



GROWTH OF INVASIVE PRUSSIAN CARP (CARASSIUS GIBELIO) IN THE TUDAKUL RESERVOIR

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Abstract

The growth of the invasive prussian carp (*Carassius gibelio*), an important commercial fish in the Tudakul reservoir, was studied. Scale is cycloid, large. A positive linear relationship ($v=1.89*SL+3.0459$; $r=0.75$) was revealed between scale sizes (v , eyepiece-micrometer units) and standard body length (SL, cm). The samples included fish with a standard length of 10.1–30.5 cm at the age of 1–4 years. The dependence of the standard and total (TL, cm) body lengths could be characterized by the regression equation: $SL=0.819*TL+0.183$ ($r = 0.99$). Total body weight (W, g) is related to body length: $W = 0.018*SL^{3.16}$ ($r=0.96$). The average growth rate of prussian carp: SL_1 - 10.7 cm, SL_2 - 18.1 cm, SL_3 - 24.4 cm, SL_4 -26.1 cm. The Rose Lee phenomenon is well manifested.

Keywords: Prussian carp, *Carassius gibelio*, growth, Rosa Lee phenomenon, Tudakul reservoir, Uzbekistan

Silver crucian carp (*Carassius gibelio* (Bloch, 1782)) is a representative of the cyprinidae family (Cyprinidae) - a highly flexible species that lived in freshwater bodies of China, Japan, the islands of Taiwan and Hainan, and has been widely distributed throughout Eurasia for several centuries. from France and Spain to the Far East, accidentally introduced into North America (Berg, 1948-1949; Atlas..., 2003, Elgin et al, 2014). It was introduced into the fish-water ponds of the middle reaches of the Syr Darya in the 1950-60s, from where it was resettled throughout the lowland regions of Uzbekistan along with the juveniles of cultivated pond objects, including the Tudakul reservoir of the lower reaches of Zarafshan. In this reservoir, the species has taken root, reproduces and became part of the commercial species. The peculiarities of the biology of silver crucian carp were mainly studied in the 1960-1970s (Kamilov, 1973; Salikhov et al., 2001; Yuldashov, Kamilov, 2018). There is currently virtually no data on the growth of silver crucian carp in the lower reaches of



the Zarafshan River. Assessment of the state of the fish population, especially commercial fish, is based on an assessment of the age and growth of individuals of a given population (Kamilov et al., 2021). The purpose of this work was to assess the size and growth of silver crucian carp in the Tudakul reservoir at the present time.

The Tudakul reservoir is an important fishery reservoir of the republic, one of the few reservoirs in the lowland part of the republic. The area of the reservoir when filled is more than 22 thousand hectares, the average depth is more than 5 m, the maximum depth is more than 20 m. The reservoir was created for irrigation purposes in the lower reaches of the Zarafshan River (39°51'15"N; 64°50'26"E). The reservoir is located in an arid zone, the climate is sharply continental, the seasonality of the climate is clearly visible: winter is relatively cold (the average monthly air temperature in January is about -2.5 ° C), summer is hot (in the daytime the air temperature remains 35 - 40 ° C for more than 1.5 months).

The material was collected in March in 2022-2023 in commercial and research catches in the Tudakul reservoir, in which fixed nets with a mesh of 18 - 60 mm were used. In fish, total (TL) and standard (SL) body lengths were measured with an accuracy of 0.1 cm, and total body weight (w) with an accuracy of 1 g. Scales were collected above the lateral line under the first rays of the dorsal fin. Using scale preparations, the age of the fish was determined, and the growth rate was reconstructed based on years of life using the method of E. Lea (Pravdin, 1966). The size of scales and annual rings (v) was measured using an eyepiece micrometer of an MBS-1 binocular.

The scales of crucian carp are cycloid, large, with smooth edges. The annual growth zone on the scales consists of zones with widely spaced and closely spaced sclerites (growth and wintering zones). A positive linear relationship was revealed between scale sizes (v, ocular micrometer units) and standard body length ($v = 1.89 \cdot SL + 3.0459$; $r = 0.75$).

The samples include fish with a total length of 14–37 cm, a standard length of 10.1–30.5 cm, and a body weight of 20–800 g at the age of 1–4 years.

The relationship between standard and total body lengths is reliably characterized by the regression equation: $SL = 0.819 \cdot TL + 0.183$ ($r = 0.99$). Total body weight is related to body length indicators by the following regression equations: $W = 0.0192 \cdot TL^{2.957}$ ($r = 0.96$) and $W = 0.018 \cdot SL^{3.16}$ ($r = 0.96$).

The restored growth rate of goldfish by age group is presented in Table 1.



Table 1. Restored growth rate of silver crucian carp in the Tudakul reservoir, 2022-2023.

Age, years	Standard body length, cm				N, copy.
	SL ₁	SL ₂	SL ₃	SL ₄	
1	15,9				20
2	10,7	20,7			89
3	10,5	19,1	25		70
4	9,6	16,2	22,8	26,1	18
average	10,7	18,1	24,4	26,1	
growth	10,7	7,4	6,3	1,7	

Discussion

The Tudakul reservoir is one of the few reservoirs built in the flat zone of the Aral Sea basin, in which the water can warm up quite well in the summer. The above determines the fishery value of the reservoir, where, with the existing fishing culture (fishing with fixed nets by coastal crews), fish productivity can be 5-10 kg/ha. The commercial ichthyofauna is formed artificially, it is dominated by acclimatized fish species (pike perch, Sander lucioperca, bream, Abramis brama, silver carp, Hypophthalmichthys molitrix, and others; it should be assumed that the herd of carp, Cyprinus carpio, is also formed from the offspring of imported cultivated Ukrainian breeds). These species were very correctly selected, introduced, took root, began to reproduce and became the main commercial fish. The silver crucian carp we studied is also invasive (Yuldashov, Kamilov, 2018). Growth is a general indicator that characterizes both the adaptive potential of a species in given conditions and all abiotic and biotic conditions. Due to this, much attention is paid to the study of the age and growth of fish from specific populations in ichthyology. The data is also important for invasive fish species that adapt (or not) to new conditions (Kamilov et al., 2021).

Silver crucian carp in the studied reservoir grows quickly. In the 2020s, the herd is testing the pressure of fishing with fixed nets. Of interest is the clearly manifested Rosa Lee phenomenon (the body sizes of younger age groups are, on average, higher than the sizes of the same younger age groups restored in older age groups). Our analysis of growth by generation in the years under study is presented in Figure 1 and clearly shows the mechanism of occurrence of this phenomenon. On average, the growth of yearlings is significantly higher than that of crucian carp of older age groups; the slowest in the initial years of life was the average growth of 4-yearlings. Fishing with fixed nets covers crucian carp with a standard length of 22 cm and above. Silver crucian carp reaches these sizes in a reservoir already at 2 years of age, although



in each generation there is a variation in body length. The fishery begins to remove the largest fish from the generation. Consequently, until 3- and 4-years of age, slow-growing individuals remain in the generation, which is manifested by the reverse calculation of the growth rate by years of life in 3- and 4-year-old fish.

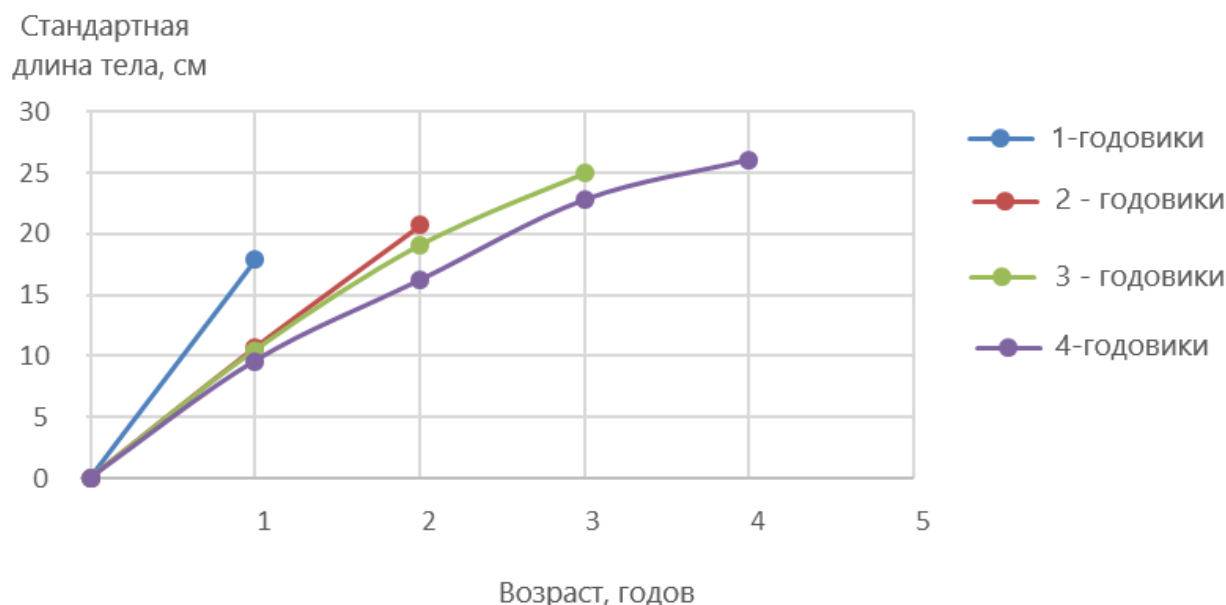


Fig. 1. Average growth rate of silver crucian carp of various age groups in the Tudakul reservoir, 2022.

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