

THE GROWTH AND FECUNDITY OF LEPOMIS GIBBOSUS (PISCES: CENTRARCHIDAE) IN THE TISA DEAD-ARM (ČURUG—BISERNO OSTRVO)

S. MALETIN, NADA DUKIĆ and DESANKA KOSTIĆ

Institute of Biology, Faculty of Sciences, Novi Sad, Yugoslavia

(Received December 15, 1988)

Abstract

L. gibbosus growth and fecundity were analysed in the former Tisa river meander, which was separated from the river bed in the middle of the last century.

Introduced into Europe over 100 years ago, this allochthonous species was quickly naturalized in this part of the expanded area. Material for this study was collected during 1985. A total of 273 specimen ageing from 3+ to 7+, with average standard length from 102 to 146 mm and body mass from 48 to 111 g was studied.

The longitudinal growth of *L. gibbosus* in the Mrtva Tisa had values similar to those of specimen in their native locality. The mean value of the absolute fecundity ranged, depending on age, from 4.474 to 11.668 eggs, and relative fecundity from 111 to 127. There was a considerable correlation between increasing absolute fecundity and an increase in age, standard length and body mass, where as only a slight correlation was found between a relative fecundity and basic biological parameters.

Introduction

L. gibbosus originated from the North America and into the European waters it was introduced as early as the end of the last century. This fish of prey, from the *Centrarchidae* family, quickly spread across the Continent, at first as an ornamental fish, because of its attractive appearance. Coming to open water systems quickly was it adjusted, becoming a significant member of an ichthyofauna, particularly in the stagnant and slow flowing waters. Without any economic value, the presence of this allochthonous species in waters is clearly harmful, because of its direct competition for a living space and nutrition, with allochthonous species (*Perca fluviatilis*, *Gymnocephalus cernua*). Direct damage comes from its feeding on roe and young fish of other species. Large number of this fish in total catch, in the lower of the Tisa river basin, was suggested by RISTIĆ (1940). Recent ecological studies of *L. gibbosus* focus on problems of diet in one, for this species typical habitat space, such as canals and stagnant tributaries (PUJIN et al. 1985, 1986).

In more detailed ecological studies, our aim was to analyse total body growth and potential fecundity, because these basic biological parameters (along with fish abundance) are the best indicators of the essential population properties. These studies are also important, bearing in mind that allochthonous species is surveyed. The studied population of *L. gibbosus* comes from a characteristic habitat space of one water ecosystem, such as the Mrtva Tisa, former meander of the Tisa river, separated from the river bed as far back as the middle of the last century.

Materials and Methods

Material for these studies consisted of 273 specimen of *L. gibbosus* caught during 1985. Body mass and longitudinal growth during the life span were analysed, based on the mean annual values. The rate of longitudinal growth was calculated, using the following formula:

$$C = \frac{10 g l_2 - 10 g l_1}{0.4343 \cdot (t_2 - t_1)}$$

where l_1 and l_2 represent mean values of calculated standard length, and t_1 and t_2 represent the age of specimen in two consecutive years, (age was determined on the basis of the generation sclerite zones on the scales). Growth constant was calculated using the formula:

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

Growth characteristic was also determined according to the formula C. 1. Given parameters were shown in correlation with age.

The absolute and relative fecundity was also studied in relation to age, standard length and body mass.

Correlation coefficients were calculated both for the absolute and relative fecundity in relation to the aforementioned parameters.

Results and Discussion

The age of studied specimen ranged from 3+ to 7+. Body mass mean values showed an increase compared to age, and ranged from 41 g at the age of 3+ to 111 g at the age of 7+. Individual body mass values varied from 30 g to 131 g. Standard deviation amounted from 5,65 for the youngest specimen (3+) to 23,19 for the specimen at the age of 6+, with an increasing tendency (Fig. 1).

The highest value of the absolute body mass growth, expressed in grams, and relative growth calculated in percentages, appeared to be between the age of 4+ and 5+, i.e. (26.49 g and 54.06% respectively). Further absolute and relative growth demonstrated gradual decrease (Fig. 2).

The measured and calculated values of the standard body length revealed an increase with regard to age and these two curves were almost identical.

The measured individual values of the standard body mass ranged from 88 to

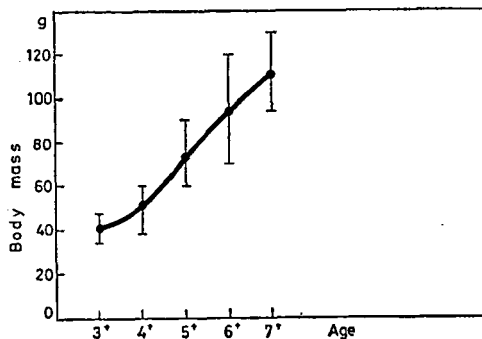


Fig. 1 Body mass of *L. gibbosus* in dependence on age

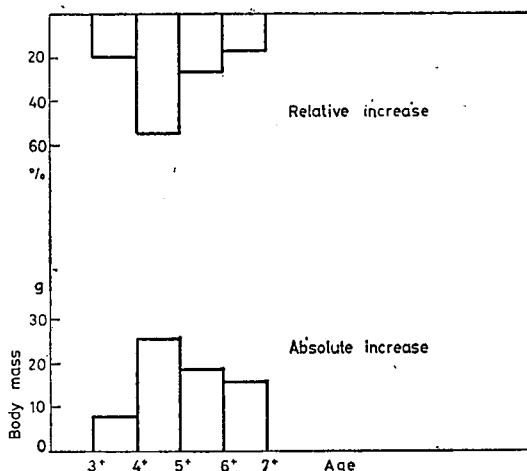


Fig. 2 Body mass absolute and relative increase of *L. gibbosus* in dependence on age

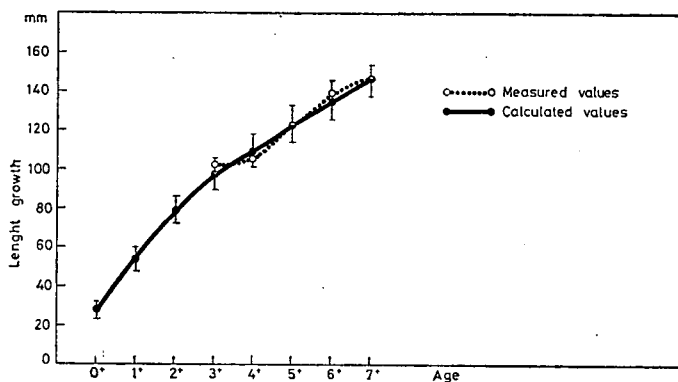


Fig. 3 Length growth of *L. gibbosus* in dependence on age

152 mm in the whole sample, while the calculated mean values ranged from 102.19 to 145.83 mm (age 3+ to 7+).

At the same time, calculated values ranged from 28.62 mm at the age of 0+ to 145.83 mm at the age of 7+. An increasing trend was also displayed by standard deviation. The lowest value of 3.896 was recorded at the age of 0+, where as the highest value of 10.121 was recorded at age of 6+ (Fig. 3).

Body mass and longitudinal growth values did not lag behind the values achieved by this species in its native area. (KEAST 1978). Poorer longitudinal growth was caused rather by somewhat shorter vegetation period in this part of the expanded area, compared to the native area, then by difficulties in the process of acclimatization. On the contrary, quickly after introduction, this species adapted and natural spawn was recorded.

A decrease in the absolute and relative growth of the calculated standard length values was recorded with regard to age (Fig. 4).

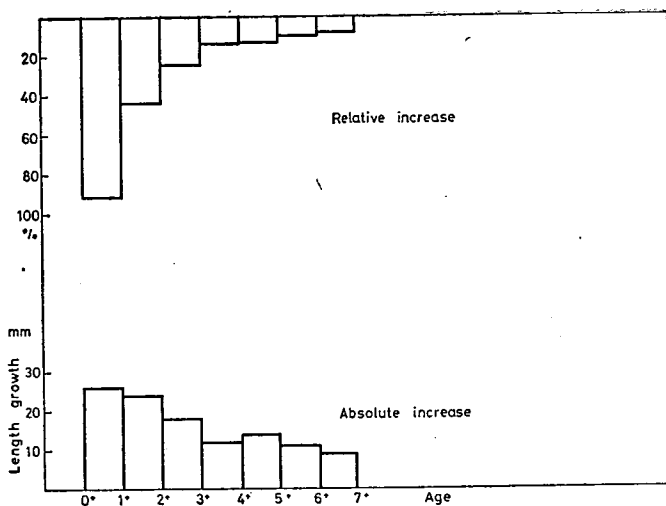


Fig. 4 Length growth absolute and relative increase of *L. gibbosus* in dependence on age

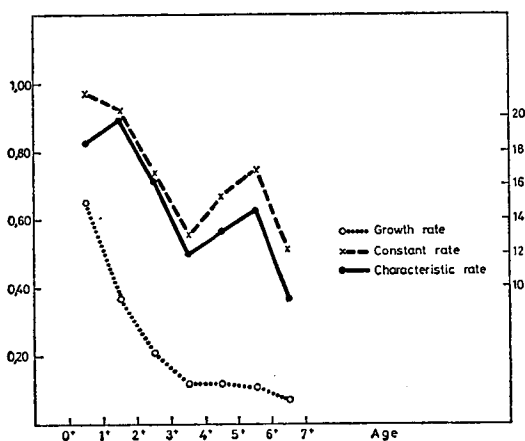


Fig. 5 Growth rate, constant and characteristic of *L. gibbosus* in dependence on age

This decrease was rather uniform, except between the age of 4+ and 5+, when slight growth increase was noticed, compared to the previous period between the age of 3+ and 4+.

In relation to age, growth rate revealed common decline, and it was more expressed up to the age of 4+, after which it became gradual. Decrease of the growth constant and rate (Fig. 5) was recorded up to the age of 4+, after which the parameters varied with considerable increase up to the age of 6+, followed by another decline. Growth characteristic varied in the similar fashion as the growth constant, with two peaks in the total decline trend during the fish life span.

Potential fecundity was analysed in 52 female specimen, aging from 3+ to 7+.

The absolute fecundity mean values ranged from 4.474 to 11.668 eggs, showing a trend of increase compared to age, standard length and body mass (Fig. 6). In the entire sample, individual absolute fecundity varied from 2.565 (specimen age 4+, standard length 81—100 mm, body mass 41—60 g) to 21.168 eggs (specimen age 6+, standard length 121—140 mm, body mass 81—100 g).

At the same time, relative fecundity mean values ranged from 111 to 127 eggs, and varied in relation to the basic parameters. Relative fecundity individual values ranged from 48.90 (female specimen age 6+, standard length 101—120 mm, and body mass 61—80 g), to 252.00 (same age, body mass and length similar to the ones in female specimen with the relative fecundity).

This showed low correlation between relative fecundity and aforementioned parameters.

Standard deviation of the absolute and relative fecundity mean values among particular age, longitudinal and mass groups was also different. Standard deviation of the absolute fecundity was the lowest in specimen aging from 3+, with standard length of 81—100 mm and body mass of 21—40 g. It was increased with age and reached the highest value at age of 6+, with standard length of 121—140 mm and body mass of 101—120 g.

Irregular variation of this parameter was noticed in relative fecundity, with the lowest value recorded in female specimen at the age of 7+, with standard length of 141—160 mm and body mass of 121—140 g. The highest values, however, were found in specimen at the age of 6+ and body length of 121—140 mm and body mass of 81—100 g.

The correlation level between the absolute and relative fecundity and particular parameters (age, length and body mass) in further studies was expressed by correlation coefficient. There was positive correlation between the absolute fecundity and basic parameters, with coefficient, ranging from $r=0.5583$ (in relation to age) to $g=0.6616$ (in relation to body mass).

In spite of being positive, the correlation between the relative fecundity and abovementioned parameters was very low. In fact, the correlation was insignificant. The lowest correlation coefficient in relation to the standard length was shown by relative fecundity, ($r=0.0097$), while the highest one was observed in relation to the body mass ($r=0.0354$).

Further fecundity analysis was aimed at studying the correlation links within certain age, longitudinal and body mass groups.

Examining the correlation in specimen, in certain longitudinal groups, led us to a conclusion that most correlation coefficients were negative, with the smallest value recorded between the absolute fecundity and standard length in the 101—120 mm length group ($r=-0.0960$) and the highest value in the 81—100 mm length group ($r=0.6783$).

The correlation between relative fecundity and standard length of specimen in certain group intervals was also negative, ranging from insignificant ($r=-0.1972$., 121—140 mm group) to significant ($r=-0.6480$ mm, 81—100 mm group).

The correlation between potential fecundity and body mass was even broader, especially when this phenomena was viewed within certain group intervals.

This correlation ranged from insignificant to high, and contrary to the correlation with standard length, the coefficients here were generally positive.

Therefore, the absolute fecundity and body mass correlation coefficient was the lowest in the group interval ranging between 81—100 g ($r=-0.0183$) and the highest in the group interval ranging between 121—140 g ($r=1.00$).

The minimum and maximum relative fecundity correlation coefficients were also recorded in the same mass group ($r = -0.0883$ and $r = 1.00$ respectively). Negative correlation coefficient values were recorded only in two groups with body mass of 21—40 g and 81—100 g.

Conclusions

— The longitudinal growth and body mass of *L. gibbosus* from the Mrtva Tisa was analysed on the basis of sample with 273 specimen aging from 3+ to 7+. Fecundity was also studied, examining 52 female specimen.

— In relation to age, body mass mean values were increased, ranging from 41 g to 111 g.

— The highest absolute and relative body mass growth, and measured standard length values showed and increase. Measured mean values ranged between 102.19—145.83 mm, as where calculated mean values ranged between 28.62—145.83 mm.

— The growth rate, constant and characteristic showed a decline up to the age of 4+, after which growth constant and characteristic experienced an increase, while the rate continued to decrease.

— Considerable correlation was observed in the absolute fecundity increase in relation to the increasing age, standard length and body mass. However, relative fecundity and basic biological parameters had an insignificant correlation.

— The highest correlation coefficients were observed between the absolute and relative fecundity on one side, and the body mass on the other.

The satisfactory body mass and longitudinal growth, along with high potential fecundity values pointed to the viability of all living conditions in certain parts of this ecosystem, typical of *L. gibbosus* living space, as well as to the successful naturalization of this allochthonous species in this section of the expanded area.

References

- KEAST, A. (1978): Feeding Interrelations Between Age — Groups of Pumpkinsed (*Lepomis gibbosus*) and Comparisons with Bluegill (*L. macrochirus*). — J. Fish. Res. Board. Can 35, 12—27.
- PUJIN, V., ĐUKIĆ, N., MALETIN, S. (1985): Nutrition of *Lepomis gibbosus* L. 1758 in Jegrička river (Yugoslavia). Fifth Congress of european ichthyologists Stocholm. — Abstracts, 128.
- PUJIN, V., RATAJAC, R., ĐUKIĆ, N., MALETIN, S., SVIRČEV, Z. (1986): A Holt-Tisza néhány betelepített halfajának táplálkozásbiológiája. A. XVII. Tiszakutató Ankét, Szeged.
- RISTIĆ, M. (1940): Ribolov i rivarske sprave na Tisi. — Ribarstvo 3, 11—12.

A *Lepomis gibbosus* (Pisces, Centrarchidae) növekedése és termékenysége a Holt-Tiszában (Čurug—Biserno Ostrvo)

MALETIN S., DJUKIĆ NADA és KOSTIĆ DESANKA
Biológiai Intézet, Novi Sad, Yugoslavia

Kivonat

A szerzők az 1985. év folyamán a Holt-Tiszából begyűjtött 273 *L. gibbosus* egyed vizsgálatát végezték a növekedés és termékenység függvényében. A 3+—7+ életkorba tartozó példányok átlaghossza 101—146 mm, tömege 48—111 g. Az abszolút termékenység középértéke az életkortól függően 4.474—11.668, a relatív pedig 111—127 ikra. Összevetve a már több mint 100 éve Európa vízébe betelepített, naturalizált alohton faj példányait a natív környezetből valókkal, a Holt-Tiszában élő *L. gibbosus* példányok azonos hosszanti növekedése mutatható ki.

Рост и плодовитость *Lepomis gibbosus* (Pisces, Centrarchidae) в мертвой Тисе (Чуруг — Бисерно Острво)

С. Малетин, Н. Дьюкич и Д. Костиц
Биологический институт, Новый Сад

Резюме

В течение 1985 г. авторами исследовано 273 особи *L. gibbosus*, пойманных в мертвой Тисе, с точки зрения роста и плодовитости. Средняя длина особей в возрасте 3+—7+ лет составляла 101—146 мм, их масса — 48—111 г. Среднее значение абсолютной плодовитости в зависимости от возраста составляло 4474—11 668, а относительной — 111—127 икринок. Сравнивая особей натурализованного в водоемах Европы уже более 100 лет вида алохтон с обитающими в нативной среде, в мертвой Тисе особями *L. gibbosus* была установлена одинаковая степень их продольного роста.

Rast i plodnost *Lepomis gibbosus* (Pisces: Centrarchidae) u Mrtvoj Tisi (Čurug—Biserno Ostrvo)

S. MALETIN, NADA DUKIĆ i DESANKA KOSTIĆ
Institut za biologiju PMF, Novi Sad, Jugoslavija

Abstrakt

Analizirani su rast i plodnost *L. gibbosus* u bivšem meandru reke Tise koji je odvojen od rečnog korita sredinom prošlog veka. Unesena u Evropu pre više od 100 godina, ova alohtona vrsta se ubrzo posle introdukcije naturalizovala u ovom delu proširenog areala. Materijal je za ova istraživanja prikupljen tokom 1985. godine. Ukupno je obradjeno 273 primerka uzrasta 3+ do 7+ prosečne standardne dužine 102 do 146 mm i mase tela 48 do 111 g. U poredjenju sa primercima iz nativnog areala, dužinski rast *L. gibbosus* u Mrtvoj Tisi ostvaruje slične vrednosti. Srednja vrednost apsolutne plodnosti se kretala, zavisno od uzrasta, od 4.474 do 11.668 jaja, a relativna od 111 do 127.

Uočava se tendencija porasta apsolutne plodnosti sa povećanjem uzrasta, standardne dužine i mase tela sa značajnom povezanošću, dok relativna plodnost i osnovni biološki parametri ostvaruju neznačajnu povezanost.