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THE GROWTH OF SILVER CARP (Hypophthalmichthys molitrix Val.) IN THE DEAD THEISS

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Abstract

In order to increase the total production in carp fish ponds in Vojvodina, in the mid-seventies, some species of phytophagous fish from the so-called Chinese complex were introduced. At that time the silver carp *(H. molitrix)* got into open waters and in this new extended areal shows a successful adaptation manifested in growth both in length and body mass and its condition (fattening coefficient). The analysed samples were caught in a stagnant water type river lake (Dead Theiss — Biserno Ostrvo) during the period 1983—1985. The fish reached these waters by planting. They belong to age categories 2+ to 4+, having a body mass of 1,465—3,513 g. and standard length of 391—572 mm. The sex ratio in this water basin is 1:1, and the mean value of fattening coefficient is 2.06. The calculated values of growth show an intensive growth at all ages, especially in the first three years (age 0+ to 2+) where the relative increase is 118 resp. 56%. The growth of treated samples does not fall at all behind the growth of samples from the natural areal, showing a successful adaptation of this allochton species in this part of extended areal, where they have good living conditions (sufficient water and food during the year, a stable temperature and oxygen regime and an optimal pH.).

Introduction

The introduction of phytophagous fish from the Far East in the waters of Vojvodine was done in order to increase the ichthyo-mass and its biologic and economic values.

Their meliorative function is also of importance, in terms of slowing the eutrophication. The growth of fish production in this way is based on the unused or slightly used nutritional resources in a water eco-system. The planting of the Dead Theiss with species of the socalled Chinese complex, was strated ten years ago, when their breeding started in the fish ponds in this area. The most numerous of these species of fish is the silver carp *(H. molitrix)*. The other two species, the grass cap *(Ctenopharyngodon idella)* and the bighead carp *(H. nobilis)*, are present in smaller number. The appearance of this fish in our waters, has the attention of several researchers, who are analysing them from different aspects (RISTIĆ 1986, TOTH 1971, IVANOVIĆ 1973, KNEŽEVIĆ et JOVANOVIĆ 1983, PUJIN et *al.* 1986), while about their growth tempo two reports were made up to date (MALETIN et KOSTIĆ 1986, MALETIN et *al.* 1987).

Material and Methods

The material was collected during a period of three years (1983—1985) by means of nets 70 m long, mesh diameter 110 mm. A total of 71 samples of silver carp were analysed, aged 2+ to 4+ body mass 1,465—3,516 and standard length 391—572 mm/35 females, 27 males and 9 juveniles). The age and reconstruction of growth were determined on the base growth zones on scales by standard methods. The fattening coefficient (Q) was calculated according to Fulton, while the body mass — standard length ratio as a correlation coefficient (r). The difference in growth between females and males for $p<0.05$ and $p<0.01$ was evaluated by Student test and the sex ratio by Hi^2 test. Apart from the analysis of biologic parameters, the most important abiotic factors were followed: water temperature, oxygen regime and pH.

Results and Discussion

The body mass growth shows very good results. The tested samples in their third year of life (age 2+) on the average reach 1,465 g., the following year 1,934 g., and in the fifth year 3,516 g. (Fig. 1).

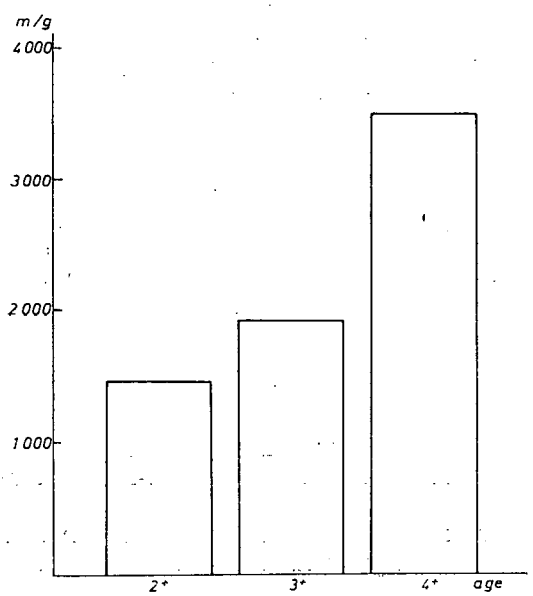

Fig. 1. Body mass growth tempo of *H. molitrix* in Mrtva Tisa

The growth in length is also very intensive. In the first year of life the samples reach on the average 115 mm of standard length, in the second 251 mm, in the third 291 mm, in fourht 474 mm and in the fifth 572 mm. An exceptionally high yearly absolute and relative growth can be noted especially in the first three years of life. In the second year the relative growth is 118% and in the third 56% (Fig. 2).

The growth in length was also analysed in relation to sex (Fig. 3). In the first two years of life it is more intensive in females, in the third it is almost equal, in the fourth it is again in favour of females, while later with the increase of growth in favour of males. These differences are, however, of no statistical importance. The sex ratio is 1:1. (Fig. 3).

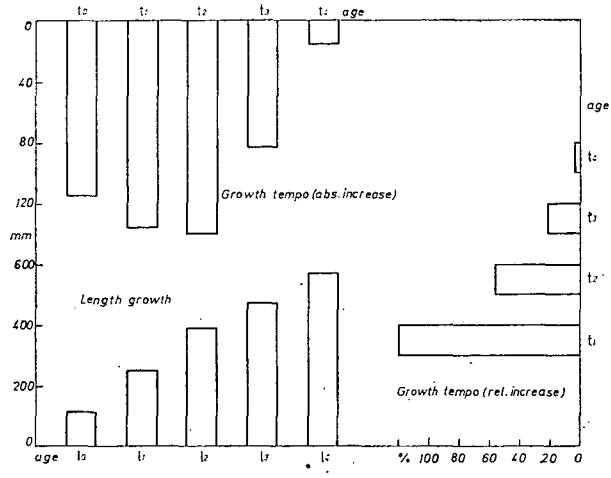

Fig. 2. Growth of silver carp *(H. molitrix)* in Mrtva Tisa-Biserno Ostrvo 1983—1985

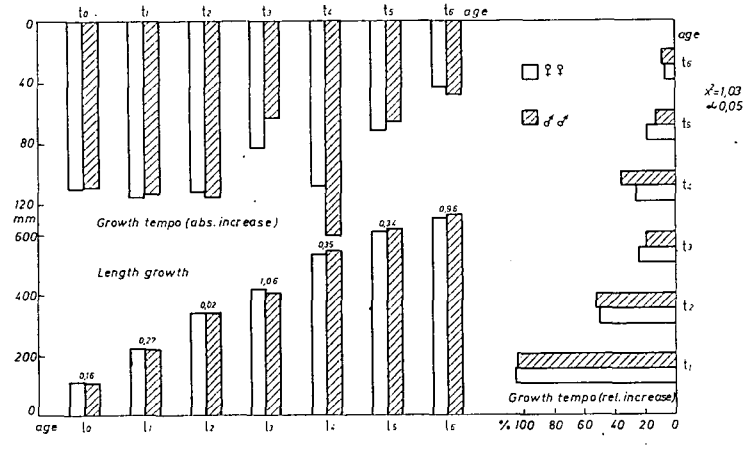

Fig. 3. Growth of females and males of silver carp *(H. molitrix)* in Mrtva Tisa-Biserno Ostrvo 1983—85

The total growth of this fast growing planktophag species was followed on the base of mass and growth correlation (coeff. r). The correlation coefficients are positive and high since $r > 0.70$ in all growth categories (0.9619—0.9888). The fattening coefficient values (Q), which indicate the general condition, are very favourable and increase with age and are from 1.9696 (for age 2+) over 2.0980 (3+) up to 2.1109 (4+) (Fig. 4).

Regarding the abiotic factor, the Dead Theiss-Biserno Ostrvo is a water ecosystem where prevail very favourable conditions and most importantly, very stable living conditions. By this we mean the most important physico-chemical parameters: water temperature, oxygen regime and pH.

This stability is maintained first of all thanks to sufficient water quantity during the year and the lack of any polluting agent (excluding of course communal waste

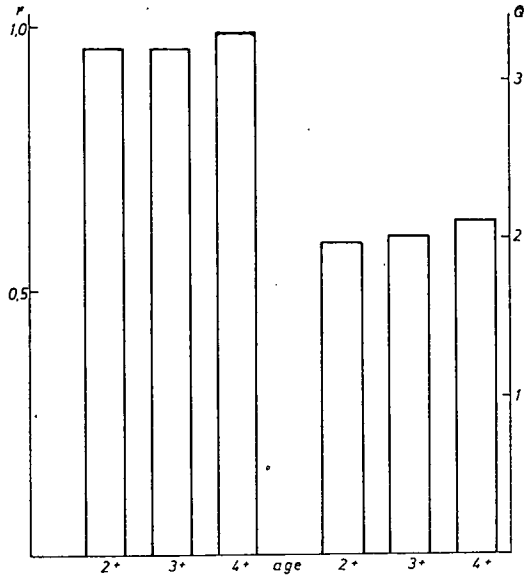

Fig. 4. Body mass and standard length correlation and coefficient of fattening of *H. molitrix* in Mrtva Tisa (1983—1985)

waters from two villages and the influence of nutrients applied in agriculture as the surrounding land is cultivated). The maximal spring temperatures of water are about 15 °C, in summer about 22—24 °C and in autumn about 10—13 °C. The oxygen regime, the quantity of dissolved O_2 in water and especially the percentage of saturation, secure the optimal living conditions to all hydrobionts, including the silver carp. The values of dissolved oxygen in the investigated period were 6.5—18.5 mg. l^{-1}, depending on the season with smaller yearly variation. The saturation of water with oxygen is between 80 to 190% (exceptionally). A specially stable oxygen regime prevailed during the year 1984. The pH values were between 7.5 and 9, but this relatively wide range lies still within the tolerant limits (Fig. 5).

Evaluating the growth of silver carp in a native areal and out of it, numerous authors gave different values, evaluating the success of adaptation in the extended part. So ZAŠEV (1961) and NIKOLSKI (1971) among the first in the world analysed the body mass and length growth of this planktophag in the Amur river basin, and these results are quoted in their discussions by ANTALFI et TÖLG (1972) studying the process of their acclimatization under the conditions in Eastren and Mid-Europe. Different growth rate in the waters of USSR was reported by HARITONOVA (1980), CHARYEV et RYLOV (1980) and many other authors stress that for the successful growth of silver carp, crucial is the food quantity and the length of vegetation period. Moderate results regarding the mass growth were observed in the waters of ČSSR by GAJDUSEK et LUSK (1982) and MÜLLER (1982) for some lakes in Switzerland. The best results were recorded in India, which can be understood having in mind the trophic rate of these water basins and the possibility of constant feeding all year long. (KARAMCHANDANI et MISHRA 1980).

A good mass and length growth of this allochthon fast growing ciprinide species in this part of extended areal (Dead Theiss-Biserno Ostrvo) is enabled due to very

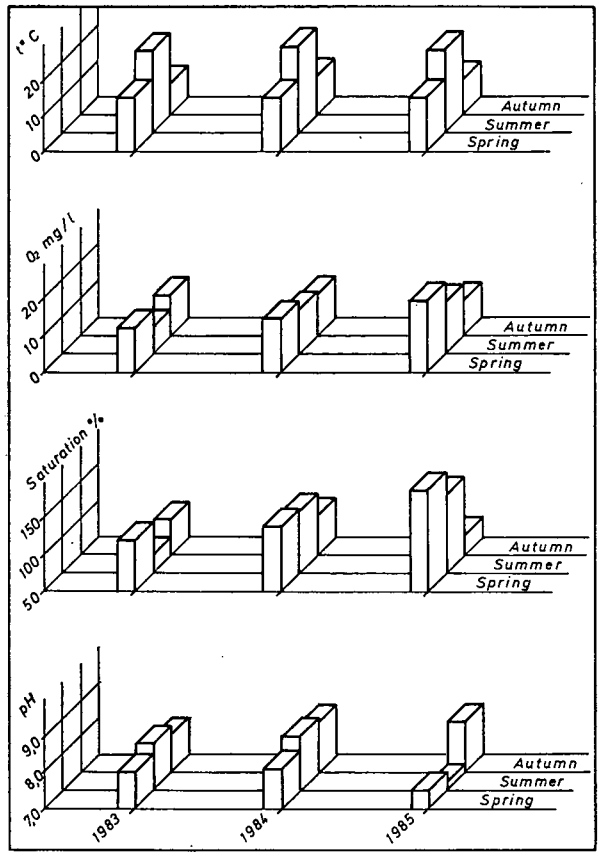

Fig. 5. Physical and chemical characteristics of water in Mrtva Tisa (mean seasonal values)

favourable and biotic abiotic factors, in the first place plankton as food not used sufficiently by autochthon planktophagous fish. This outstanding planktophag finds it abundantly and consumes it in great quantities, proved through intestinal analyses (PUJIN et *al.* 1986). The successful growth of silver carp in this river lake can also be noted by comparing these results with the growth rate of this introduced species in some other water eco-systems in Vojvodina such as the Danube and Bosut, another river lake Carska bara, parts of the hydrosystem Danube-Theiss-Danube canals and one fish pond (at Žabalj). The growth rate of the analysed individuals from the Dead Theiss falls only behind individuals from the fish pond, (Fig. 6).

Conclusion

H. molitrix has very successfully adapted in eutrophic waters of Vojvodina, testified by its intensive mass and length growth and high values of coefficients r and Q. The total growth in the Dead Theiss does not fall at all behind its growth in native areal, being the consequence of very favourble abiotic and biotic factors (sufficient water quantity all year long, stable temperature and oxygen regime, optimal pH and

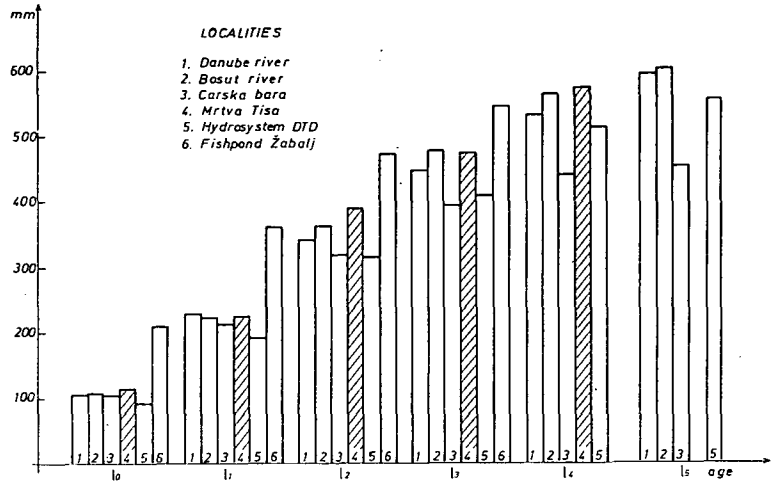

Fig. 6. Length growth of silver carp *(H. molitrix)* in diverse hydroecosystems of Vojvodina

abundant food). The introduction of silver carp in such a river lake is slowing the process of eutrophication and contributes to the increase of the total ichthyo production quantitatively and qualitatively so that this act could be considered as justified. It could be expected that by introducing the other two phitophagous species *(C. idella and H. nobilis)* the results would be even more successful.

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