

# Multiple snake invasions in the Balearic Islands and tools to deal with them



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Neftalí Sillero & Enrique Ayllón

background



origin



impact



actions



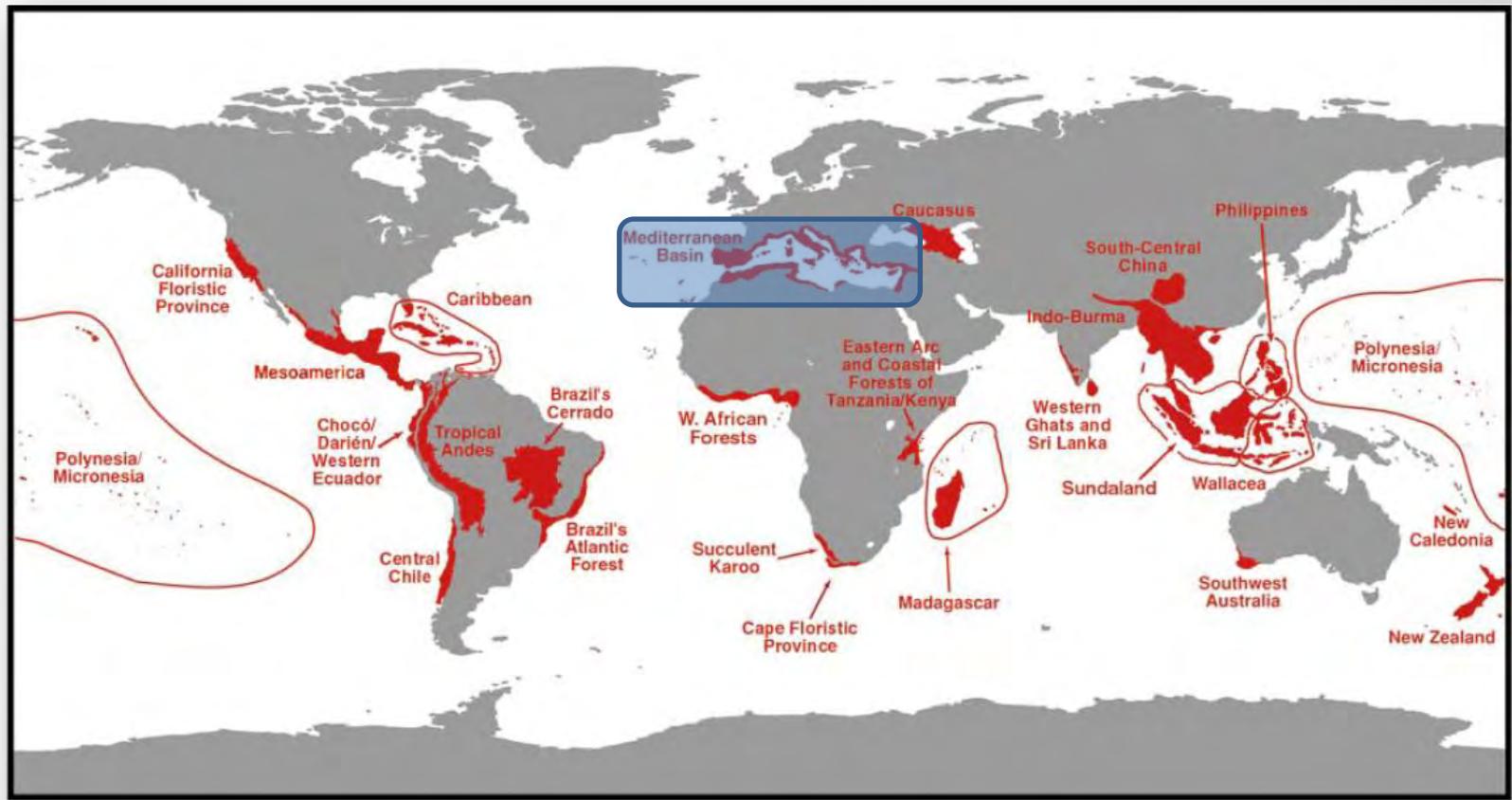
background

origin

impact

actions

# Global biodiversity hotspots

Myers *et al.* (2000)

# The Mediterranean Basin



Messinian salinity crisis



Glacial refugia

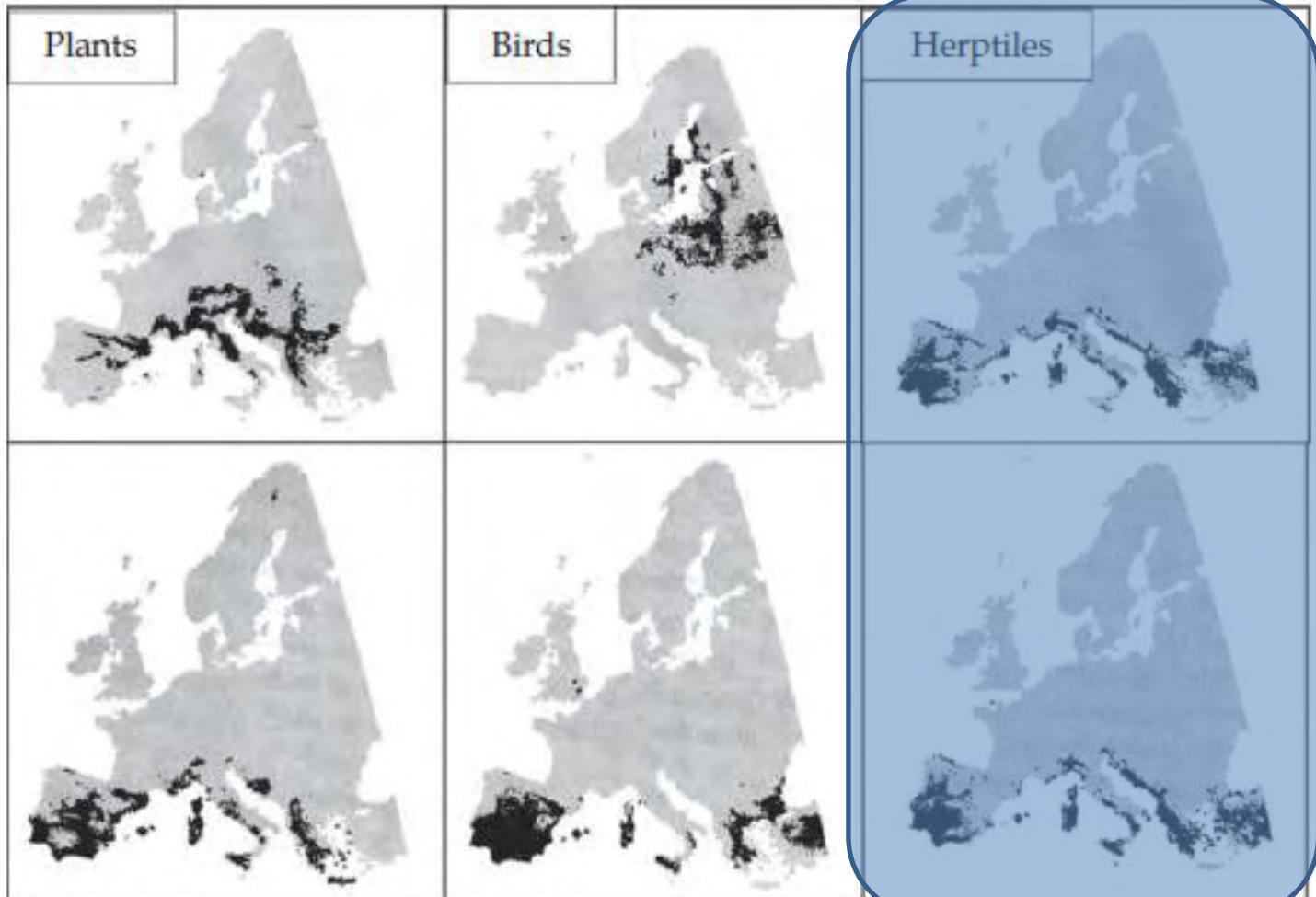
background

origin

impact

actions

## Species and endemism richness

Araújo *et al.* (2000)

background

# Since the Neolithic...



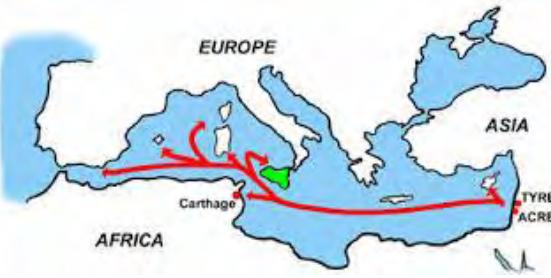
Nuraghi

Phoenicians

Ancient Greeks

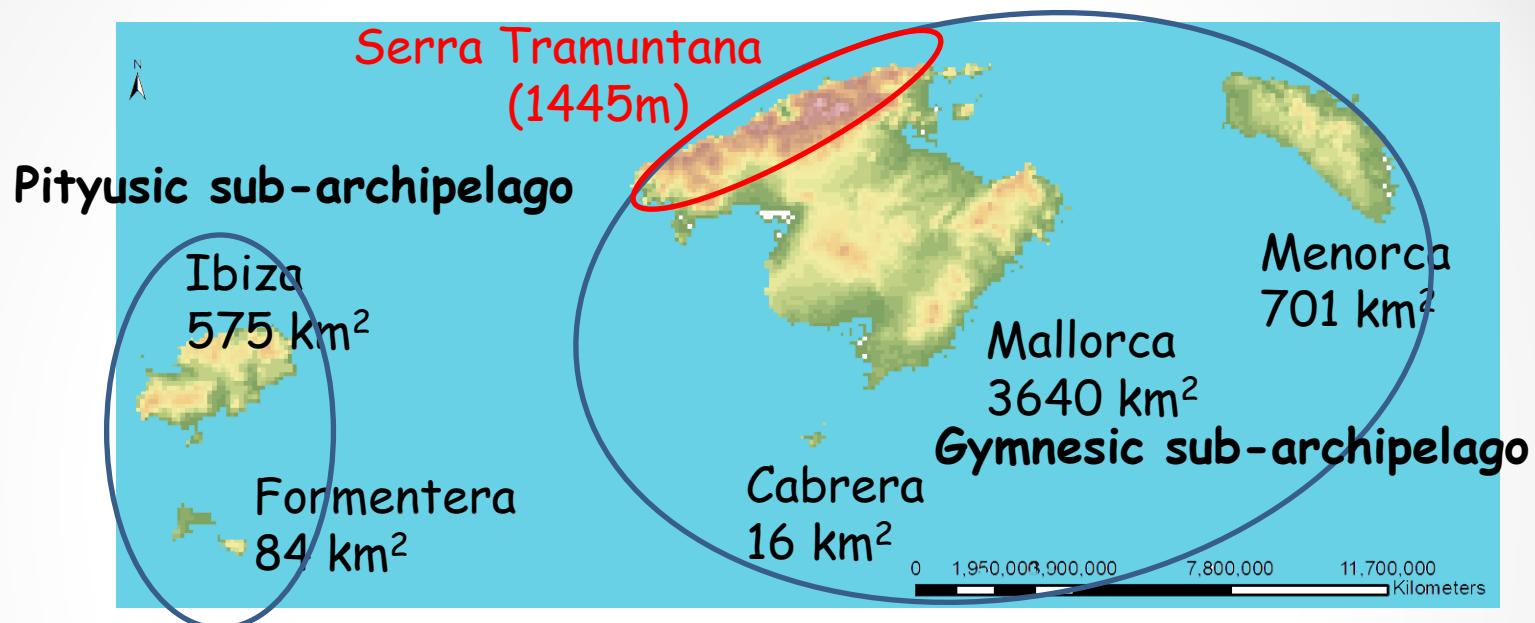
Romans

Arabs



background

# The Balearic Islands



impact



actions

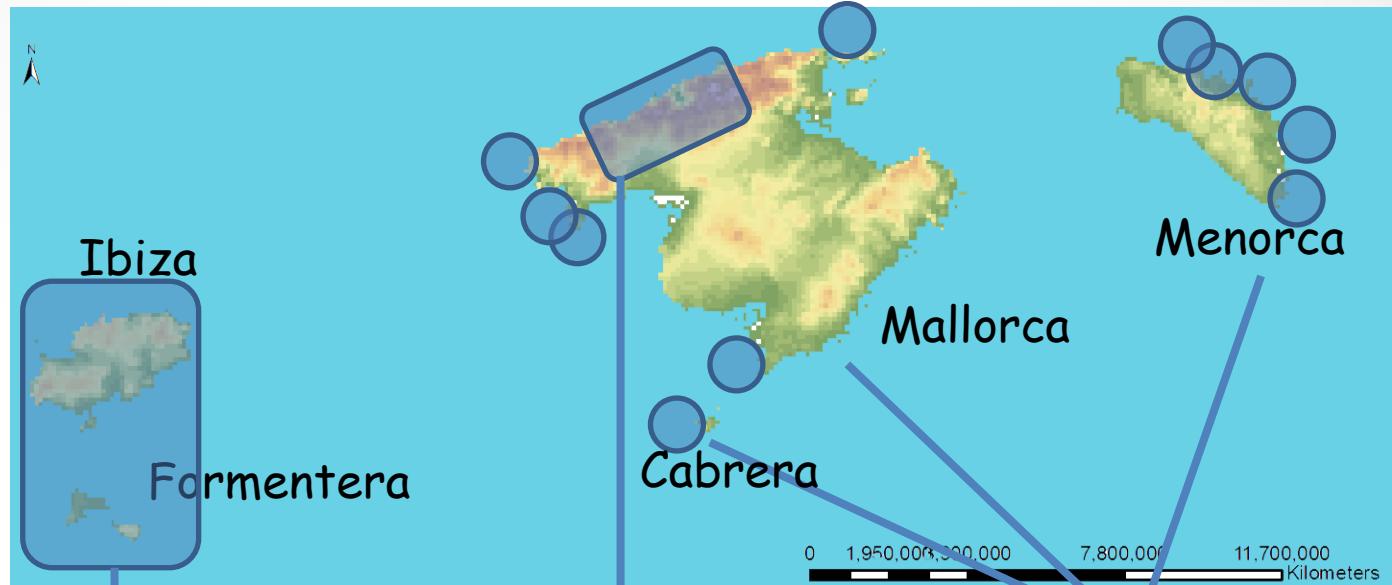
background

origin

impact

actions

# Native herpetofauna



*Podarcis pityusensis*



*Alytes muletensis*

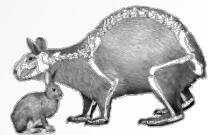


*Podarcis lilfordi*

background

# Multiple historical and recent invasions

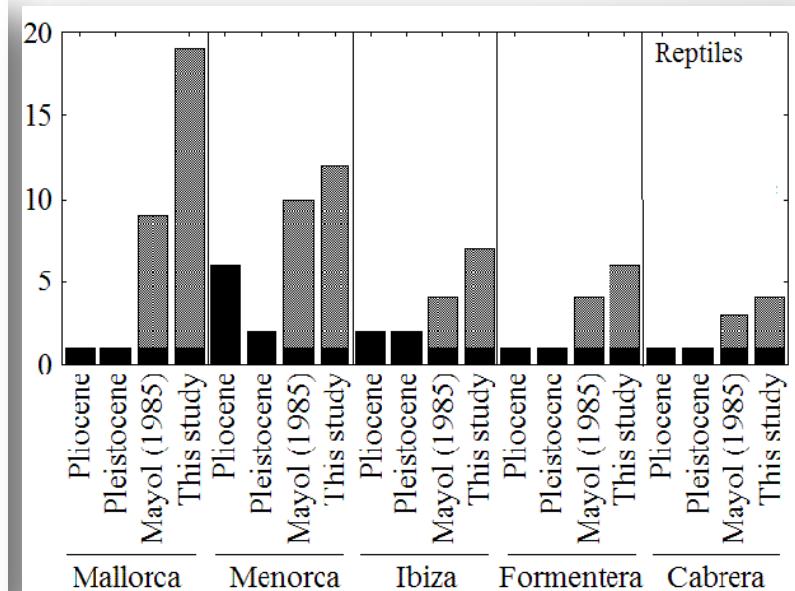
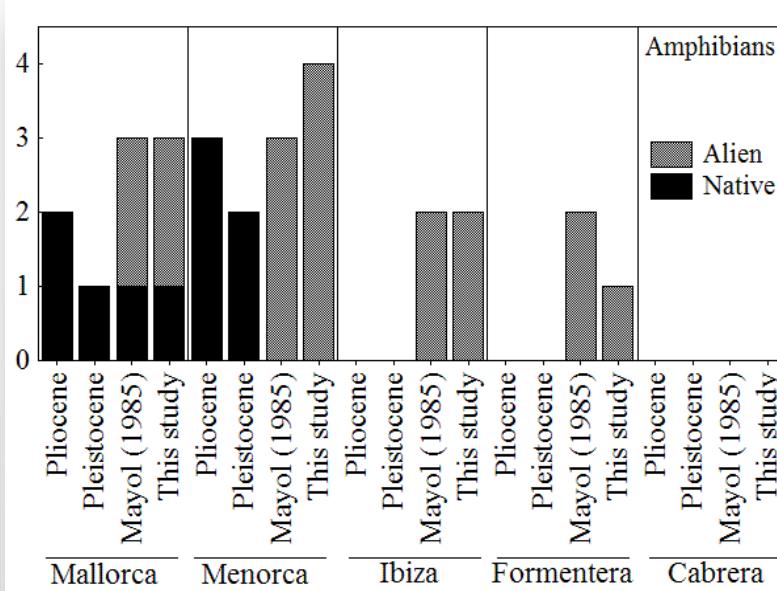
First human settlements: 3000 BCE



*Nurolagus Myotragus Hypnomis Capra Atelerix Rattus Mustela*  
*rex† balearicus† morpheus† aegagrus algirus sp. nivalis*

Bover et al. (2008)

Herpetofauna follows the same pattern



Pinya & Carretero (2011)

impact

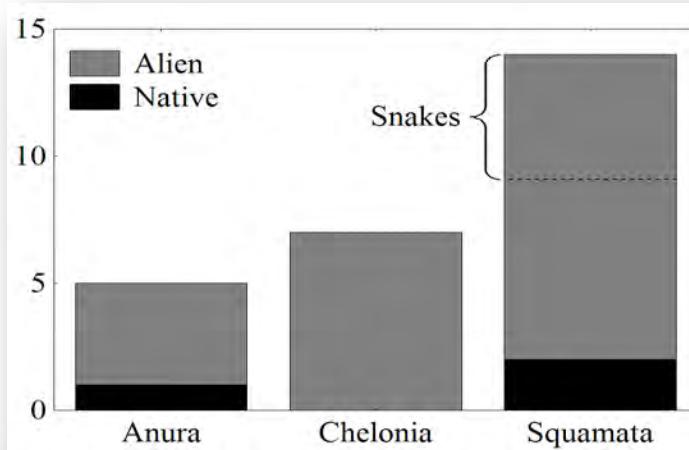
actions

origin

background

# Historical and recent aliens

500BCE      0      500CE      1000CE      1.500CE      2000CE



origin

impact

actions

## Reptiles



large  
snakes

background

origin

impact

actions

	Mallorca	Menorca	Ibiza	Formentera	Cabrera
<b>CHELONIA</b>					
<i>Testudo hermanni</i>	Na	Na	-	-	-
<i>Testudo graeca</i>	Na	-	Ex	Na	-
<i>Emys orbicularis</i>	Na	Na	-	-	-
<i>Trachemys scripta</i>	Na	Aa	Aa	-	-
<i>Chrysemys picta</i>	Na	-	-	-	-
<i>Mauremys leprosa</i>	Na	Aa	-	-	-
<i>Chelydra serpentina</i>	Aa	-	-	-	-
<b>SQUAMATA</b>					
<i>Chamaeleo chamaeleon</i>	Aa	-	-	-	-
<i>Tarentola mauritanica</i>	Na	Na	Na	Na	Na
<i>Hemidactylus turcicus</i>	Na	Na	Na	Na	Na
<i>Podarcis lilfordi</i>	Nv	Nv	-	-	Nv
<i>Podarcis pytiusensis</i>	Na	-	Nv	Nv	-
<i>Podarcis sicula</i>	-	Na	-	-	Na?
<i>Psammodromus algirus</i>	Na	-	-	-	-
<i>Scelarcis perspicillata</i>	-	Na	-	-	-
<i>Timon lepidus</i>	Aa	-	-	-	-
<i>Macroprotodon mauritanicus</i>	Na	Na	-	-	-
<i>Natrix maura</i>	Na	Na	-	-	-
<i>Malpolon monspessulanus</i>	Aa	-	Na	Aa	-
<i>Hemorrhois hippocrepis</i>	Na	-	Na	-	-
<i>Rhinechis scalaris</i>	Aa	Na	Na	Aa	-

Pinya &amp; Carretero (2011)

background

Are they really aliens?

Where they come from?

How did they arrive?

origin

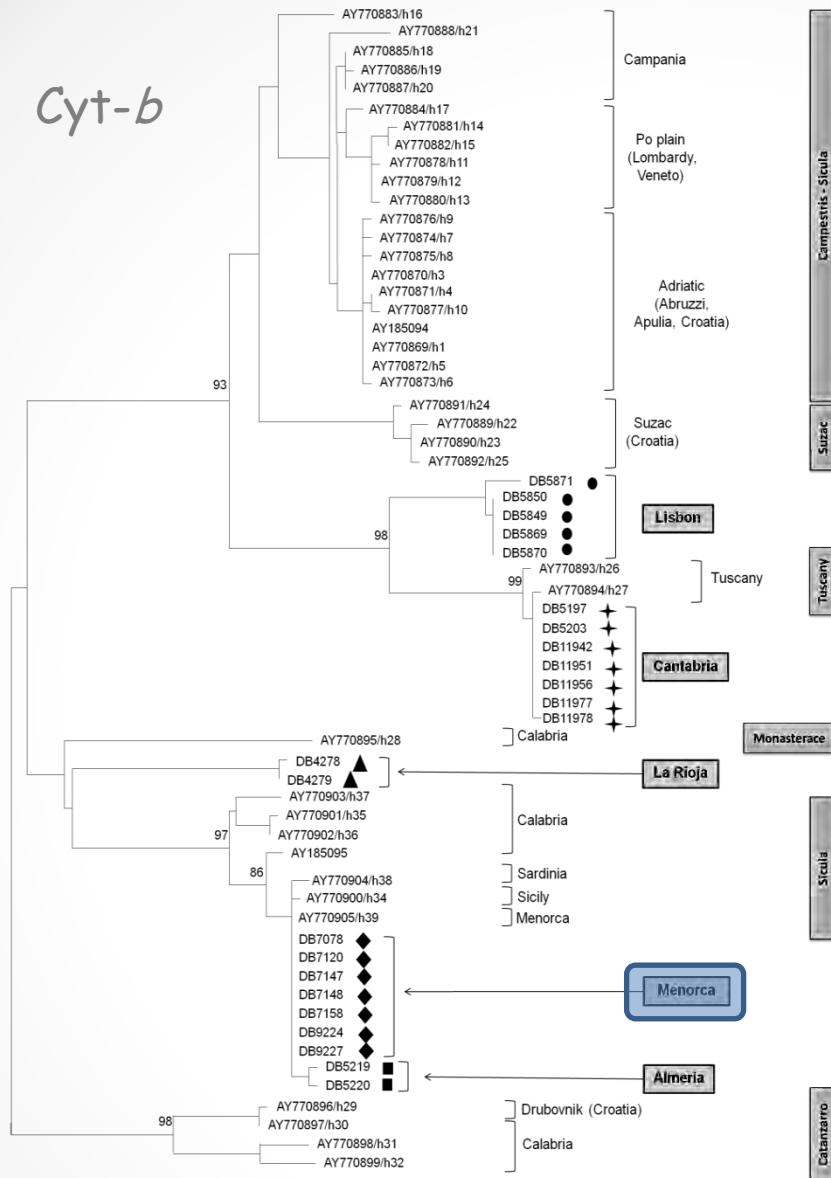
impact

actions

# snakes in the Balearics

background

Cyt-b



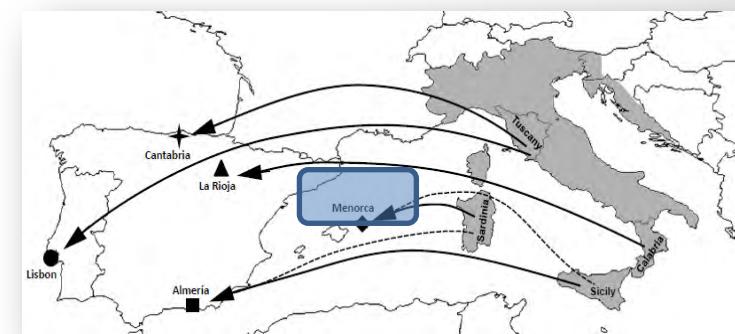
*Podarcis sicula*



origin

impact

actions



Silva-Rocha et al. 2012

# snakes in the Balearics

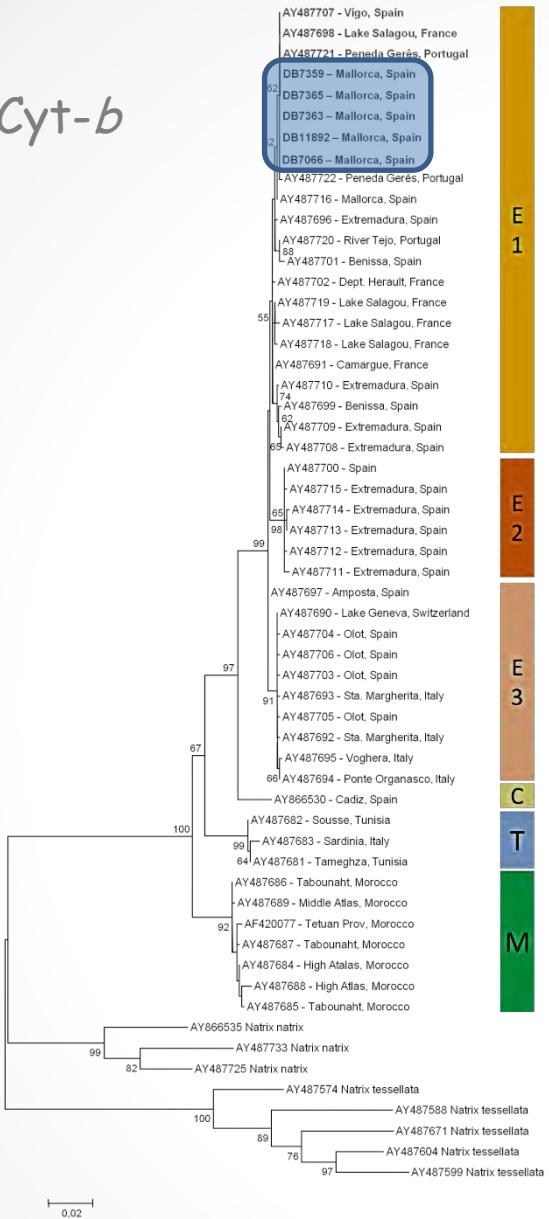
background

Cyt-b

origin

impact

actions



E  
1

E  
2

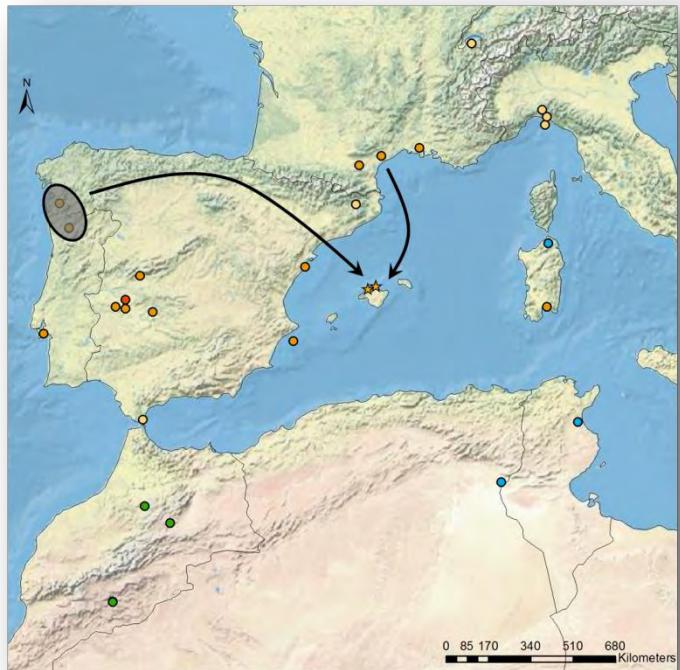
E  
3

C

T

M

*Natrix maura*



Type of introduction: Active (religious) or passive (cargo?)  
Distribution: Mallorca and Menorca  
Origin: European

# snakes in the Balearics

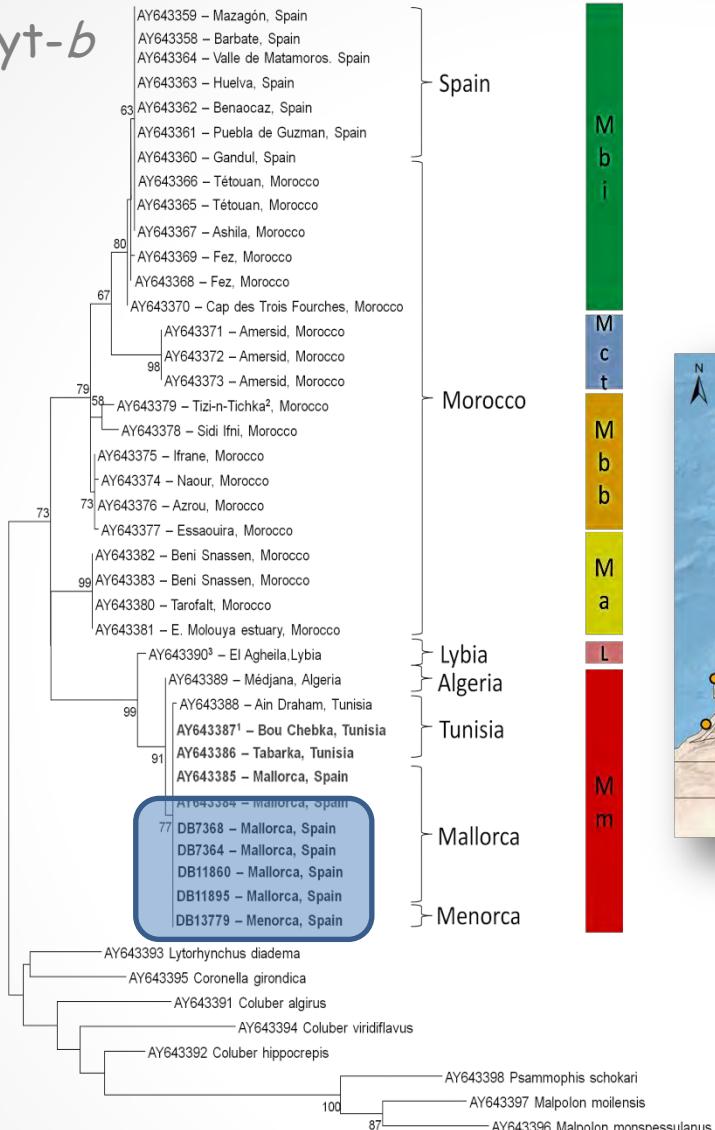
background

origin

impact

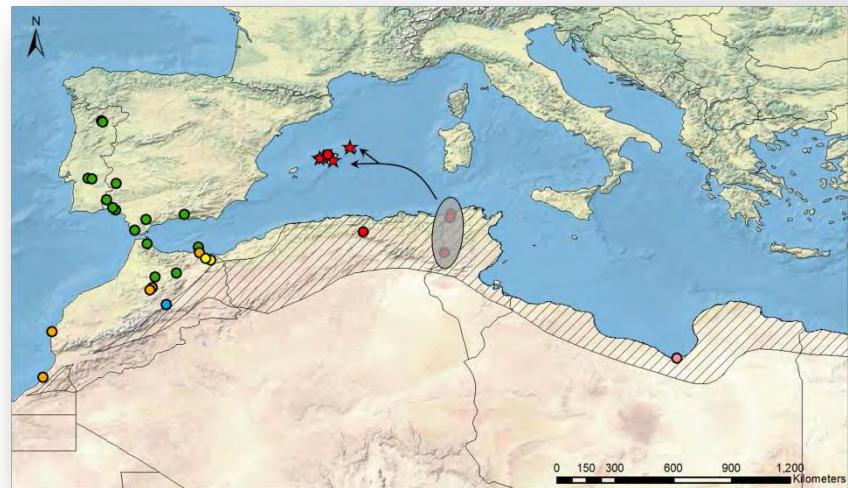
actions

Cyt-b



M  
b  
i  
M  
c  
t  
M  
b  
b  
M  
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L  
M  
m

*Macroprotodon* sp.



Type of introduction: Active (religious) or passive (cargo?)  
Distribution: Mallorca and Menorca  
Origin: Tunisia/Algeria (*M. mauritanicus*)

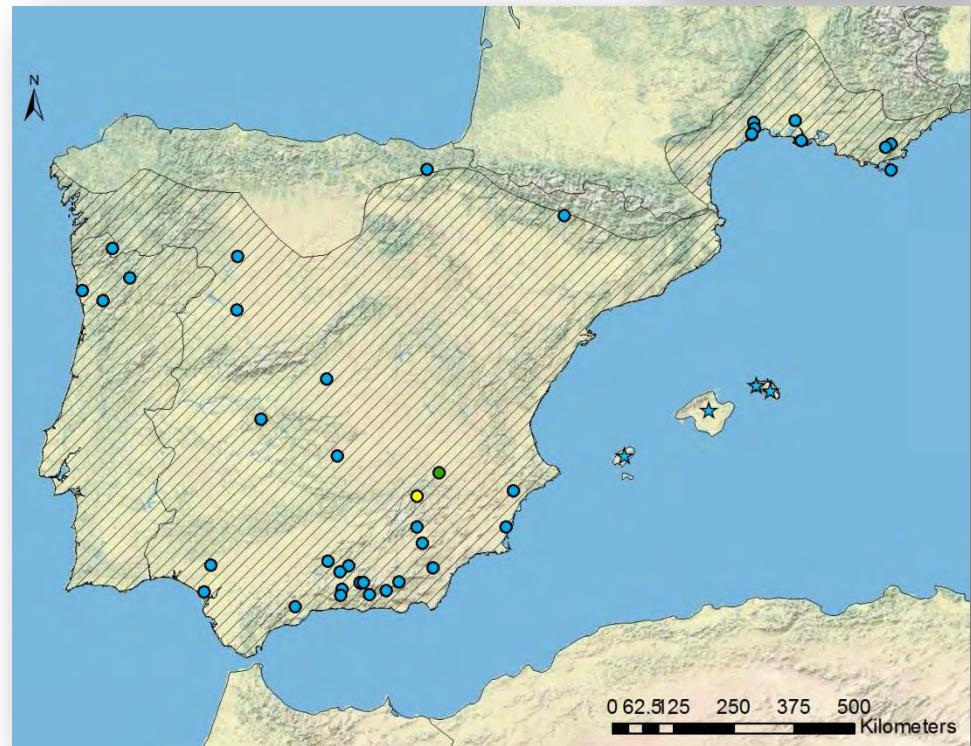
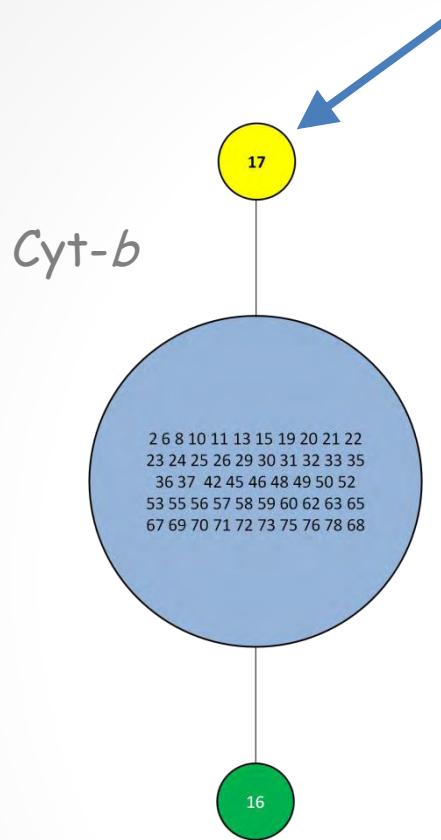
*Rhinechis scalaris*

background

origin

impact

actions



Type of introduction: Tree trade (Menorca?)

Distribution: Menorca (Mallorca, Ibiza and Formentera)

Origin: Iberian Peninsula

*Hemorrhois hippocrepis*

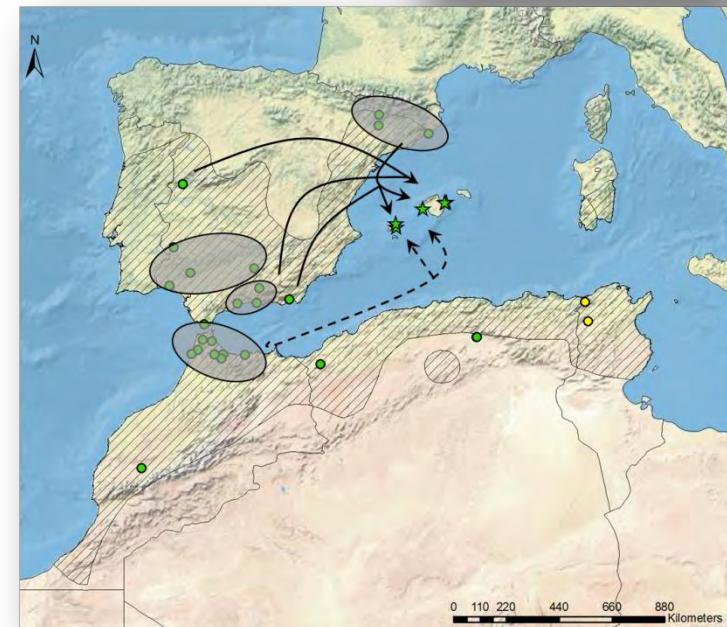
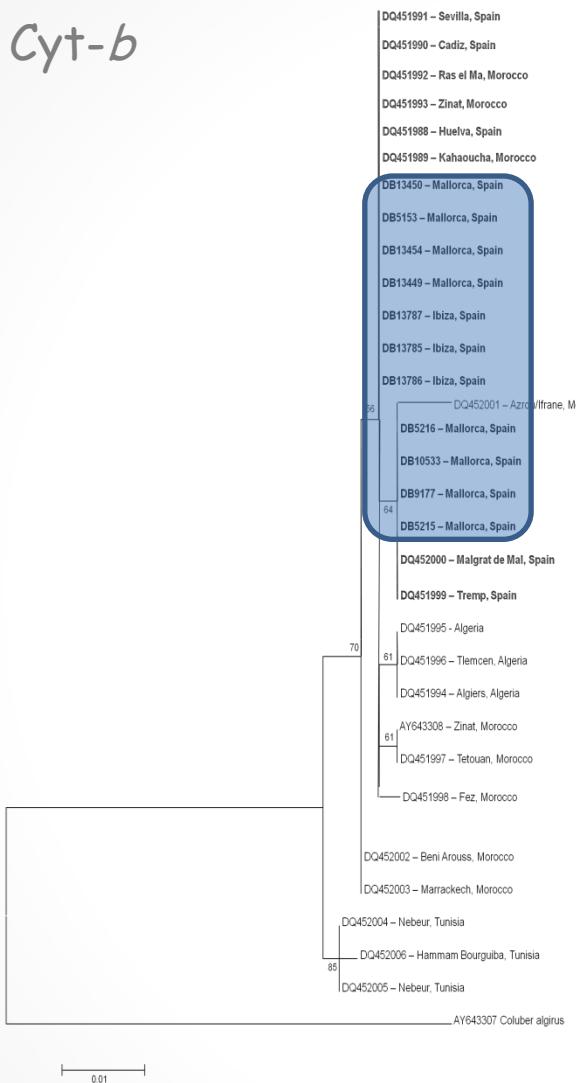
background

origin

impact

actions

Cyt-b



Type of introduction: Tree trade

Distribution: Mallorca, Ibiza and Formentera

Origin: Iberian Peninsula (N Africa)

# snakes in the Balearics

## *Malpolon monspessulanus*



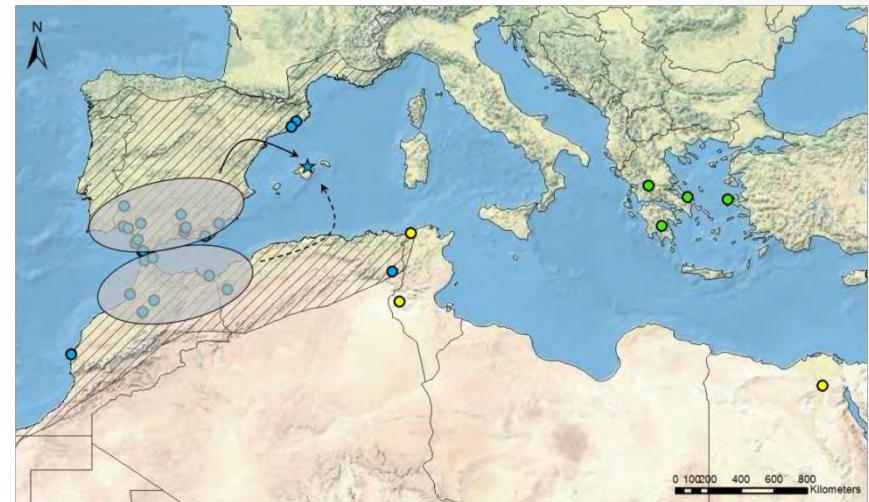
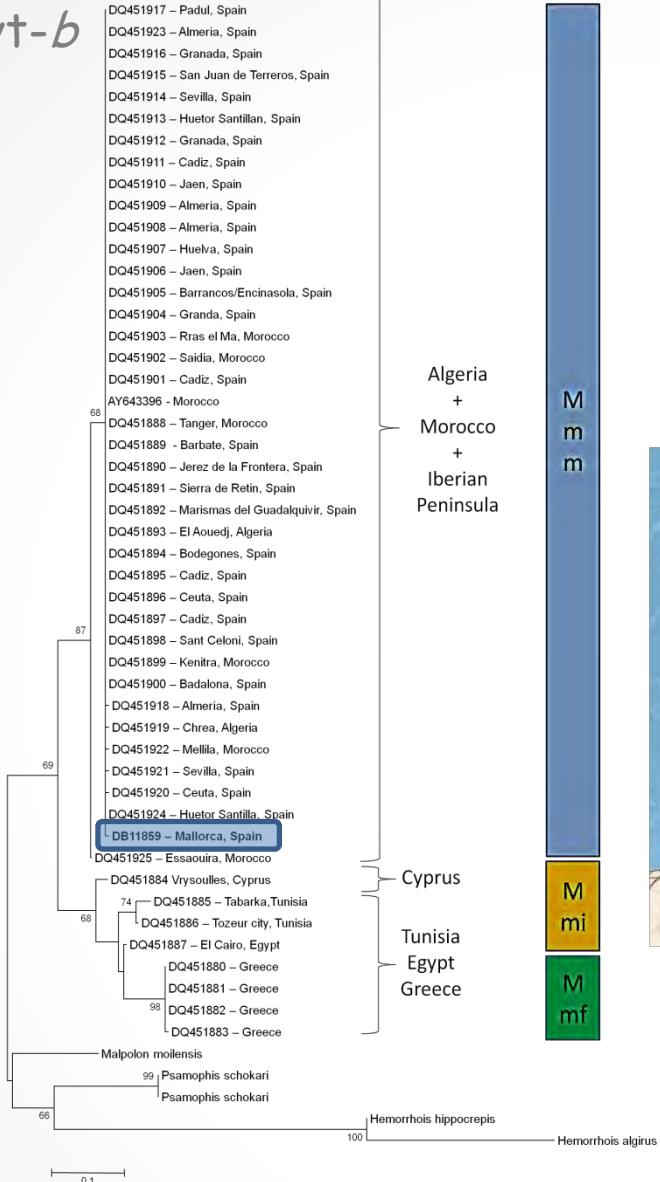
background

origin

impact

actions

Cyt-b



Type of introduction: Tree trade

Distribution: Mallorca, Ibiza and Formentera

Origin: Iberian Peninsula (N Africa)

background

Are they really aliens?

Where they come from?

How did they arrive?

Why did not they arrive earlier?

origin

impact

actions

# snakes in the Balearics

background

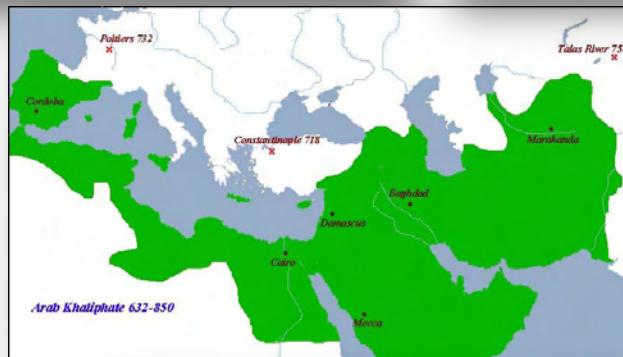
## Cargo trade



origin



impact



actions



Catalan-Aragonese Empire XV Century



background

## More cargo trade...only?



origin

impact

actions

background

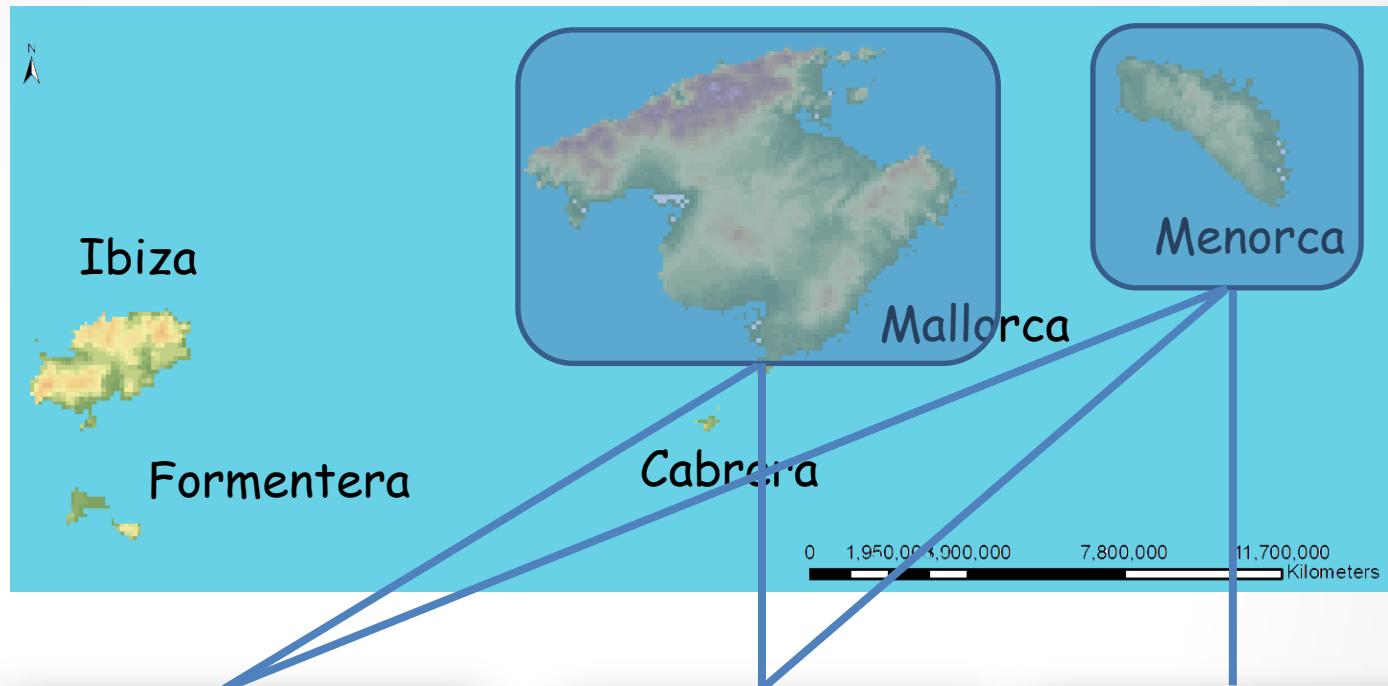
origin

impact

actions

## Alien snakes (1985)

Mayol (1985)



*Natrix maura*



*Macroprotodon  
mauritanicus*



*Rhinechis scalaris*

background

# Pet trade...only?



*Trachemys scripta*



*Chelydra serpentina*

impact



actions

background

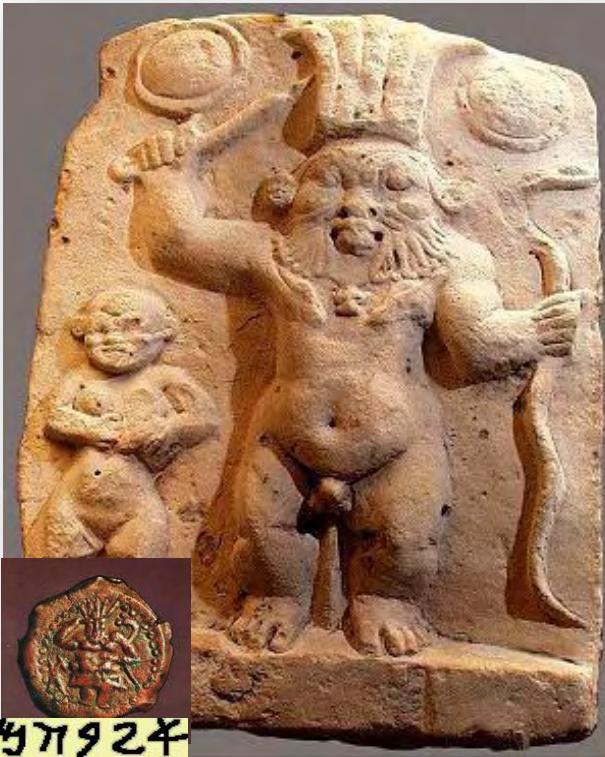
origin

impact

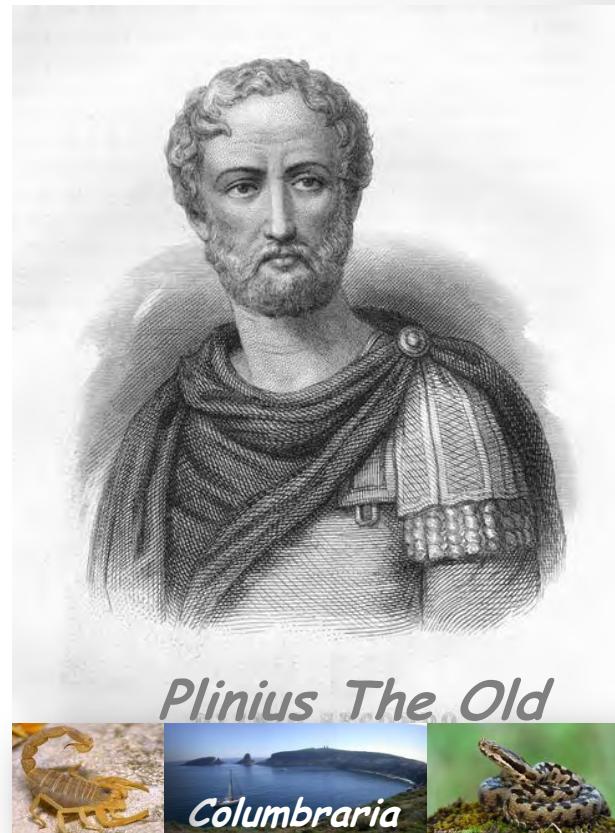
actions

# Back to the past

Ibiza, an island refractory to venom and toxic for snakes



Bes, the serpenticide god



Plinius The Old



Columbraria



"The land of Ebussus [Ibiza] repels the snakes, and that of Columbraria [Columbretes] begets them and is very harmful for everyone, unless you bring Ebessian soil with you"



background

origin

impact

actions



## So, what else?

Since the Ancient Greeks, olive culture has been important in the economy of the Balearic Islands.

I century: the historian *Diodorus Siculus* already mentions the existence of grafted olive trees in Ibiza.



However extensive olive tree only starts at the end of XX century.

background

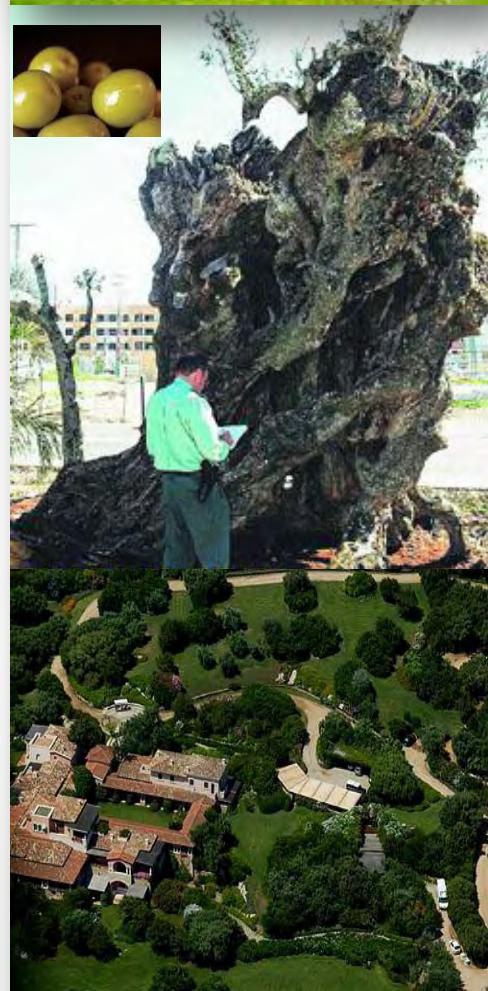
origin

impact

actions

## So, what has changed?

During the last 25 years the use of old olive trees for gardening has greatly increased across the Mediterranean Basin.



background

# Common Agricultural Policy (EU)

Removal of low production olive trees  
(north, <15% slope)

origin

Reused for:

- Public gardens
- Roundabouts
- Touristic urbanisations

impact



actions



background



origin

About 950,000 trees have been removed over the last decade.  
Same has been transplanted far from the original sites.

impact



actions



Inside the old, hollow trees  
stowaways are travelling

background

origin

impact

actions

# Olive tree trade is not exclusive from the Balearics...

Girona, Zaragoza, Rioja



Aix en Provence, Cannes



but...



Capdepera (Mallorca)



Magaluf (Mallorca)



Sant Llorenç (Ibiza)

background

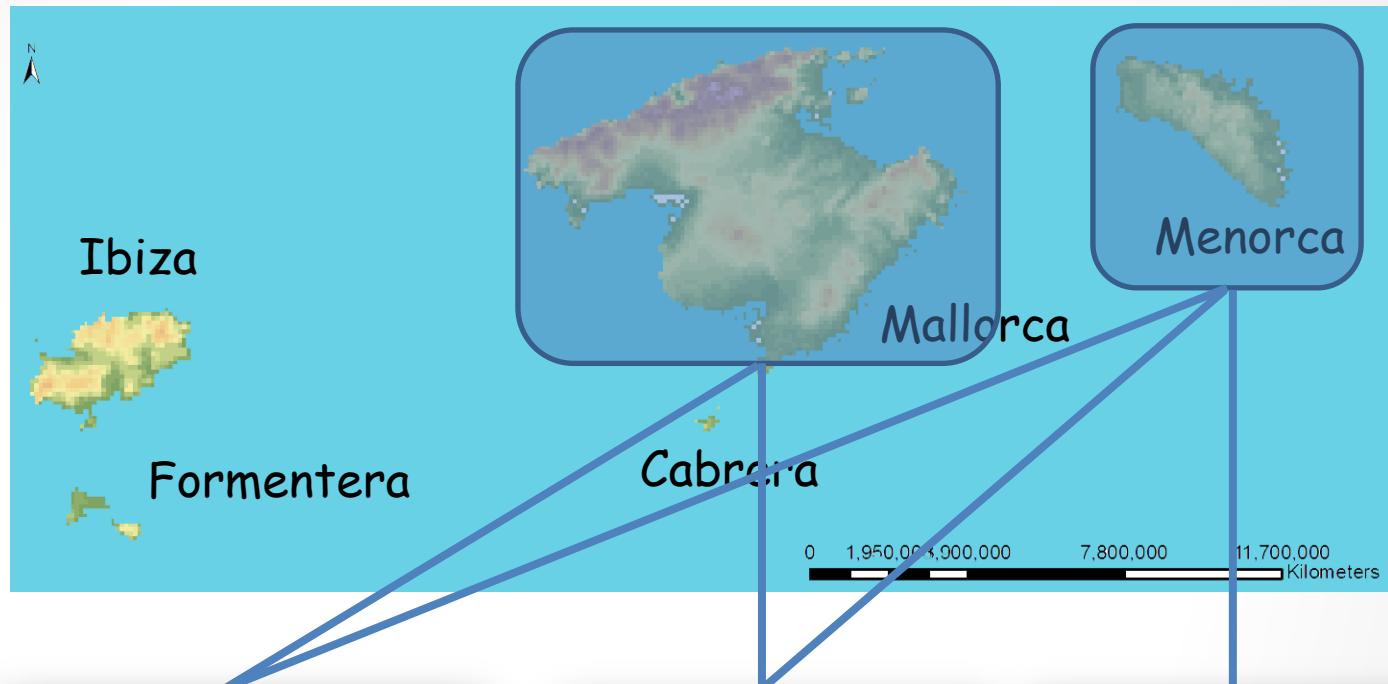
origin

impact

actions

# Alien snakes (2014)

Pinya &amp; Carretero (2011)



*Natrix maura*



*Macroprotodon  
mauritanicus*



*Rhinechis scalaris*

background

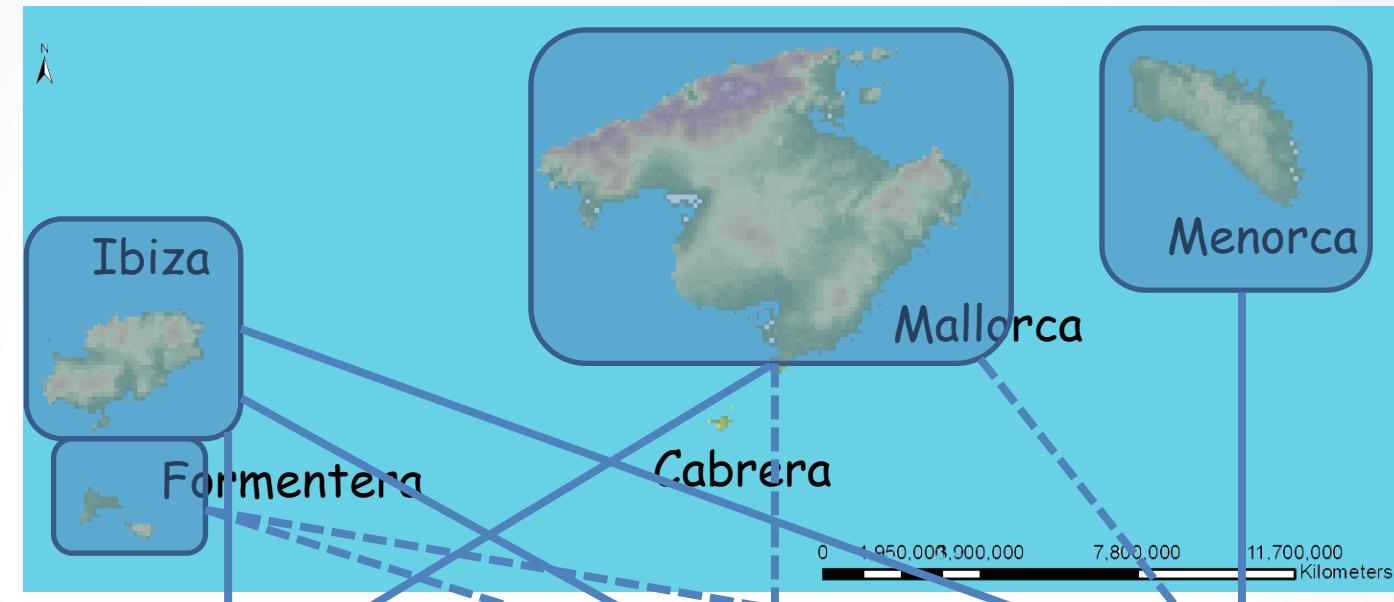
origin

impact

actions

# Alien snakes (2014)

Pinya &amp; Carretero (2011)



*Hemorrhois hippocrepis*



*Malpolon monspessulanus*



*Rhinechis scalaris*

background

origin

impact

actions

## Which would be the effects?

- on ecosystems
- on species
- on people

background

## Prey



*Hemorrhois hippocrepis*



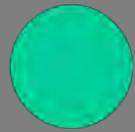
*Rhinechis scalaris*



*Malpolon monspessulanus*



Insects



Reptiles



Birds



Mammals



background

## Predators



*Hemorrhois hippocrepis*  
(active forager)



*Rhinechis scalaris*  
(active forager)



*Malpolon monspessulanus*  
(sit and wait)



origin

impact

actions

background

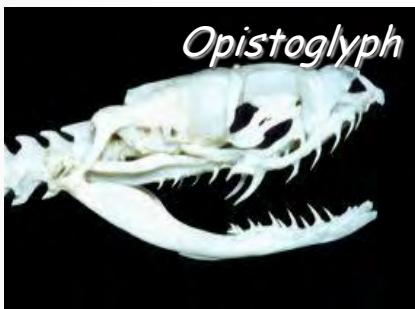


Aglyph

## Risk to humans?



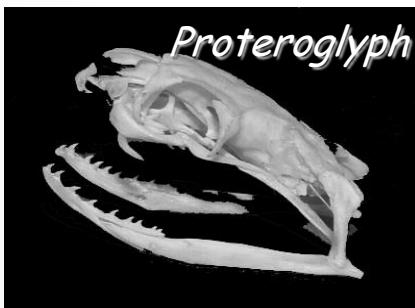
origin



Opistoglyph



impact

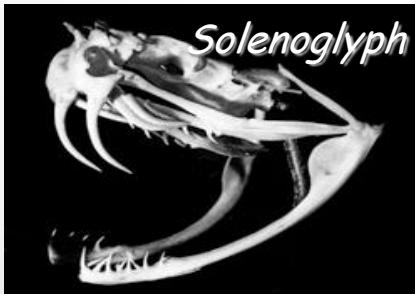


Proteroglyph

None of the large three ophidians recently introduced in the Balearics is dangerous to humans.

Only *Malpolon monspessulanus* have opistoglyph inoculating teeth making bite difficult; venom is little active to humans

actions



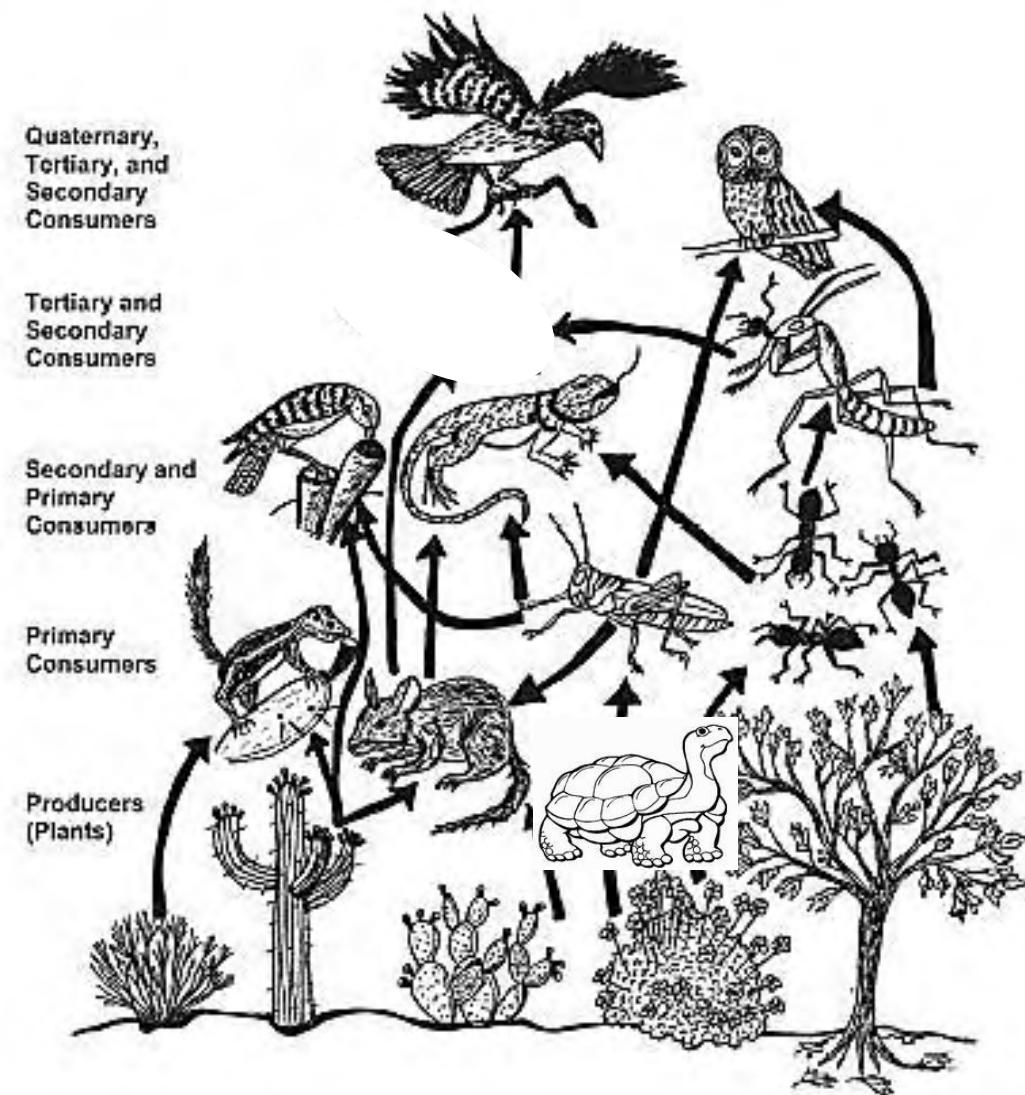
Solenoglyph

background

origin

impact

actions



background



Impact on ground nesting birds  
Stronger effects on native lizards

origin



Ibiza & Formentera



*Podarcis pityusensis*



impact



Mallorca & Menorca



*Podarcis lilfordi*



actions

background

origin

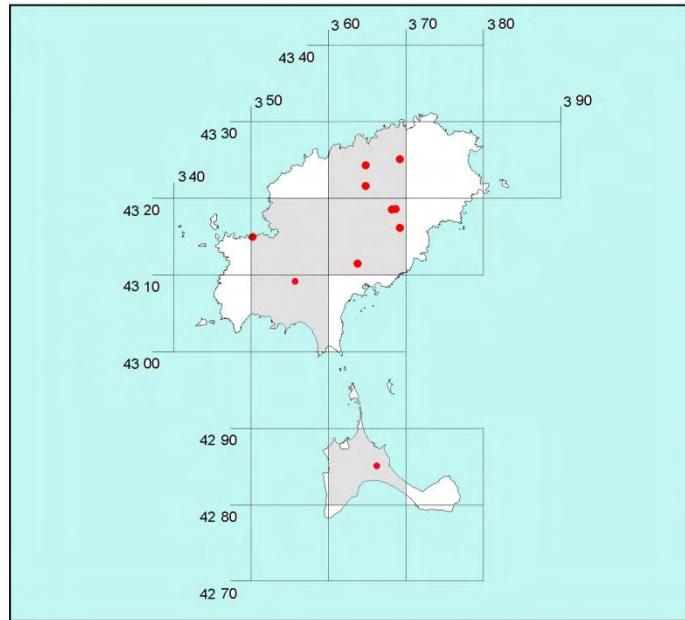
impact

actions

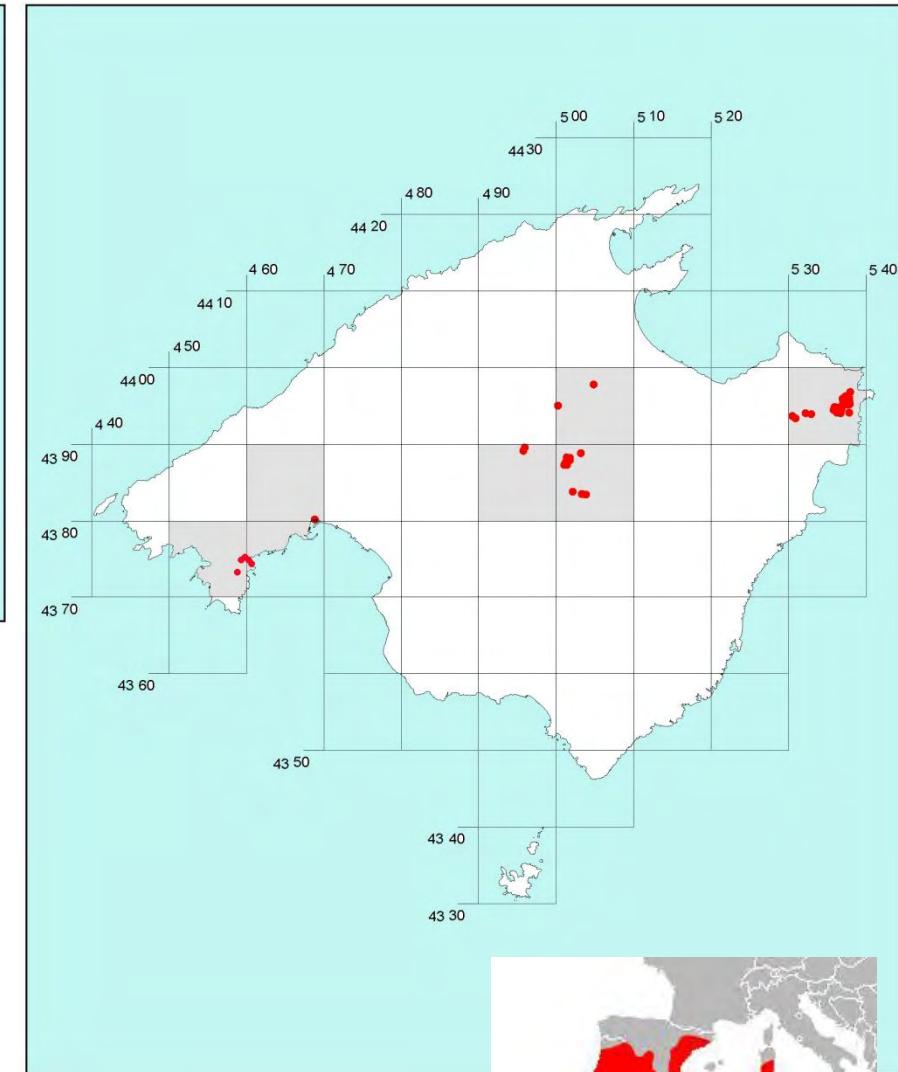
## What can be done?

- Monitoring
- Predicting
- Extirpating

background



origin



impact



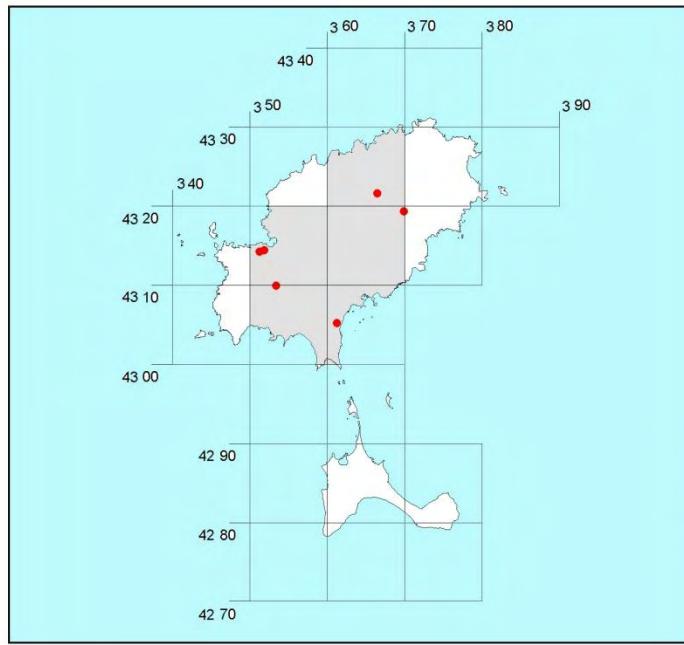
actions

*Hemorrhois hippocrepis*



# snakes in the Balearics

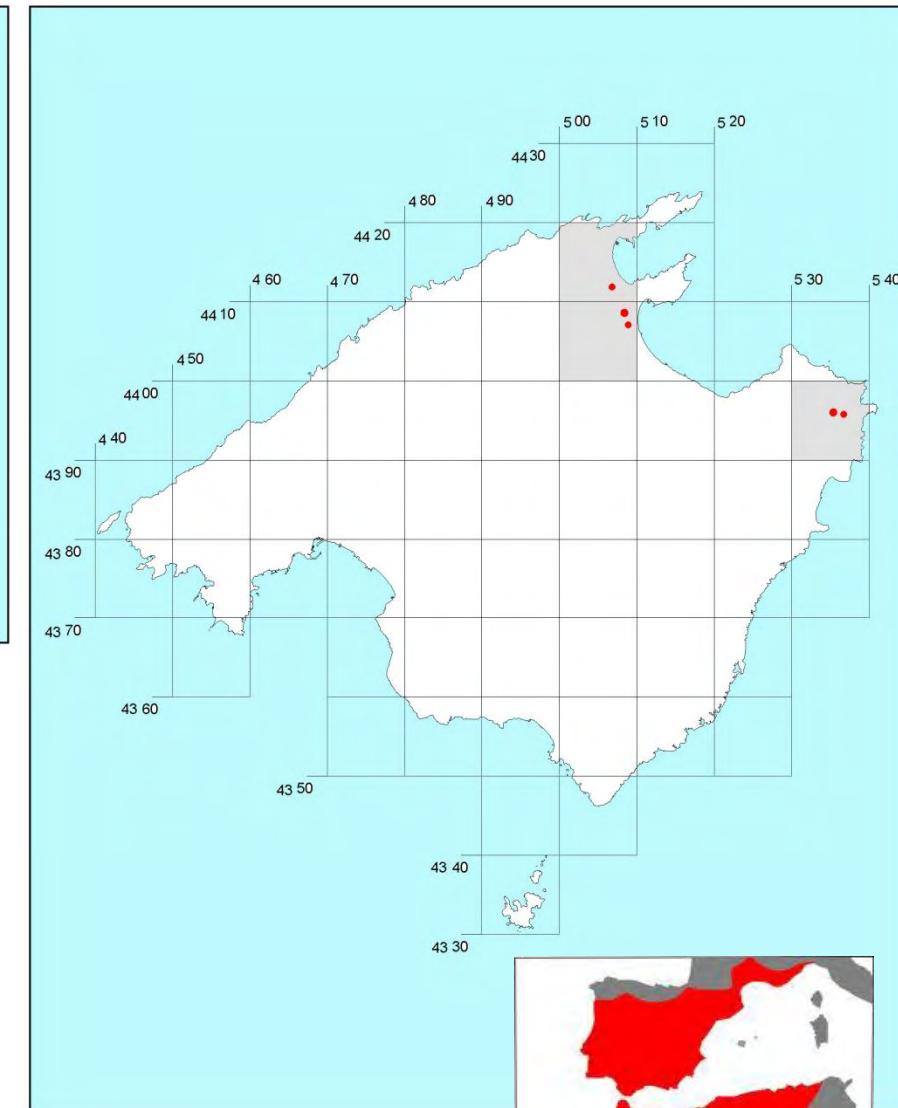
background



origin

impact

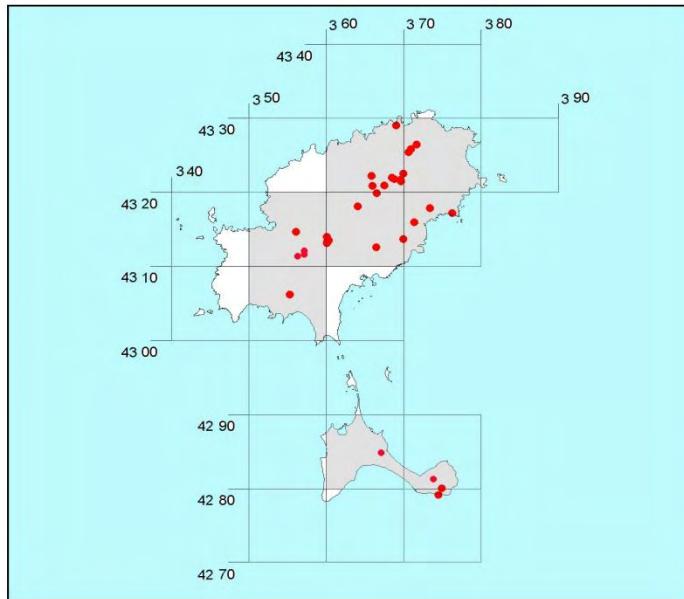
actions



*Malpolon  
monspessulanus*



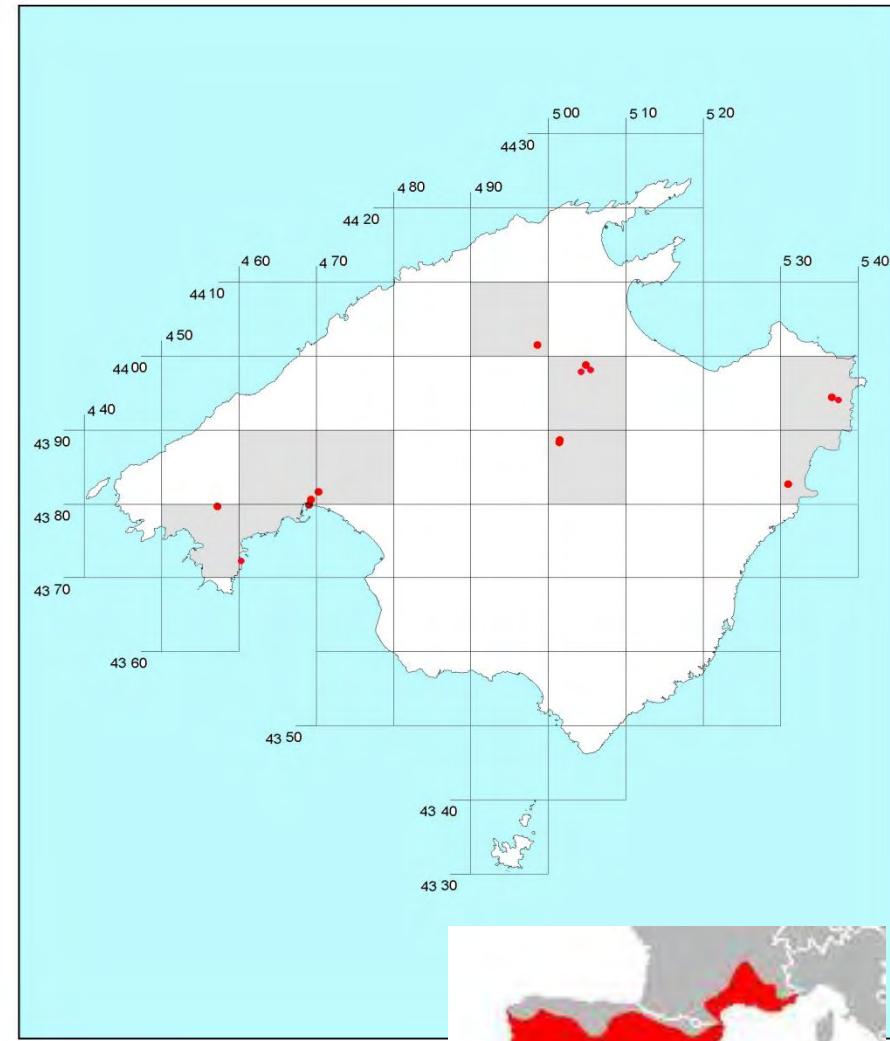
background



origin



impact



actions

*Rhinechis  
scalaris*



background

origin

impact

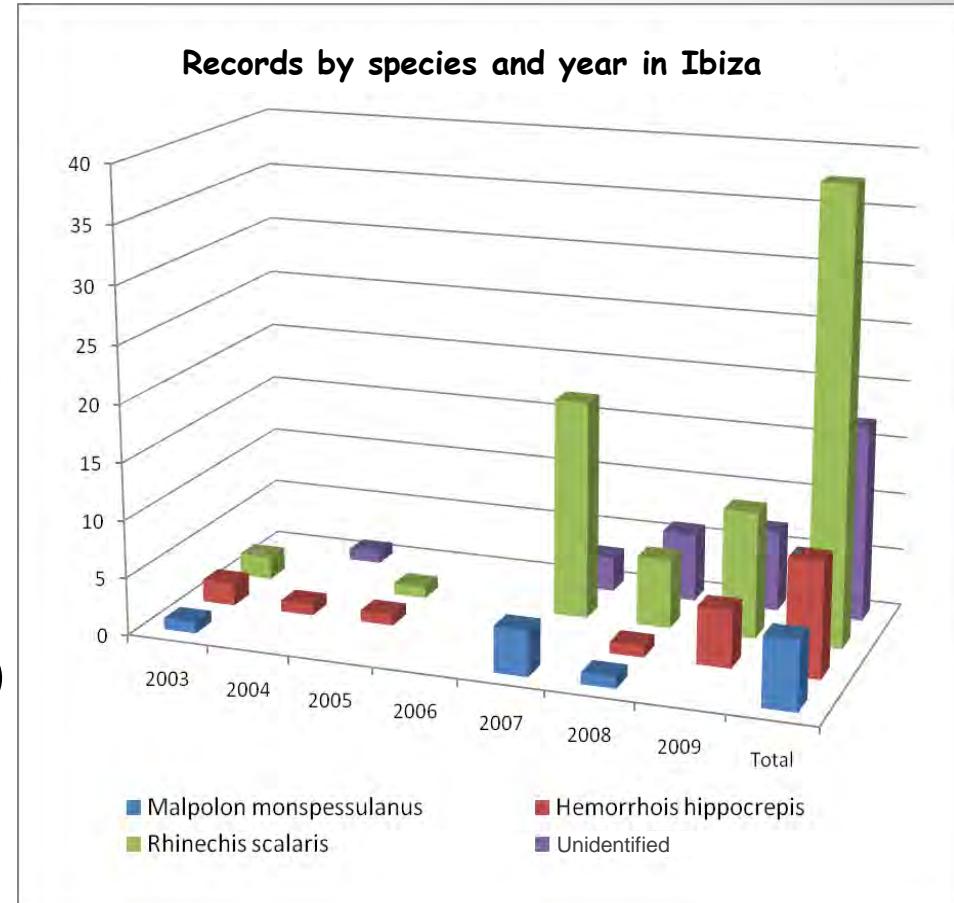
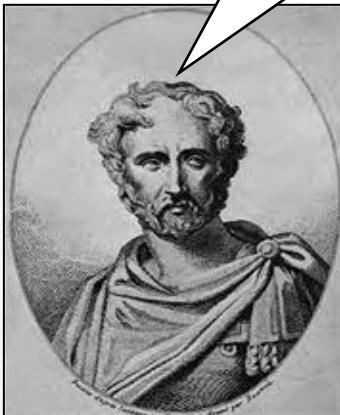
actions

# Monitoring

First record in Ibiza:  
2003

Since then: hundreds  
of observations and  
captures.

**Ego erravi**  
(I was wrong)



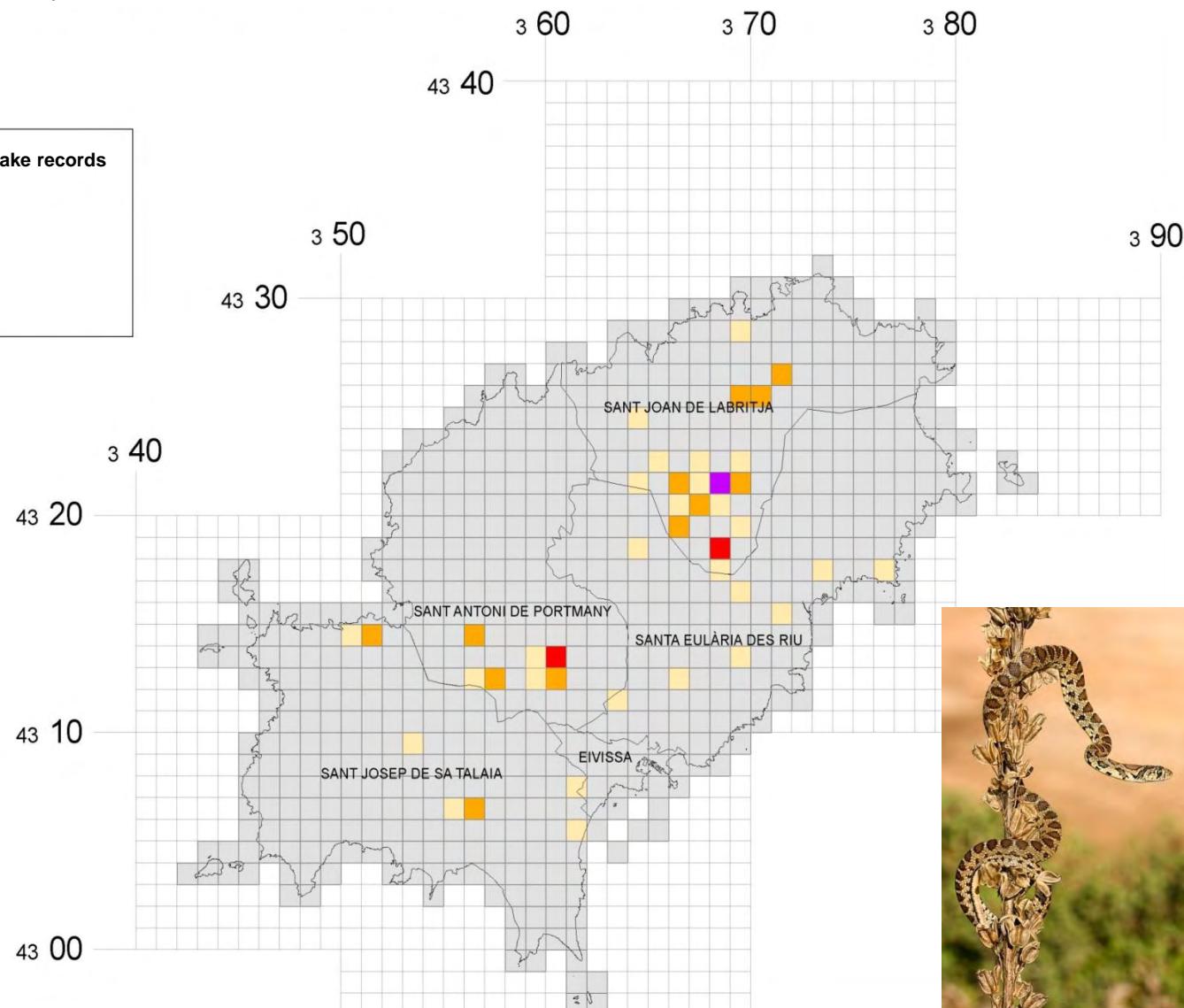
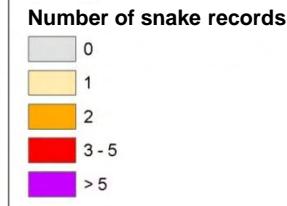
background

origin

impact

actions

### Record quantification in Ibiza



background

origin

impact

actions

# Predicting expansion with ecological modelling

## MaxEnt models from native range projected to the future

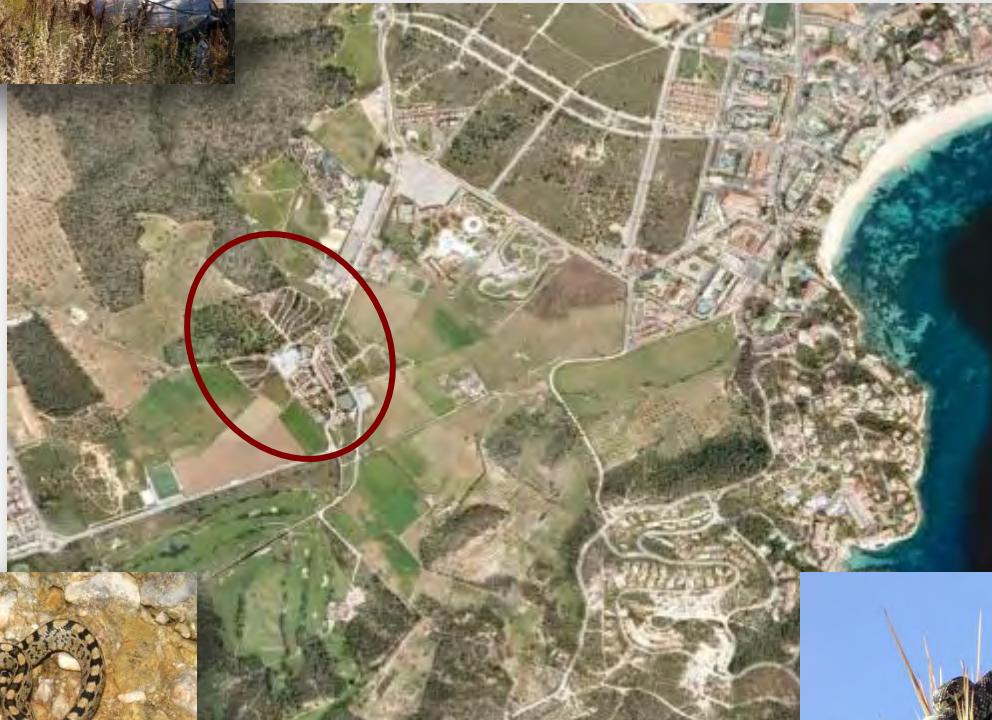


background



Testing snake trapping (2011)

origin



impact



actions



background

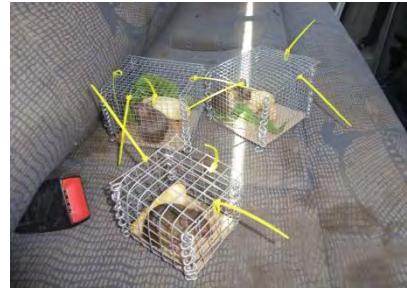


Test in a high density area:  
**Sa Porrassa**  
- 10 funnel traps (4 weeks)  
- 10 sticky traps (4 weeks)

origin



+



=



impact

actions



background

## Test in a low density area: surroundings of Capdepera (W Mallorca) close to a tree nursery

origin



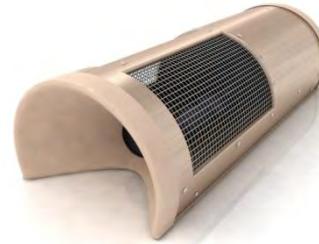
impact

Effectiveness decreases as we move away from hotspots



actions

background



origin

impact

actions

### Hotspots:

- Dog detection
- Manual collection
- Trapping
- Fumigation
- Fences
- Decrease of refuges for snakes and their prey

### Low density areas:

- Information networks
- Dog detection
- Manual collection
- Trapping (many or large traps)

Mangement guidelines for owners of tree nurseries and importers

Legislation (Balearics, Spain, EU)

background

origin

impact

actions



# ¡Gracias! Thank you!

Govern de les Illes Balears  
Servei de Protecció d'Espècies  
Agentes de Medio Ambiente  
de Ibiza y Formentera  
Departaments de Medi Ambient  
de Consells Insulars y Ayuntamientos  
Centros de Recuperación de Fauna de Sa Coma  
COFIB  
Universitat de Lleida  
Life-Lampropeltis

www.diariodeibiza.es ▾

# DIARIO de IBIZA

Local Actualidad Deportes Economía Opinión Ocio Vida y Estilo

Pitiusas y Baleares Formentera hoy Esquelas Ibiza Nights Fiestas patronales

● ÚLTIMO MINUTO Fenati gana la carrera de Moto3, con Efrén Vázquez segundo y Ál...

Diario de Ibiza » Pitiusas y Baleares

VOTE ESTA NOTICIA ★ ★ ★ ★ ★

Medio ambiente

## Ratones y perros contra las culebras

El Consell pone en marcha un programa piloto que pretende evitar el asentamiento en la isla de las serpientes llegadas desde la Península

03.05.2014 | 05:30

Trampas con ratones usados como cebo y perros adiestrados para localizar culebras son las dos medidas incluidas en el proyecto piloto impulsado por el Consell de Ibiza para intentar que las culebras de herradura, escalera o bastarda no se asienten en la isla. En los últimos 11 años, desde que empezaron a avistarse, se han atrapado unos 200 ejemplares que han causado mucha preocupación entre la población.

NIEVES GARCÍA GÁLVEZ | SANT LLORENÇ

Desde el año 2003 que se avistó la primera culebra en Ibiza ya se han cazado alrededor de 200. Once años después y tras un incremento primero casi «por goteo» y desde 2009 o 2010 más significativo, el Consell de Ibiza pone en marcha un proyecto piloto que busca «evitar el asentamiento en la isla de las serpientes», cuya presencia ya ha generado «preocupación y alarma social» entre la población, resaltaron ayer, en la



Ayllón muestra los dos tipos de trampas que se instalarán para atrapar a las culebras. juan a. riera

