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# Goodbye to innocence – The silent death and disappearing of the Ibiza wall lizard *Podarcis pityusensis* (BOSCÁ, 1883) caused by introduced snakes.

MARTEN VAN DEN BERG and MIKE ZAWADZKI, September 2023

## Abstract

The Ibiza wall lizard *Podarcis pityusensis* (BOSCÁ, 1883) is the only living endemic land vertebrate of the Pityusic Islands. It has not only become the symbol of these islands, but also plays a significant role in the sub-archipelago's ecosystem. For centuries, Ibiza was famous for being completely free of snakes. Unfortunately, this is no longer the case. The introduction of three snake species on Ibiza has changed the natural balance of the island. The horseshoe whip snake *Hemorrhois hippocrepis* is of particular concern as it is threatening to wipe out the native lizards. Not only does *Podarcis pityusensis* disappear at a worrying rate on Ibiza: the population from the little offshore island Illot de S'Oro, representing the subspecies *Podarcis pityusensis hortae*, has already become extinct due to this new predator.

**Keywords:** *Podarcis pityusensis*, *Hemorrhois hippocrepis*, extinction event.

## Introduction

Human activities have had a significant impact on global biodiversity, leading to the extinction of many species. The reasons include habitat destruction, overhunting, pollution, and introduction of non-native species. Introduction and establishment of alien invasive species is one of the major threats to biodiversity on a global scale (BROOKS et al. 2006). Especially island ecosystems are most vulnerable to invasive species, for one thing because of the small area, for the other thing because many island species have evolved without being used to predators. On the Balearic Islands of Mallorca and Menorca the sister species *Podarcis lilfordi* has become extinct on the main islands more than 2.000 years ago, most probably due to the introduction of the two mammals *Martes martes* and *Mustela nivalis*, as well as the snake *Macroprotodon cucullatus* (ALCOVER et al. 1981). Today you can find *Podarcis lilfordi* only on the offshore islands.

Three species of snakes have been introduced to Ibiza and Formentera as blind passengers in old ornamental olive trees transported from southern Iberian Peninsula: the horseshoe whip snake, *Hemorrhois hippocrepis*, the ladder snake, *Zamenis scalaris*, and the Montpellier snake, *Malpolon monspessulanus*. At least the Montpellier snake does not seem to have established itself on Ibiza, since no specimen of the species has been caught here since 2010 (ÁLVAREZ et al. 2010, MATEO et al. 2011). In contrast to this, *Hemorrhois hippocrepis* has a tremendous negative impact on Ibiza, where it has largely devoted itself to eating lizards and with success since *Podarcis pityusensis* represents 55.4 % of the observed prey (HINCKLEY et al. 2017). *Zamenis scalaris* seems not to have such a major impact on the lizard populations. It is largely found in Formentera. However, a preliminary study has shown that more than half of the prey of *Zamenis scalaris* in Formentera is constituted by *Podarcis pityusensis* (SILVA-ROCHA et al. 2018).

With the rapid expansion of *Hemorrhois hippocrepis* on Ibiza as well as the somewhat incalculable situation with *Zamenis scalaris* in Formentera, *Podarcis pityusensis* is threatened by extinction, if effective measures are not taken immediately to eradicate the invasive snakes.

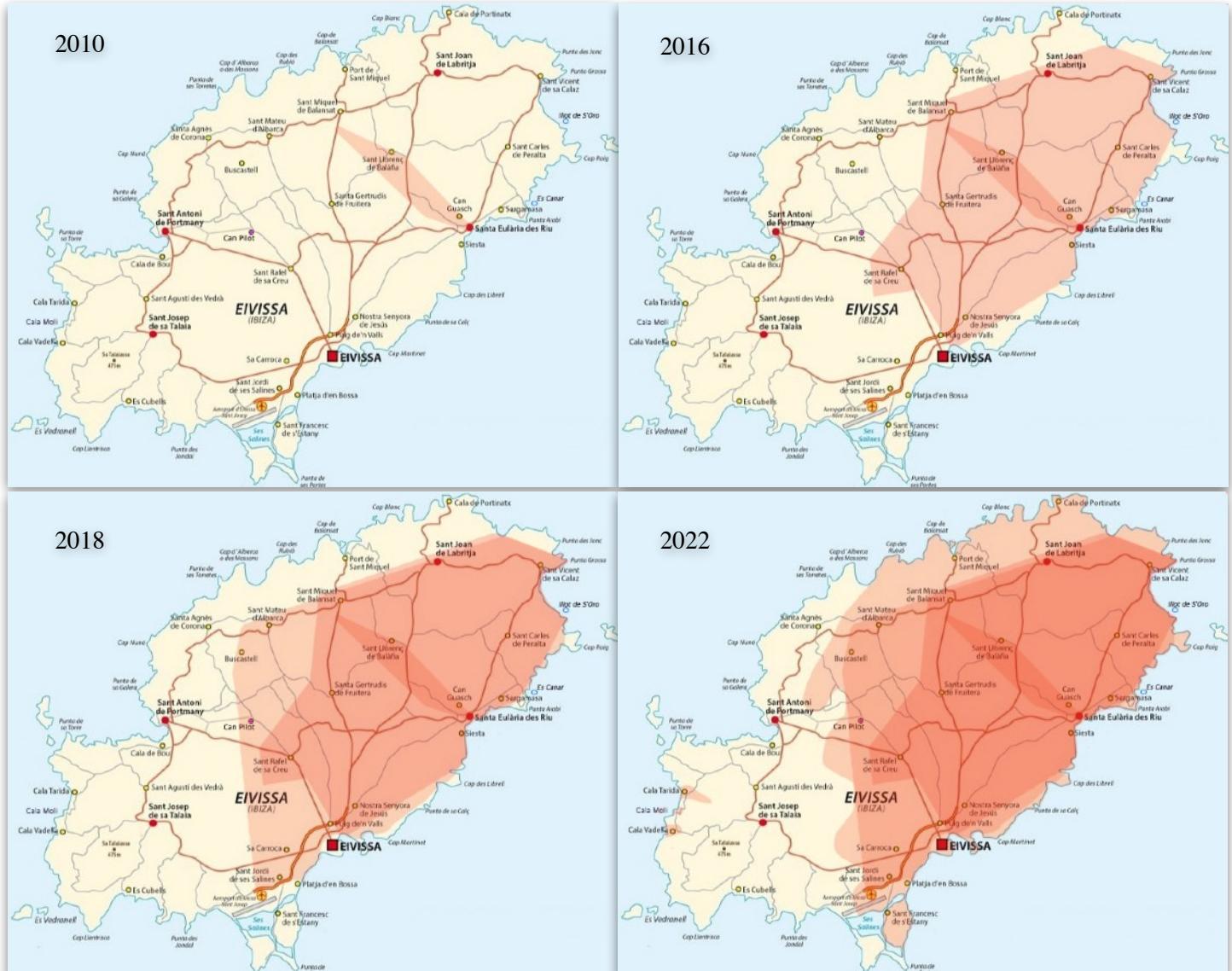
## Home of the lizards

*Podarcis pityusensis* inhabits Ibiza and Formentera as well as more than 40 offshore islands. 23 subspecies are currently recognized, some of which differ considerably in terms of coloration and pattern, but also in size (PÉREZ-MELLADO 2009, SALVADOR 2015). Although the lizards seem to be missing on some small barren rocky islets, some new island populations have been discovered even recently (VAN DEN BERG 2010, VAN DEN BERG & ZAWADZKI 2010, ROMERO 2012, VAN DEN BERG & ZAWADZKI 2017, ZAWADZKI & VAN DEN BERG 2017, VAN DEN BERG & ZAWADZKI 2023).

Some populations of *Podarcis pityusensis* have been reported from outside its actual range, which are due to human introductions. Such populations can be found on Mallorca in Palma (MÜLLER 1927, EISENTRAUT 1949, ZAWADZKI 2012) as well as on the Illetas Islands in the bay of Palma (EISENTRAUT 1949, ZAWADZKI et al. 2018), and in Cala Ratjada (FRITZ 1992, ZAWADZKI 2005). In addition, the species has been able to establish itself on mainland Spain in Barcelona (CARRETEO et al. 1991, BRUEKERS 2007), San Juan de Gaztelugatxe (SOCIETAT CATALANA D'HERPETOLOGIA 2001, GARCÍA-PORTEA et al. 2001) and on Monte Urgul in San Sebastian (SANZ-AZKUE et al. 2005) as well as in the harbor of Denia, Alicante Province (COLODRO et al. 2020) and Kiko port in Oliva, Valencia Province (SAPENA 2023).

## Olive trees as Trojan Horses

It happened quietly and almost unnoticed. Around the year 2000 snakes began to arrive in Ibiza. Aside from the dwarf viper *Vipera latastei ebusitana* that went extinct around 4.000 years ago, shortly after the first humans arrived, Ibiza was free of snakes (TORRES-ROIG et al. 2021). The first specimens of *Hemorrhois hippocrepis* and *Zamenis scalaris* had officially been found in Ibiza around 2003. However, several locals told us stories that some snakes from mainland Spain had already been released on Ibiza in the early 1970s (ZAWADZKI 2020), but probably without being able to establish themselves. There was a story on the island that snakes will never survive because of the soil. The first recorded sighting of a horseshoe whip snake on Ibiza was on



**Image 1.** Cumulative range expansion of *Hemorrhois hippocrepis* on Ibiza in the years 2010, 2016, 2018 and 2022, after merging data from MONTES et al. (2021) and CIRER COSTA & CANDELA MARTÍNEZ (2023). It should be emphasized that these data provide a conservative picture of the situation.

17 May 2003, when a member of the Servei d'Agents de Medi Ambient noticed a specimen escaping from the trunk of an imported olive tree (MONTES et al. 2021).

The sad certainty that this was not an isolated case was soon to be confirmed. During the following years, snake populations were detected in the surroundings of garden centers near Sant Llorenç de Balafia and Santa Eulària des Riu. The secret newcomers not only felt comfortable, but they also reproduced in their new home. After seven years they started to spread on Ibiza and were seen at more remote locations (MONTES et al. 2015; MONTES et al. 2021; see image 1).

**Image 2.** Ornamental trees at an Ibiza garden center.



The ladder snake was sighted for the first time on Formentera in 2006 (ZAWADZKI 2020). It has a low capture rate in Ibiza but is extremely abundant in Formentera. By 2016 *Zamenis scalaris* had invaded an area of around 350 hectares on Formentera, which corresponds to 4.2 % of the island area (SILVA-ROCHA et al. 2018).

This indicates that *Hemorrhois hippocrepis* and *Zamenis scalaris* have successfully naturalized on the Pityusic Islands. The situation in Formentera is said to be still under control while in Ibiza half of the island suffers high density of the new invaders.

The Montpellier snake (*Malpolon monspessulanus*) does not seem to have established itself on Ibiza, since no specimen of the species has been caught here since 2010 (ÁLVAREZ et al. 2010; MATEO et al. 2011).

### **The creeping danger – Our encounters with snakes**

Since *Podarcis pityusensis* has been the subject of our herpetological studies, that are based on taxonomy as well as ecology and reproductive behavior, we have been to the Pityusic Islands many times. Although we had been aware of the arrival of invasive snakes, our first encounter with snakes on Ibiza was in May 2014, when we actively searched for them during two visits around a landscaping company called Noah's Garden near Sant Llorenç de Balafia, and close to two tributary torrents of the Riu de Santa Eulària: Torrent des Verger and Torrent des Garrovers. We determined these two snakes as *Zamenis scalaris* (VAN DEN BERG et al. 2014). The first established range expansion polygon in 2010 (MONTES et al. 2021) corresponds to the course of the torrents between the two original source locations: Sant Llorenç de Balafia and Santa Eularia des Riu. It is believed that torrents are favored by *Hemorrhois hippocrepis* during the dry and hot summer, due to the cooler and wetter local conditions, and thus can be considered as serpent highways (CIRER 2023 pers. com.).

In May 2015 we saw the first snake on the premises of our home base at Can Pilot (VAN DEN BERG et al. 2015), which then was still outside the range expansion of *Hemorrhois hippocrepis* according to MONTES et al. (2021) (see image 1). It did worry us

at that moment, but still the local lizard population was as abundant as it used to be. The first time we realized that also our “home population” was in decline was in 2017 (VAN DEN BERG & ZAWADZKI 2017). During our field investigations in 2018 the situation was similar to the year before, but when we returned to Can Pilot in 2022, we were in shock. The stone walls, where in previous years easily thirty lizards and more could be counted within a short time, were almost empty. The first herpetological aspect we encountered was a *Tarentola mauritanica* basking in a crevice on one of the stone walls. Right below it, a *Hemorrhois hippocrepis* was sunbathing in the grass. The next morning, we were able to capture this specimen. The same afternoon we spotted another horseshoe whip snake crawling along the wall of our chicken shed. Unfortunately, it did not show itself again, so we were unable to catch it. Overall, on the whole premises the number of *Podarcis pityusensis* was in free fall. However, we were still able to observe about forty lizards in a single transect performed in sub-optimal weather conditions. It was striking that this mainly concerned young adults or juveniles. The older and bigger adults had almost vanished at all. We observed this phenomenon in other places in Ibiza where the lizards were in sharp decline, too. It might be an indication that *Hemorrhois hippocrepis* primarily preys on the larger lizards.

In April 2023, the situation had become critical at our home base. We had already been warned by the owners of Can Pilot that all lizards had disappeared. They had installed two snake traps after our last visit in 2022 and were able to catch three snakes. The observation on the lizards was not entirely correct, but it took us some time to find a first specimen of *Podarcis pityusensis*. During seven complete transects around the premises we were only able to discover and identify eight lizards (one young male, one young female, and six juveniles). Just outside our gate of the premises, we found a roadkill *Hemorrhois hippocrepis*. And during a transect from the Sant Antoni de Portmany area back to Can Pilot, another roadkill horseshoe whip snake was found. We expect Can Pilot to be truly free of *Podarcis pityusensis* by 2024.

On the other hand, the *Tarentola mauritanica* population did not seem to be affected by the snakes like the *Podarcis pityusensis* population, at

least at Can Pilot. They were still present in normal numbers in 2023; fourteen specimens counted, like in previous years. But at other places we got the impression that even *Tarentola mauritanica* suffers from the presence of the snakes and is decreasing in numbers.

During a transect at Sant Carles de Peralta on 23 April 2022 in an abandoned meadow area with stone walls we did not see any lizard nor gecko, but once again a large *Hemorrhois hippocrepis* basking on the ground between some scrub cover. This specimen was removed also from nature.

We could also see the drastic decline in lizard populations in other places on Ibiza. During a transect at Punta Arabi in April 2018 we encountered a normal distribution of lizards with both, young and adult specimens, considering that there was never a large abundance of lizards in this pine forest coastal area. In 2022 we walked this transect again, counting one older male *Podarcis pityusensis* accompanied only by a few juveniles. Our 2023 transect at Punta Arabi resulted in no observations at all – the lizards had vanished!

A similar situation at Cala Xarraca. In 2018 nothing out of the ordinary, but in 2022 no lizards anymore on the walls around the parking area, which also happens to be the ending of a torrent. Only when we went up the path along the coastline we still were able to spot some young adult and juvenile lizards. We have not assessed the situation at Cala Xarraca in 2023, but the outcome might be guessed; only juveniles at best.

During a transect in 2023 from Sa Canal towards Punta de ses Portes on the most southern part of Ibiza, the area around Es Pouet de sa Trinx showed a markedly reduced lizard density compared to previous visits. At the same time, the situation around the tower of Punta de ses Portes still seemed steady.

In hindsight, the first time we noticed that something was wrong, was in May 2013. During a sampling session about 2 km to the north of Santa Gertrudis de Fruitera in a meadow surrounded by stone walls we experienced a somewhat different situation compared to the usual occurrence and behavior of *Podarcis pityusensis*. Despite the good weather



Image 3. One of the last juveniles at Can Pilot (April 8, 2023).

conditions, we did not see many lizards, and we were unsuccessful in catching them, too. That was extraordinary, but the alarm bells remained silent.

A second moment was at Es Figueral in March 2016, the day we caught our first *Hemorrhois hippocrepis* in a torrent. In 2013 lizards were not seen in large numbers at this location, but we were still able to survey lizards for our study. In 2016 we spotted only very few lizards (VAN DEN BERG et al. 2016). Nowadays it is no longer possible to encounter a *Podarcis pityusensis* at Es Figueral, at least we failed in 2018, 2019, 2022 and 2023.

Image 4. Young *Hemorrhois hippocrepis* caught at Es Figueral (March 2016). Foto MICHAEL KRONIGER.





Image 5. 152 cm long *Hemorrhois hippocrepis* caught in a meadow near Sant Carles de Peralta (April 2022).

### While there is life, there is hope

Fortunately, we were able to observe normal lizard densities in the southwestern part of Ibiza, in particular at Can Ramonet, Ses Païsses, Cala Comte and Sa Caleta.

At the town of Ibiza and the area to the east of the city walls everything seemed as usual in 2022, which was also confirmed by ANTONIA CIRER (2023 pers. com.) This may have to do with the fact that snakes do not really like the busy city life, which is also suggested in VEZ GARZÓN et al. (2023).

### The situation on Formentera

As opposed to Ibiza, the ladder snake *Zamenis scalaris* is extremely abundant in Formentera. It has been sighted on the island for the first time in 2006, and by 2016 it has invaded an area of around 350 hectares, which corresponds to 4.2 % of the island area (SILVA-ROCHA et al. 2018). Despite this fact, the snake situation on Formentera is said to be under control (VAQUER FERRER 2022). Maybe this is because the snake population is still confined to the area of La Mola, although some occasional sightings have been made in some other areas of the island. But the Consortium for the Recovery of the Fauna of the Balearic Islands (COFIB) is still optimistic about the eradication of *Zamenis*

*scalaris* on Formentera (VAQUER FERRER 2022).

We spotted our first *Zamenis scalaris* on Formentera to the south of Pilar de la Mola in May 2011 during one of our sampling events of *Podarcis pityusensis*. But because of the abundance of *Podarcis pityusensis* a real threat for the population seemed so unlikely at that moment. But as we have now experienced so bitter, this is probably a similar misjudgment of the situation like it had been the case when the first snakes were sighted in Ibiza. And indeed, in some areas in Formentera, like Pilar de la Mola and around Far de la Mola, and even some places near La Sabina, in the north of the island, the number of lizards has decreased from 2018 to 2023 (ZAWADZKI & VAN DEN BERG, unpublished observations).

### The bitter fate of the lizards of the Illot de s'Oro

Looking back at our trip to the Illot de s'Oro in March 2016, it turned out to be a historical visit. This little island is situated at the east coast of Ibiza near Platja des Figuerol and is home to the subspecies *Podarcis pityusensis hortae*. We encountered a population of about 30–40 individuals. Two years later imagery surfaced showing a specimen of *Hemorrhois hippocrepis* swimming in the direction of Illot de s'Oro (MONTES et al. 2021; see image 6). It turned out that this specimen, or a congener, had feasted on this island. ELBA MONTES was still able to observe lizards in 2017 on Illot de s'Oro, but the little island turned out to be completely without lizards in 2018 and 2019 (MONTES et al. 2021). This event happened in a short time, a few months at most. We now can confirm the extinction of the lizard population on Illot de s'Oro representing the subspecies *Podarcis pityusensis hortae* after a survey on 2 October 2021.



Image 6. *Hemorrhois hippocrepis* on its way to Illot de s'Oro, as recorded on April 17, 2018 by LAUREN YOUNG.

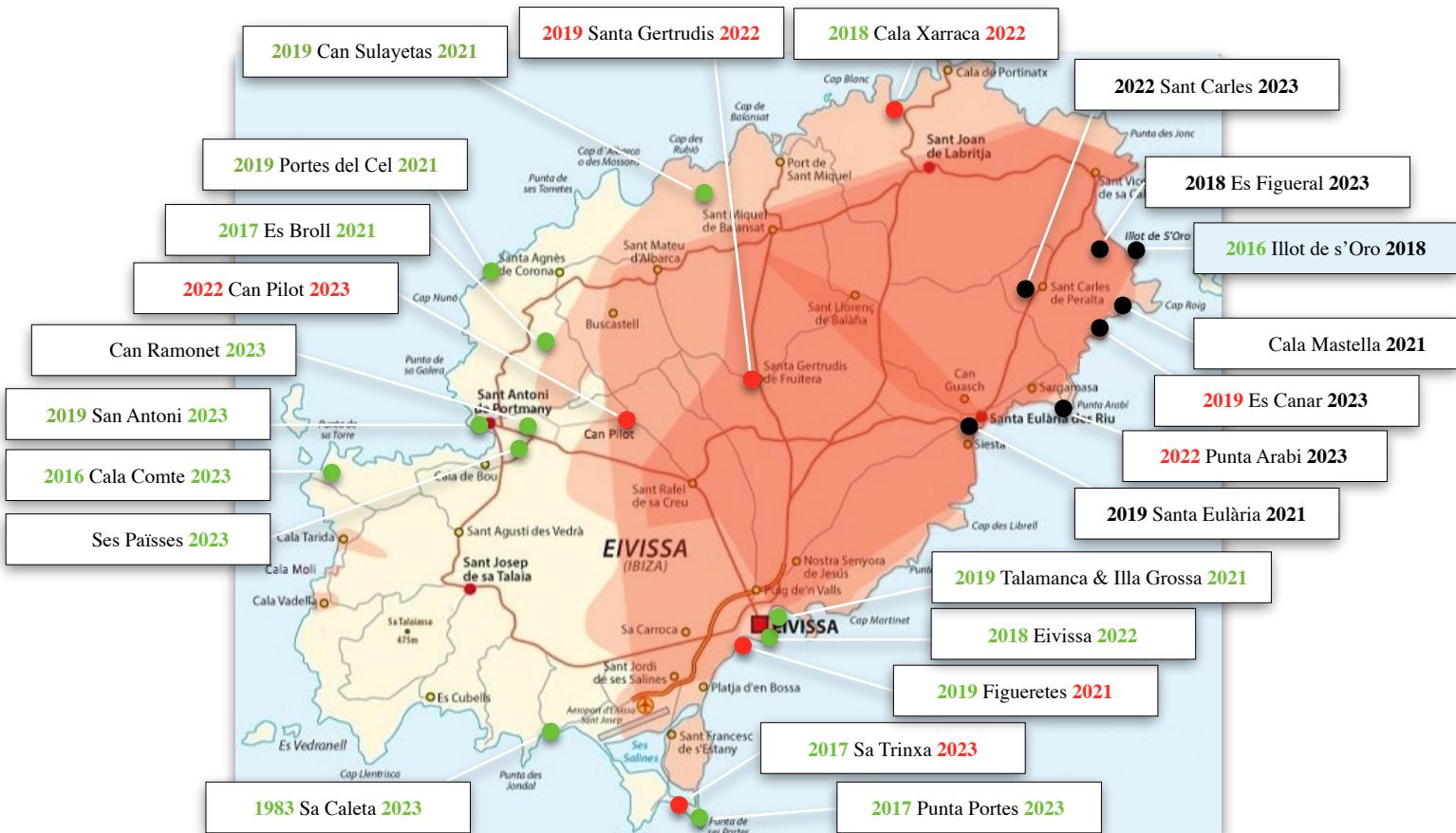


Image 7. Observations on Ibiza populations of *Podarcis pityusensis*. Year in green = stable population. Year in red = declining population. Year in black = extinct population. Dots in color of last observation. The 2018/2019 observations on Ilot s'Oro by MONTES et al. (2021).

## What can be expected?

To figure out how far west the snakes had moved from our location at Can Pilot, we did a transect in 2023, accompanied by our Ibiza resident colleague ANTONIA MARIA CIRER, mostly along the Cami de

s'olivera. We started this transect close to Sant Antoni de Portmany along the Cami d'enmig. The *Podarcis pityusensis* lizard density could be considered as normal along this dirt road. The same applied to the first part of the route back to Can Pilot. At a certain point, just before passing the



Image 8. Ilot de s'Oro, former habitat of the extinct *Podarcis pityusensis hortae*.



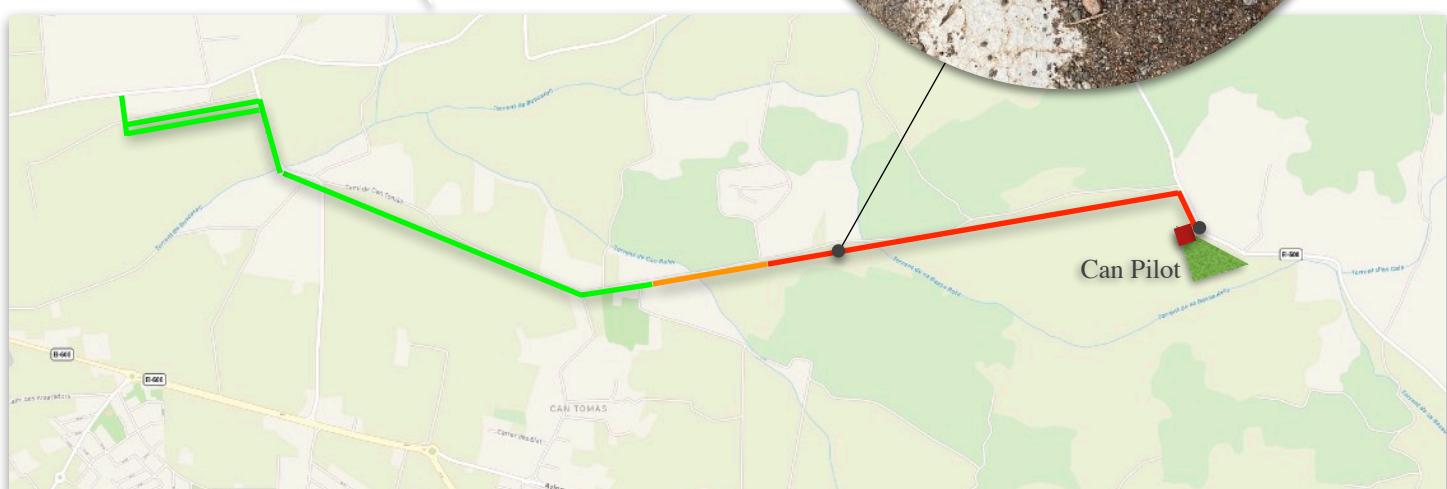
Image 9. One of the last males of *Podarcis pityusensis* on Ilot de s'Oro (March 29, 2016).

Torrent de Can Rafel, we noticed that we started to see fewer lizards. That stopped completely, even prior to finding a dead *Hemorrhois hippocrepis* on the edge of the road, just before passing the Torrent de sa Bassa Roja. These observations are shown in image 10. It is possible that Sant Antoni de Portmany will soon be besieged by the snakes. Torrent de Buscastell will lead the way.

But it is probably not just the torrents that snakes spread along. There are western enclaves reported in the final reports of the 2021 and 2022 campaigns of SOS Salvem sa Sargantana Pitiusa (CIRER 2021; CIRER 2022; see image 1). It is not very likely that in the same period snakes have escaped from the plantation of ornamental trees at Cala Tarida, Cala Moli and Cala Vedella. It is more likely that the snakes deployed amphibious forces to establish a

bridgehead. On the island of S'Espartar, which is situated in front of the Calas mentioned before, two large shedded snakeskins were found around 2013, and we were asked to look around for snakes during our fieldwork on S'Espartar that year. Since these skins had not been blown to the island by the wind, the snakes must have come either by boat or reached the island swimming. With that, all hope disappears that the offshore islands might be safe domiciles for the lizards, that cannot be reached by the snakes. At the latest, the fate of the Illot de s'Oro should have shown everybody what reality looks like and what we must expect.

Ibiza resident scientist ELBA MONTES wrote her doctoral thesis about the fight against invasive snake species on islands. When it comes to the snake situation on Ibiza, she finds straight words for this drama and puts her finger on the problem: “Ibiza has lost its innocence. The lizards will disappear.” (KRAMER 2018).



**Image 10.** Transect on April 4, 2023. Green line = normal amount of lizards. Orange line = fewer lizards. Red line = no lizards. Black dots = roadkill *Hemorrhois hippocrepis*.

## Snake control measures undertaken so far

The Insular Council of Ibiza started a pilot program in 2014 to assess the distribution of the invasive snakes, the state of the populations, learn about aspects of their biology and control the populations of snakes in Ibiza. This pilot project was carried out in 2014 and 2015 under the scientific advice and participation of the Spanish Herpetological Society (MONTES et al. 2015).

Since 2016, the Consortium for the Recovery of the Fauna of the Balearic Islands (COFIB) has been carrying out the control actions for invasive snakes on the islands of Ibiza and Formentera, entrusted to it by the Government of the Balearic Islands. Since the beginning of the project, the trapping effort has been increasing in relation to the number of traps used, starting the campaigns in Ibiza with 145 traps in 2016 and ending with 1246 traps in 2022. Similarly, on Formentera the trapping effort has been increased from 78 traps in 2016 to 394 in 2022. Thanks to this effort a total of 7,118 captures of *Hemorrhois hippocrepis* and 293 captures of *Zamenis scalaris* have been obtained on Ibiza, while on Formentera, a total of 4,237 *Zamenis scalaris* have been captured (COLOMAR et al. 2023).

In addition to the official efforts to control the invasive snakes on Ibiza, private initiatives have also been established. For instance the volunteer network of SOS Salvem sa Sargantana Pitiüsa, with 158 volunteers in 2022. These were able to catch 885 snakes with 257 traps during 2021 and 1117 snakes during 2022 using 334 traps (CIRER 2021; CIRER 2022).

When it comes to terms of prevention measurements the autonomous government has not covered itself in glory. This is carefully worded by FEBRER SERRA et al. (2023): “*Current legislation has been shown to be ineffective in terms of prevention and the application of rapid action protocols against these species (invasive snakes)*”.

But this is about to change, as can be read in Diario de Ibiza’s issue of February 22, 2023: “*The Balearic Parliament unanimously approved yesterday (2023-02-21) the validation of the decree law that regulates the “pioneering” measures to regulate the importation to the Pityusic Islands of ornamental*



Image 11. Still cosy circumstances at some places along Camí de s'olivera.

*trees (olive trees, carob trees and holm oaks with a trunk of more than 40 centimeters in diameter) to avoid “the accidental entry” of snakes and thus stopping the loss of biodiversity that they cause, especially on the Pityusic (*Podarcis pityusensis*) and Balearic (*Podarcis lilfordi*) lizards.*

*Apart from the biosecurity measures, as explained by the Balearic Minister for the Environment, MIQUEL MIR, the decree incorporates the Pityusic lizard and the Balearic lizard into the catalog of endangered species and special protection with the consideration of vulnerable species. “It is not a minor fact because it allows the Administration to have more capacity and diligence to act when it comes to conserving these species”, he said.*

*The limitation of the entry of ornamental trees will occur in the months of egg laying and hibernation of the snakes. During this period, the seller or the intermediary must obtain authorization from the Ministry of the Environment and provide the documentation that guarantees traceability and that measures have been adopted to prevent the entry of snakes. Between April 1 and June 14 and September 15 and October 15, ornamental trees may enter without restrictions. In addition, between April 1 and October 30, nursery owners or individuals who sell or distribute trees will have to install traps to capture snakes” (RODRÍGUEZ MARTOS 2023).*

## Is enough being done?

The European Union's Birds Directive and Habitats Directive are the key pieces of legislation that require local governments to protect and manage Natura 2000 sites, which are designated under these directives. The Birds Directive (Directive 2009/147/EC) aims to conserve all species of wild birds, their habitats and migration routes within the EU. It requires member states to establish a network of Special Protection Areas (SPAs) for birds, which are sites designated for the conservation of bird species and their habitats. Many of these SPAs are also designated as Natura 2000 sites.

The Habitats Directive (Directive 92/43/EEC) aims to protect natural habitats and species of wild fauna and flora within the EU. It requires member states to establish a network of Special Areas of Conservation (SACs) for the conservation of habitats and species listed in the directive. Under annex II and IV of the Habitats Directive are listed *Podarcis lilfordi* and *Podarcis pityusensis*, among others. Many of these SACs are also designated as Natura 2000 sites.

Under these directives, member states must designate and manage Natura 2000 sites in a way that ensures the conservation and protection of the habitats and species they contain. Local governments play a key role in managing these sites and must ensure that their policies and actions are consistent with the objectives of the directives.

Large parts of the Balearic Islands have been designated as a Natura 2000 area, but if a threat arises outside these areas which could affect conservation and protection of the habitats and species inside a Natura 2000 area, local governments are still required by European law to take adequate action.

It is legitimate to ask whether the local government's commitment can be regarded as sufficient. According FEBRER SERRA et al. (2023) this is questionable, and we agree. Admittedly the local government has, with the deployment of COFIB, committed to bringing the snakes under control. The same applies to a half-hearted import ban on ornamental trees. But it is clearly not adequate enough!

An extinction event is now underway on Ibiza and things are not going well on Mallorca either. During COFIB's 2022 campaign, a shed snakeskin was reported on Illa dels Conills. After confirming this finding, COFIB proceeded to prospect and place traps for the capture of snakes on the islet. Illa dels Conils is inhabited by endemic and catalogued species such as the Lilford's wall lizard (*Podarcis lilfordi*) and the European storm petrel (*Hydrobates pelagicus*). Between May and November 2022, a total of 10 traps were placed on the islet which resulted in the capture of 6 horseshoe whip snakes. During this campaign two important findings were confirmed: The absence of observations of *Podarcis lilfordi* on the islet, and the predation of the horseshoe whip snake on the *Hydrobates pelagicus* (PICÓ et al. 2023).

## What is needed

First of all, what we need is consensus on the fact that this is a major problem, that also will have far-reaching ecological consequences (LAPIEDRA 2023). It is extremely important that everyone involved now pulls together. It is neither convincing nor helpful when certain influential herpetologists publicly proclaim that the snakes will not eat all the lizards in Ibiza before 2030 and try to substantiate this with very incomprehensible and disrespectful arguments (ROMERO 2022).

Consensus is also necessary on the fact that lizards have the same protection status as, for example, bird species, and that they are entitled to equal treatment, especially taking into account the fact that we are talking about the only endemic vertebrates of the Balearic Islands.

Secondly, we need real preventive action. A complete import ban on ornamental trees for an indefinite period of time could be a good start. The import ban that is now in force only causes bureaucratic disorder and will not be enforceable, and therefore pointless. The financial damage that companies suffer with the import ban on ornamental trees does not outweigh the financial consequences of failing to implement such an import ban. In 2020 COFIB was granted 853,000 euro by the Ministry of Environment and Territory to combat snakes in the Pityusic Islands alone (ANONYMOUS 2022).

Thirdly, especially in the case of the surrounding islets we need monitoring, monitoring, monitoring and even more monitoring. It has now been proven that the current monitoring approach is seriously flawed with one confirmed extinct population of *Podarcis pityusensis* on Illot de s'Oro (see above) as well as a possible extinction events on Illa Grossa de Santa Eularia, Illa de'n Calders and Illa des Canaret (unpublished). Passive monitoring, in this case by using the yield of traps, can only be applied to the inhabited islands, but only as added value to active monitoring, which is demonstrated to be much more efficient (PIQUET et al. 2023). All the other islands, and there are a lot of them, need active monitoring on a very regular basis.

Finally, we need a far more effective way of eradicating invasive snakes. With the passive way, by using traps, we are not going to win this war. We are not saying that we should stop using these traps, on the contrary, the more traps the better. But to get rid of or control the snake populations, it takes a natural enemy of the snakes. Of course, we cannot release more exotics on the Balearic Islands to achieve this! Therefore, the only solution remaining is to do it ourselves; active hunting of snakes, possibly supported by specially trained dogs.

## Conclusion

The attentive reader will have understood by now that the participants present at the recently held congress “Invasiones Biológicas en Islas” at Santa Eularia des Riu, from April 19 till April 22, 2023, have all the necessary knowledge available to come to a strong conclusion. Unfortunately this was limited to the announcement that they will make a formal request to the Ministry of Ecological Transition for the inclusion of the horseshoe whip snake in the catalog of invasive species on all the Balearic Islands, and regarding biological invasions, that they call for the need of early detection and immediate response with the involvement of citizens (ANONYMOUS 2023). Therefore, we will draw the only possible effective conclusion: The government must take immediate action regarding real preventive measures and facilitating sufficient personnel and support resources to monitor and eradicating invasive snakes. This will not be a small effort, but doing too little is not an option and certainly not according law. Consideration could also be given in using qualified volunteers for the work that has to be done. Here, too, an active approach by the government would be preferable.

Finally, a last consideration. Perhaps it would be wise to postpone any attempted eradicating of *Podarcis pityusensis* at San Juan de Gaztelugatxe (Basque country) for a while.

**Image 12.** ANTONIA MARIA CIRER during her poster presentation at the AHE Congress “Invasiones Biológicas en Islas” at Santa Eularia des Riu (April 19 - 22, 2023).





## 2018 - Can Pilot lizard apartments

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Image 13. 2022: Last tenant of the Can Pilot lizard apartments moves out, never to be seen again.



## 2023 - Can Pilot lizard apartments

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