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# SPAWNING OF THE EUROPEAN MUDMINNOW (*UMBRA KRAMERI* WALBAUM) IN THE BASIN OF THE RIVER ÉR

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**Abstract**. The European mudminnow reaches its maturity at the age of two years. It spawns in May and June in the Ér basin.
The number of the forming eggs in the 3rd maturing stage ranges from 626 to 2689 depending on the age of the fish. Literature data show much less eggs than above. The reason of the difference is that a great number of eggs are absorbed in the 4th maturing stage.
A similar phenomenon can be observed at the brown bullhead (*Ictalurus nebulosus*) which guard the eggs and the descendants, too. It is probable that this is the physiological background of the switch from the wide-spread r-selectionist reproduction strategy to K-selectionist strategy, characteristic of the egg-guarding fishes.

*Key words: maturing stage, egg number, egg guarding, r-K selectionist strategy.*

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## Introduction

The river Ér (Ier) flows in a ditch with a direction NW-SE in the NW region of Romania between the rivers Kraszna (Crasna) and Berettyó (Barcău). It flows into the river Berettyó on the territory of Hungary.

In the lightly inclining basin there formed a slowly flowing marsh with little islands and backwaters which offered the mudminnow ideal circumstances for life. After the draining of the region finished in 1972, the conditions of existence of the species grew narrow, but in spite of these facts the patches of the remained marshes and the connecting canals made possible the surviving of the fish.

There are different data concerning the eggs in the works of, in the one hand, Geyer (1940), Pintér (1975) and Bota (1981), and on the other hand Makarov (1936) and Pavlov (1953). Our previous observations were closer to the latter ones (Wilhelm 1987).

## Material and methods

Samples were gathered between 1973 and 1995 with a scratching net. This is the single successful fishing instrument to lift out this fish with mud because it is very cautious, and hides in the mud at the smallest disturbance.

The sampling sites are indicated on Fig. 1. At the 3rd site fish was sampled in each months.

We measured the total and standard (without the caudal fin) length and the weight of the individuals. The age of the fishes was determined from the annual rings of the scales. The scales were cleaned in thin hypochlorite solution, and then studied with stereomicroscope. We took out the ovaria of the fishes, measured their weights, than counted those eggs that were at least in the 3rd maturing stage and were visible to the naked eye. Since there were not very many eggs, we did not apply the method of recounting after the tests, we counted directly the eggs.

The maturing stages of the eggs were determined with the Nikolski's (1963) method.

## Results and discussion

We found that both the males and females reach their sexual maturity at the age of 2 years. At this age their standard length is approximately 50 mm, their weight is 2 g (Table 1). This corresponds to the literature data (Pintér 1975, Botta 1981), although in Pavlov's opinion (1953) on the Lower Danube the mudminnow reaches these dimensions at the age of one year, and in his opinion this species becomes mature at this age. So the reaching of maturity does not depend on age but on dimensions.

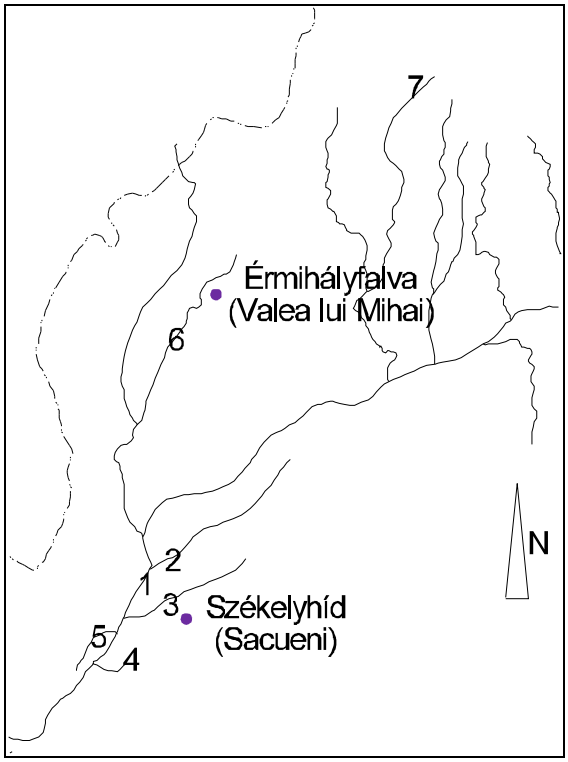


Fig. 1. Location of sampling sites. 1. Ér bed near Székelyhíd (Săcueni); 2. Draining branch near Kiskereki (Cherechiu); 3. The former main course of Ér near Székelyhíd; 4. The former backwater of Ér near ágya (Cadea); 5. The old backwater near Csokaly (Ciocaia); 6. Brook Móka (Mouca) near Érsemjén (Simian); 7. Boggy marsh near Reszege (Resighea).

Table 1 shows the distribution of standard body length and weight according to sex and age, and it indicates the length and weight of different age-groups. It can be seen that the dimensions of females exceed those of males.

Concerning the division of sexes, it is noticeable that at a younger age there are more males than females, but this proportion changes soon. The age reached by females exceeds the age of males. A five years old male is very rare, but we found even seven years old females.

Studies concerning the maturing of the eggs show that the growth of ovocytes starts immediately after the spawning, but at younger generations these remain in the 2nd maturing stage during winter. The older, 5-6 years old individuals reach the 3rd maturing stage in November-December, so their eggs are visible to the naked eye and they can be counted easily. This stage is reached by the younger generations only in February. The reaching of the 4th maturing stage is at the end of April and early May at every generations.

As it was mentioned earlier, there are very different data concerning the number of eggs. Pavlov (1953) had found a number of 835-1666 eggs at the population living on the Lower Danube, while in Makarov's opinion (1936, quoted by Pavlov), the number of the eggs varies between 1582 and 2707. On the other hand, Pintér (1975) mentioned 100-200 eggs. According to Geyer's observations (1940) an 8 cm long female spawned 214 eggs in laboratory conditions. Botta (1981) reports 75-80 spawned eggs in aquarium.

Our observations concerning the number of the eggs in the 3rd maturing stage are summarized in Table 2. Consequently the number of the eggs found in a female varies between 626 and 2689, and it shows considerable individual differences. We found the increase of the egg number with age, the common phenomenon of fish.

Therefore there is a considerable difference between the number of eggs found in the dissected fishes and the number of the spawned ones. The interpretation is given by studying the ovaria of the fishes reached the 4th maturing stage. In this period a great just before spawning there were counted 149 mature eggs with diameters of about 2 mm and 313 eggs which were visible to naked eye, but they could be counted only under the microscope.

In this stage the ovaries are somewhat similar to the ovaries of those fishes which spawn several times every year, but the mudminnow spawns once a year, and after spawning their ovaries are full of ovocytes showing typically the 2nd maturing stage.

We found a similar phenomenon of spawning of the brown bullhead (Wilhelm 1979, 1980).

According to our observations in the Ér basin, the mudminnow spawns in May and June. The temperature of the water necessary to the spawning was 12.5-16 ºC by Geyer (1940), 12-18 ºC by Balon (1967) and 20 ºC by Botta (1981), but they mention a spawning in April. In April we measured 8-11 ºC water temperature in the Ér basin, and even the average air temperature varied between 9.2-12.8 ºC

Table 1. Distribution of standard bodz length and weight according to sex and age.

| Age | Sex | Standard length (mm) | | Weight (g) | | n |
|---|---|---|---|---|---|---|
| | | Average | Extreme values | Average | Extreme values | |
| 2-2+ | male | 49.8 | 43.5-56.0 | 1.71 | 1.42-3.85 | 47 |
| | female | 49.7 | 44.0-57.0 | 2.38 | 1.14-3.10 | 41 |
| 3-3+ | male | 56.1 | 51.0-69.5 | 3.24 | 2.67-3.95 | 9 |
| | female | 57.4 | 53.0-68.5 | 3.40 | 2.73-5.06 | 20 |
| 4-4+ | male | 67.4 | 62.0-74.5 | 6.11 | 4.17-8.24 | 5 |
| | female | 67.7 | 60.0-78.5 | 5.37 | 3.90-7.95 | 8 |
| 5-5+ | male | 72.0 | — | 6.78 | — | 1 |
| | female | 77.0 | 72.0-88.5 | 8.69 | 7.22-11.25 | 9 |
| 6-6+ | male | — | — | — | — | — |
| | female | 85.3 | 80.5-89.0 | 14.22 | 11.18-18.21 | 5 |
| 7-7+ | male | — | — | — | — | — |
| | female | 101.0 | 100.0-102.0 | 23.72 | 19.67-27.78 | 2 |

in the study years, and it got warm to 12.7-18 ºC only in May. Considering these data, it can be ascertained that our observations correspond to the literature data, because the time of spawning is mainly determined by the water temperature.

Table 2. Distribution of the egg numebr in the 3rd maturing stage according to age.

| Age | Number of eggs | | n |
|---|---|---|---|
| | Average | Extreme values | |
| 2 | 854 | 699-1271 | 4 |
| 3 | 843 | 626-1415 | 10 |
| 4 | 1780 | 1027-1877 | 4 |
| 5 | 1548 | 1059-2290 | 9 |
| 6 | 2190 | 1514-2689 | 5 |
| 7 | 2465 | — | 1 |

It would be very difficult to observe the elements of behavoiur concerning the spawning of the mudminnow in the water of marshes and swamps. But it was visible that the specimens caught in the spawning time, both males and females, were brightly coloured. Their colour was golden and gleaming decorated with longitudinal whitish streaks on their abdominal part. The colour of the older specimens was quite dark brown, and on the dark background the light streaks were more effective.

In August at the 8th sampling site we caught descendants at the sunny parts of the clumps in the marshes, on the parts which stood near the open water surface. It is probable that the nests were there, as well, and they were not in the shady water which gets warm slowly among the clumps. We always caught mature females with the descendants, this points to a descendant-guarding behaviour although this was not mentioned earlyer from the laboratory studies.

Concerning the seasonal migration of the species, the monthly repeated fishings at the 3rd sampling site show (Table 3) that mainly young, immature individuals migrate. During autumn the young animals disperse and only the mature part of the population remain in the place sharing the hiding places. Therefore in spring the spawning pairs nead not devote much energy to the division and protection of the territory.

Table 3. Dynamics of the mudminnow according to sex and age at the 3rd sampling site.

| Time of sampling | juv. | male | female | Sum |
|---|---|---|---|---|
| 16 September 1983 | 26 | 7 | 2 | 35 |
| 4 October 1983 | 35 | 4 | 11 | 50 |
| 2 November 1983 | 12 | 9 | 11 | 32 |
| 12 November 1983 | 8 | — | 1 | 9 |
| 18 November 1983 | — | 2 | 3 | 5 |
| 20 December 1983 | — | 3 | 8 | 11 |
| 29 December 1983 | 3 | 1 | 7 | 11 |
| 13 January 1984 | — | 2 | 2 | 4 |
| 3 February 1984 | 4 | 6 | 8 | 18 |
| 21 February 1984 | — | 3 | 1 | 4 |
| 25 February 1984 | — | 8 | 6 | 14 |
| 10 March 1984 | — | 1 | 2 | 3 |
| 10 April 1984 | — | 2 | 2 | 4 |
| 4 May 1984 | — | — | 2 | 2 |
| 16 May 1984 | 2 | 2 | — | 4 |
| 11 June 1984 | — | 2 | 1 | 3 |
| 18 June 1984 | — | — | 1 | 1 |
| 6 July 1984 | — | 5 | 5 | 10 |

## Conclusion

In the Ér basin the mudminnow spawns in May and June. Probably the time of spawning depends mostly on the water temperature. The spawning happens in pairs, so it is not necessary to the whole population to be synchronized. This must be the reason of the relatively long spawning period, but every individual spawns only once a year. The spectacular difference between the number of forming and spawned eggs can be explained by the regress and absorption of a great part of the eggs in

the 4th maturing stage. During the maturation a certain number of the eggs are absorbed at each species, but at the mudminnow this process is very considerable. A similar phenomenon can be observed at the brown bullhead, which guards the eggs and descendants, too. We think that this is the physiological background mechanism of the change from r-selectionist reproduction strategy to K-selectionist strategy. While the former one is characteristic of the greatest number of the fish species, the latter can be found only at the guarders of eggs and descendants.

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