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MORPHOLOGICAL CHARACTERISTICS OF COMMON CARP, CYPRINUS CARPIO, YEARLINGS FROM PONDS IN LOWER ZARAFSHAN RIVER

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Abstract:
The meristic and plastic characteristics of common carp (Cyprinus carpio) year-lings cultured in pond farming environments in lower stream of Zarafshan river (Bukhara region, Uzbekistan) were determined. Meristic indicators were deter-mined: D IV 18-19, A III 5, in the lateral line 37-39 scales, on the first gill arch 26 - 28 rakers. Indices of plastic characteristics are given according to the classical scheme for measuring fish of the cyprinid family, as well as according to the meth-od of geometric morphometry.

Keywords: Common carp, Cyprinus carpio, fish morphology, Uzbekistan.

Introduction

The development of pond fish farming in the temperate zones of Eurasia largely began with the cultivation of carp, *Cyprinus carpio,* in the conditions of earthen ponds. Since the 1960s, the development of pond fish farming in Uzbekistan has become economically much more attractive due to the development of polyculture, when fast-growing herbivorous fish of the Chinese faunal complex began to be cultivated in ponds with carp (Kamilov et al., 2003). Carp - a representative of the carp family (*Cyprinidae*) has occupied the niche of benthophagus in this polyculture, while the carp is additionally fed with cereal-based feed, and it remains one of the main cultivated fish both in Uzbekistan and in the world (FAO, 2020).

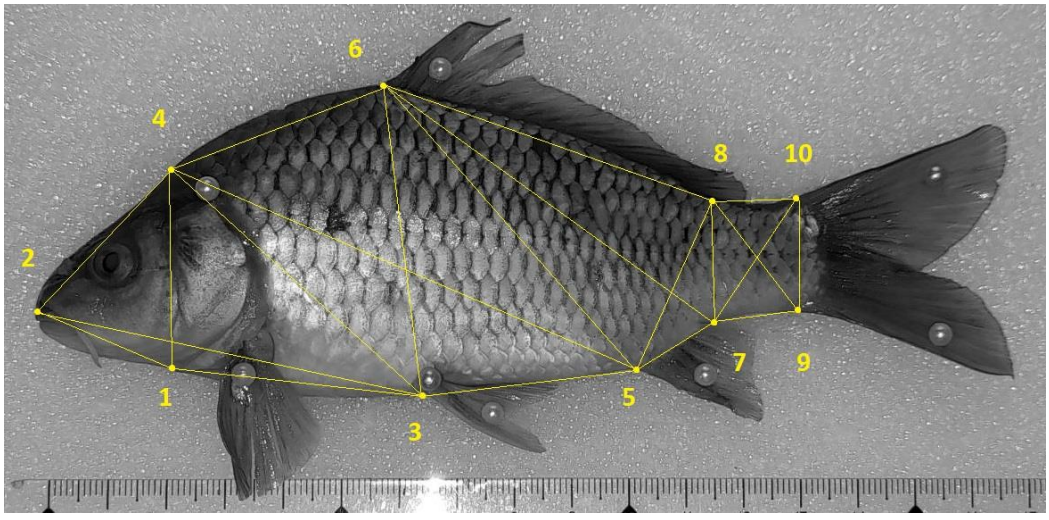
In the early 1960s, for the development of pond fish farming, scaly carp of the Ukrainian breed group was brought to the newly created fish farms in the middle reaches of the Syr Darya in the Tashkent region. With the development of the method of artificial factory reproduction, pond fish farms were created in all plain regions of Uzbekistan, where the offspring of carp were brought, partially mixed with the local wild form of carp (carp). In particular, the carp was brought to the fish farms of the Bukhara region

in the lower reaches of the Zarafshan, where they have since mastered the methods of reproduction from the formed broodstocks.

Despite the commercial importance of carp, work on the morphological features of this valuable species was practically not carried out. The purpose of this work was to study the morphological features of fish planting material (one-year-olds) of carp grown in the Bukhara region in the lower reaches of the Zarafshan River.

Material and Methodology

The material was collected in March 2024 at the Nodir Nozim quli fish farm in the Bukhara region in the lower reaches of the Zarafshan River. One-year-old carps were selected without choice when fishing the pond after wintering. We selected 25 random individuals, measured their total (TL, cm) and standard (SL, cm) body lengths, total body mass (W, g). The whole fish were fixed in a 4% formalin solution. In the laboratory, the fish were placed on their sides, their fins were straightened, and digital photographs were taken with a tripod. The axis of the camera was strictly perpendicular to the plane on which the recorded fish was lying. Plastic features were measured from digital photographs using the Ruler tool in Photoshop. Traits were measured according to the scheme of measurements of fish of the carp family (*Cyprinidae*) (Pravdin, 1966). We also identified 10 landmarks along the perimeter of the body of the fish lying on its side. The whole fish were photographed at a strict right angle using a fixed tripod. From the photographs, the distances were measured in a straight line between landmarks, i.e. the so-called "truss" protocol was compiled (Strauss, Bookstein, 1982; Strauss, Bond, 1990). The sounding lines are indicated in the following format: for example, "2 – 4" indicates the sounding between landmarks 2 and 4 in a straight line (Fig. 1). To neutralize the effect of allometric growth of fish, indices (%%) of plastic traits in relation to standard body length were calculated.



Rice. 1. Landmarks on the surface of the body of marketable carp yearlings

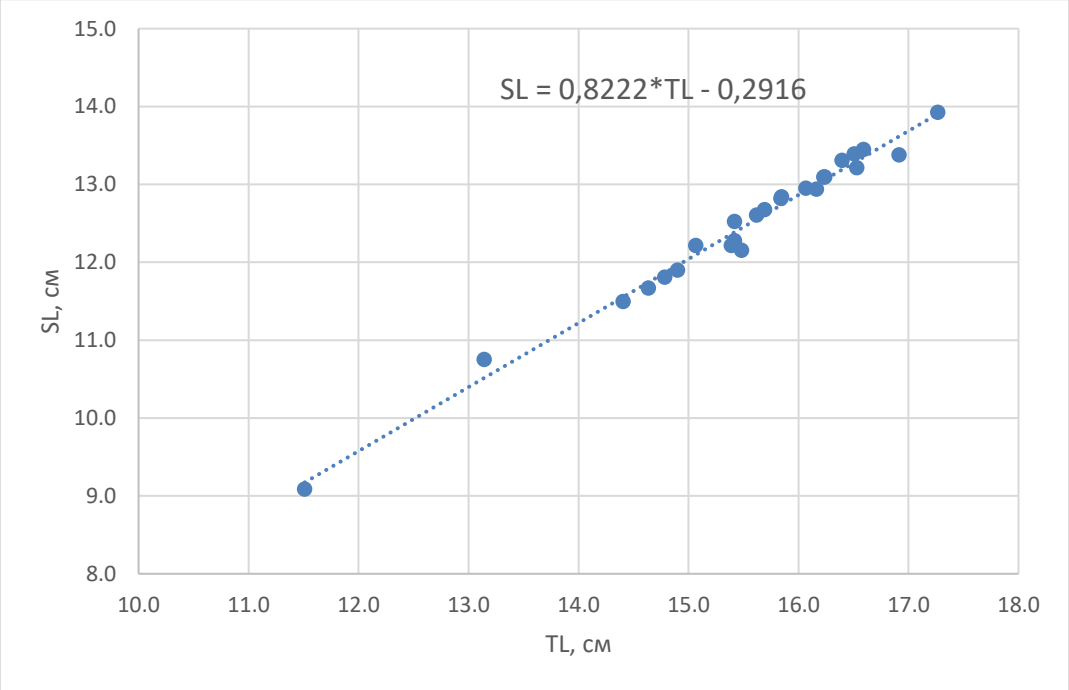
Outcomes

In our sample, carp have 18-19 rays in the dorsal fin IV, and 5 rays in the anal III. There are 37 - 39 scales in the lateral line. The first gill arch has 26-28 stamens. Pharyngeal teeth are three-row 1.1.3-3.1.1. There are two pairs of antennae on the upper lip. A cultivated carp, even at the age of one year, already has a fairly tall body. Lower mouth. In the dorsal and anal fins, there is a serrated bony ray. Note that 10 individuals from the sample had a scaly cover known as mirror scattered carp, the rest had their entire body completely covered with large scales.

In the studied sample of one-year-old carps, there were individuals with a total length of 11.5 – 17.3 (on average 15.5) cm, a standard length of 9.1 – 13.9 (12.5) cm. The total body weight of one-year-olds was 24.0 – 97.0 (67.04) g.

A strong positive relationship (r = 0.99) was found between the standard and total body length of one-year-old carps, which is reliably characterized by the regression equation: SL = 0.8222 * TL – 0.2916 (Fig. 2)

A strong positive relationship (r = 0.87) was also found between total body weight and body length even within a generation, characterized by the equation of regression of the power function: W = 0.396*SL2.9374 (Fig. 3).



Rice. 2. Dependence of the standard length on the total body length of one-year-old carp

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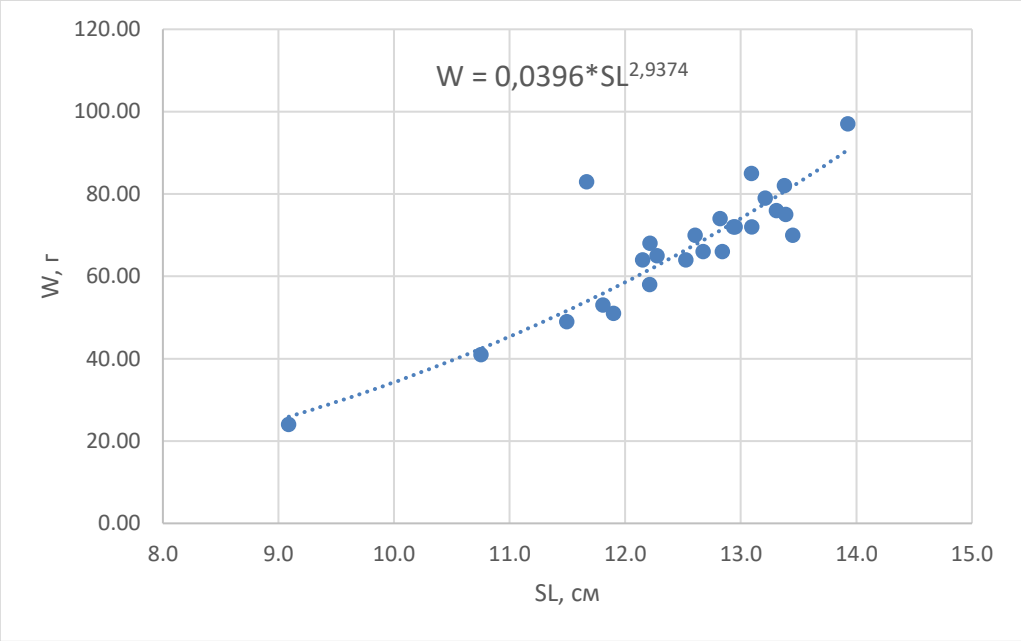

Rice. 3. Dependence of total body weight and standard body length of one-year-old carp

Indices of plastic traits of one-year-old carp according to the classical scheme of carp measurements are presented in Table 1, signs of geometric morphometry ("truss-protocol") – in Table 1.

Table 1 Indices of plastic traits of carp yearlings according to the classical scheme of carp measurements

Index	*Min - Max.*	*Xсред. ± Sx*	*Cv, %*
Total body length (TL)	122,2 – 127,4	124,50 ± 0,26	1,04
Body length	65,1 – 78,4	70,53 ± 0,56	3,97
Snout length	7,2 – 14,2	10,22 ± 0,38	18,45
Eye diameter	5,1 – 7,2	6,10 ± 0,12	10,10
Postorbital region of the head	10,9 – 17,5	13,88 ± 0,34	12,09
Head length	22,5 – 34,4	29,06 ± 0,58	10,02
Head height at the back of the head	18,3 – 25,4	21,99 ± 0,40	9,04
Maximum body height	35,2 – 39,9	37,17 ± 0,26	3,45
Lowest body height	12,8 – 15,6	14,18 ± 0,14	5,00
Antedorsal distance	44,0 – 52,9	46,55 ± 0,41	4,52
Postdorsal distance	8,8 – 18,5	11,28 ± 0,44	19,43
Length of the caudal stalk	6,9 – 12,4	9,59 ± 0,22	11,44
Base Length: D	37,4 – 48,6	45,84 ± 0,43	4,69
Maximum height D	13,4 – 20,0	17,06 ± 0,27	7,87
Length of base A	13,7 – 17,5	15,54 ± 0,21	6,84
Maximum height A	15,7 – 19,0	17,42 ± 0,17	4,76
Length P	18,1 – 22,3	20,65 ± 0,22	5,36
Length V	15,5 – 19,8	17,95 ± 0,19	5,25
Distance P-V	25,2 – 34,4	29,89 ± 0,43	7,26
Distance V-A	35,9 – 47,2	41,62 ± 0,61	7,28

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Table 2 Indices of plastic features of geometric morphometry of carp yearlings

Index	*Min - Max.*	*Xcpeд. ± Sx*	*Cv, %*
2-4	22,6 – 27,5	25,32 ± 0,32	6,3
4-6	24,9 – 31,8	28,11 ± 0,39	7,0
6-8	43,4 – 48,1	45,56 ± 0,24	2,6
8-10	5,5 – 11,3	7,98 ± 0,33	20,4
9-10	13,4 – 17,2	15,31 ± 0,19	6,1
7-9	7,0 – 12,6	9,25 ± 0,30	16,4
5-7	10,0 – 16,6	13,47 ± 0,38	14,0
3-5	26,8 – 35,02	29,36 ± 0,38	6,5
1-3	24,1 – 32,8	28,62 ± 0,39	6,8
1-2	16,7 – 25,3	22,07 ± 0,39	8,9
3-4	36,5 - 43,2	40,69 ± 0,32	3,9
2-3	43,1 – 52,2	49,82 ± 0,36	3,6
1-4	20,2 – 28,0	25,42 ± 0,32	6,4
5-6	36,1 – 67,5	45,7 ± 1,11	12,1
3-6	35,1 – 47,4	37,40 ± 0,49	6,5
4-5	59,6 – 66,4	63,12 ± 0,35	2,8
7-8	13,6 – 16,7	15,20 ± 0,17	5,5
5-8	9,3 – 27,4	24,65 ± 0,71	14,5
6-7	49,3 – 55,1	51,71 ± 0,29	2,8
7-10	15,5 – 19,4	17,50 ± 0,21	5,9
8-9	14,6 – 18,7	16,54 ± 0,20	6,0

Discussion

The wild form of the species (carp) lived in the Aral Sea, where, as the water salinized into the species, it disappeared from the ichthyofauna of this reservoir, and was also found in different types of plain water bodies in the basins of the Amu Darya, Syr Darya, Kashkadarya, and Zarafshan basins (Berg, 1949). But, in the early 1960s, for the needs of the development of pond fish farming, the Ukrainian scaly carp was brought to Uzbekistan in the middle reaches of the Syr Darya, the factory mass reproduction of this object was mastered, the offspring of the carp were regularly stocked in all regions of Uzbekistan, as well as in plain reservoirs and lakes accumulating drainage waters. The high-backed cultivated carp has adapted well to the conditions of natural water bodies and has replaced the wild carp everywhere (Salikhov et al., 2001).

In the regions of natural distribution of the species, the following meristic indicators were noted: D III – IV 15 – 22, A III – IV 5 – 6, in the lateral line 32 – 41 scales, on the first gill arch 21 – 29 stamens (Atlas ..., 2003).

In the reservoirs of Uzbekistan, the following meristic indicators were noted in the carp: in the dorsal fin III-IV 18-19, in the anal III 5 rays. In the lateral line, scaly forms have

36-40 scales. The first gill arch has 25-30 stamens. Pharyngeal teeth are three-row 1.1.3-3.1.1. Our data fits well into these ranges of indicators.

Carp is included in the list of the most cultivated aquaculture objects in the world (FAO, 2020). And in Uzbekistan, it ranks second after silver carp (*Hypophthalmichthys molitrix*) as an object of fish farming. Since the early 1960s, when the Ukrainian scaly carp was introduced in Uzbekistan, artificial reproduction of the species has been carried out, breeding mainly uses 4-5-year-old fish, i.e. more than 10 complete generations have passed in new conditions for the species. Like other objects that are kept in open conditions, the anthropogenic factor is increasingly affected. For such an important object, it is necessary to monitor biological characteristics and their changes, about which information is provided by morphological indicators controlled by polygenes. Morphometric indicators reflect not only genetic conditions, but also the adaptive potential of species. It is important to record phenotypic changes in the species in the process of their ontogenesis, as, for example, Chinese specialists do in relation to silver carp and other valuable species (Cao, 2008; Yu et al., 2010). In Uzbekistan, despite the value of carp for industry, practically no morphological studies have been carried out.

It should be noted that we have analyzed one-year-old carp (in fish farming, this is a valuable age group known as fish planting material. From a biological point of view, these are immature generations of carp in local conditions.

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