CHANGES IN THE GROWTH OF PIKE PERCH *(STIZOSTEDION LUCIOPERCA)* IN THE AREA OF LAKE-TISZA

Á. Harka

Harka, Á. (1992): Changes in the growth of pike perch ***(Stizostedion lucioperca)*** *in the area of Lake-Tisza. - TISCIA 26,9-12.*

Abstract. The storage lake of the river Tisza was established in 1978 near Kisköre. From the growth analysis of pike perch living in the lake it is concluded that the growth rate of body weight decreased after swelling up the water. Longitudinal growth of pike perch, however, increased in time, and as a consequence, average body length of individuals over 3 years is greater than was earlier. Longitudinal growth is more important than the growth rate of weight, that is why the growth of pike perch is recently a little more favourable, than was before the establishment of storage lake, but it can be qualified as moderate compared with other rivers and ponds.

Keywords: age, body length, body weight, Bertalanffy-model

Á. Harka, Kossuth Lajos Secondary School, H-5350 Tiszafüred, Hungary

Introduction

The reservoir that was established by swelling up the water of river Tisza between Kisköre and Tiszafüred in 1978, is called Lake-Tisza. Its total area is 120 km^2, and its depth is about 1-1.5 m. The water of the reservoir is drained every autumn, and the fish species hide themselves in winter partly in the riverbed, and partly in the deeper water of backwaters that can be found at this area.

Annual harvest of pike perch was about 7-8 tones before the development of the reservoir. It increased after swelling up the water - it reached 50 tones in 1982 - but later decreased gradually, and the quantity changed between 14 and 19 tones from 1986.

The aim of this study is to find the changes in the growth rate of pike perch as a consequence of establishment of the storage lake. The basis of the comparison is the result of an investigation on the growth of pike perch that was carried out in the reach of Tisza in question before building the reservoir (Harka, 1975, 1977).

Material and Methods

Data of 82 pike perch individuals were used for growth analysis. Fish were caught in the north-eastern basin of Lake-Tisza near Tiszafüred and Poroszló, between 1987 and 1990. Standard body length of specimens varied between 290 and 710 mm, and their weight between 270 and 4400 g.

Relationship between body length (L) and weight (W) was calculated with the formula ($W = aL^b$) suggested by Tesch (1971), and with its logarithmic form, respectively. Linear regression analysis of measured data was performed (Sváb, 1973).

Age determination was made with scalimetry. Total oral radius (S) of scales and distance of annual rings developed in winter, from the focus of scales (S_n) were measured. Measurements were made by using a microfilm reader equipment and applying 21.5x magnification.

Body length of fish in the time of development of a new annual ring (L_n) was calculated by Lea (1910) method, because the correlation between body length and scale radius was no close enough.

Growth dynamics was estimated with Bertalanffy-type growth model that was suggested by Dickie (1971). Parameters of Bertalanffy-function were determined with Gulland (1963) method.

Results and Discussion

Relationship of body length and weight

The relationship between standard body length (L_c) and weight (W) of pike perch from Lake-Tisza is as follows:

$$\lg W = -4.9388 + 3.0132 \lg L_c$$

Body length is given in mm, and weight in g (Fig. 1).

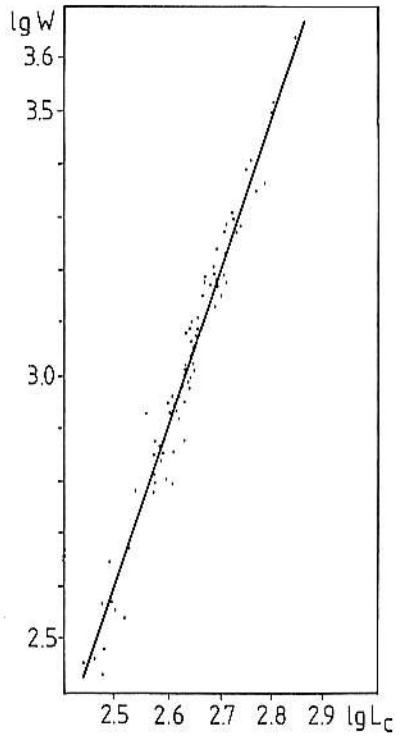

Fig. 1. Relationship between body length (L_c) and weight (W) of pike-perch in Lake-Tisza ($\lg W = -4.9388 + 3.0132 \lg L_c$; $r=0.987$).

The parameters of this function were the following in the period before swelling up.

$$\lg W = -5.6303 + 3.2837 \lg L_c$$

It can be seen from the comparison of the functions that pike perch starts recently with larger weight than earlier, but the growth rate decreased. The more favourable start gives some advantage up to 360 mm body length, but the smaller growth rate of body weight results in a greater and greater lag of larger individuals. Since just the individuals old enough for catching are in worse condition, this change is evaluated as negative one in general.

Growth of body length in time

It could be established on the basis of pattern of scales that the age of studied individuals varied between 2 and 9 years. The two oldest age classes, however, were represented only by 1-1 individuals, therefore the growth was analyzed up to the age of 7 years.

Table 1. shows the calculated standard body length in the age classes. Body weights are given on the basis of the function mentioned above.

Saturation curve was fitted to body length data which were calculated from the annual rings of scales. Parameters of Bertalanffy-function describing above curve are as follows:
asymptotic body length L_∞ = 1020.6 mm; growth rate k = 0.1234; hypothetical age at 0 body length t_0 = -0.356 year. Expected standard body length (L_t) of pike perch living in the north-eastern basin of Lake-Tisza is:

$$L_t = 1026.6\,[1 - e^{-0.1234(t+0.356)}]$$

in the age of t years.

Fig. 2. shows the growth curve with averages and extreme values calculated from scale data.

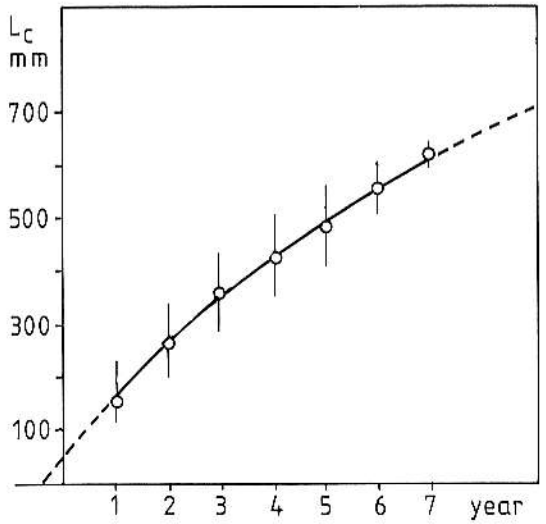

Fig. 2. Growth of pike-perch in Lake-Tisza according to Bertalanffy-model. Dots are averages calculated from scale data, vertical lines represent extremes.
($L_t = 1026.6\,[1 - e^{-0.1234(t+0.356)}]$).

The relationship concerning the period before development of storage lake is:

$$L_t = 790\,[1 - e^{-0.1676(t+0.42)}]$$

Table 1.Body lengths of pike perch in different age classes calculated from scale data, and the corresponding calculated body weights.

Age year	Data n	Body length in mm min.	max.	mean	Body weight in g min.	max.	mean
1	82	110	233	153	16	157	44
2	82	195	325	261	92	427	220
3	72	284	438	358	284	1048	571
4	48	347	500	422	520	1562	937
5	21	401	560	484	804	2198	1416
6	7	506	598	549	1619	2679	2071
7	3	608	631	616	2816	3150	2929

Table 2. Growth of body length and weight of pike-perch before (1977) and after (1990) filling up the storage lake.

Age year	Body length in mm 1977	1990	Body weight in g 1977	1990
1	167	157	47	48
2	263	257	207	210
3	344	346	500	515
4	413	424	911	951
5	471	494	1403	1506
6	520	555	1942	2139
7	562	609	2506	2830

Table 2. shows the body lengths calculated with above two functions and the related body weights. Data clearly show that longitudinal growth of pike perch increased, their body length is greater from the 3rd year than was in the past. Also this change - similarly to the deterioration of condition mentioned above - manifested itself in the age class which is ripen for catching, but the effect is opposing.

Data of body weight in the Table 2. also show that the later of opposite changes is more important. The overweight coming from the quicker longitudinal growth compensates the drawback originating from the weaker condition. Recently the pike perch is "slimmer" than its ancestor was, but its weight is larger at a given age because of the increased longitudinal growth.

This quicker growth can, however, be qualified as moderate compared with that of pike perch from other waters (Fig. 3.) because it is quicker than in the Yugoslavian reach of Tisza (Maletin and Budakov, 1984), but slower than in river Száva, and than that observed by Maletin and Kostic (1989) in one of backwaters of Tisza near Curug in Yugoslavia.

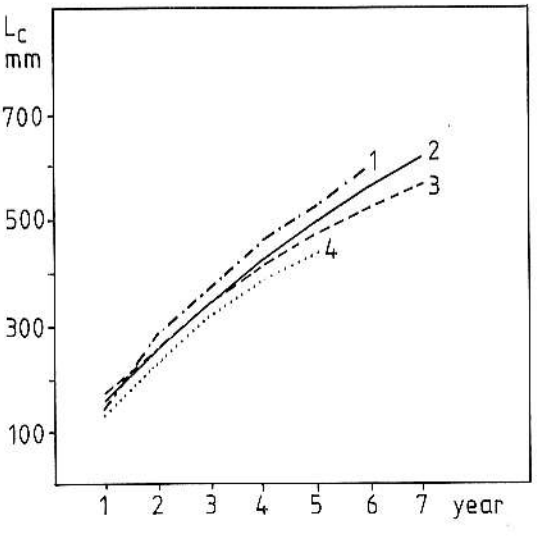

Fig. 3. Growth of standard body length of pike perch in some closer rivers. 1. river Száva, Yugoslavia (Maletin and Budakov, 1984); 2. Lake-Tisza (present study); 3. river Tisza, Hungary (Harka, 1977); 4. river Tisza, Yugoslavia (Maletin and Budakov, 1984).

The advantageous change of pike perch in Lake-Tisza was really probable, since a rich food supply developed inthe newly flooded area. But the reality is more complicated, because the surplus food should have taken positive effect also on the condition i.e. on body weight related to body length. It is not proved with data, but according to the observations by fishermen, it occurred in the first period. Pike perch individuals were thicker in the first years after swelling up the storage lake, and they became slim only in the last years. Probably the first cause of deterioration of condition is that larger areas of the bottom is covered with sediment that results the decrease of food supply. Also the decrease of longitudinal growth can be expected on this basis. The unfavourable environment has a negative effect on the reproduction, that is why we can find in the future, that the proportion of less demanding Volga-zander (*Stizostedion volgensis* Gmelin) will increase against pike perch.

References

Dickie, M.D. (1971): Mathematical models of growth. In: Ricker (ed.): Methods for assessment of fish production in fresh waters. Oxford.

Gulland, J.A. (1965): Manual of methods for fish stock assessment. Fish population analysis. - FAO Fish. Tech. Rep. 40.

Harka, Á. (1975): Investigation of the relation between body length and body weight of the pike-perch (*Lucioperca lucioperca* L.) in the Tisza-stretch at Tiszafüred. - Tiscia 10,77-80.

Harka, Á. (1977): Growth of pike-perch (*Lucioperca lucioperca* L.) in the Tisza-stretch at Tiszafüred. - Tiscia 12,109-115.

Maletin, S. and Budakov, L. (1984): Das Wachstum des Zanders (*Stizostedion luciopeca* L.) in der Donau und einigen nebengewässern in der Vojvodina. - 24. Arbeitstagung der IAD, Szentendre, Ungarn, Wiss. Kurzref. pp. 187-190.

Maletin, S. and Kostic, D. (1989): Fish growth rate in the Tisza backwater (Curug - Biserno Ostrvo) depending on type of nutrition. - Tiscia 24,87-93.

Tesch, F.W. (1971): Age and growth. In: Ricker (ed.): Methods for assessment of fish production in fresh waters. Oxford.