

Origin, Status, and Conservation of the Mallorcan Midwife Toad

Adult *Alytes muletensis* emerging from a rock crevice. Photo: C. Lopez



Six million years ago, following a gradual decrease in sea level, dry land separated the Mediterranean Sea from the Atlantic Ocean, and connected the European mainland with the Balearic Islands. A million years later, sea level had risen again connecting Atlantic and Mediterranean waters through the Strait of Gibraltar, and re-isolating the Balearic Islands — but not before a number of animal species from the mainland had successfully colonized them. Among the animals new to the islands was the ancestor of the Mallorcan midwife toad, *Alytes muletensis* (Sánchez and Adrover, 1979). This anuran became established on the larger islands of Mallorca and Menorca, where it evolved practically without predators until the arrival of humans.

Pressures that began with the arrival of humans led to the extinction of many Balearic animal species. Apart from dozens of species of invertebrates, only the Mallorcan midwife toad and the wall lizards *Podarcis lilfordii* and *Podarcis pytiusensis* remain of the previous fauna. What has saved these animals is their ability to inhabit areas that are largely inaccessible to humans — the midwife toads in remote mountain streams; the lizards on small islets that surround the main islands. Nonetheless, these species face continuing threat.

Living fossils

At Cova de Muleta (Mallorca), on the outskirts of Sóller in the Serra de Tramuntana, archaeologists from the Deià Museum found fossil bones of what appears



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Alytes muletensis

to be an amphibian that lived in the Balearic Islands thousands of years before the arrival of humans. These remains were studied in 1979 by doctors Sanchiz and Adrover, who confirmed the discovery of a new fossil species — which they named *Baleaphryne muletensis* (after the place where the fossils had been found).

Almost a century earlier, in February of 1881, the first Spanish herpetologist, Eduard Boscà, had reported finding the larval stage of the olive midwife toad *Alytes obstetricans boscai*. This data was cited in papers well into the twentieth century. In the summer of 1978, Joan Mayol and Gabriel Pomar visited a mountain stream where Boscà had found the larvae, and began moving stones. They found a small anuran, which they took to the city to study and photograph. Identification keys indicated it belonged to the genus *Alytes*, but it did not

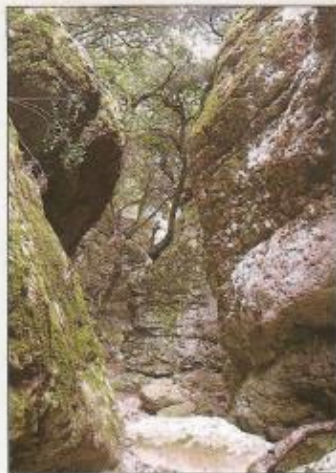
seem to correspond with the illustrations. The presence of the genus *Alytes* in the stream had been confirmed, but whether it was *A. obstetricans* was questionable. The animal eventually died and was preserved (MAYOL, 1985).

Joan Mayol and Joan Antoni Alcover compared the preserved specimen with specimens of *A. obstetricans* in scientific collections, and found that it did not appear to be the same. Then a new idea arose: Could the midwife toad that was found by Mayol and Pomar in 1978 be related to the fossils found years earlier? To resolve this question, bones were compared with the fossils — and were a perfect match. A living fossil had been discovered.

Still not known by the scientists was that this species formed part of the cultural heritage of the local resi-



Subadult hiding in a crevice along a streambed. Photo: S. Pinyá/CECH



A mountain stream through an oak grove is typical habitat of this species. Photo: S. Pinyá/CECH

dents of the Serra de Tramuntana. The locals called the animal *ferretet*, and said it was able to call from one place but be heard from another (MAYOL, 1985), like a ventriloquist, making it difficult to find.

Aware of the discovery, state administrators made efforts to include the *ferretet* in a list of protected species long before the scientific description of the species was even published. This gave the amphibian a certain legal status that paved the way for its conservation.

Meanwhile, leading herpetologists were beginning studies of the species, which led to extensive published literature (MAYOL, et al., 1984). These studies revealed that the *ferretet* is indeed a very close relative of *Alytes obstetricans*, which is abundant in western Europe. Consequently, the name that had been given the fossils was changed to *Alytes muletensis*, which is more correct from a taxonomic standpoint.

Description

The Mallorcan midwife toad is a relatively primitive anuran. In coloration it is yellowish with a multitude of black markings of various shapes and sizes. It measures about 4 centimeters in length and has bulging eyes and relatively thin legs that allow it to climb vertical rock

faces in its mountain stream habitat.

During mating, the female deposits elastic strings of eggs which the male fertilizes and wraps around his hind limbs. The male then protects the eggs until they are about to hatch. The Mallorcan midwife toad produces clutches of only 8–15 eggs (much smaller than the clutches of *Alytes obstetricans*, which consist of 40–90 eggs) — this small clutch size is indicative of evolution in a predator-free environment.

When the eggs are ready the male midwife toad releases them into the water, which triggers hatching. Tadpoles remain in the water for a variable period of time, from a few weeks to more than a year, depending mainly on the temperature of the water — development is slower at cool temperatures and faster at warm temperatures.

When the time is right, the tadpoles begin to metamorphose. Legs appear, the tail is resorbed, and the filter-feeding mouth parts of the aquatic larva change into the predatory mouth of the insectivorous terrestrial frog.

Following metamorphosis, the froglet spends most of its time hunting and eating all kinds of invertebrates — whatever fits into its mouth. During the breeding season, from April to September, feeding is interspersed with mating activity.

Alytes muletensis Population Data

Estimated population: 4,000–5,000 specimens
1991 annual census: 15,000 tadpoles
2004 annual census: 30,000 tadpoles (a record number)
2005 annual census: 22,797 tadpoles
2006 annual census: 24,108 tadpoles
In 1991 there were 11 population localities
In 2004 there were 34 population localities
Total surface area of suitable habitat in the Serra de Tramuntana: 180 km ² .
Area of habitat occupied by population localities: Less than 10 km ² .

Habitat and its conservation

The Mallorcan midwife toad lives almost exclusively in one type of habitat — narrow ravines and rapid mountain streams — which are characteristic of the Serra de Tramuntana. In such ravines, water collects in practically permanent pools. Furthermore, many of these rugged areas are inaccessible to most of the vertebrates that now inhabit the island of Mallorca (ALCOVER et al., 1984). During the day, the midwife toads hide in crevices along the walls of the ravines. They come out at night to hunt.

In addition to these more protected ravine habitats, manmade ponds and reservoirs are also inhabited by the midwife toad. In some cases these places are even more favorable than the mountain ravines, being in areas that are warmer and have more abundant prey.

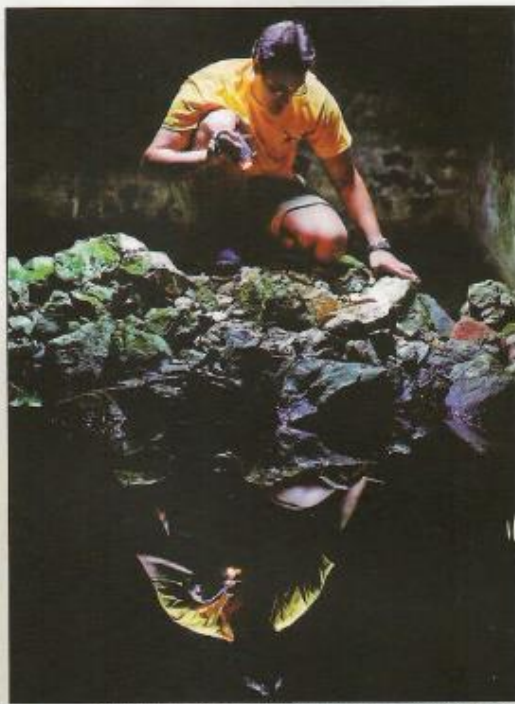
Conservation of suitable habitat is key to the survival of the Mallorcan midwife toad. The Balearic government environmental agency have included all areas that are home to the frogs in a network of nature sites that are considered important to the community.

Threats

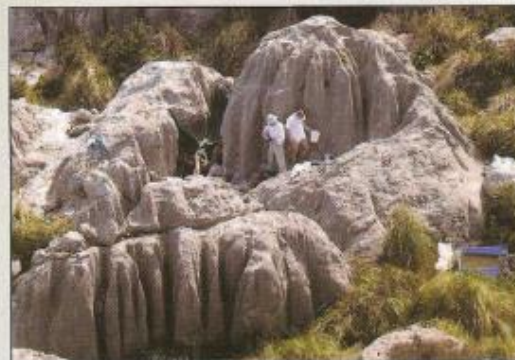
The survival of the Mallorcan midwife toad is threatened in two general ways: habitat destruction and introduced animal species.

The habitat of the species is vulnerable to changes caused by human activities. The construction of dams, other alteration of water courses, and pollution, for examples, can upset the ecological balance in the ravines of the Serra de Tramuntana. Hikers and Sunday strollers who are not familiar with or respectful of the delicate nature of these habitats can also cause disturbances that negatively affect the species.

Predators that cause particular impact on *Alytes* populations are the viperine water snake, *Natrix maura*, and the Coruna frog, *Rana perezi*, both of which were introduced by humans.



Carrying out a census of *Alytes muletensis* in a cavern in the Serra de Tramuntana. Photo: S. Torrens



Midwife toad conservation activity by members of CECH and the Balearic government. Photo: A. Morales/CECH

The viperine water snake was introduced to Mallorca for use in medicine or mysticism. These freshwater snakes are specialized in feeding on invertebrates (mainly worms), fish, and amphibians (both larvae and adults) (SANTOS, 2000; SANTOS et al., 2000). On Mallorca, they feed mainly on the Coruna frog, which is abundant in ponds and streams. In habitat occupied by the Mallorcan midwife toad, viperine water snakes feed on both the tadpoles and the adult frogs, and can end up eliminating entire populations of the amphibians. Predation by viperine water snakes has affected the distribution of the midwife toad on Mallorca, reducing it to the



Male midwife toad carrying eggs. Photo: C. Pache

most inaccessible areas of the Serra de Tramuntana (ALCOVER et al., 1984).

The Coruna frog has been seen eating adult midwife toads, but it is not known if this is common practice.

Midwife toad tadpoles are taken by other predators that have evolved along with them and pose no significant threat to the species. These include aquatic insects such as water bugs of the genus *Notonecta*, and beetles of the genus *Ditiscus*, which sometimes feed on small tadpoles (OLIVER, pers. comm.).

Conservation projects

Since the discovery of Mallorcan midwife toads, many projects have

been carried out for conservation of the species, such as repopulation and reintroduction programs. Water troughs and pools have been constructed in suitable areas, and "seeded" with tadpoles bred in captivity. Private entities such as Marireland Mallorca, the Barcelona Zoo, and the Jersey Zoo (Durrell Wildlife Conservation Trust) have collaborated with captive breeding of the species — although currently no longer breeding the frogs for repopulation, they continue to participate by focusing efforts on educating the public about the species and relevant environmental issues. A reserve of captive Mallorcan midwife toads is

maintained in case the survival of the species in the wild becomes further threatened in the future.

After the EU funded project LIFE-FERRERET carried out from 1994 to 1997, and the conclusion of the *Plan de Recuperación del Ferreret* in 2002, necessary measures for continuing conservation of this species have been stipulated. A second recuperation program is underway that will include conservation and maintenance of existing wild populations, and augment research for increasing knowledge of the biology and ecology of the species (OLIVER, pers. comm.).

The Mallorcan midwife toad is lucky to be legally protected at the local, national, and international levels. Until recently the species was listed as "critically endangered" by the IUCN, but the status has been changed to "vulnerable." This decrease in level of threat corresponds with the positive results of conservation efforts made by many dedicated people — certainly a success for the herpetology world.

The future

For now, it can be said that the species status of the Mallorcan midwife toad is healthy. However, it must also be recognized that if species maintenance measures are relaxed because of successes gained, all might be lost. To prevent such a mistake, diligence is required in continuing to guarantee habitat conservation, reduce predation pressure, increase knowledge of the



Close-up of a clutch with several infertile eggs. Photo: C. Pache



Alytes muletensis tadpole, with light coloration. Photo: C. Pache

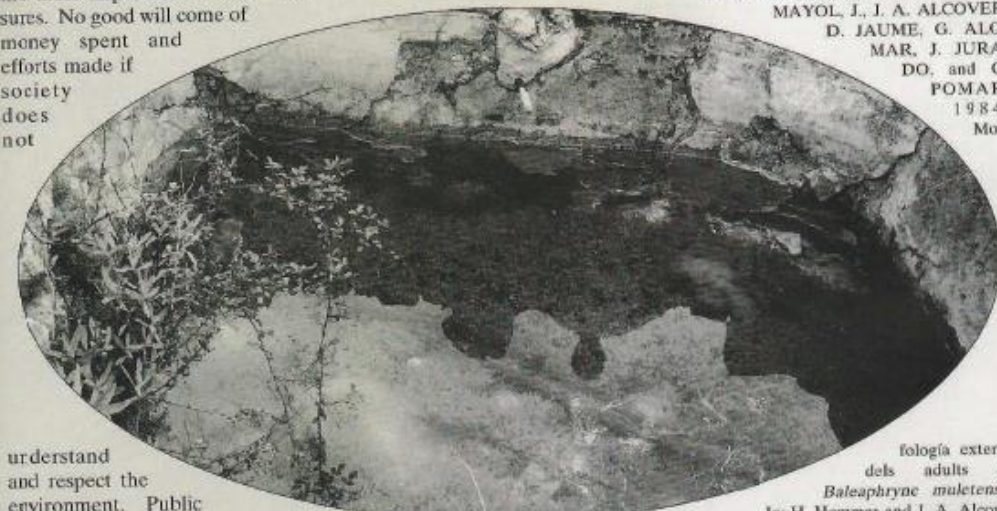


The viperine water snake, *Natrix maura*, and the Coruna frog, *Rana perezi*, are the main predators of the Mallorcan midwife toad. Photo: C. Pache

biology of the species, and educate the public about the ecological and cultural importance of this amphibian on the island.

Personally we consider habitat conservation and public education the most important of these measures. No good will come of money spent and efforts made if society does not

understand and respect the environment. Public awareness and education are of vital importance for the conservation of not only the precious Mallorcan midwife toad, but of all the other island species as well.



Amblystoma muletensis breeding locality in a manmade pond. Photo: S. Riera/CECH

Acknowledgments

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Bibliography

- ALCOVER, J. A., J. MAYOL, D. JAUME, G. ALOMAR, G. POMAR, and J. JURADO. 1984. Biología i ecologia de les poblacions relictos de *Baleophryne muletensis* a la muntanya mallorquina. In: H. Hemmer and J. A. Alcover (eds.), *Història biològica del Ferreret*. Editorial Moll, Palma de Mallorca.
- MAYOL, J., J. A. ALCOVER, D. JAUME, G. ALOMAR, J. JURADO, and G. POMAR. 1984. Mor-

fologia externa dels adults de *Baleophryne muletensis*. In: H. Hemmer and J. A. Alcover (eds.), *Història biològica del Ferreret*. Editorial Moll, Palma de Mallorca.

MAYOL, J. 1985. Els Amfibis i Reptils de les Illes Balears. In: *Manuale d'Introducció a la Natura* 6. Editorial Moll, Palma de Mallorca.

SANTOS, X. 2000. *Ecologia de la culbra viperina, Natrix maura (Linnaeus, 1758), en el Delta del Ebro*. Doctoral thesis, University of Barcelona.

SANTOS, X., J. GONZÁLEZ-SOLÍS, and G. A. LLORENTE. 2000. Variation in the diet of the viperine snake, *Natrix maura*, in relation to prey availability. *Ecography* 23: 185-192.