

GROWTH AND FECUNDITY OF *CARASSIUS AURATUS* GIBELIO BLOCH, 1783 IN MRTVA TISZA

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Abstract

The growth and the fecundity of the *Carassius auratus gibelio* in Mrtva Tisza, the former meander, cut off at land reclamation from the main flow of the Tisza river have been analyzed. The material has been gathered within 1983 and 1984. The absolute growth is higher with the 1984 specimens, but the relative growth shown the equal growth tempo. Comparing this specimen with the specimens from the Tisza, Szava and Danube rivers, Palić Lake, west Siberia and Moscow Lake District waters, the specimen from Mrtva Tisza has shown the higher growth tempo, while compared with the specimen from Kazakstan and Semipalatinsk District the growth tempo is lower. The speed and the constant growth in Mrtva Tisza during tested period have shown the uniform decrease. The absolute fecundity has shown the tendency of increase with the body mass increase, standard length and age. The relative fecundity has shown the lower dependence compared with these three biological parametres. The average values for the absolute and the relative fecundity of the separate categories according to the body mass, length, and age of the specimens from Mrtva Tisza have had the higher values from the values in the mentioned literature, due to the more favourite ecological conditions, but first of all due to the nourishment.

Introduction

Mrtva Tisza (Bačko Gradište—Čurug) artificially cut off meander is located on the right bank of the Tisza river. It was cut in 1858 (BUKUROV 1948). It is 23 km long, about 120 m wide and the depth is from 2 m to 12 m, 4 m in average. The total surface of the water glass is 350 ha. The bank is covered with the reed.

The ichthyofauna of this stagnant tributary was examined by GRGINČEVIĆ 1974, 1977, RISTIĆ 1977; giving taxonomy and ecology of some fish species. *C. auratus gibelio*, as the introduced species, in this locality have not arisen the interest of the explorers up to the present. MALETIN *et al.* 1981; PUJIN *et al.* 1981; MALETIN *et al.* 1982, PUJIN *et al.* 1982, BUDAKOV *et al.* 1983a, BUDAKOV *et al.* 1983b, BUDAKOV *et al.* 1983c, BUDAKOV *et al.* 1984, BUDAKOV *et al.* MALETIN 1984, have examined the taxonomy and ecology of this species in different waters of Vojvodina.

The aim of the work has been to explore the growth tempo and the fecundity of this alochtone species whose expansion on the territory of Vojvodina has been decreasing mildly.

Materials and Methods

The material was gathered within 1983 and 1984. One hundred and sixty individuals all together have been analyzed, 88 individuals in 1983 and 72 individuals in 1984. The length of the body without caudal fin (standard length) has been measured, and to determine the age the scales above the lateral line in the part of the dorsal fin have been taken. The scales have served both for the reconstruction of the length growth by the reciprocal reading on the basis of the lateral radius according to Чугунова 1959, as per the following formula:

$$l_n = \frac{s_n}{s} l$$

The growth speed has been calculated according to the following formula:

$$C = \frac{\log l_2 - \log l_1}{0.4343 (t_2 - t_1)}$$

as well as the growth constant per Шмальгаузен quoted by Чугунова 1959, as per following formula

$$K = C \frac{t_1 + t_2}{2}$$

The absolute and relative fecundity have been calculated with totally 115 female fish, and out of that number 44 individuals were gathered in 1983 and 71 within 1984. These values have been expressed with regard to the body mass, standard length and age.

Results and Discussion

Growth

C. auratus gibelio in the tested material belongs to the age classes from 3+ to 7+ (1983 specimen) and from 3+ to 6+ (1984 specimen). The calculated values of standard length in separate years of life are higher with 1984 specimen with regard to 1983 specimen. The absolute growth is higher in 1984 as well as up to age 4+, while with older age classes it has been lower. The relative growth, however, has the similar values in the tested years up to 5+ of age (Table 1, Fig 1).

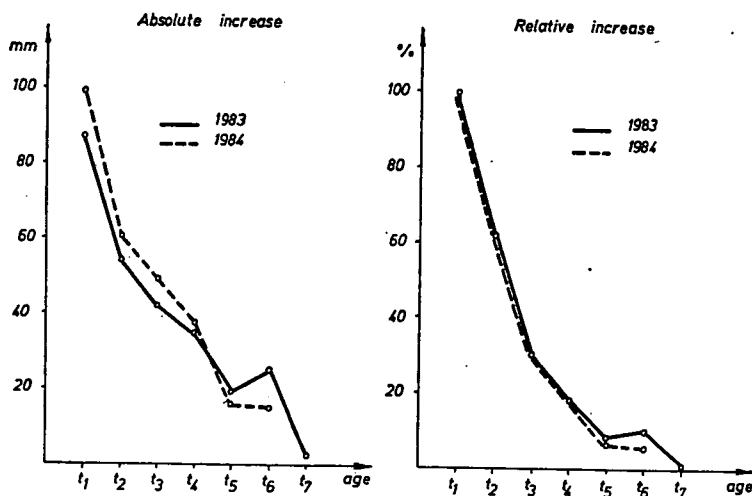


Fig. 1. The growth tempo of *C. auratus gibelio* in Mrtva Tisza

The growth of the specimens from Mrtva Tisza compared with those from the Tisza, the Sava and the Danube rivers has been considerably higher (BUDAKOV et al., 1979) as well as compared with specimens from Palić Lake (MALETIN et BUDAKOV 1983), while compared with regard to the specimens from Ludoš it has been approximately equal (PUJIN et BUDAKOV 1979, MALETIN et BUDAKOV 1983). The better growth of *C. auratus gibelio* from Mrtva Tisza with regard to the Tisza, the Szava, the Danube rivers has been due to the higher degree of the trophicity of this ecological system (RISTIĆ et al. 1974). In comparison with specimens from USSR waters accord-

Table 1. Length growth of *C. auratus gibelio* in Mrtva Tisza (in mm)

Growth	n	1 ₁	1 ₂	1 ₃	1 ₄	1 ₅	1 ₆	1 ₇
1983								
3+	16	87,57	141,49	179,43				
4+	37	87,17	145,48	191,03	224,37			
5+	32	87,32	138,42	179,86	213,31	238,20		
6+	2	91,45	141,27	187,38	223,69	254,43	277,61	
7+	1	83,33	116,67	150,00	183,33	216,67	250,00	266,67
M	88	87,32	141,71	184,31	218,86	238,51	263,80	266,67
Absolute increase		54,39	42,60	34,55	19,65	25,29	2,87	
Relative increase (%)		62,29	30,06	18,74	8,98	10,60	1,09	
1984								
3+	3	117,30	168,71	226,67				
4+	38	102,52	165,67	215,60	255,94			
5+	25	93,81	152,44	198,87	324,60	263,65		
6+	6	88,94	146,96	191,27	228,15	253,77	276,82	
M	72	98,98	159,64	208,22	245,79	261,74	276,82	
Absolute increase		60,66	48,58	37,57	15,95	15,08		
Relative increase (%)		61,28	30,43	18,04	6,49	5,76		

ding to Кривошеков (1953) and Дмитриева (1957) we can state the growth in Mrtva Tisza has been better, while Серов (1959) and Соколов и Новиков (1973) quote the higher values.

The speed and constant growth during the both tested years have shown the uniform decrease (Table 2). The values are similar to those of Ludoš (MALETIN et

Table 2. Speed and constant of growth of *C. auratus gibelio* in Mrtva Tisza

Growth	1983			1984		
	M	C	K	M	C	K
1+	87,32	—	—	96,98	—	—
2+	141,72	0,48	0,72	159,64	0,51	0,76
3+	184,31	0,26	0,65	208,22	0,28	0,70
4+	218,86	0,18	0,63	245,29	0,16	0,56
5+	238,51	0,08	0,36	261,34	0,07	0,31
6+	263,80	0,08	0,44	276,82	0,05	0,27
7+	266,67	0,01	0,06			

BUDAKOV 1983), while the values from the Tisza, the Sava and the Danube rivers (BUDAKOV et al. 1979) and Ludoš (PUJIN et BUDAKOV 1979) are considerably lower.

Fecundity

The absolute fecundity has been from 11 968 to 360 672, and the relative fecundity has been from 92 to 440 eggs. The values of the absolute fecundity have been increased with the increase of the body mass up to 0—1000g, and then slight decrease can be perceived, while the relative fecundity has been increased with the body mass growth up to 800 g, and then it has been decreased (Table 3, Fig. 2).

Table 3. Absolute and relative fecundity of *C. auratus gibelio* from Mrtva Tisa with regard to body mass (in g)

Body mass	n	Absolute fecundity			Relative fecundity		
		\bar{x}	min.	max.	\bar{x}	min.	max.
0—200	8	21 011	11 968	34 200	150	92	285
201—400	3	61 745	36 890	101 088	213	176	259
401—600	32	110 291	60 656	174 506	219	110	320
601—800	33	207 145	124 920	303 322	275	159	402
801—1000	37	235 778	141 772	360 672	267	171	440
1001—1300	2	230 007	209 696	250 318	206	169	243

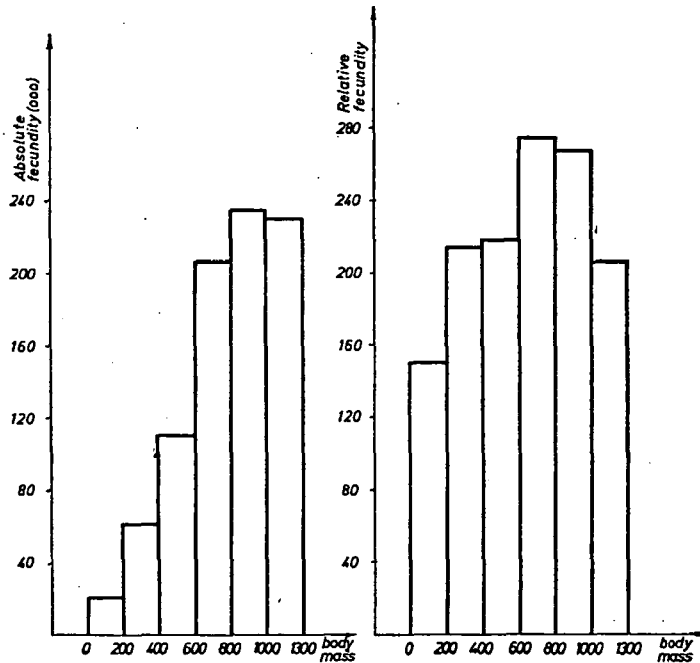


Fig. 2. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisa in dependence on the body mass (g)

The average values for the separate mass groups are higher with regard to the average values of the individuals from the Tisza, the Sava, and the Danube rivers (MALETIN et al. 1979).

Regarding the standard length (Table 4, Fig 3) the absolute fecundity is in the positive correlatin as well, while the relative one has not shown any direct dependence. These values as well are higher with regard to the specimens from the Tisza, the Sava and the Danube rivers. Кривошеков (1953) quoted the increase the absolute fecundity with regard to the standard length increase, but these values are lower regarding the values for Mrtva Tisza.

Table 4. Absolute and relative fecunditi of *C. auratus gibelio* from Mrtva Tisza with regard to the standard length (in mm)

Standard length	n	Absolute fecundity			Relative fecundity		
		\bar{x}	min.	max.	\bar{x}	min.	max.
100—150	3	19 833	11 968	34 200	172	109	285
151—200	7	34 677	14 801	72 545	152	92	205
201—250	29	106 546	60 656	170 912	217	110	314
251—300	68	215 025	102 120	360 672	270	159	440
301—350	8	236 049	209 496	309 019	243	169	315

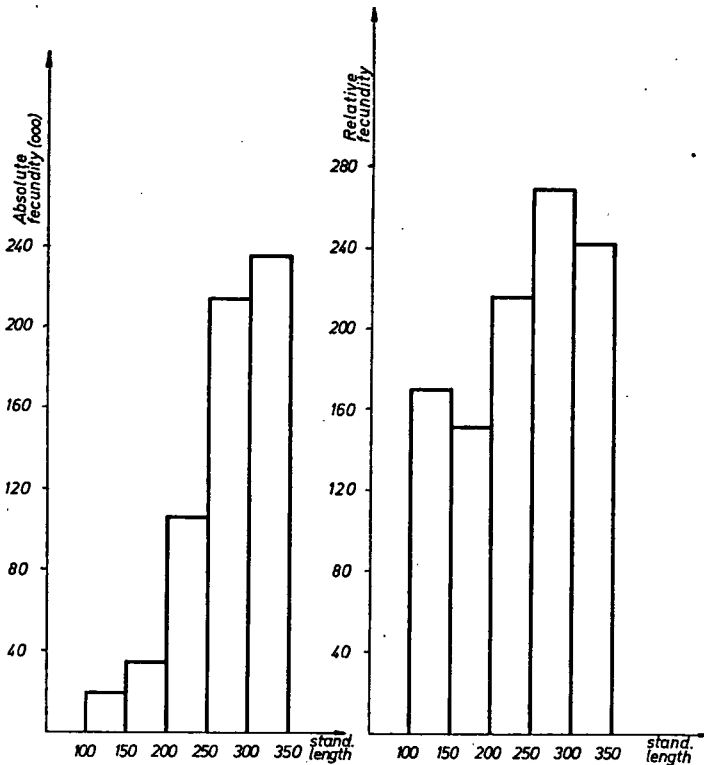


Fig. 3. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisza in dependence on the standard length (mm)

Compared to the age the absolute and relative fecundity have shown the tendency of growth, although the lower values have been noted with the separate age categories (Table 5, Fig. 4).

Table 5. Absolute and relative fecundity of *C. auratus gibelio* from Mrtva Tisza with regard to the age

Age	n	Absolute fecundity			Relative fecundity		
		\bar{x}	min.	max.	\bar{x}	min.	max.
3+	14	84 977	11 968	225 231	212	92	331
4+	54	191 146	13 332	360 672	259	121	440
5+	39	168 164	22 545	309 019	234	110	381
6+	7	216 242	124 920	250 318	247	159	286
7+	1	268 520	—	—	353	—	—

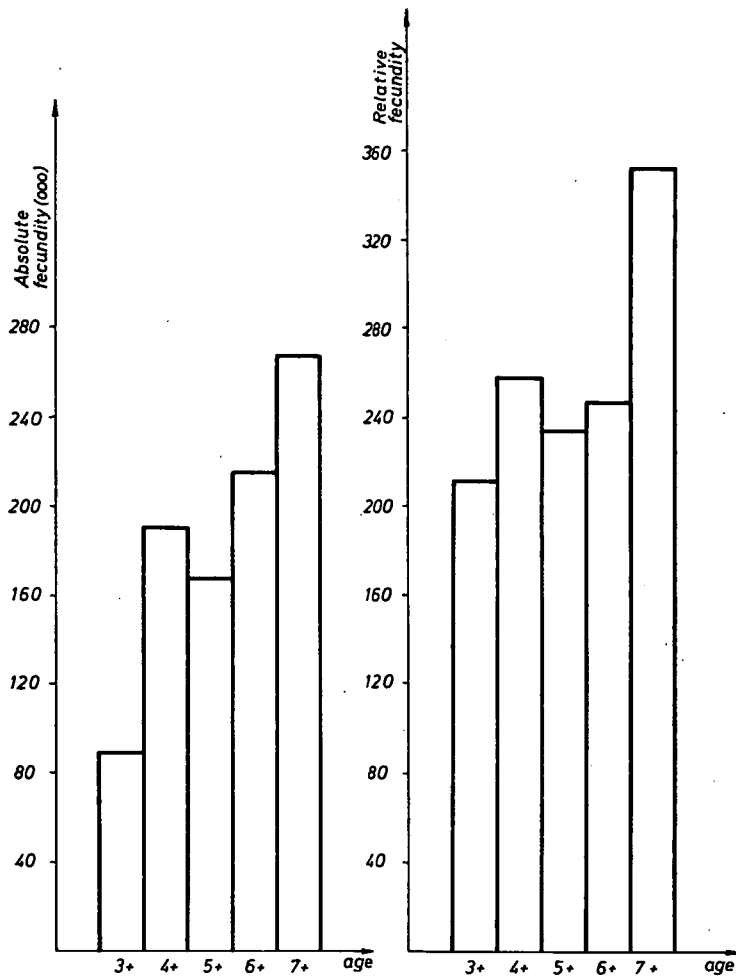


Fig. 4. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisza in dependence on the age

These values have been considerably higher compared to the values of the Tisza, the Sava, and the Danube rivers specimens. Кривошеков 1953 stated as well the increase of the absolute fecundity from 3+ to 5+, but the values have been considerably lower. The better fecundity has been together with the growth the consequence of the favourite ecological conditions.

Conclusion

The growth and the fecundity of *Carassius auratus gibelio* in Mrtva Tisza within 1983 and 1984 have been analyzed.

The absolute growth have been higher with the specimens out of 1984, but the relative growth shows the equal growth tempo. Comparing the specimens from the Tisza, the Sava and the Danube rivers and from Palić Lake, the West Siberia rivers and the Moscow Lake Distric the specimen from Mrtva Tisza have shown the higher growth tempo, while the growth tempo has been lower when compared to the specimens from the Kazahstan and Semipalatinsk District waters. The speed and the constant growth in Mrtva Tisza during tested period have shown the uniform decrease.

The absolute fecundity have shown the increase tendency with increase of body mass, standard length and age. The relative fecundity has shown the lower dependence with regard to these three biological parameters. The average values for the relative and absolute fecundity of the separate body mass and age categories of the specimens from Mrtva Tisza have been higher than those in the mentioned literature, being the consequence of the favourite ecological conditions, first of all nourishment.

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A Holt-Tiszai *Carassius gibelio* Bloch, 1783 növekedése és termékenysége

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Kivonat

A szerzők az 1983/84-ben a Holt-Tiszából begyűjtött *Carassius auratus gibelio* növekedését és termékenységét vizsgálták. Megállapítást nyert, hogy az abszolút növekedés 1984-ben nagyobb, annak ellenére, hogy a viszonylagos növekedés üteme egybevágó. Továbbá a Holt-Tiszai példányok növekedési üteme nagyobb értékeket mutat, összevetve a Tisza, Száva, Duna, Palicsi-tó, valamint a nyugat Szibéria és a Moszkvai térség tavaival. A Kazahsztáni és a Szemipalatinusi térséghez viszonyítva ez az érték kisebb. A Holt-Tiszai példányok növekedési állandója és üteme egyenletes csökkenést mutat. Az abszolút termékenység a növekedéssel, súlygyarapodással, korossággal együtt növekszik, míg a relatív termékenység kevésbé függ az említett biológiai paraméterektől. A Holt-Tiszai példányok termékenységének abszolút és relatív átlag értékei nagyobbak a felhasznált irodaloméhoz viszonyítva, ami a kedvezőbb ökológiai tényezőknek, elsősorban a táplálkozási adottságoknak tulajdonítható.

Развитие и плодовитость *Carassius auratus gibelio* Bloch, 1783 в Мертвой Тисе

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Резюме

На основании собранных в 1983—84 годах материалов авторы изучили рост и плодовитость *Carassius auratus gibelio* в Мертвой Тисе. Выяснилось, что в 1984 году абсолютный его рост высокий, несмотря на то, что темп относительного прироста ровный. Дальней-

шие исследования показали, что темпы роста популяции в Мертвой Тисе выше чем в рр. Савы, Дуная, озера Палич, а также озер Западной Сибири и озер, расположенных в окрестностях Москвы. Однако, в сравнении с озерами Казахстана и Семипалатинска являются меньшими. Темпы роста популяций, живущих в Мертвой Тисе, постепенно снижаются.

Абсолютная плодовитость растет вместе с развитием, возрастом и прибавлением веса, причем релятивная плодовитость меньше зависит от уповянутых биологических параметров.

Результаты абсолютной и релятивной плодовитости представителей Мертвой Тисы выше результатов, приведенных в литературных источниках, что показывает на более благоприятные в настоящее время экологические условия и в первую очередь на питательную среду.

Rast i Plodnost *Carassius auratus gibelio* Bloch, 1783 U Mrtvoj Tisi

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Abstrakt

Analizirani su rast i plodnost *Carassius auratus gibelio* u Mrtvoj Tisi, bivšem meandru, koji j. melioracijom odsečen od glavnog toka reke Tise. Materijal je sakupljen u toka 1983. i 1984. godine. Apsolutni prirast je veći kod primeraka iz 1984. g., no relativni prirast ukazuje na podjednak tempo rasta. U poredjenju sa uzorkom iz Tise, Save, Dunava, Palića, voda zapadnog Sibira i jezera Moskovske oblasti uzorak iz Mrve Tise pokazuje veći tempo rasta, dok je u odnosu na uzorak iz voda Kazahstana i Semipalatinske oblasti tempo rasta manji. Brzina i konstanta rasta u Mrtvoj Tisi u ispitivanom periodu pokazuju ravnomeran pad. Apsolutna plodnost pokazuje tendenciju povećanja sa porastom mase, standardne dužine i uzrasta. Relativna plodnost pokazuje manju zavisnost u odnosu na ova tri osnovna biološka parametra. Prosečne vrednosti za relativnu i apsolutnu plodnost pojedinih masenih, dužinskih i uzrasnih kategorija primeraka iz Mrtve Tise su veće od vrednosti u citiranoj literaturi, što je posledica povoljnijih ekoloških uslova, pre svega ishrane.