

# Thirty years of study, conservation, captive breeding and population reinforcement of Hermann's tortoise (*Testudo h. hermanni*) in the Sierra de l'Albera (Eastern Pyrenees, Catalonia)

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## ABSTRACT

Description of the main regression causes of Hermann's tortoise (*Testudo h. hermanni*) population in the Sierra de la Albera (easternmost stretch of the Pyrenees in Catalonia) in recent decades, along with the conservation actions taken in the last 30 years.

## RESUMEN

Se describen las principales causas de regresión de la población de tortuga mediterránea (*Testudo h. hermanni*) de la sierra de la Albera (Pirineo oriental, Catalunya), en los últimos decenios y las diferentes acciones de conservación realizadas en los últimos 30 años.

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## INTRODUCTION

A unique natural population of Hermann's tortoise (*Testudo h. hermanni*) remains in the Iberian Peninsula, in the Sierra de la Albera (easternmost stretch of the Pyrenees) in Catalonia. This small population (~80 km<sup>2</sup>) has been studied from the end of the 1980s to the present-day. Its declining population size seems to have slowed down in the last few decades (Bertolero et al. 2020). The last censuses show certain population stability, albeit at a low population renewal rate. Currently, the average population is 0.8 tortoises/ha. However, densities are 4 tortoises/ha in some small valleys in the area (Bertolero, 2019).

This study aims to compile not only the main causes of *T. h. hermanni* population decline in the Sierra de la Albera, but also the conservation actions that have been taken in the last 30 years.

## CAUSES OF SPECIES

### REGRESSION IN THE SIERRA THE LA ALBERA

The causes of this declining population are varied. They began being detected and studied more than 35 years ago (Félix, 1984, Budó et al. 2004).

- Loss of habitat due to agriculture. For more than 300 years, the substitution of forest and Mediterranean scrub to favour vineyard and olive cultivation has severely transformed thousands of hectares of Hermann's tortoise habitat, which has reduced this species' distribution, and has continued until the present-day (Vilardell et al. 2007a). Unfortunately, all the studies are based on approximations and no accurate data about this habitat change are available.

- Forest fires. Within the species' range, wildfires have been very common in the Sierra de la Albera in the last 70-80 years. The high

recurrence of these disturbances has been an important cause of species regression (Félix et al. 1989; Félix 1999; Badiane et al. 2017).

- Habitat disturbance due to human activities.

Certain areas of the distribution range have been highly frequented by people in recent years because some architectural, cultural or leisure elements have attracted the public. These activities with marked human presence disturb the tortoise population in this area (Budó, 2001).

- Poaching and trade.

Since the first quarter of the 20th century, having tortoises in house gardens became very fashionable in Catalonia (Félix, 1995). As tortoises did not benefit from any kind of protection measures, poaching and trade have been very common until 1986. In 1986, Catalan legislation prohibited specimen possession and commercialisation.

- Predation.

Given the uncontrolled increases in wild boar (*Sus scrofa*) populations in recent years, high tortoise predation rates have been found, especially in tortoise nests (Vilardell et al. 2007b). Numbers of other predatory species have also increased, with a similar impact on tortoise survival, such as beech marten (*Martes foina*) and badger (*Meles meles*). Different studies indicate that the predation of these three species can be as high as 73% of the nests in the area (Budó et al. 2003, Budó and Capalleras 2006).

- Low genetic diversity.

Genetic studies carried out on different Hermann's tortoise populations in Europe indicate that the Albera population is the least diverse of all those studied. This narrow genetic variability may be one of the factors that hinders

population growth (Zenboudji et al. 2016).

- Emerging diseases.

Another factor to take into account is the detection of a certain load of pathogens, such as Herpesvirus and Mycoplasma, in Albera population specimens. The origin of these emerging diseases is unknown because no studies support whether these diseases have developed in natural populations or been transmitted by uncontrolled released specimens of any land tortoise species, which are regularly detected in the distribution area (Budó et al. 2018).

### CONSERVATION ACTIONS

In order to preserve the Hermann's tortoise population in the Albera, different actions and legislative measures have been taken by the Catalan administration over the years. These measures have led to conservation and preservation actions being taken with the last Iberian tortoise population.

- Legislation

To international and European legislation, another has been added since 1986, which the Catalan government has more forcefully applied to eliminate poaching, trade and possession in private homes. It has had a very positive impact.

- Habitat protection (the Sierra de la Albera Natural Park)

In 1986, the Catalan government declared a large part of Hermann's tortoise's habitat and distribution area in the Sierra de la Albera to be Natural Park and Nature Reserves. In 2006 with Natura 2000 Network approval, almost the entire species' distribution area in Catalonia was protected. However, the management of agricultural, forestry and recreational practices in this area continues to be a key aspect for species conservation.

- Captive breeding (Centre de Reproducció de Tortugues de la Albera). In 1984, a naturalist association created a captive breeding centre for Hermann's tortoises called the Centre de Reproducció de Tortugues de la Albera (CRT La Albera). This centre encouraged the administration to act by taking subsequent measures to recover the tortoise population. Nowadays, the CRT La Albera develops conservation programmes with captive Hermann's tortoise breeding, and also with the two native freshwater turtles of Catalonia: the Mediterranean turtle (*Mauremys leprosa*) and the European pond turtle (*Emys orbicularis*). After several years of study to know the various biology, ecology and habitat aspects of

Hermann's tortoise, juveniles born in captivity have been released to reinforce the wild population (Figure 1).

- Environmental education and awareness campaign.

Along with the captive breeding work, the CRT La Albera opted to open its facilities to the general public. Thousands of visitors come to the centre every year, mostly families and groups of schoolchildren. Visitors can learn about the work done by the CRT La Albera to conserve tortoises and, above all, can be made aware about conservation problems and about not having turtle and tortoises as pets.

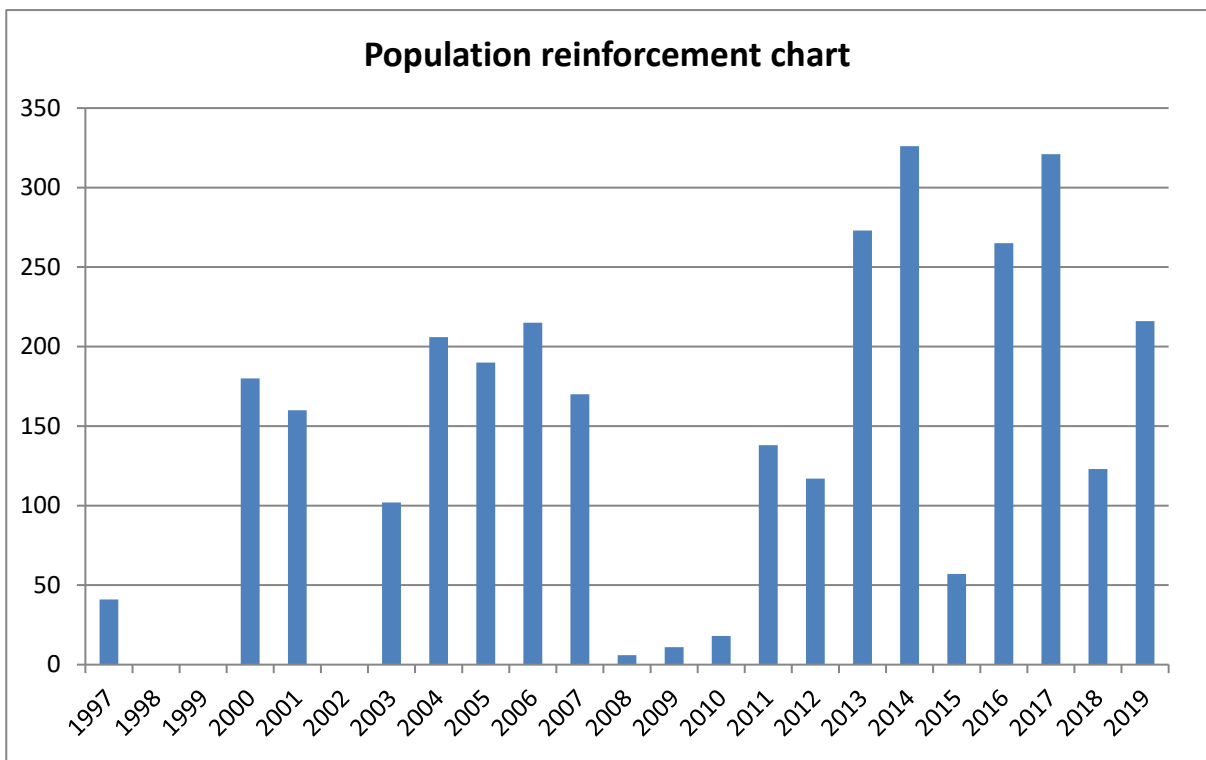


Figure 1: The number of specimens released in the population reinforcements conducted in the last 23 years. During this period, 3,135 Hermann's tortoise juveniles have been released.

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