

MAINTENANCE CONDITION OF SOME CYPRINID SPECIES GROWN IN A SUPERVISED SYSTEM

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Abstract

The researches from the present study had as main objective the determination of the maintenance condition for three cyprinid species (*Cyprinus carpio*, *Carassius auratus gibelio* and *Aristichthys nobilis*) of two summer-old from a systematic farm of Iasi County. For this we referred to the calculating on the values of height, fattening, quality and fleshy indices, which permit a subsequent morphological and physiological characterization of a fish population, from a certain exploitation or geographical area. As regards the methods of work, it were used the classical variants applied in the selection and melioration practice at fish, all the obtained results being rigorous analyzed and interpreted statistically, referring to the calculation of a big number of statistical parameters. Thus we can mention, on the basis of the average confidence interval limits that the corporal weight varies between 371.409-622.19 g in common carp, 131.263-263.936 g in Prussian carp and 648.111-955.888 g in bighead carp. Kiselev index values (1.09 in Prussian carp, 1.13 in common carp and 1.47 in bighead carp) and that of the profile one indicate a higher expressivity and a harmonious degree of development for Prussian carp and common carp, whereas the Fulton coefficient and the fleshy index classifies the bighead carp and the common carp on the first places as to the most accentuated degree of fattening, as well as the biggest percent weight of the head versus the standard length of the body.

Key words: cyprinids, bodily indices, systematic farm

INTRODUCTION

Cypriniculture is the branch of pisciculture dealing with the growth of fish species from the *Cyprinidae* family, first represented by the common carp (*Cyprinus carpio*), followed by the Prussian carp (*Carassius auratus gibelio*) - among the autochthonous species - as well as by the acclimatized Asian cyprinids (*Aristichthys nobilis*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*).

As known, common carp is a precocious species, characterized by a rapid growing rhythm, by a high valorization of the additional food it gets, and also by its relatively high resistance to parasitary diseases. It gets its food by scraping the bottom of the water up to a 20 cm depth, its basic menu including larvae, worms, shells, plants etc.; however, the big individuals, the protein necessary of which is probably higher, also eat small fish, frogs or crawfish once, as a general rule, common carp eats an amount of food equal to twice its weight [1].

Prussian carp is one of the extra fish in the cypriniculture ponds farming, together with autochthonous common carp, a culture system meant at increasing production per unit of surface, which results in cost lowering. It is a cyprinid species present in almost all piscicultural basins and, in spite of the periods in which systematic measures had been taken for its combat and elimination from ponds (once it is also a fodder-consumer), the species did not only survived, it even became more prosperous [10].

By its high prolificity, Prussian carp is actively multiplying, thus becoming a serious competitor to the food provided for common carp. Nevertheless, Prussian carp evidences a slower growing rhythm, comparatively with cultured common carp, which justifies once more the measures taken for restricting its extended presence in the pisciculture of our country, if considering first that it represent once of the cyprinid species with a low ratio of artificial food valorization [6].

Bighead carp is largely considered in literature as a predominantly zooplanktonophagous species, especially in situations in which the zooplankton biomass is abundant; however, when the zooplanktonic concentrations are reduced, it may also consume phytoplankton, even if to a lower extent [3, 4, 5].

The present study has determined the values of some bodily indices and the coefficients of major importance in fish selection and melioration, by means of which the maintenance conditions and physiological comfort of the piscicultural population under investigation may be also established.

MATERIALS AND METHOD

The experiments were performed on 100, two summer-old individuals of *Cyprinus carpio*, *Carassius auratus gibelio* and *Aristichthys nobilis*, each from the Piscicultural Farm of Vlădeni, district of Iași. In a first stage, morphological characterization of the piscicultural population involved determination of the main biometric (standard length, length of the head, height and circumference) and gravimetric (bodily weight) parameters, the obtained data being statistically processed [13]. There followed calculation of some bodily indices and coefficients (the profile index, the Kiselev index, the fleshy index and the Fulton coefficient), which provide information on the maintenance and health condition of a piscicultural population [6, 11].

RESULTS AND DISCUSSION

The present study analyzed the morphological characteristics of three, two summer-old, cyprinid species (*Cyprinus carpio*, *Carassius auratus gibelio* and *Aristichthys nobilis*) from the systematic farm of Vlădeni, Iași district. Consequently, a first objective was to determine the value of the main statistical indices (average value, error and standard deviation of the average value, the median, variance, range, confidence level, variation and precision coefficient of the average value) for each variable in part.

As to the standard length of the body, bighead carp registers the highest mean values (34.8 cm), followed by common carp (26 cm) and Prussian carp (18.8 cm). The maximum thresholds of variance and of standard deviation were recorded for bighead carp (3.075, respectively, 1.753), while the minimum ones - in common carp (0.375, respectively, 0.612).

Starting from the mean values and from standard deviation there have been calculated, with a probability of 95% ($\alpha = 0.05$), the limits of the confidence intervals over which each bodily variable in part varies. Consequently, as also evidenced in Table I, standard length is between 25.239 and 26.76 cm in common carp, between 16.807 - 20.792 cm in Prussian carp and between 32.622 and 36.977 cm in bighead carp, respectively.

Table I. Values of the main statistical indices of standard length in common carp, Prussian carp and bighead carp

Statistical indices	Species		
	Common carp	Prussian carp	Bighead carp
Average	26	18.8	34.8
Standard error	0.27	0.717	0.784
Median	26	18	34.5
Standard deviation	0.612	1.604	1.753
Variance	0.375	2.575	3.075
Range	1.5	4	4.5
Minimum	25.5	17.5	32.5
Maximum	27	21.5	37
Confidence level (95%)	0.76	1.992	2.177
Upper limit	26.76	20.792	36.977
Lower limit	25.239	16.807	32.622
VC%	2.053	8.535	5.038
m%	1.053	3.817	2.253

VC% = average variation coefficient, m% = average precision coefficient

The average length of the head (Table II) takes highest values in the bighead carp (11.5 cm), once known the fact that, out of all

species of Asian cyprinids, *Aristichthys nobilis* attains the largest sizes of this variable [6, 12].

Table II. Values of the main statistical indices of head length in common carp, Prussian carp and bighead carp

Statistical indices	Species		
	Common carp	Prussian carp	Bighead carp
Average	8.4	4.7	11.5
Standard error	0.187	0.2	0.353
Median	8.5	4.5	11.5
Standard deviation	0.418	0.447	0.79
Variance	0.175	0.2	0.625
Range	1	1	2
Minimum	8	4.5	10.5
Maximum	9	5.5	12.5
Confidence level (95%)	0.519	0.555	0.981
Upper limit	8.919	5.255	12.481
Lower limit	7.881	4.144	10.518
VC%	4.98	9.515	6.874
m%	2.227	4.255	3.074

VC% = average variation coefficient, m% = average precision coefficient

The ratio between the length of the head and the standard length of the body evidences the fact that, in the case of *Cyprinus carpio* and *Aristichthys nobilis* species, it is of 3.09 and 3.02, respectively, while in *Carassius auratus gibelio*, the ratio is obviously in favor of standard length - i.e., 4 times larger than the size of the head (18.8 cm, respectively, 4.7 cm).

As illustrated in Table III, maximum bodily height attains approximately equal

values in common carp (11.2 cm) and bighead carp (11.5 cm), while the one recorded in the Prussian carp is much lower (8 cm). The highest variation coefficient was registered in the case of Prussian carp (10.825%), while the highest values of variance (0.875) and of standard deviation (0.935) occurred in the individuals of the *Aristichthys nobilis* species.

Table III. Values of the main statistical indices of height in common carp, Prussian carp and bighead carp

Statistical indices	Species		
	Common carp	Prussian carp	Bighead carp
Average	11.2	8	11.5
Standard error	0.406	0.387	0.418
Median	11	7.5	11
Standard deviation	0.908	0.866	0.935
Variance	0.825	0.75	0.875
Range	2.5	2	2
Minimum	10	7.5	10.5
Maximum	12.5	9.5	12.5
Confidence level (95%)	1.127	1.075	1.161
Upper limit	12.327	9.075	12.661
Lower limit	10.072	6.924	10.338
VC%	8.109	10.825	8.134
m%	3.626	4.841	3.637

VC% = average variation coefficient, m% = average precision coefficient

As to the average circumference of the two summer-old representatives of common carp, Prussian carp and bighead carp, the assertion may be made, with a 95% probability, that it oscillates between 20.215 -

25.584 cm in *Cyprinus carpio*, between 15.522 - 18.877 cm in *Carassius auratus gibelio* and between 21.256 and 25.823 cm, respectively, in *Aristichthys nobilis* (Table IV).

Table IV. Values of the main statistical indices of circumference in common carp, Prussian carp and bighead carp

Statistical indices	Species		
	Common carp	Prussian carp	Bighead carp
Average	22.9	17.2	23.54
Standard error	0.966	0.604	0.822
Median	23	17	23
Standard deviation	2.162	1.35	1.839
Variance	4.675	1.825	3.383
Range	5	3.5	4.7
Minimum	20.5	16	21.5
Maximum	25.5	19.5	26.2
Confidence level (95%)	2.684	1.677	2.283
Upper limit	25.584	18.877	25.823
Lower limit	20.215	15.522	21.256
VC%	9.441	7.854	7.813
m%	4.222	3.512	3.494

VC% = average variation coefficient, m% = average precision coefficient

Literature data show that, when large amounts of food are available, an intense growth rhythm is registered in all species here under study, the bodily weight of the two summer-old individuals oscillating between 400 - 500 g in common carp, 200 g in Prussian carp and 900 g, respectively, in bighead carp [6, 8, 9]. As observed from the

data listed in the Table below, the *Aristichthys nobilis* species showed a higher growing potential than the other two, up to average values of 802 g, bodily weight ranging, in all three species under investigation, within the normal variation intervals given in the literature for this stage of development.

Table V. Values of the main statistical indices of weight in common carp, Prussian carp and bighead carp

Statistical indices	Species		
	Common carp	Prussian carp	Bighead carp
Average	496.8	197.6	802
Standard error	45.162	23.892	55.426
Median	480	180	769
Standard deviation	100.986	53.425	123.937
Variance	10198.2	2854.3	15360.5
Range	258	134	310
Minimum	379	156	640
Maximum	637	290	950
Confidence level (95%)	125.39	66.336	153.888
Upper limit	622.19	263.936	955.888
Lower limit	371.409	131.263	648.111
VC%	20.327	27.037	15.453
m%	9.09	12.091	6.911

VC% = average variation coefficient, m% = average precision coefficient

The maintenance conditions of a piscicultural population may be established by means of certain indices and bodily coefficients

(the profile index, the Kiselev index, the fleshy index and the Fulton coefficient), which may be used for a morphological characterization of a

piscicultural population, as well as for estimating the extent of fish physiological control.

The profile index, also defined as the height index, evidences the bodily form of

the fish, thus permitting their classification into a certain profile type, on also indicating the extent of harmonious development.

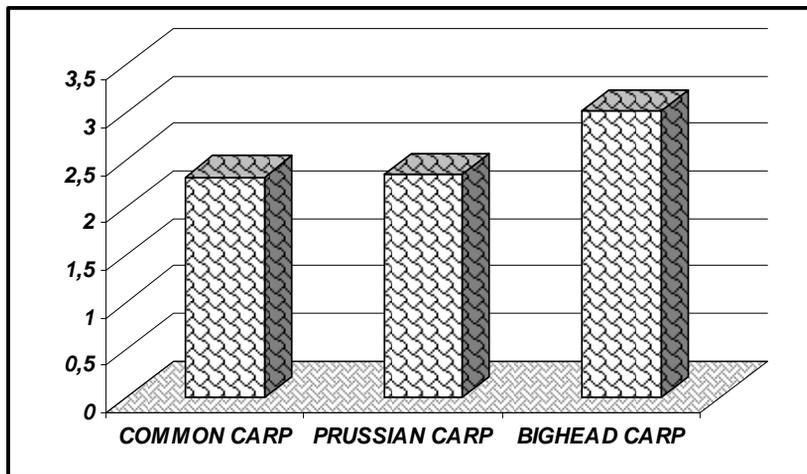


Fig.1. Profile index in representatives of two summer-old common carp, Prussian carp and bighead carp

Figure 1 shows that the individuals belonging to the *Carassius auratus gibelio* species have the most slender shape (2.32), no significant differences being recorded - from this point of view - between common carp and Prussian carp, while a reverse situation is to be noticed in the case of bighead carp (3.02).

The quality index may be established from the Kiselev relation, providing

information on the quality of the fish, piscicultural selection usually preferring the individuals with the lowest value of this parameter. The most expressive corpulence was recorded for the *Carassius auratus gibelio* species (Fig.2), the average values of the ratio between standard length and bodily circumference attaining the lowest order of magnitude (1.09).

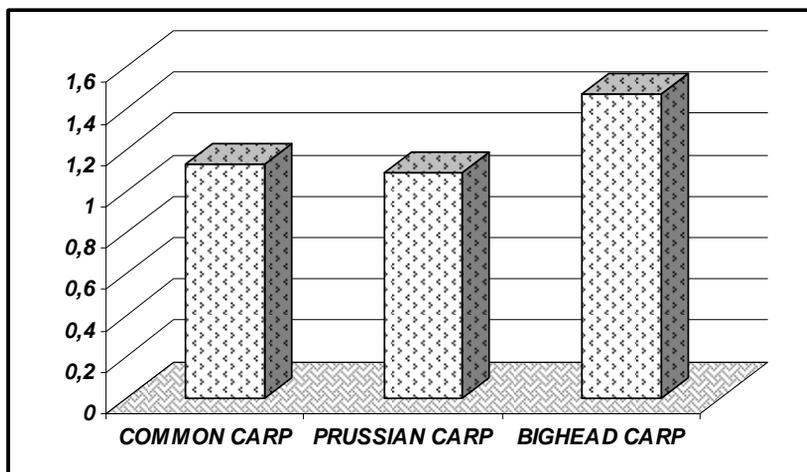


Fig. 2. Kiselev index in representatives of two summer-old common carp, Prussian carp and bighead carp

Figure 3 provides a graphical comparative representation of the average values of the fattening index, known as reflecting the maintenance conditions of the fish in an aquatic basin, established on the basis of the Fulton relation. Consequently, the higher are the values of the fattening index, the better developed is the fish. Biometric analysis showed that the best "general condition" of the organism was noticed in the bighead carp, seen as the most

vigorous one while, on the contrary, the fattening index recorded for the *Carassius auratus gibelio* population represents only 63.97% of the value recorded for *Aristichthys nobilis*. In common carp, the Fulton coefficient takes values close to 3, the literature of the field indicating, in this development stage, a maximum value of 3.33 for this morpho-physiological parameter [2, 7].

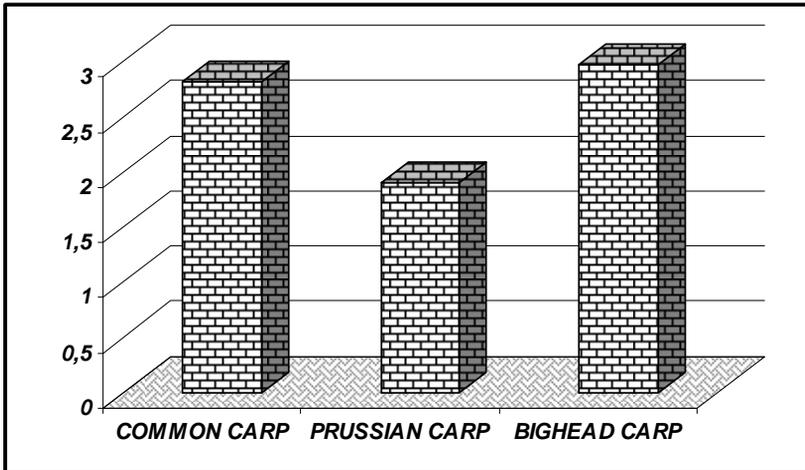


Fig.3. Fulton coefficient in representatives of two summer-old common carp, Prussian carp and bighead carp

A last objective of the present study was to determine the fleshy index, expressing the percent weight of the head or of the caudal peduncle from the standard length of the body - the lower is the threshold attained, the higher is the fleshy index of the fish under

study. Similarly with the previously described case, the fleshy index takes higher values in bighead carp and common carp (33.04% and 32.3%, respectively) while, in Prussian carp, the head represents only 25% of bodily length (Fig.4).

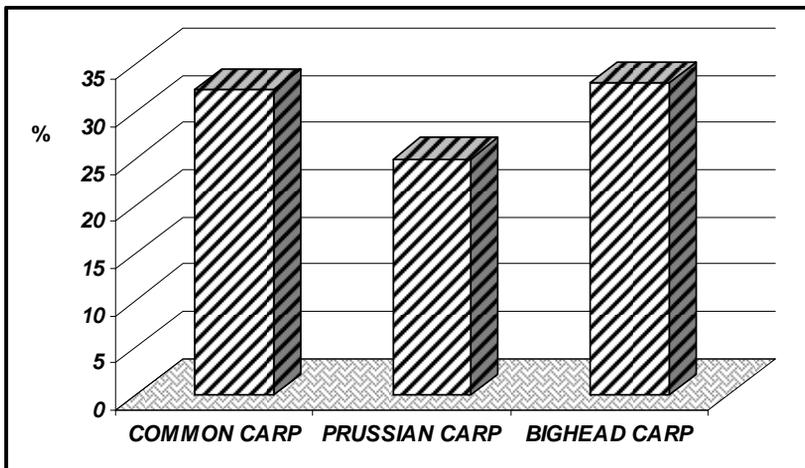


Fig.4. Fleshy index in representatives of two summer-old common carp, Prussian carp and bighead carp

CONCLUSIONS

Analysis of the main morpho-physiological indices and coefficients led to the conclusion that the three species under investigation evidence a good maintenance condition and a harmonious development, especially in the representatives of *Aristichthys nobilis* and *Cyprinus carpio* species, which is closely correlated with the trophic spectrum and growth rhythm of each species in part.

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