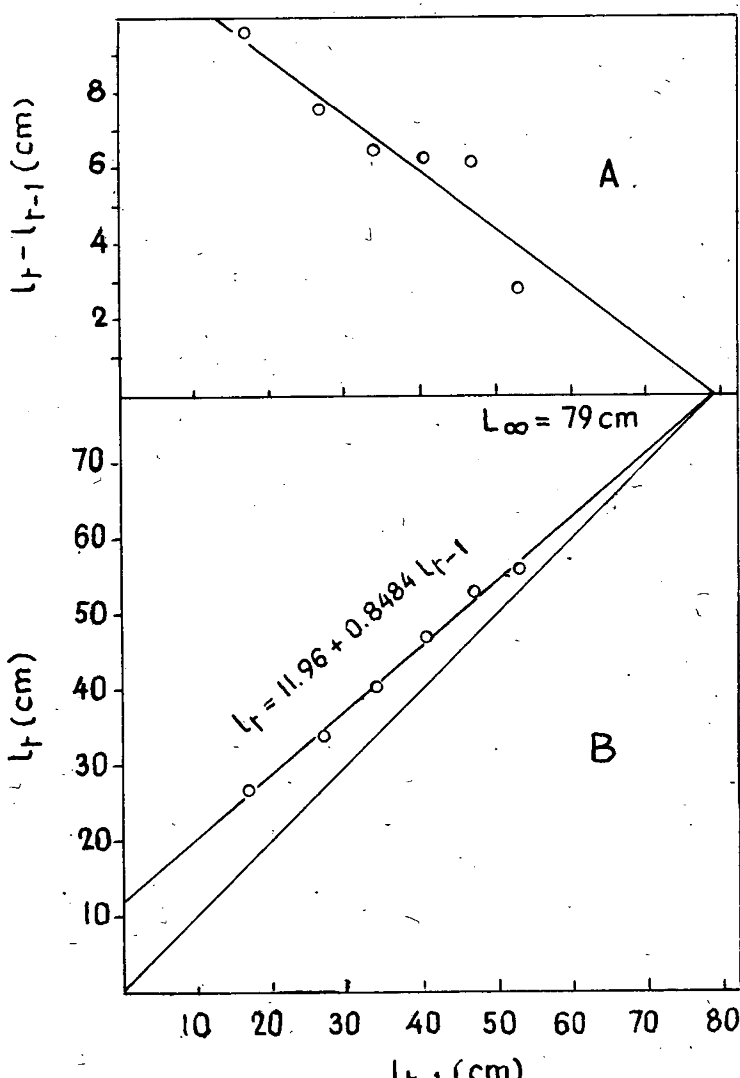

Fig. 1. Alternative plotting of the values of the difference between the body lengths measurable in the consecutive years (A) and the body length achieved in the consecutive years (B) (Walford-plot). (l_t = body length in the age of t years, l_{t-1}: the body length 1 year earlier).

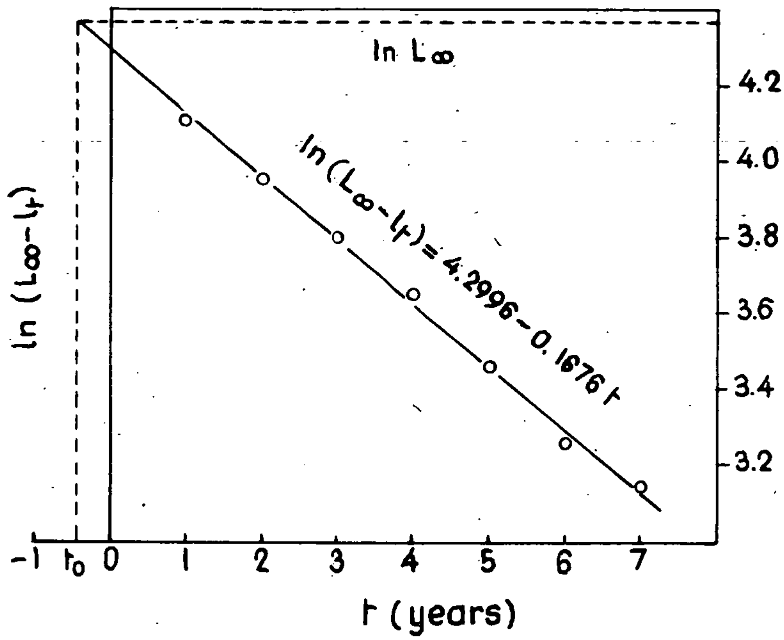

Fig. 2. Plotting of the natural logarithm of unsaturation, as a function of time (difference in cm of the assymptotic body length and the standard length, reached in the single years).

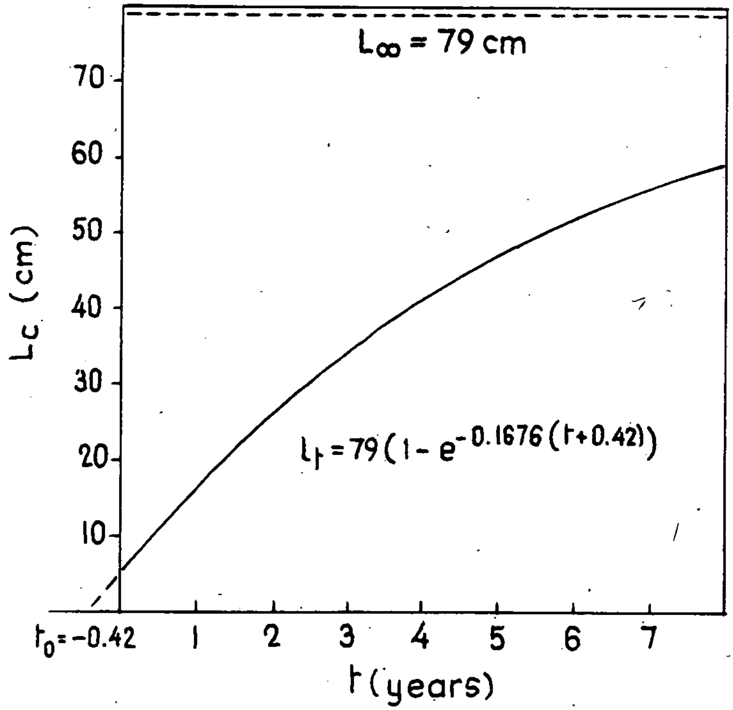

Fig. 3. Body length of the pike-perch in the Tisza in the consecutive years, according to Bertalanffy's growth model.

from which the assymptotic body length is:

$$L_\infty = \frac{11,97}{l_{-0,8484}} = 78,76 \text{ cm}.$$

Plotting the $(L_{00} - l_t)$ values as a function of time, we get a straight line (Fig. 2) the equation of which is:

$$\ln (L_\infty - l_t) = 4,2996 - 0,1676t.$$

From that, the further parameters of BERTALANFFY's equation can be determined:

$$t_0 = \frac{4,2996 - \ln L_\infty}{0,1676} = 0,416$$

$$K = \frac{\ln (L_\infty - l_t) - \ln L_\infty}{t_0 - t} = 0,1676.$$

The equation of the saturation function describing the growth of the pike-perch population of the river stretch at Tiszafüred is therefore the following:

$$t_t = 79(1 - e^{-0,1676/t + 0,42}).$$

The body lengths achieved in the single years are shown in Fig. 3.

Evaluation

The growth-rings in the squamae of the pike-perch in the Tisza are generally blurred, thus the estimate of the age of life at the individuals order than (4+) is in many cases uncertain. The results achieved should therefore be regarded primarily of informative character and it would not be right to try drawing a conclusion from these data concerning the finer changes in the tempo of growing.

Table 2. *Comparison of the bodily dimensions calculated on the basis of squamae and of Bertalanffy's equation*

Age-group	Actual age (year)	Calculated body length (cm)	
		On the basis of squamae	An the basis of Bertalanffy
0+	0,42	—	5,3
1+	1,42	17,1	16,7
2+	2,42	26,7	26,3
3+	3,42	34,0	34,4
4+	4,42	40,6	41,3
5+	5,42	46,9	47,1
6+	6,42	53,0	52,0
7+	7,42	55,9	56,2

Comparing the body lengths obtained on the basis of squamae with those calculated from BERTALANFFY's equation, the function seems to represent the growth of population in interval $1 \leqq t \geqq 7$ satisfactorily. (Table 2).

Comparing the data of growing with Biró's data (1970) concerning the Balaton

(Table 3), we can see that the 1-year old pike-perch were backward both in respect of length and weight. But this backwardness was overtaken in the second Summer, and after becoming two years old they preceded them. By reason of these, although the condition of the pike-perch being smaller than 561 mm is inferior to the condition of those in the Balaton (HARKA 1975), the more favourable picture is shown by the stock in the Tisza.

Table 3. *Comparison of body length and body weight of the pike-perch in the Balaton and in the Tisza*
(Body length in cm, body weight in g)

Age-group	Bodi lenght		Body weight	
	Balaton	Tisza	Balaton	Tisza
1+	17,5	17,1	63	51
2+	25,1	26,7	196	217
3+	31,4	34,0	397	482
4+	36,7	40,6	645	861
5+	42,3	46,9	1020	1379
6+	46,9	53,0	1414	2069
7+	50,6	55,9	1798	2455

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