

## Re-introduction of the Mallorcan midwife toad, Mallorca, Spain

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### Introduction

The Mallorcan midwife toad (*Alytes muletensis*, Sanchíz & Alcover, 1977) or *ferreret* was first described in the 1970s as *Baleaphryne muletensis* from upper Pleistocene fossils, and was considered extinct. The discovery of live tadpoles in 1980 led to further research which confirmed the species as extant and endemic to Mallorca (Mayol & Alcover, 1981). Subfossils suggest that the species was once widespread across the island, but today it is confined to a few gorges within the Serra de Tramuntana mountains in the north-west part of the island. There are currently about 34 populations within the mountains and adjacent areas (16 original wild populations plus 18 re-introductions). These are largely isolated from each other by physiographic barriers, but there is little evidence of any inbreeding depression. Re-introduction of captive bred toads started in 1989 and it is estimated that about 25% of the wild toads stem from captive bred stock. The successful re-introduction program contributed to the downgrading of the species from 'Critically Endangered' to 'Vulnerable' in the Global Amphibian Assessment of 2004. There is little evidence that wild populations are continuing to decline, but the recent discovery of chytridiomycosis in four populations gives cause for concern.



Mallorcan midwife toad (*Alytes muletensis*)

### Goals

- Goal 1: Identification of potential re-introduction sites within the species' historic range.
- Goal 2: Habitat management and creation at potential re-introduction sites.
- Goal 3: Sustainable populations of toads established in all areas where there is suitable habitat, hydrology and absence of introduced predators.
- Goal 4: Annual monitoring of all toad populations (both natural and re-introduced).

### Success Indicators

- Indicator 1: Self-sustaining populations established at re-introduction sites.
- Indicator 2: Overall geographical distribution of the species extended.

### Project Summary

A captive breeding program was initiated at Jersey Zoo in 1985 following the collection of 8 animals from the wild. This was supplemented by a further 12 individuals in 1987 and the species was bred for the first time in 1988.

Further breeding colonies were subsequently established at other collection-based institutions and Universities in Europe, with the Balearic Island government retaining formal ownership of all animals. Following an assessment of potential re-introduction sites by the Mallorcan conservation authority (Conselleria d'Agricultura i Pesca), 76 tadpoles were returned to Mallorca and released at 2 sites in 1989. Since that time releases of both toadlets and tadpoles occurred on an annual basis up to 1997 (Buley & García, 1997), and then less regularly until 2001.

Meetings of all project partners have occurred at approximately two-yearly intervals to evaluate progress and decide upon future goals. In 1996 an extensive health screening program of captive toads was established (probably the first for any amphibian in a captive-breeding program). Toads underwent parasitological and bacterial screening for three months prior to release, and fecal samples were collected from both captive and wild toads for analysis by the veterinary department at Jersey Zoo. As all toads in captivity were descended from the original 20 founders collected in 1985 - 1987, and three new bloodlines were established in captivity in 1997 with the collection of 25 tadpoles from each of three wild populations (Buley & Gonzalez-Villavicencio, 2000; Roca *et al.*, 1998, 2000).

With concerns growing towards the end of the 1990s about the global impact of emerging infectious diseases on amphibians, a recommendation was made that no further re-introductions should be carried out until i) the disease implications of further re-introductions became clearer; and ii) genetic analysis of both wild and captive populations was carried out. Microsatellite DNA analysis was completed in 2006, and revealed that although populations in different gorges were largely isolated, wild populations retained relatively high levels of genetic diversity. Equally, there was no evidence that reintroduced or captive toads had suffered any loss of fitness or genetic variability for up to eight generations of captive breeding (Kraaijeveld-Smit *et al.*, 2005; 2006). Screening for chytridiomycosis (*Batrachochytrium dendrobatidis*) was added to the health screening protocol in



Toad tadpoles in a natural pool

## Amphibians



Artificial cistern which is used by *Alytes* (now constructed as a conservation management measure)

2005, and chytrid-positive animals have subsequently been identified in four populations. The impact of chytrid remains unclear, but successful breeding still appears to be occurring in the populations concerned.

A complete census of all *Alytes muletensis* breeding sites is carried out annually. As the adult toads spend most of their lives underground and are very difficult to survey, the censuses consist of counts of tadpoles observed in each pool. Although it is difficult to relate such simple counts to actual population sizes, the presence of

abundant tadpoles spread across several size classes provides a useful index of breeding success. Breeding populations of toads have become established at all 18 sites where re-introductions were carried up to 2001, and wild populations appear to be stable, and in some cases, increasing. Since its early days, the conservation program for the Mallorcan midwife toad has embraced a multidisciplinary approach to species recovery. In this respect, the wider components of the project have included conservation education initiatives, publicity, applied ecological research, predator control, conservation genetics, health screening and habitat management and creation. In addition to using natural torrent pools as breeding sites, the toad also breeds successfully in artificial cisterns constructed for the watering of livestock. Construction of such cisterns in suitable areas has proved to be a successful supplementary conservation action.

### Major difficulties faced

- Alien predators and competitors – notably the viperine snake (*Natrix maura*) and Spanish marsh frog (*Rana perezi*) – remain a widespread and very significant threat and are very difficult to control.
- A burgeoning human population coupled with climate change means that water is in short supply on Mallorca. Consequently, torrents flow less frequently than they once did and breeding pools may be more prone to desiccation.
- Because of the two points mentioned above it is impossible to completely neutralize the threats to the toads on the island, and re-introductions may therefore need to be accompanied by management measures to minimize the impact of alien predators and desiccation.

### Major lessons learned

- A small partnership of co-operative stakeholders that meet regularly enabled decisions to be made quickly and appropriate actions implemented.

- A health screening program was in place before reliable methods for the detection of chytridiomycosis were known. Chytridiomycosis (and possibly other emerging infectious diseases not yet known to science) may therefore have gone undetected for several years.
- Management decisions have been informed by scientific research (more scientific papers have been published on *Alytes muletensis* than on any other amphibian species in a captive breeding/re-introduction program).
- The program has been running for nearly 30 years, and during this time has tried to embrace new ideas and protocols in re-introduction practice as they have been developed. Consequently the whole program has 'evolved' rather than been 'planned'.

### Success of project

Highly Successful	Successful	Partially Successful	Failure
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### Reasons for success/failure:

- The Mallorcan midwife toad was the only amphibian species in the Global Amphibian Assessment to be downgraded from 'Critically Endangered' to 'Vulnerable' in 2004.
- All of the 18 re-introductions appear to have been successful. This has resulted in a doubling of the original geographical range of the species.

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