

FECUNDITY OF PHYTOPHIL FISH SPECIES IN "BACKWATER TISZA" (BISER ISLAND)

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Abstract. Potential fecundity was investigated in three typical phytophil fish species (*Scardinius erythrophthalmus*, *Carassius carassius* and *Carassius auratus*) and in a phytolithophil one (*Rutilus rutilus*) in Backwater Tisza during 1985-1987 period. The relationship between gonadal weight, absolute and relative fecundity in comparison to body weight, standard length and age were examined by linear regression $y=ax+b$, and were estimated by coefficient of correlation r , significance of which was tested at $p<0.01$ and $p<0.05$. It is noted that absolute fecundity and gonadal weight intensively enlarge with increase of basic biological parameters, and level of this relationship was confirmed by highly significant correlation. Relative fecundity shows weaker dependency on parameters analyzed, and stronger connection usually occurs in comparison to standard length. Absolute and relative fecundity values are within optimal range in all examined species.

Keywords: crucian and prussian carp, roach, rudd, Tisza backwater

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Introduction

Several years ichthyological investigations of this backwater in Tisza valley cover a wide range of taxonomic and ecological analysis of populations. These studies include mostly all dominant species with more or less economical value, which are - in wide biological sense - an important biotic factor in overall hydrobiocenosis. Other than a number of faunistic - taxonomic investigations (Grgincevic et al., 1987; Kostic and Maletin, 1989), the majority of examinations was mostly ecological, analyzing firstly the rate of growth and length and body weight, and secondly the fecundity and diet of the most numerous fish species in this locality (Maletin et al., 1985; Maletin and Budakov, 1986; Jovanovic et al. 1988; Maletin, 1989; Maletin and Kostic, 1989a; Maletin et al., 1989; Maletin et al., 1990).

Fecundity analysis of certain fish species was relatively neglected until recently in Backwater Tisza. Most authors today are convinced that this problem is best approached by correlation-regression analyses of basic parameters on absolute fecundity, weight, length and age of

examined specimens in certain group distances (Bastl, 1980; Petrovski and Sidorovski, 1980; Zivkov, 1983, 1984, 1985; Soric and Ilic, 1986) thus interpreted results give more real insight into the reproduction potential of certain fish population than discussing this phenomenon in comparison with gonadal and body weight only.

From the point of view of these investigations, there are very interesting data given by Triapicina, (1975), Bastl, (1977), Zivkov, (1980) and Volodin, (1981), concerning fish population in still water, reservoirs and river backwaters with hydrological regime and trophic level similar to those of our localities.

Investigations of fecundity dynamics were carried out with roach (*Rutilus rutilus*) which is strictly phytolithophylic species, as well as with rudd (*Scardinius erythrophthalmus*), crucian carp (*Carassius carassius*), and prussian carp (*Carassius auratus*), which are typical phytophlic species. All four species are dominant or subdominant in fish community of Backwater Tisza (Kostic and Maletin, 1992). Moreover, they reach very good growth in weight and length under optimal nutrient conditions and stable hydrological and oxygen regime (Maletin and Kostic, 1989b).

Material and methods

Material for these investigations was collected before spawning period during 1985-1987, with standing nets, fishing traps and electrofishing apparatus. Absolute fecundity and gonadal weight were analyzed in *R. rutilus* (26 females), *S. erythrophthalmus* (50), *C. carassius* (41) and *C. auratus* (50), in comparison to certain weight, length and age categories. For determination of age and potential fecundity, standard methods were used (Chuginova, 1959; Pravdin, 1966). Relationship between examined parameters was estimated by linear equation $y=ax+b$, and the correlation coefficient r was tested at $p<0.01$ and $p<0.05$ significance levels.

Results and discussion

The analyzed specimens of *R. rutilus* belonged to age categories of 2 to 5 years, with average body weight 8-83 g and standard length 76.5-157 mm, and were grouped to nine categories. Gonadal weight categories ranged from 0.5 to 20.7 g. Increase of average ovary weight in comparison to body weight, standard length and age (basic biological parameters) is very evident. Its rate is relatively slow, especially in comparison to the growth of length. In specimens larger than 35 g (i.e. 115 mm), gonadal weight increases rapidly. This tendency is especially obvious analysing the whole sample in correlation to age (Fig. 1). Absolute fecundity in some weight, length and age categories ranged between 1,400 and 30,000 with steady increasing tendency, and with some deviations in small-sized specimens (up to 50 g, i.e. 90 mm). In larger individuals, this increase is more expressed and correlated with gonadal increase. In contrast to these two parameters, the relative fecundity shows different tendency. Values are ranging between 175 and 355, with obvious variability. Some decrease of this parameter is noted in specimens around the center of increasing body weight, length and age. This is especially visually apparent to body weight and age. In some length categories, decrease of relative fecundity in comparison to increase of length growth can be observed.

This tendency of increase or decrease of fecundity parameters was noted in roach by Zivkov (1983 and 1985) in reservoir Batak, Bulgaria. Average absolute fecundity of roach from this Bulgarian water basin is very similar to those of specimens from Backwater Tisza. Analyzing of fecundity and sexual maturity in *R. rutilus* from Lake Dojransko jezero, Petrovski and Sidorovski

(1980) also noted an increasing tendency of absolute fecundity, and the values of relative fecundity are within the same limits established in our investigations.

Analyzing the correlation of gonadal weight, absolute and relative fecundity with the basic biological parameters, highly significant coefficients were obtained for the ovary weight and the absolute fecundity ($p<0.01$, Fig. 2), but different relationship was established in relative fecundity. In comparison to body weight and age, correlation was positive but not significant, and in comparison to the growth in length it was negative and significant ($p<0.05$). High level of significance was described between the absolute fecundity and the basic biological parameters in roach, as well as weaker one between the relative fecundity and the same parameters by the quoted authors.

Caught specimens of *S. erythrophthalmus* were 2, 3 and 4 years old. The whole sample was grouped to eleven weight and length categories ranging from 9.5 to 58 g and 78 to 129 mm respectively. Average ovary weight was 0.3 - 4.6 g. Their increase in comparison to basic biological parameters (age, body weight and standard length), has different rate for different weight and length categories. In smaller specimens (15-20 g and 85-90 mm), this growth is stepwise. A bit less relative gonadal weight appears in the categories of 20-25 g and 90-95 mm. In medium size specimens and the biggest ones, rate of ovarian weight growth is intensive, with a minor decrease in 45-50 g and 115-120 mm categories. Enlargement of gonads with age (2-4 years) is extremely intensive. Absolute fecundity of rudd ranges between 2,880 and 13,625 and increases permanently with increase of age. Intensive growth of this parameter values is noted also in comparison to increase of body length and weight, except for some minor deviations in smallest and biggest categories. Average relative fecundity ranges between 177 and 303, with more or less oscillations. The biggest values are noted in smallest and youngest categories, and relative fecundity varies with increasing body weight and length, but slightly relative fecundity is noted by Triapicina (1975) in ecological studies of rudd from Volga delta.

Level of relationship of gonadal weight and absolute fecundity in comparison to body weight, standard length and age is positive, highly significant, which can be seen from the values of correlation coefficient r (Fig. 4). Relative fecundity, however, shows different correlation between these parameters and growth rate. This relationship is negative and slow with non-significant coefficients. The same analysis has been

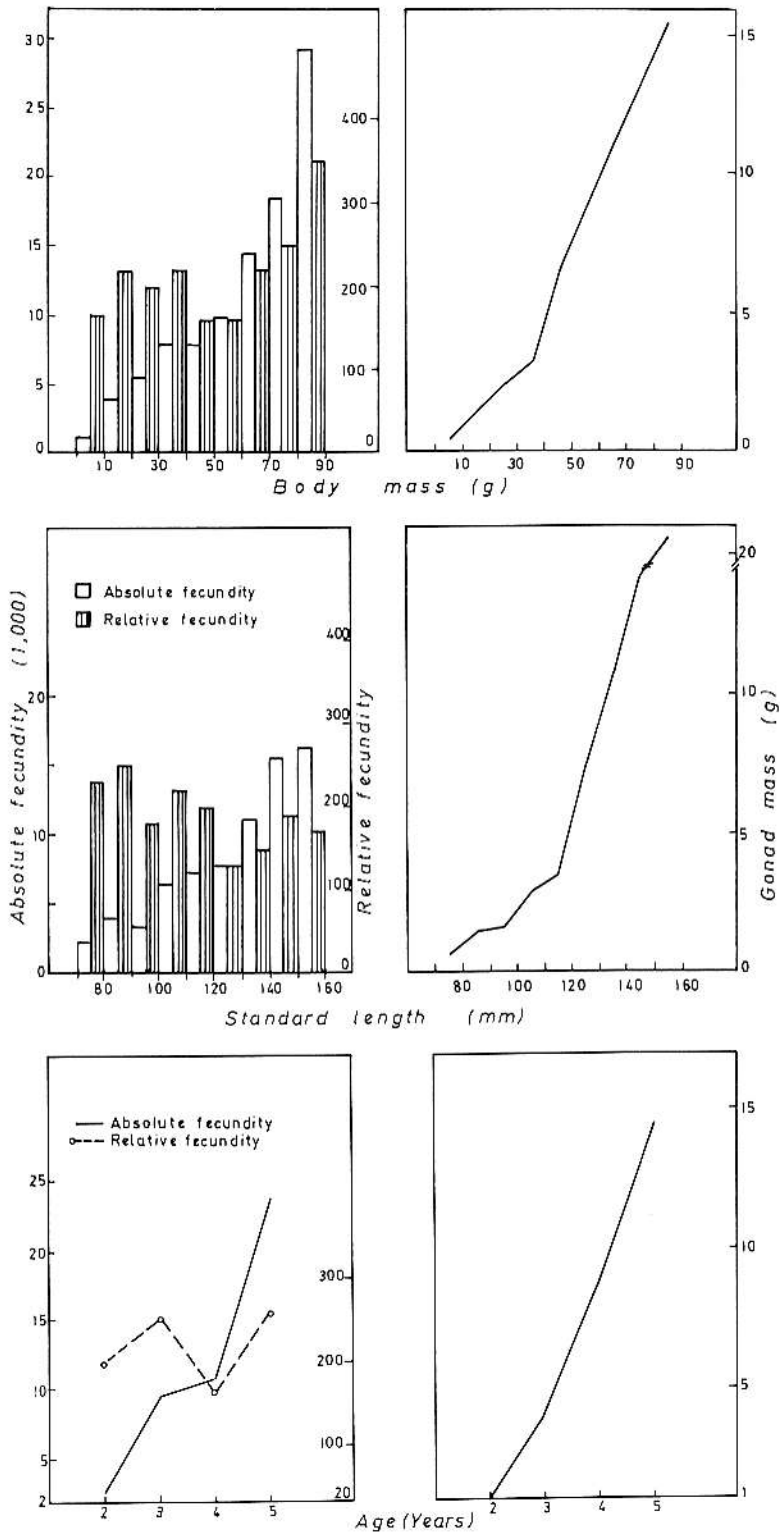


Fig. 1. Fecundity and gonad weight of roach (*R.utilus*) related to body weight, standard length and age

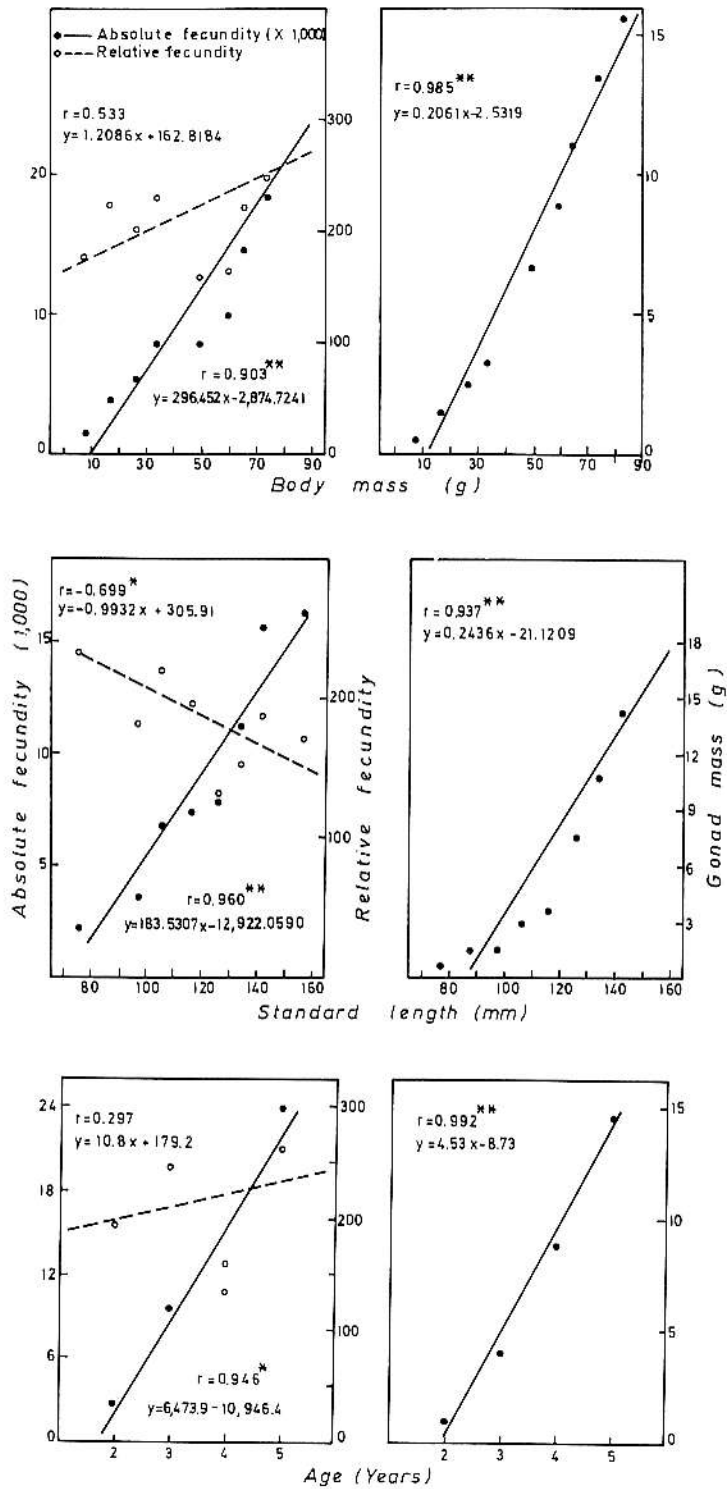


Fig. 2. The correlation of fecundity and gonad weight of roach (*R.utilus*) in relation to body weight, standard length and age

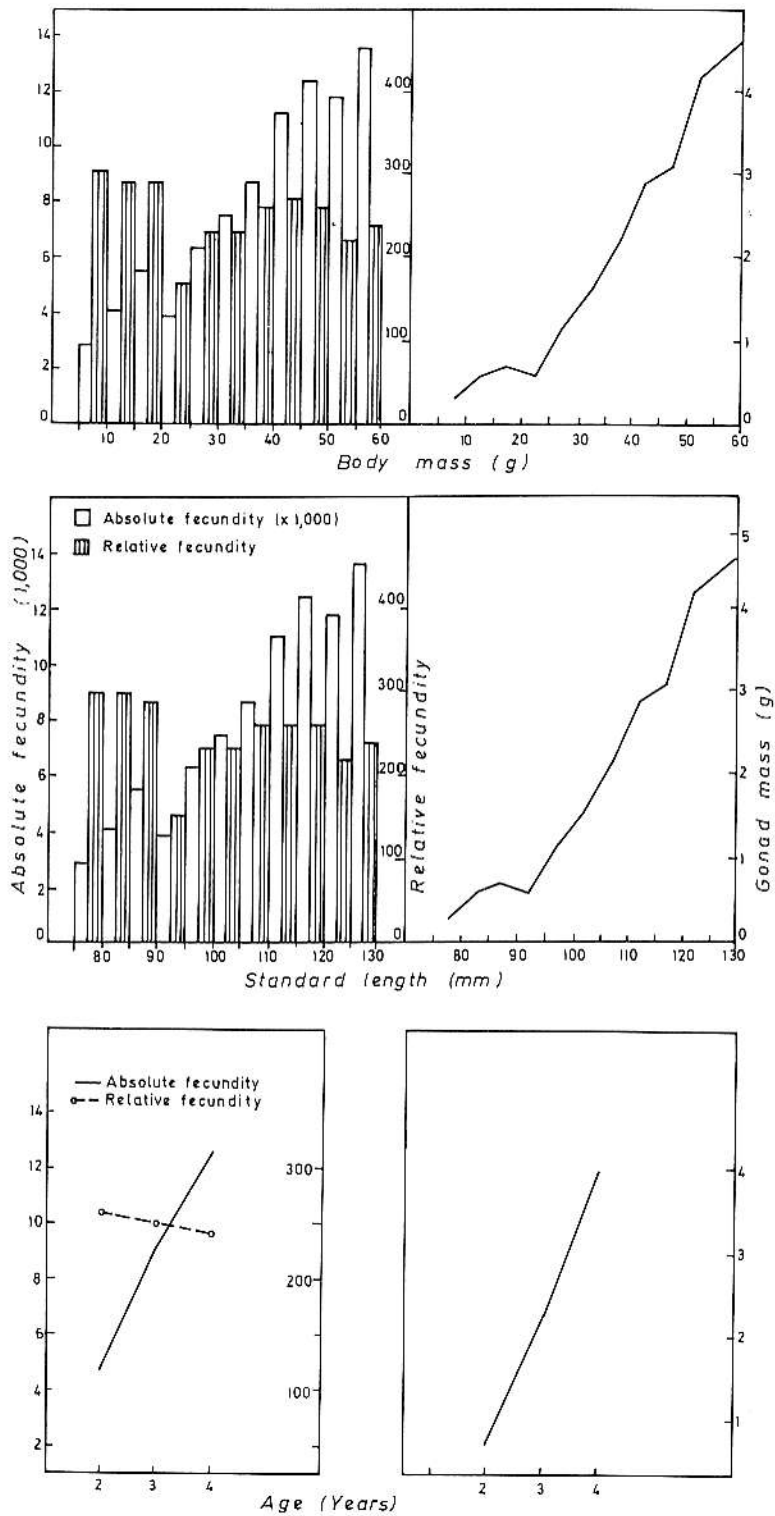


Fig. 3. Fecundity and gonad weight of rudd (*S. erythrophthalmus*) related to body weight, standard length and age

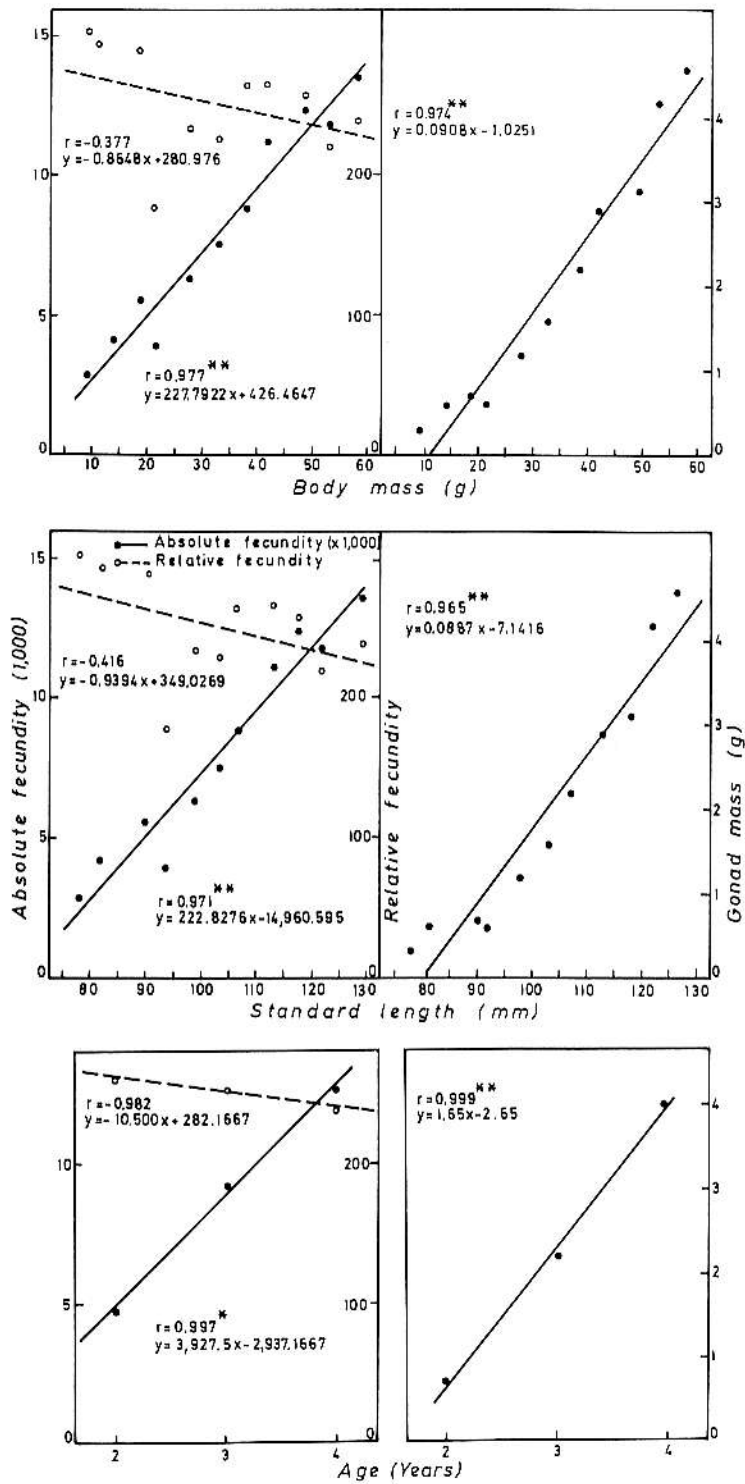


Fig. 4. Correlation of fecundity and gonad weight of rudd (*S. erythrophthalmus*) in relation to body weight, standard length and age

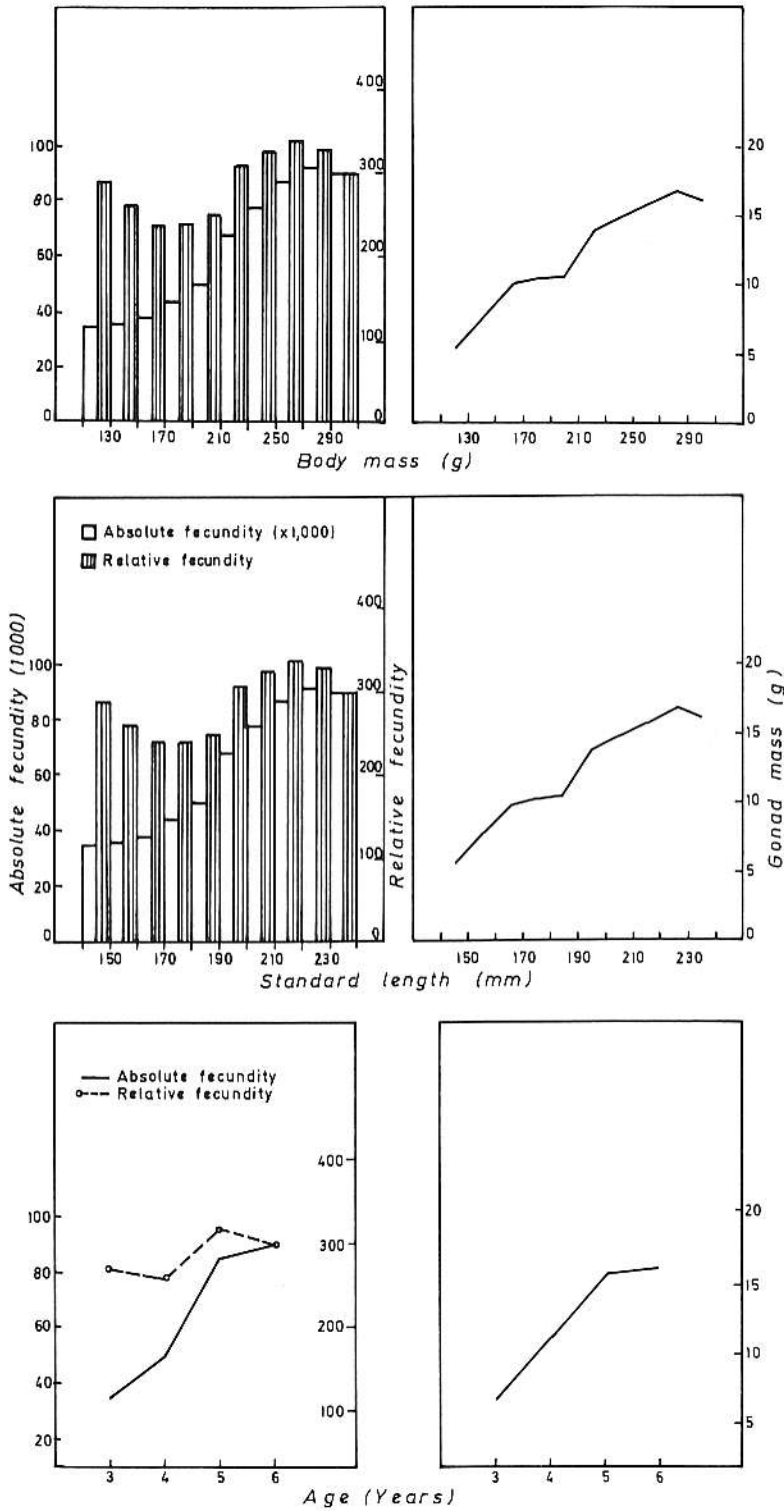


Fig. 5. Fecundity and gonad weight of crucian carp (*C. carassius*) related to body weight, standard length and age

presented by Triapicina (1975) with high level of correlation between the absolute fecundity and the biological parameters indicating the absence of connection between the relative fecundity and the above parameters, especially age.

Individual age of *C. carassius* in the examined samples ranged between 3 and 6 years. Average values of body weight ranged between 123 and 310 g in different groups, and those of standard length were between 148 and 238 mm (total of ten weight and length groups). Average ovary weight varied from 5.6 to 16.1 g and an increasing tendency of this parameter in comparison to the body weight, length and age can be established (except the last categories). Some stagnation has been noted in gonadal weight in specimens with body weight 150-190 g and length 160-190 mm (Fig. 5). Absolute fecundity was calculated on the basis of average values of each weight, length and age categories, and ranged from about 35.000 to over 92.000 with a distinct increasing tendency, except for the last categories, showing a typical sigmoid curve.

Relative fecundity ranged between 236 and 338 and, in contrast to the previous two parameters, showed lower dependency on the basic biological parameters. The highest values were noted in medium weight and length categories, whereas in comparison to the age there was a very slow irregular increase.

Correlation between the ovary weight (and absolute fecundity) and the biological parameters is positive in all cases, with high and significant coefficients. It is interesting that the relationship of the relative fecundity and the body weight, as well as the standard length and the age were also positive and significant ($p < 0.05$, Fig. 6). Analyzing the correlation between the absolute fecundity and the body weight in crucian carp, Astatin and Podgorny (1968) has stated a positive correlation of these parameters and underlined that total fecundity in *C. carassius* is lower than that of *C. auratus*. Relationship of absolute fecundity and body weight is also less distinct in crucian carp than in prussian carp.

Sample of *C. auratus* was grouped into six weight and five length and age categories, and individual age ranged from 2 to 6 years. Average body weight within the categories was 260-870 g, and length 200-292 mm. Average gonadal weight was 41.2 - 141.7 g. In comparison to basic ecological parameters, a very intensive growth of ovaries could be observed (Fig. 7), especially in comparison to growth in weight and length. Absolute fecundity of examined individuals ranged from 28.210 to over 152.000 with a distinct increasing tendency in dependence on age, body weight and standard length. High values and the

same tendency were also noted in our previous analyses of prussian carp fecundity in this water basin (Maletin and Budakov 1986), and similar results were obtained also on the basis of potential fecundity of this fish in lake Palic and Obedska bara (flood zone of river Száva, Maletin et al. 1987). In comparison to same categories relative fecundity of *C. auratus* is more similar, ranging between 123 and 171, which values are similar to those observed in our investigation on population from Obedska bara. Values were especially similar when observing the age.

Very strong relationships were established according to the correlation analyses between the absolute fecundity and all the basic biological parameters. Connection was positive, strong and highly significant (Fig. 8). The same has been stated by Zivkov (1983, 1984) for this parameter in comparison to body weight, length and age of prussian carp fecundity in reservoir Batak. Dependency of gonadal weight and another two parameters is also positive, highly significant when r ranged up to 0.999. These results were also obtained in the population from Batak (Zivkov, 1985).

Relative fecundity was somewhat different. In all three cases, connections were also positive and stronger only in length categories ($p < 0.05$), while this relationship for the weight and age categories proved to be non-significant.

Absolute and relative fecundity of examined fish during the last period of investigation point out the potential power of the reproductive activity of analyzed populations. Reproductive potential of dominant species has been influenced by total favourable abiotic and biotic factors (hydrological regime, temperature, pH, oxygen regime, food resources, competitive relationships) which were analyzed in details in our previous investigations (Maletin, 1989).

Conclusion

Analyses of fecundity dynamics of phytophagous fish species (*R. rutilus*, *S. erythrophthalmus*, *C. carassius* and *C. auratus*) from Backwater Tisza - Biser island showed a very intensive increase of gonadal weight and absolute fecundity in comparison to the increase of body weight, standard length and age in 1985-1987 period. Level of this dependency has been confirmed by high values of the correlation coefficients, which were positive and highly significant ($p < 0.01$). Relative fecundity showed a weaker dependency on the

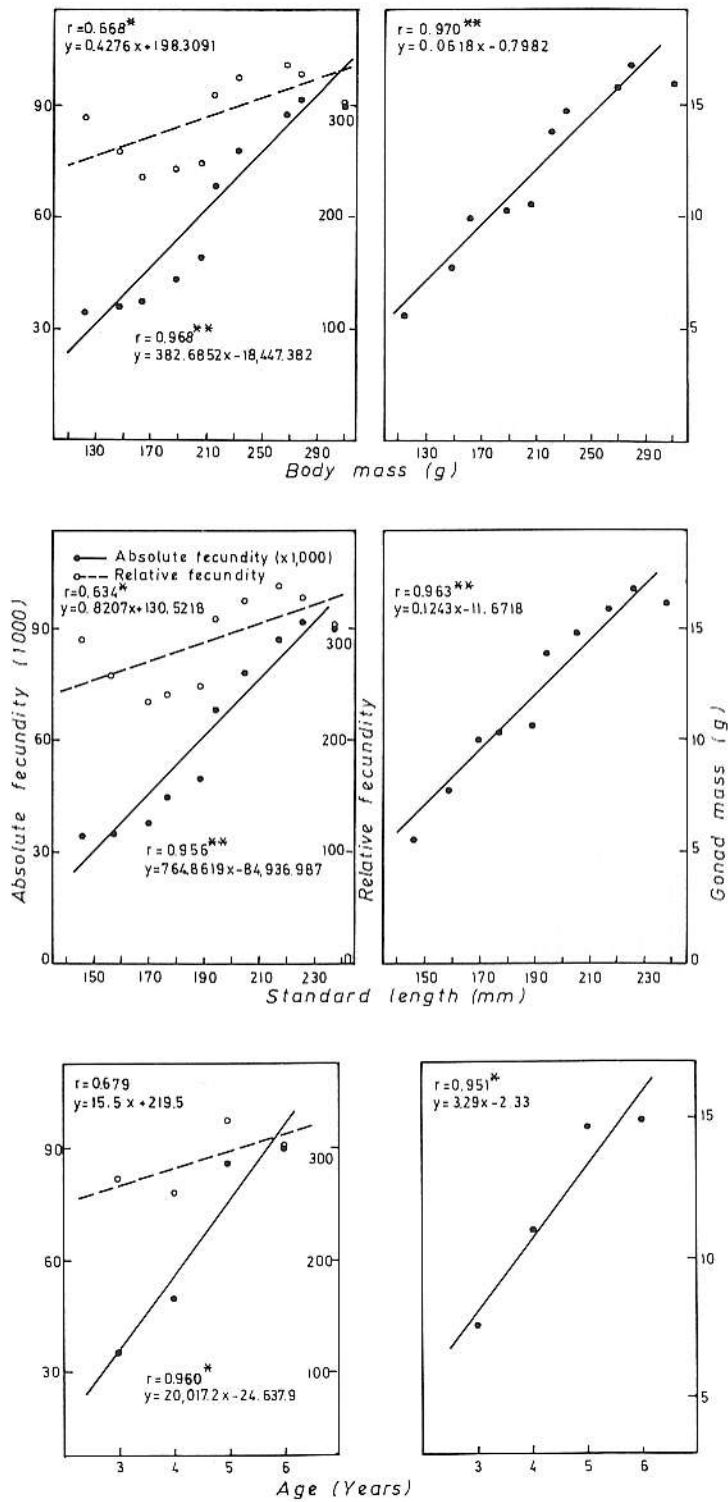


Fig. 6. Correlation of fecundity and gonad weight of crucian carp (*C. carassius*) in relation to body weight, standard length and age

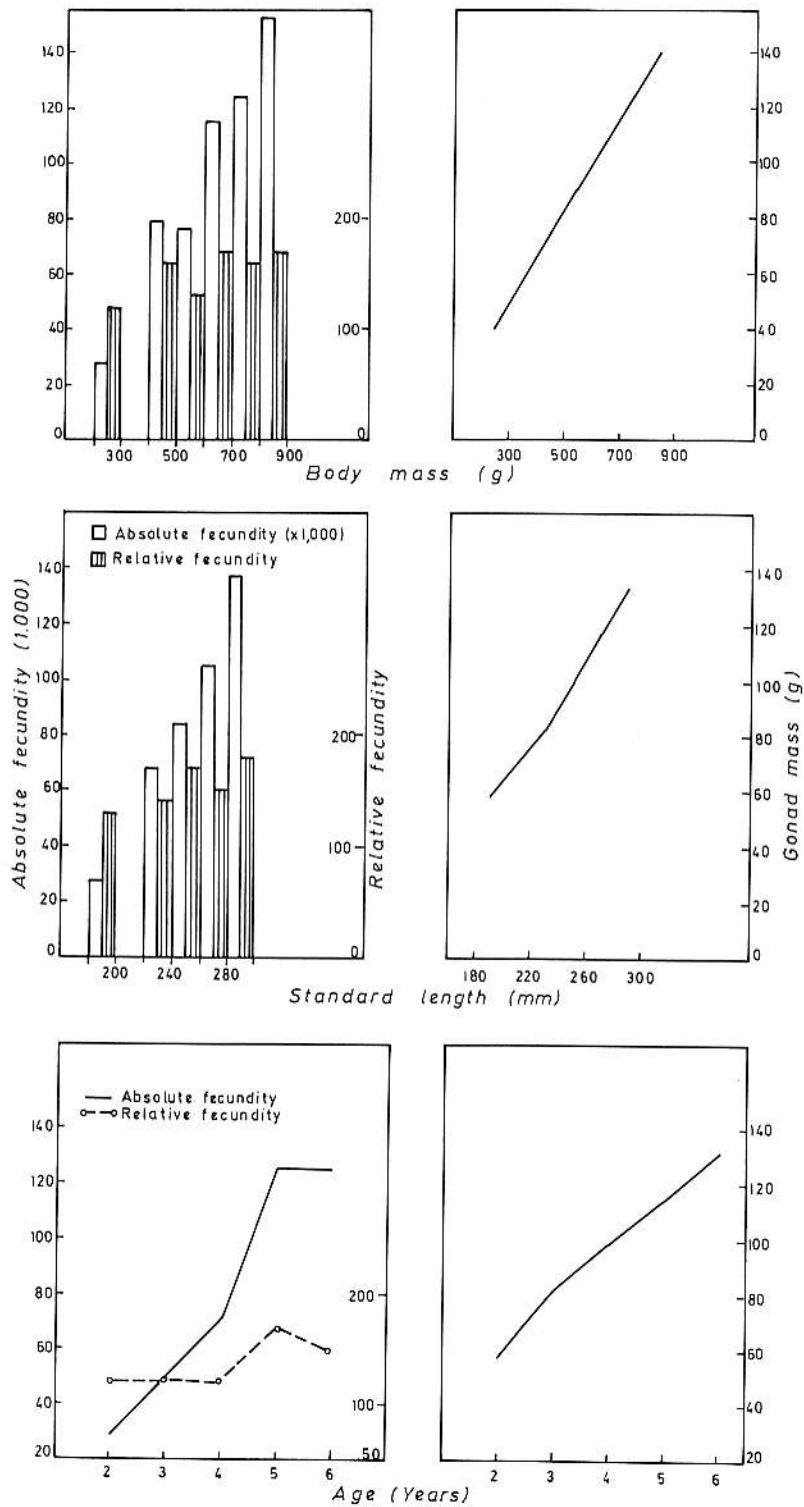


Fig. 7. Fecundity and gonad weight of prussian carp (*C. auratus*) related to body weight, standard length and age

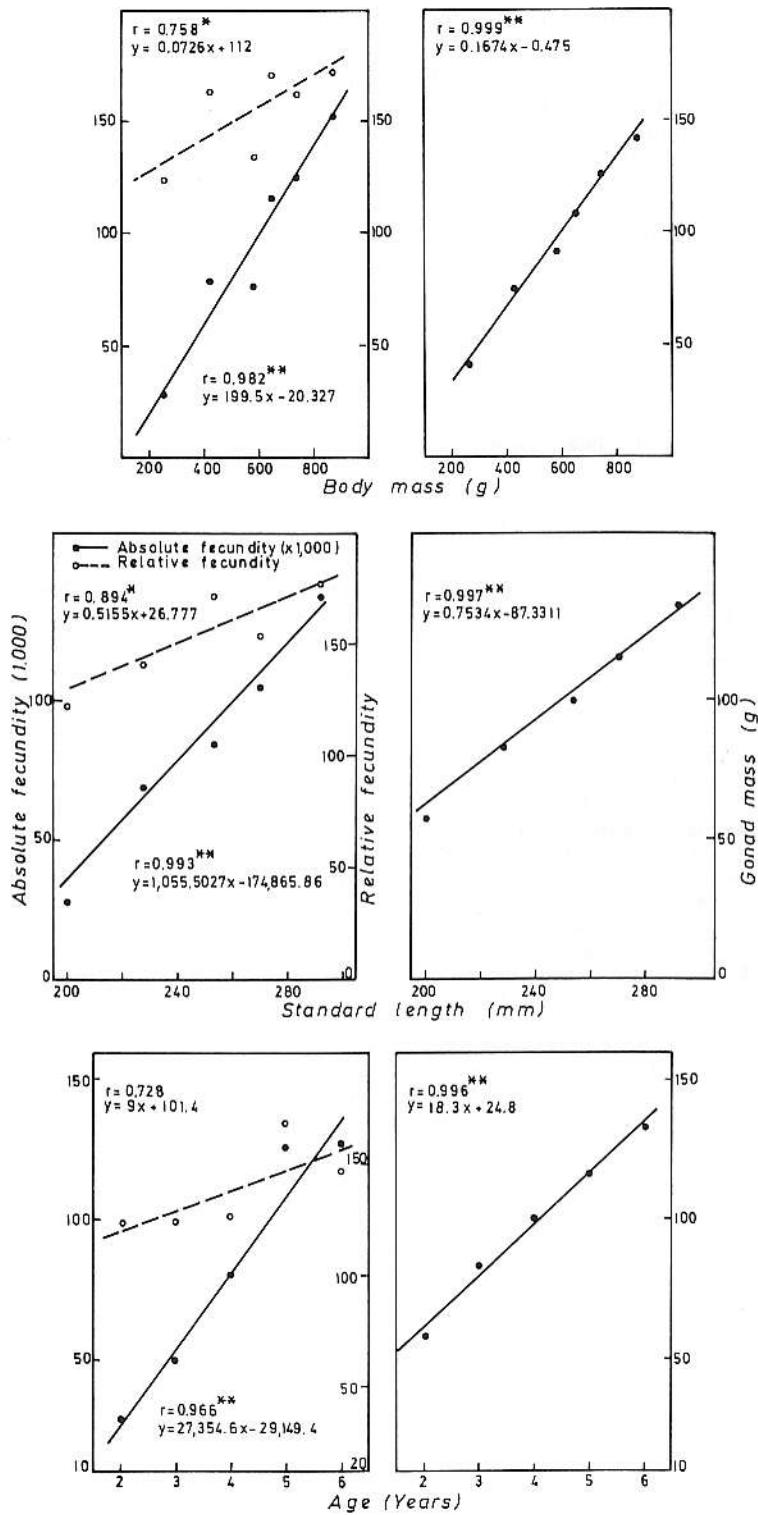


Fig. 8. The correlation of fecundity and gonad weight of prussian carp (*C. auratus*) in relation to body weight, standard length and age

basic biological parameters, however a stronger, but negative one was shown for the standard length (*R. rutilus*), or a positive for the body weight and standard length (*C. carassius*), or for the standard length only (*C. auratus*).

Values for absolute and relative fecundity of examined fish species lie between the limits stated by other authors for similar investigations. Highly expressed potential fecundity in the analyzed populations points out the good living conditions and water quality of this ecosystem.

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