Global Re-introduction Perspectives: 2013

Further case-studies from around the globe

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Captive-breeding, re-introduction and supplementation of the European mudminnow in Hungary

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Introduction

The European mudminnow (*Umbra krameri*, Walbaum 1792*:* Actinopterygii: Esociformes: Umbridae) is a relict and endemic species living mainly in marshes and fens in the catchment area of the Danube and Dniester (Tatár *et al.*, 2012). The species is categorized as Vulnerable on the IUCN Red List (IUCN, 2012) and is listed on the Annex II of the European Union Council Directive on the Conservation of natural habitats and of wild fauna and flora, the Appendix II of the Bern Convention and the Red List of many European countries including Hungary. In the latter country the species is listed as strictly protected.

European mudminnow
© Csaba Posztós/Photomania

The European Mudminnow Conservation Program is taking place mainly near Szada, a little village 25 km from Budapest. Between 2008 and 2012, we created seven isolated little ponds fed by groundwater ("Illés Ponds", GPS: N 47° 37' 37,02"; E 19° 17' 31,83")

with irregular shores and bottoms in the area (volumes: 50 - 60 m^3, surfaces: 30 - 40 m^2, mean depths: 1 - 1.5 m, max. depth: 2.5 m.) at locations where the vegetation was degraded (so we did not alter important habitat).

Goals

- Goal 1: To investigate natural habitats and ecological needs of the European mudminnow.
- Goal 2: Creation and monitoring of new habitats (ponds) with regard to the results of Goal 1.
- Goal 3: To create European mudminnow breeding stock in the new habitats with the release of captive bred individuals (*in situ* and *ex situ* conservation).
- Goal 4: Supplementation at historic and recent natural habitats with the release of captive bred individuals.
- Goal 5: Cryopreservation of European mudminnow sperm for later breeding (*ex situ* conservation).

Success Indicators

- Indicator 1: Creation of new habitats ("Illés' Ponds") in the Model Area of Szada and complex monitoring of new and natural habitats.
- Indicator 2: Artificial propagation of the European mudminnow and cryopreservation of sperm.
- Indicator 3: Survival of the captive bred and released individuals in new habitats.
- Indicator 4: Breeding of the released individuals in the new habitats.
- Indicator 5: Releases to supplement natural populations with captive bred individuals and with those born in the new habitats.

Project Summary

Feasibility: The species is known to have been extirpated from many of its original habitats. It is estimated that mudminnow populations have declined by more than 30% in the past 10 years. The main reason for this decline is considered to be habitat destruction, especially channelization followed by the destruction of river and stream floodplains (Wanzenböck, 1996). Recently, the invasive and aggressive Amur sleeper (*Perccottus glenii*, Dybowski, 1877) supplants *U. krameri* in Hungarian waters. For instance three original European mudminnow habitats were monitored in Hungary in 2010 and in two of them we could catch only Amur sleepers and no *U. krameri*. Systematic stockings of mudminnows into adjacent streams, canals and still waters might help to develop self-sustaining populations of *U. krameri* in places where the species disappeared or occurs only sparsely. The best method for the maintenance of populations would be the preservation of a variety of suitable micro-habitats. Furthermore, artificial propagation of mudminnow could also help to increase its stocks (Bíró & Paulovits, 1995).

The main objectives of the European Mudminnow Conservation Program are the *in situ* and *ex situ* protection of *Umbra krameri* in order to preserve and increase natural stocks.

Long-term goals of the program:

- Reconstruction of wetlands and creation of still waters to improve ecological conditions and increase the number of mudminnow habitats in Hungary and other countries.
- Sperm cryopreservation for gene bank and artificial propagation for stocking to sites in Hungary and other countries.

Release in the Model Area of Szada © Bálint Bajomi

- Genetic research on different populations in the distribution area of genus *Umbra*.
- Monitoring of water quality, zooplankton, macro-invertebrate, macrophyte and fish populations in natural habitats of mudminnow and Amur sleeper (*P. glenii*).
- Monitoring in reconstructed and new (artificially created) habitats.
- Developing a method for the control of spreading of the invasive Amur sleeper.
- Developing Model Area of Szada: creating further separated ponds for *U. krameri* and other endangered marsh fish populations (e.g. *Misgurnus fossilis, Carassius carassius & Leucaspius delineatus*).

Implementation

Results of the first five years (2008 - 2012):

- Seven new ponds (“Illés” ponds) fed by groundwater were created in the Model Area of Szada (average sizes of water surfaces and mean depths 30 - 40 m^2, 1 - 1.5 m).
- The majority of water quality indicators of three years old ponds has reached the characteristic values experienced in natural habitats of the mudminnow.
- The majority of the quantities and numbers of zooplankton and macro-invertebrate species of Illés’ ponds have reached the characteristic values experienced in natural habitats of mudminnow in two years.
- Reproduction in captivity, embryo and larva development of European mudminnow were investigated in the labs of the Department of Aquaculture, Szent István University, Gödöllő. Apart from them, the possibilities of pre-nursring and rearing were investigated in controlled condition and artificial pond.
- Propagation and larvae rearing may help in strengthening population considerably, thus supplementing decreased stocks and ponds of Model Area of Szada.

Captive bred juvenile © Csaba Posztós / Photomania

- Stocking of broodfishes in natural habitats and Model Area of Szada (stocked fishes grew faster in the artificially created ponds than literature sources describe).
- We have three different rescued stocks of *Umbra krameri* in four ponds of Model Area of Szada (these separated ponds serve as refuges of endangered Hungarian mudminnow populations).
- Stocked mudminnows spawned in two years old ponds in spring 2011 and 2012.
- We created a European Mudminnow Database which contains biological and ecological data about mudminnow and its habitats.

Post-release monitoring

Results of the post-release monitoring:

- Indicator 1: Physio-chemical, hydrobiological fish fauna and botanical data in seven new ponds and 10 natural habitats.
- Indicator 2: A total of 42 female mudminnows saved from endangered habitats and 864 reared individuals.
- Indicator 3: The population persisted in all four new water bodies where releases took place.
- Indicator 4: Breeding occurred at three release areas among four.
- Indicator 5: We supplemented populations at three natural habitats with 864 captive-bred individuals and 257 fish coming from the wild-born generation of the 3rd Illés pond. They had altogether a conservation value of about US$ 1,225,181 (In Hungary, individuals of species protected under national law have a conservation value in money fixed by law. This is used e.g. when punishing people killing protected animals. The value of one mudminnow individual is US$ 405).

Major difficulties faced

- Fundraising is a difficult issue, so the long term planning and implementation of the project is uncertain (there are no funding opportunities in the public sector giving bigger amounts for several years in Hungary). We tried to apply for international funds, but we did not succeed because our project was considered as of local importance.
- The long process of applying for permits cause difficulties, because we can run out of time at the end of the breeding period.

- Local inhabitants have released *Cyprinidae spp.* and a predatory European perch *(Perca fluviatilis)* into one of the new ponds at Model Area of Szada. We could not catch the latter fish, so it has damaged the European mudminnow and Crucian carp *(C. carassius)* populations of the pond. Wide information dissemination among local inhabitants is not necessarily a good solution to this problem - if more people know about the ponds, more can harm them.
- Reproduction strategy of *U. krameri* is to rear relatively small amount of larvae (100 - 250/female). Contrary to other fish species the artificial propagation methods (for instance using hormone administration for induction of ovulation) are not effective with this fish species so we had to develop new captive breeding methods.

Major lessons learned

- The Model Area of Szada chosen for creating new habitats was ideal, because it is not under legal protection, so applying for permits was easier. It is in vicinity of a species-rich Natura 2000 protected area, with an existing population of the European mudminnow.
- Creating several little habitats instead of one big increased the success of the project. Despite the fact that some of the ponds are close to each other (within 25 m), they all provide different conditions for life, so we could choose those which had high potential for fish survival. Moreover in little ponds monitoring is more efficient, has lower costs and removal of potentially establishing invasive fish species is cheaper. The natural self-purification potential of the created water bodies was high already after a short period of time: in the ponds with high nitrogen compounds (nitrate, nitrite & ammonium) concentration, the nutrient concentration decreased from 97.4% to 76% in 3 years.
- The European mudminnow has an opportunistic alimentation and wide tolerance to water quality. Its decline is due mainly to the draining of fens and marshes, so its populations can be increased with the creation of new water bodies. In 14 - 22 months after the creation of the ponds, the European mudminnow can be released in security, because a suitable food base becomes available. The year after release the fish can already breed.
- According to our studies and other Hungarian and foreign investigations, the invasive and predatory Amur sleeper is a major danger to the mudminnow populations. To make it more difficult for the establishment of invasive fish species, the ponds at the Model Area of Szada are fed by ground water and they do not have connections with each other and different surface water bodies.
- The advantage of captive breeding is the possibility to raise more healthy juveniles and release them to several habitats. The disadvantage is that in order to preserve genetic diversity it is possible to release many juveniles descending from a few parents only at a young age (adaptation, selection), or only a few individuals at older age to avoid potential inbreeding depression. This area needs further study in the near future.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- Extensive collaboration among different NGOs (e.g. Tavirózsa and Nimfea Associations - Hungary, Umbra Association - Slovakia), Directorates of National Parks, Universities, authorities and Government Institutes, Local government of Szada village, "VITUKI" Institute (ceased operation from 2012) and media (national and local TVs, radios, gazettes etc.).
- Organization of field and lab work (*ex situ* and *in situ* conservation) in harmony with the life cycle of the European mudminnow.
- According to Seddon (1999), *"we could consider any re-introduction as comprising a sequence of three objectives: the survival of the release generation; breeding by the release generation and their offspring; and persistence of the re-established population, perhaps assessed through extinction probability modelling."* The first elements of this definition is already accomplished: the released generation has survived. The second element partly came true (breeding by the release generation). More time is needed to evaluate further criteria (breeding of the offspring and persistence of the population), so long-term success of the program will be known only a few years later.

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