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Natrix astreptophora and Anguis fragilis on the island of Ibiza

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RESUMEN: En esta nota se recogen las primeras observaciones de dos especies de reptiles continentales, culebra de collar mediterránea (*Natrix astreptophora*) y lucón (*Anguis fragilis*) en los alrededores de Roca Llisa (Ibiza). Se valora el origen de su introducción y se pone de manifiesto la necesidad de llevar a cabo un control sobre los agentes importadores para evitar introducciones posteriores de estas u otras especies.

The island of Ibiza, located in the Western Mediterranean Sea, was invaded by three different snake species in 2003: the Montpellier snake (*Malpolon monspessulanus*), last seen in 2010; the ladder snake (*Zamenis scalaris*), which maintains a small population on the island; and the horseshoe whip snake (*Hemorrhois hippocrepis*), which is quickly spreading and threatening the endemic Ibiza wall lizard (*Podarcis pityusensis*) (Montes *et al.*, 2021). These snakes continue to enter the island inside the holes of big olive trees used for gardening (Álvarez *et al.*, 2010), and the urgent need of controlling the entrance of snakes has been stated on different occasions, warning that the entrance of any other organism is a matter of time (Ayllón, 2015; Silva-Rocha *et al.*, 2018). Currently, the most thriving invader on Ibiza (*H. hippocrepis*) feeds on the only endemic terrestrial vertebrate (*P. pityusensis*), which conforms 56% of its diet (Hinckley *et al.*, 2017), and the lizard is disappearing from the areas where the snake has high density populations (Montes *et al.*, 2021).

This is one of many unexpected impacts that the arrival of alien organisms may have on the native biota of islands, where the species are more naïve and less adapted to defend or compete than continental counterparts (Whittaker & Fernández-Palacios, 2006).

In the golf course of Roca Llisa (Santa Eulària des Riu, Ibiza; 38°56'45.8"N / 1°29'37.5"E; 45 masl), on June 2018, a snake was spotted and killed. The snake was impossible to retrieve, and only some pictures were sent to E.M. (Figure 1). Because of the color pattern, we identified it as *Natrix astreptophora*, but we were not able to take measurements or other natural history traits from the specimen. Two years later, on 4th June 2020, on the waste treatment facility of Ca na Putxa (38°56'30.7"N / 1°28'48.7"E; 166 masl), very close to Roca Llisa, a worker found and killed a slow worm (*Anguis fragilis*; Figure 2), and almost a year later, on 4th March 2021, M.R. found and killed another one. The first one was not kept and it was not possible to inspect, but



Figure 1: Specimen of *Natrix astreptophora* found in the golf course of Roca Llisa (Ibiza), from different angles.

Figura 1: Espécimen de *Natrix astreptophora* encontrado en el campo de golf de Roca Llisa (Ibiza), desde diferentes ángulos.

from the picture and video we identified it as an adult male; and the second one was a male (identified upon dissection of the animal) of 20.5 cm of snout-vent length and 27 cm of total length.

How the snake arrived in Ibiza remains unknown; it might have traveled as a stowaway in olive trees or other nursery trees, given that its preferred habitat includes the edge of crops and it is present across most of the Iberian Peninsula (Pleguezuelos, 2018). *Natrix astreptophora* prefers environments with elevated edafic humidity and close to marshes or river gallery formations (Pleguezuelos, 2018), making Ibiza suitable only in very specific areas of the island (like the golf course pond where it was captured, Figure 1). The slow worms were likely introduced as stowaways in the large *Erica multiflora* cargo used as a biofilter to clean the air from the waste facility, imported from the southern region of France (between Cahors and Potier), within the slow worm range (Dely, 1981); given that the first one was seen during the *E. multiflora* unload in the waste facil-

ty, and the second one some meters away from the biofilter. There are multiple cases of species introductions with nursery trade (Hulme, 2009; Bergey *et al.*, 2014), and the closest example is the current snake invasion on this island (Silva-Rocha *et al.*, 2018). The presence of *A. fragilis* within its native range is closely linked to forests and scrublands with *E. multiflora* and other plant species, with a clear preference towards a mean annual rainfall higher than 600 mm, cold, cloudy and wet climatic conditions, and negatively correlated to annual sun hours and the mean temperature of the warmest month (Galán & Salvador, 2015); whereas the island of Ibiza has a typical Mediterranean warm climate, with an average yearly rainfall of 413 mm, high annual sun hours (a monthly mean ranging between 151 and 334 h) and the mean temperature of the warmest month is 26.3° C (August); standard meteorological averages for the Ibiza Airport weather station, 38°52'22"N / 1°22'23"E; www.aemet.es. This makes the island an unsuitable habitat for the



Figure 2: Specimens of *Anguis fragilis* found in the waste facilities next to Roca Llisa (Ibiza).

Figura 2: Especímenes de *Anguis fragilis* encontrados en las instalaciones de residuos próximas a Roca Llisa (Ibiza).

slow worm. One of the biofilters from the waste facility started working on December 2020, increasing the environment temperature to 27 - 35° C with 100% humidity. We suspect that due to the changes in environmental conditions, the second slow worm had to go out and was then captured.

Natrix astreptophora mainly feeds on anurans, amphibian larvae, earthworms, but also oligochaetes, insects and micromammals (Pleguezuelos, 2018). Snails and earthworms are frequent prey of *A. fragilis*, but it preys on arthropods as well (Galán & Salvador, 2015). There are some endemic arthropods and snails on Ibiza that might potentially become prey to these two species, like the endemic coleopteran *Geonemus palaui* or the endemic snails *Iberellus tanitianus*, *Xerocrassa caroli* and *X. ebositana*, all of them listed as Vulnerable on the Spanish Red List, except for

I. tanitianus (Verdú & Galante, 2009). There are also anurans (*Pelophylax perezi* and *Bufo balearicus*, the latter is listed as extinction risk in the Balearic Endangered Species List [Decree 75/2005, of July 8]) and micromammals (*Rattus rattus*, *Mus* sp., *Apodemus sylvaticus* and *Crocidura ichnusae*) that would sustain *N. astreptophora* if more specimens were to arrive (Balearic Bioatlas; <http://bioatlas.caib.es/>).

It is unlikely that any of them has established on the island forming reproductive populations, due to habitat low suitability and the lack of other conspecifics. The impossibility to make predictions about the outcomes of an unprecedented introduction should not be a motive to disdain these findings. Rather, they are a warning that these or any other species could enter the island and become a problem, in addition to the *H. hippocrepis* invasion (Ayllón, 2015; Montes *et al.*, 2021). As

an example, some specimens of Iberian worm lizard (*Blanus cinereus*) were detected in a tree nursery in 2004 on Ibiza (Mateo & Ayllón, 2012). We urge policy makers with jurisdiction over invasive species management to control the entrance of organisms to the island as a priority.

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Microhumedales de importancia para anfibios en el entorno periurbano de Sevilla

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En los últimos años se ha puesto de manifiesto la importancia de la conservación y recuperación de humedales (Gibbs, 2000). Sin embargo,

las charcas temporales y demás microhumedales han recibido menos atención (Collinson *et al.*, 1995), continuando su destrucción, especial-