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Black nerite - an aquatic snail reintroduction in Hungary

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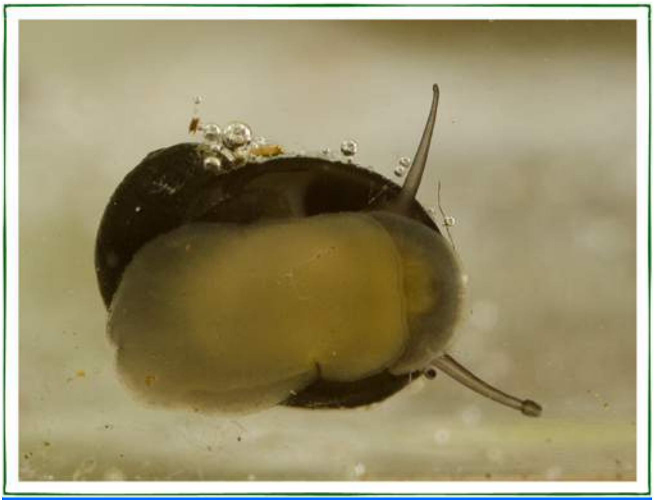
Introduction

Black nerite (*Theodoxus prevostianus*) (Pfeiffer, 1828), is distributed in the Pannonian bio-geographical region of Central Europe and inhabits hypothermal springs and lives attached to hard substrate. Historically, 15 - 20 populations were known, but the majority have become extinct during the past 50 years. Now only four remaining populations are known: two in Austria (Bad Vöslau, Bad Fischau), one in Slovenia (Bušeča vas) and one in Hungary (Kács). Therefore, this species is of high conservation concern; it is legally protected in Hungary, listed in Annex IV of the European Habitats Directive and categorized as endangered (EN) by IUCN. In Kács, there are two groups of springs (a cool, ~15.4 °C and a hypothermal, ~22 °C). Their water form two separate, approximately 50 - 100 m long stream sections (so called cold- and warm branches) before their confluence. Total population size is estimated to 3 - 3.2 million specimens, of which ~25% are found in the warm branch, 1 - 2% in the cold branch and the rest in the joint section.



Black nerite snail © Bálint Bajomi

Despite the legal protection, the species' conservation status and long term persistence at Kács seemed unsatisfactory, mostly because the population is located within a private property outside of the Bükk National Park.

Goals

- Goal 1: Select suitable recipient sites, which were historic locations of the black nerite and their habitat conditions seem to be adequate to support this species again.
- Goal 2: Reintroduce black nerite individuals to these sites in order to establish self-sustaining populations.
- Goal 3: Raise public awareness for the project and the species specifically, and freshwater invertebrate conservation in general.
- Goal 4: Maintain suitable hard substrate (rock/concrete surfaces free of vegetation) for the species, monitor population persistence to detect undesirable changes in population size.

Success Indicators

- Indicator 1: Survival of the translocated population at the new location was defined as the indicator of short-term success.
- Indicator 2: Presence of locally hatched offspring was defined as the indicator of mid-term success.
- Indicator 3: Permanent establishment of a self-sustaining population was defined as the indicator of long-term success.

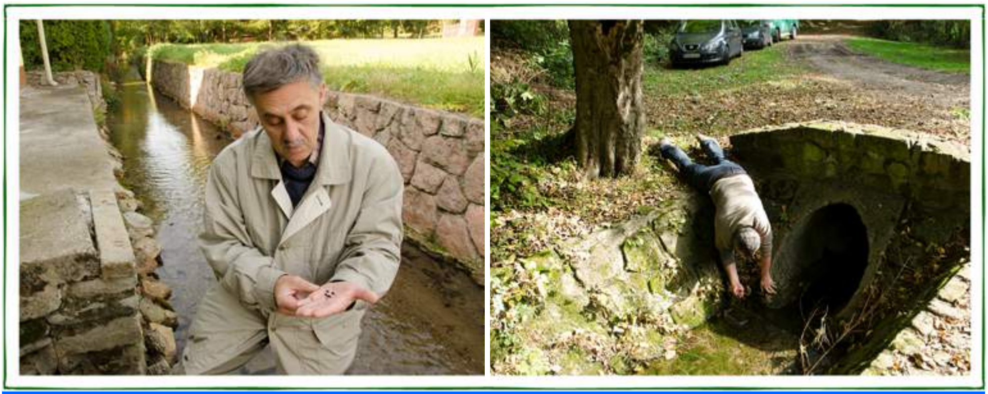
Project Summary

Feasibility: The vulnerability of the Kács population was so obvious that the idea of creating insurance populations had long been considered prior to the alarming disturbance events of 2010 (see Fehér *et al.*, 2011 for details). The idea of reintroduction was first proposed by one of us (Gábor Majoros) in 1999. The plan took the form of a proposal during the Annual Meeting of Hungarian Malacologists in 2009.

Prior to this, we have investigated the intraspecific molecular diversity and phylogenetic relationships of this species. Three diverging intraspecific mitochondrial lineages were revealed, of which one comprised the Kács population. This was a good reason to treat the Kács population as a distinct conservation unit and it gave a final impulse to the decision of establishing one or more refuge populations at new locations.

We planned to reintroduce black nerite to such locations, where it had become extinct in past decades. Preliminarily, three sites seemed suitable to host black nerite populations again: Fényes Springs in Tata, Csónakázó-tó in Miskolctapolca and Vízfő Spring in Sály. In Tata, the springs had dried out in the 1960s due to groundwater extraction in connection with coal mining. In Miskolctapolca, the extinction of the population was connected to the reconstruction of the Cave Bath, which is fed by the same springs as the Csónakázó-tó. Vízfő Spring in Sály was captured in the 1970s and there were periods when the outflow completely dried up, causing the extinction of that population.

In March 2010, we analyzed the water quality in the three proposed sites. Regarding Calcium (Ca) and Magnesium (Mg) content, Vízfő Spring was closest to the hypothermal spring of Kács. Fényes Springs had the same Ca content but three times higher Mg content. In the outflow of Csónakázó-tó in Miskolctapolca, we measured hardly any Mg but high Ca content. The chemical oxygen demand



Donor site - Kács (left) and release site - Sály (right) © Bálint Bajomi

of the water seemed to be sufficiently low (<10 mg/L) at each site, except at Miskolctapolca where it was slightly higher than optimal. Sulphide, an indicator of anaerobic processes like rotting, could not be detected in any of the analyzed locations.

We proposed to introduce 200 specimens per year for a period of three years to each locations (1,800 specimens altogether). We applied for permission to the Hungarian National Inspectorate for Environment, Nature and Water in March 2010. After a long procedure, we got permission to reintroduce black nerites to Miskolctapolca and Sály but not to Tata, and we were allowed to collect only 200 specimens per year between 2010 and 2012 (600 specimens altogether).

Implementation: Regarding the low number of specimens we were allowed to collect, we preferred to start with one location and not to spread the permitted quantity into more than two batches (200 specimens in 2010 and 400 in 2012). We choose Vízfő Spring, which seemed to be the most promising on the basis of water quality data. Animals were hand collected and carried between wet tissue paper in a plastic cooling box. The duration of the transport was less than 30 minutes, therefore the box was neither cooled nor heated actively. The specimens were tempered gradually to the temperature of the recipient environment in a plastic bucket before releasing to the wild. The animals were released at two spots about 15 m and 30 m from the spring's outflow. The first spot was in the concrete section, the other one was in the natural section of the brook. Animals were initially sheltered by small clay pots to avoid immediate drifting of the withdrawn specimens caused by the strong water current in the stream.

Post-release monitoring: The follow up monitoring was performed somewhat irregularly, twice a year on average and neither living specimens nor empty shells were found up to August 2014, almost two years after the second translocation. At the following visit on 24th October 2015, however, numerous adult specimens were detected. One year later on 15th October 2016 the population still existed and found to occupy at least a 400 - 500 m long section down from the outlet. Living specimens were observed also upstream from the upper release spot, demonstrating the species' ability to spread upstream. Some of the specimens were found to carry the remnants of freshly freshly-hatched egg capsules attached to their shells. We have randomly set quadrates of 30 cm x 30 cm along the populated stream section to count those animals which are visible to the naked eye. Extrapolating these quadrat counts to the whole populated area, the number of adult and sub-adult specimens was estimated to be 5,000 - 20,000.

These observations let us to assume that most, if not all, of the observed individuals were born and developed *in situ*, which indicated the action was success in the mid-term. For the assessment of the long-term success of the action, of course, further population monitoring is necessary. In addition to this, active habitat management might be required to maintain suitable hard substrate for the species.

Major difficulties faced

- We were allowed to reintroduce only a small number of individuals.
- Nerites are dioecious without apparent sexual dimorphism. Therefore, it was impossible to determine the sex ratio in the donor population. In extreme situation, a skewed sex ratio combined with small number of individuals can result in the complete exclusion of one sex.

Major lessons learned

- The most noteworthy lesson of our program was the long latency of the reintroduced population. At least two years have passed after the second round of translocations and the density of the establishing population still remained below the detection threshold. The sudden increase in population size started just after that. This long latency underlines the importance of long-term follow-up monitoring in any gastropod reintroduction program.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
√			

Reason(s) for success:

- Suitable habitat conditions at the recipient site and similar physico-chemical properties of the water in the host and recipient sites.
- In order to compensate the low number of adult specimens we are allowed to collect, we selected as many specimens with unhatched egg capsules attached to their shells as possible.
- Austrian black nerite populations were known to show increased egg laying activity from August to February and to have two waves of increased mortality in September and in March, therefore we timed both translocations in late autumn.

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