PROGRAMME

DAY 1 29TH JAN 2018

WORKSHOP

RESTORATION OF ISLAND ECOSYSTEMS

09h30
Registration

10h00
Formal Opening with all LIFE Berlengas partners

10h30
The threat of invasive species to island birds
STEFFEN OPPEL (RSPB)

11h00
Coffee break

The Berlengas case study

MODERATOR: JOANA ANDRADE (SPEA)

11h20
Rat Eradication from Berlengas Island
PEDRO GERALDES (SPEA)

11h40
Removing Carpobrotus from Berlenga Island
How difficult to achieve this objective?
ANA ISABEL FAGUNDES (SPEA)

12h00
Q&A

12h30
Lunch

Eradication Impacts on native species

Problems in restoration projects and decisions

MODERATOR: MARIA JESUS FERNANDES (ICNF)

14h30
Habitat restoration and IAS management
Which are the new challenges?
PAULO OLIVEIRA (IFCN)

14h50
Crypto-ecology and ecosystems
The overlooked impacts and their importance in the restoration ecology of islands
MANUEL NOGALES (IPNA-CSIC)

15h10
The Forgotten side of Island Restoration
Biosecurity and Incursion Response
KAREN VARNHAM (RSPB)

15h30
Q&A

15h50
Coffee break

Recovering habitats in inhabited/ /touristic islands

Communicating with the public & community engagement in ecological restoration

MODERATOR: ANA ALMEIDA (SPEA)

16h10
Ecological restoration of Bagaud Island (SOUTH-EASTERN FRANCE)
Eradicating invasive taxa: Rattus rattus and Carpobrotus sp.
ELISE BUISON (UNIVERSITY OF AVIGNON)

16h30
The Isles of Scilly Seabird Recovery Project
PAUL ST PIERRE (RSPB)

16h50
The eradication of Carpobrotus sp. on the Island of Giannutri (TUSCAN ARCHIPELAGO, ITALY)
Insights and first results from a low-impact approach
LORENZO LAZZARO (UNIVERSITY OF FLORENCE)

17h10
Q&A

17h30
Coffee break

PROGRAMME

DAY 2 30TH JAN 2018

WORKSHOP

RESTORATION OF ISLAND ECOSYSTEMS

Economic and social implications

Landscape ecology and restoration

MODERATOR: TERESA MOUGA (MARE-LEIRIA)

09h30
Social implications of invasive alien plants control in the Mediterranean islands
GIUSEPPE BRUNDU (UNIVERSITY OF SASSARI)

09h50
Soil and water lines stabilization using natural engineering techniques
The case study in São Miguel Island on the scope of Project Life Terras do Priolo
FILIPE FIGUEIREDO (SPEA)

10h10
Micropropagation and seed germination of endemic plants from Berlengas' Archipelago
INÊS FRANCO (MARE-LEIRIA)

10h30
Q&A

10h50
Coffee break

Protecting species and habitats around Europe.

The importance of LIFE projects to island ecosystem recover

MODERATOR: PEDRO GERALDES (SPEA)

11h10
The Shiant Isles Recovery Project
Securing safe breeding places for seabirds in Scotland
LAURA BAMBINI (RSPB)

11h30
LIFE Puffinus Tavolara
Protection of the largest population of Puffinus yelkouan on Earth and containment and eradication of invasive alien species
PAOLO SPOSIMO (NEMO)

11h50
Rodent control at seabird colonies in Malta
PAULO LAGO (BIRDLIFE MALTA)

12h10
Out of sight, out of mind?
Preliminary findings on the biology and control of the Argentine ant in Madeira archipelago
MÁRIO BOEIRO (CE3C)

12h30
Q&A

12h50
Lunch

14h30
Round tables to exchange of experiences
Definition of topics for each group to discuss
MODERATOR: JOANA ANDRADE (SPEA)

16h30
Cofee break

16h50
Presentation of each group ideas

17h30
Closing Remarks

DAY 3 31TH JAN 2018

09h00 - 16h00
Field Trip to Berlenga

The threat of invasive species to island birds

Steffen Oppel

Senior Conservation Scientist

Islands host many unique species

- world has around 465,000 islands that cover 5.3% of the world’s land area

- 19% of all bird species (1947 species) occur only on islands

Tershy et al. 2015. BioScience 65: 592–597

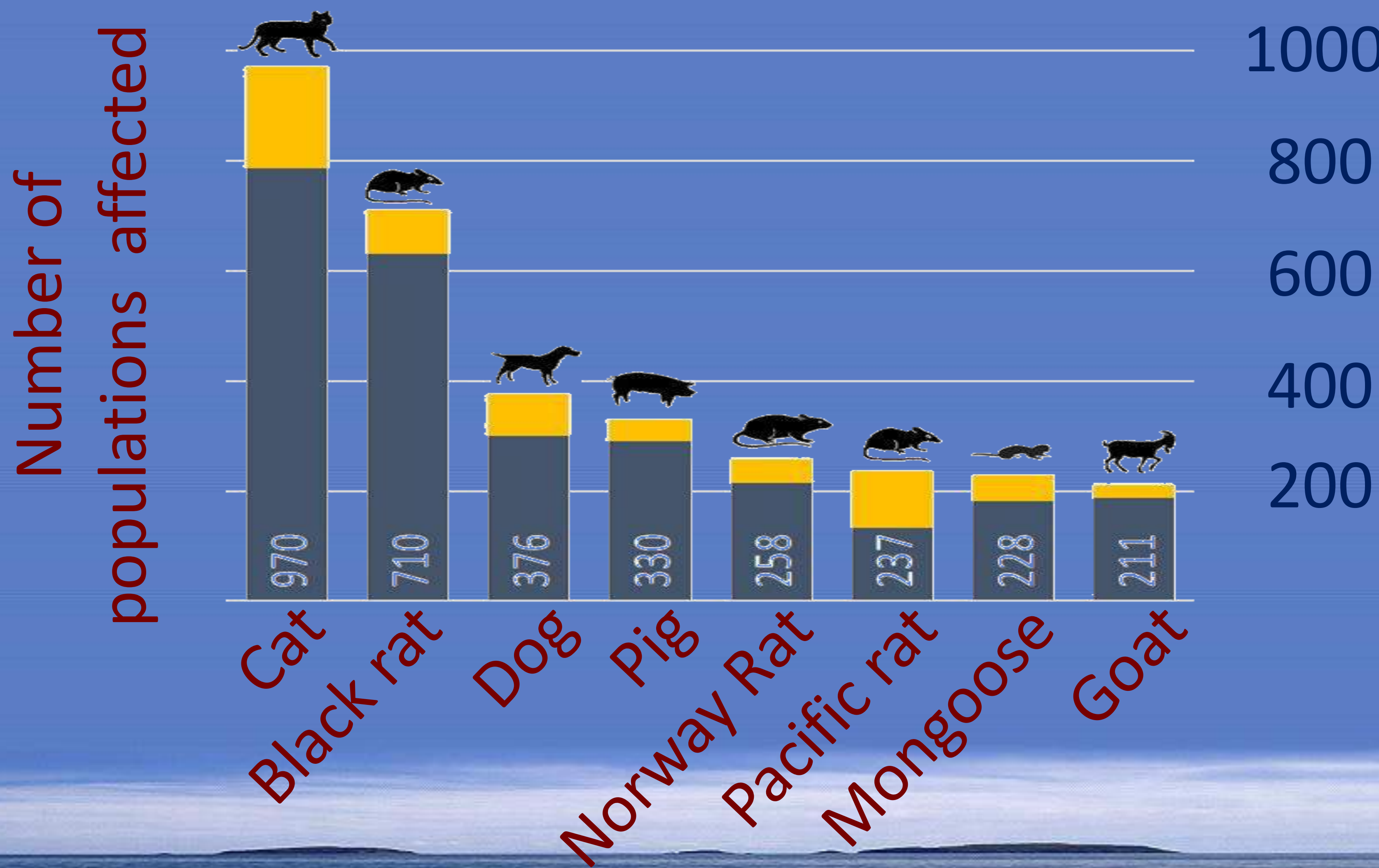
Humans bring non-native species

- humans have spread mammals, birds, reptiles and other species for >1000 years
- only a small p… …ed species establish wild popu… …ive species
- there are >18… …ecies on >90% of the wo…

Invasive mammals threaten island birds

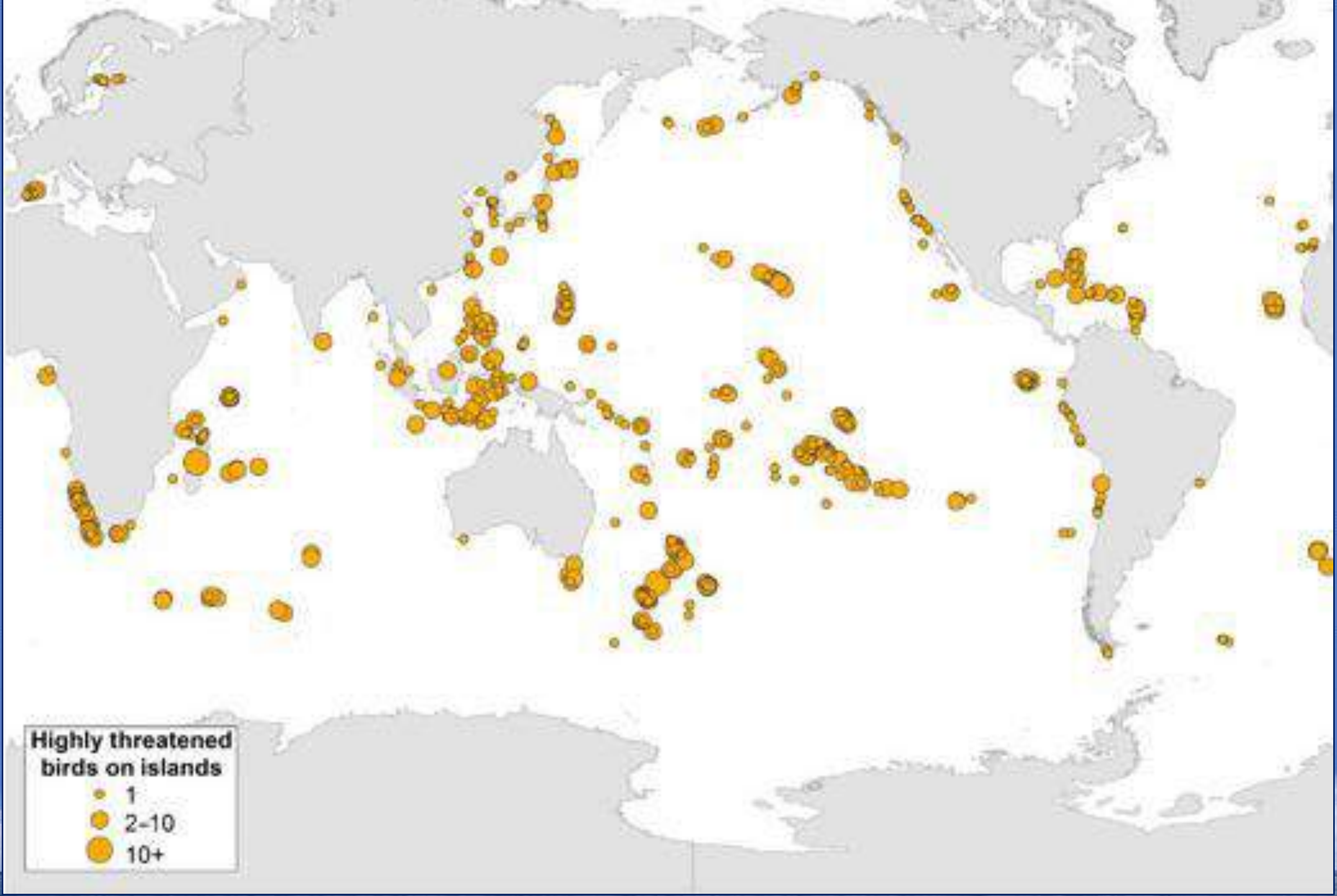
- many endemic bird species are flightless and have no natural defenses against mammals
- invasives kill adults and chicks, and destroy habitats
- 95% of the 137 bird species that went extinct occurred on islands

The 10 most detrimental vertebrates



Holmes et al. 2017. submitted

Islands with the most threatened birds

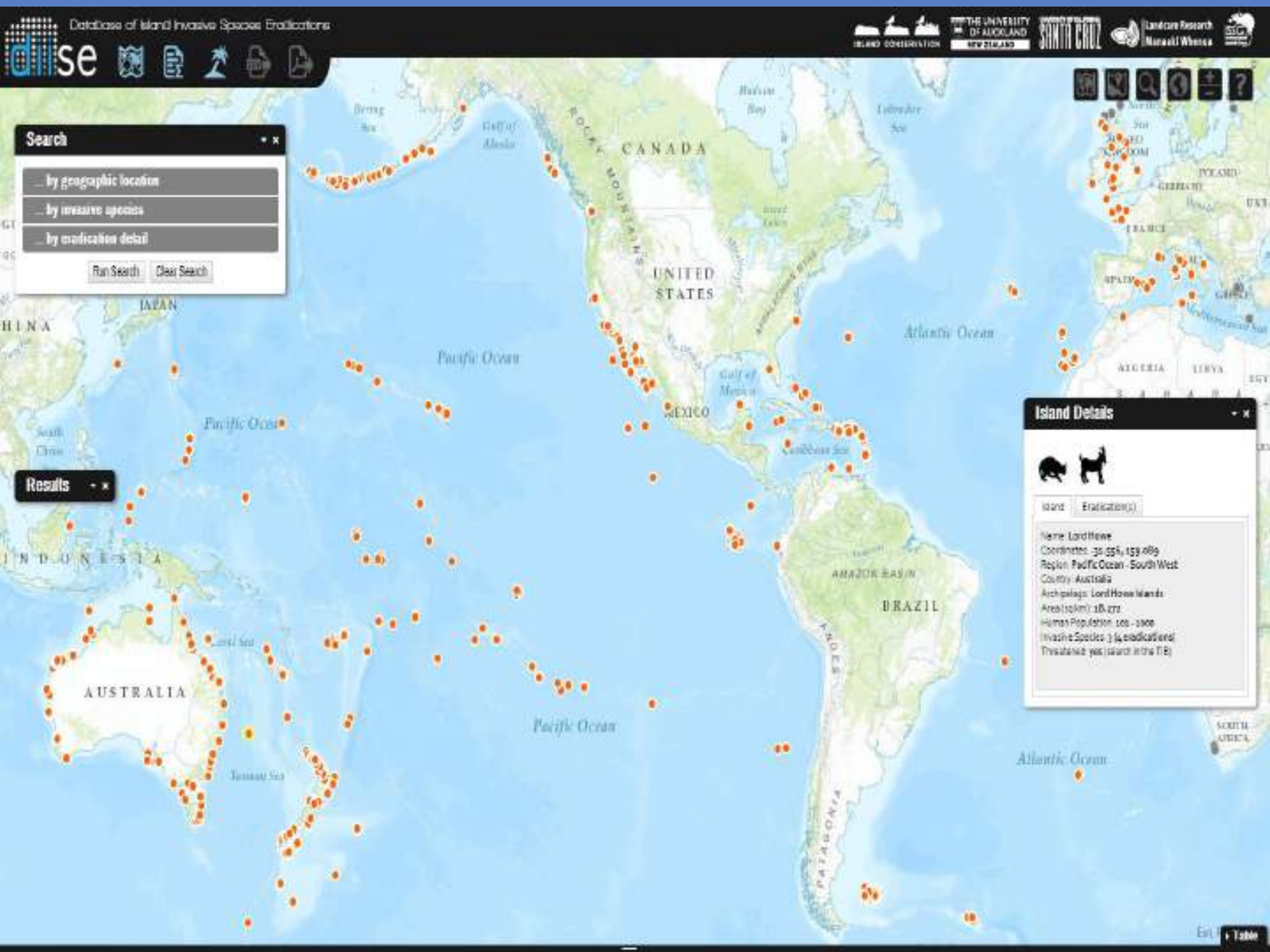


Spatz et al. 2017. Science Advances 3

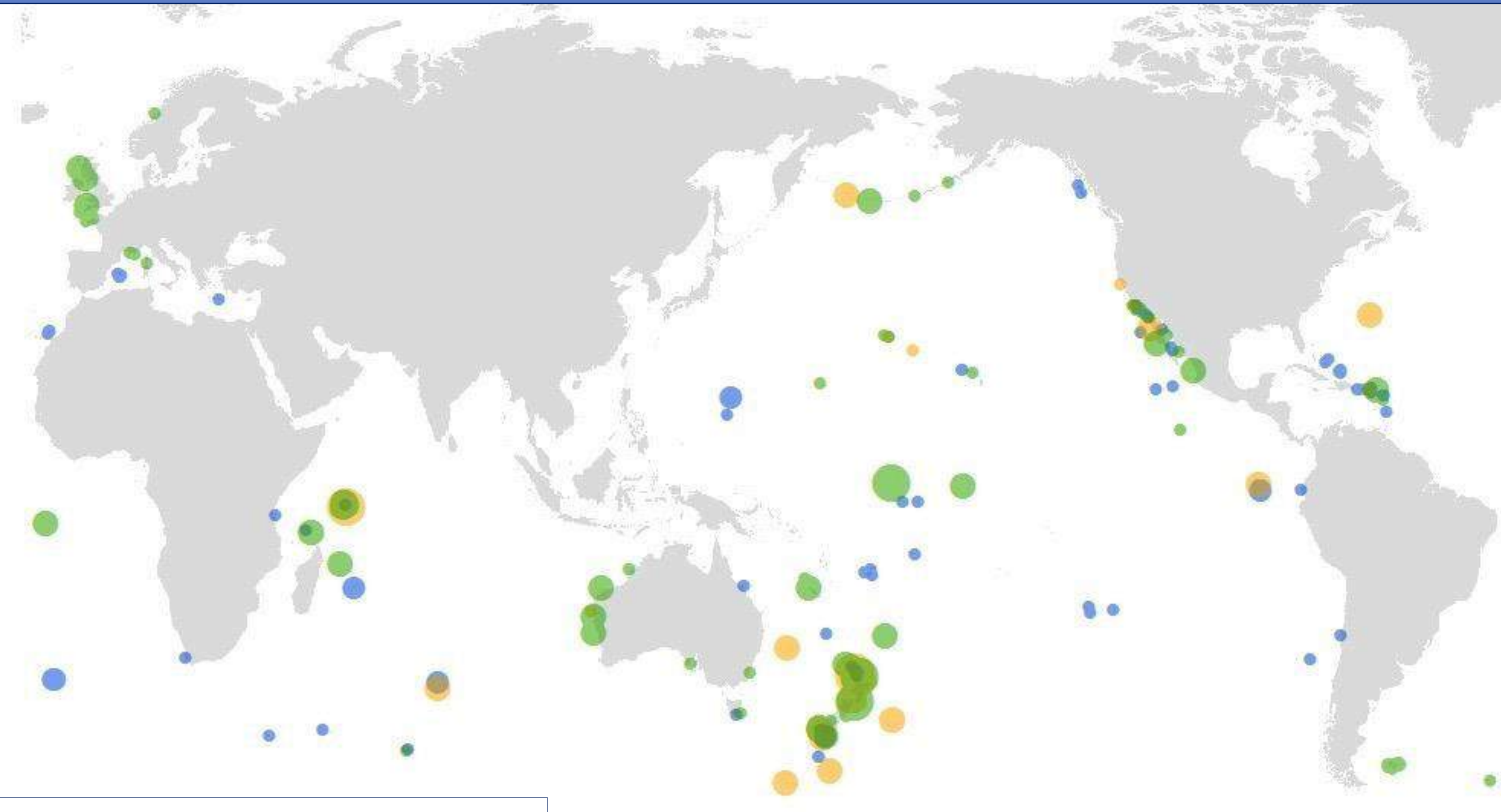
Eradication of invasive species

- pioneered by New Zealand in the 1970s
- one of the most effective conservation management actions worldwide
- eradications successfully completed on >900 islands

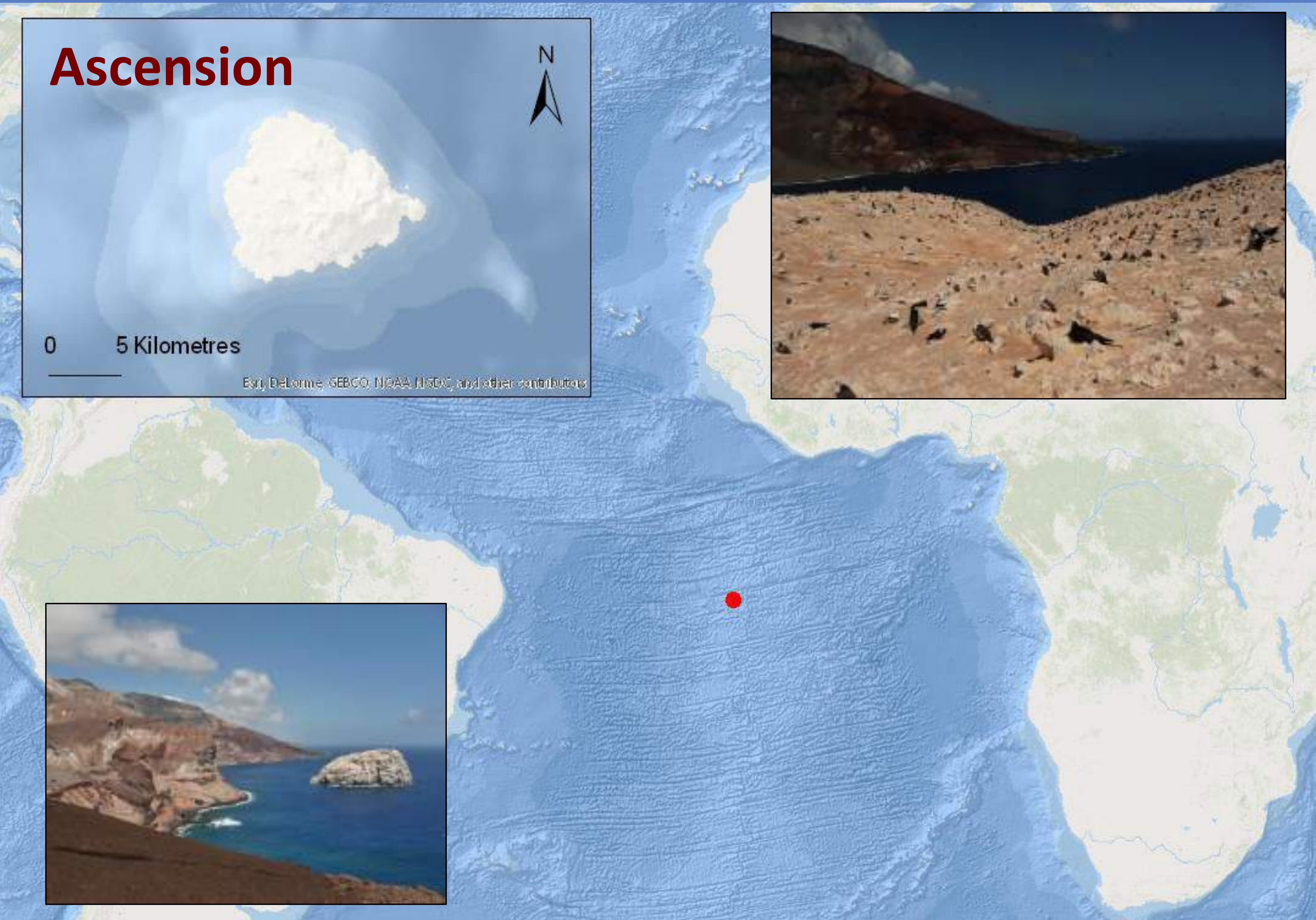



Database of Island Invasive Species Eradications
dise
Search
... by geographic location
... by invasive species
... by eradication detail
Run Search
Clear Search
Results
CANADA
UNITED STATES
MEXICO
BRAZIL
AUSTRALIA
JAPAN
Pacific Ocean
Atlantic Ocean
Island Details
Island
Eradication(s)
Name: Lord Howe
Region: Pacific Ocean - South West
Country: Australia
Archipelago: Lord Howe Islands
Table

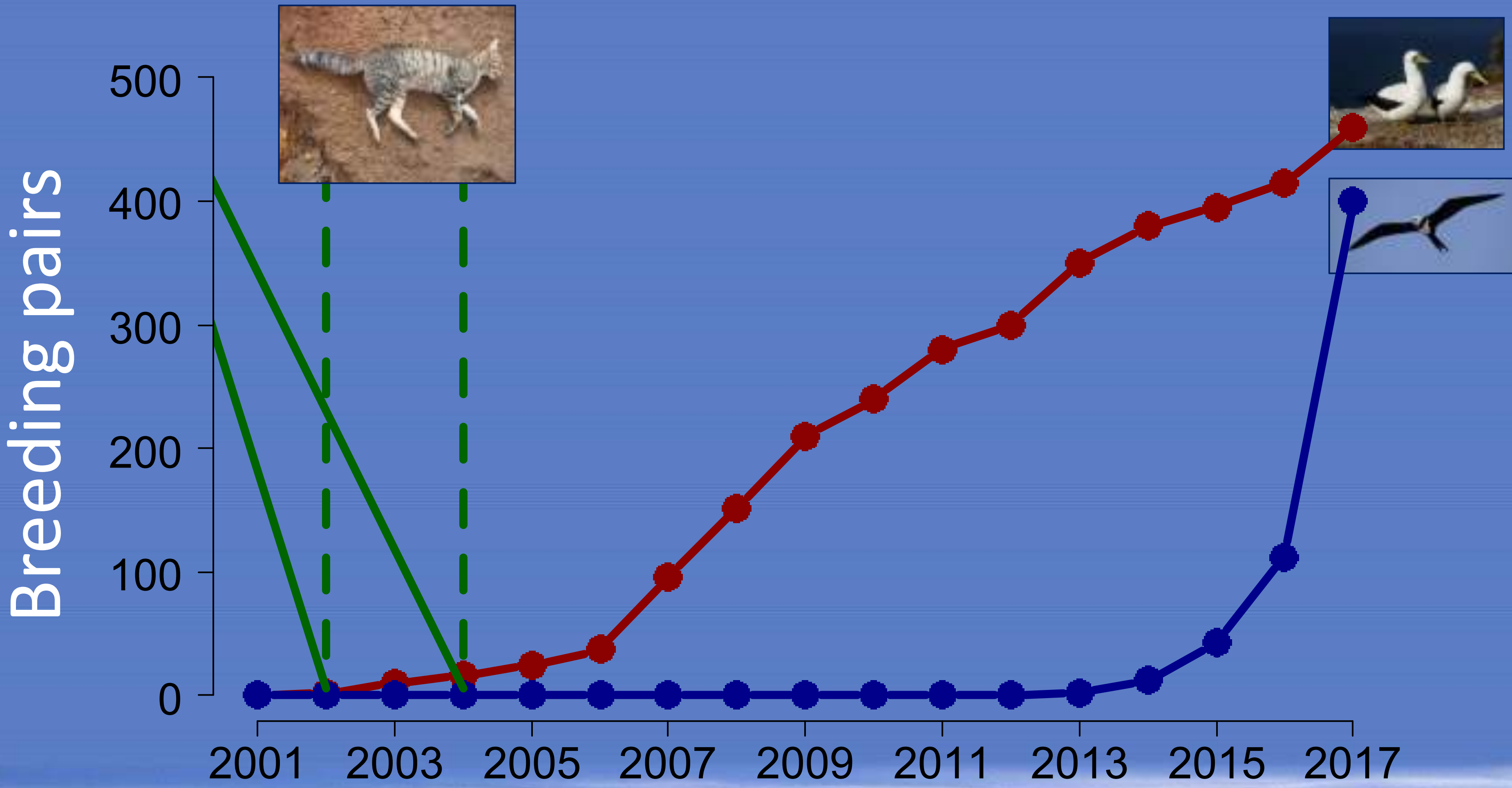
Global island restoration success



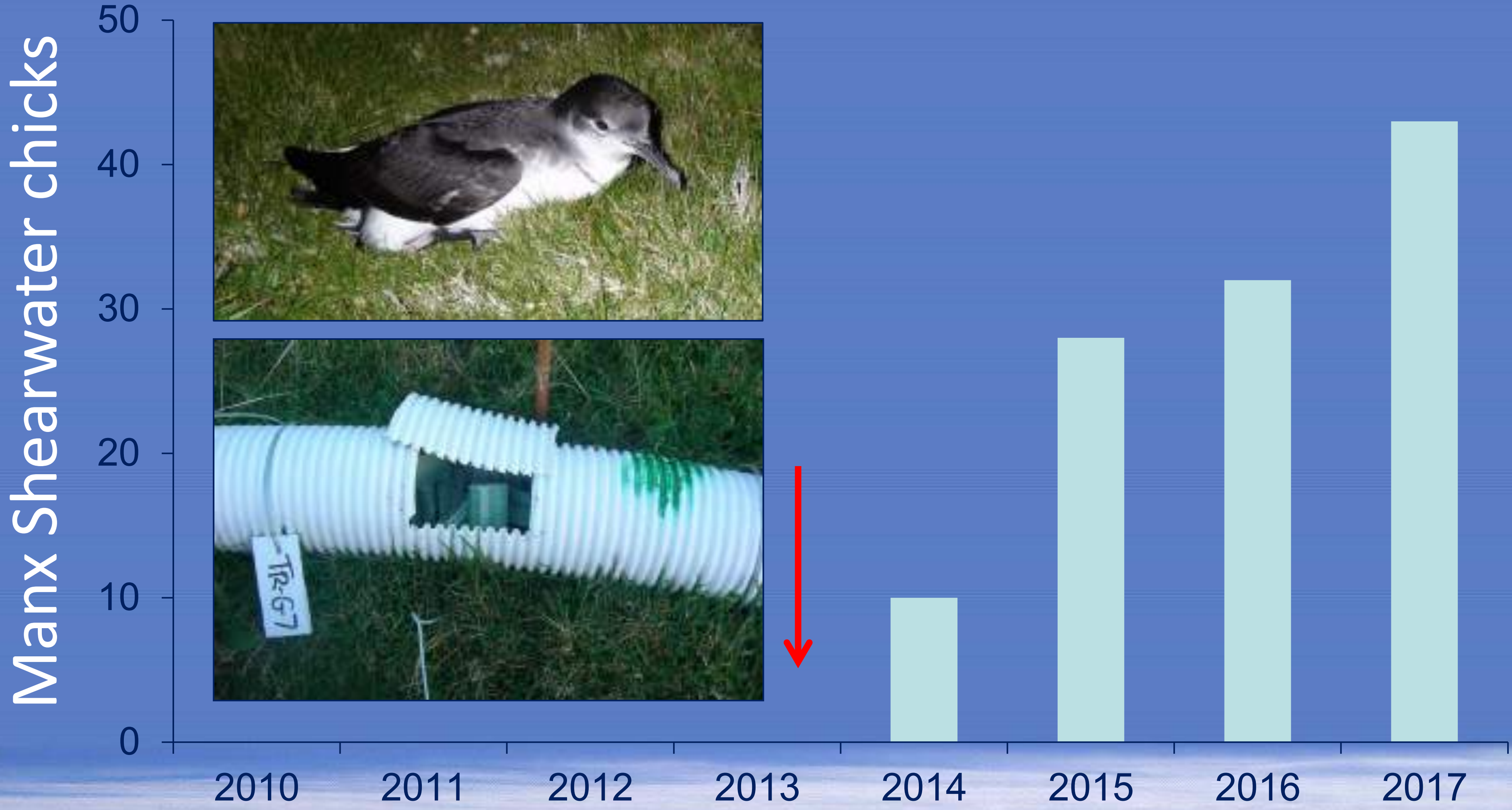
Jones et al. 2017. PNAS 113:4033-4038


Ascension
N
0
5 Kilometres
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

Ascension without cats



St Agnes (Isles of Scilly) without rats



Interactions of invasive mammals

- many islands invaded by >1 alien species
- eradication of just one alien species may increase abundance of other alien species
- need to understand influence of different alien species ***before*** an eradication

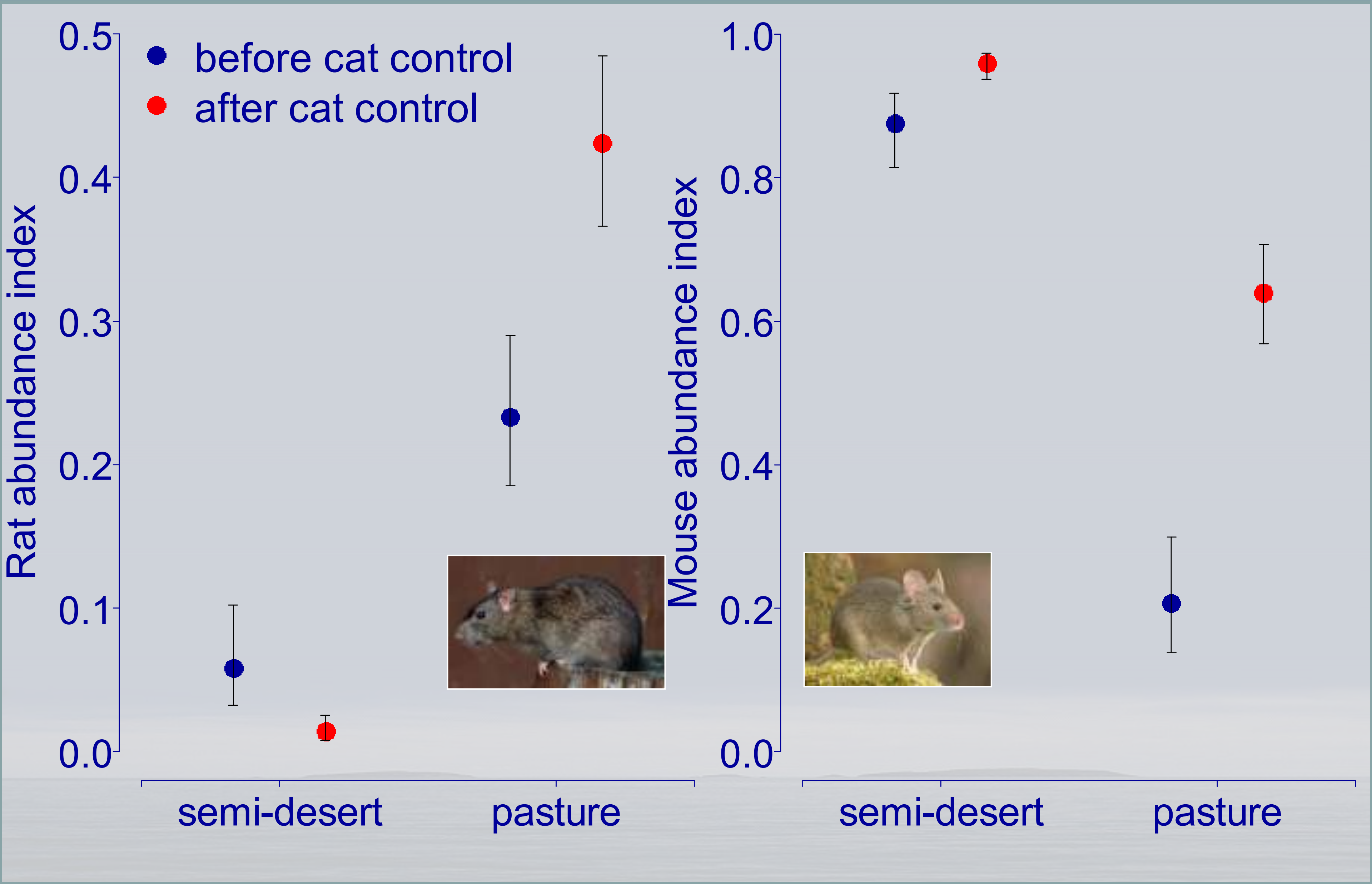
Cats and rats on Corvo (Azores)

- removing rats may increase negative effect of cats
- cats and rats need to be eradicated simultaneously
- cat eradication very contentious on an inhabited island with domestic cats

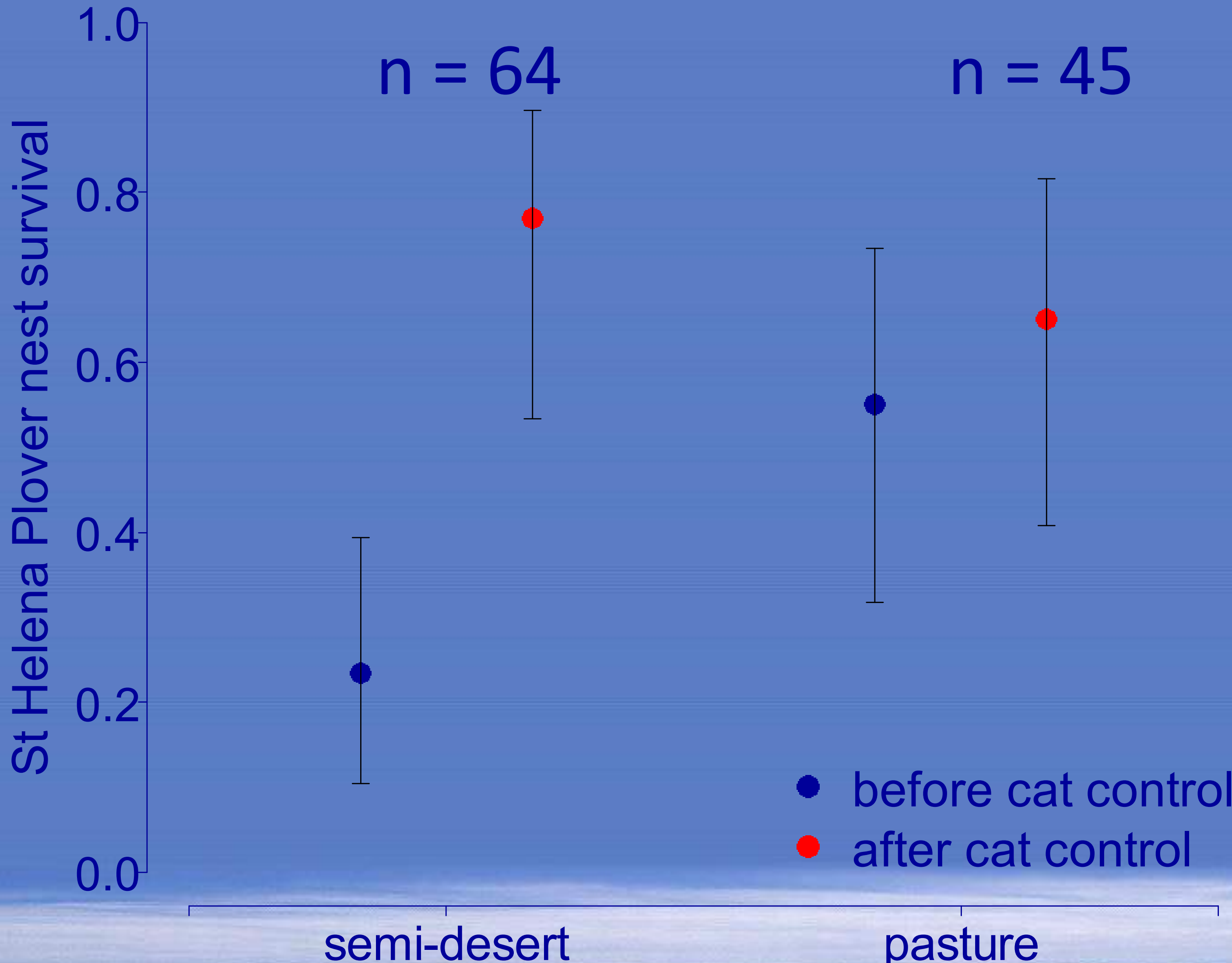
Hervias et al. 2013. *Biological Invasions 15: 143-155*

Cats and rats on St Helena (South Atlantic)

Cat control altered rodent abundance



Benefits of cat control differ by habitat



Oppel et al. 2014. J. Applied Ecol. 52: 1246–1254

St Helena islanders want compensation over unusable new £285m airport

Isolated UK outpost in South Atlantic expected to attract tourists but runway is deemed too windy to land planes on

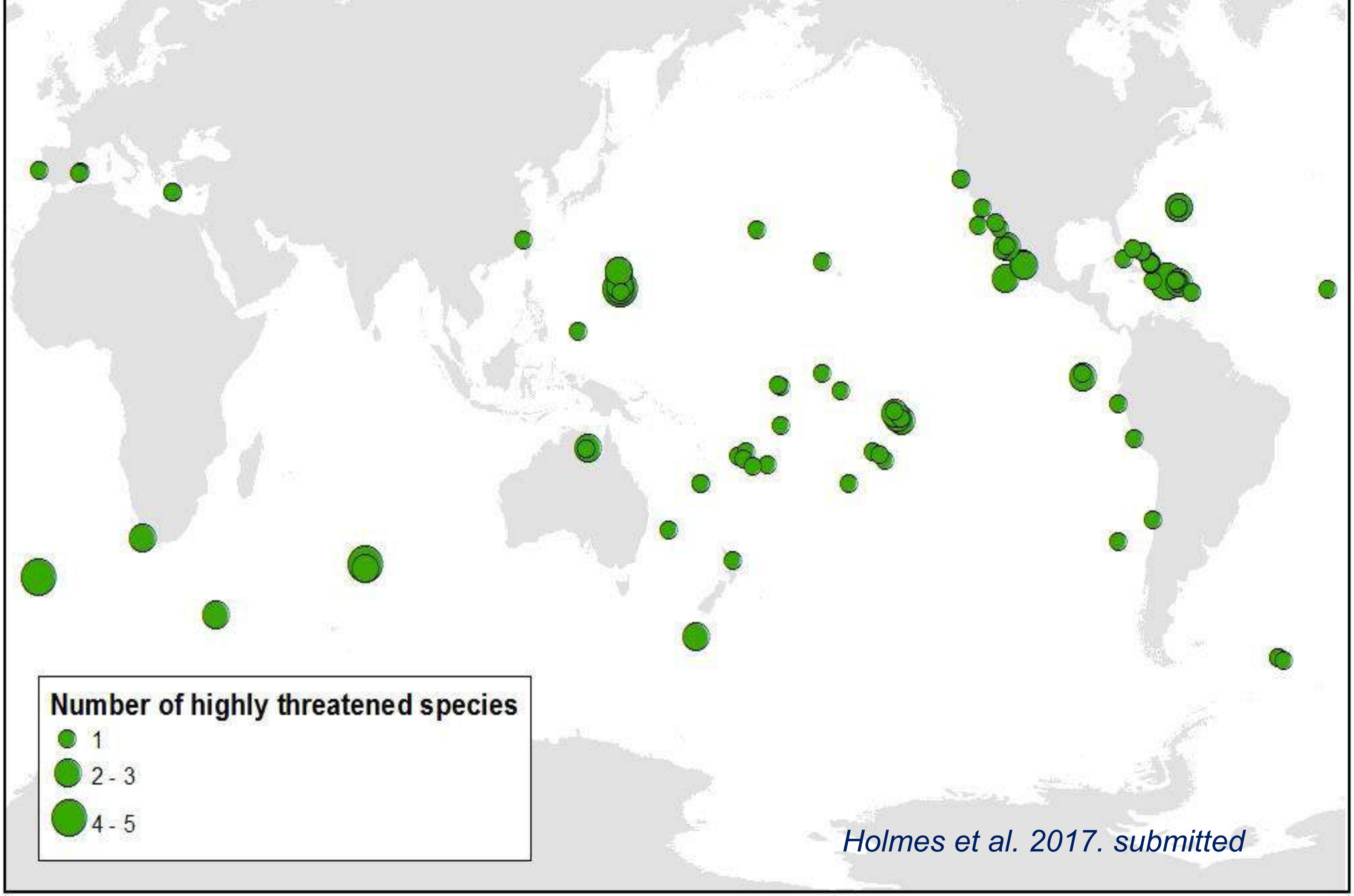
Prioritising the work ahead

- invasive species affect highly threatened birds on 1279 islands worldwide

- we cannot eradicate all invasives from all islands – so we need to prioritise the islands that we ***can*** restore

- islands where the most threatened species could be saved by eradications are top priority

The highest priority islands worldwide



Holmes et al. 2017. submitted

… in UK Overseas Territories

Island	Native species to save	Invasives to eradicate
Gough	7 seabirds	mice
Anegada	6 reptiles	rats, mice, cats, dogs, goats, cattle, donkeys, sheep, pigs, green iguanas
Little Cayman	11 reptiles	rats, mice, cats, dogs, green iguanas
Henderson	7 birds	Polynesian rats
Guana Island	4 reptiles	cats, dogs, sheep

Dawson et al. 2015. Conservation Biology 29:143-153

… in the United Kingdom

Stanbury et al. 2017. European Journal of Wildlife Research 63:31

What is ‘biosecurity’?

- preventing invasive species from getting to islands is more efficient than removing them
- biosecurity = rigorous measures to prevent invasive species getting to or establishing on islands
- need to establish effective biosecurity ***before*** an eradication attempt

Backup plan to detect (re)invasions

- invasions generally involve few individuals
- keep tight detection and trapping network around island to detect first invaders
- … e a

Russell et al. 2005. Nature 437: 1107-1107.

Conclusions

- protect what you have by improving biosecurity and rapid response plans

- restore islands where invasive species can be eradicated and where threatened native species will benefit

- consider biological interactions prior to eradication planning unless all invasive species can be eradicated simultaneously


rspb
steffen.oppel@rspb.org.uk
@RSPBScience

Rat eradication from Berlenga Island

2015 - 2018

Sociedade Portuguesa para o Estudo das Aves - Life Berlengas project (LIFE13NAT/PT/000458)

Preparing the eradication

- The biggest populations of several seabirds in Continental Portugal, namely Cory's shearwater *Calonectris borealis*, Band-rumped storm-petrel *Hydrobates* castro, Shag *Phalacrocorax aristotelis*, Yellow-legged gull *Larus michahellis.* The native vegetation includes three endemic species of conservation concern

- The presence of IAS in Berlengas (Black-rat *Rattus rattus*) is considered to have a significant impact on several seabird species and on the island vegetation. It is also thought that it prevents colonization of the main island by prospecting Band-rumped storm-petrels that are often registered there

- The Blackrat is one of the most distributed and diffused rodents, and considered one of the main causes of the decline and extirpation of various species of plants mainly by seeds depletion, and of seabirds by predation of eggs and chicks.

Berlengas archipelago

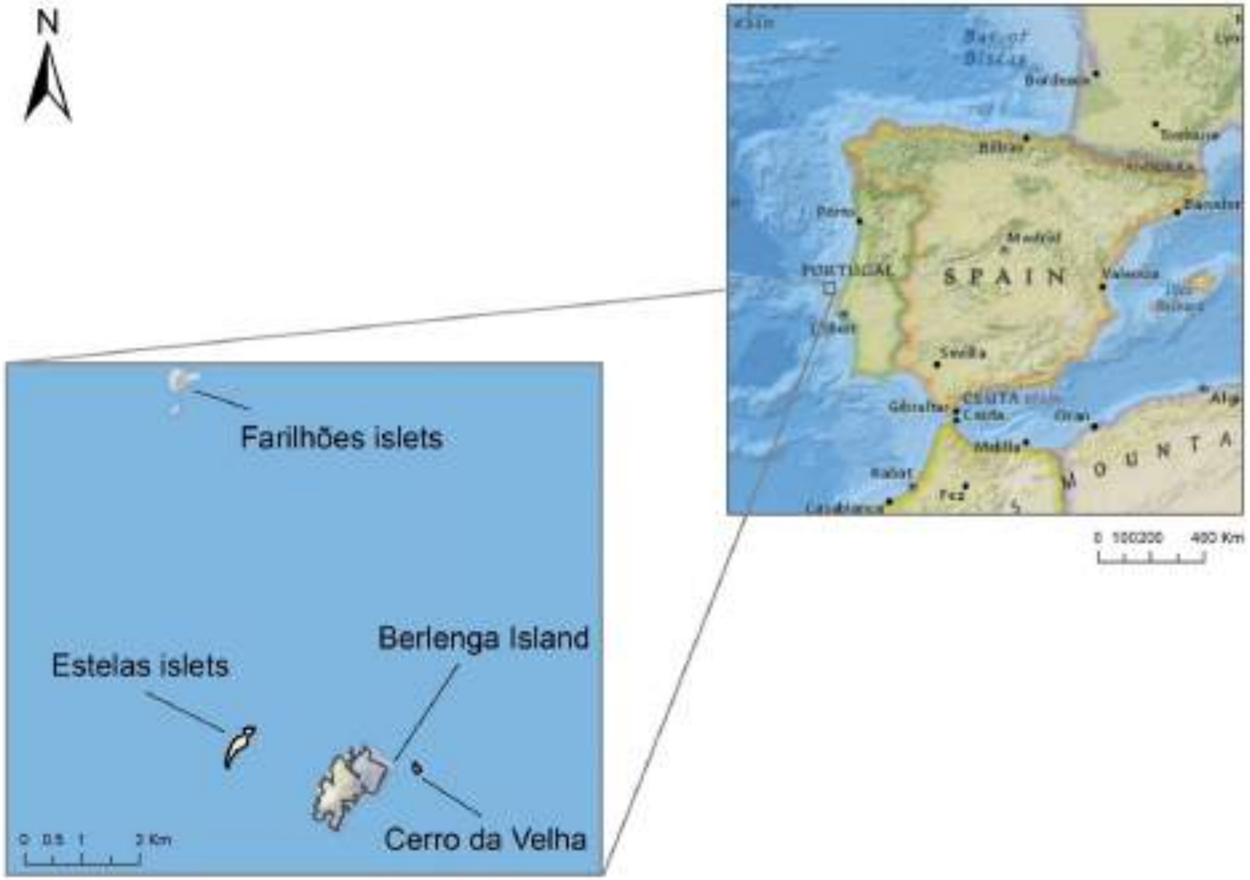


Figure 1 – Berlenga Island and the position of Farilhões islets in the top and Estelas islets in the left.

Objectives

- Berlenga is the main island of Berlengas archipelago located about 10 km off Peniche, Continental Portugal
- The island has an area of 78.8 ha and a maximum altitude of 92 m and is the only island with a population of Black rat
- A typical Atlantic influence is noted in the north and west cliffs and a Mediterranean in the south and east cliffs
- The climate is seasonal with a wet winter followed by a dry long season, from spring to late autumn

Baseline Studies

- Capture of Black-rats occurred from January to December 2015 using Sherman® XLF15 live traps
- Traps were set in 3 grids 5x6m, and spaced by 50m within each grid
- Grid position was chosen in order to sample the main type of habitats present on Berlenga Island
- Each grid was sampled once (2 days of pre-baiting plus 4 days of trapping) every other month using peanut butter as bait
- A unique numbered mark was placed in the ear of each trapped rat

Tese Mestrado - Tânia Nascimento

CARACTERIZAÇÃO DE UMA POPULAÇÃO INSULAR DE ROEDORES INVASORES.
O CASO DO RATO PRETO (RATTUS RATTUS) NA ILHA DA BERLENGA.

Tânia Nascimento

Áreas Vitais (radio-tracking)

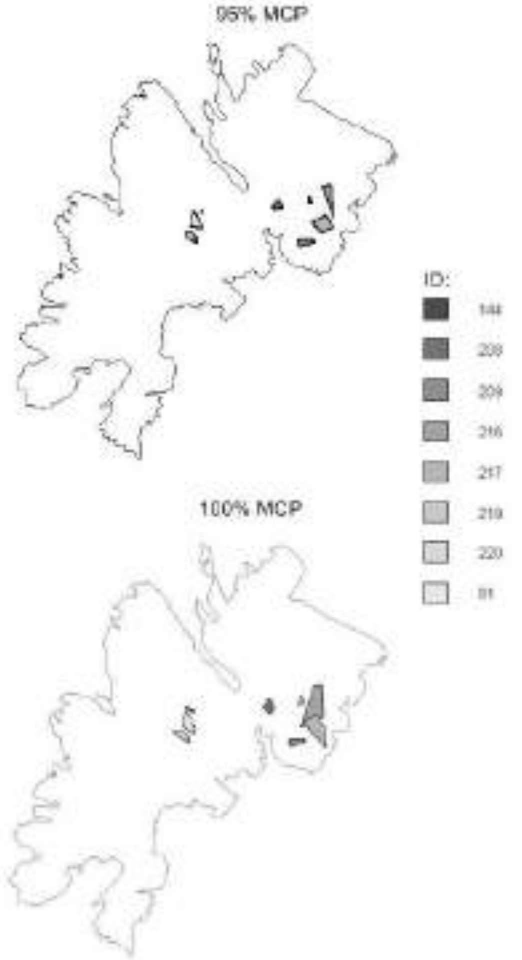


Figura 7 – Áreas vitais dos 8 ratos seguidos em 95% e 100% dos mínimos polígonos convexos calculados.

Figure 2 – Measuring and marking a captured Black-rat in the left image, and a ear mark in the right image.

Results (Distribution and abundance)

- Density of rats was estimated using Spatially Explicit Capture-Recapture models (SECR).

- The presence of rats on the small islets located near Berlenga (>1km) was assessed 3 times (July 2014, April and September 2015) using wax-blocks mixing peanut butter and paraffin. **No sign of rats were detected**.

Capture-recapture

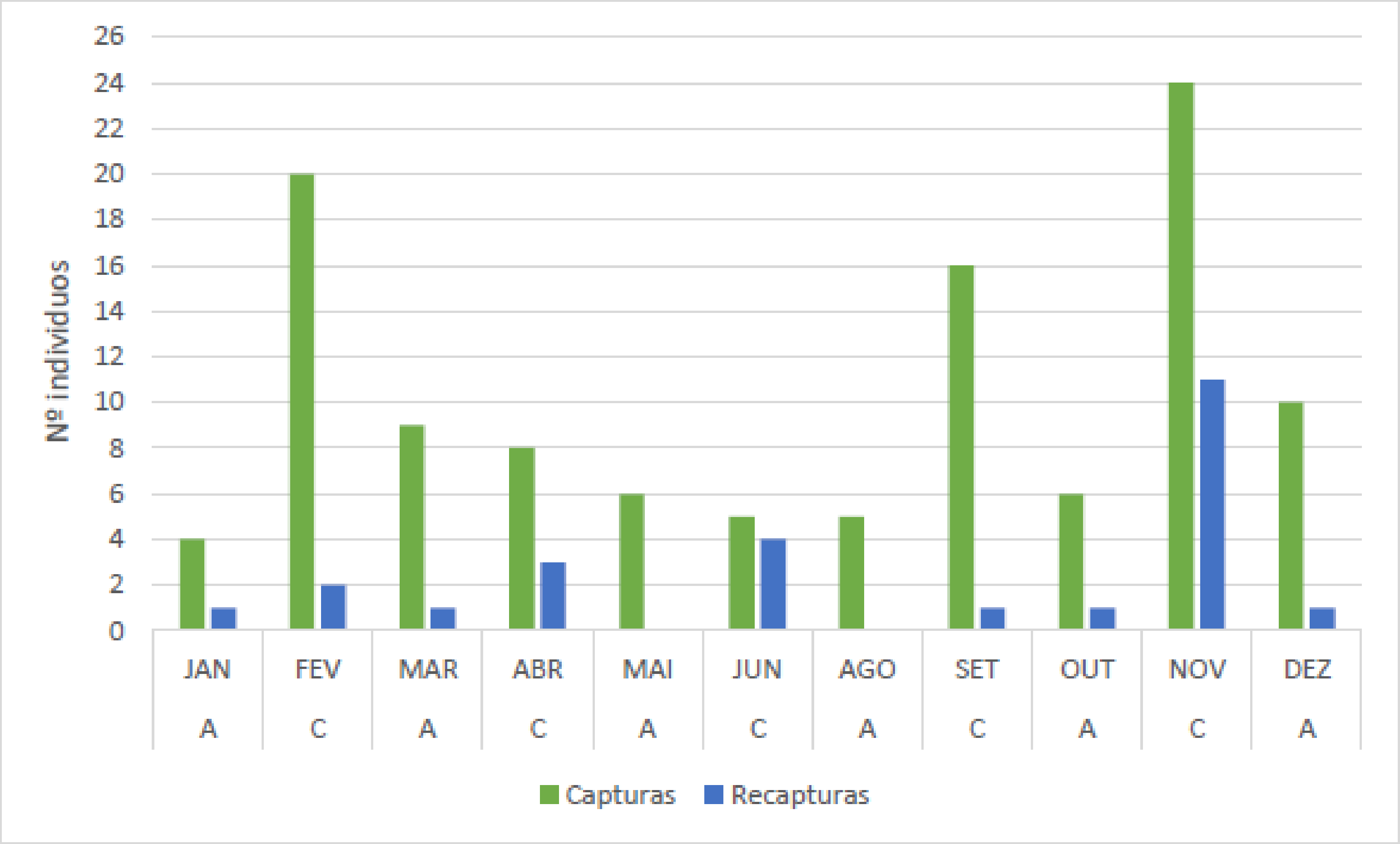


Figura 3 – Número de indivíduos capturados e recapturados em cada mês com a respetiva grelha onde foi efetuada a amostragem (A- Ilha Velha; C- Berlenga).

Grid	Density (ind/ha)	SE	IC 95%	Detection function	AIC
A	40.15	16.52	18.49 - 87.18	Expontential	555.0*
	38.06	15.36	17.78 - 81.48	Half-normal	556.34
	41.42	18.35	18.06 - 94.97	Hazard rate	556.46
B	36.36	9.64	21.82 - 60.59	Expontential	725.37*
	30.43	6.99	19.51 - 47.47	Half-normal	726.93
	35.85	23.72	11.00 - 116.80	Hazard rate	730.29

Table 1 – Results of the SECR models. * indicate the best models based on the smaller AIC value.

2800 > Berlengas < 3100 Rats!

Dieta

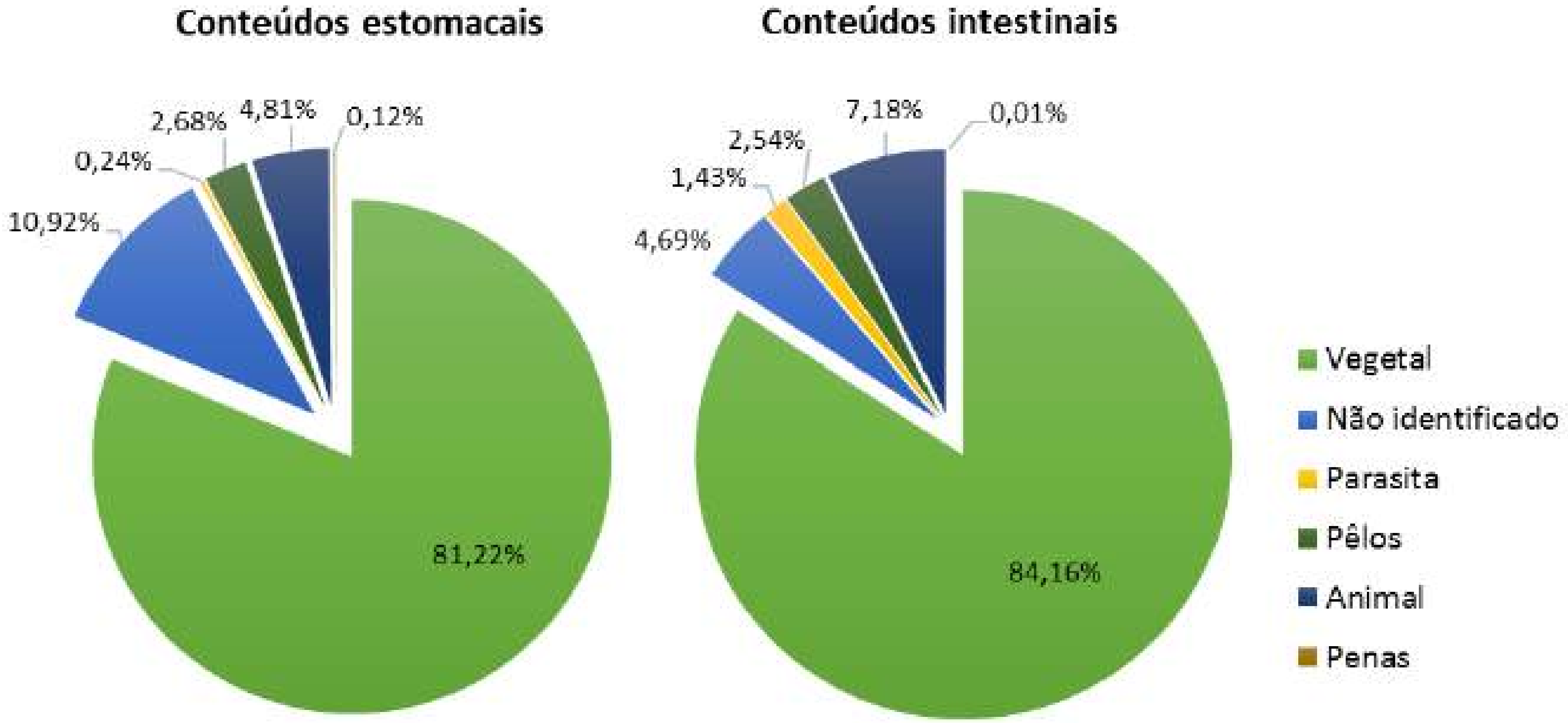


Figura 8 – Proporção de cada grupo de itens encontrados nos conteúdos estomacais e intestinais.

Análise Genética (Mith of relic species!)

Rattus rattus

19 amostras de ratazana-preta capturadas na ilha Berlenga Grande antecederam a campanha de erradicação.
Extracção de ADN genómico para PCR (Polymerase Chain Reaction) de marcadores moleculares adequados
Foram seleccionados 2 marcadores moleculares mitocondriais – citocromo b e d-loop, para avaliar a origem da colonização de determinada população de uma determinada espécie em ilhas/arquipélagos assim como evidenciar a diferenciação de populações.

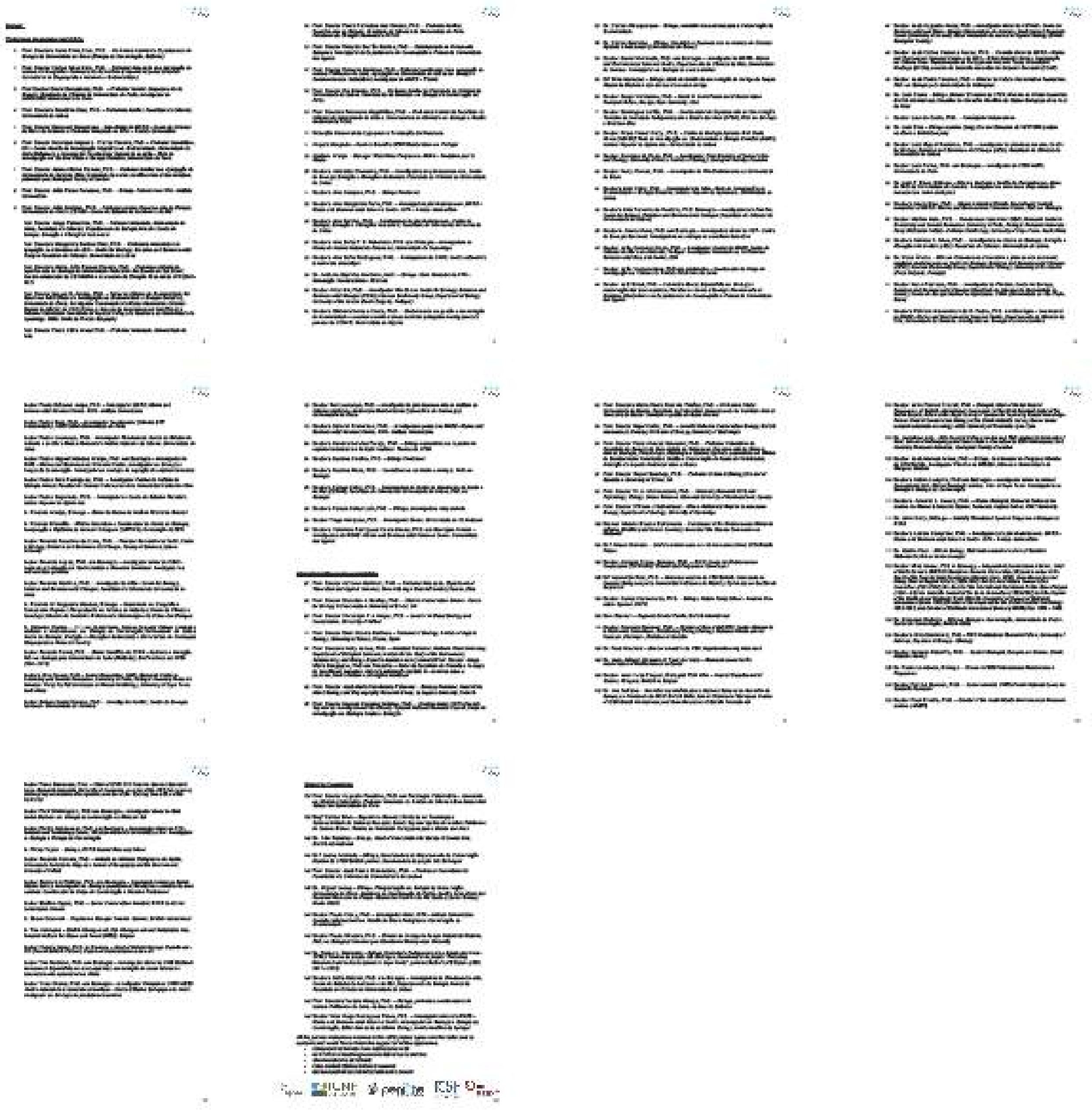
As sequências foram truncadas a 700 pares de bases
Uma única sequência para a ilha Berlenga que apresentava total redundância/identidade com sequências publicadas provenientes de:
Espanha, França, Itália, Tunísia, ilhas Canárias (Tenerife, La Palma, El Hierro, La Gomera, Gran Canária, Lanzarote), Senegal e Benim

Esta ausência de diferenciação genética ao longo de áreas geográficas bastante vastas é coerente com uma colonização recente (do ponto de vista evolutivo).

Public reactions

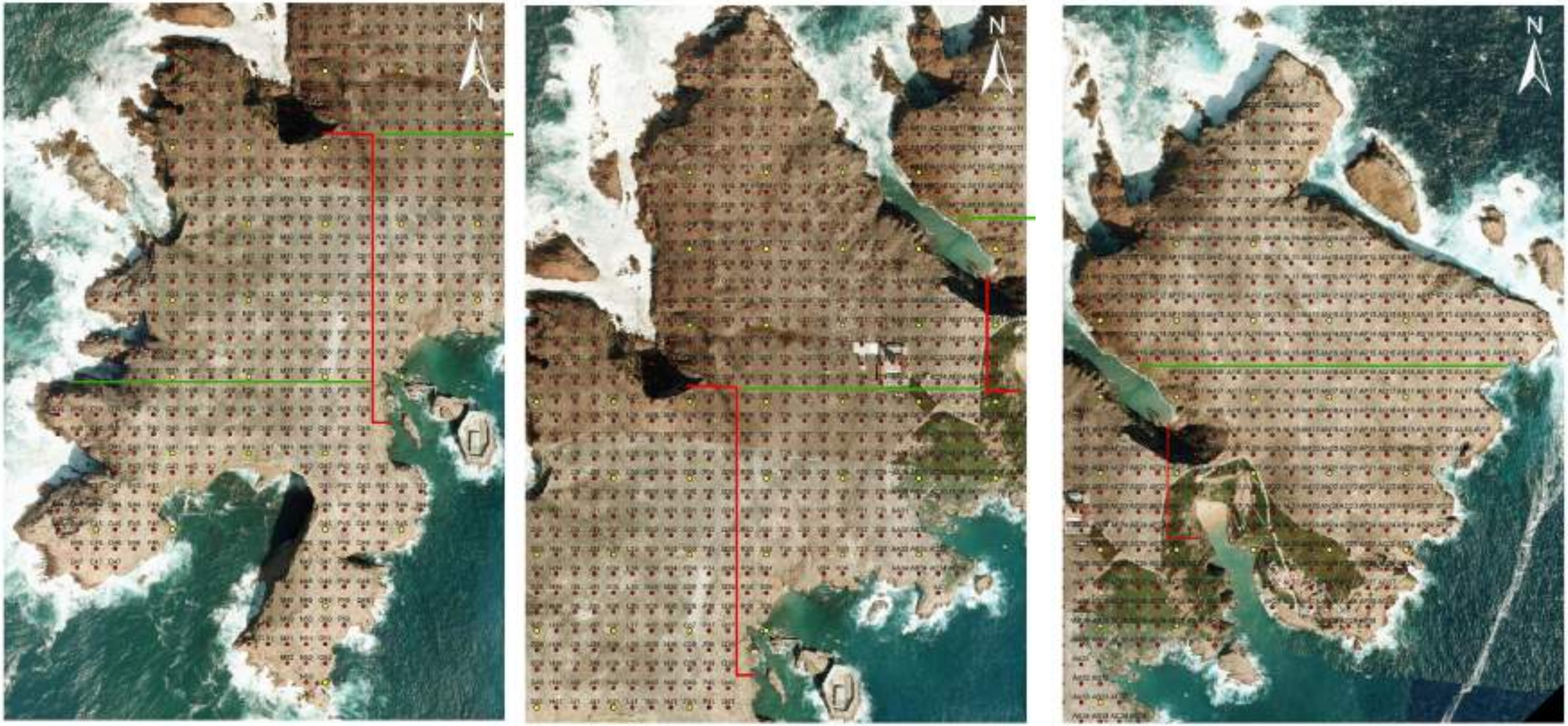
Berlengas

Supporting the project LIFE Berlengas



Knock-down phase

- 400 Kg of Talon block pellets and 100Kg of Racumin grain pellets calculated necessary
- A grid of 1000 baiting stations spaced 25x25m covered the entire island.
- Each station was baited with 4 cereal pellets containing 0.005% of anticoagulant Brodifacoum (branded as Talon).
- Extra stations were set around and inside the main building areas (fortress, lighthouse and fishermen houses).



Berlengas

ATENÇÃO!

CAMPANHA DE DESRATIZAÇÃO DA BERLENGA A DECORRER

As espécies introduzidas invasoras presentes na ilha da Berlenga contam-se entre as principais ameaças ao seu frágil ecossistema, causando impactos negativos sobre a sua fauna e flora nativas.

De **setembro a dezembro de 2016** decorrerão as operações de desratização da ilha.

Por favor não mexa nas estações rateiras e não as mova de local!

Rato-Preto *Rattus rattus*

Estudos genéticos comprovam que os ratos da Berlenga não possuem diferenças dos restantes existentes no país.

Caixa-rateira. Por favor não mexer, não danificar, não retirar

Informação constante em cada estação rateira

Para saber mais sobre o projeto, visite

www.berlengas.eu

– Espécies Exóticas Invasoras são uma das principais causas de extinção animal e são globalmente consideradas como a segunda maior ameaça à biodiversidade, a seguir à fragmentação e perda de habitats;
– O rato-preto e o coelho fazem parte da lista da União Internacional para a Conservação da Natureza (UICN) das 100 piores espécies invasoras do mundo;
– A Reserva Natural das Berlengas foi classificada com base nos seus valores naturais, incluindo importantes colónias de aves marinhas, uma subespécie endémica de réptil e três plantas endémicas. Está comprovado que estes grupos beneficiam enormemente de ações de erradicação de roedores exóticos invasores;
(7)- A equipa do projeto Life Berlengas, está a atuar de acordo com todas as regras nacional e internacionalmente acordadas para o controlo e gestão de roedores, tendo estudado a dinâmica populacional, genética e densidade populacional das espécies de mamíferos presentes antes de iniciar a operação de erradicação.

O Life Berlengas segue as linhas orientadoras da UICN:

- A erradicação de espécies exóticas invasoras novas ou já existentes é preferível e mais efetiva economicamente do que o controlo a longo prazo, especialmente nos novos casos.
- Sempre que possível deverá ser promovida a erradicação como a melhor opção de gestão de espécies exóticas invasoras em zonas em que a prevenção falhou. É economicamente muito mais eficaz do que o controlo continuado e melhor para o ambiente. Avanços técnicos aumentam o número de situações em que a erradicação é possível, especialmente em ilhas.
- Onde relevante, deverão ser procurados benefícios significativos para a diversidade biológica através da erradicação de espécies chave de mamíferos predadores (p. ex.: ratos, gatos, mustelídeos, cães) de ilhas e de outras áreas isoladas que tenham espécies nativas importantes.

Em caso de acidente ligue **808 250 143 (CIAV)**

(Produto ativo Brodifacoume 0,005% - Antídoto Vitamina K)

Coordenação do projeto:
Sociedade Portuguesa para o Estudo das Aves

Contactos:
E-mail: spea@spea.pt
Tel: 213220430

Parceiros spea ICNF peniche CICS.NOVA ICSH Cofinanciamento

Berlengas

ATENÇÃO!

CAMPANHA DE DESRATIZAÇÃO DA BERLENGA A DECORRER

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Por favor não mexa nas estações rateiras e não as mova de local!

Rato-Preto *Rattus rattus*

Estudos genéticos comprovam que os ratos da Berlenga não possuem diferenças dos restantes existentes no país.

Caixa-rateira. Por favor não mexer, não danificar, não retirar

Informação constante em cada estação rateira

Para saber mais sobre o projeto, visite

www.berlengas.eu

ZONA DE CONTROLO DE RATOS

(Produto activo Brodifacoume 0,005% - Antídoto Vitamina K)

NÃO MEXER! NÃO DANIFICAR! NÃO RETIRAR!

*Em caso de acidente ligue **Centro de Informação Anti-Veneno***

TEL 808 250 143

Berlengas

Soc. Port. Estudo das Aves

www.berlengas.eu

spea@spea.pt Tel: 213220430

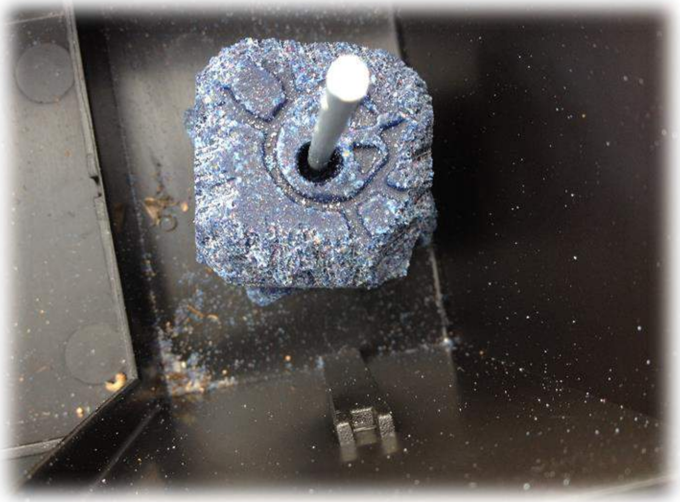
ESTAÇÃO RATEIRA Nº ______

Data:____________________________

Baiting Operations

• Figure 3 – Baiting station view at top images. Pellet consumed by Black-rats at top left. Field team at top right.

Common problems







Bait distribution methodology

- All baiting stations were visited twice a week and pellets were replaced when needed.

- Additionally, paper bags filled with 4-6 pellets were used to bait inaccessible cliffs, caves, ground cavities and walls.

Period	Date (from - to)	N of people	Main tasks
1	21/09 - 22/09	17	Setting traps and bait replacement
2	24/09 - 25/09	17	Bait replacement
3	28/09 - 29/09	17	Bait replacement (2 pellets)
4	02/10 - 14/10	6	Bait replacement (2 pellets)
5	27/10 - 09/11	4	Bait replacement (2 pellets)
6	10/11 - 07/12	6	Bait removal and changed by peanut buter wax-blocks
7	09/12 - 13/12	6	Setting snap-traps and bait stations with cereal pellets in strategical places
8	12/01 - 22/06	6 - 8	Monitoring phase

Table 2 – Knock-down phase from September 21st to December 22nd, 2016 (period 1 to 7). Period 8 correspond to the Mop-up phase and occurred in 2017. Number of people involved in each period is also presented.

Mop-up phase

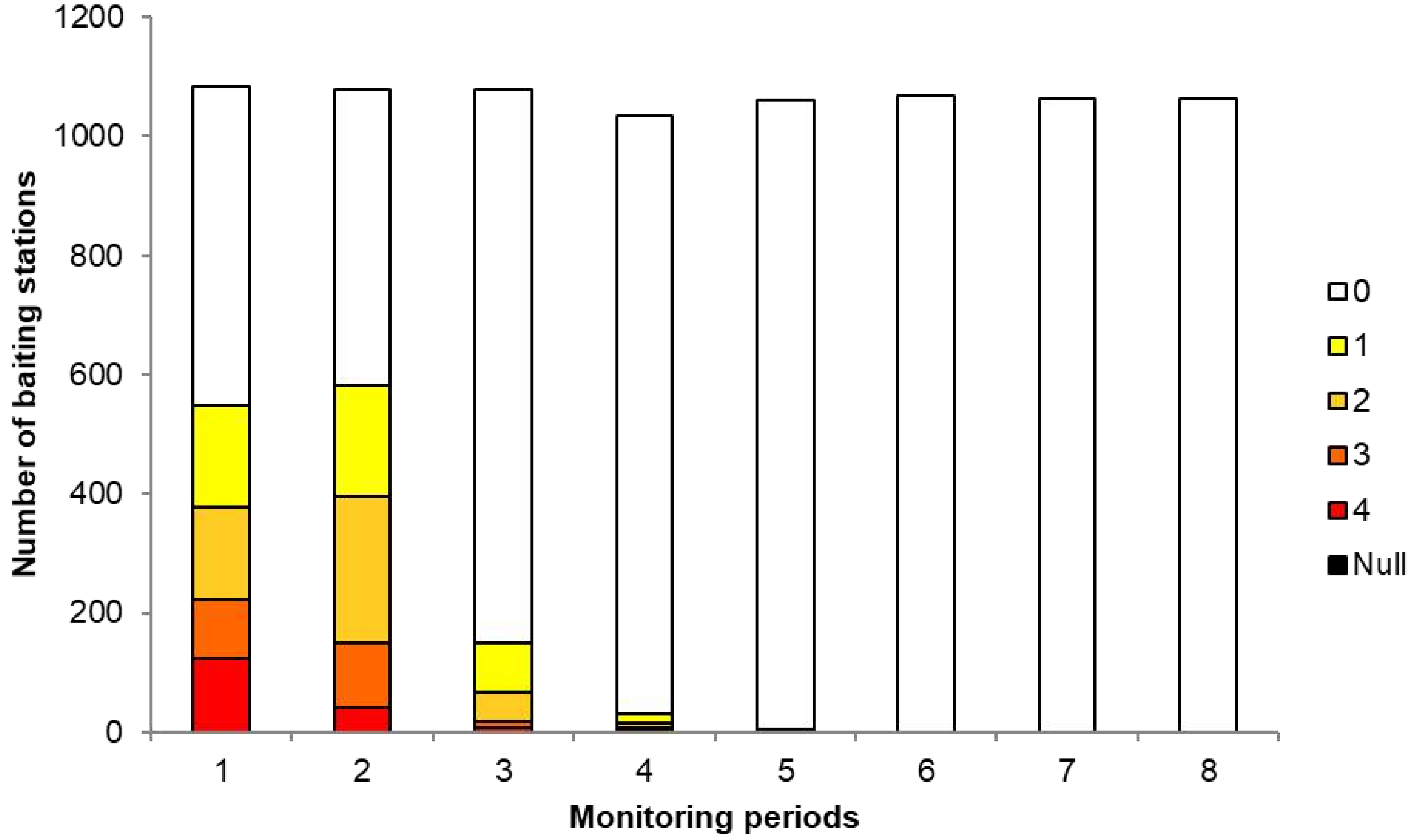
- The last sign of presence of Black-rat was recorded during the 5th monitoring period (November 2016).

- Mop-up phase started after 2 monitoring periods with no recorded signs of Black-rats. Cereal pellets were totally removed and replaced by 2 wax-blocks (mixture of peanut butter and paraffin).

- Mop-up phase lasted 6 months (corresponding to period 8). Baiting stations were visit once per trimester. If a possible sign of rat was detected, wax-blocks were immediately replaced by cereal pellets in that baiting station and in the surrounding ones, until the next visit.

- 10 snap-traps covered with a metal mesh were strategically placed in sites where rats were known to be more abundant or harder to eradicate.

- Figure 4 – Evolution of bait consumption along the monitoring periods.



Vermelho - consumo total; Laranja escuro - consumo >50%; Laranja claro - consumo <50%; Amarelo - vestígios de rato; Branco - Sem consumo; **Preto** - Sem informação visitada

Period 1 – 20 Set

Figure 4 - Level of pellet consumption by black-rat over the knock-down phase:

- Very high
- High
- Medium
- Low
- No consumption
- No data

Period 2 – 24 Set

Figure 4 - Level of pellet consumption by black-rat over the knock-down phase:
- Very high
- High
- Medium
- Low
- No consumption
- No data

Period 4 – 2 Oct

Figure 4 - Level of pellet consumption by black-rat over the knock-down phase:

- Very high
- High
- Medium
- Low
- No consumption
- No data

Period 5 – 27 Oct

Figure 4 - Level of pellet consumption by black-rat over the knock-down phase:

- Very high
- High
- Medium
- Low
- No consumption
- No data

Monitoring Phase - Biosecurity

- **Good Nature Traps at main entrance points**
- **5 Lines of 10 Snap traps (n=50)**

Habitat restored for birds and plants!

- Life Berlengas project (LIFE13NAT/PT/000458) is co-funded by the LIFE programme of European Commission and by the Portuguese National Fund for Conservation of Nature and Biodiversity. We greatly appreciate the support of each member of the field teams (including ICNF wardens, volunteers and SPEA colleagues). To our amazing cooks who so well feed our stomachs and moods during field work. To the “Associação Amigos da Berlenga” and the National Maritime Authority for the logistical support. To ICNF for all the necessary licenses.

Co-funded by the LIFE program of European Commission

Thank You!

Removing *Carpobrotus* from Berlenga Island. How difficult to achieve this objective?

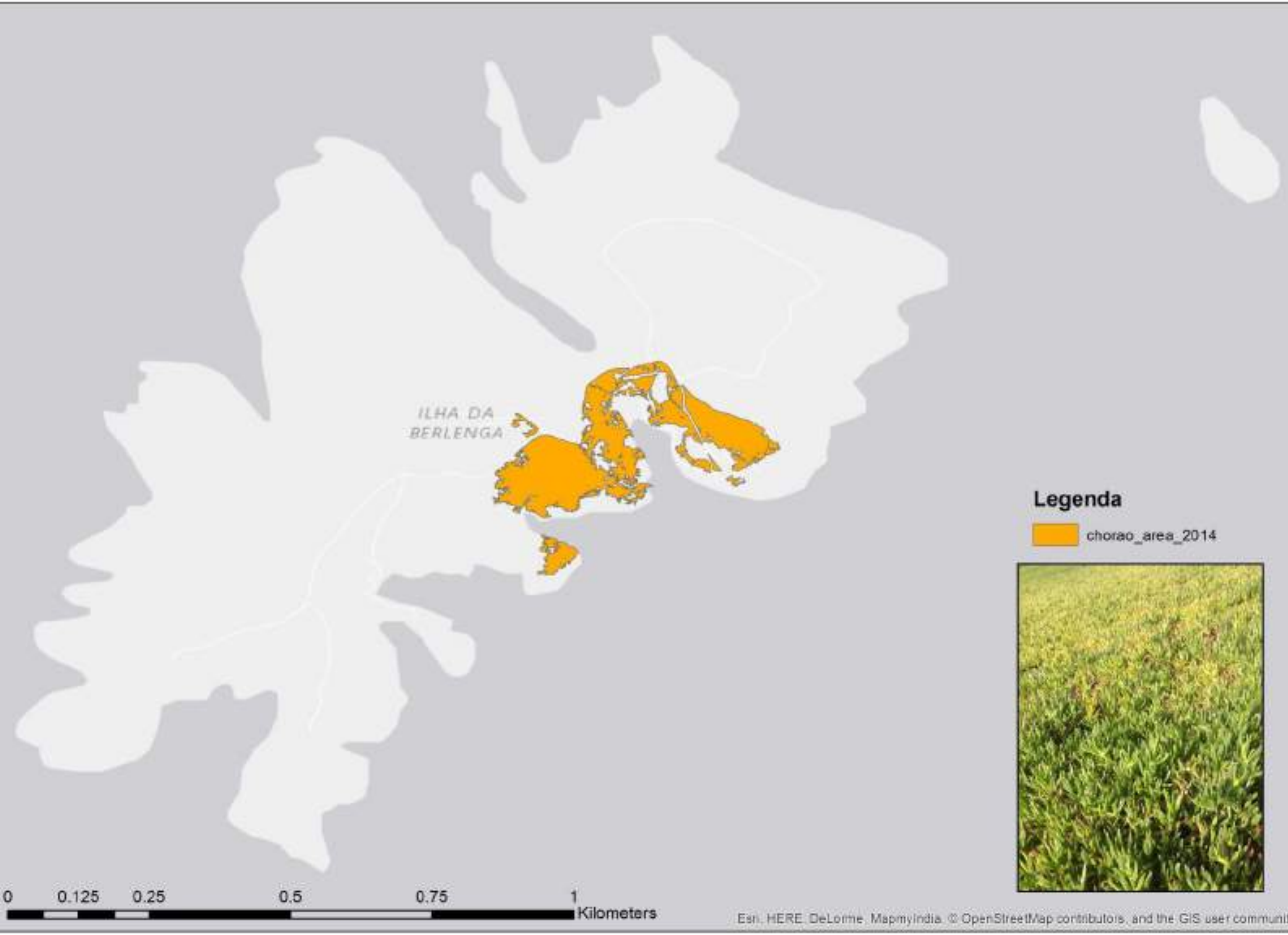
Ana Isabel Fagundes, Nuno Oliveira, Eduardo Mourato, Paulo Crisóstomo, Pedro Geraldes, Joana Andrade

Carpobrotus in Berlengas

- Introduced in the fishermen's village in the 1950s
- Quickly spread throughout several slopes of the island
- In 2014 the area occupied was almost 4 ha

1950_Author unknown

1986_Author unknown



ILHA DA
BERLENGA
Legenda
chorao_area_2014
0
0.125
0.25
0.5
0.75
1
Kilometers

Threats to Native Vegetation

- 3 endemic plants present on Berlenga Island
- Berlengas Thrift (*Armeria berlengensis*) **CR**
- Berlengas Rupturewort (*Herniaria berlengiana*) **VU**
- Berlengas Fleabane (*Pulicaria microcephala*) **VU**

Removing *Carpobrotus*

- Manual removal along the contour lines delimiting strips to prevent soil erosion.
- Use of a brush cutter to cut the upper part of the strip.
- The material removed is rolled and left to dry on top of the *Carpobrotus* mat immediately below.
- Strips with 2-4 meters wide. Removal of the remaining strips in two or three passages.

Removing *Carpobrotus*

- Works carried out especially outside the summer season
- Annually is necessary to check the strips and remove resprouts
- In the most inaccessible places, it is necessary to abseil to reach the *Carpobrotus* patches

© Miguel Lecoq

© Fotojonic

Results

- From October 2014 to December 2017 the project team removed 30.826 m^2 of *Carpobrotus* (~80%).

	Total Hours	Man-hours	Removed area (m^2)
2014	58	313	8.528
2015	66	415	
2016	80	622	15.138
2017	150	984	30.826
TOTAL	354	2334	

Necessary 95 man-day to remove 1 ha

© Miguel Lecoq


July 2014


December 2015

December 2016


December 2017

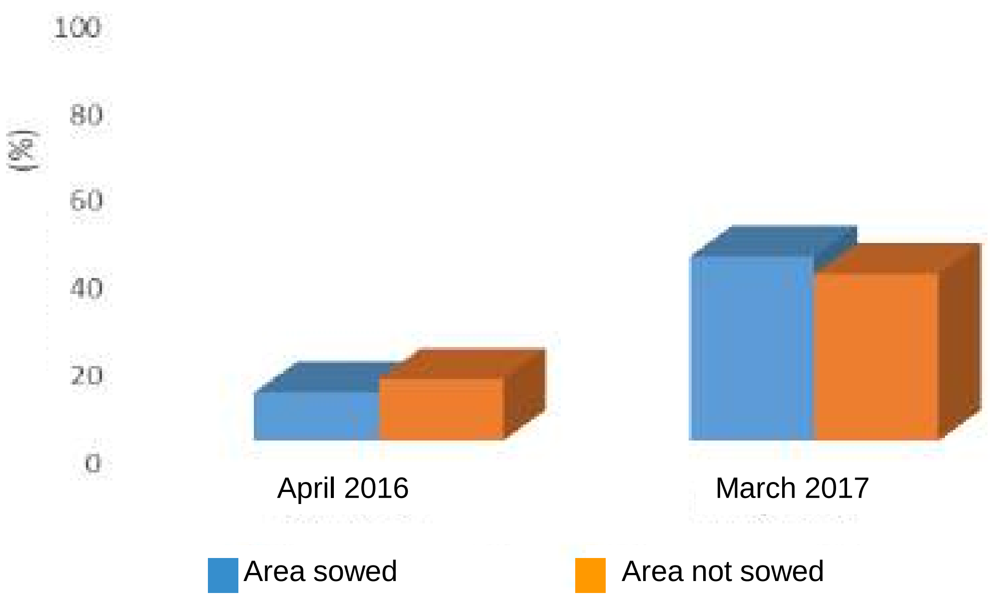
January 2015

November 2016

January 2018

Monitoring

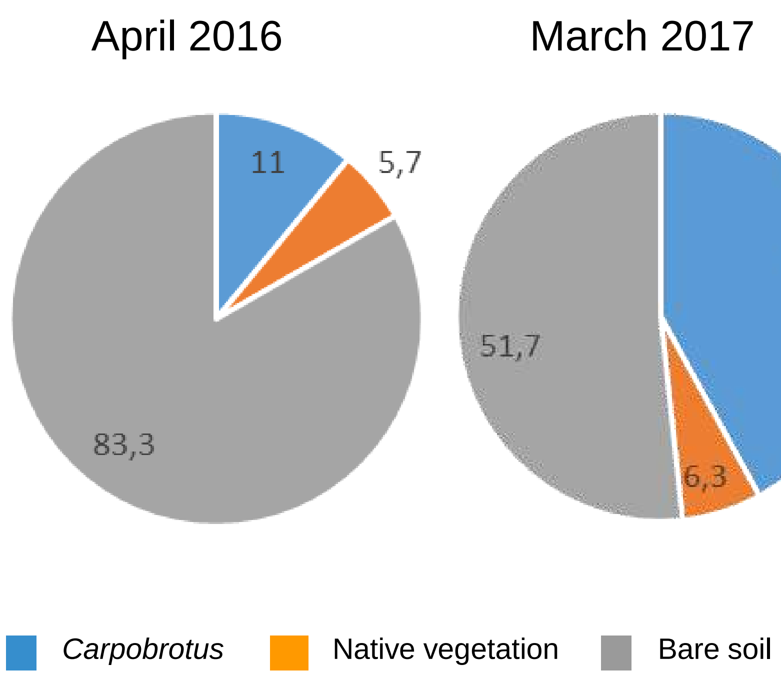
- Monitoring areas show a rapidly increase of *Carpobrotus* growth



Average percentage of *Carpobrotus* coverage in the monitoring strips

Monitoring

- The vegetation recover is very slow



Average percentage of vegetation coverage in the strip that was sowed

October 2015


November 2015


January 2016


April 2016


January 2018

Problems found

Problems found

Problems found

- Some rock falls were observed on the path to the beach which required the use of coconut blankets

Removing *Carpobrotus* from Berlenga Island. How difficult to achieve this objective?





THANK YOU!!





www.berlengas.eu

Ana Isabel Fagundes, Nuno Oliveira, Eduardo Mourato, Paulo Crisóstomo, Pedro Geraldes, Joana Andrade

MAP OF THE TALK

- Madeira, biodiversity and natural history
- Vertebrate Invasive Species in Madeira
- Eradication and control of IAS
- The future:
  - Are we facing the end?
  - Are we all going to jail?

Habitat restoration and IAS management:
Which are the new challenges? The Madeira case study

IFCN

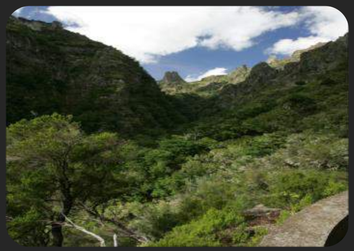
Paulo Oliveira

RESPECT

MADEIRA: ISLANDS, SMALL ISLANDS AND ISLETS

MADEIRA: BIODIVERSITY AND NATURAL HISTORY






- Diversity of habitats
- 7571 taxa (2008)
- 1419 taxa are endemic (20%)

- Many vulnerable or in danger due to the threat of IAS

“INVASIVE ALLIEN SPECIES ARE
A MAJOR DRIVER OF BIODIVERSITY LOSS”

IAS DISTRIBUTION

Invasive vertebrate species 1990

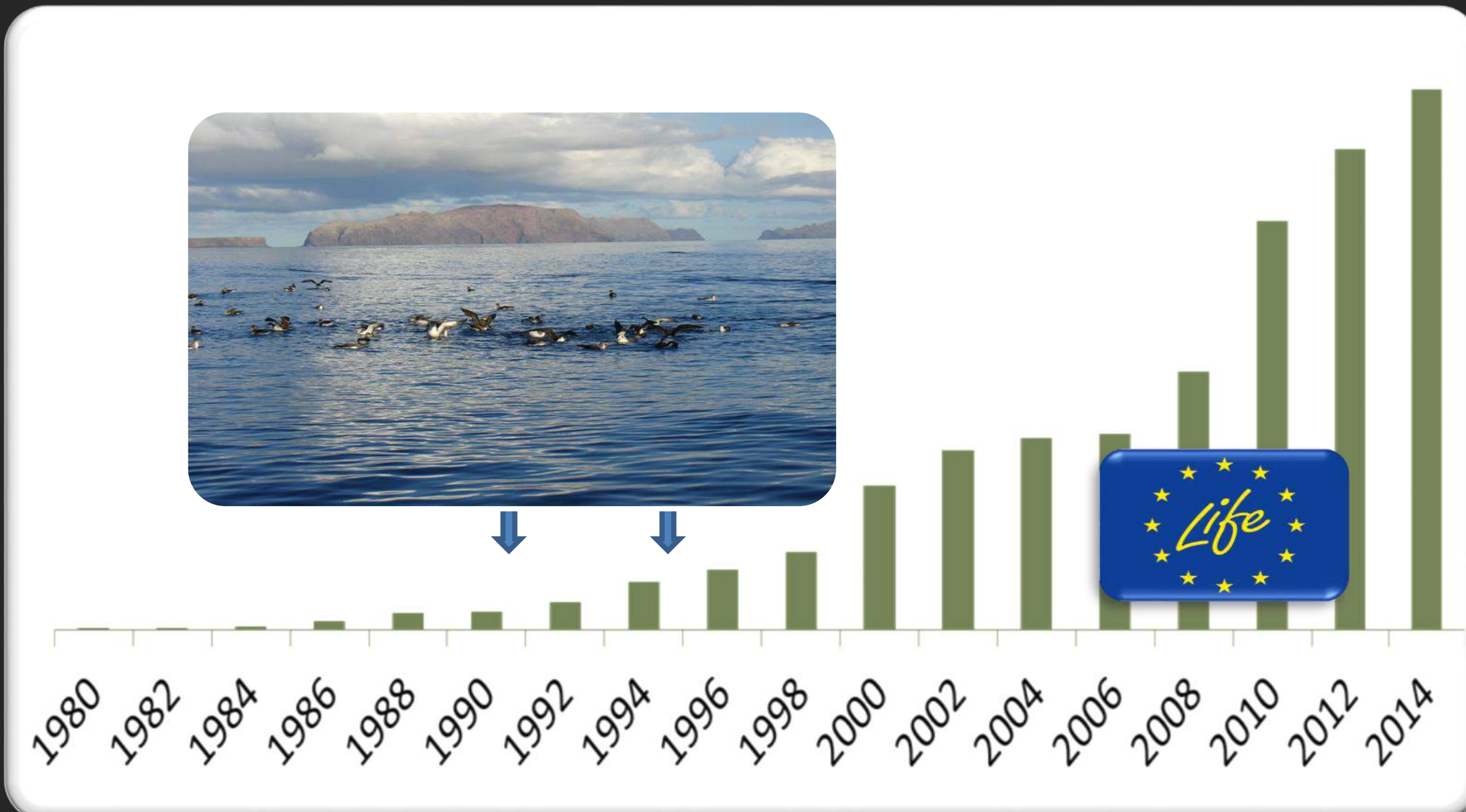
Island/islet	Human	Size (ha)/ Altitude (m)	Vertebrate Invasive species in 1990							
			Goat	Pig	Rabbit	Rats (sp)	Mice	Cat	Ferret	n
Madeira	280.000	74175/1862	P	P	P	P	P	P	P	7
Porto Santo	4000	4043/517	P	-	P	P	P	P	P	6
Deserta Gr	(*)	1028/479	P	-	P	-	P	P	-	4
Bugio	-	321/388	P	-	P	-	P	-	-	3
Selvagem Gr.	(*)	241/163	-	-	P	-	P	-	-	2
Ilhéu da Cal*	(*)	140/178	-	-	P	-	P	-	-	2
Ilhéu de Ferro	-	25/130	-	-	P	-		-	-	2
Ilhéu Chão	(*)	43/100	-	-	-	-	P	-	-	2
Ilhéu de Cima	(*)	31/124	-	-	P	-		-	-	2
I. da metade	(*)	20/ 98	-	-	-	P	P	P	-	3
Selvagem Pq.	-	20/49	-	-	-	-	-	-	-	0

IAS DISTRIBUTION

Invasive vertebrate species 2018

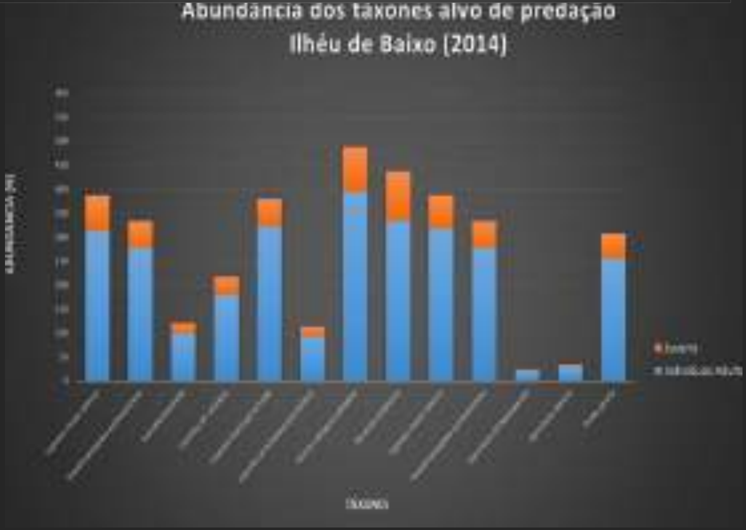
Island/islet	Human	Size (ha)/ Altitude (m)	Vertebrate Invasive species 2018							
			Goat	Pig	Rabbit	Rats (sp)	Mice	Cat	Ferret	n
Madeira	280.000	74175/1862	✖	✖	P	✖	✖	✖	✖	7
Porto Santo	4000	4043/517	P	-	P	P	P	P	-	6
Deserta Gr	(*)	1028/479	✖	-	✖	-	P		-	3
Bugio	-	321/388	✖	-	✖	-	✖	-	-	✖
Selvagem Gr.	(*)	241/163	-	-	✖	-	✖	-	-	✖
Ilhéu da Cal*	(*)	140/178	-	-	✖	-	✖	-	-	✖
Ilhéu de Ferro	-	25/130	-	-	✖	-		-	-	✖
Ilhéu Chão	(*)	43/100	-	-	-	-	✖	-	-	✖
Ilhéu de Cima	(*)	31/124	-	-	✖	-		-	-	✖
I. da metade	(*)	20/ 98	-	-	-	✖	✖	✖	-	✖
Selvagem Pq.	-	20/49	-	-	-	-	-	-	-	0

ERADICATION PROJECTS



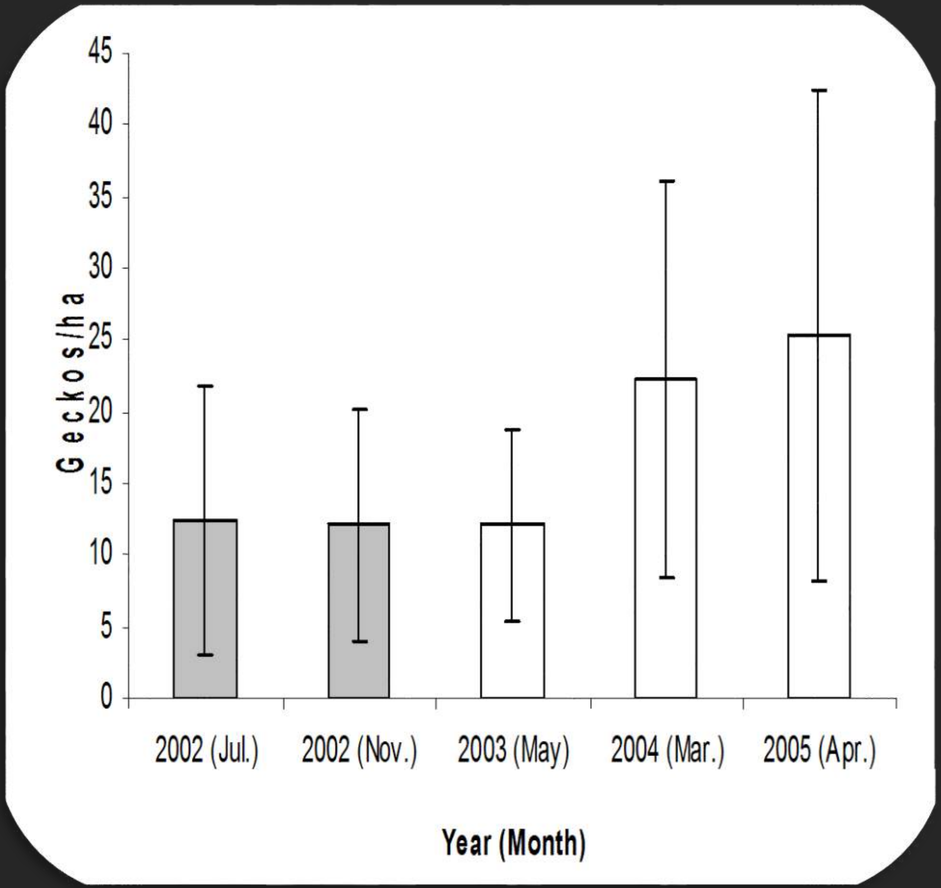
RESULTS

Land snails in I. Baixo (Porto Santo)



RESULTS

Geckos in Selvagem Grande



“INVASIVE ALLIEN SPECIES MANAGEMENT IS A KEY MEASURE TO ENSURE CONCRETE, EFFECTIVE AND LONG LASTING RESULTS IN TERMS OF NATURE CONSERVATION”

THE PRESENT CHALLENGES

- Legislation conflict and lack of specific legislation

  - EU Regulation 1143/2014

  On the prevention and management of the introduction and spread of invasive alien species

  - EU Regulation 528/2012

  Concerning the making available on the market and use of biocidal products

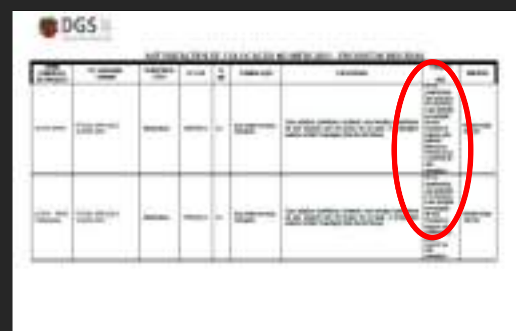
    - Biodiversity is mentioned only 2 times!
    - Nature conservation is not mentioned!

THE PRESENT CHALLENGES

- Legislation conflict and lack of specific legislation
  - National legislation
    - Types of use
      - Professional, non professional, industrial, domestic, etc
    - Rodenticide list of DGS and DGAV
      - 110 products

TP 14 (rodenticida) Uso Não profissional - Interiores e exteriores (em torno de edifícios).

TP 14 (rodenticida) Uso Profissional - dentro de casa, fora de casa (só à volta dos edifícios) e em esgotos.



Biocida de Uso Veterinário. Rodenticida para controlo de ratos e ratazanas nas instalações pecuárias (TP14).	Difenacume 0,005%, excipientes q.b.p. 100%

THE PRESENT CHALLENGES

- Legislation conflict and lack of specific legislation
  - National legislation
    - Shooting
      - Legally what we do is “density control” of cinegetic species!

THE PRESENT CHALLENGES

- Legislation conflict and lack of specific legislation
  - National legislation
    - Feral/wild cat control
      - Euthanasia can only be performed by a vet. (only one)

THE PRESENT CHALLENGES

- Lack of communication skills
  - Extreme Animal Lovers/Rights Movements

Invasive vertebrate species 2018

Island/islet	Human	Size (ha)/ Altitude (m)	Vertebrate Invasive species 2018							
			Goat	Pig	Rabbit	Rats (sp)	Mice	Cat	Ferret	n
Madeira	280.000	74175/1862	P	P	P	P	P	P	P	7
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Ilhéu da Cal*	(*)	140/178	-	-	P	-	P	-	-	2
Ilhéu de Ferro	-	25/130	-	-	P	-		-	-	1
Ilhéu Chão	(*)	43/100	-	-	-	-	P	-	-	1
Ilhéu de Cima	(*)	31/124	-	-	P	-		-	-	1
I. da metade	(*)	20/ 98	-	-	-	P	P	P	-	3
Selvagem Pq.	-	20/49	-	-	-	-	-	-	-	0

THANK YOU

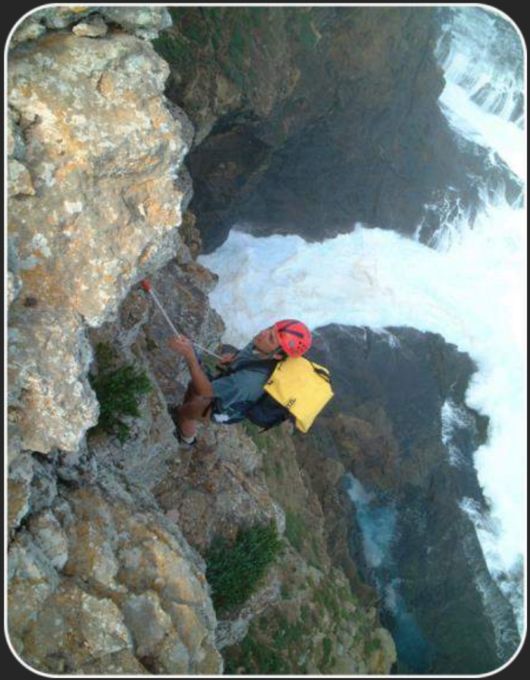
- OVERCOME THE LEGISLATION CONFLICT
- PROMOTE SPECIFIC LEGISLATION
- IMPROVE COMMUNICATION WITH PUBLIC

IFCN

Habitat restoration and IAS management:
Which are the new challenges? The Madeira case study

Paulo Oliveira

- Operational and technical skills



THANK YOU

IFCN Instituto das Florestas e Conservação da Natureza IP-RAM

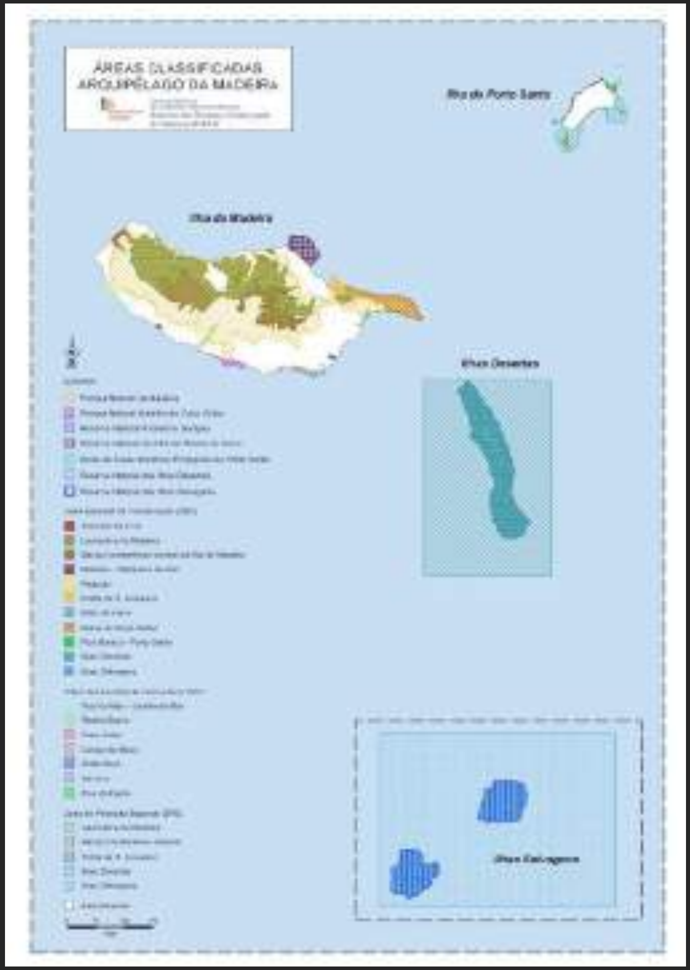
Região Autónoma da Madeira

Eradication and control of vertebrate IAS in Madeira Archipelago: a short review

Paulo Oliveira

MADEIRA: PROTECTED AREAS

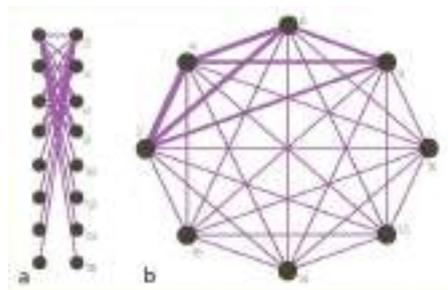
Protected Areas and Natura 2000 sites



- 7 Protected areas
- 18 Natura 2000 Sites
- 75 % of the territory

‘Crypto-ecology and ecosystems: overlooked interactions and their importance in the restoration ecology of islands’

Manuel Nogales, Félix M. Medina & Marta López-Darias



Ecological network

Island Ecology and Evolution Research Group (IPNA, CSIC)

CABILDO DE LA PALMA

CSIC

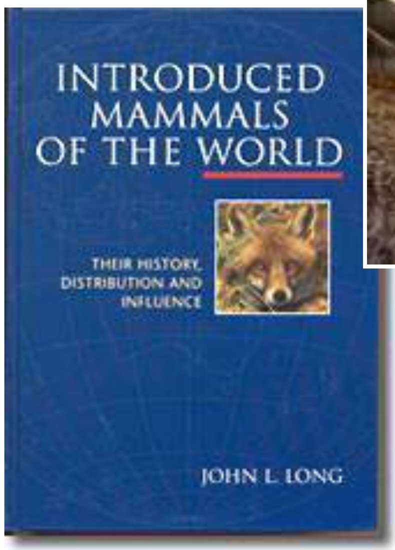
Invasive species on islands

Food and reproduction as basic requirements for a new establishment

Specially drastic effects on oceanic islands

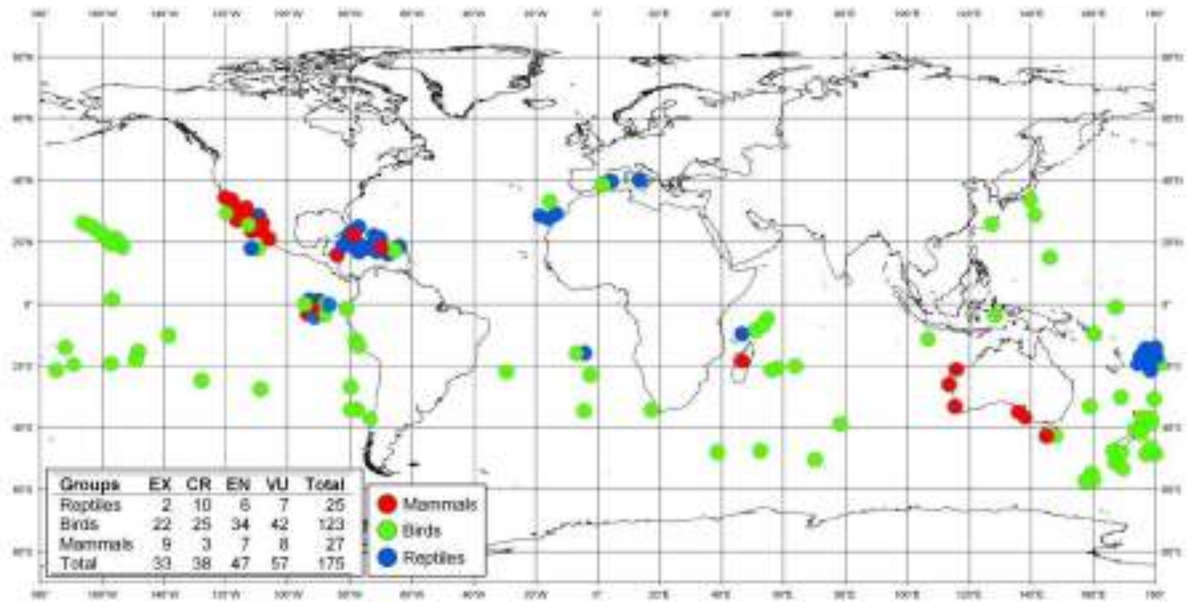
We often have to restore insular habitats that have been invaded by exotic species

Introduced mammals



Mammals have caused numerous impacts on island ecosystems but especially carnivores and rodents …

e.g. Direct impacts of feral cats on islands: predation



(Flannery & Schouten 2001)

Zoothera terrestris

Groups	EX	EW	CR	EN	VU	Total
Reptiles	2	-	10	6	4	25
Birds	20	2	25	34	42	123
Mammals	9	-	3	7	8	27
Total	31	2	38	47	56	175

(Medina *et al.* 2011)

When a species disappears, its interactions also disappear and also therefore its ecological role …

Medina *et al.* (2011). *Glob. Chang. Biol.*

Affected ecological processes

Introduction of parasites and diseases

Tompkins *et al.* (2003)

Competition with native biota

Gurnell *et al.* (2004)



Hybridization

Domestic cat

Felis silvestris catus

Driscoll *et al.* (2007)

Felis s. silvestris

Scotland

Kitchener *et al.* (2007)

Disruption of plant-animal interactions


Traveset & Richardson (2006). *TREE*

The main 'animal-plant' interactions

Herbivory

Mutualisms

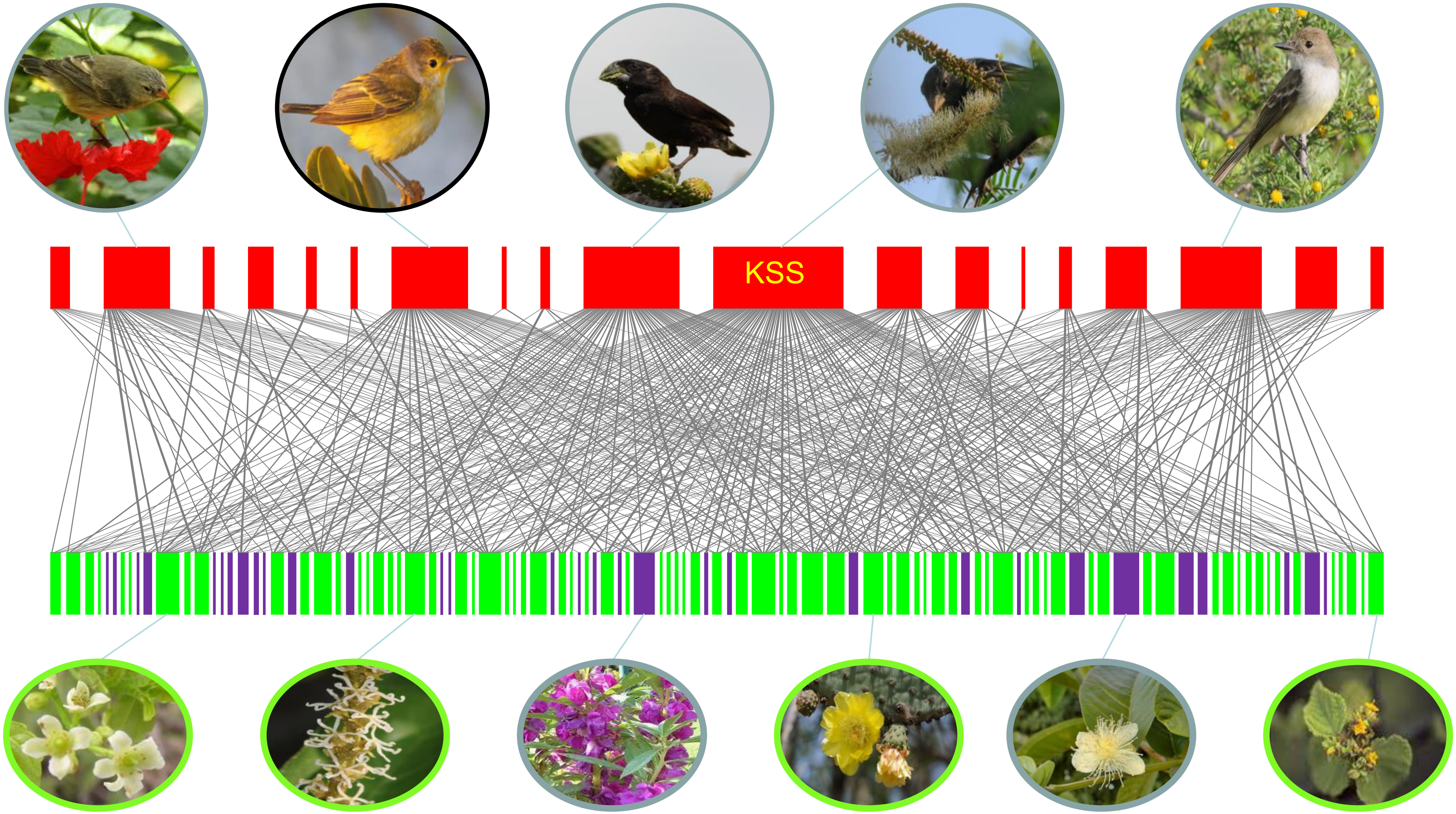
Pollination (e.g. Galápagos)

Seed dispersal (e.g. Canaries)

Pollination network (plants-birds) in the Galápagos islands

12 islands

19 bird spp.



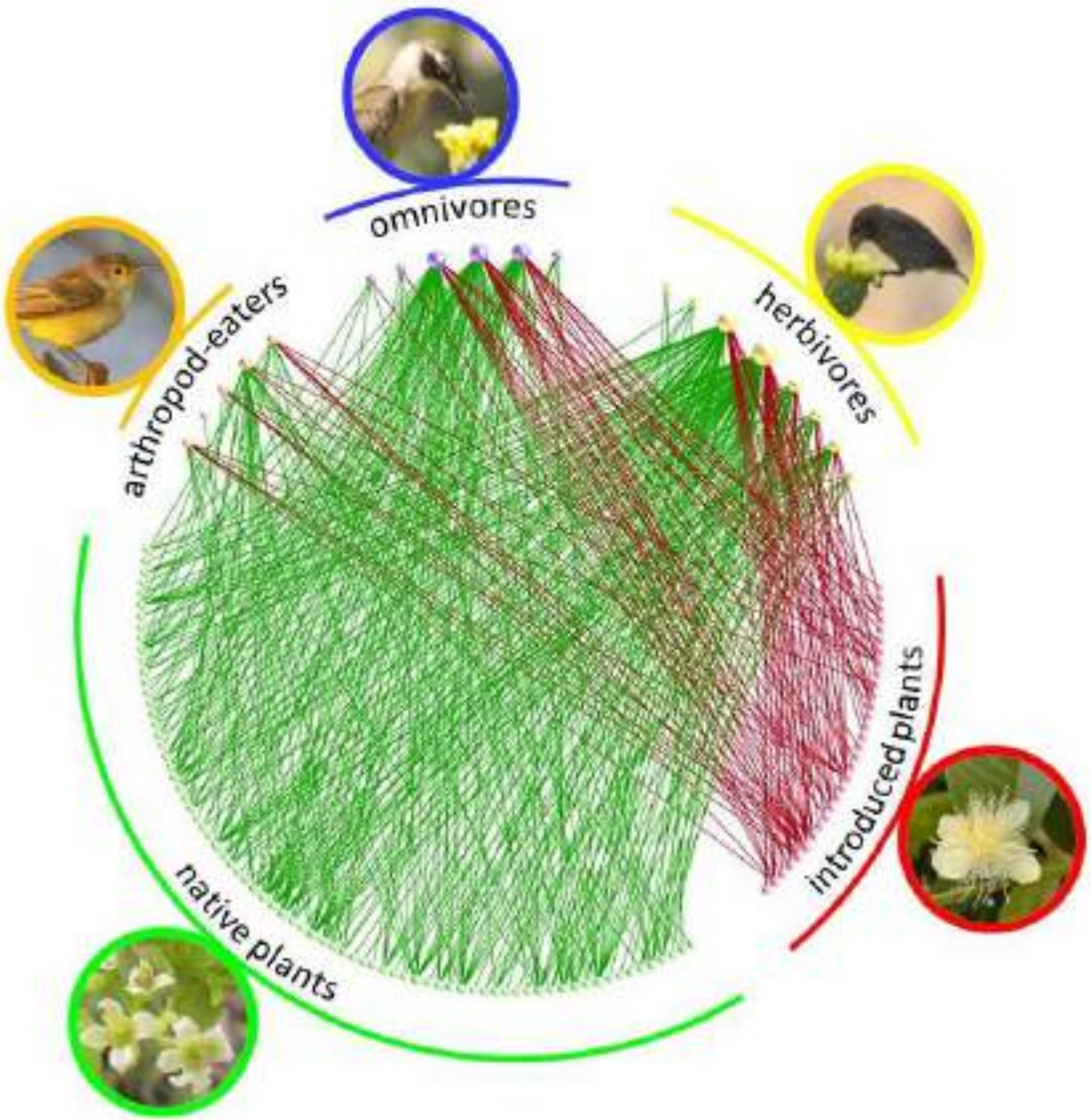
106 plant species (29% exotics)

Traveset *et al*. (2013). *Proc. R. Soc. B.*

n = 420 interactions (in 5 years)

(adding 20 times more interactions than those previously known on the Galápagos)

Galápagos archipelago: pollination by birds



Generalization was the main pattern (no modularity):

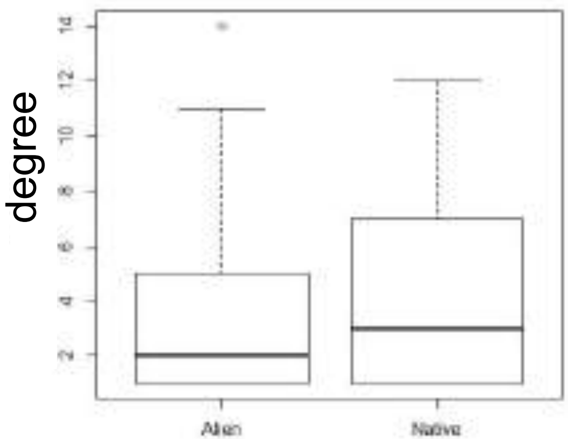
A probable massive ecological response of the bird communities to a poorly used food resource. We call this:

"Interaction release"

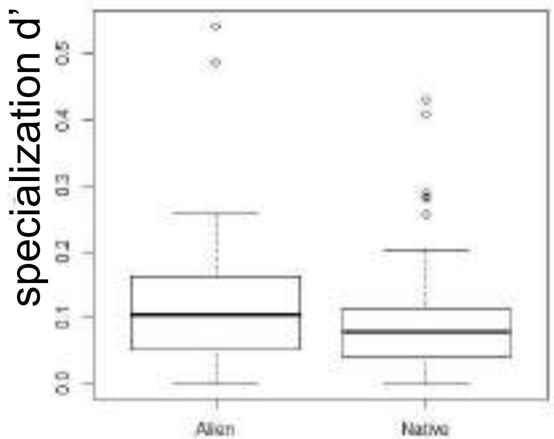
Traveset *et al*. (2015). *Nat. Comm.*

Galápagos: integration and settlement of introduced plants

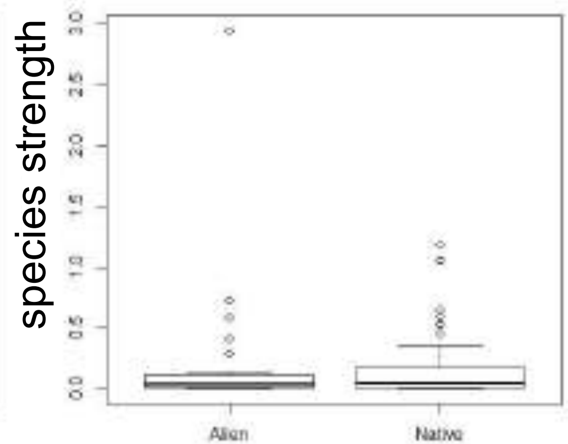
Number of partners
(species)



Specialization degree
(availability of partners)



'Community level
importance'



Lantana camara

(invasive)

Lantana peduncularis

(endemic)

We did not find differences in interaction patterns between native and introduced plants, and the latter are fully integrated in the community …

Galápagos archipelago: ‘*Pollination effectiveness*’

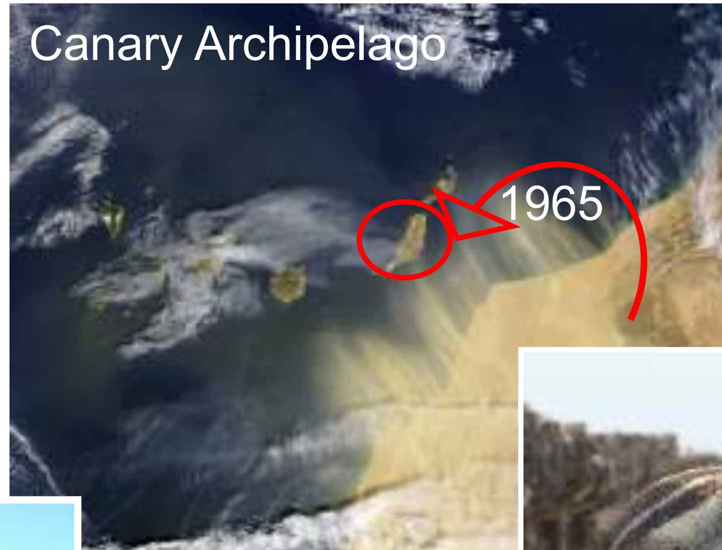
Cordia lutea

Opuntia spp.

Waltheria ovata

Hervías *et al.* in prep.

The Barbary Ground Squirrel and disruption of native seed dispersal systems



1,660 km^2, max. alt. 807 m a.s.l.

100 km from Africa

Island emerged 22-11.8 M yrs ago

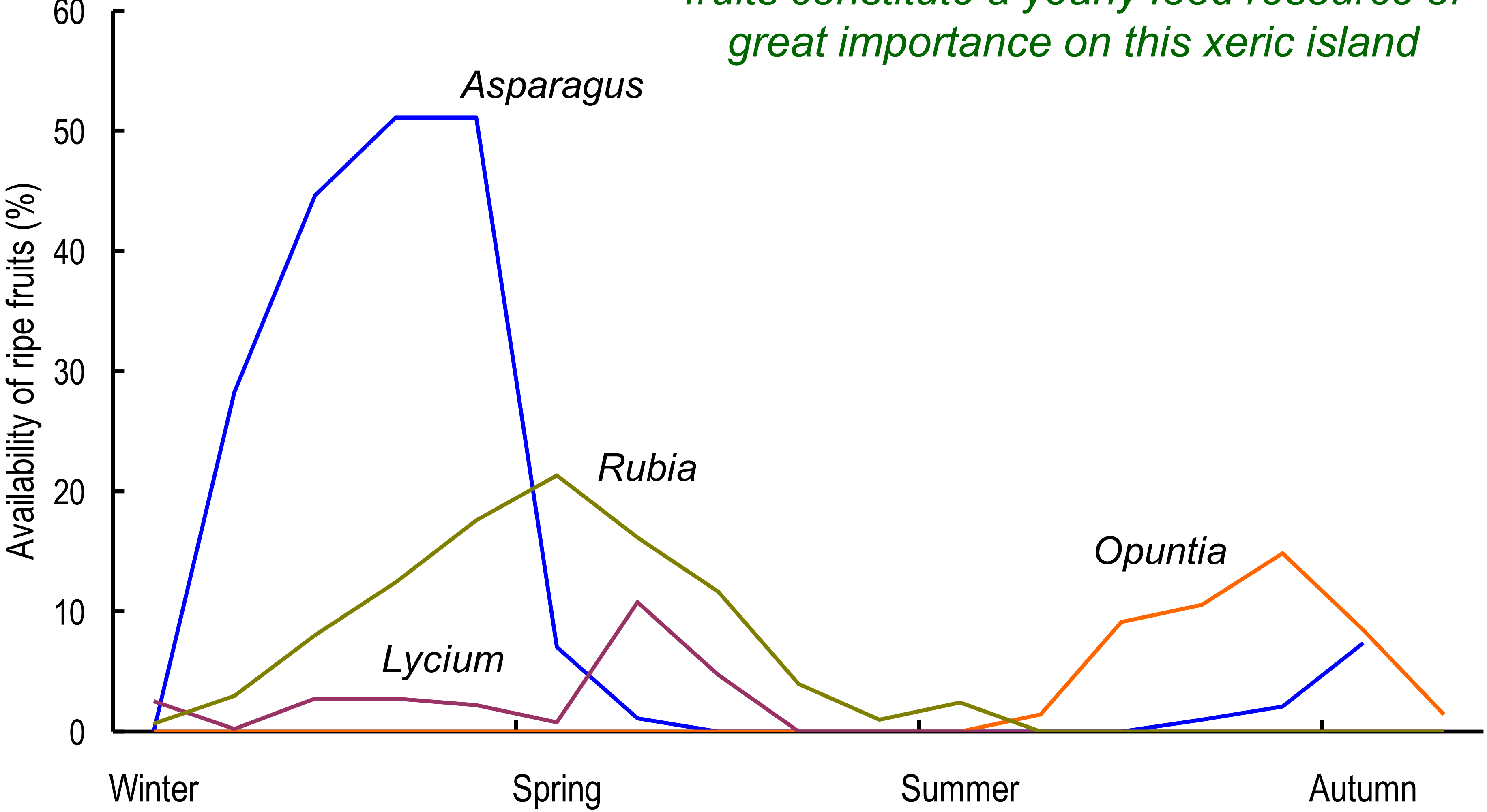
< 100-300 mm annual rainfall

20ºC annual mean temperature

López-Darias & Nogales (2009). *J. Arid Environ.*

Seasonal availability of fleshy fruits

This ground squirrel is totally omnivorous and apart from terrestrial molluscs, fleshy fruits constitute a yearly food resource of great importance on this xeric island



Four seed dispersal systems on Fuerteventura Island

Native spp.

Sylvia melanocephala/conspicillata

Gallotia atlantica

Larus cachinnans

Corvus corax

Lycium intricatum

Rubia fruticosa

Asparagus pastorianus

Oryctolagus cuniculus

Opuntia maxima

Atlantoxerus getulus

Exotic spp.

(Nogales *et al*. 2005. *Funct. Ecol*.)

Fruit consumption (mouth treatment and its seed damage)

Year

Plant species (Plant status)	Dispersers	Mean ± SD undamaged seeds/dropping	Range (min-max)	Total undamaged seeds	% F undamaged seeds	% F damaged seeds	Total droppings analised
Rubia fruticosa (N)	*Gallotia atlantica*	1.35 ± 2.60	0 -18	1712	94.31	5.69	1272
	Atlantoxerus getulus	0.27 ± 1.17	0 -18	367	50.35	49.65	1359
	Oryctolagus cuniculus	0.17 ± 0.69	0 - 7	224	40.41	59.59	1284
Lycium intricatum (N)	*Gallotia atlantica*	0.26 ± 1.48	0 - 29	333	77.97	22.03	1272
	Atlantoxerus getulus	0.03 ± 0.23	0 - 3	43	10.51	89.49	1359
	Oryctolagus cuniculus	-	-	-	0.00	100.00	1284
Asparagus pastorianus (N)	*Gallotia atlantica*	0.10 ± 0.35	0 - 1	128	93.10	6.90	1272
	Atlantoxerus getulus	0.01 ± 0.05	0 - 1	2	1.32	98.68	1359
	Oryctolagus cuniculus	0.04 ± 0.22	0 - 1	52	37.10	62.90	1284
Opuntia maxima (I)	*Gallotia atlantica*	0.26 ± 0.88	0 - 8	335	78.42	21.58	1272
	Atlantoxerus getulus	0.61 ± 1.69	0 - 15	824	76.90	23.10	1359
	Oryctolagus cuniculus	0.10 ± 0.44	0 - 6	132	57.32	42.68	1284

Native spp.

Introduced sp.

↑ Lizards

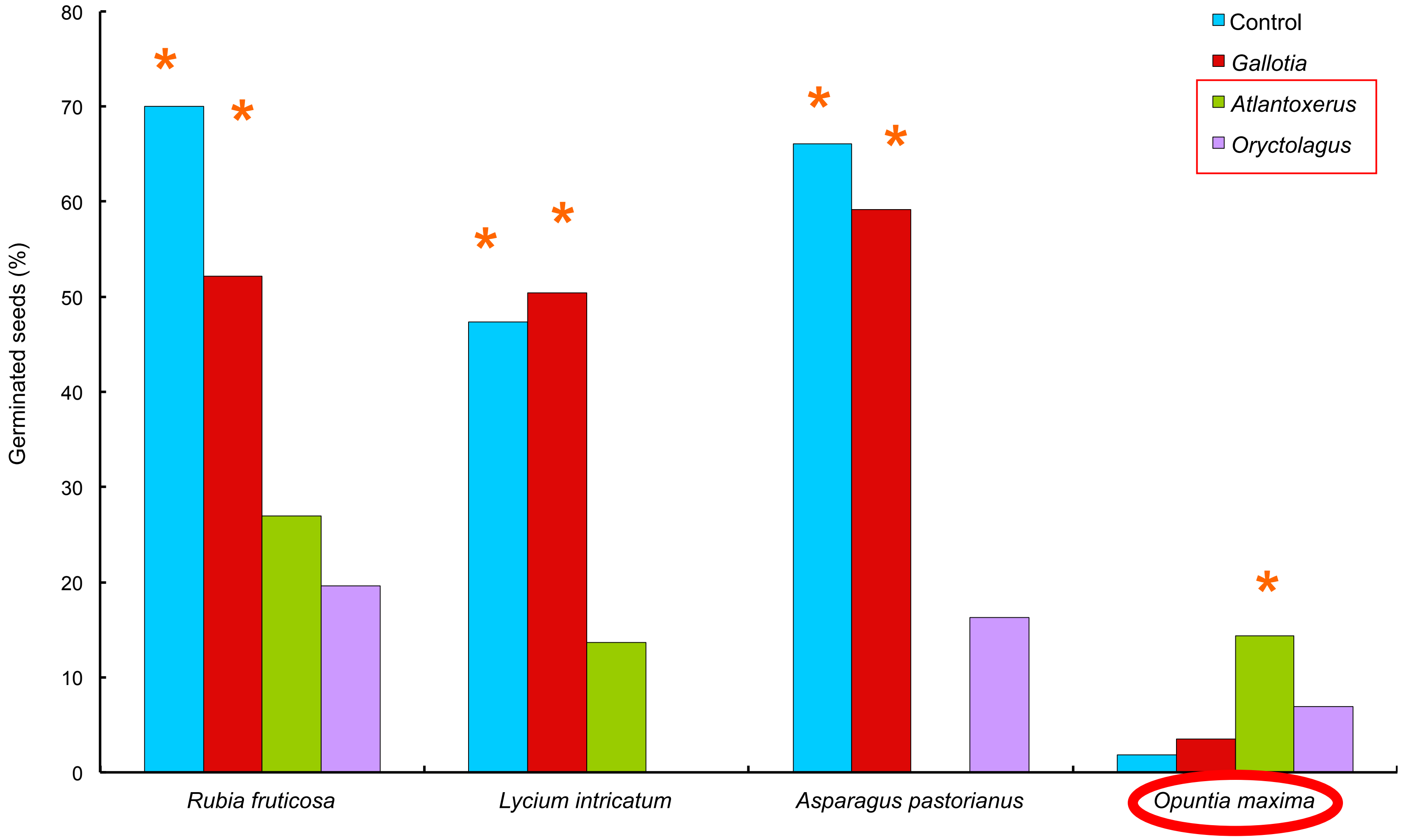
↑ Ground Squirrels

↔

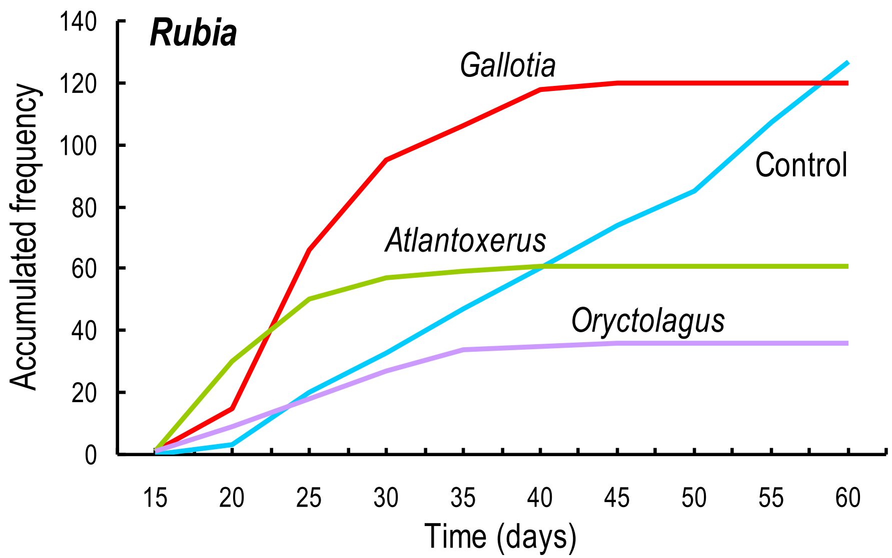
↑ Ground Squirrel

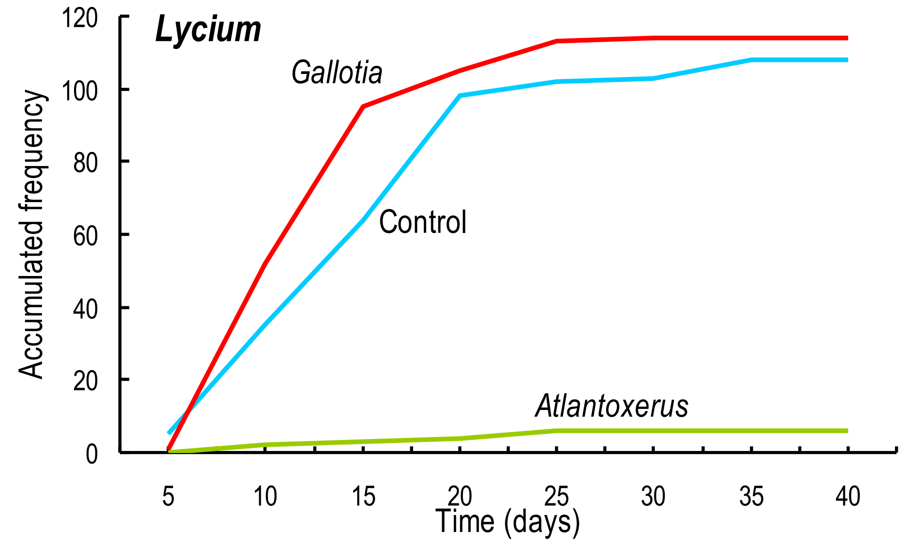
Melt-down effect?

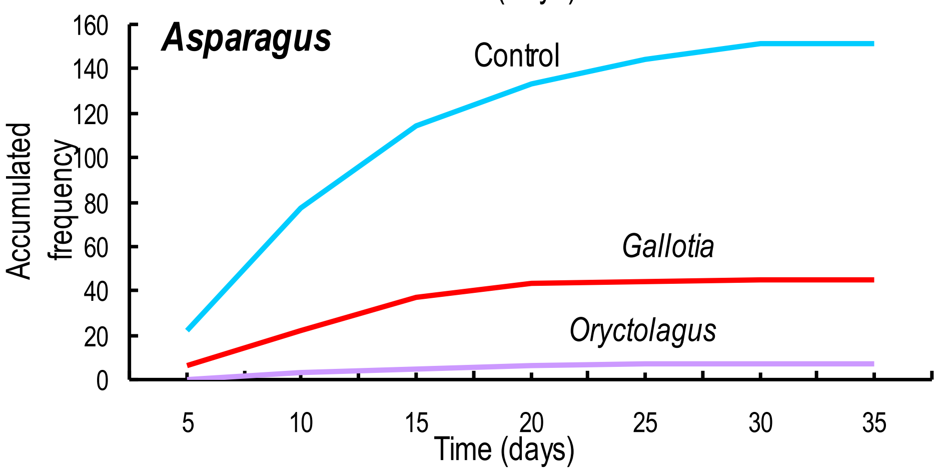
Percentage of seedling emergence

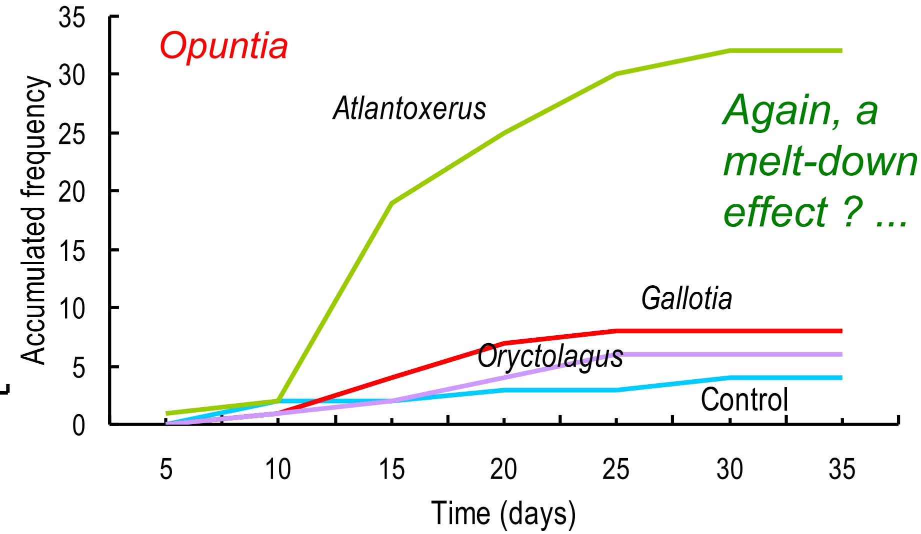


Seedling emergence (*"germination speed"*)





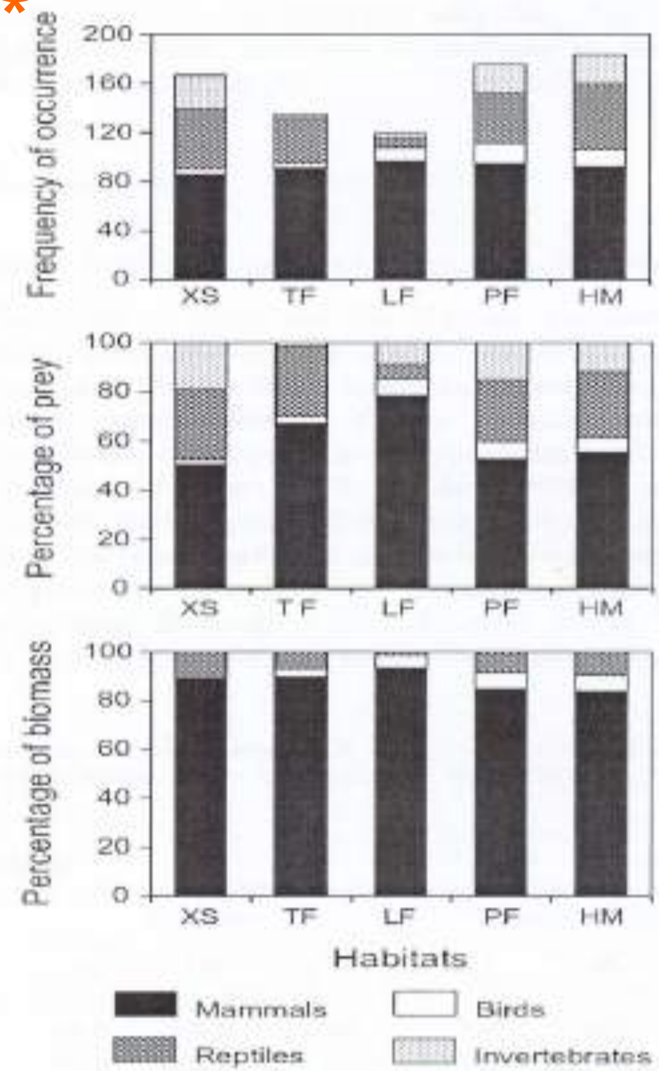




Ecological processes in disruption of seed dispersal systems by feral cats

Felis catus

*



Frugivorous lizards

Fig. 2. Results of the scats analysis of feral cats in the different habitats on La Palma Island. XS – xerophytic shrub, TF – temperate forest, LF – laurel forest, PF – pine forest, HM – high mountain.

Seed dispersal systems affected by feral cats

Table 2. Number of seeds and frequency of occurrences of each plant species observed in the scat analysis of feral cats *Felis catus* in the Canary Islands. Data from xerophytic scrub on Tenerife and from the juniper forest on El Hierro (between brackets).

Plant species (*n* = 8)	No. of seeds	% seeds damaged	% occurrence
● *Plocama pendula*	194	1	● 7.5
● *Rubia fruticosa*	12 (61)	– (–)	● 3.5 (6.5)
● *Scilla haemorrhoidalis*	4	–	1.0
● *Neochamaelea pulverulenta*	3	–	1.5
● *Withania aristata*	14	7.1	1.5
● *Opuntia dillenii*	66	15.2	● 19.0
● *Opuntia ficus-barbarica*	(1)	(–)	(0.4)
● *Juniperus phoenicea*	(71)	1.4	● (6.9)

Gallotia galloti

Plocama pendula

Opuntia dillenii

Nogales et al. (2006). *Ecography*

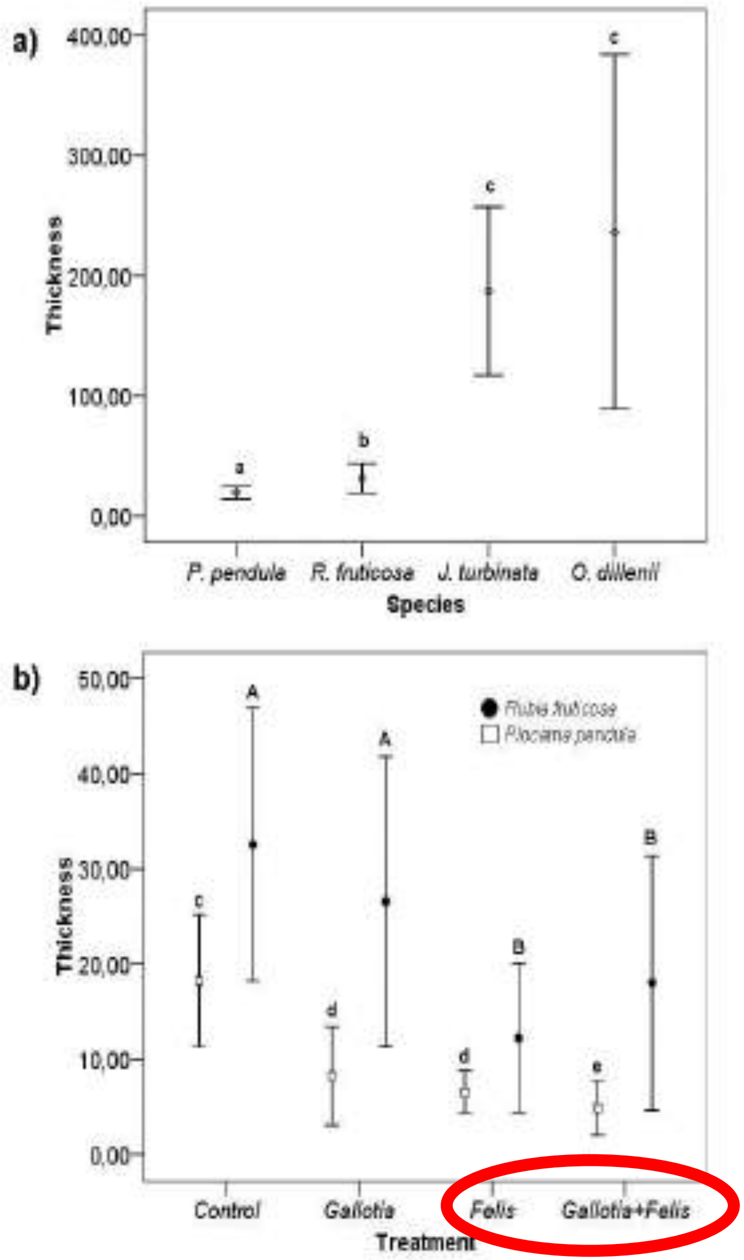
Seed coat thickness and gut effect after cat digestion


Plocama pendula


Rubia fruticosa


Juniperus turbinata


Opuntia dillenii

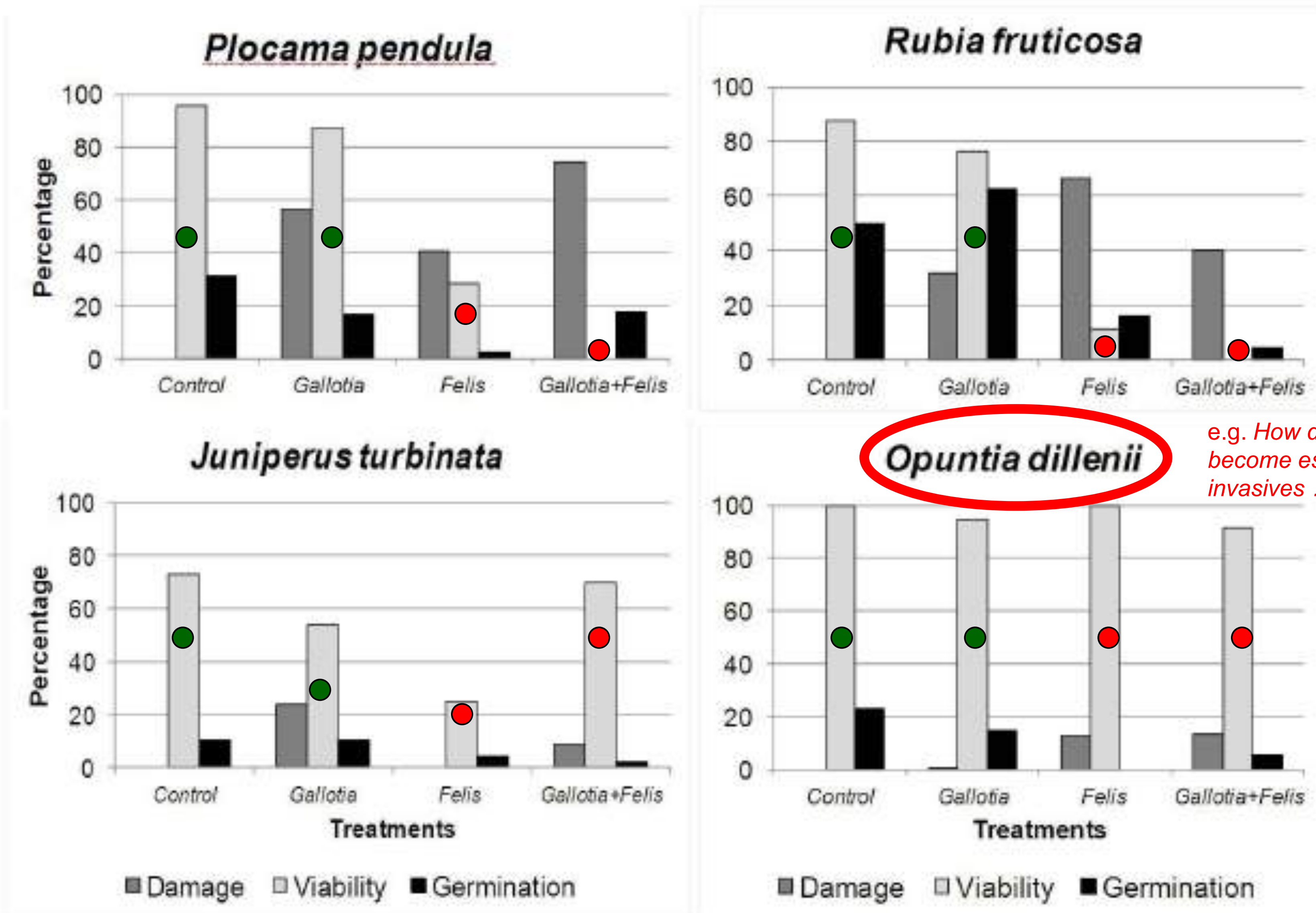



A cat after predating an iguana in the Galápagos

Using sausages as 'pseudo-lizards' … containing seeds

Nogales *et al*. (2015). *Biol. Invas.*

Percentage of seed viability and emergence after cat digestion



Seed coat thickness

e.g. *How do exotic plants become established and then invasives …*

Seed coat thickness

Nogales *et al*. (2015). *Biol. Invas*

Take-home message

1) Native vertebrates are basically **legitimate mutualistic organisms** for the reproduction and dispersal of many native insular angiosperms, whose evolutionary history has been clearly favoured by these ecological interactions.

2) Some introduced plants, insects and mammals function as **disruptors of ecological processes**, in which native plants and animals have successfully evolved for a long time, independently of the presence of these invasive animals.

3) An initial knowledge of native mutualistic interactions, basically using **ecological networks**, provides a basic idea of ecosystem structure. It can also identify **keystone species** crucial to restoring ecological interactions in island environments.

4) Lastly, it is recommended that island restoration tasks have to be focussed on the long-term **self-functioning** of these habitats.

Muito obrigado pela sua atenção…

Manuel Nogales

Marta López-Darias

Félix M. Medina

To our institutions …

CSIC

CABILDO DE LA PALMA

Berlengas

| Cofinanciamento

fundo biodiversidade

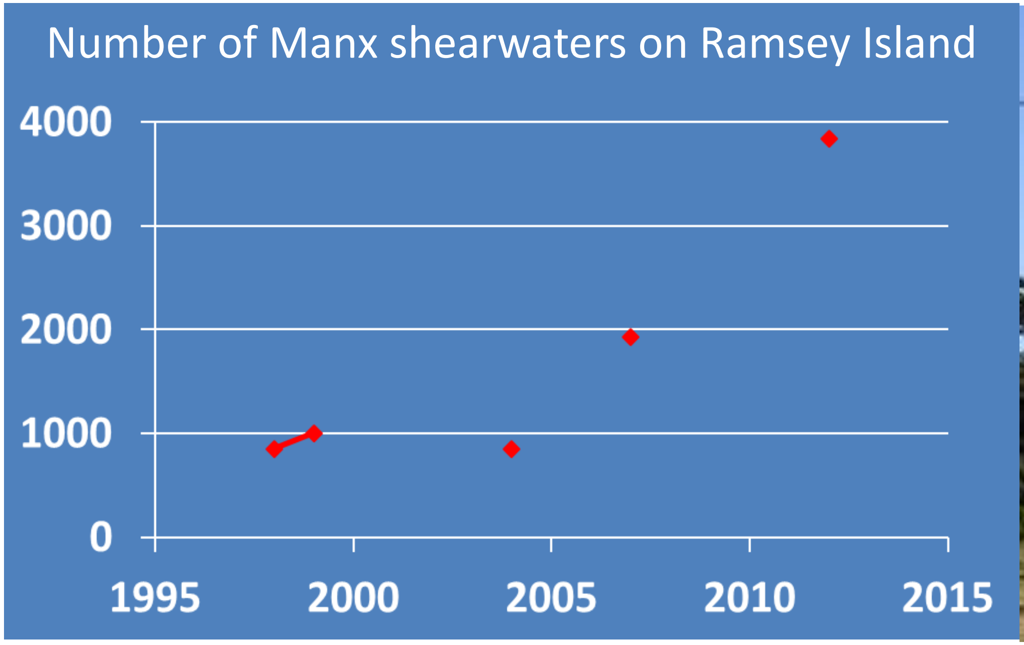

The Forgotten Side of Island Restoration
Biosecurity and Incursion Response
Dr Karen Varnham
RSPB Seabird Island Restoration Project
Restoration of Island Ecosystems Workshop
Peniche, January 2018

So what do we mean by island restoration?

- Often used as a synonym for eradication of invasive species
- But simply removing invasives will not ‘restore’ an ecosystem to its pre-invaded state
- May also involve translocations of lost species, or ecological analogues
- Also includes biosecurity – preventing invasive species returning, or reaching new islands

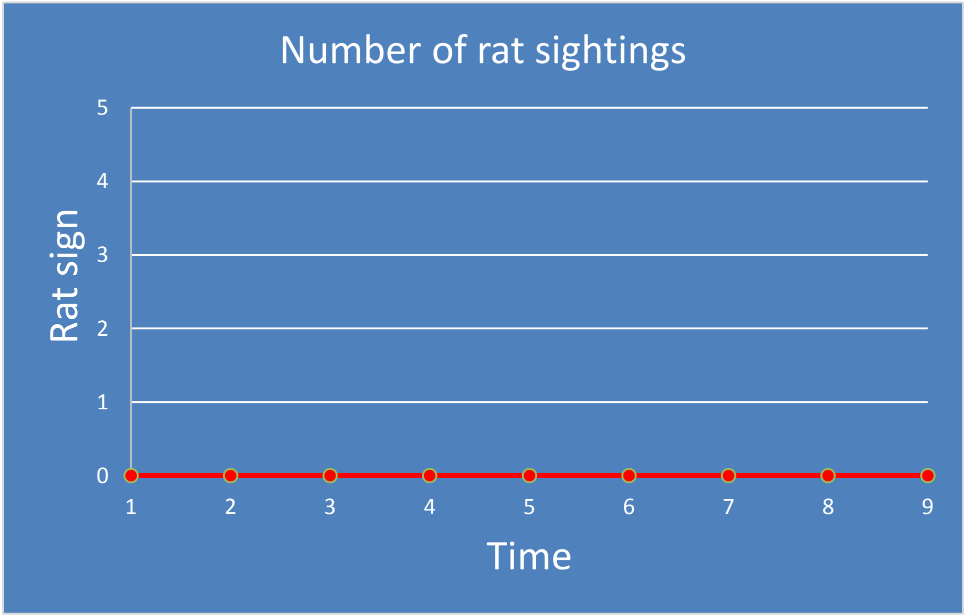
Eradication!

- Big, exciting projects
- Quick and highly effective
- Helicopters! (sometimes)
- More birds!



Biosecurity

- Long term commitment
- Nothing happens for years
- Difficult to fund
- Why is it so important anyway?



Because rat invasions occur all the time!

- Noises Islands, NZ, 2.2km offshore, invaded six times in 20 yrs
- UK – In 2017 there were known or suspected incursions on Coquet, Inchmickery, Copeland, Craigleith & Puffin Islands *and these are just the ones we know about*

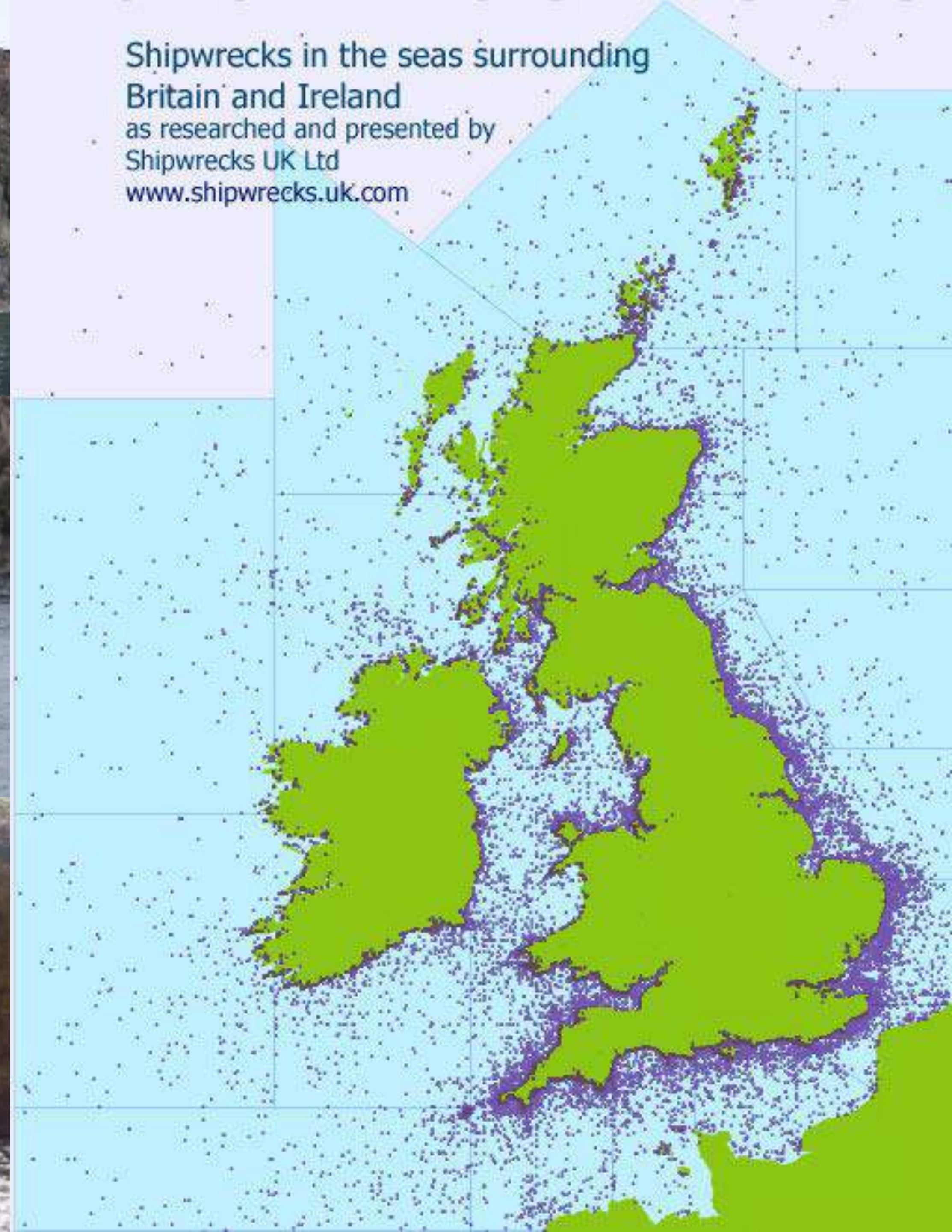
Most of the time we don't know because we're just not looking!


Black rats can swim at least 750m
Brown rats can swim at least 2km


Rum 2011


St Kilda 2008


Stroma , Orkney1993


Shipwrecks in the seas surrounding
Britain and Ireland
as researched and presented by
Shipwrecks UK Ltd
www.shipwrecks.uk.com


Other invasion pathways


The Seabird Island Restoration Project

- Began in 2013, now extended to 2019
- **Aims**
  - develop a strategy for UK eradication/ biosecurity work, based on agreed priority islands
  - ensure all projects are carried out to international best practice standards (Best Practice Toolkit)
  - build capacity for rat eradication and biosecurity work – well trained and motivated staff
  - Share with and learn from other organisations

SIRP in a nutshell...

Choosing the 'best' sites

(most to gain/ most to lose)

+

Best practice methods

+

Well trained, well-informed people

=

Greatest conservation gains

Biosecurity planning

- ‘Eradication mindset’ – total eradication of rats is fully achievable providing correct methods are followed
- Need to extend this to ‘Biosecurity mindset’ – recognition that there is an ever-present threat of invasive species invading/ reinvading BUT that this can be effectively managed with the right skills and tools

Biosecurity planning

1. PREVENTION Risk species and pathways – what could arrive and how? Put multiple obstacles along these pathways
2. DETECTION Routine surveillance - network of monitoring tools specifically designed for the island and suite of invasives expected
3. RESPONSE Incursion response – detailed and well-resourced plans for responding rapidly and effectively to signs of key invasive species

Surveillance & incursion response tools






Roseate Tern LIFE Project – aims to protect and enhance roseate tern populations in UK & ROI

Working with island managers we've written biosecurity plans for key islands

Inchmickery & Fidra, *Scotland*
Blue Circle & Swan, *N. Ireland*
Rockabill, *Republic of Ireland*

Skerries, *Wales*
Ynys Feurig, *Wales*
Coquet, *England*

What do biosecurity plans look like?

- Site description, pathway analysis, detailed, bespoke plans for surveillance and incursion response, list of equipment needed
- Island staff encouraged to get necessary training, store necessary equipment know where more can be bought, know exactly who to contact for permissions and advice
- Get as much in place as possible beforehand – aim to launch response within 48 hours

Incursion response methods

- Responding to probable/ definite signs of rats
- Use a grid of poison bait stations supported with a range of monitoring tools
- Train incursion response teams!



Who needs biosecurity?

- Feb 2017 – rat confirmed on 8ha Coquet Island
- Draft biosecurity plan implemented
- SIRP staff able to go and help with training and incursion response (great learning opportunity)
- Rat caught in March. Phew!

Wider biosecurity training

- Under the Shiants LIFE project, able to extend training to reach wider audiences
- 4 x 2 day biosecurity courses for people and organisations involved in island management
- Nature conservation organisations, local government, landowners, community groups etc

Overseas work

- SIRP officially only covers UK and Crown Dependencies, but keen to take opportunities to work on - and learn from - other projects
- E.g. Yelkouan LIFE project in Malta, Darwin-funded Iguana conservation project in Turks & Caicos Islands (post-hurricane redevelopment, rat assessment)




Other activities

- Training in safe and effective rodenticide handling – meet new EU requirements
- Planning trials of new trap types – Goodnature A24
- Develop more incursion response hubs
- Develop use of indicator dogs
- Continue education and training

Conclusions

On any given island, invasive species (re)invasion is unlikely but given enough islands over enough time, unlikely events become probable

MS Oliva hits Nightingale Island, Tristan da Cunha, 2011

Fortunately no rats came ashore

Conservationists need to shift their thinking from ‘it probably won’t happen’ to ‘what if it did?’

And to share information about what they find

We need ongoing surveillance, robust incursion response plans, and a team of highly motivated, trained people to implement them

Thanks very much for listening
Any questions?

Thanks to Sarah Havery for photos and technical support, and to the Roseate Tern and Shiants LIFE projects for financial support

Ecological restoration of Bagaud Island (south-eastern France). Simultaneous eradication of two invasive taxa: *Rattus rattus* and *Carpobrotus* sp.

Elise Buisson

Laurence Affre, Elise Krebs, Annie Aboucaya, Aurélie Allègre, Alain Barcelo, Laurence Berville, Nathalie Bigeart, Julie Braschi, Lenka Brousset, Julie Chenot, Hélène De Méringo, Damien Fourcy, Pascal Gillet, Patricia LeQuilliec, Yannick Limouzin, Olivier Lorvelec, Frédéric Médail, Jean-Yves Meunier, Camille Montegu, Marine Pascal, Michel Pascal, Aurélie Passetti, Philippe Ponel, François Rifflet, Lise Ruffino, Coralie Santelli, Eric Vidal

Ce programme est cofinancé par l'Union Européenne

Bagaud Island: a wildlife sanctuary – since 2007

Port-Cros National Park

Bagaud Island: 58 ha

Bagaud Island: a wildlife sanctuary – since 2007

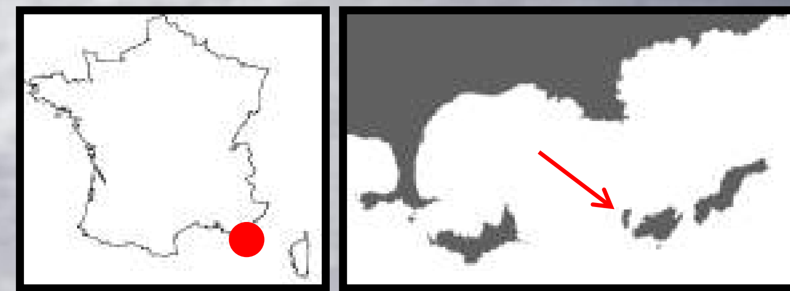
Leaf-toed gecko

Mediterranean shearwater

Orobanche sanguinea

Storm petrel

Urticicola suberinus



Port-Cros National Park

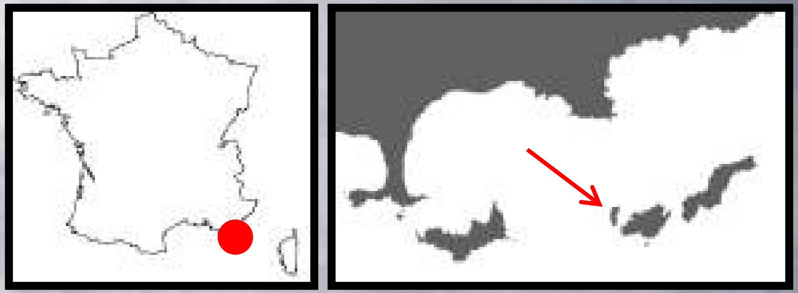
Bagaud Island: 58 ha

© Thibaut Vergoz

Bagaud Island: a wildlife sanctuary – since 2007

Leaf-toed gecko

Shearwater



Port-Cros National Park

Bagaud Island: 58 ha

- Stable population of rats
- 1.6 ha invaded by iceplants

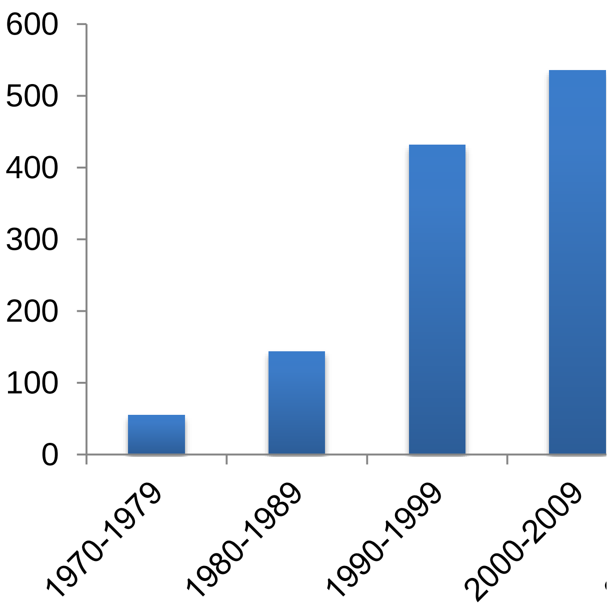
Orobanche sanguinea

Storm petrel

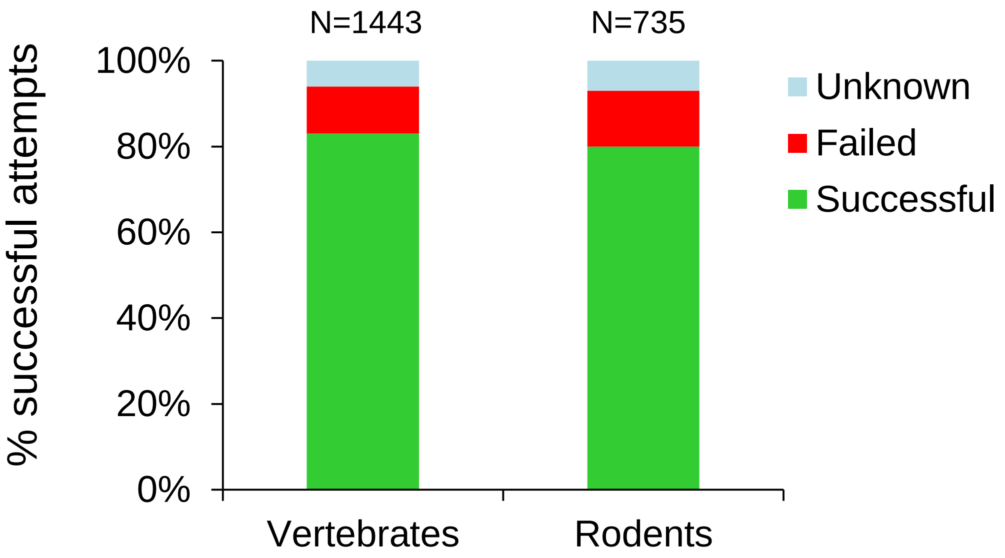
Urticicola suberinus

Invasive species eradication on islands is feasible!

= complete removal of all individuals of a distinct population



Number of vertebrate eradication attempts



Status of all completed eradication attempts

(1630-2012)

Data from DIISE http://eradicationsdb.fos.auckland.ac.nz/ 22Sept.2013

The issues with black rat – *Rattus rattus*

Hydrobates pelagicus

Ruffino *et al*. 2009 *Biol. Invasions*

Traveset *et al.* 2009 *Biol. Invasions*

Pimelia criba

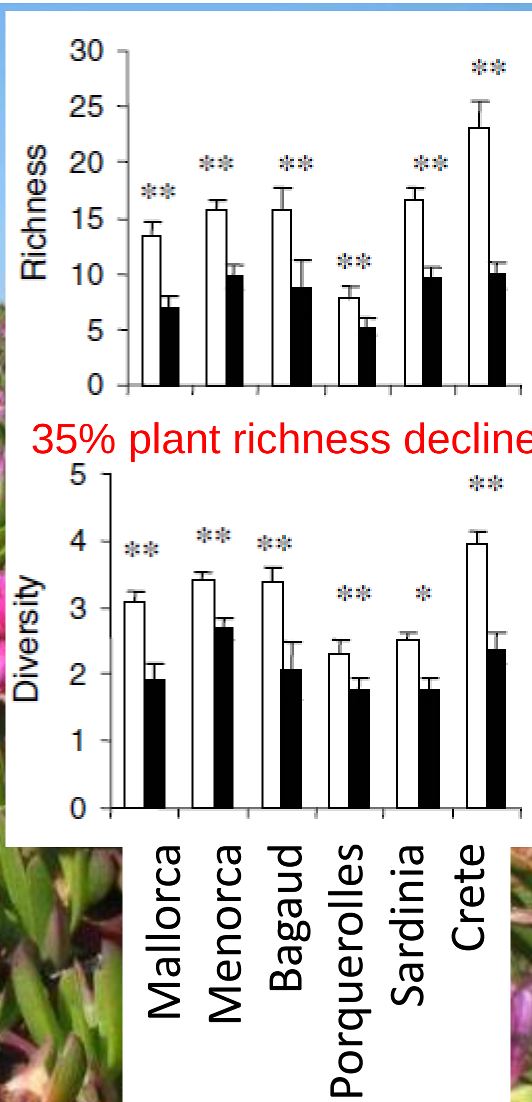
Palmer & Pons 1996 *Acta Oecol*.

Podarcis lilfordi

Pérez-Mellado V., unpublished

The issues with iceplant – *Carpobrotus* sp.

Several reproductive strategies:
- Pollinators + autogamy
- 650-1800 seeds/fruit
- Clonal growth



Vila et al. 2006 *J.Biogeo.*
Carpobrotus-invaded (black) and control (white) plots

The issues with the combination of both

Potential for invasional meltdown!

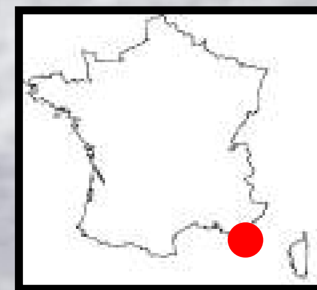
- Up to **260 seeds/feces**
- Up to **115m dispersal**

Bourgeois et al. 2005 *Ecoscience*

- Up to **47%** in assimilated diet

Ruffino *et al*. 2011 *Pop. Ecol.*

Bagaud Island: a wildlife sanctuary

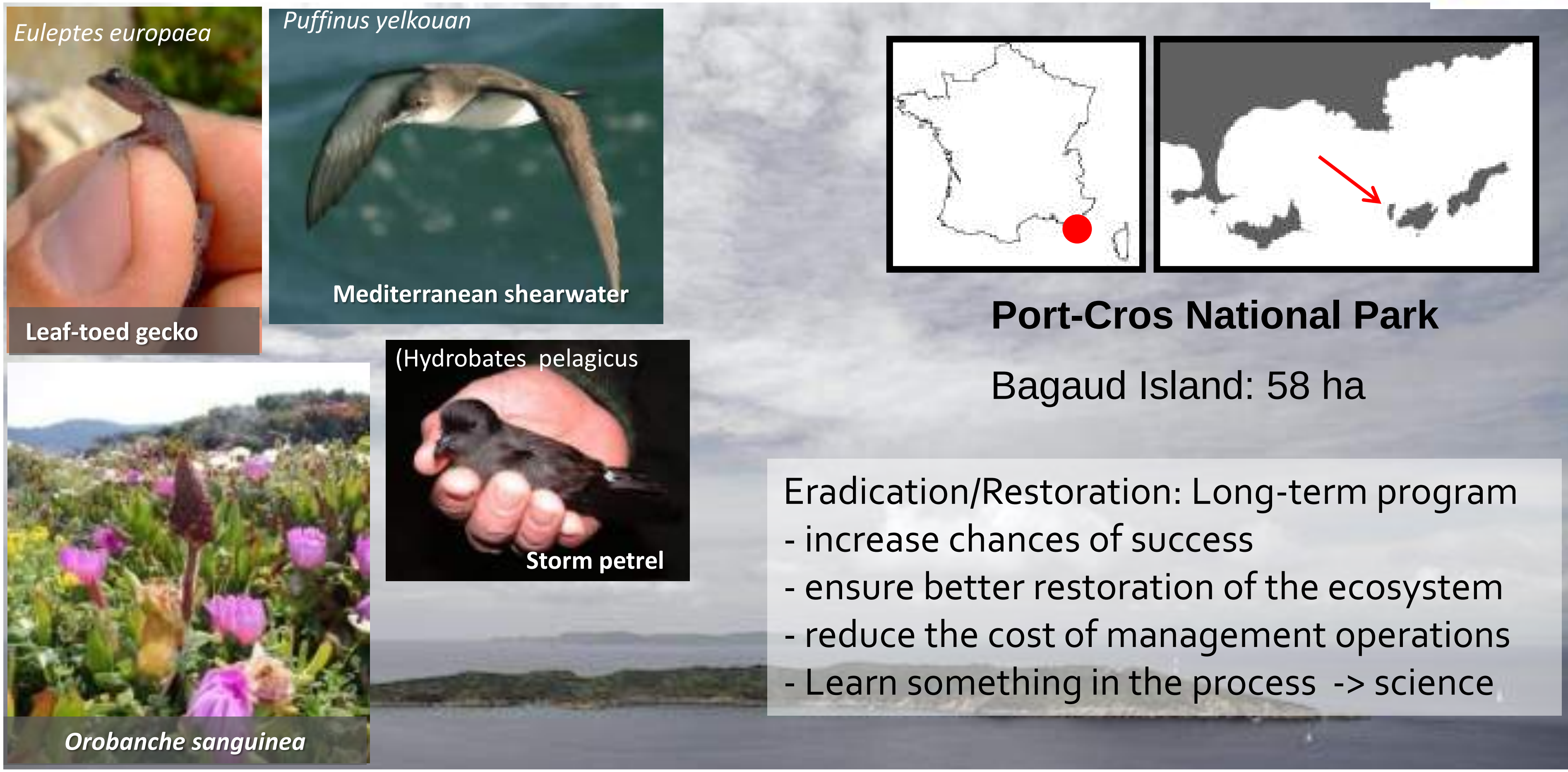


Port-Cros National Park

Bagaud Island: 58 ha

Eradication/Restoration: Long-term program
- increase chances of success
- ensure better restoration of the ecosystem
- reduce the cost of management operations
- Learn something in the process -> science

Bagaud Island: a wildlife sanctuary



2006 2009 2010 2011 2012 2019

planning

pre-monitoring
& trials

Rat eradication

post-monitoring
biosecurity

Iceplant eradication

Pre-monitoring (2010-2011)

Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)

Pre-monitoring (2010-2011)

Plants

- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m²-plots)
- Seed bank, particularly in *Carpobrotus* patches

Sampling

	Adjacent native plant communities 6 replicates	***Carpobrotus* 9 replicates**
C. acinaciformis - inland	6 x 2 depths 0-5 cm 5-10 cm	9 x 3 depths Litter 0-5 cm 5-10 cm
C. edulis – coast	6 x 2 depths 0-5 cm 5-10 cm	9 x 2 depths Litter 0-5 cm (shallow soils)

Chenot et al. 2014

Pre-monitoring (2010-2011)

Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)
- Seed bank, particularly in *Carpobrotus* patches

Results

in *Carpobrotus* patches	native plant seeds	*Carpobrotus* seeds
Litter		
Topsoil 0-5 cm	27.4 %	21.7 %
Soil 5-10 cm	4.8%	2.8 %

Chenot et al. 2014

Pre-monitoring (2010-2011)

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- Island-wide inventory
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Results

in *Carpobrotus* patches	native plant seeds	*Carpobrotus* seeds
Litter	9.8 %	**33.5 %**
Topsoil 0-5 cm	27.4 %	21.7 %
Soil 5-10 cm	4.8%	2.8 %

→ **remove Carpobrotus + litter?**

Chenot et al. 2014

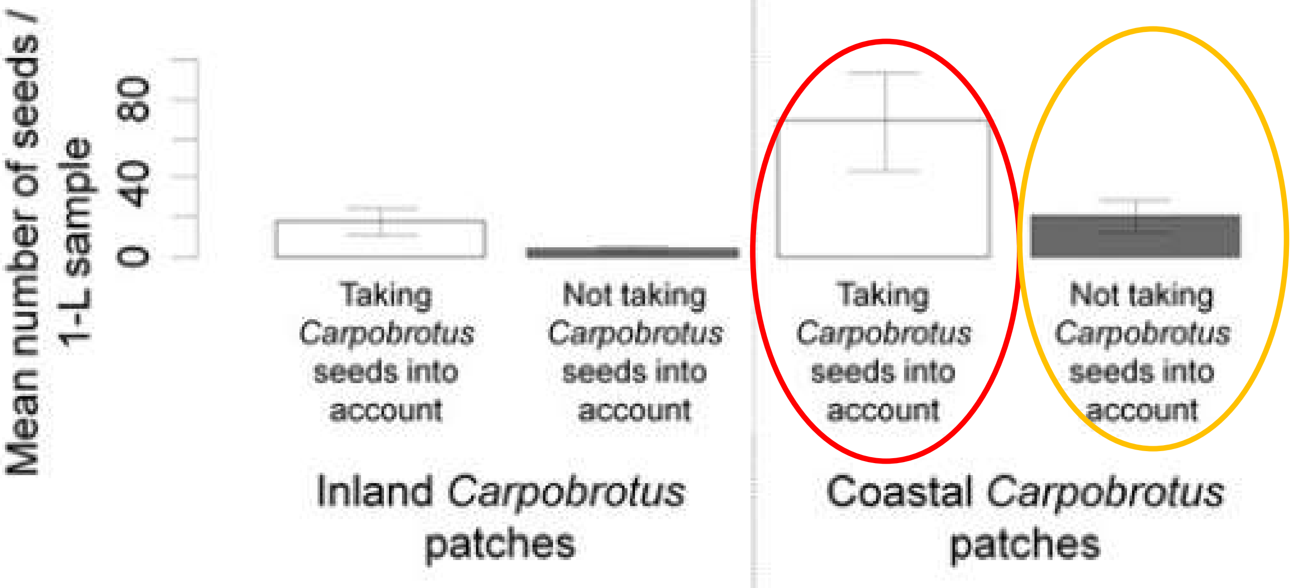
Pre-monitoring (2010-2011)

Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m²-plots)
- Seed bank, particularly in *Carpobrotus* patches

Results

In the litter

More *Carpobrotus* seeds on the coast



maxT = 3.03, $p=0.012$

Chenot et al. 2014

Pre-monitoring (2010-2011)

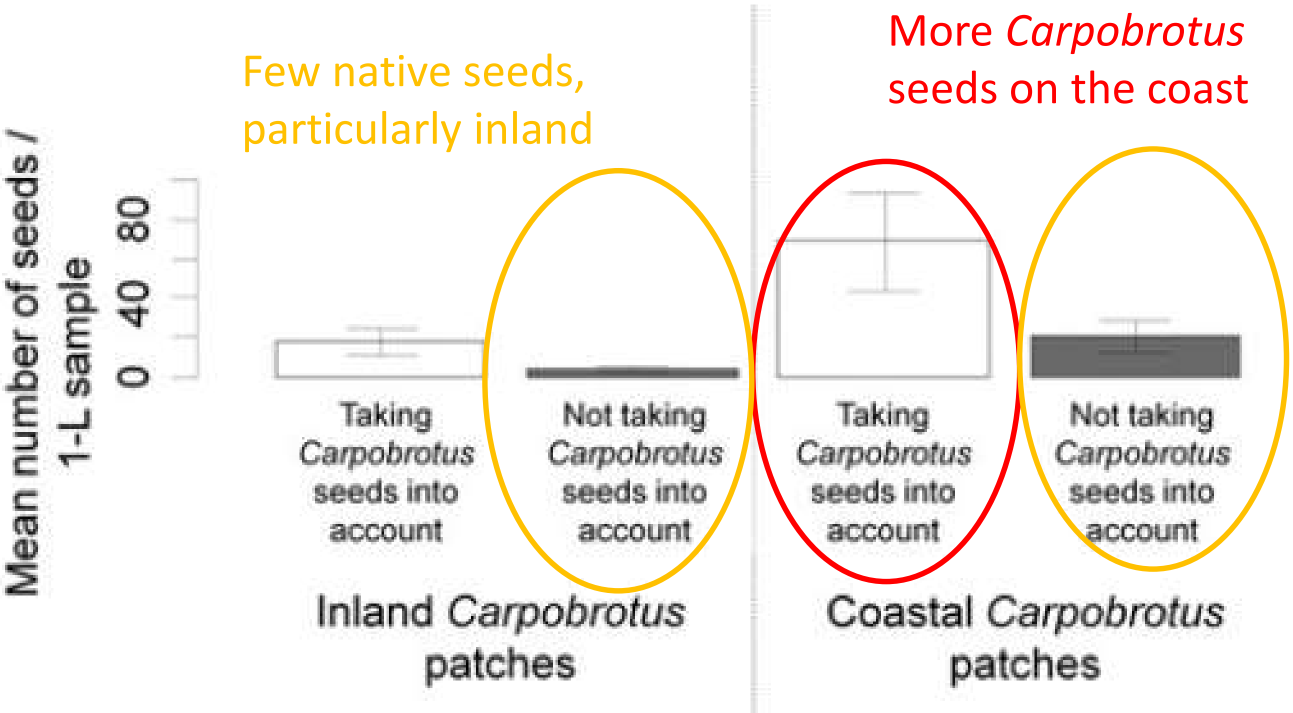
Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)
- Seed bank, particularly in *Carpobrotus* patches

Results

In the litter

Few native seeds, particularly inland

More *Carpobrotus* seeds on the coast



maxT = 3.03, p=0.012

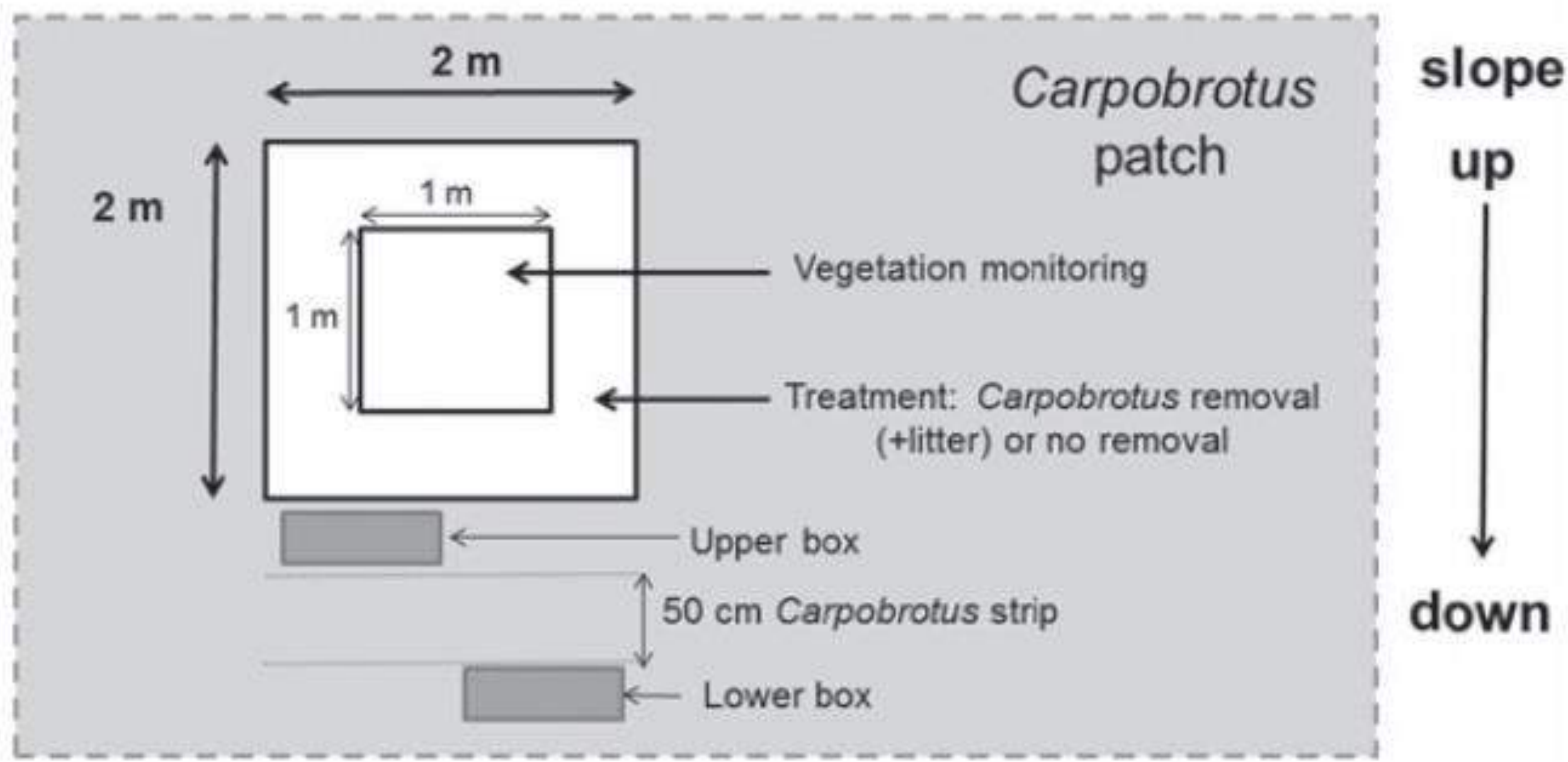
Chenot et al. 2014

Carpobrotus eradication trials (2010)

Removal of
Carpobrotus mat + litter

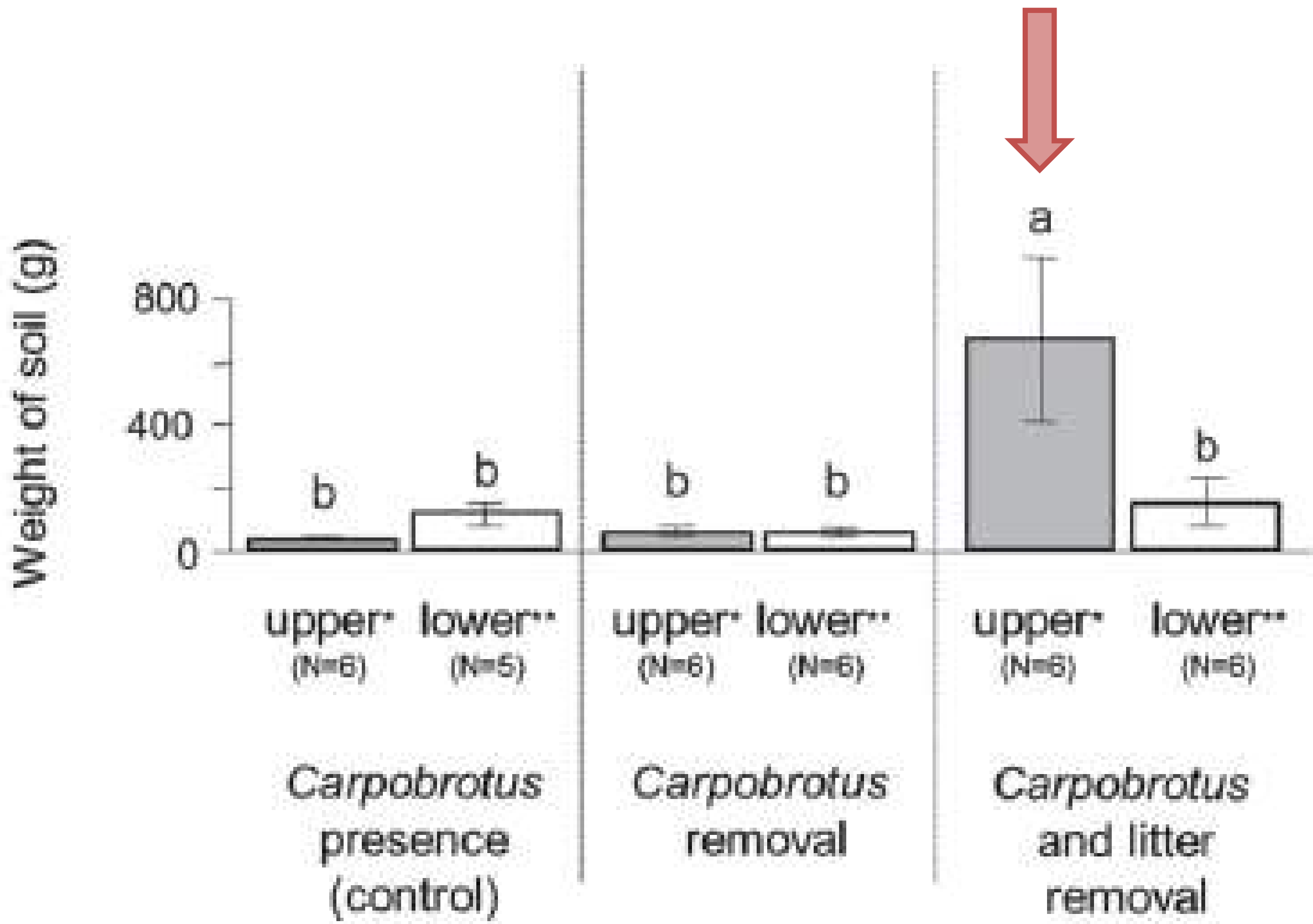
Removal of *Carpobrotus* mat only

Carpobrotus eradication trials (2010)



Chenot et al. 2018

Carpobrotus eradication trials (2010)

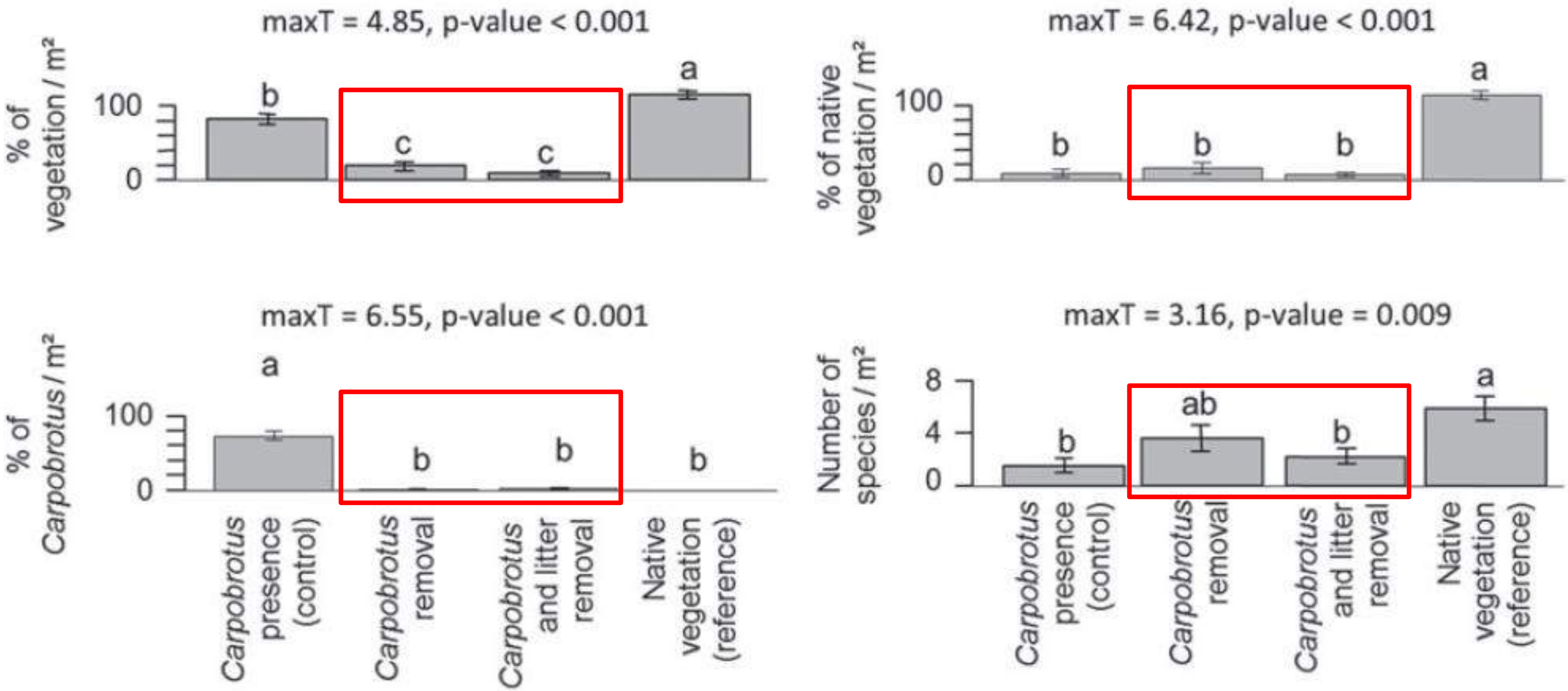


maxT = 4.07, p=0.001

Chenot et al. 2018

Carpobrotus eradication trials (2010)

In the short-term (< 1 yr study)



In the long-term, may lead to higher follow-up cost (removing germinations)

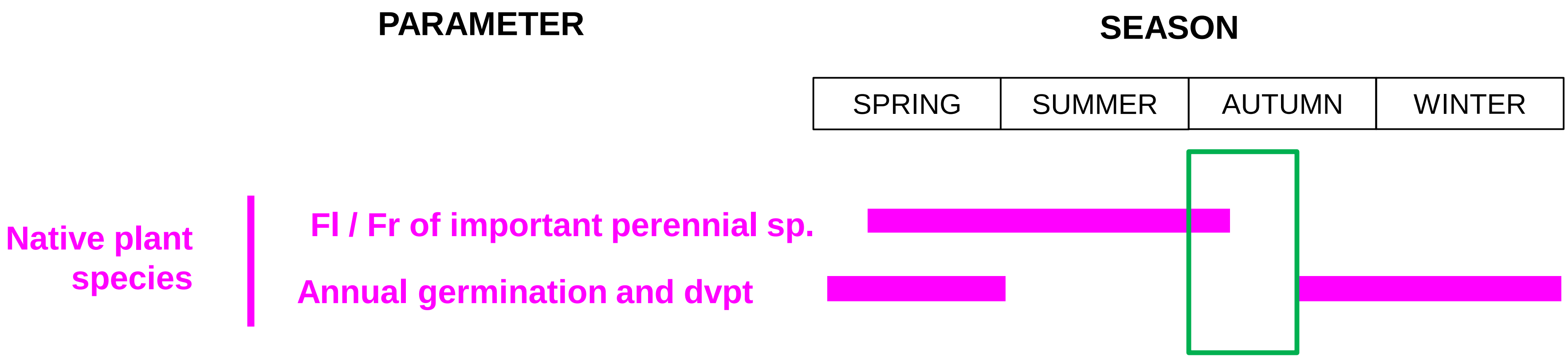
Chenot et al. 2018

Pre-monitoring (2010-2011)

Plants

- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)
- Plant phenology (germination and flowering)

When? → eradication planning



Ruffino et al. 2015

Pre-monitoring (2010-2011)

Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)

Arthropods
- Ground arthrop.
- Litter arthrop.
- Flying arthrop.

Pre-monitoring (2010-2011)

Plants

- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)

Arthropods

- Ground arthrop.
- Litter arthrop.
- Flying arthrop.

Reptiles

- Transects
- Quadrats
- Rocky areas/buildings
- ”Shelter plates”

Pre-monitoring (2010-2011)

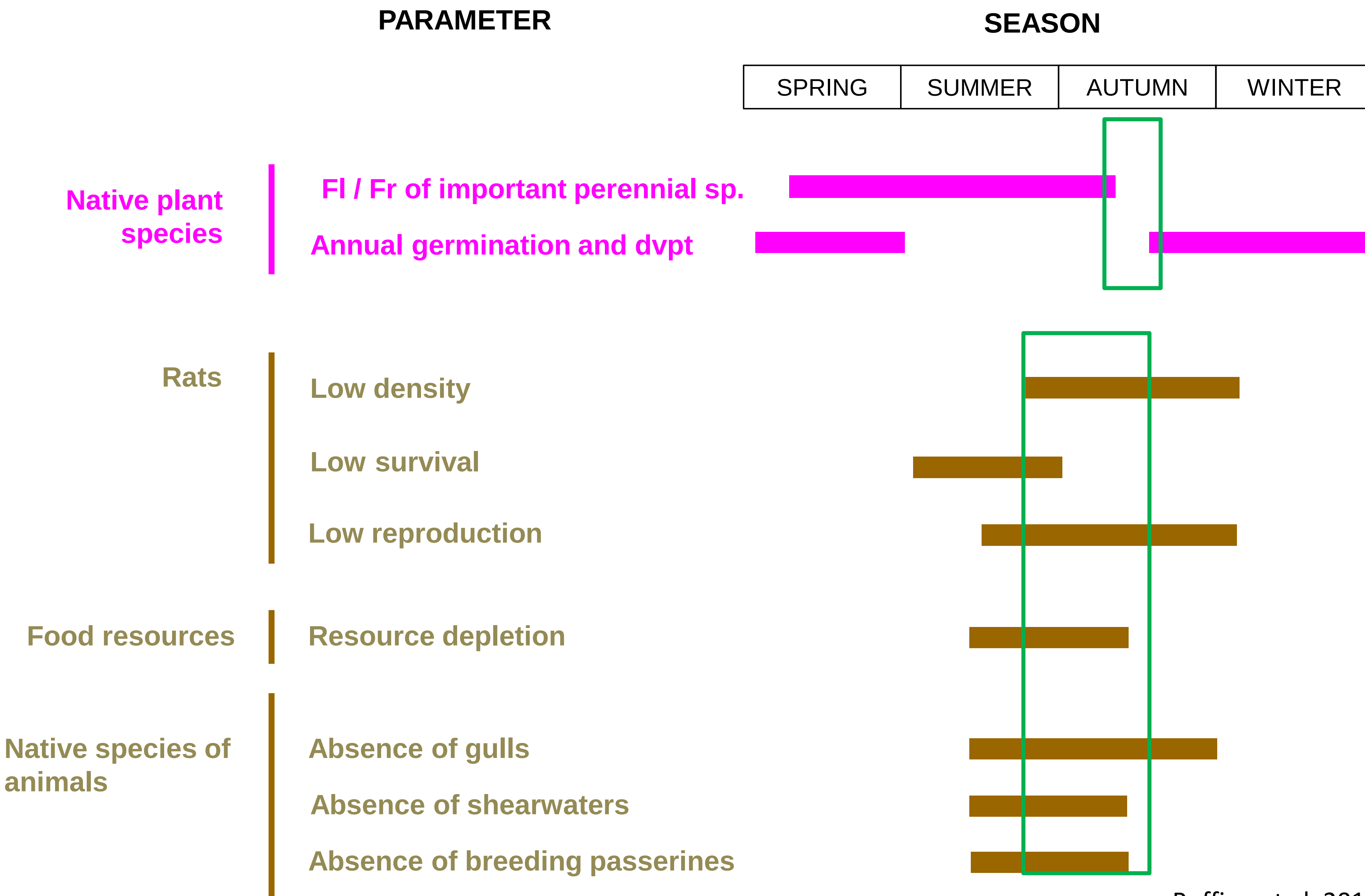
Plants
- Island-wide inventory
- Mapping of rare plants
- Long-term monitoring (27 16m^2-plots)

Arthropods
- Ground arthrop.
- Litter arthrop.
- Flying arthrop.

Reptiles
- Transects
- Quadrats
- Rocky areas/buildings
- ”Shelter plates”

Birds
- Calling – singing contacts
- Monitoring of seabird burrows

When? → eradication planning



Ruffino et al. 2015

Rat eradication

Rat eradication – choose the method

Cost estimation in **EUROS per HECTARE** of island treated during the period of rat eradication
(not including post-monitoring studies)

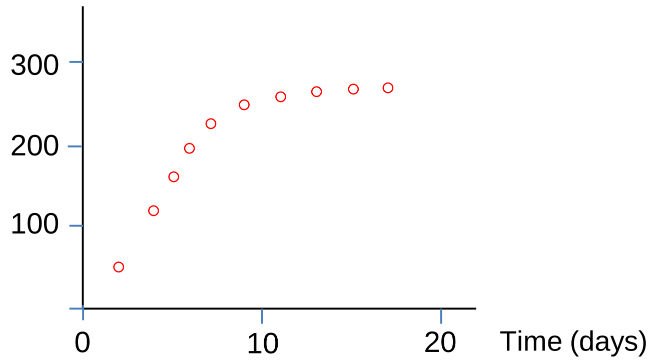
	Trapping + ground poisonning	**Aerial baiting**	
	This study	*Other studies**	
Material (including bait)	600	164	
Boat expenses	130	127	
Staff	1,163	720	
Opening vegetation paths	0.51	-	
Helicopter	-	722	
TOTAL	**1,893**	**1,733**	**+9%**

* Samaniego-Herrera *et al*. J.Appl.Ecol. 2013 Eradication of black rats from a Mexican Island (80ha)

Rat eradication – site preparation

Rat eradication – 2011/2012

Step 1:
Trapping



Modified from Pascal *et al*. 2006 *Biol. Invasions*

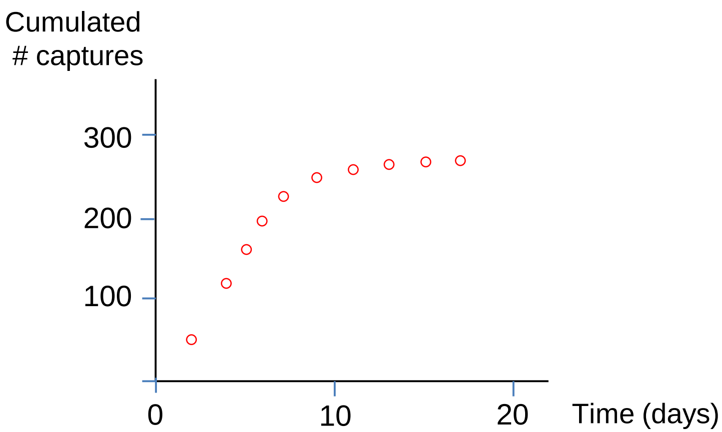
Up to 85% of
resident population

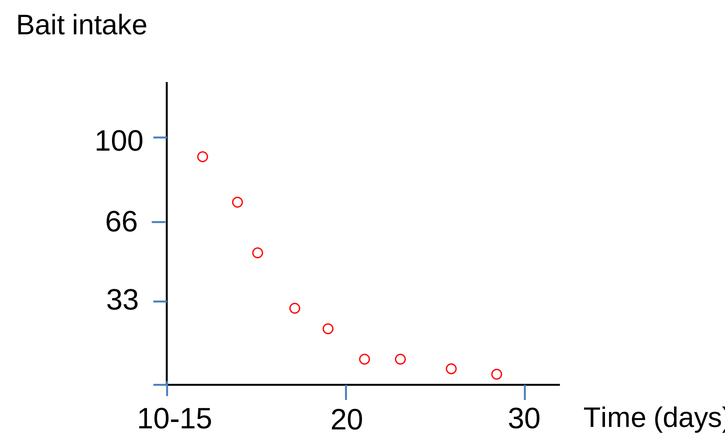
Rat eradication – 2011/2012

Step 1:
Trapping

Step 2:
Poisonning

Bromadiolone 50ppm
(anticoagulant)





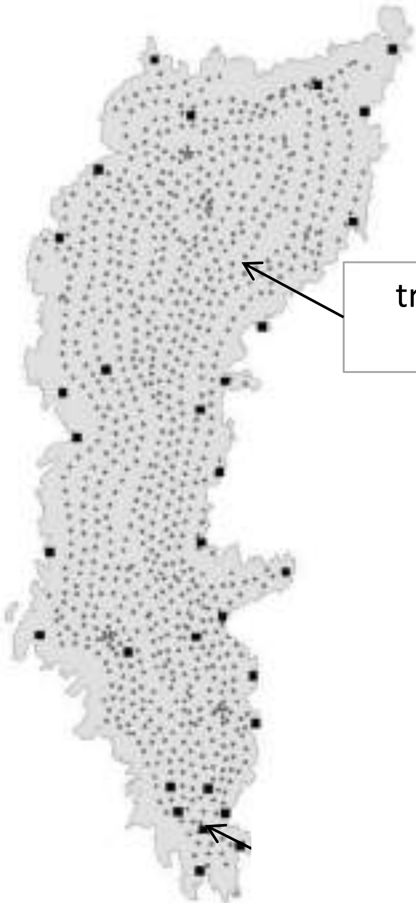
Modified from Pascal *et al*. 2006 *Biol. Invasions*

Up to 85% of
resident population

Limited amount of toxic baits
(reduced by >90%)

→ 150kg toxic baits instead of 1,200kg (10kg/ha x 2)

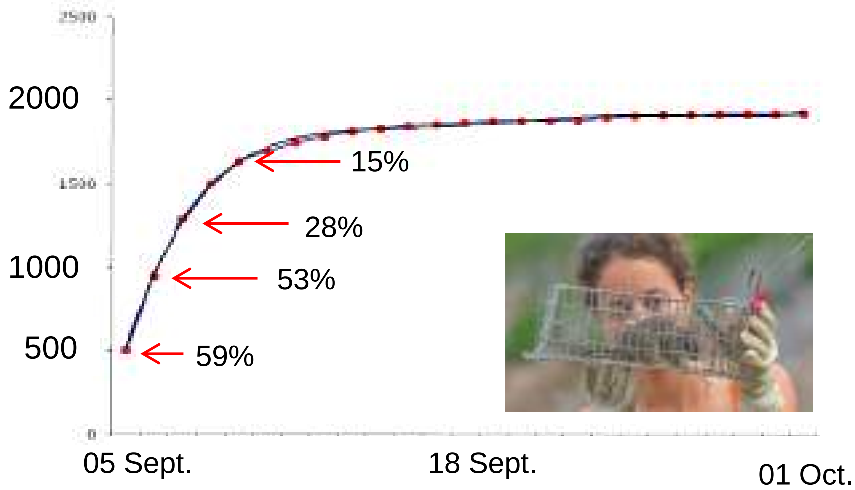
Rat eradication – 2011/2012



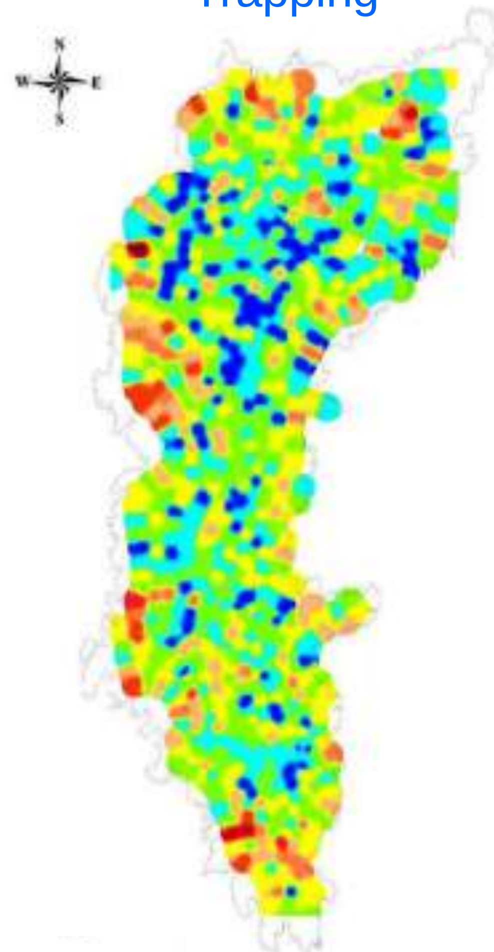
- with 886 traps + toxic bait stations
- first trapping in sept. 2011
- Toxic bait used until no more consumption

Rat eradication: results

Cumulated # captures

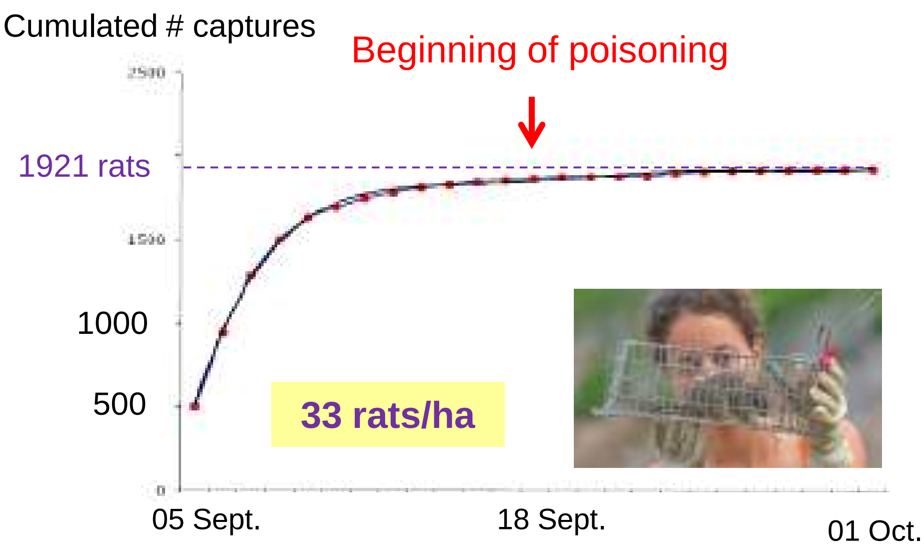


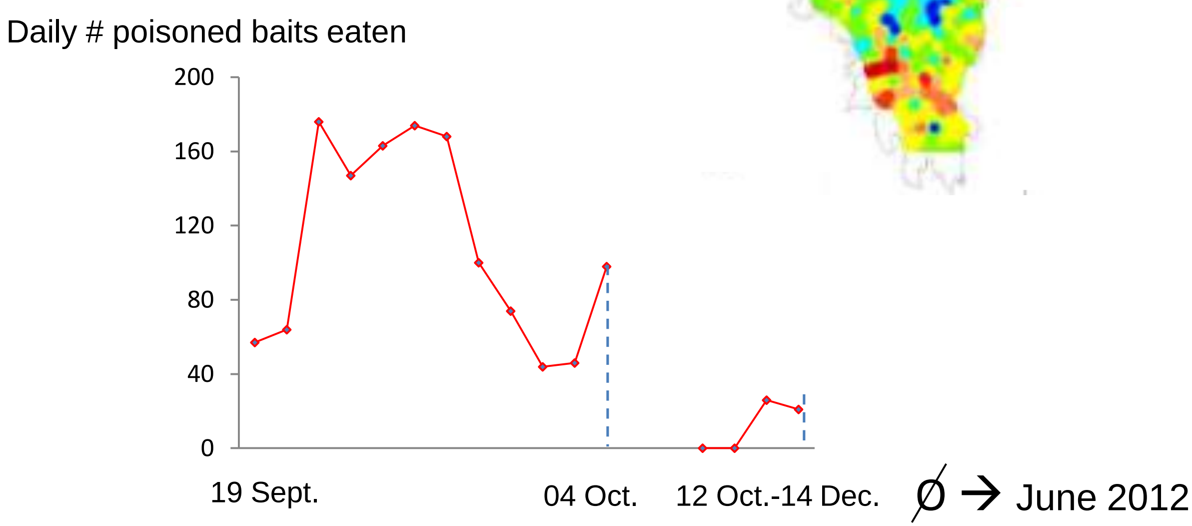
Trapping

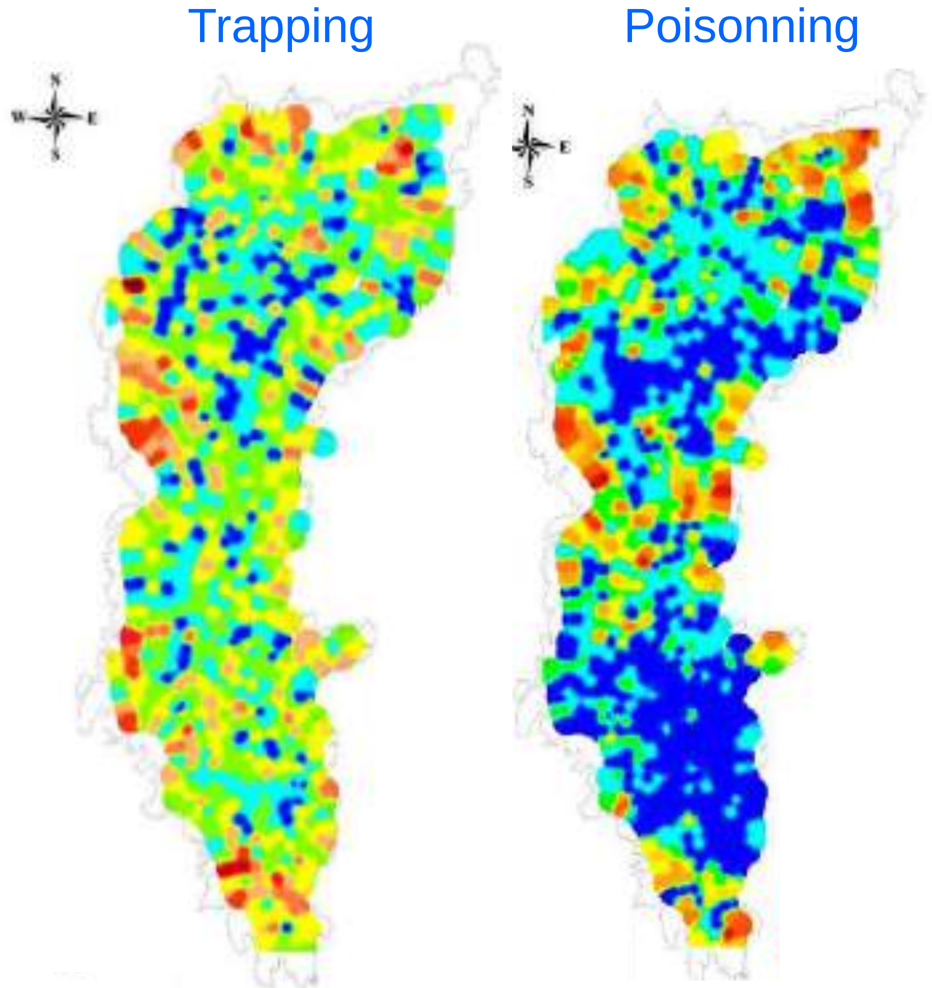


Ruffino et al. 2015

Rat eradication: results



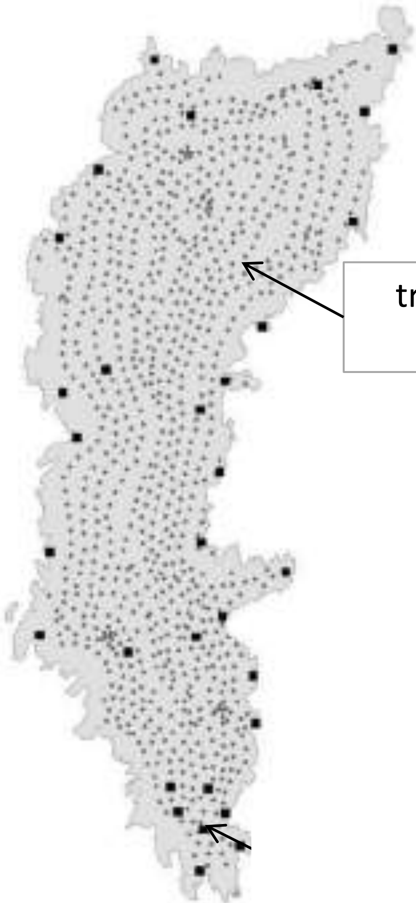




DAILY CHECK	WEEKLY	MONTHLY

Ruffino et al. 2015

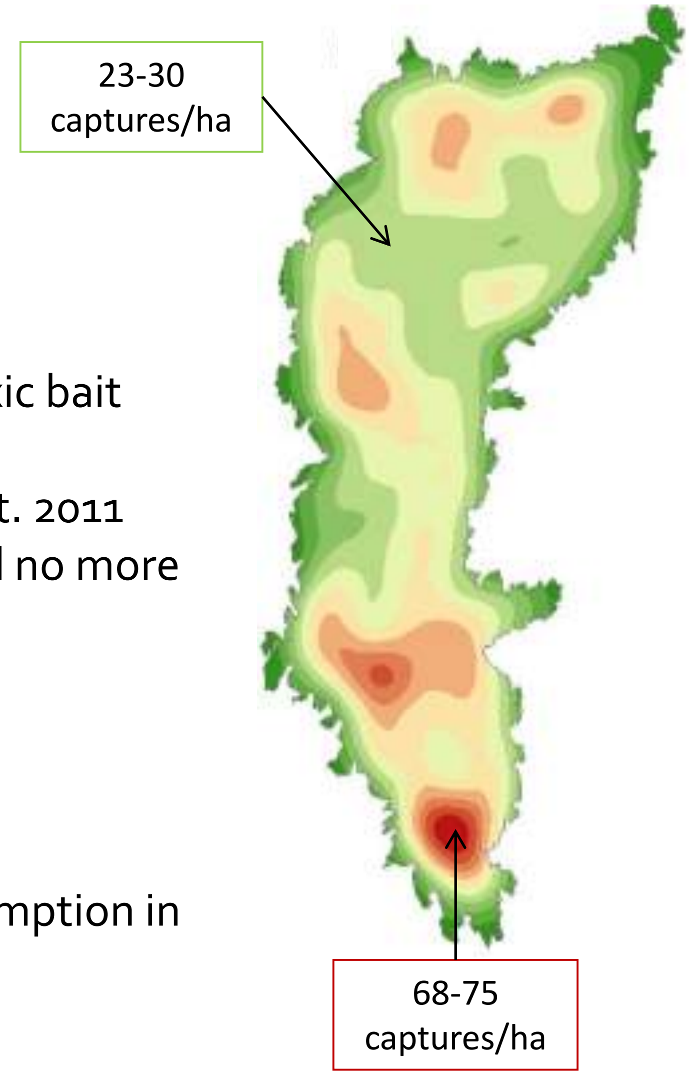
Rat eradication: results



- with 886 traps + toxic bait stations
- first trapping in sept. 2011
- Toxic bait used until no more consumption

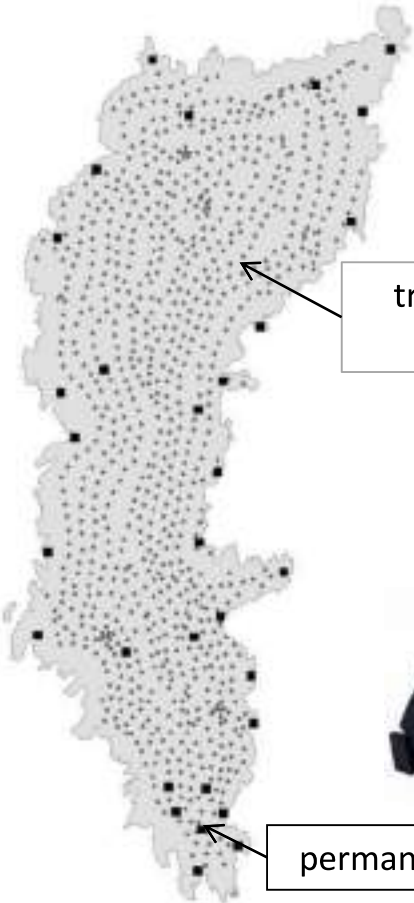
Result

- 1921 captured rats
- 33 captures/ha
- no more bait consumption in June 2012



Ruffino et al. 2015

Rat eradication: results



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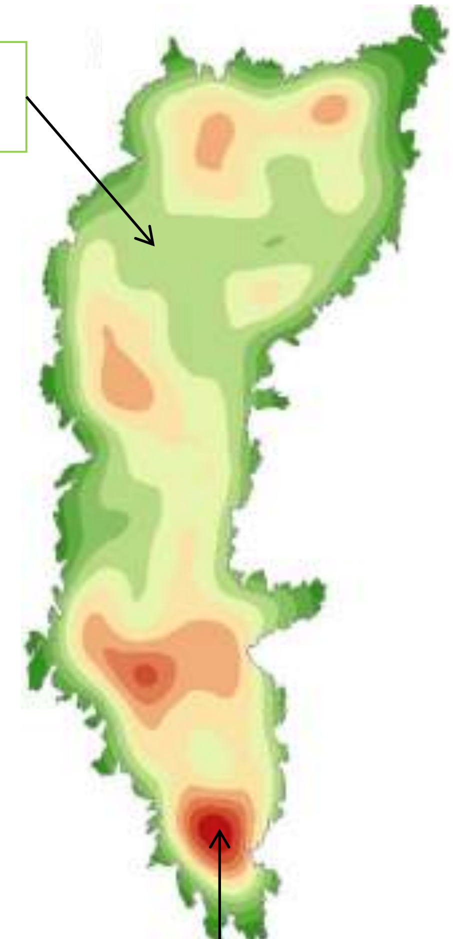
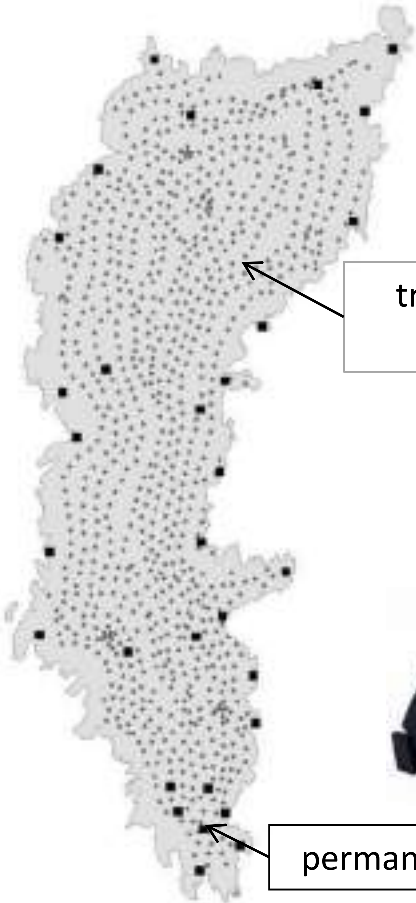


Presence of 31 permanent bait stations all around and in the island to detect a reinvasion

Ruffino et al. 2015

Rat eradication: results



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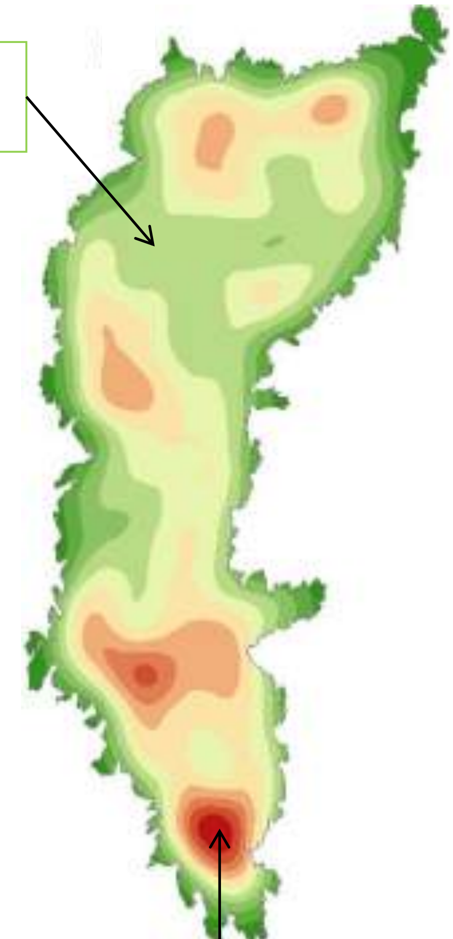
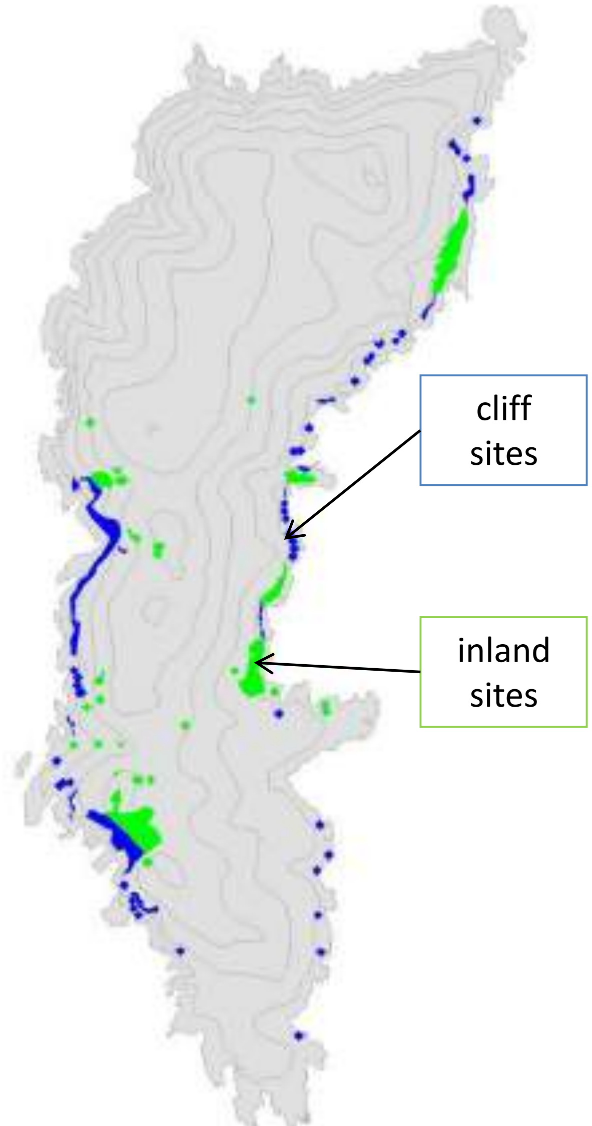


Presence of 31 permanent bait stations all around and in the island to detect a reinvasion

Unfortunately, traces of bait consumption were detected in summer 2016

Iceplant eradication

- manual uprooting
- 2011: initial uprooting on inland sites
- 2012: initial uprooting on cliff sites
- 2012-2019: uprooting every new germinated plant
  → exhaust seed bank



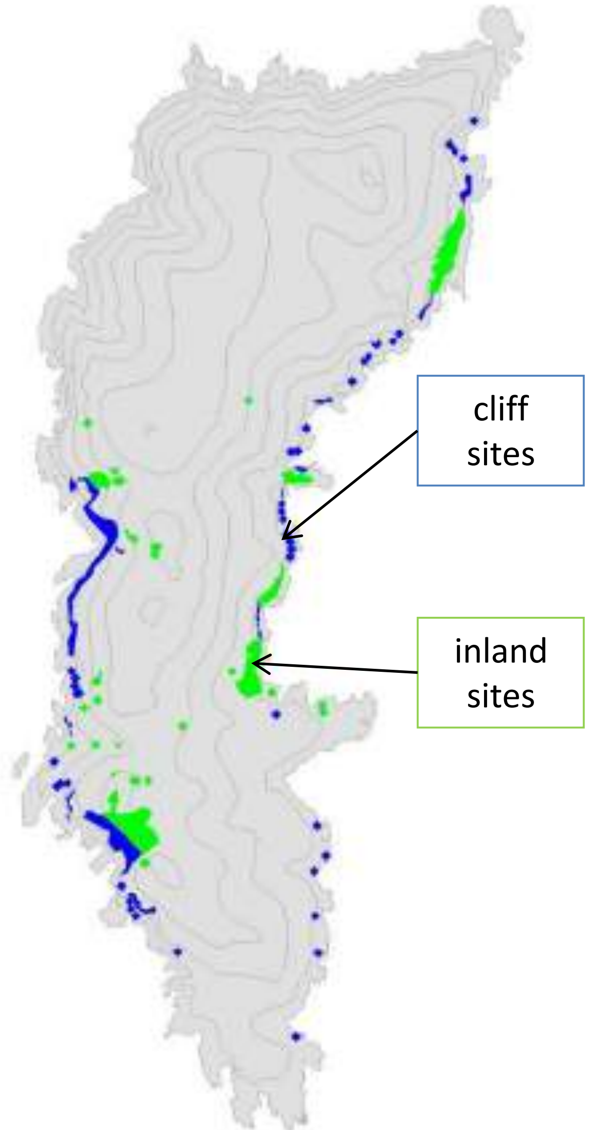
Ruffino et al. 2015

Iceplant eradication: results

- manual uprooting
- 2011: initial uprooting on inland sites
- 2012: initial uprooting on cliff sites
- 2012-2019: uprooting every new germinated plant
  → exhaust seed bank

Results of initial uprooting

- 2011: 1ha on inland sites
- 2012: more than 0.8ha on cliff sites
- 40 tons total



Ruffino et al. 2015

Iceplant eradication: results

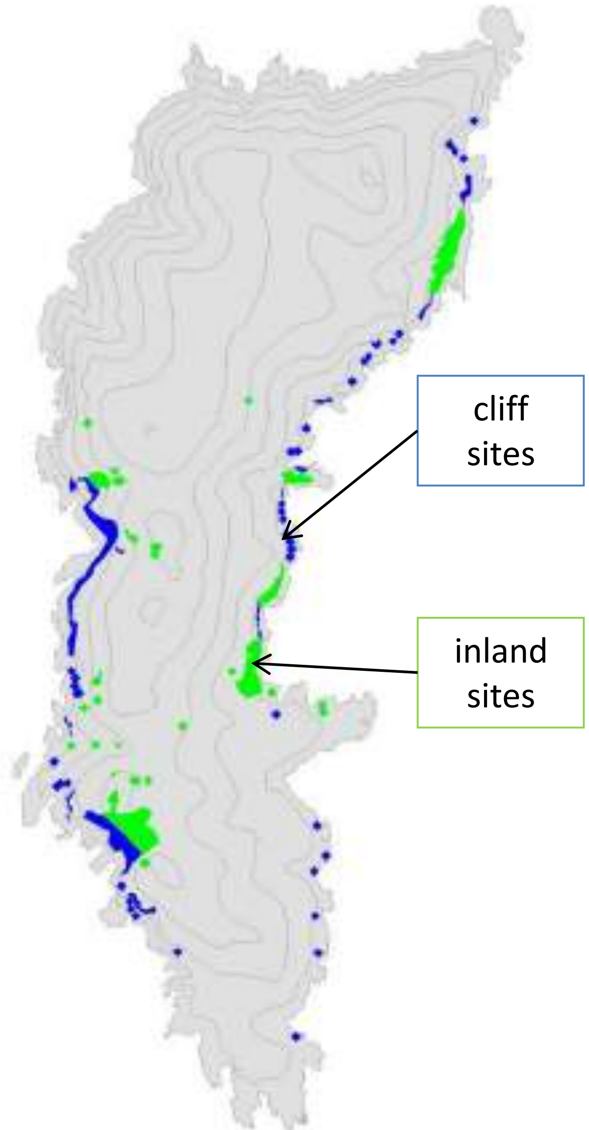
- manual uprooting
- 2011: initial uprooting on inland sites
- 2012: initial uprooting on cliff sites
- 2012-2019: uprooting every new germinated plant
  → exhaust seed bank

Results of initial uprooting

- 2011: 1ha on inland sites
- 2012: more than 0.8ha on cliff sites

Results of control uprooting on test sites

	sept. 2012	oct. 2013
Total ind. removal	1878	↗ 30979
Nb seedlings	1230	27062
Nb resprouts	648	3917
% seedlings	**65**	↗ **87**
% individuals	**35**	↘ **13**

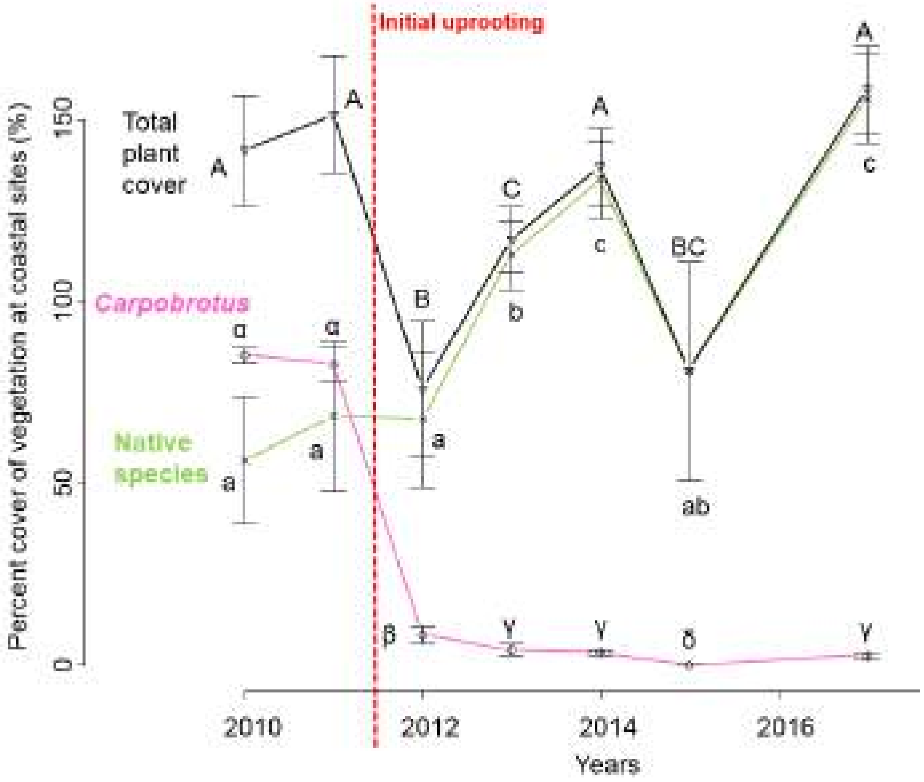


Changes detected on flora

Positive and visible effects

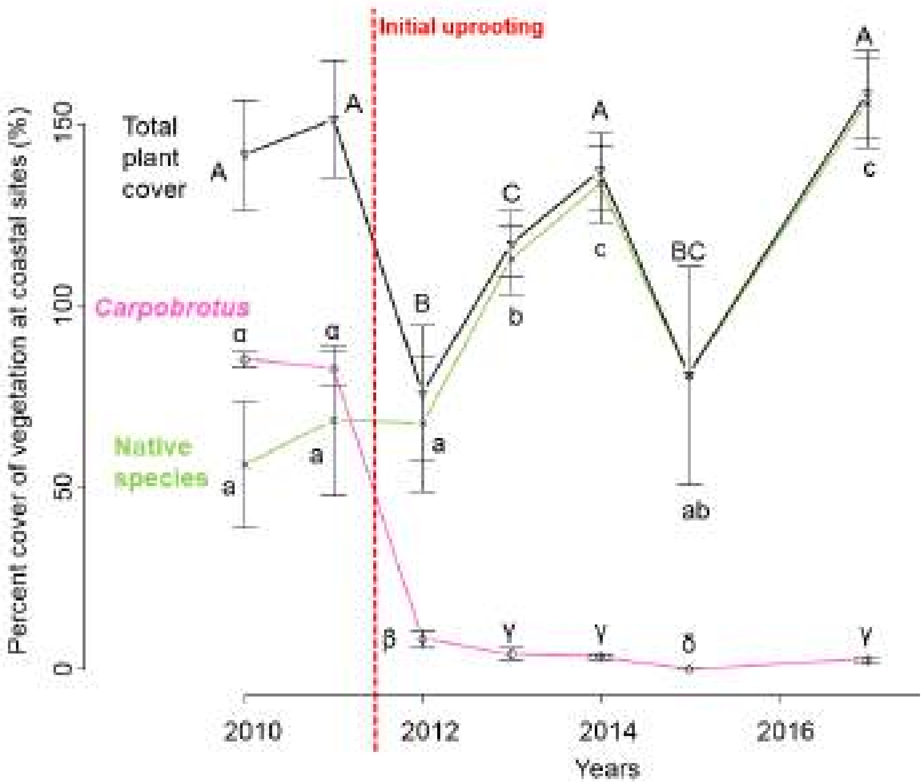
Changes detected on flora

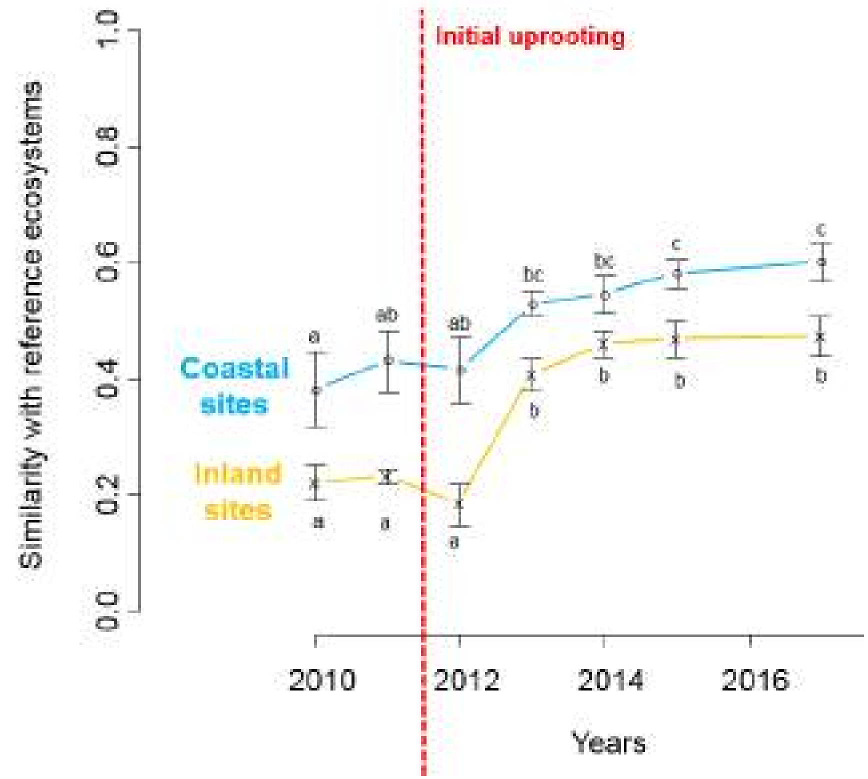
Positive and visible effects



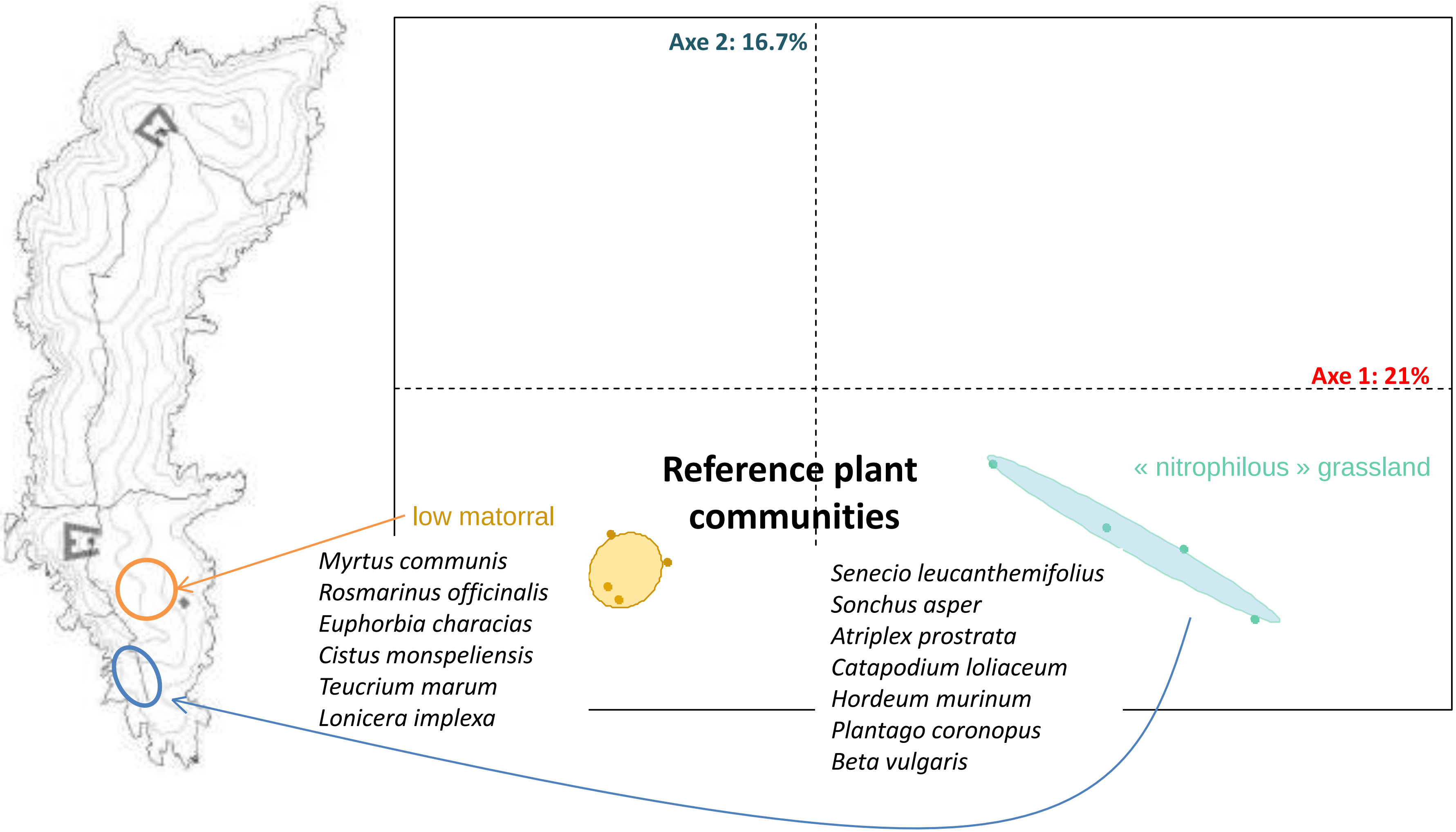
Changes detected on flora

Positive and visible effects



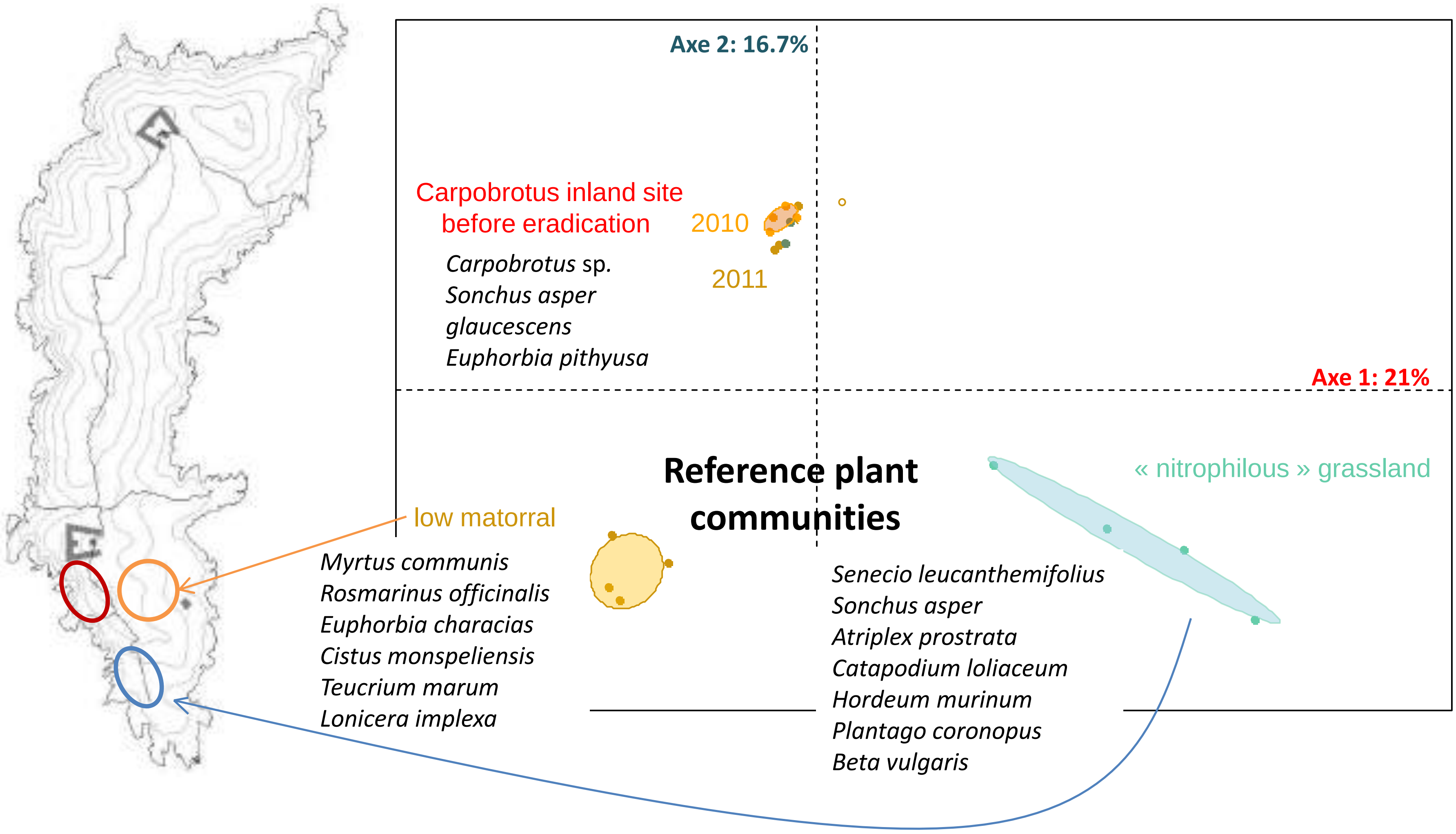


Changes detected on flora



CA with Carpobrotus plots (from 2010 to 2014) and indigenous vegetation plots

Changes detected on flora



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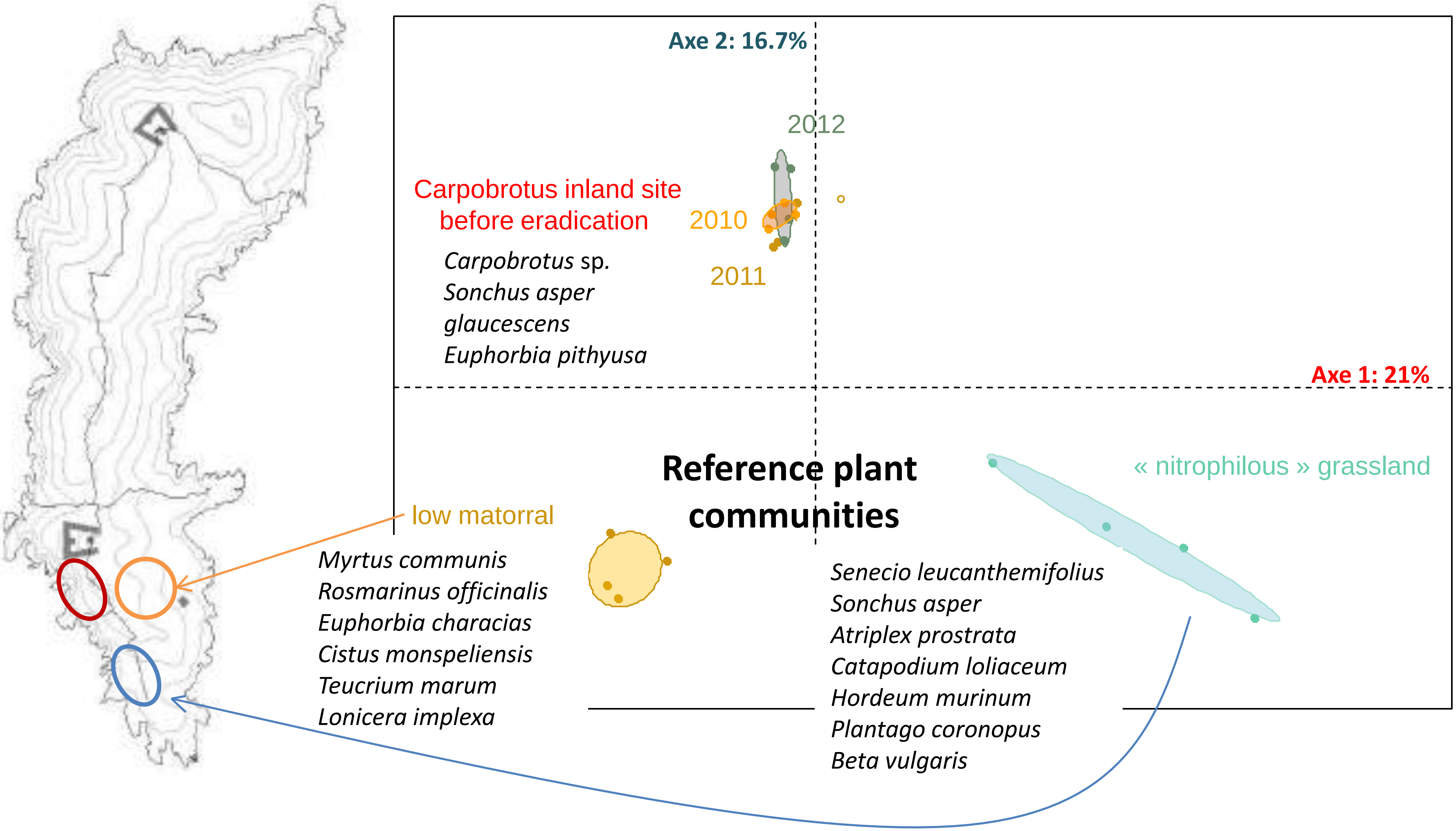
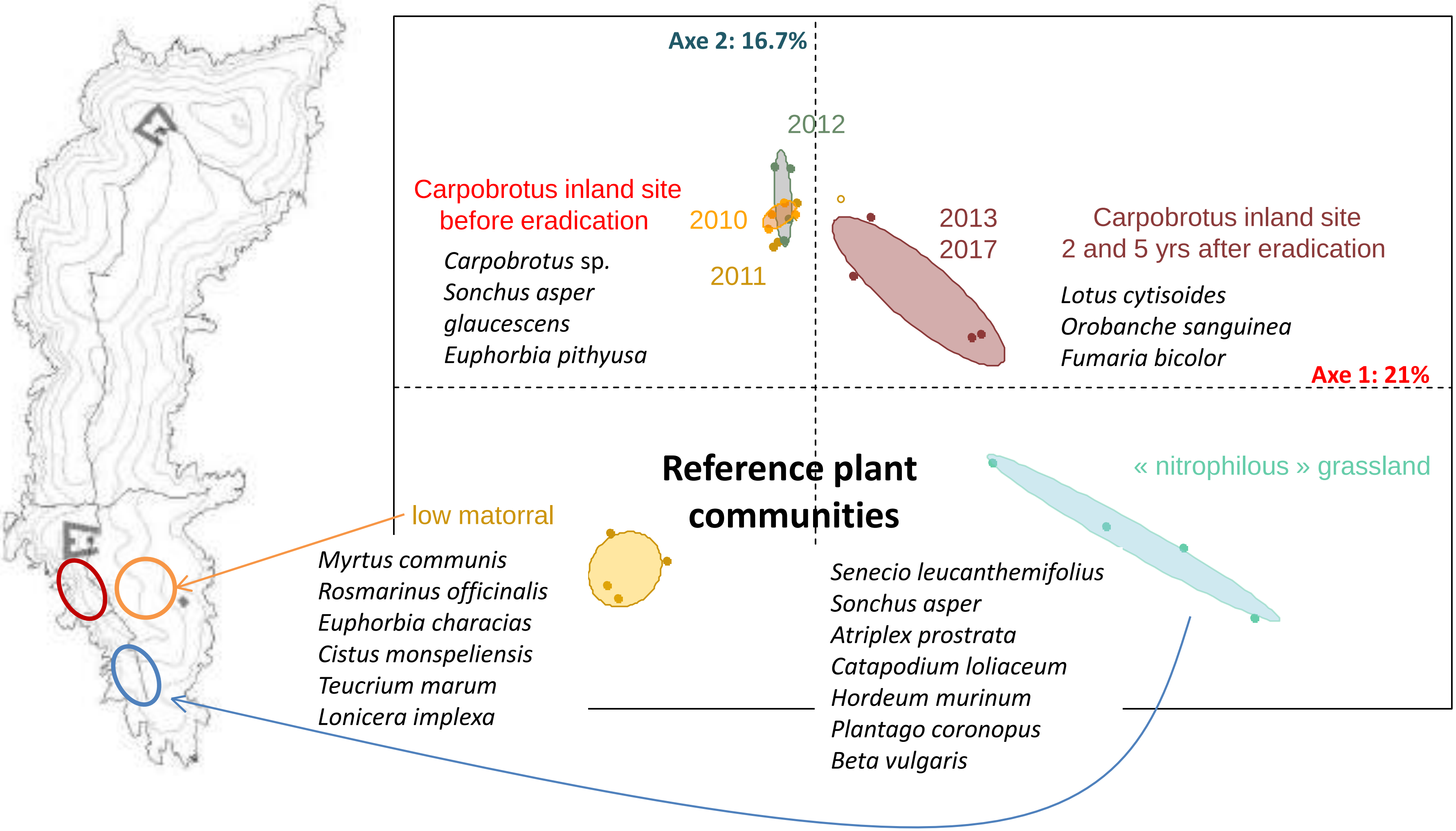
Changes detected on flora



CA with Carpobrotus plots (from 2010 to 2014) and indigenous vegetation plots

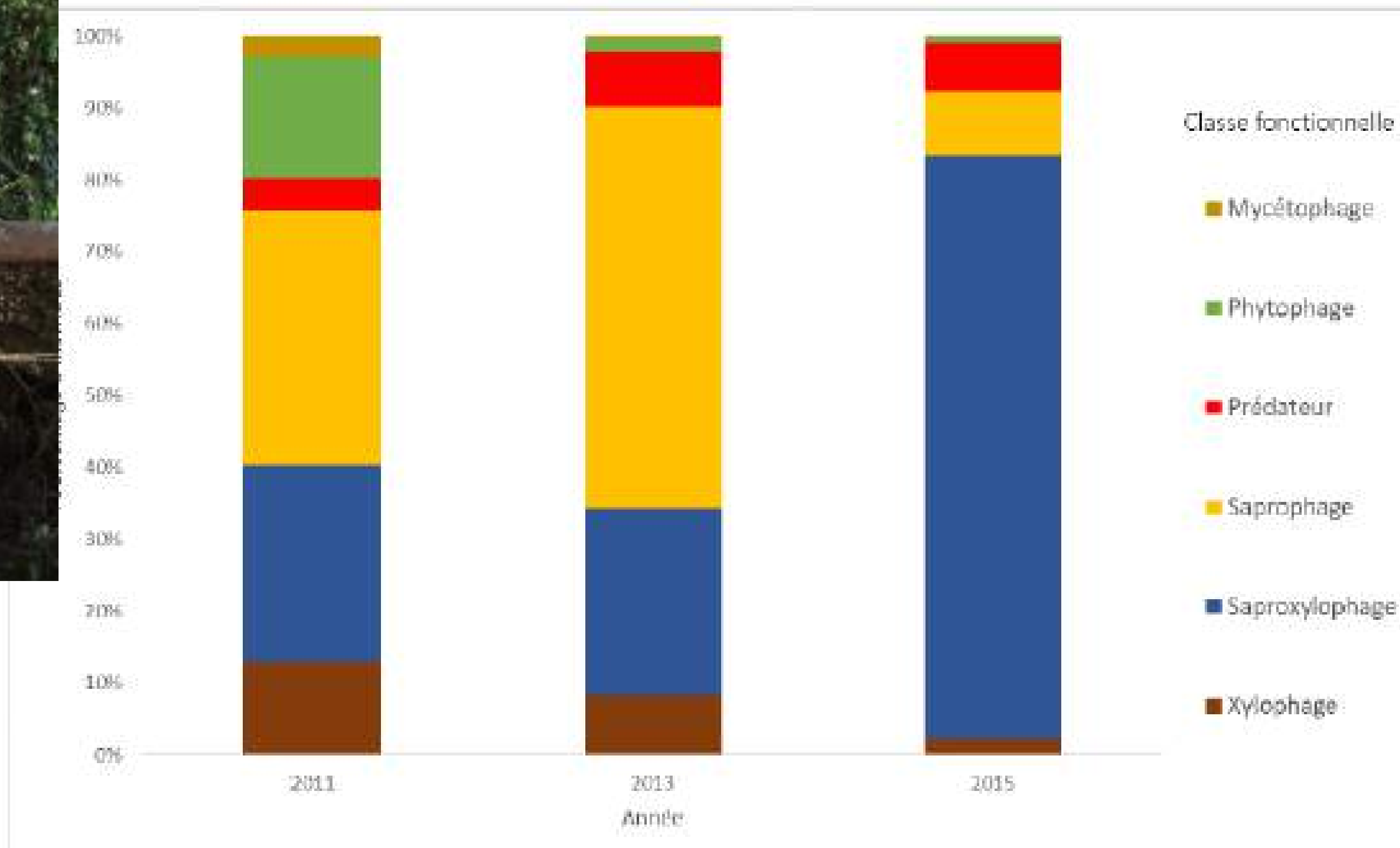
Changes detected on flora



CA with Carpobrotus plots (from 2010 to 2014) and indigenous vegetation plots

Changes detected on arthropods – preliminary results

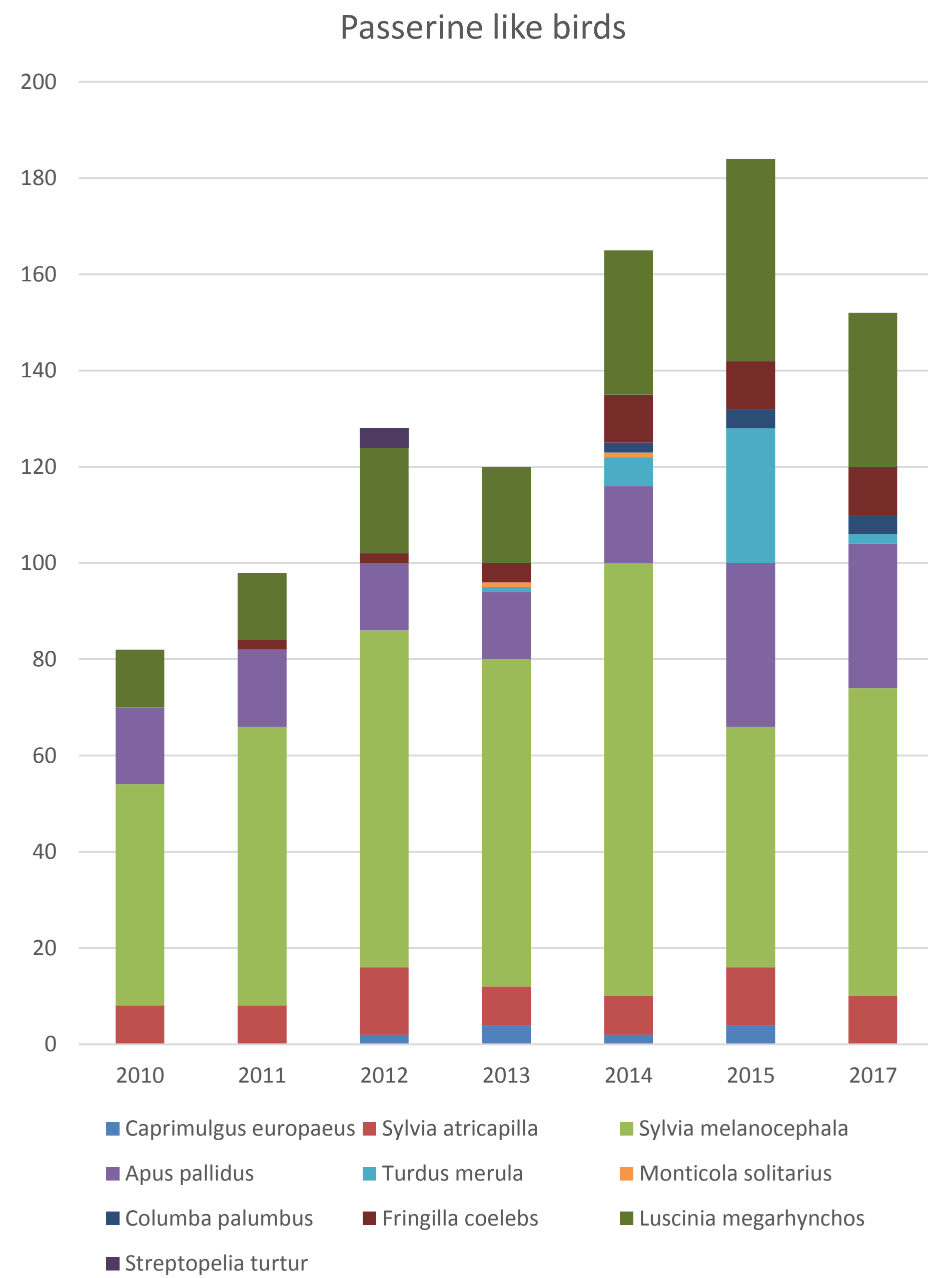
Poly-traps – flying insects



Changes detected on bird populations

RATS: potential predation of eggs and juveniles

Monitoring by PAI: abundance index by number of breeding pairs



Changes detected on bird populations

RATS: potential predation of eggs and juveniles

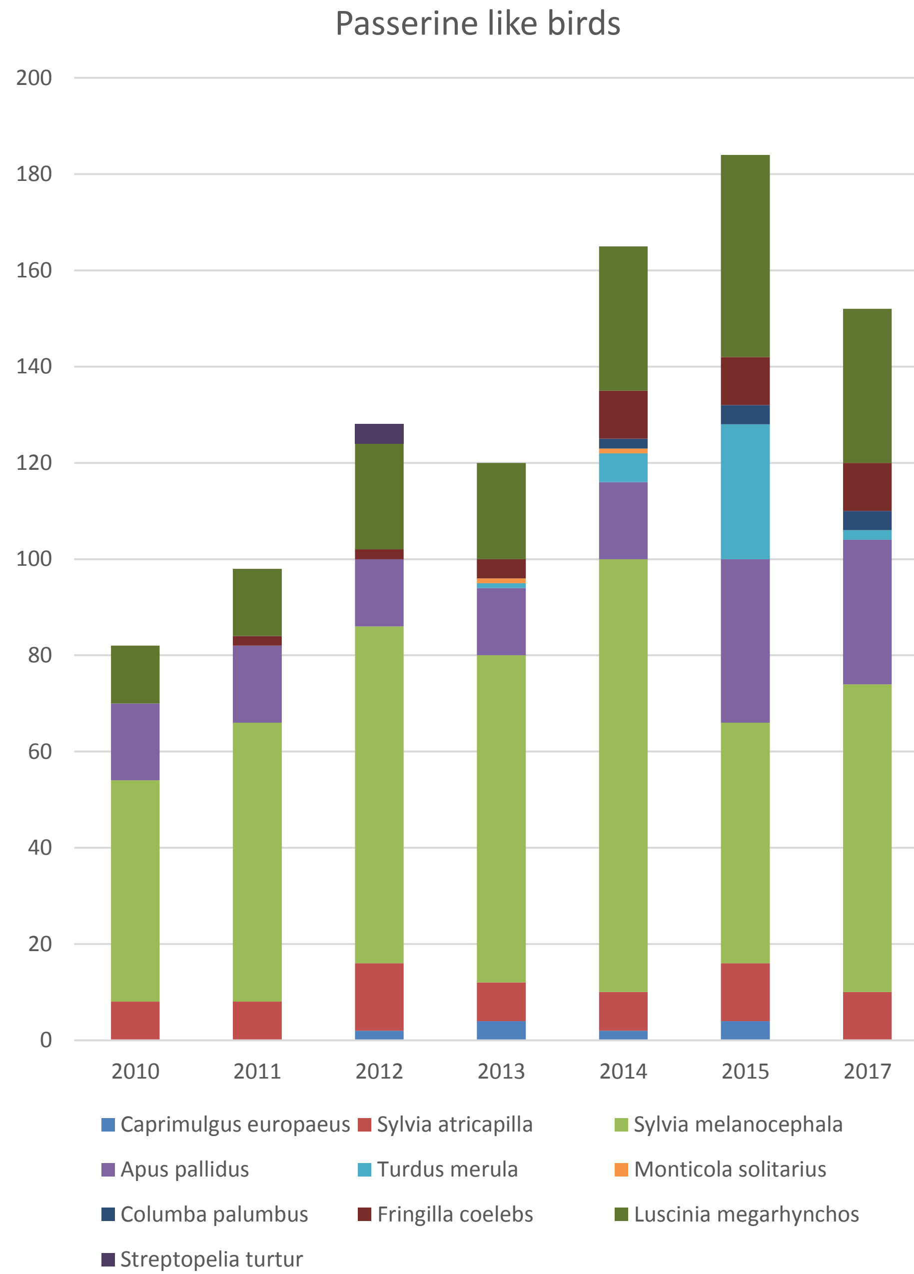
Monitoring by PAI: abundance index by number of breeding pairs

Sylvia melanocephala

Abundance: +49% btw 2010 - 14

Abundance: -20% btw 2014 - 15

Abundance: +16% btw 2015 - 17



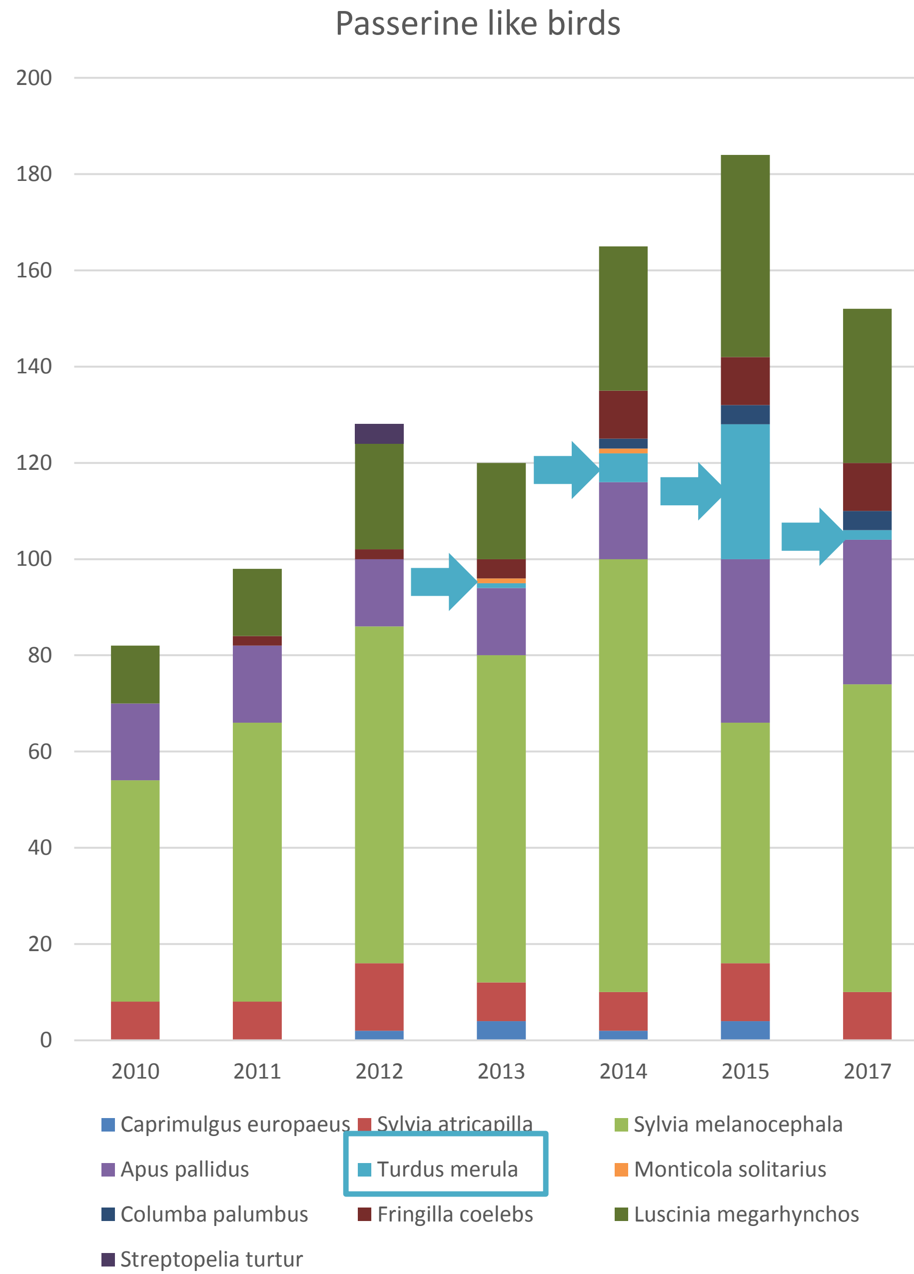
Changes detected on bird populations

RATS: potential predation of eggs and juveniles

Monitoring by PAI: abundance index by number of breeding pairs

3 new species

Turdus merula



Changes detected on bird populations

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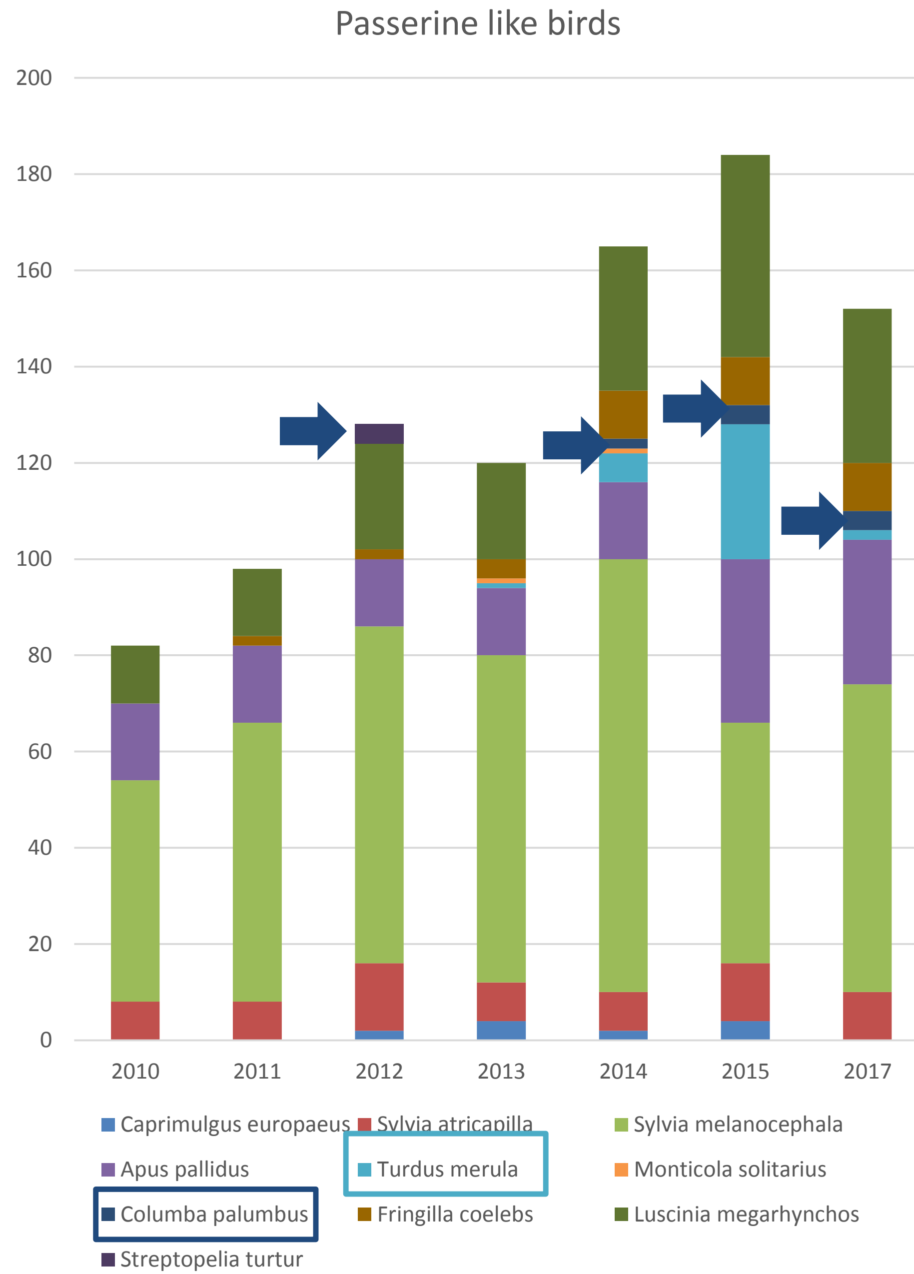
3 new species

Turdus merula

Columba palumbus



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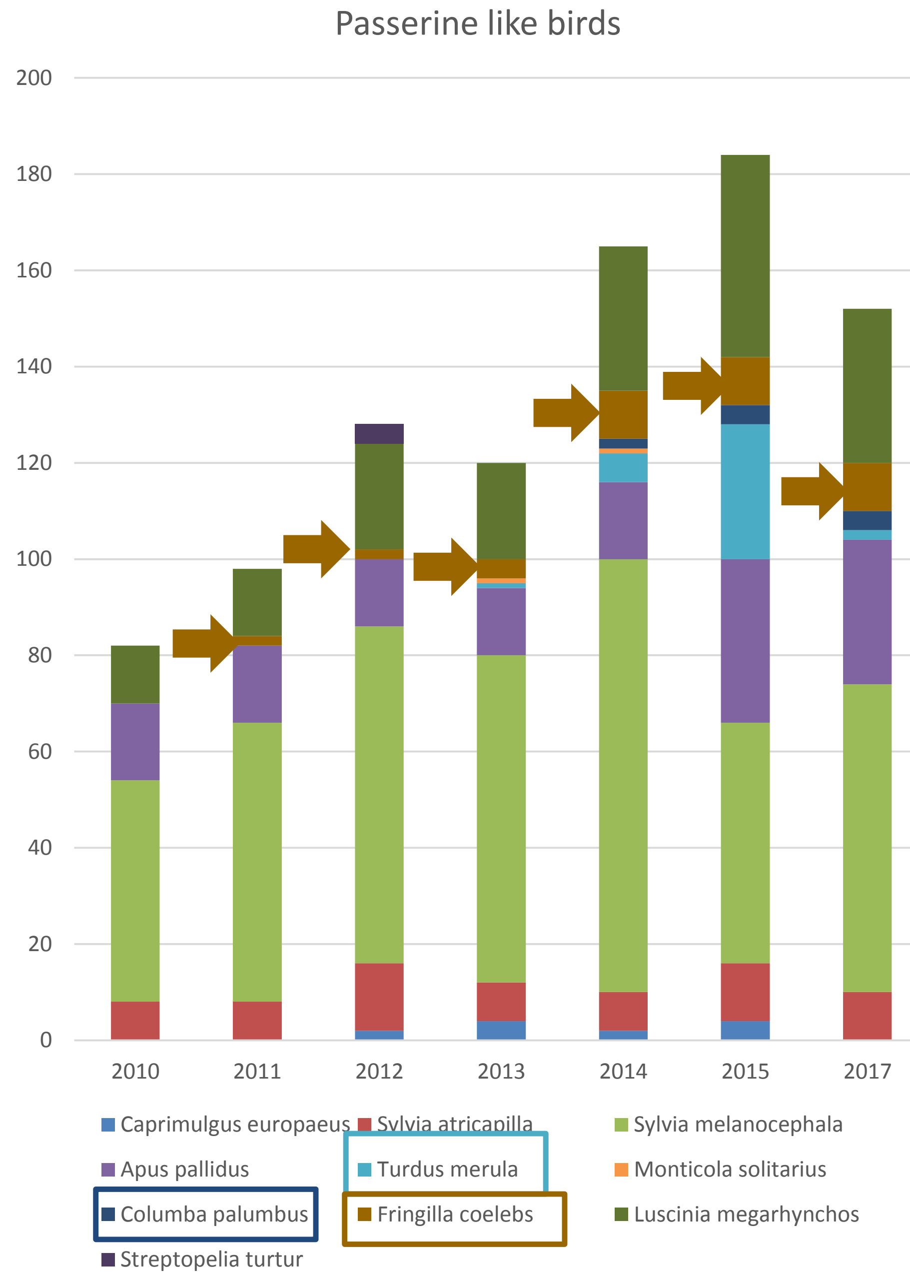
Turdus merula

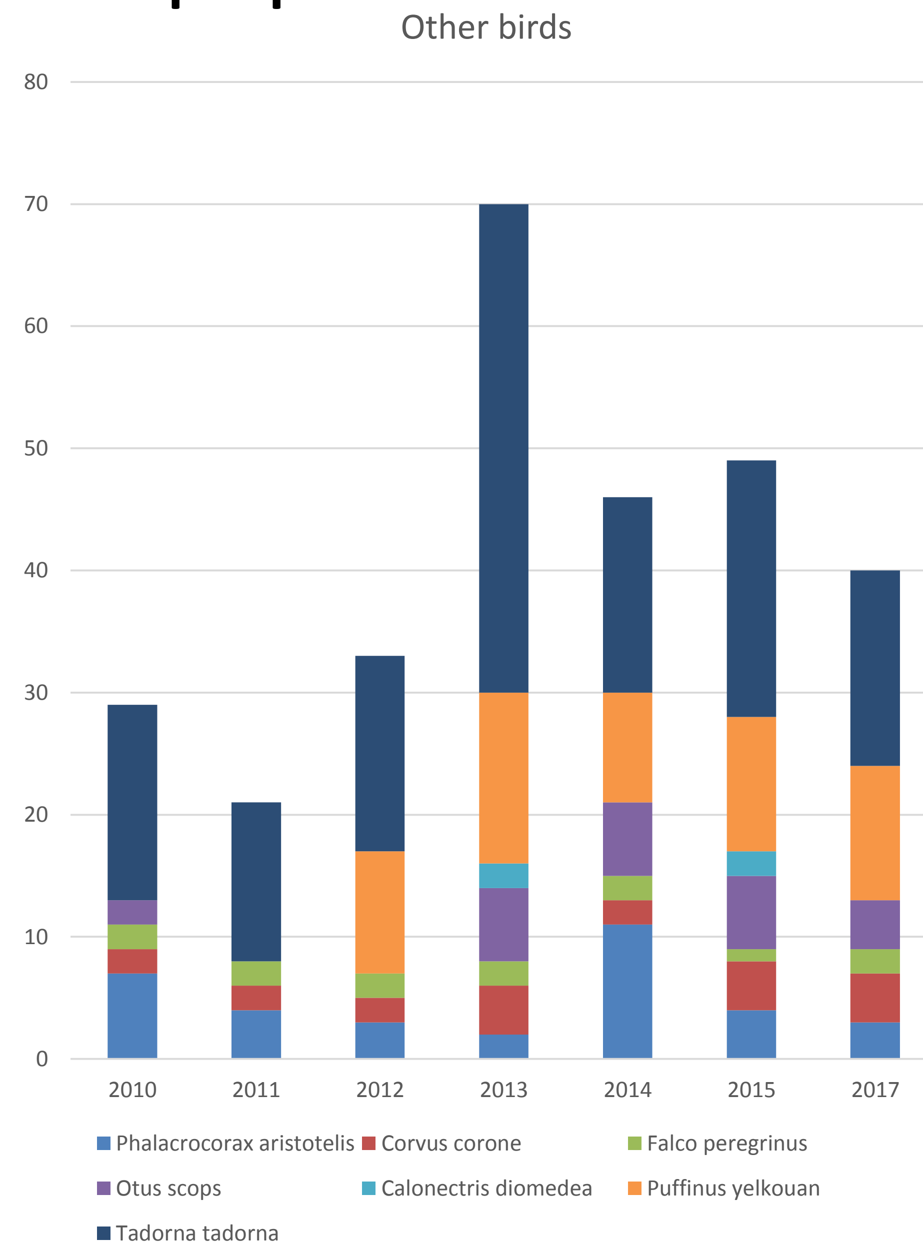
Columba palumbus

Fringilla coelebs



Changes detected on bird populations

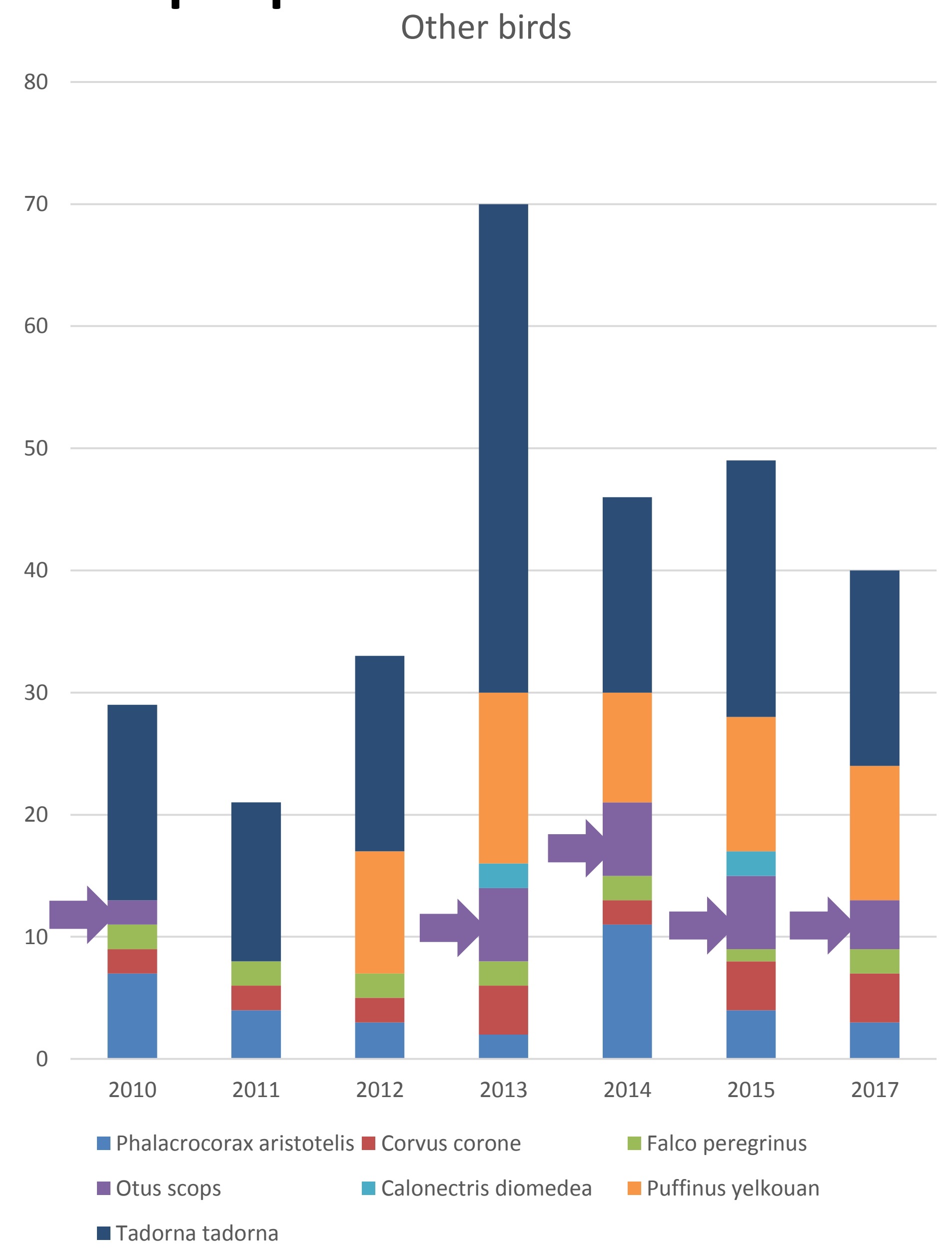
Phalacrocorax aristotelis
Corvus corone
Falco peregrinus



Changes detected on bird populations

Phalacrocorax aristotelis
Corvus corone
Falco peregrinus

Otus scops



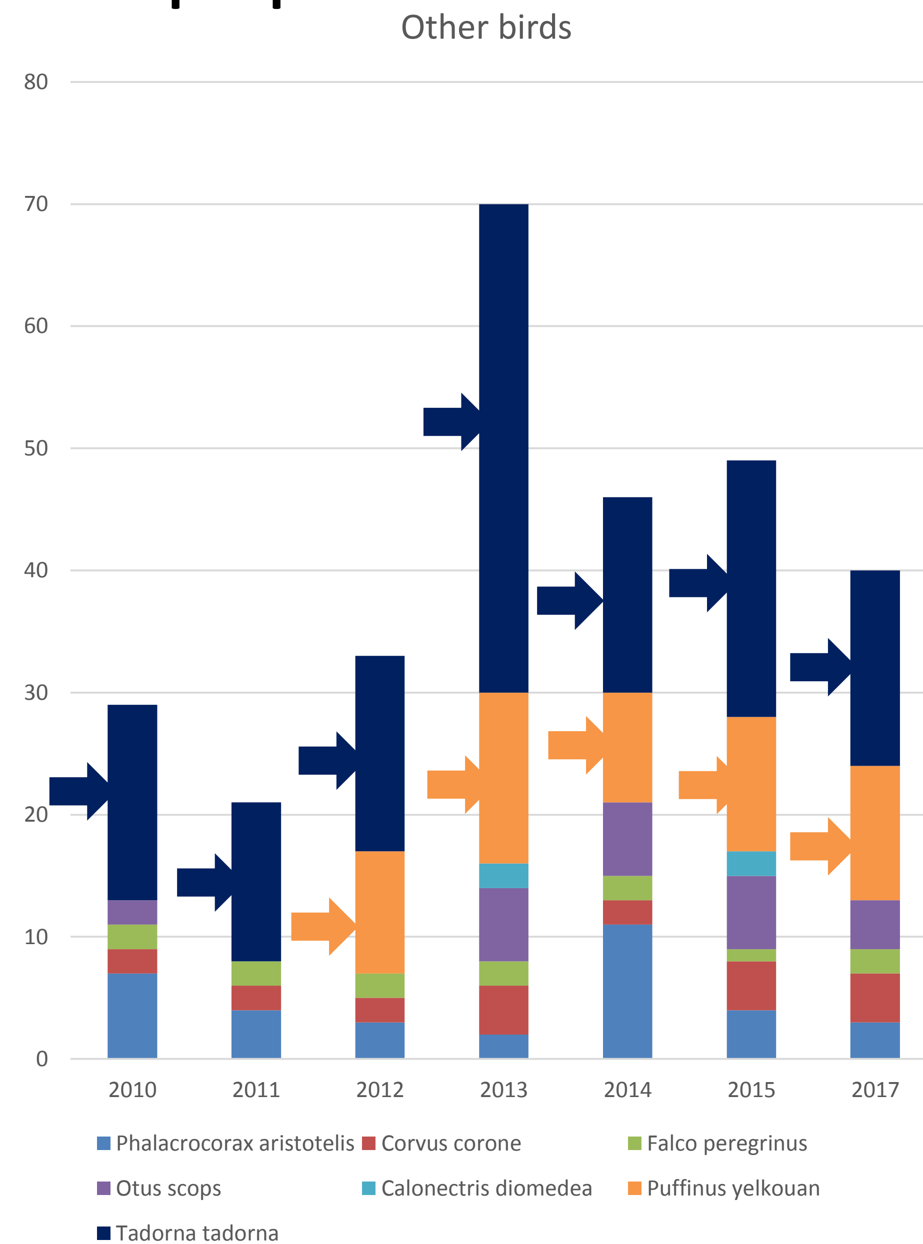
Changes detected on bird populations

Phalacrocorax aristotelis
Corvus corone
Falco peregrinus

Otus scops

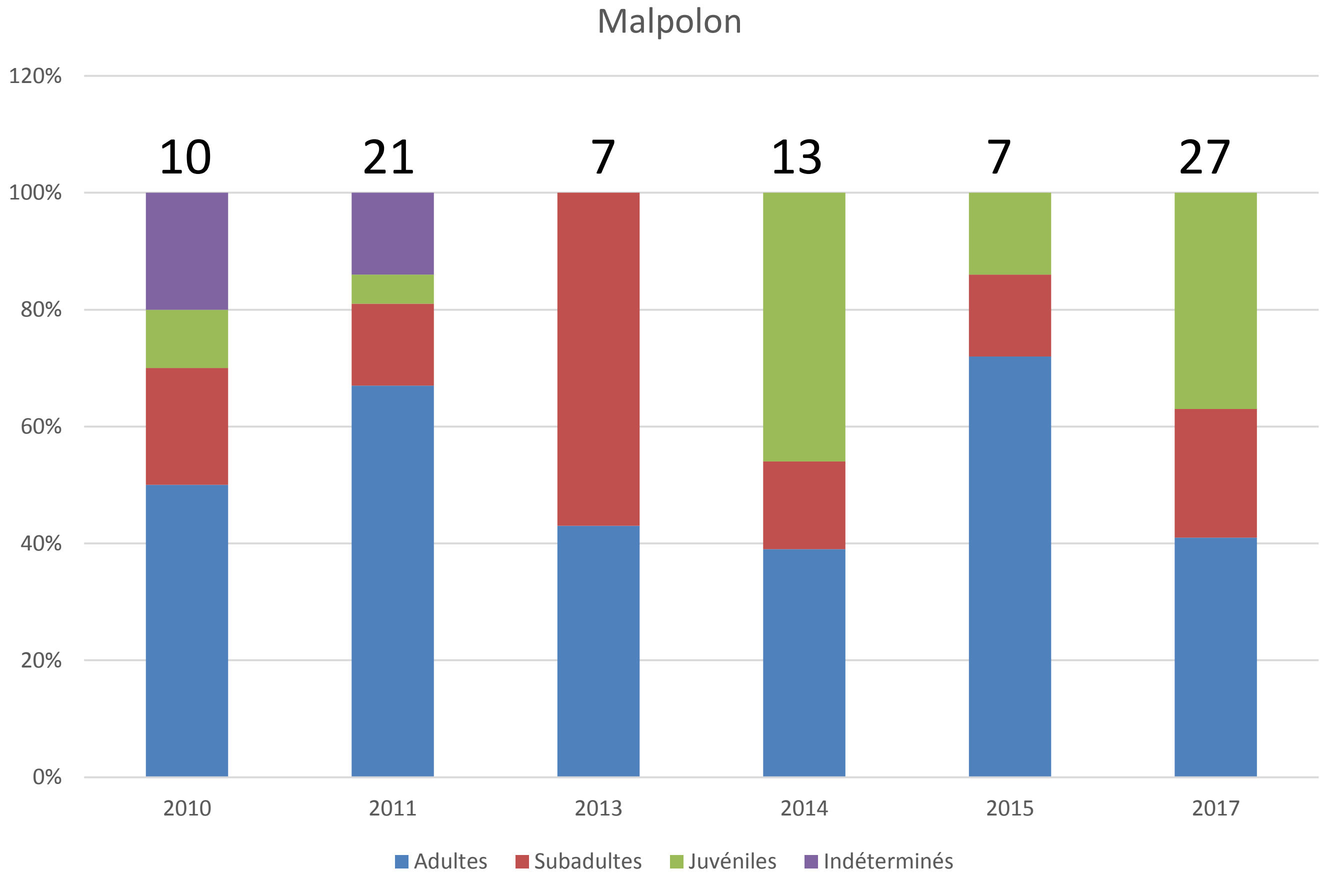
Calonectris diomedea

Puffinus yelkouan



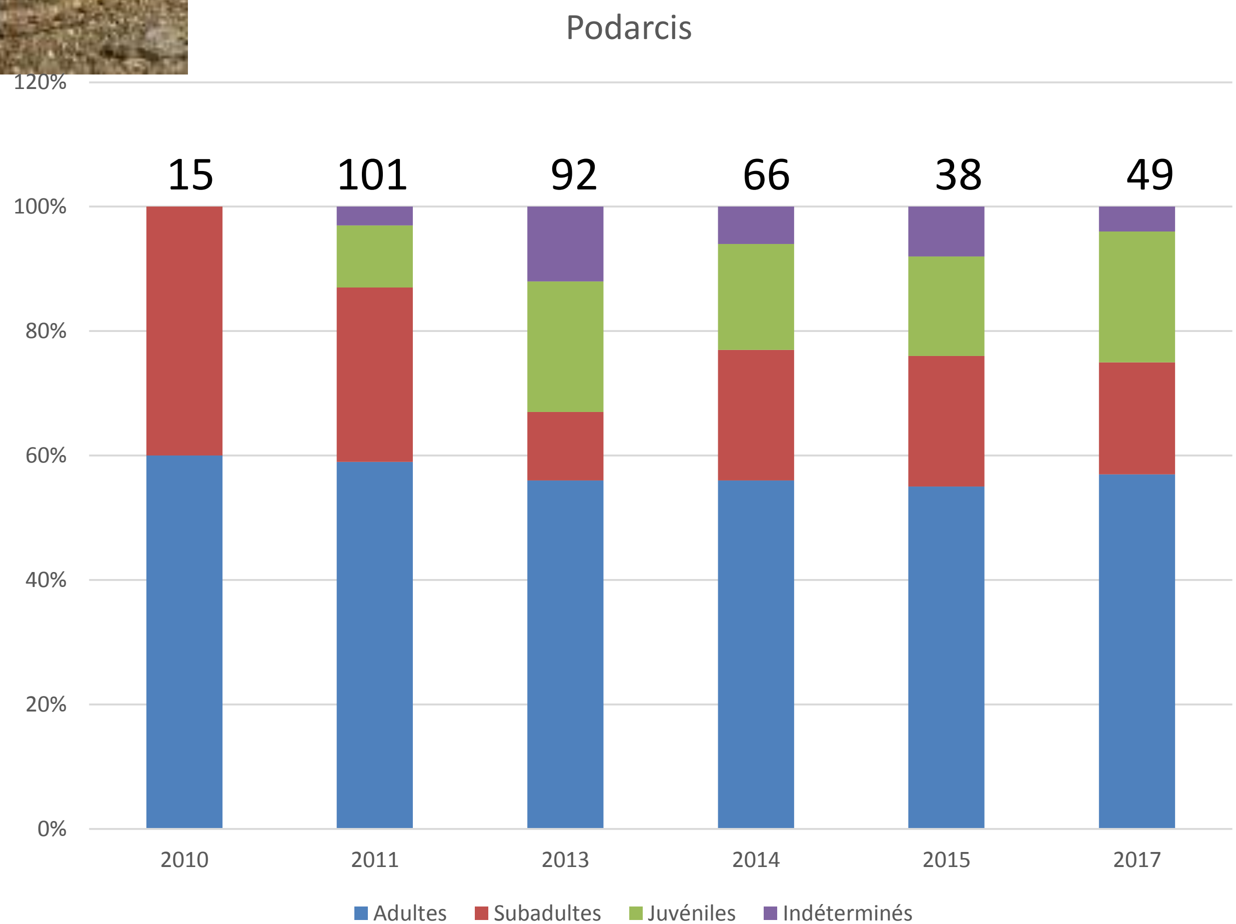
Changes on reptile populations

Malpolon monspessulanus



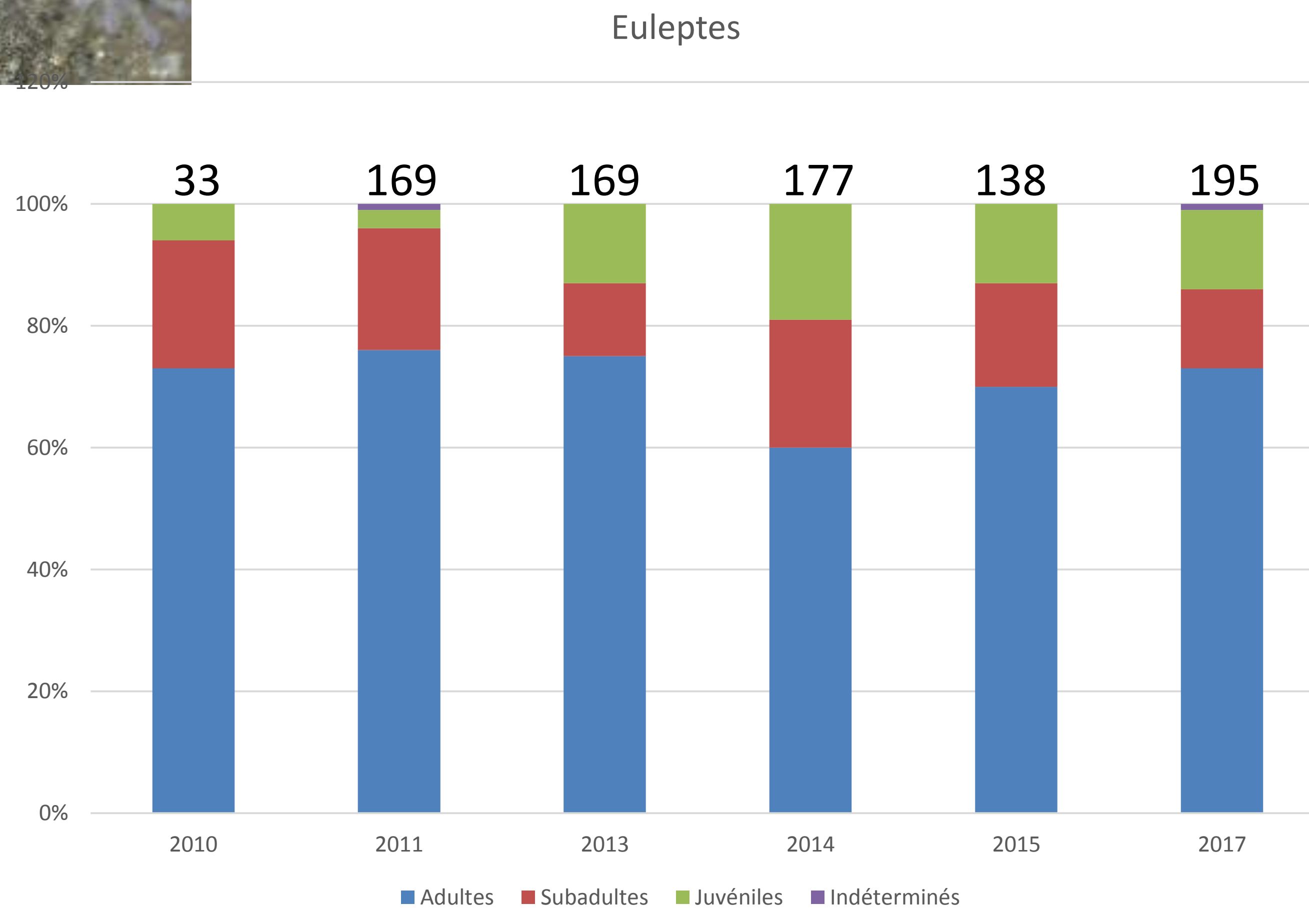
Krebs et al. 2015

Changes on reptile populations



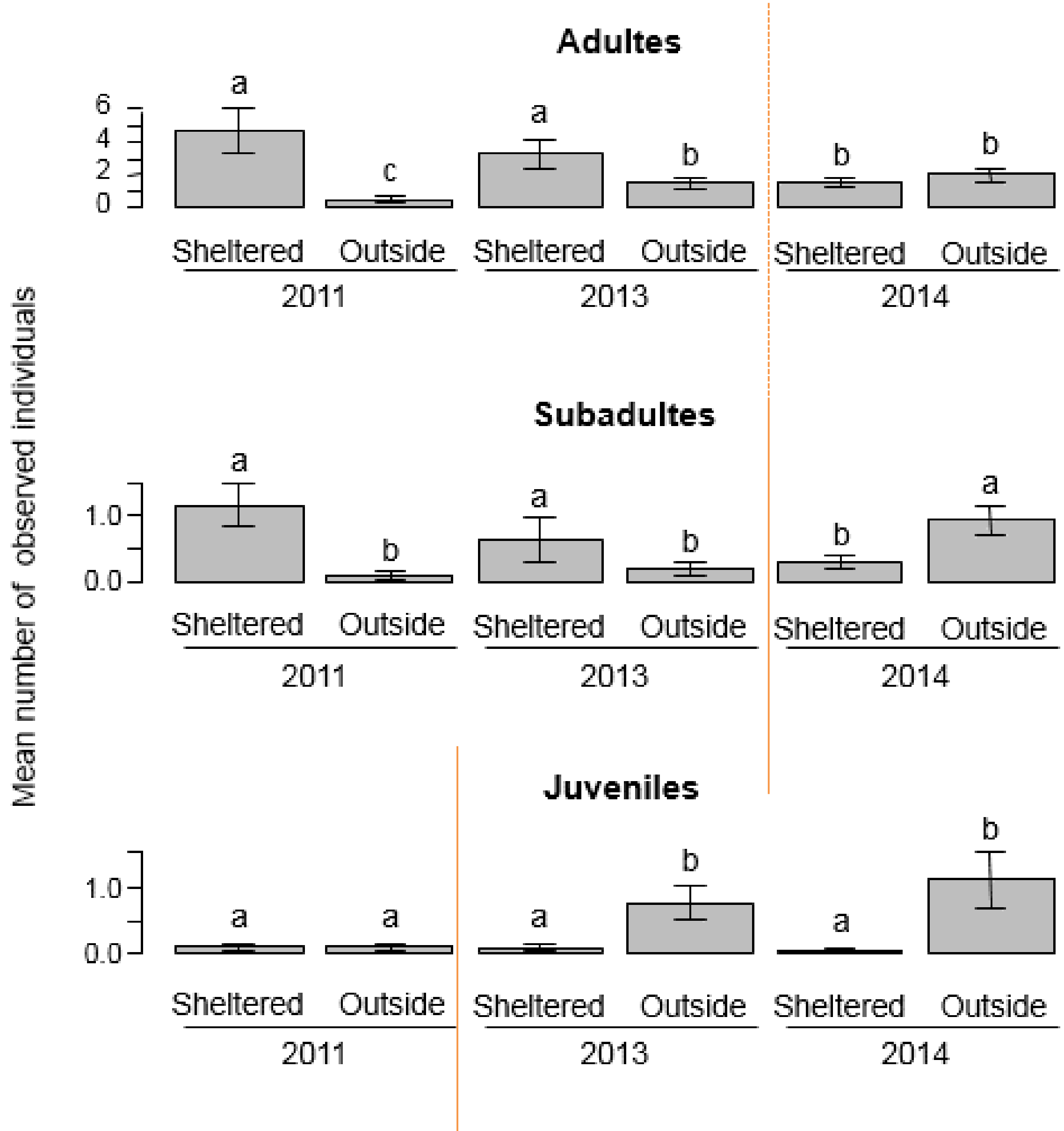
Krebs et al. 2015

Changes on reptile populations



Krebs et al. 2015

Changes on reptile populations



Krebs et al. 2015

Working hours and costs

Rat eradication (Sept. 2011- June 2012)

	# WORKING HOURS	COST in €
Pre-monitoring studies	To be evaluated	
Opening vegetation paths	**1,408** hours (44 days – 4 pers)	
Setting of trapping grid	**624** hours (13 days- 6 pers)	
Trapping (step 1)	**810** hours (8 days – 18 pers)	
Poisonning (step 2)	**637** hours (6 days -14 pers)	
TOTAL	**3,479 WORKING HOURS**	**255,000**

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TOTAL	**3,479 WORKING HOURS**	**255,000**

Carpobrotus eradication (Nov. 2011 – Dec. 2012)

	# WORKING HOURS	COST in €
Carpobrotus inland (2011)	**408** hours (52 days – 1 pers)	12,300 euro
Carpobrotus on cliffs (2012)	**1,400** hours (50 days- 3.5 people)	101,200 euro
TOTAL	**1,808 WORKING HOURS**	**113,500**

What now?

Long term biocontrol / monitoring

POISONNING STATIONS

Until Dec. 2012..............Poison line kept as a ”barrier”

2012-2019.....................20 permanent poisonning stations

Sept. 2014....................Large scale trapping (340 stations)

Sept. 2014-2016...........Regular controls of bait stations

Sept. 2016....................Large scale trapping (340 stations)

What now?

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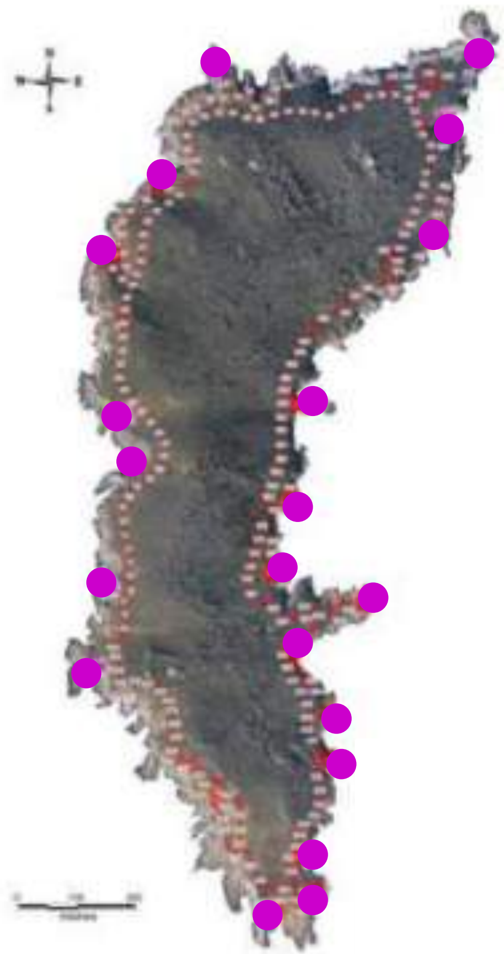

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Port-Cros~1km

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Long term biocontrol / monitoring

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Until Dec. 2012..............Poison line kept as a ”barrier”

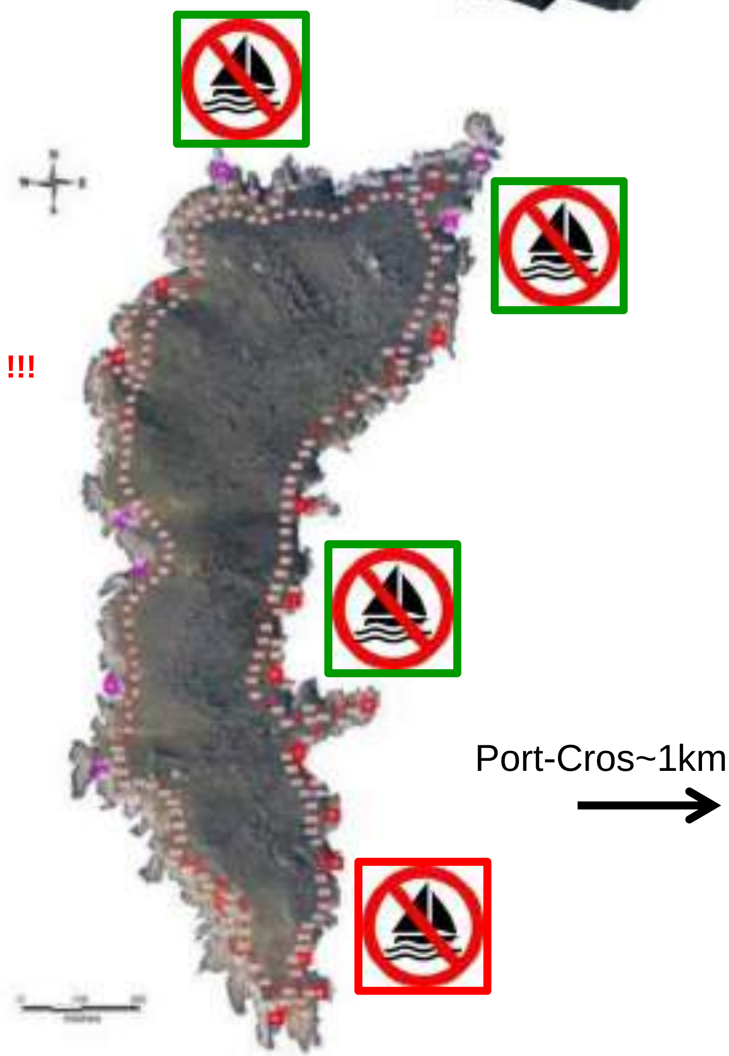
2012-2019.....................20 permanent poisonning stations

Sept. 2014....................Large scale trapping (340 stations)

Sept. 2014-2016...........Regular controls of bait stations

Dec. 2015 .... First traces of rats in Regular controls of bait stations !!!

→ 2016 toxic bait stations every month
+ March 2016 – 25 traps for 3 nights – no catch
+ Sept. 2016 – 52 traps for 3 nights – 1 catch



What now?

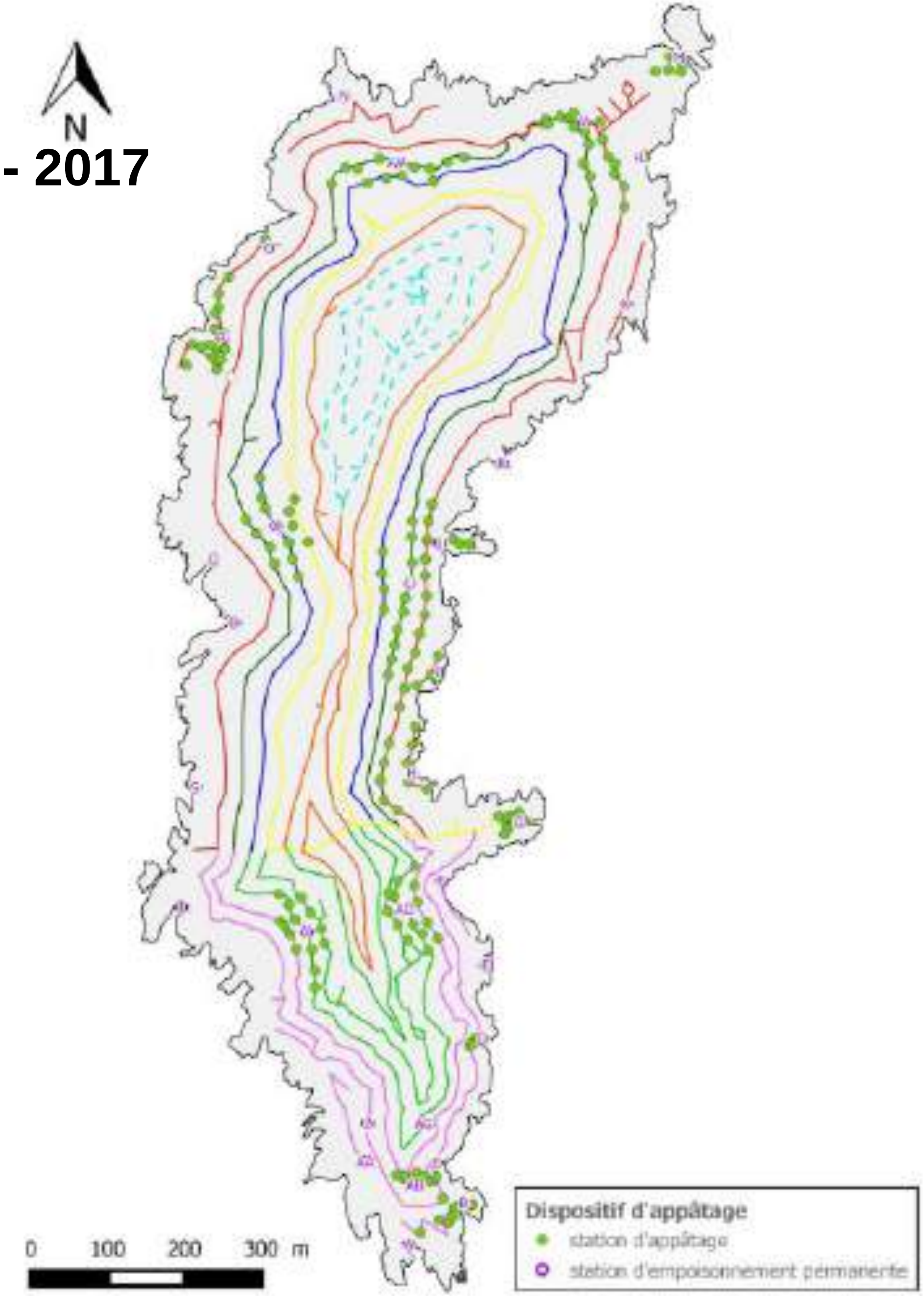
Long term biocontrol / monitoring - 2017

POISONNING STATIONS

→ 2017 toxic bait stations every 3 weeks

control date	05/04	27/04	17/05
# controlled stations	116	109	127
# with traces of rats	67	31	54
% with traces of rats	58	28	43

control date	07/06	27/06	18/07
# controlled stations	145	154	145
# with traces of rats	76	61	49
% with traces of rats	52	40	34



Dispositif d'appâtage en place depuis mai 2017

What now?

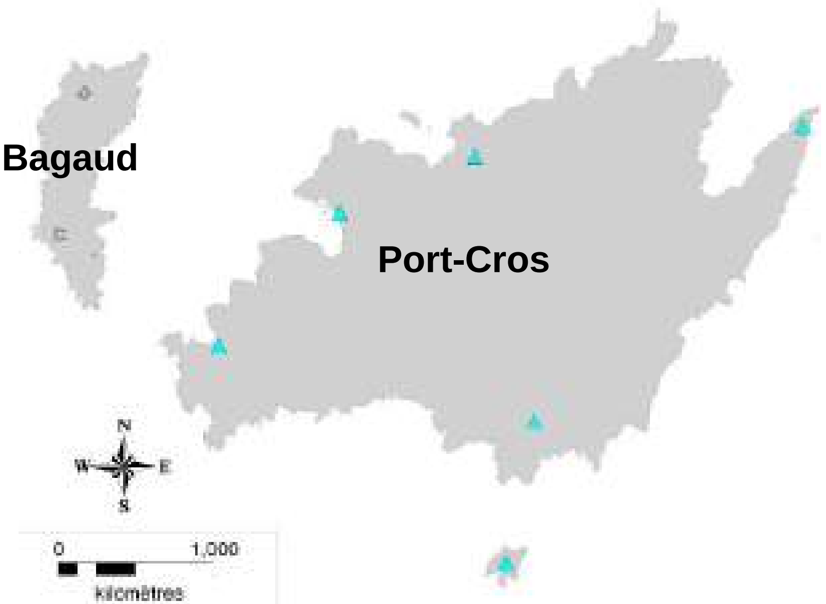
Long term biocontrol / monitoring - 2018

POISONNING STATIONS

→ 2018 toxic bait stations every months + a few good nature traps

→ After summer 2018 - Large scale trapping (340 stations)

GENETIC SAMPLES: survivors or invaders?



Genetic samples from black rats on nearby Port Cros Island and islets

How have we been doing all of this?

Financial partners

FONDATION TOTAL

Conservatoire du littoral

Overall coordination

imbe

Port-Cros Parc National

Scientific framework

imbe

INRA SCIENCE & IMPACT

Technical partners for scientific monitoring

imbe

Port-Cros Parc National

Dream

REPTIL'VAR

Technical partners for management operations

Port-Cros Parc National

Porquerolles Conservatoire Botanique National Méditerranéen

Domaine du Rayol Le Jardin des Méditerranées

pim

imbe

NATUROscope Centre d'étude et d'initiation à l'environnement

Research on Global Changes→ elise.buisson@imbe.fr

There have been many island restoration projects carried out globally to date, but few removing rats successfully with a community of the size of St Agnes and Gugh. This project provides a successful case study and we hope will inspire other island communities in tackling invasive species threatening their wildlife heritage.

The purpose of this talk is to set out how the project engaged and communicated with the community through the various stages of the project, and how the communities views were collected and used in the design and delivery of the project to establish and maintain community support. There is a summary of key outcomes at the end.

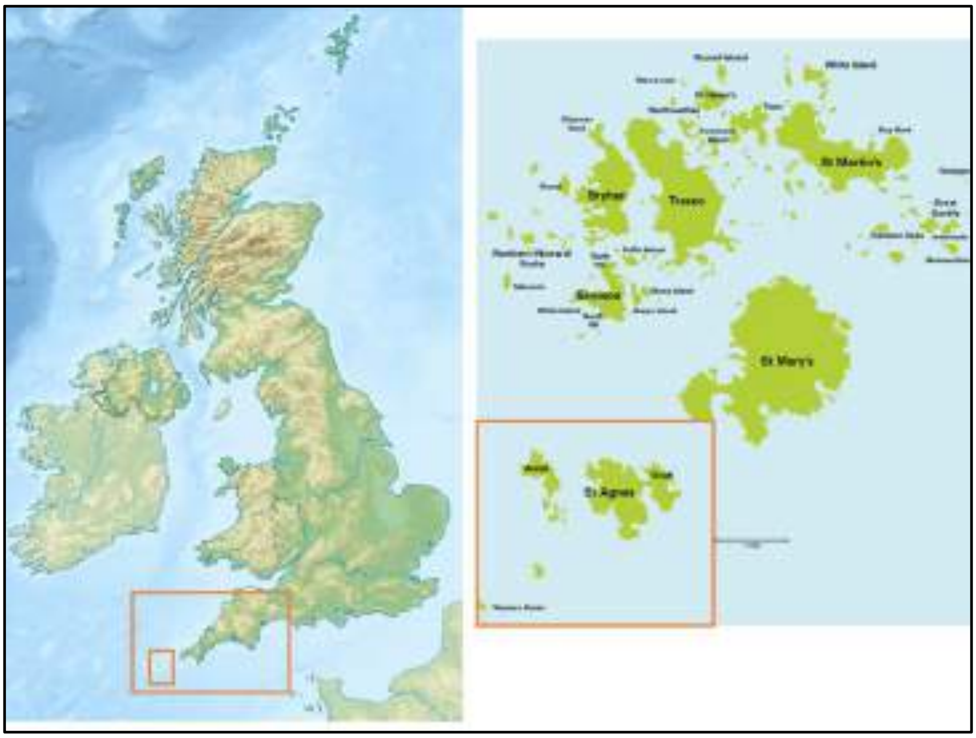
Project partners:
Co-ordinating beneficiary RSPB.

Associated beneficiary Isles of Scilly Wildlife Trust (IoSWT) who manage most of the seabird colonies on the Isles of Scilly as nature reserves.

Co-financiers: Duchy, Natural England (NE), Isles of Scilly Area of Outstanding Natural Beauty (IoS AONB), Isles of Scilly Bird Group (ISBG).

Main Funding partners: LIFE Nature and the Lottery Fund.

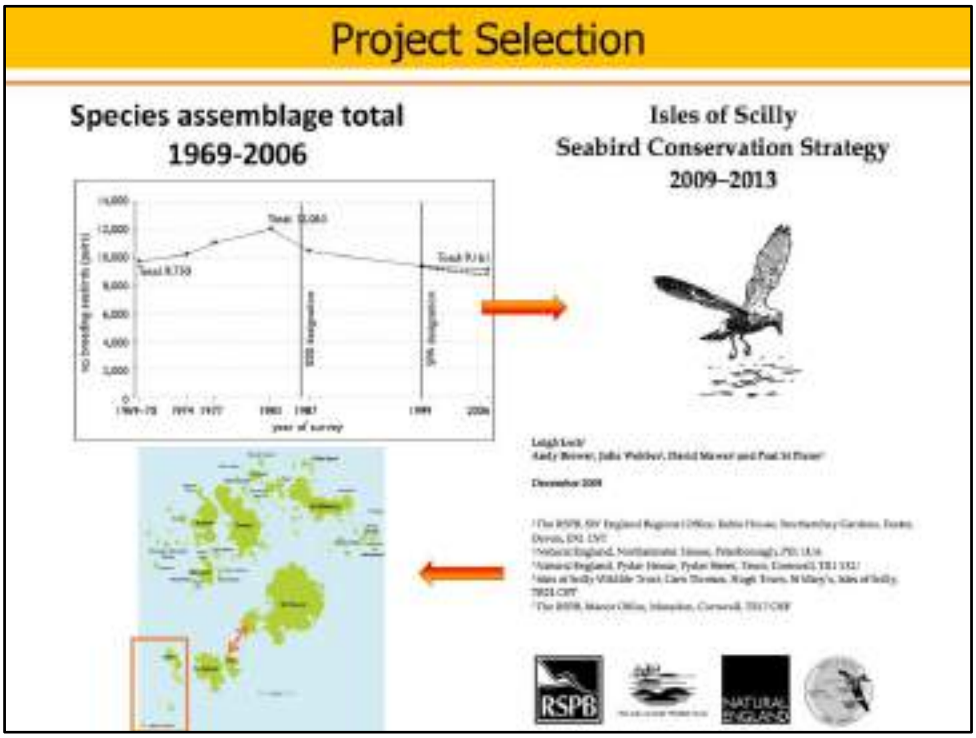
I would especially like to mention both Jaclyn Pearson the Project Manager and Elizabeth Bell the rat removal contractor (Wildlife Management International Ltd [WMIL]) for providing much of the information and pictures in this talk.



Located 45 km of the south west tip of Cornwall, UK

- Focus of work was on two inhabited islands St Agnes and Gugh (142 ha) which have around 85 residents
- Main habitats are farmland, ponds, maritime heathland and grassland, rocky shores and sandy beaches.
- There is one pub, a Post Office and shop, two cafes, campsite, two community halls and a number of farms.
- Brown rats were accidentally introduced to the Isles of Scilly from shipwrecks in the 1700’s, and were widespread and abundant across both islands (McCann 2005).

The two key beneficiaries or species were Manx shearwater and European storm petrel



Background to the 'Isles of Scilly Seabird Recovery Project'

The seabirds on the Isles of Scilly have been monitored for a long time and this work has highlighted their importance. This:

- resulted in their designation as an SPA, part of the Natura 2000 network in 1999
- Also highlighted a worrying decline of over 20% in 25 years

A group of organisations concerned about these declines decided to write a seabird strategy highlighting the key issues and identifying potential actions to try and improve the seabirds status.

- The main driver for many species was thought to be changes in food source available at sea, however for burrow-nesters the distribution of breeding birds was being controlled by rats, which was something that could be potentially addressed locally on the islands.

The strategy, highlighted the previous work that had been carried out to remove brown rats on some of the uninhabited islands and the problems of maintaining some of them as rat-free due to incursions from the inhabited islands. Rats appearing on Annet, the most important seabird island within the Isles of Scilly, identified the potential scale of the threat. The need to assess the potential to remove brown rats from inhabited islands was identified as a key action and St Agnes and Gugh was identified as being potentially the best place to start because:

- They had an existing tide swept, deep water channel of over 1.1km providing significant natural biosecurity
- It removed the threat from rats re-invading Annet, the most important seabird island, which had an incursion in 2004
- Provided the opportunity for Manx shearwaters and storm petrels to breed successfully on the cleared inhabited islands because of the existing otherwise suitable habitat.

As this would be one of the largest community-based island restoration projects for rats ever attempted at the time, support and involvement of all the community on St Agnes and Gugh would be critical:

- In 2010 there was a workshop facilitated by the IoS AONB, on the main inhabited island of St Mary's, to initially sound out the views of key residents. They agreed that a feasibility study should be commissioned and they helped identify the various questions or issues that need to be addressed.

- WMIL were commissioned to carry out a feasibility assessment and produce an operational plan. This required the inclusion of a social and economic evaluation (via interview questionnaires) to identify the level of community support for the project, the operational requirements, including identifying information on dissemination requirements and community, contractor and project staff activities required to deliver a successful project.

Keys findings were:

- It was feasible to remove the brown rats and this needed to be done using a ground-based operation using rodenticide
- Rats were having a significant impact on the community and businesses on theses islands
- There was 100% collective support from he community for the project to seek funding, not solely for seabirds but also for benefits to people
- The community wanted people working on the project to be easily identifiable (orange hats), bespoke training on waste management, involvement in various elements of the project including the school, wanted regular updates during the project e.g. through face-to-face contact and newsletters as well as updates on funding schemes beforehand
- The community also identified two main risks which were that economic benefits may take time and only apply to some community members, and that inconvenience may reduce the support for the delivery phase due to the intrusive nature of the work.
- Poisoning non-target species, particularly pets was one of the main concerns and operational measures to remove these risks were thoroughly explained.

Between the end of the feasibility phase (summer 2011) and project start (January 2013) two key strands of work were undertaken:

1. Making a successful funding bid which was achieved by establishing a formal project management structure and nominating a lead partner to make the bid, which was the RSPB. The funding processes required further targeted engagement with key audiences providing the community further input into design and giving the project a clear idea of how we were going to engage with the community though the key phases of the project, and what dissemination activities would be required.

2. Maintaining communication with the islanders on St Agnes and Gugh was achieved through an interim communications plan with a few press releases sent, information was placed on websites, and the RSPB and AONB delivered education activities to maintain face-to-face contact with the community.

St Agnes Representative' (a resident and Councillor) Richard McCarthy who became a member of the steering group was a key person during this period, helping to communicate with the islanders on a more personal level and getting islanders to sign up to the project.

At the start of the project a range of preparatory, public awareness and dissemination actions were carried out:

- RSPB started employing project staff and suitable contractors (WMIL), who were required to have excellent communication skills as they would provide the essential face-to-face contact with the community

- A website was produced and a Facebook page started
- Logo’s, leaflets and newsletters were designed and produced (project logo design was selected by the school children)
- Signs we located at the quay, the shop, and the campsite on St Agnes as well as on other islands.

- Awareness raising events for visitors started promoting the project including RSPB Date with Nature, the Wednesday afternoon IoSWT wildlife trip with St Agnes Boating and as well as guided walks and talks carried out by project staff and supporters
- Complimentary actions supported by Lottery Funding targeting young people began, including regular activities with the school. This included annual events to celebrate NATURA 2000 day

Community conservation actions to reduce food and harbourage for rats in preparation for eradication included:

- Beach cleans were supported by the project
- The 'apple day' activity was a great success, helping remove a potential food source for rats and winning a LIFE photographic competition
- Bonfire night celebrations were supported by the project and removed much harbourage, the last main community event before baiting started.

- Bespoke waste management advice and support was provided by the project which provided many residents with rat proof bins and composters reducing food for rats during the eradication
- Sheds, livestock pens and paddocks were cleared or adapted by farmers to ensure access in and around buildings to provide full baiting tunnel coverage.
- work not completed was carried out by WMIL and IOSSRP personnel the month before the eradication.

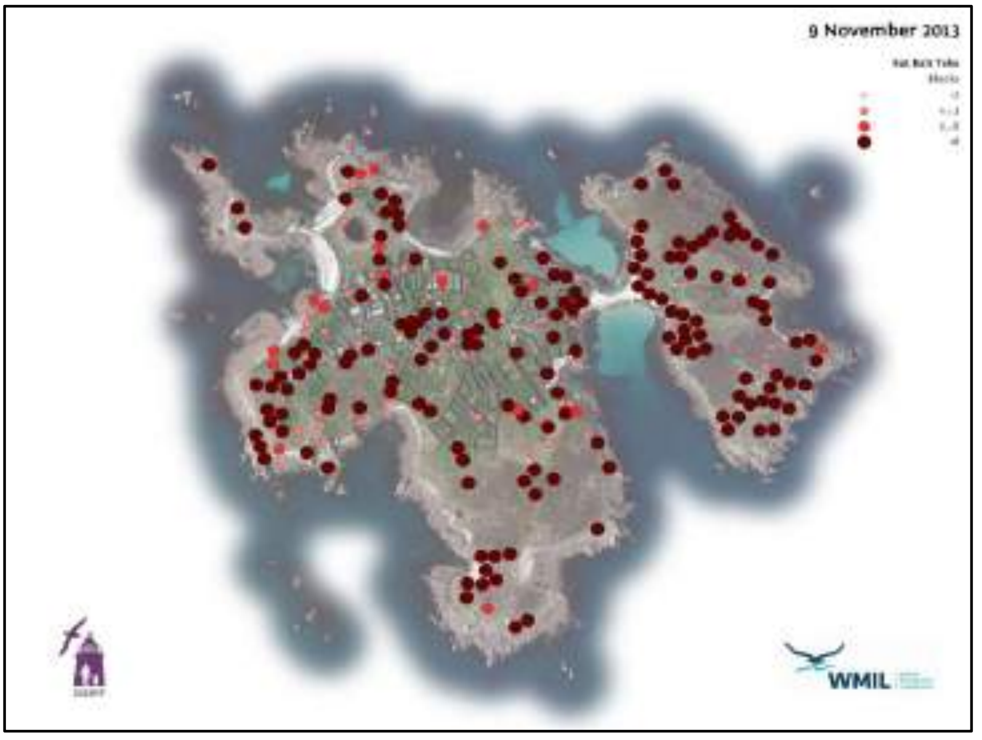
‘

- The project delivered talks about biosecurity risks from boats to all community members regarding and the Harbour Users Group (for all boat users on Scilly).

- Details were collected on any access restrictions for land and properties to help maintain community support through then most intrusive phase of the project.

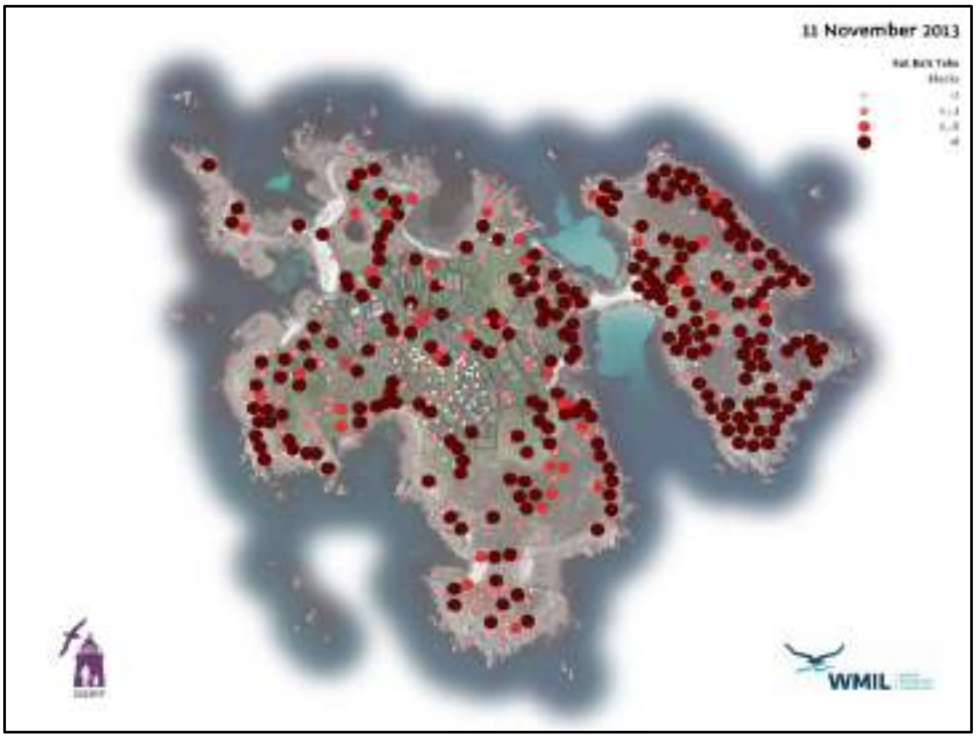
The eradication and short term monitoring phase followed.

- WMIL recruited staff and volunteers to carry out operation.
- The ratters wore orange hats to identify themselves. They provided daily face-to-face contact with the islanders during the removal operation and were introduced via meetings and newsletters.

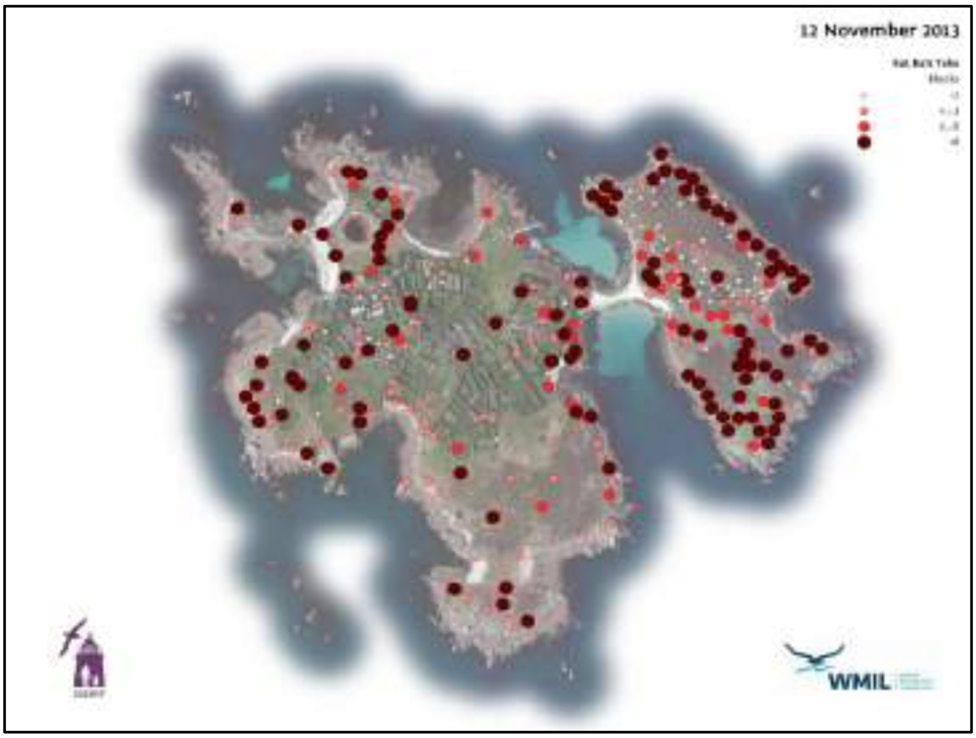


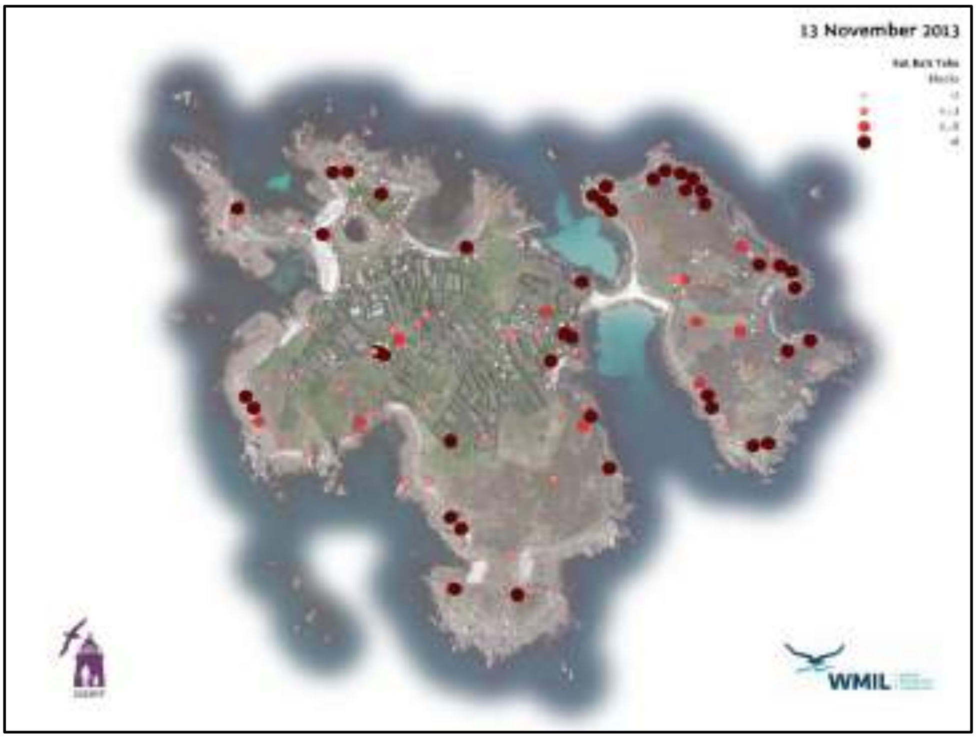
WMIL use GIS technology to monitor real time bait take which was a useful way of disseminating the operational progress to the community and beyond.

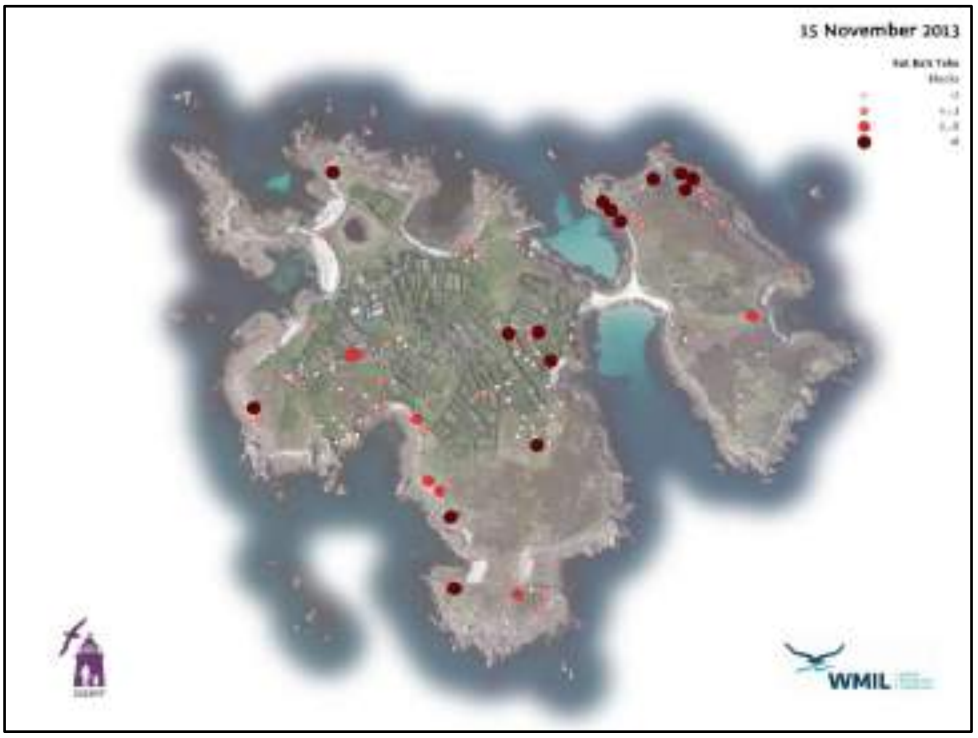
WMIL started on **8 November** and the last rat sign was 22 days later on **30 November.**



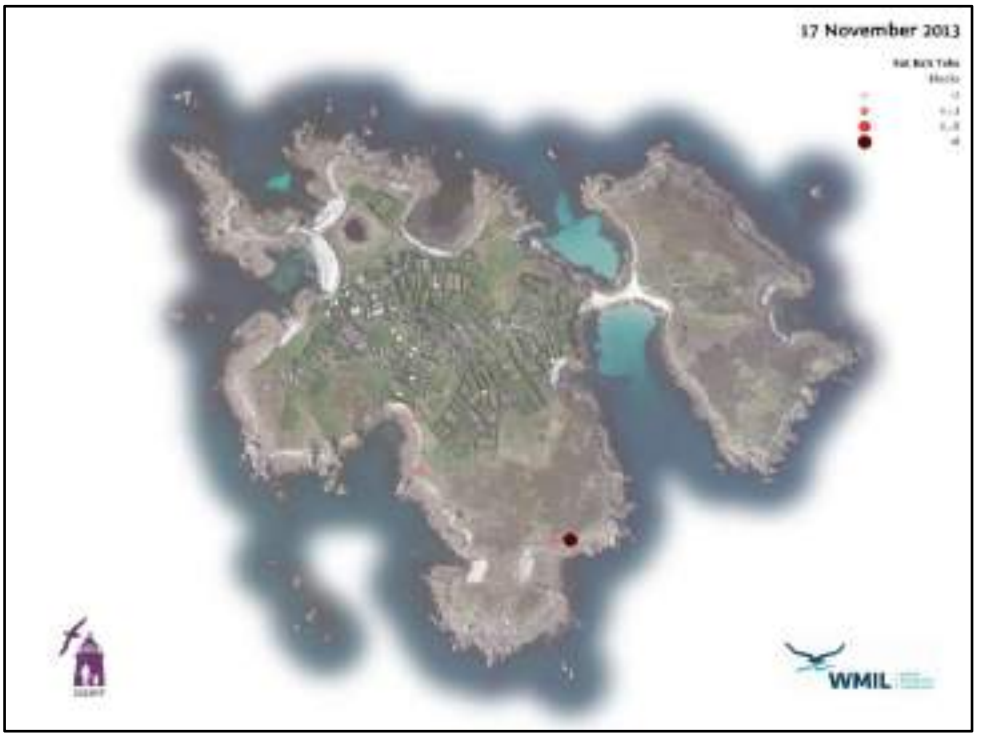
11 November 2013
WMIL


12 November 2013
WMIL


13 November 2013
WMIL


15 November 2013
WMIL

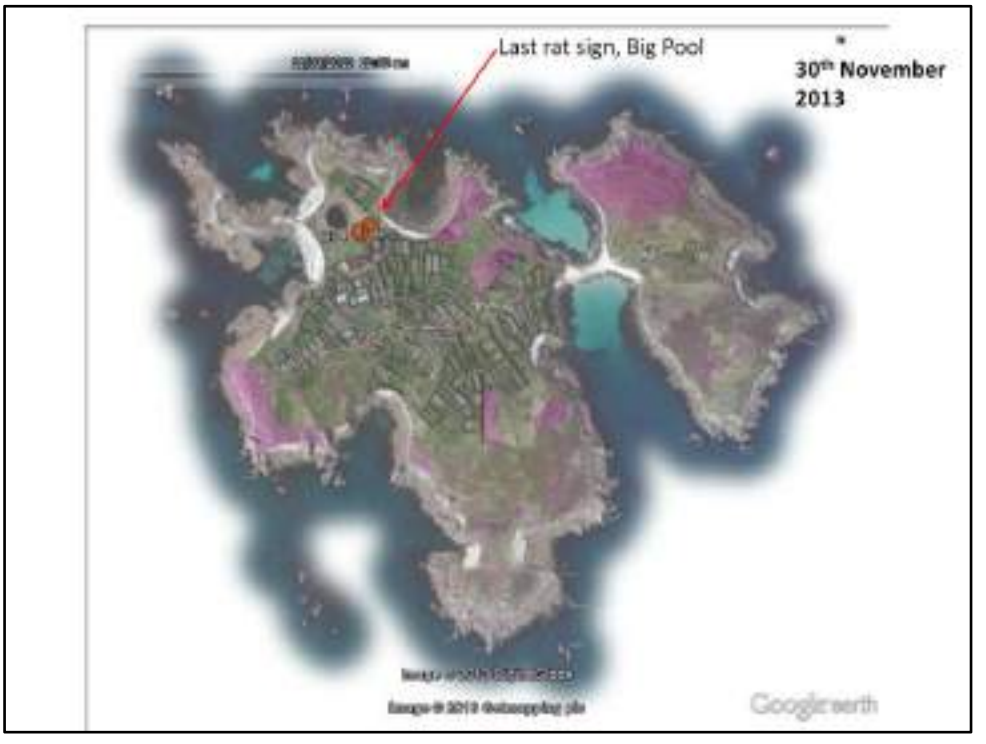

16 November 2013
WMIL


17 November 2013
WMIL


18 November 2013
WMIL


19 November 2013
WMIL


22 November 2013
WMIL



There was no rat-sign after three and a half weeks.

WMIL trained IOSSRP personnel and the initial group of community members so they could be involved in the remaining project phases.

Post eradication monitoring and final check phase

During this phase:

- IOSSRP personnel trained 12 community members to assist checking the permanent monitoring stations and surveillance from 'rat on a rat' (ROAR) calls. (a 24 hour hotline based at IOSWT where anyone can report potential rat sign).

- There were 28 ROAR's during this project phase, the community members assisted the IOSSRP team

- The community was continually updated through face book, newsletters and face-to-face meetings

Community members also joined IOSSRP personnel to assist Manx shearwater and storm petrel breeding surveys and ‘evening chick-check walks’.

During this time monitoring of the key species showed breeding success for the first time in living memory post eradication for both Manx shearwater and European storm-petrel

and numbers of the endemic Scilly shrew increased on these islands.

At the end of two years WMIL came back for three months to carry out the final and St Agnes and Gugh at the end of which these two islands were declared rat-free. This was celebrated with the community by holding a Rat free party.

The community was again interviewed by WMIL and project staff at this stage to identify if there had been any changes in the views of the community now that the main phases of the project had been completed. A questionnaire was completed by WMIL and IOSSRP staff using semi-structured interviews and compared to the results in 2012.

The findings included:

- There was a 47% increase in the number of residents feeling sympathetic towards seabirds and none of the community felt that the removal had any negative impact on species.
- 100% of the community were happy with the project procedures and methods. When asked if it was helpful having WMIL team members assisting 'rat removal ready' action 'shed clearance' one person said *"it generated goodwill in the community and got everyone on board with the project".*
- 100% of the community felt that the communication methods were right. Common themes were, 'clear explanation of what we needed to do and when', 'involved everyone and engagement with all children at the school', 'the team was passionate about the cause', 'we felt listened to, as things were altered if we asked them to be'.
- 100% of the community felt the project had positively affected their day-to-day life. A strong theme was they no longer need to worry about rats.
- One theme that stood out was that 'the community was united and not divided in any way, it was a community project'.
- 100% of the population felt the project had benefited the local economy with most of this benefit to certain sectors; agricultural, fishing and particularly tourism and that the benefits had potential to increase.
- 68% of the community felt that their businesses had benefited from the project.
- 17% of the community had developed new products, a farmer explained that '*Apple day had been the catalyst to a new apple juice product and cider products he developed'*
- Publicity generated by the project was also highlighted as an additional benefit particularly for the tourism industry. One community member explained that *'Visitors on his 'wildlife trips' had increased as there has been high publicity of the project combined with interpretation resources so he could offer improved tours"*.

Rat free-status had been successfully achieved however the project working with the community has put in place a range of measures to maintain the islands as rat free into the future.

- A total of 32 community members signed up to carry out the ongoing biosecurity monitoring
- There tasks include checking permanent monitoring stations once a month, maintaining biosecurity on boats and freight, checking on any potential rats signs and assisting the mainland rat response team if a rat is found.
- These would be supported by the IoSWT and RSPB.
- A group of RSPB volunteers were recruited and trained on the mainland to act as a rapid response team in case rats ever reappeared.

Project outcomes

90 St Agnes and Gugh residents involved in project, the entire community

68% of the community felt that businesses had benefited from project.

47% increase in the number of residents feeling more sympathetic to seabirds and the challenges they face.

8 million people read about the project

6 million viewers saw the project on TV,

1,600 young people engaged in seabird activities.

300 volunteers contributed 24,000 hours

360 community members from other inhabited islands attended talks, walks and activities.

32 'Seabird Heritage Volunteers' continuing bio-security and tasked with keeping the island 'rat- free' for the future.

113 Manx shearwater and **15** storm petrel chicks fledged, the first in living memory

There were a number of factors that made this project successful, including:

- Support built over a long period of time
- Good project planning and delivery
- Good communication and community involvement through the various stages of the project development and delivery
- Positive, flexible and approachable staff, contractors and volunteers

Thank you

The eradication of *Carpobrotus spp.* on the Island of Giannutri (Tuscan Archipelago, Italy): insights and first results from a low-impact approach

Lorenzo Lazzaro[1], Giulio Ferretti[1], Renato Benesperi[1], Bruno Foggi[1], Francesca Giannini[2], Paolo Sposimo[3], Michele Giunti[3]

[1] Department of Biology, University of Florence, Via La Pira 4, 50121 Firenze, Italy.
[2] National Park of the Tuscan Archipelago, Portoferraio, Italy
[3] Nature and Environment Management Operators s.r.l., Piazza M. D'Azeglio 11, 50121 Firenze, Italy.

resto con Life
Island conservation in Tuscany, restoring habitat not only for birds
www.restoconlife.eu
info@restoconlife.eu

NEMO

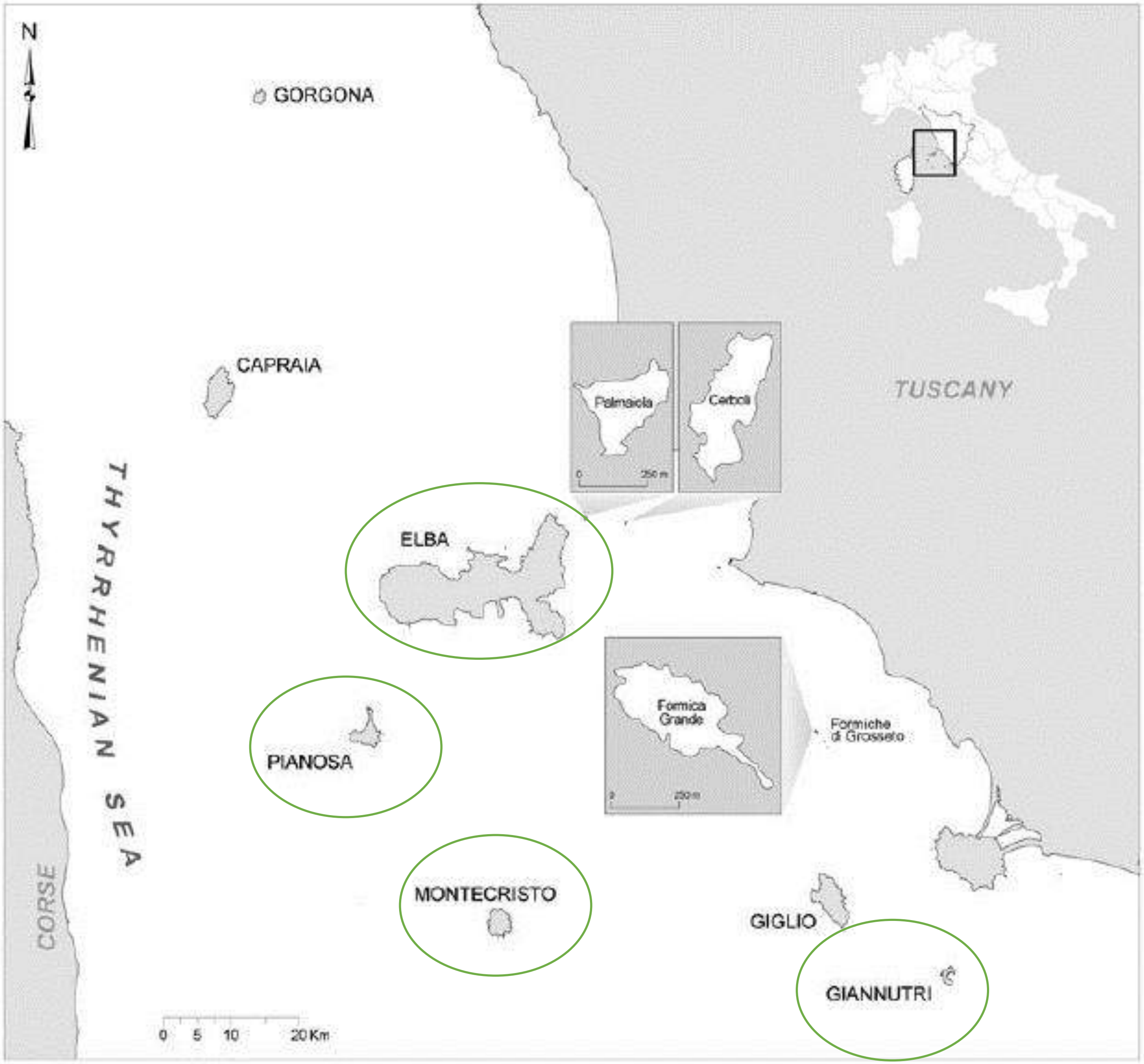
WORKSHOP
RESTORATION OF ISLAND ECOSYSTEMS
FROM 29TH TO 31ST JANUARY 2018
PENICHE - PORTUGAL

CALL2013: LIFE+ Nature: project developed on NATURE2000 sites focused on habitat or species listed in EU directives.

Broad-spectrum approach: EUR 3,123.67 million

The project aims the re-naturalization of complex systems altered in part by human intervention, so as to protect sea birds and avifauna; endemic reptiles and typical Mediterranean habitats

The Tuscan Archipealgo National Park (TANP)



GIANNUTRI

- Eradication of *Carpobrotus* spp.
- Control of *Mesembryanthemum cordifolium, Senecio angulatus, Opuntia monacantha*

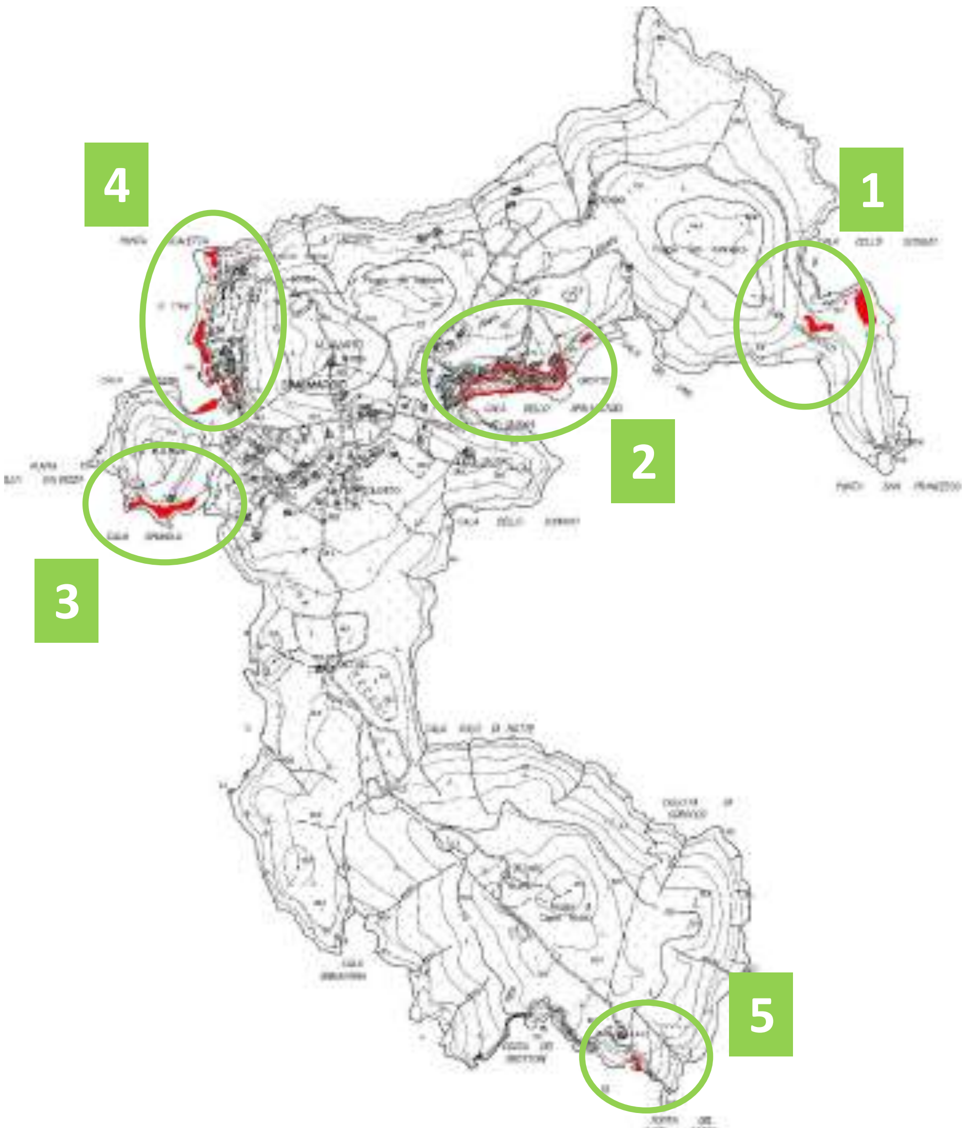
- Restoration of habitats covered by the thick mat of *Carpobrotus* planting native species such as *Euphorbia dendroides, Juniperus phoenicea* subsp. *turbinata* and *Pistacia lentiscus*

- Dealing with resident and seasonal population

  Increasing public awareness,

  Suggest/Provide alternative ornamental plant species

Carpobrotus spp. on Giannutri: 5 sites of invasion



1. P.ta S.Francesco (4800 m^2)
2. Cala Spalmatoio (ca 1000 m^2)
3. Cala Maestra – P.ta Scaletta (5000 m^2)
4. Cala Ischiaiola (3200 m^2)
5. Grottoni (150 m^2)

Tot about 14000 square meters

Carpobrotus spp. on Giannutri: 5 sites of invasion

Carpobrotus spp. on Giannutri: 5 sites of invasion




Treatment trials in 2012

Treatment trials:

- Chemical treatment with various concentrations of:
  - **Gliphosate**
  - **Triclopyr (+ Fluoroxipir)**
  - **Picloram**
- Manual removal
- Covering with mulching sheets

Treatment trials in 2012

Landscape fabric mulching sheets resulted more effective and more resistant than common black nylon mulching sheets

The final plan for the eradication

2014 – approval of the EU Life project "RESTO con LIFE"

2015 – accurate survey of *Carpobrotus* presence on the Island and preparation of the eradication plan

Choice of 2 different treatments (manual removal and covering with mulching sheets), mainly basing on :

- Inclination of the substratum
- Presence of non-target species (especially if conservational interest)
- *Carpobrotus spp*. stand surface and cover ~100%

About 14000 square meters of *Carpobrotus* mats

- Mostly treated with mulching sheets (about 90 %)
- Remaining 10 % manually treated, and mostly accumulated under the mulching sheets

Manual Removal – spring/summer 2016

Covering with mulching sheets - spring/summer 2016

Covering with mulching sheets – spring/summer 2016

September 2016 – removing the mulching sheets

Due to a rainy season the sheets we removed after 4 months instead of only 2 months

November 2016 – removing the mulching sheets

May 2017 – removing the mulching sheets

May 2017 – looking for seedlings and resprouts

In may 2017 we found ONLY about 100 seedlings, almost only in the areas manually treated. Few more in June 2017

Next survey in may 2018

A breakdown of time and costs

Main intervention :

- 11-20 may + 25 may to 1 June – 18 days
- 4 to 5 people (80 pp*days)

Monitoring of the mulching sheets

- Further 2 days in June and July – 4 pp*days

Removing the mulching sheets

- September 2016 – 3 pp * 5 days – 15 pp*days

Plantation of demonstrative native plants in the settlement

November 2016 – 4 pp * 3 days – 12 pp*days

INCLUDING FURTHER INSPECTION ON THE ISLAND TO MONITOR THE RESULTS AND TO LOOK FOR RESPROUTS AND SEEDLINGS

TOT 140 pp*days

TOTAL COST ABOUT 100.000 Euros

MEAN COST OF ABOUT 7 EUROS PER SQUARE METER

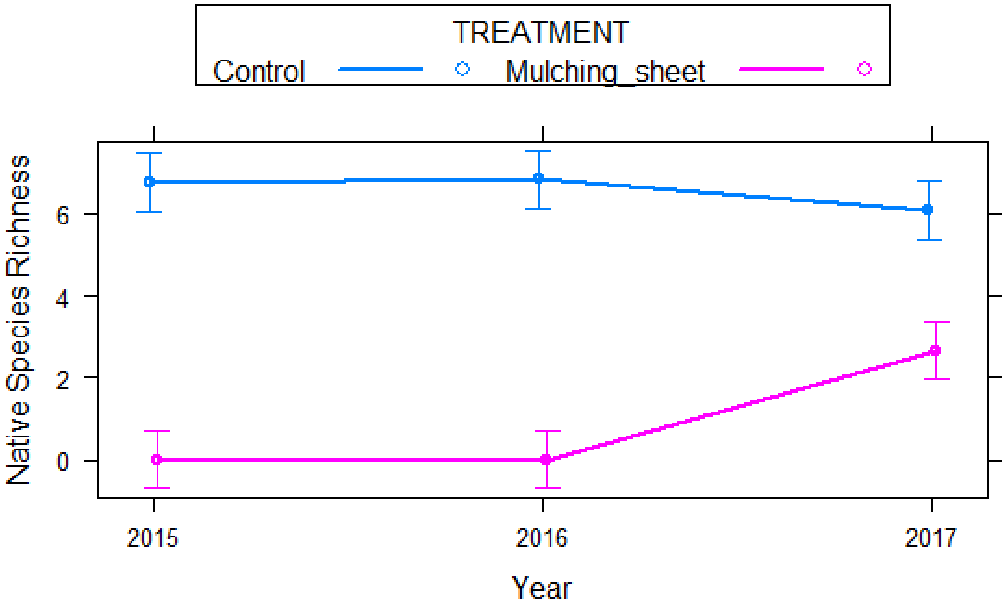
Monitoring the effects of the treatments

- Rocky cliffs
  - Manual Removal
  - Mulching Sheets
  - Control
- Loose soil
  - Mulching Sheets
  - Control

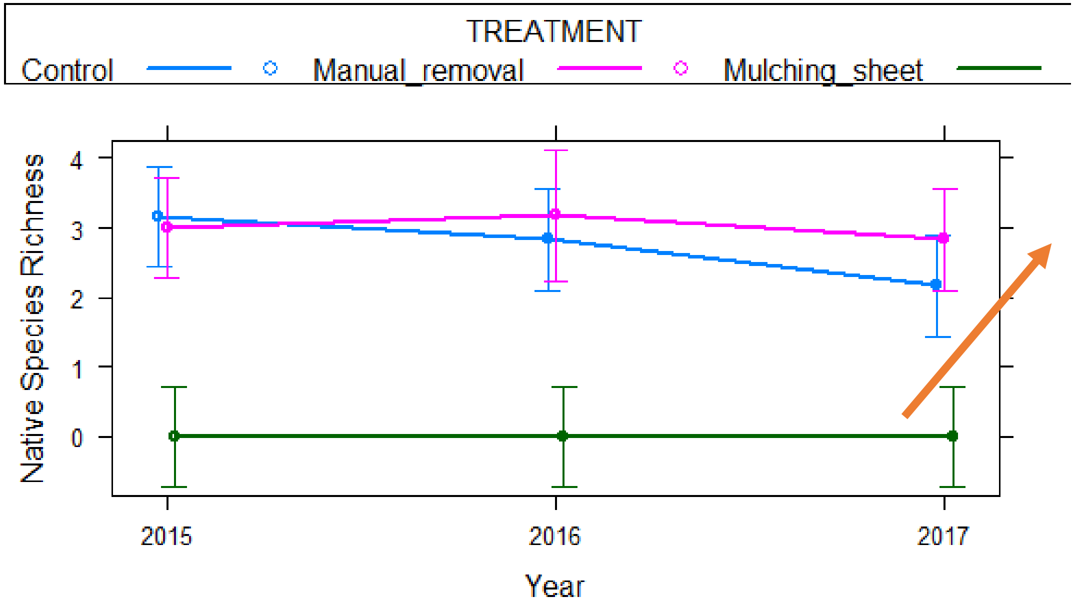




Monitoring the effects of the treatments



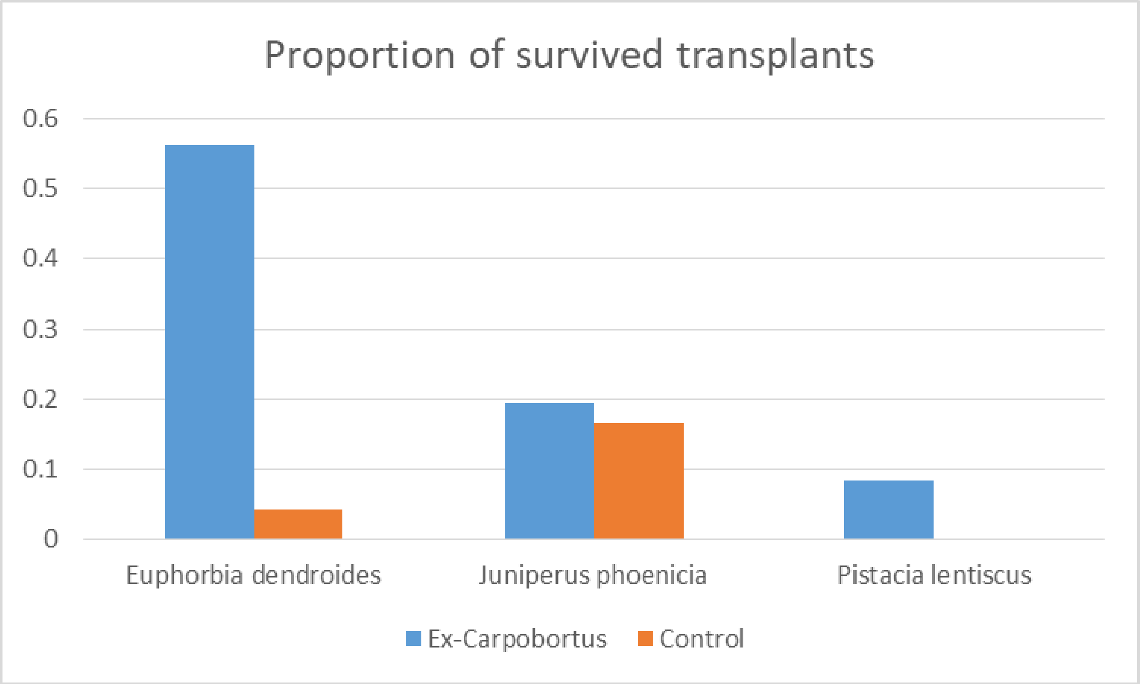
Recover of species on loose soils treated with mulching sheets



Still few recover in rocky cliffs treated with mulching sheets - None in monitoring plots

Restoration of the sites – preliminary translpantations

Pistacia lentiscus	24
Euphorbia dendroides	72
Juniperus phoenicia	48



Restoration of the site – plantation in 2017

350 plant transplanted in the site with loose soil

Further 350 are going to be transplanted in autumn 2018

Increasing Public Awareness

1) Meetings with the resident population to explain the action

2) Plantation of ~100 individuals of native species to substitute Carpobrotus in the settlement

3) Further meetings, with the dissemination of a list of suggested species to replace alien invasive species toward a "green gardening" in Giannutri


GRAZIE
DEI FIOR.....


Social implications of invasive alien plants control in the Mediterranean islands

Giuseppe Brundu

Department of Agriculture, University of Sassari, Italy
Corresponding author: gbrundu@uniss.it

uniss

Introduction

Human agency in biological invasions: Old and New Plant Hunters

Human agency in biological invasions: Key stakeholders

LIFE ASAP: Education, Communication and Codes of Conduct

LIFE PUFFINUS: Education, Communication, Flag Eradication

LIFE IAP-RISK: Prevention through Prioritisation and Risk Analysis

Who cares about (invasive) alien plants?

If a genie (coming out of a magic bottle) granted you ONE wish right now, what would you wish for?

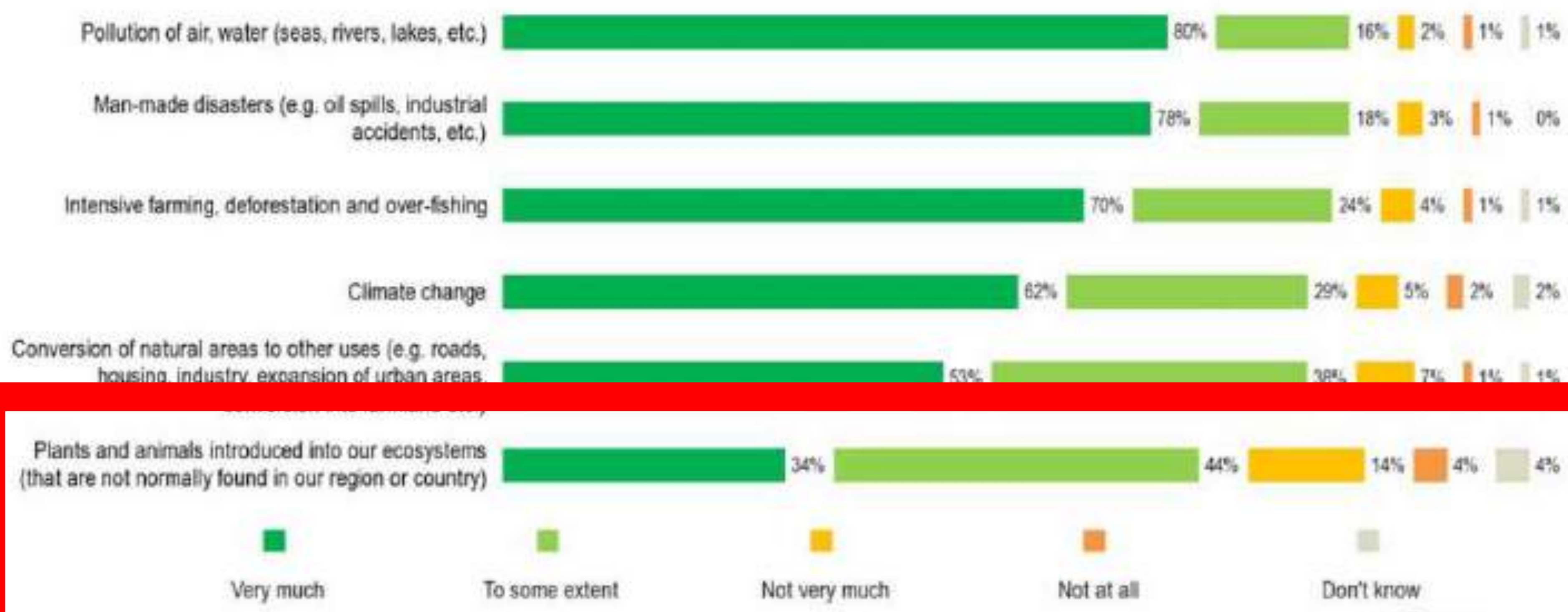
(please do not ask for more wishes)

European Commission

2013

Flash Eurobarometer 379

Q7. For each of the aspects from the following list, please tell me if you think it threatens biodiversity...



http://data.europa.eu/euodp/en/data/dataset/S2091_83_4_436_ENG

2007

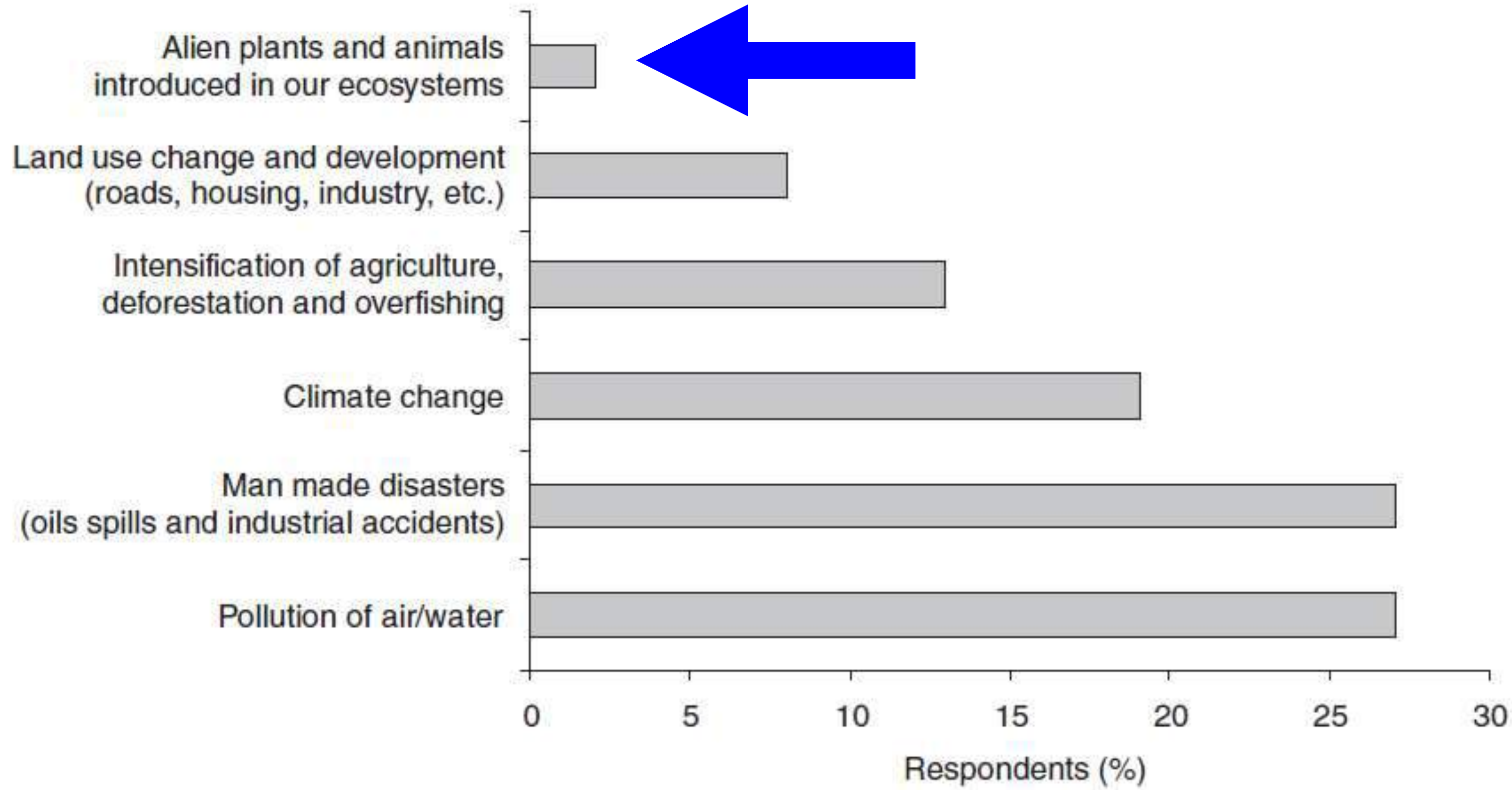


Figure 5: Perceptions of the major threats to biodiversity held by European citizens. Data from Gallup Organisation (2007).

4.11.2014 EN Official Journal of the European Union L 317/35

REGULATION (EU) No 1143/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 22 October 2014

on the prevention and management of the introduction and spread of invasive alien species

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Who benefits from (invasive) alien plants?

Commiphora myrrha (Nees) Engl & *Commiphora* spp.

http://discoveringegypt.com/ancient-egyptian-kings-queens/hatshepsut/

Hatshepsut The Woman Who Was King 1473–1458 BC

Musgrave T, Gardener C, Musgrave W (2000) The Plant Hunters: Two Hundred years of Adventure and Discovery Around the World. The Orion Publishing Group.

https://en.wikipedia.org/wiki/Launeddas

https://en.wikipedia.org/wiki/Aulos

http://pamelakelt.weebly.com/secret-life-of-plant-hunters.html

INDEPENDENT News Voices Culture Lifestyle Tech Sport US election

Environment › Nature

The plant hunters: Adventurers who transformed our gardens would put Indiana Jones to shame

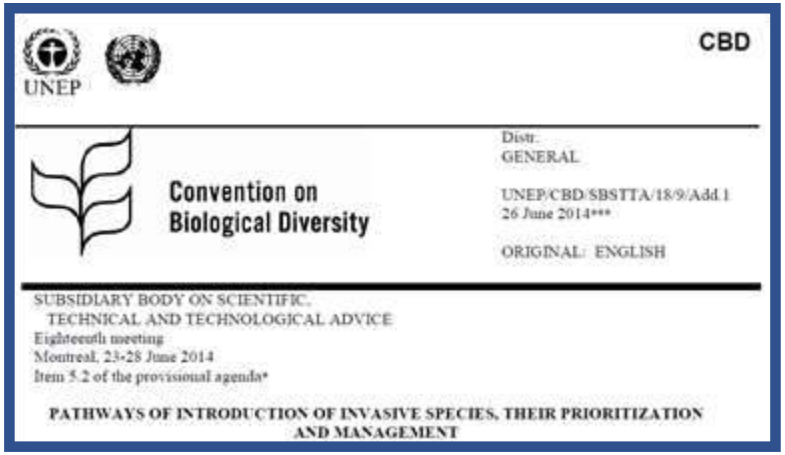
Victoria Summerley digs up their remarkable stories

86 shares

During his travels in eastern Asia, **Robert Fortune** set the standards for future **plant hunters** who were to follow in his footsteps. His success in sending living plants to Europe and North America, moreover, was greatly increased by his use of the **Wardian case**, which had been invented by a London physician, Nathaniel Ward, shortly before Fortune's departure for China in 1843. RF cut his hair in the local style and traveled incognito, eventually smuggling out no fewer than 20,000 plants.

Spongberg SA (1993) Exploration and introduction of ornamental and landscape plants from eastern Asia. p. 140-147. In: J. Janick and J.E. Simon (eds.), New crops. Wiley, New York. - Sarah Hayden Reichard and Peter White (2011) Horticulture as a Pathway of Invasive Plant Introductions in the United States. BioScience 51 (2): 103-113.

Human agency in biological invasions: Pathways of Introduction and Spread: A plethora of reasons, mechanisms and vectors


UNEP

CBD

Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/18/9/Add.1
26 June 2014***

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE
Eighteenth meeting
Montreal, 23-28 June 2014
Item 5.2 of the provisional agenda*

PATHWAYS OF INTRODUCTION OF INVASIVE SPECIES, THEIR PRIORITIZATION AND MANAGEMENT

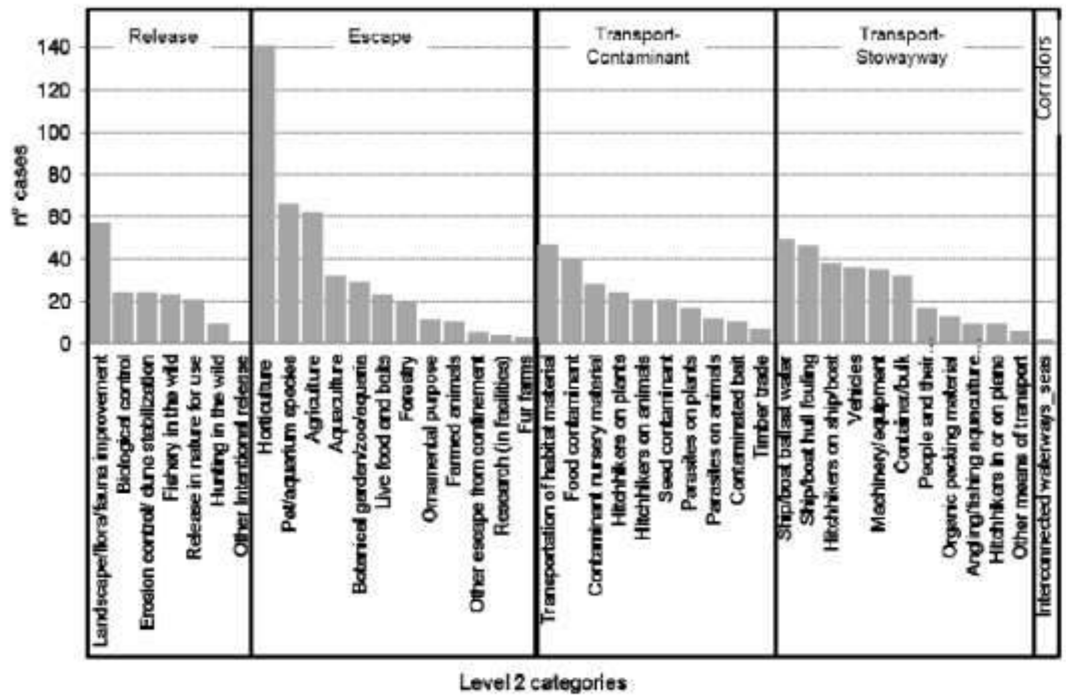
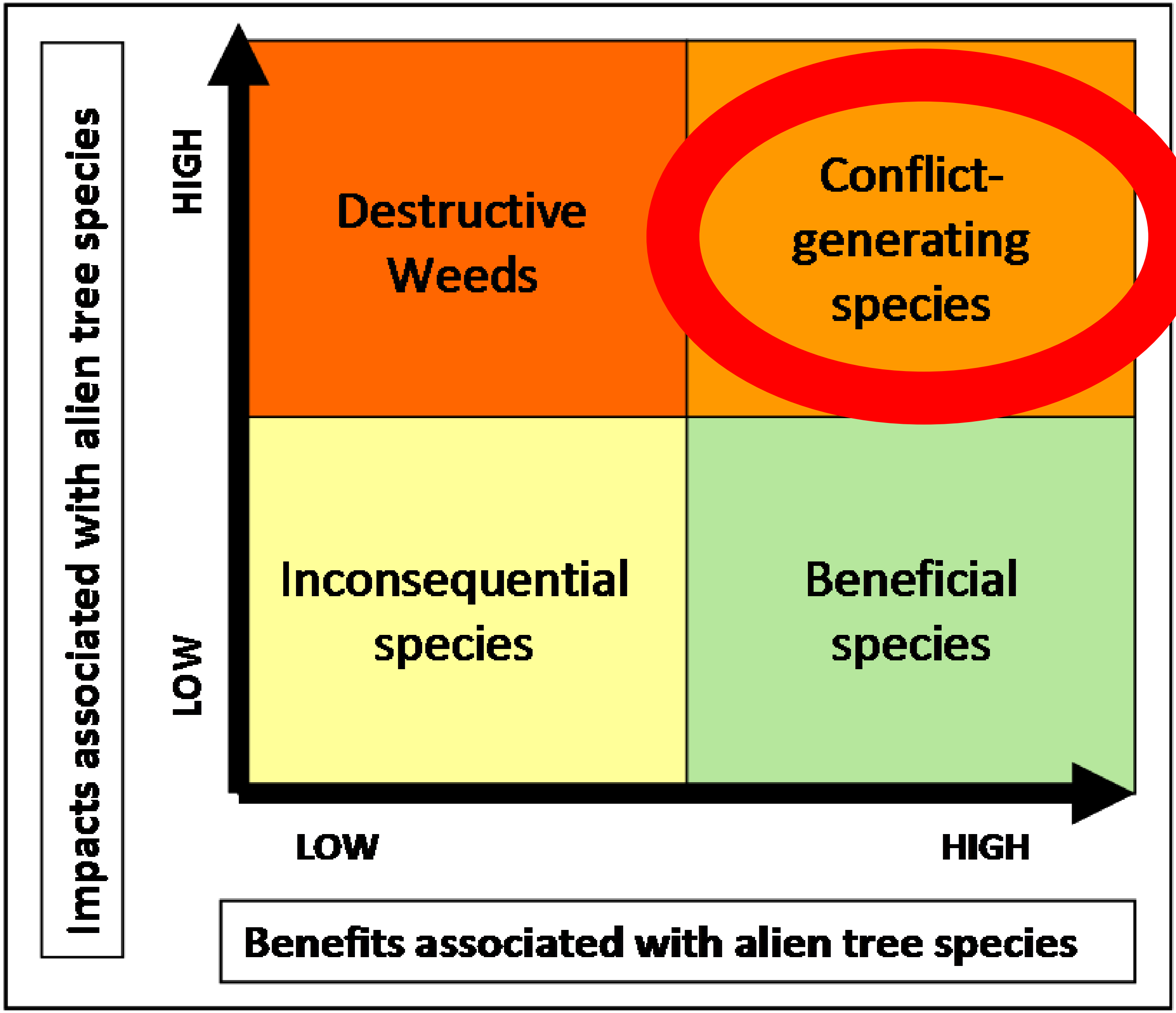


Figure 1b. Frequencies of introduction pathways of known cases of introduction of over 500 invasive alien species profiled in the Global Invasive Species Database (GISD); level 2 categories.

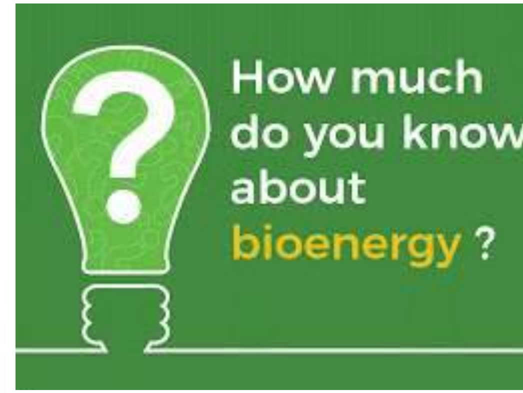


Redrawn from van Wilgen & Richardson (2014).

Biol Invasions (2014) 16:721–734
DOI 10.1007/s10530-013-0615-8
ORIGINAL PAPER


LIFE11 ENV/IT/000243 RII Project
workshop
Management of Robinia Pseudoacacia
and other invasive species
7th March 2014 9.30 A.M
Sala Civica, Via Morandi 9 Albinea (RE)


HUNGARY BEES
WILD ACACIA HONEY
PRODUCT OF HUNGARY
Raw Honey


How much do you know about bioenergy ?

NeoBiota 35: 1–34 (2017)
doi: 10.3897/neobiota.35.11909
http://neobiota.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
NeoBiota
Advancing research on alien species and biological invasions

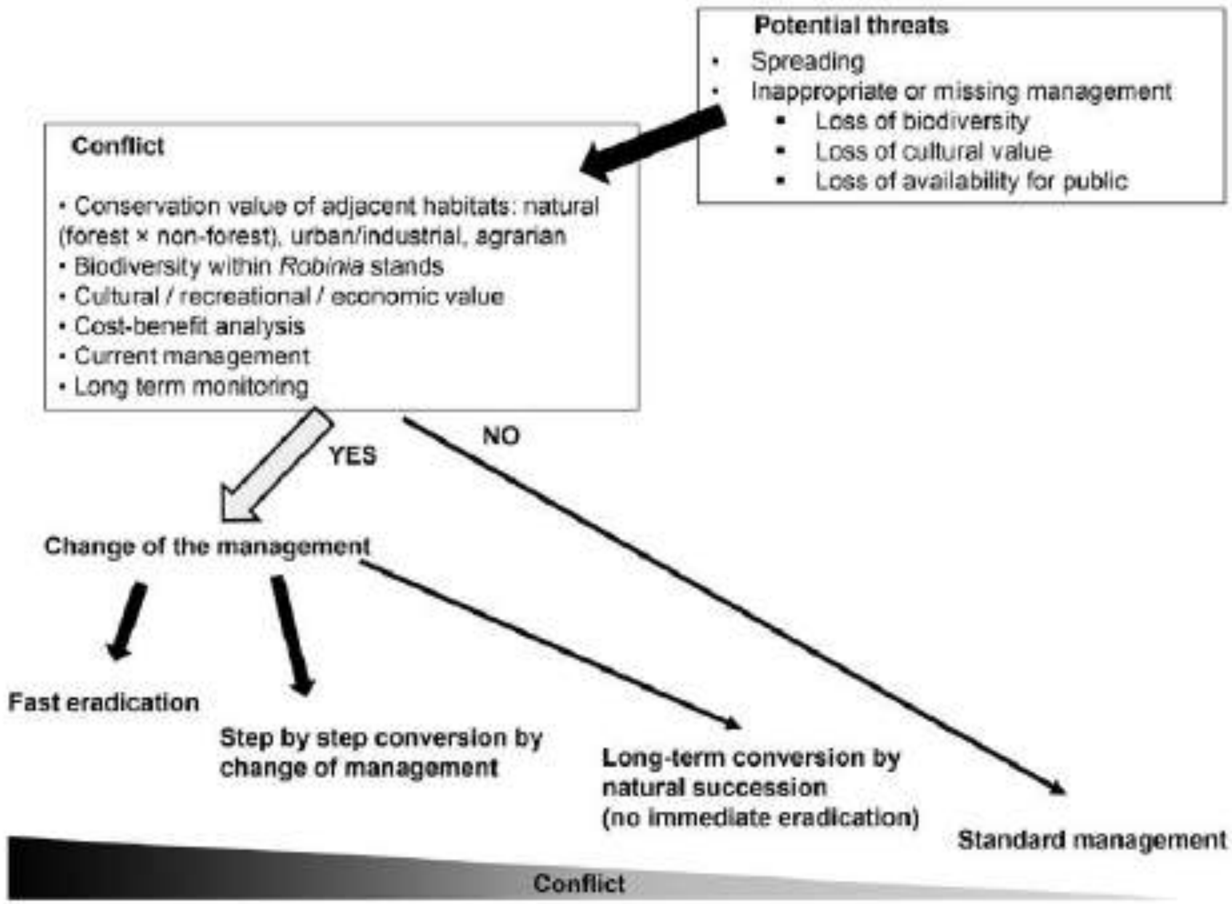


Figure 1. Decision framework for selecting suitable *Robinia* management. Width of arrows indicate importance of the management. Shading indicates the number of potential sites covered (white – relatively few occurrences, black – most of the sites). Data come from the reviewed literature and project reports.

Can we stop the process?

ARTICLE

Received 16 Feb 2016 | Accepted 28 Dec 2016 | Published 15 Feb 2017 DOI: 10.1038/ncomms14435 OPEN

No saturation in the accumulation of alien species worldwide

Hanno Seebens et al.#

Although research on human-mediated exchanges of species has substantially intensified during the last centuries, we know surprisingly little about temporal dynamics of alien species accumulations across regions and taxa. Using a novel database of 45,813 first records of 16,926 established alien species, we show that the annual rate of first records worldwide has increased during the last 200 years, with 37% of all first records reported most recently (1970–2014). Inter-continental and inter-taxonomic variation can be largely attributed to the diaspora of European settlers in the nineteenth century and to the acceleration in trade in the twentieth century. For all taxonomic groups, the increase in numbers of alien species does not show any sign of saturation and most taxa even show increases in the rate of first records over time. This highlights that past efforts to mitigate invasions have not been effective enough to keep up with increasing globalization.

ARTICLE

Received 16 Feb 2016 | Accepted 28 Dec 2016 | Published 15 Feb 2017 DOI: 10.1038/ncomms14435 OPEN

No saturation in the accumulation of alien species worldwide

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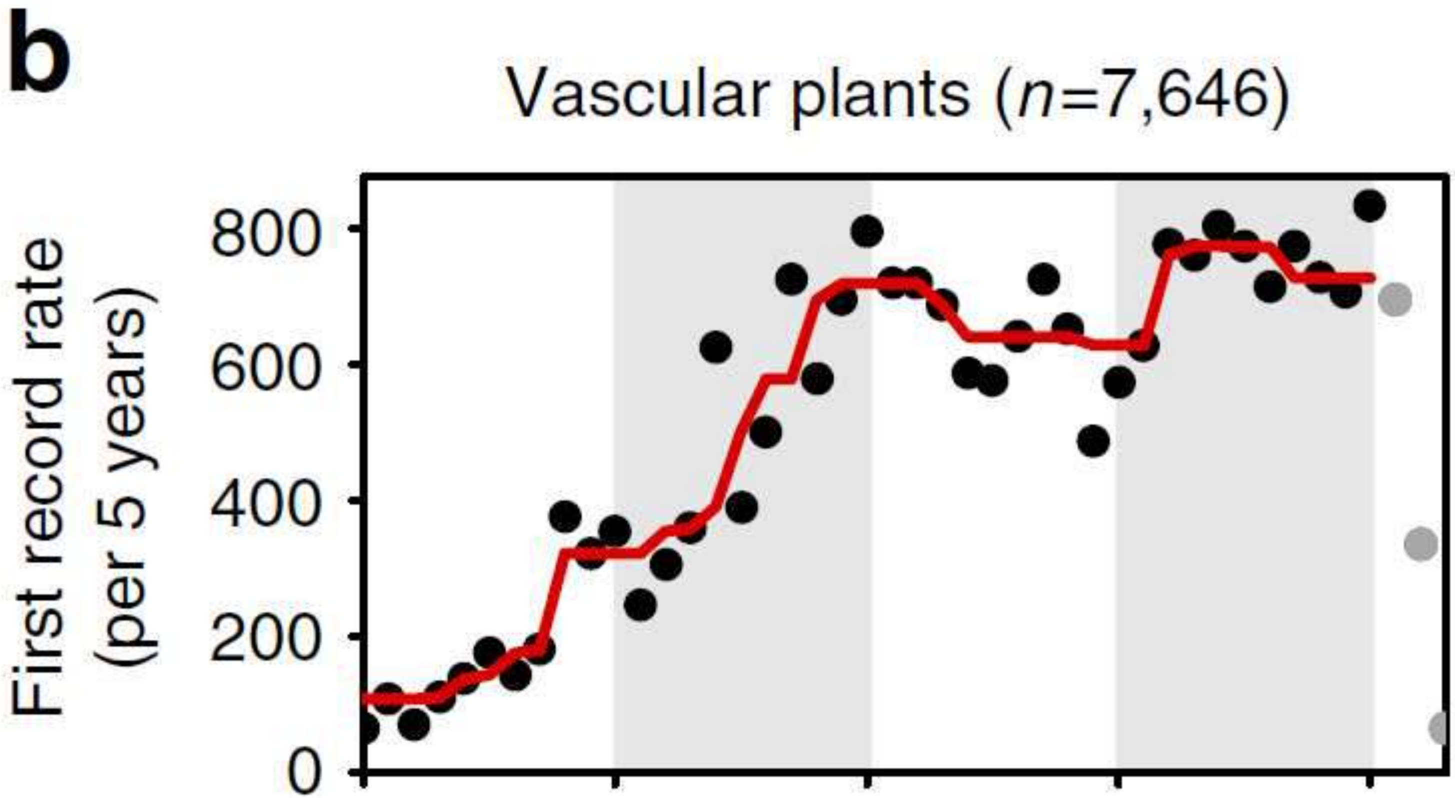


ARTICLE

Received 2 Sep 2015 | Accepted 7 Jul 2016 | Published 23 Aug 2016 DOI: 10.1038/ncomms12485 OPEN

Global threats from invasive alien species in the twenty-first century and national response capacities

Regan Early[1], Bethany A. Bradley[2], Jeffrey S. Dukes[3,4], Joshua J. Lawler[5], Julian D. Olden[6], Dana M. Blumenthal[7], Patrick Gonzalez[8,9], Edwin D. Grosholz[10], Ines Ibañez[11], Luke P. Miller[12], Cascade J.B. Sorte[13] & Andrew J. Tatem[14,15,16]

Invasive alien species (IAS) threaten human livelihoods and biodiversity globally. Increasing globalization facilitates IAS arrival, and environmental changes, including climate change, facilitate IAS establishment. Here we provide the first global, spatial analysis of the terrestrial threat from IAS in light of twenty-first century globalization and environmental change, and evaluate national capacities to prevent and manage species invasions. We find that one-sixth of the global land surface is highly vulnerable to invasion, including substantial areas in developing economies and biodiversity hotspots. The dominant invasion vectors differ between high-income countries (imports, particularly of plants and pets) and low-income countries (air travel). Uniting data on the causes of introduction and establishment can improve early-warning and eradication schemes. Most countries have limited capacity to act against invasions. In particular, we reveal a clear need for proactive invasion strategies in areas with high poverty levels, high biodiversity and low historical levels of invasion.

Most Countries have limited capacity to act

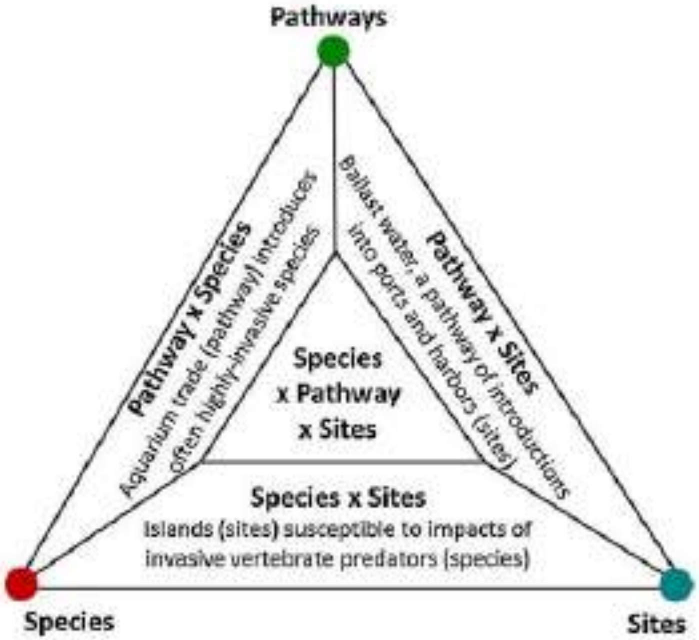
We need PRIORITIES

Biol Invasions (2016) 18:299–314
DOI 10.1007/s10530-015-1013-1

PERSPECTIVES AND PARADIGMS

Prioritizing species, pathways, and sites to achieve conservation targets for biological invasion

Melodie A. McGeoch · Piero Genovesi · Peter J. Bellingham · Mark J. Costello · Chris McGrannachan · Andy Sheppard



Target 5 Combat Invasive Alien Species

By 2020, Invasive Alien Species (IAS) and their pathways are identified and prioritised, priority species are controlled or eradicated, and pathways are managed to prevent the introduction and establishment of new IAS.

Action 15 Strengthen the EU Plant and Animal Health Regimes

15) The Commission will integrate additional biodiversity concerns into the Plant and Animal Health Regimes by 2012.

Action 16 Establish a dedicated legislative instrument on Invasive Alien Species

16) The Commission will fill policy gaps in combating IAS by developing a dedicated legislative instrument by 2012.

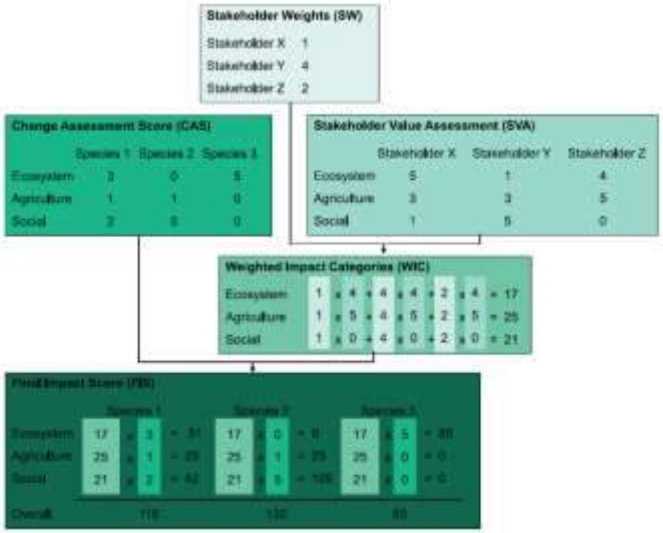
NeoBiota 15: 69–100 (2012)
doi: 10.3897/neobiota.15.3323
www.pensoft.net/journals/neobiota

REVIEW ARTICLE

NeoBiota

A conceptual framework for prioritization of invasive alien species for management according to their impact

Sabrina Kumschick[1], Sven Bacher[2], Wayne Dawson[3], Jaakko Heikkilä[4], Agnieszka Sendek[5], Therese Pluess[2], Tamara B. Robinson[1], Ingolf Kühn[5]



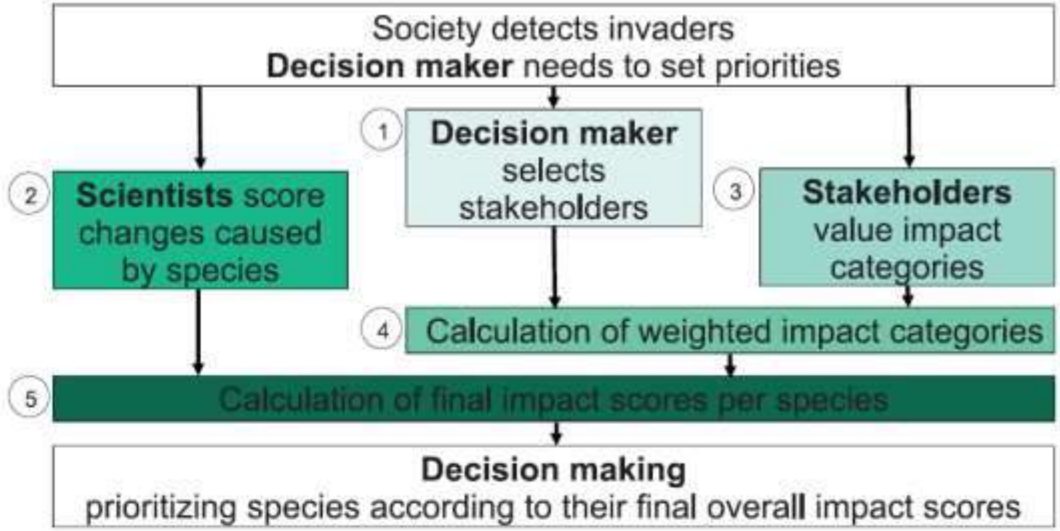


Figure 1. Schematic overview of the conceptual framework to assess change in different impact categories for each species, capture stakeholders' interests and weigh stakeholders and calculate a final impact score for each species, see chapter "framework for impact evaluation" of IAS for a brief and the following chapters for detailed explanation.

CBD Guiding principles and key stakeholders

COP 6 Decision VI/23

Sixth Meeting of the Conference of the Parties to the Convention on Biological Diversity
the Hague, Netherlands
7 - 19 April **2002**

Alien species that threaten ecosystems, habitats or species

The Guiding Principles are:

- Precautionary approach;
- **Three-stage hierarchical approach**;
- Ecosystem approach;
- The role of States;
- Research and monitoring;
- **Education and public awareness**;
- Border control and quarantine measures;
- Exchange of information;
- Cooperation, including capacity-building;
- Intentional introduction;
- Unintentional introduction;
- Mitigation of impacts;
- Eradication;
- Containment; and
- Control.

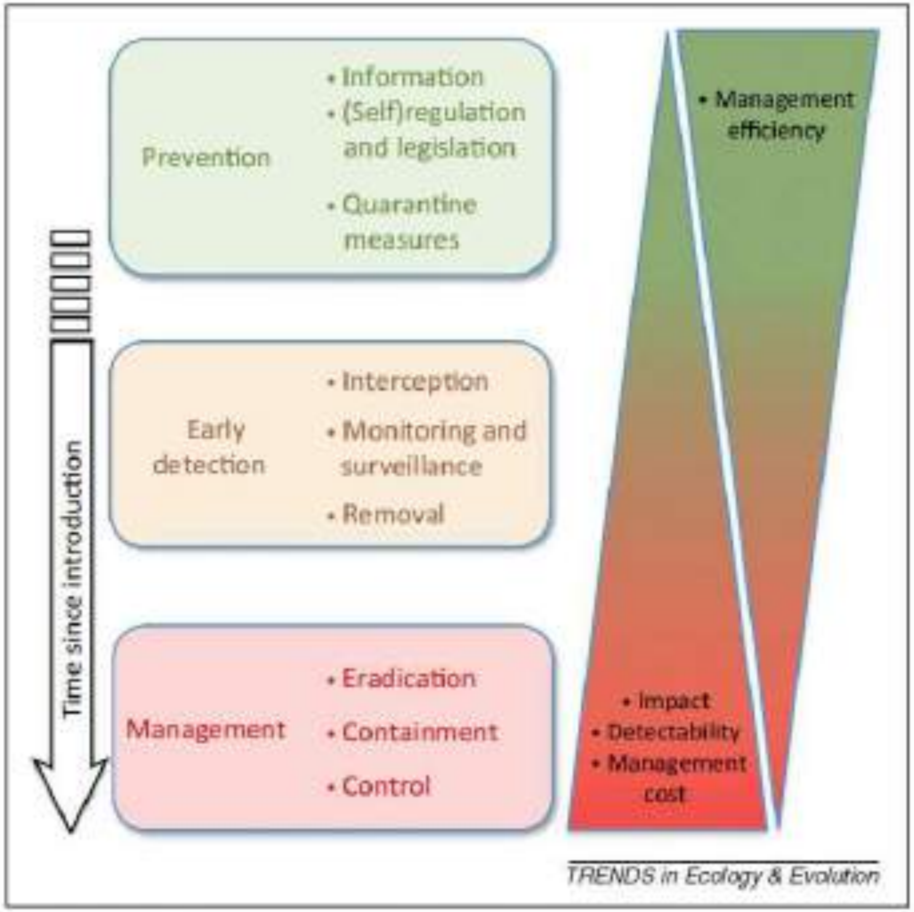


Figure 1. Management strategy against invasive species. The optimal strategy evolves with time since introduction, with management efficiency decreasing and management costs increasing with time since introduction.

Review
Cell Press

Impacts of biological invasions: what's what and the way forward

Daniel Simberloff[1], Jean-Louis Martin[2], Piero Genovesi[3], Virginie Maris[2], David A. Wardle[4], James Aronson[2,5], Franck Courchamp[6], Bella Galil[7], Emili García-Berthou[8], Michel Pascal[9], Petr Pyšek[10,11], Ronaldo Sousa[12,13], Eric Tabacchi[14], and Montserrat Vilà[15*]

Trends in Ecology & Evolution January 2013, Vol. 28, No. 1

Journal of Environmental Management 205 (2018) 286–297

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

A framework for engaging stakeholders on the management of alien species

Ana Novoa [a,b,c,*], Ross Shackleton [a], Susan Canavan [a,b], Cathleen Cybèle [d,e], Sarah J. Davies [a], Katharina Dehnen-Schmutz [f], Jana Fried [f], Mirijam Gaertner [a,g], Sjirk Geerts [h], Charles L. Griffiths [i,j], Haylee Kaplan [b], Sabrina Kumschick [a,b], David C. Le Maitre [k], G. John Measey [a], Ana L. Nunes [a,b,l], David M. Richardson [a], Tamara B. Robinson [a], Julia Touza [m], John R.U. Wilson [a,b]

1. Searching for new species and varieties, germplasm collection, conservation of species and genetic resources;
2. Production on large scale, breeding (including the creation of new hybrids or varieties), research and development, GM;
3. Trade and vectors, packing and packaging;
4. Retailers;
5. Consumers, including Public Administration;
6. Virtualisation of floricultural supply chains and internet trade (e-commerce).

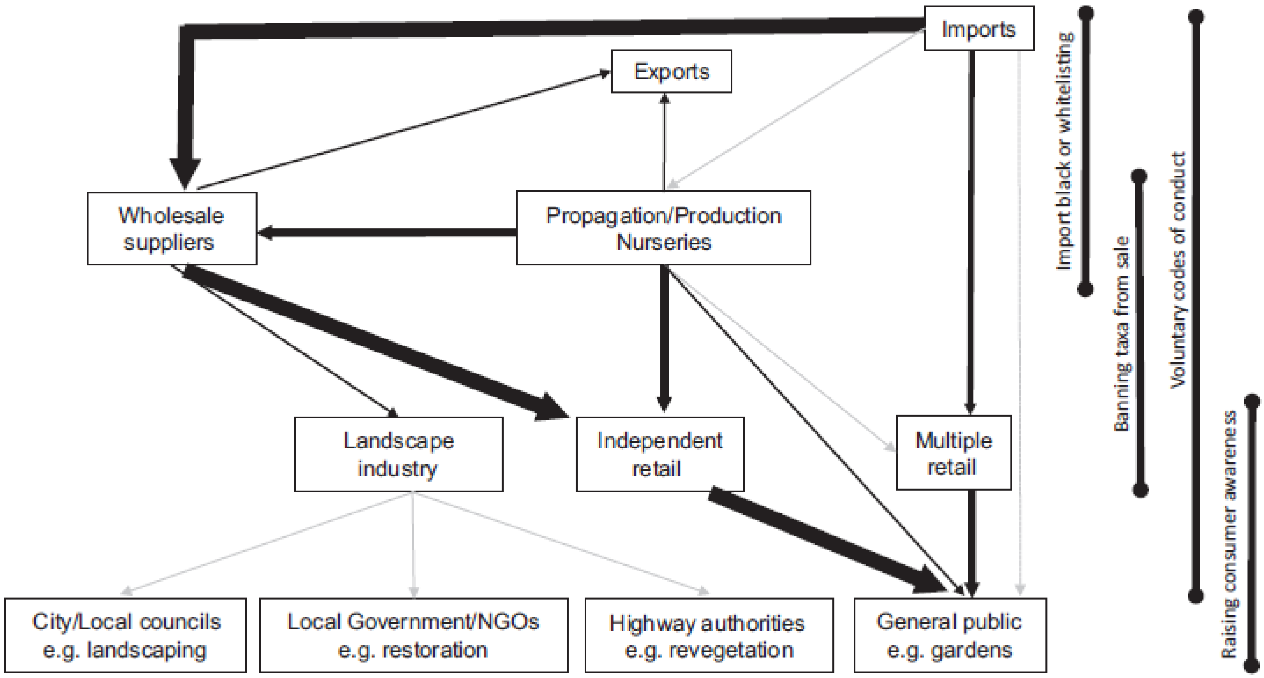


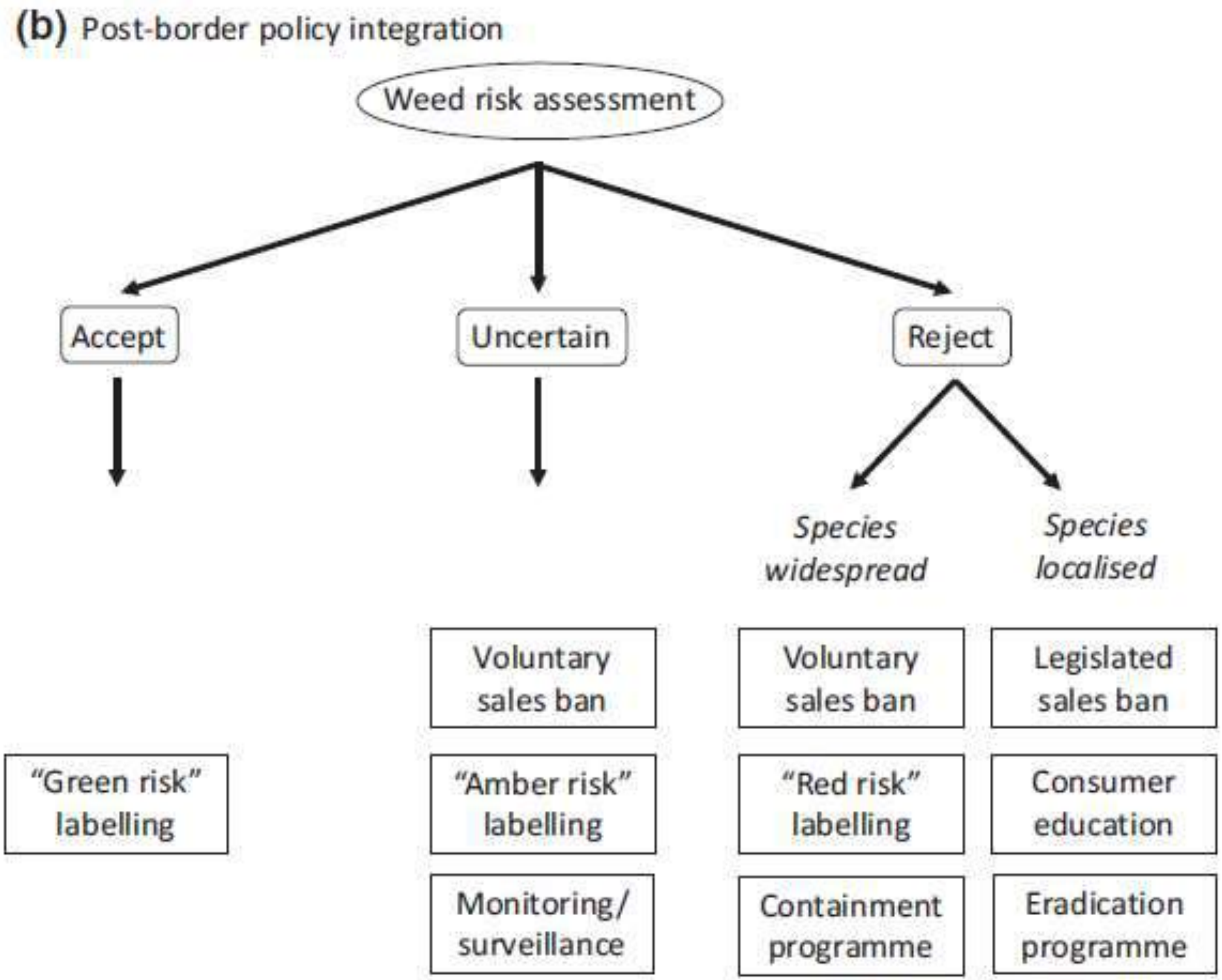
FIGURE 2 Schematic illustration of the ornamental nursery supply chain identifying the route of alien germplasm from import, through propagation, to retail and subsequent use. The size and shading of the arrows represent the relative magnitude of the flows between each component and are based on financial data from Great Britain (Barney, 2014). The domain of four major policy instruments across the supply chain is also depicted

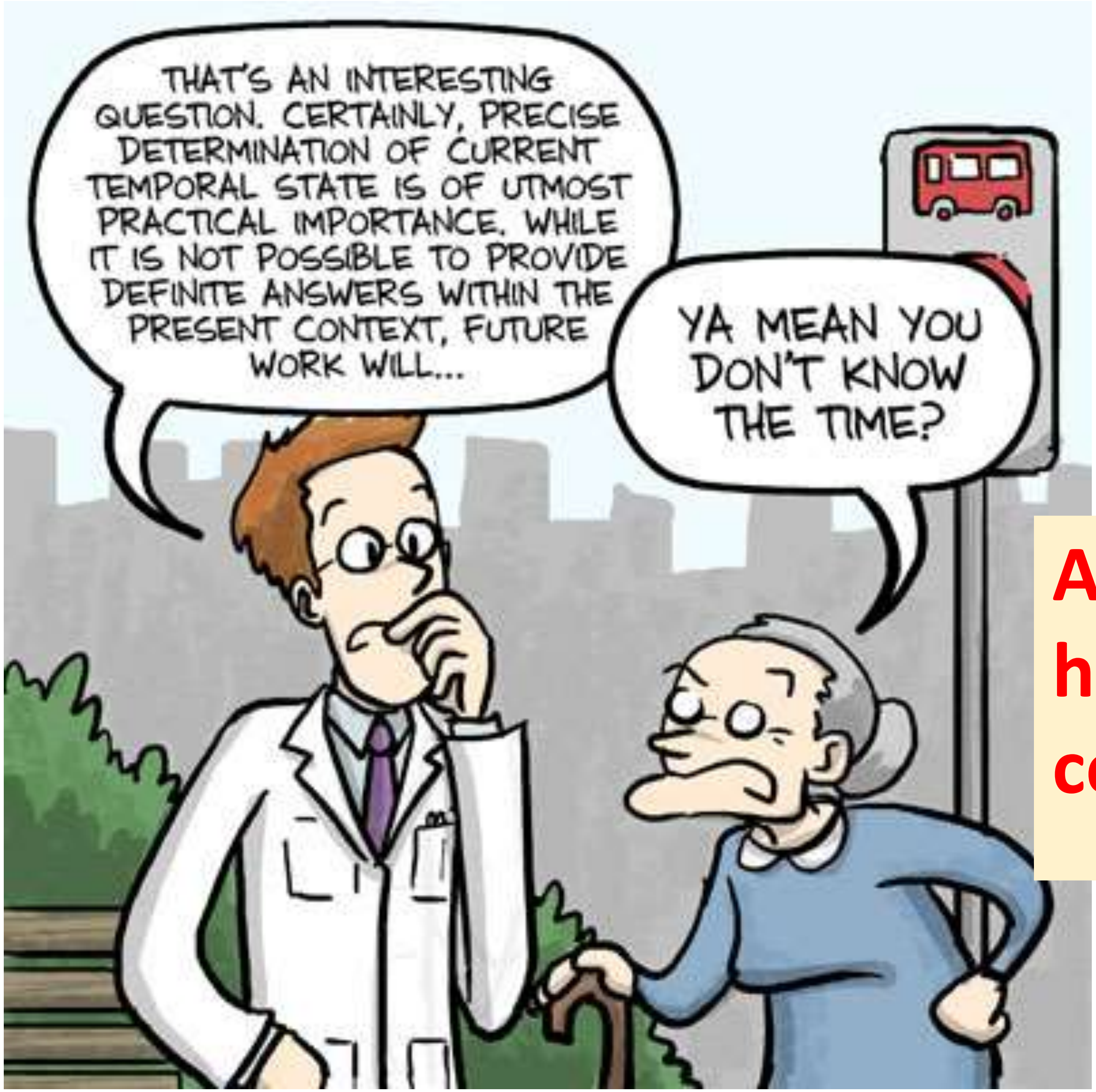
Received: 23 March 2017 | Accepted: 7 June 2017
DOI: 10.1111/1365-2664.12953

POLICY DIRECTION

Journal of Applied Ecology

Integrating invasive species policies across ornamental horticulture supply chains to prevent plant invasions


(b) Post-border policy integration
Weed risk assessment
Accept
Uncertain
Reject
Species widespread
Species localised
Voluntary sales ban
Voluntary sales ban
Legislated sales ban
"Green risk" labelling
"Amber risk" labelling
"Red risk" labelling
Consumer education
Monitoring/ surveillance
Containment programme
Eradication programme



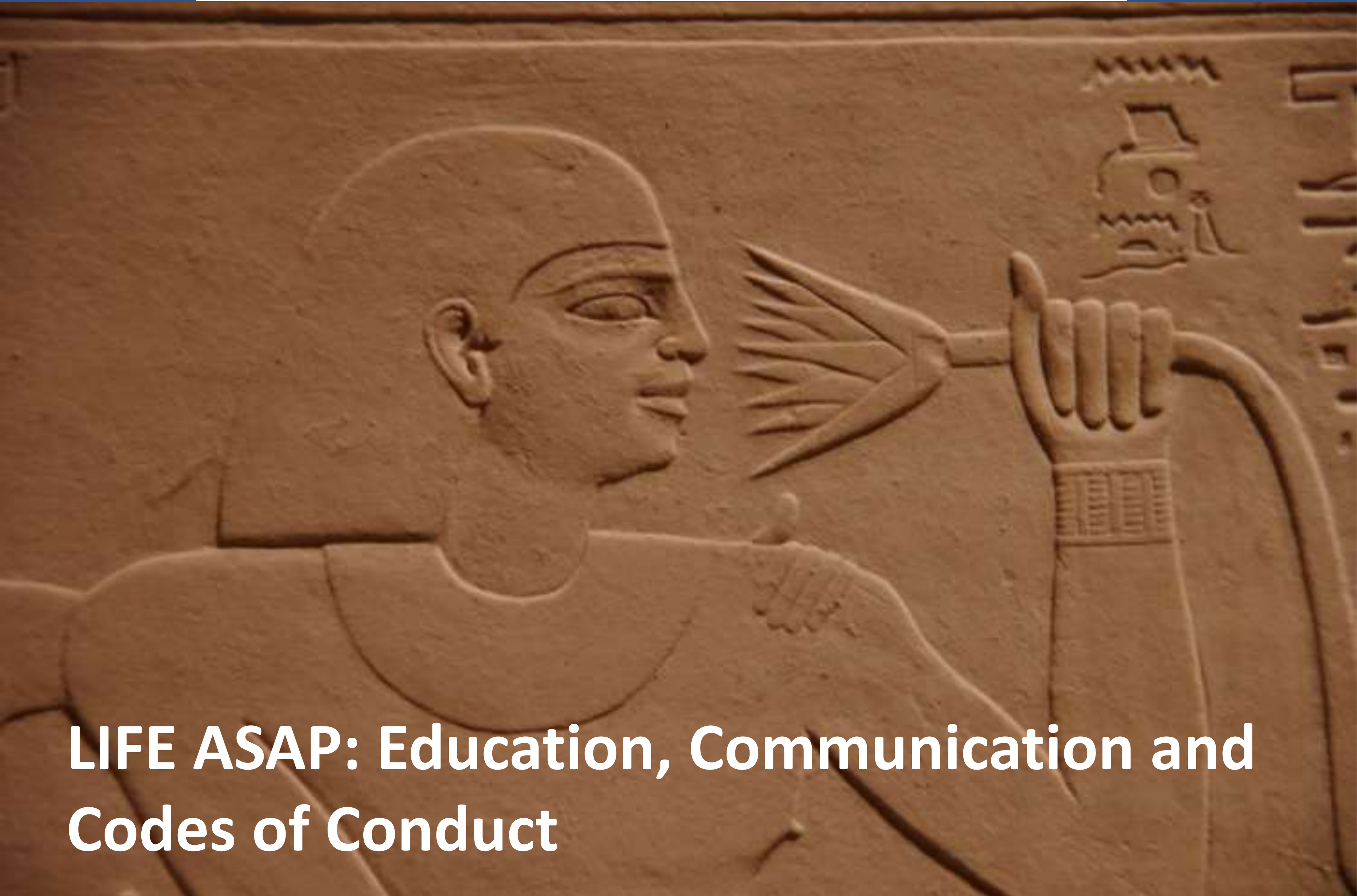
Are scientists hopeless at communicating?

https://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/communicating-as-a-scientist-14238273

2016	Radu Guiasu	Non-native Species and Their Role in the Environment: The Need for a Broader Perspective. Brill Online (Biology e-books).	http://booksandjournals.brillonline.com/content/books/9789047426134
2016	Torah Kachur	Conservationists debate 'invasive species' vs. 'non-native' labels. Canadian Broadcasting Corporation (CBC) News: Technology & Science, March 3, 2016.	http://www.cbc.ca/news/technology/conservationists-debate-invasive-species-vs-non-native-labels-1.3474200
2016	Erica Goode	Invasive, but not always unwanted. New York Times (March 1, 2016): D1.	http://www.nytimes.com/2016/03/01/science/invasive-species.html?_r=0
2016	Linda Rodriguez McRobbie	Humans make a mess, but invasive species get the blame. Boston Globe, November 27, 2016.	https://www.bostonglobe.com/ideas/2016/11/27/humans-make-mess-but-invasive-species-get-blame/2HAvSQBjvnRWGjCwRS8XrJ/story.html
2016	Rebekah White	So shoot me. New Zealand Geographic, Issue 141 (Nov-Dec 2016).	https://www.nzgeo.com/stories/so-shoot-me/
2016	Anonymous	Alien plants can come in peace, not to damage our ecosystems. The Asahi Shimbun (Japan), October 24, 2016	http://www.asahi.com/ajw/articles/AJ201610240026.html
2016	Fred Pearce & Tao Orion, interviewed by Gary Price	A new look at invasive species. Viewpoints Radio, May 22, 2016.	https://viewpointsradio.wordpress.com/2016/05/22/16-21-segment-1-invasive-species/
2016	G. Bonanno	Alien species: to remove or not to remove? That is the question. Environmental Science & Policy 59 (2016) 67–73	
2016	Peter Chapman	Benefits of invasive species. Marine Pollution Bulletin 107: 1–2.	

The exponential growth of invasive species denialism

Ricciardi, A. & Ryan, R. Biol Invasions (2017). https://doi.org/10.1007/s10530-017-1561-7



LIFE ASAP: Education, Communication and Codes of Conduct

http://www.lifeasap.eu/en/media-en/press-review/file/2017-03-31-Rassegna-stampa%252Epdf

NATIONAL GEOGRAPHIC ITALIA

Specie invasive: presto una black-list italiana

Piante e animali esotici hanno causato quasi il 60% delle estinzioni animali conosciute e costano all'Europa 12 miliardi l'anno. Oggi il progetto ASAP mira a individuare le specie più pericolose per l'Italia e a sensibilizzare l'opinione pubblica

di Federico Formica

Una macro del capo del punteruolo rosso asiatico, fotogra

L'invasione aliena è una realtà. Piante, insetti e pesci: natura in scacco

Topi a Ponza, gamberi della Luisiana e piante esotiche: 580 specie introdotte dall'uomo causano danni all'ambiente

Piante, insetti e pesci. L'Europa e l'Italia in particolare sono sotto l'attacco di oltre tremila specie aliene che arrivano dal canale di Suez o attraverso gli aerei. E così la biodiversità, patrimonio unico del Belpaese è a rischio.

A lanciare l'allarme è Legambiente. Dalla rana toro americana al tamia siberiano, dal fico degli Ottentotti all'erba pesce

The LIFE ASAP project seeks to limit the spread and impact of IAS in Italy through public awareness and participation. Specific objectives are:

- To translate into Italian the European voluntary codes of conduct and guidelines for managing IAS and circulate this material to key stakeholder groups that can help prevent the spread of IAS (e.g. florists, horticulturists, landscape architects, pet shops, aquarists, anglers and hunters);
- To train personnel from public administrations in how to support the implementation of the new EU Regulation on IAS;
- To draft a national IAS blacklist in collaboration with the Italian scientific community and propose a set of priorities for the Italian government; and
- To train knowledge multipliers (teachers, conservation professionals, zoos, botanical gardens) about IAS and with their input to develop an information campaign focused on schools and the general public. The awareness campaign will make use of a range of media channels, including information displays in zoos, botanical gardens, national parks and airports, online activities (social media, website etc.) and citizen science activities using apps.

Publications

- European Code of Conduct on International Travel and Invasive Alien Species (2017)
- European Code of Conduct for Invasive Alien Trees (2017)
- European Code of Conduct on Horticulture and Invasive Alien Plants (2008) - Illustrated version (2011)
- European Code of Conduct on Pets and IAS (2011) - Illustrated version (2016)
- European Code of Conduct for Botanic Gardens on Invasive Alien Species (2012)
- European Code of Conduct on Zoological Gardens and Aquaria and IAS (2012) - Illustrated version (2016)
- European Code of Conduct on Hunting and IAS (2013) - Illustrated version (2016)
- European Guidelines on Protected Areas and IAS (2013) - Illustrated version (2014)
- European Code of Conduct on Recreational Fishing and IAS (2014)
- European Code of Conduct on Recreational Boating and IAS (2016)
- European Strategy on Invasive Alien Species (2003) - Illustrated version (2011)
- Methods to control and eradicate non-native terrestrial vertebrate species (Nature and environment No. 118) (2001)
- Introductions of non-native organisms into the natural environment (Nature and Environment No. 73) (1998)
- Introduction of non-native plants into the natural environment (Nature and Environment No. 87) (1998)

CONVENTION DE BERNE
BERN CONVENTION

Recommendations

Training at the Botanic Garden of Catania (IT)

Expected results: The project expects to achieve the following results:

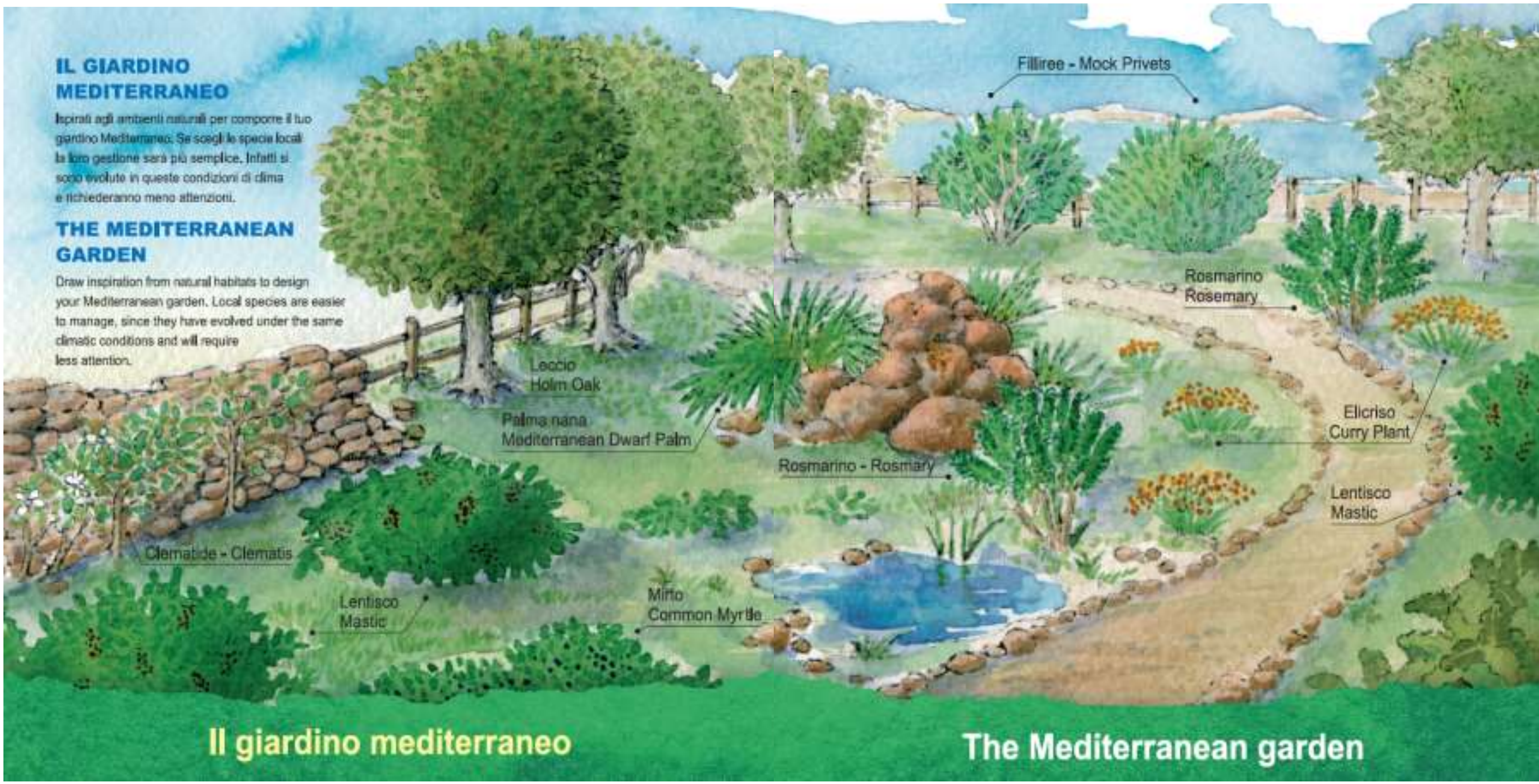
- Adoption of codes of conduct and voluntary practices by the different stakeholders and target groups (500 hunters and at least one national hunting association, 500 anglers and at least one national angling association, 500 nature professionals (foresters, agronomists, landscape architects, biologists and veterinarians), 200 relevant businesses (hatcheries, aquaculture companies, pet shops, florists and garden centres), and adoption of guidelines on IAS management in at least four protected areas;
- 115 representatives of public administrations trained to apply the IAS Regulation;
- At least 50 scientists involved in drafting a national IAS blacklist and a horizon scanning/priority setting proposal for the Italian government;
- Training of at least 100 IAS knowledge multipliers from zoos, botanical gardens, aquariums and museums, and a further 300 knowledge multipliers among teachers, academics and nature professionals; and
- 800 pupils and members of the public will have taken part in IAS information activities.

LIFE PUFFINUS

Life Puffinus TAVOLARA

http://www.lifepuffinustavolara.it/?lang=en

Life Puffinus TAVOLARA



LIFE IAP-RISK (Preparatory project)

LIFE IAP-RISK

Bulletin OEPP/EPPO Bulletin (2016) **46** (3), 603–617 ISSN 0250-8052. DOI: 10.1111/epp.12336

A prioritization process for invasive alien plant species incorporating the requirements of EU Regulation no. 1143/2014

E. Branquart[1], G. Brundu[2], S. Buholzer[3], D. Chapman[4], P. Ehret[5], G. Fried[6], U. Starfinger[7], J. van Valkenburg[8] and R. Tanner[9]

[1]*Invasive Species Unit, Service Public de Wallonie, Gembloux (Belgium); e-mail: etienne.branquart@spw.wallonie.be*
[2]*University of Sassari, Sassari (Italy)*
[3]*Agroscope Institute for Sustainability Sciences, Zurich (Switzerland)*
[4]*NERC Centre for Ecology and Hydrology, Edinburgh (UK)*
[5]*Ministry of Agriculture, National Plant Protection Organization, Montpellier Cedex 2 (France)*
[6]*Anses, Laboratoire de la Santé des Végétaux, Unité Entomologie et Plantes Invasives, Montferrier-sur-Lez Cedex (France)*
[7]*Julius Kühn Institut (JKI), Federal Research Centre for Cultivated Plants, Institute for National and International Plant Health, Braunschweig (Germany)*
[8]*National Plant Protection Organization, Wageningen (The Netherlands)*
[9]*European and Mediterranean Plant Protection Organization, Paris, France*

http://www.iap-risk.eu/

LIFE IAP-RISK

NeoBiota 35: 87–118 (2017)
doi: 10.3897/neobiota.35.12366
http://neobiota.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
NeoBiota
Advancing research on alien species and biological invasions

The prioritisation of a short list of alien plants for risk analysis within the framework of the Regulation (EU) No. 1143/2014

Rob Tanner[1], Etienne Branquart[2], Giuseppe Brundu[3], Serge Buholzer[4], Daniel Chapman[5], Pierre Ehret[6], Guillaume Fried[7], Uwe Starfinger[8], Johan van Valkenburg[9]

http://www.iap-risk.eu/

LIFE IAP-RISK

EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

17-23149

Pest Risk Analysis for

Pistia stratiotes

PRA – PM/9

Bulletin OEPP/EPPO Bulletin (2017) **47** (3), 526–530

ISSN 0250-8052. DOI: 10.1111/epp.12427

European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Data sheets on pests recommended for regulation
Fiches informatives sur les organismes recommandés pour réglementation

Cardiospermum grandiflorum

http://www.iap-risk.eu/

The love of gardening is a seed once sown that never dies.

Gertrude Jekyll (1843-1932)

uniss

Soil and Water lines stabilization using natural engineering techniques. The case study in São Miguel Island on the scope of the project Life+ Terras do Priolo.


Espanha
Portugal
Marrocos
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Image Landsat / Copernicus
US Dept of State Geographer
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

spea

Portuguese Society for Study of Birds

Priolo (*Pyrrhula murina*)

- The Azores bullfinch is an endemic passerine species from the east of São Miguel island

- Very small and localized distribution

- In 1996, the estimate was of 60-200 breeding couples

Main Reasons – Loss of Habitat

Degradation of the remaining natural habitats by Invasive Alien Species

Distribution of land occupation in S. Miguel Island

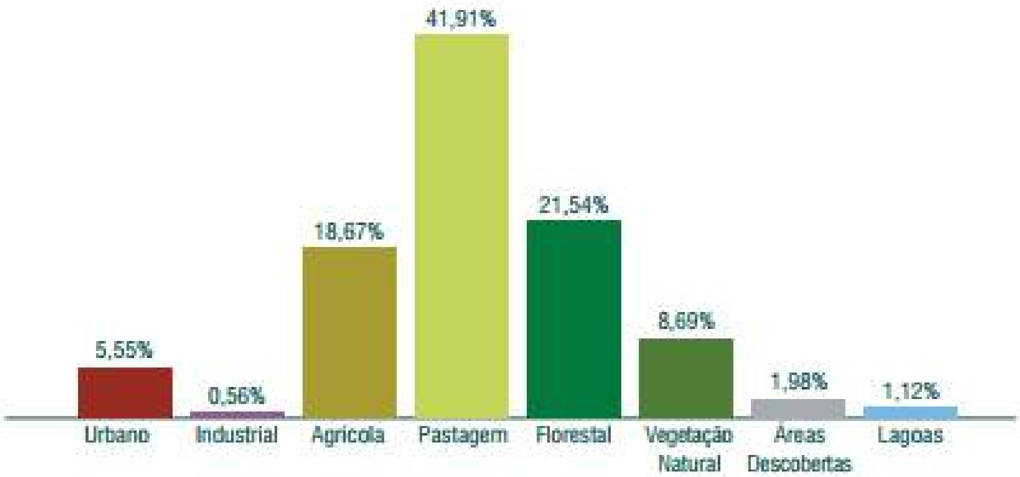
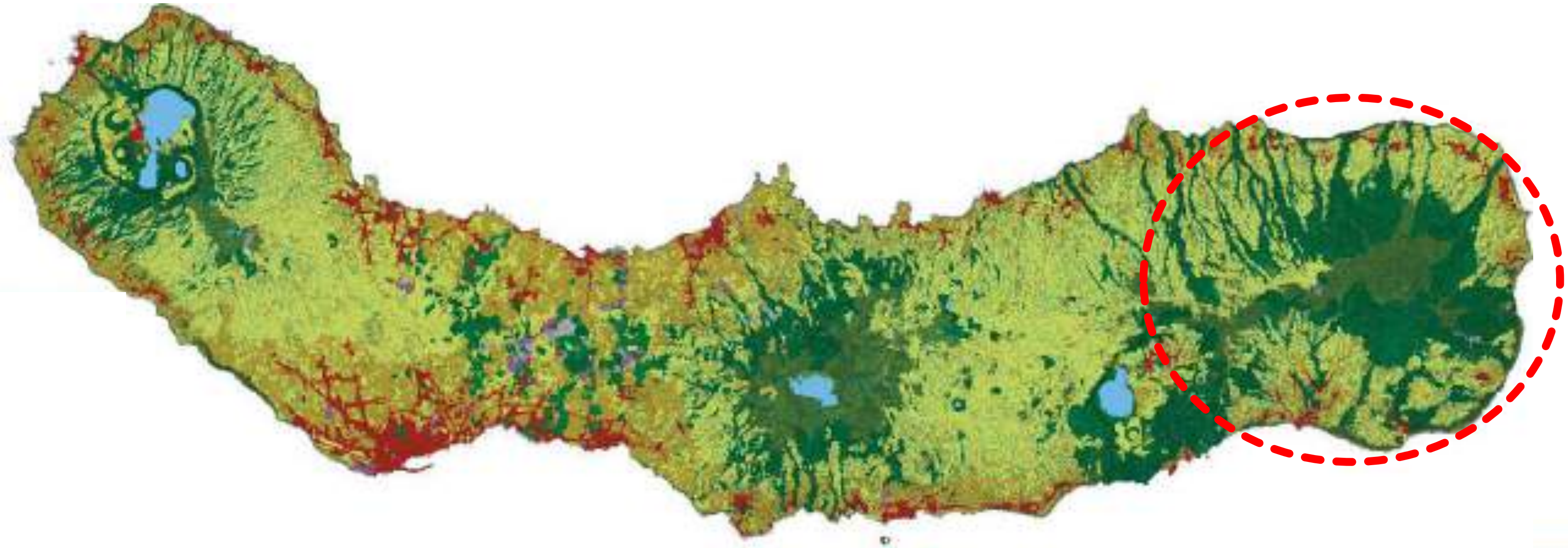
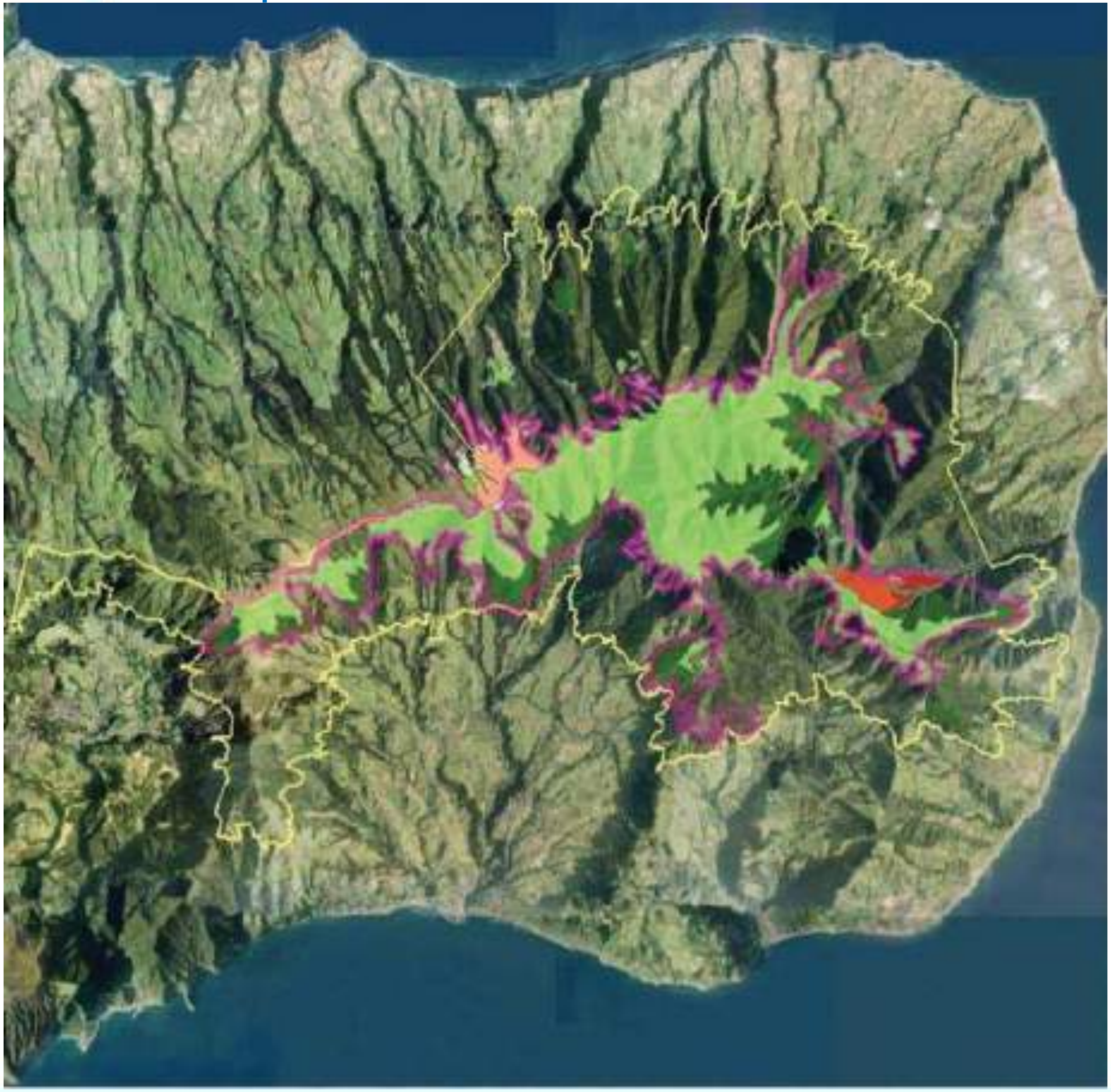
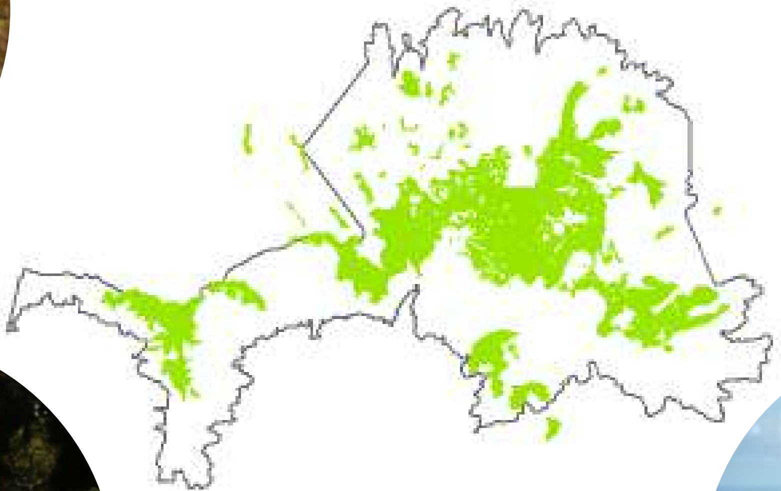


Figure – percentage of land occupation on the island of S. Miguel (COS-Açores , 2007)



Site of Community Importance Area Serra da Tronqueira/Planalto dos Graminhais





...re – Natural vegetation in the SPA Pic...
.../Ribeira do Guilherme

spea

Main Invasive Alien Species


Hedychium gardnerianum
(Kahila garland-lily)


Clethra arborea
(Lily of The Valley Tree)


Pittosporum undulatum
(Australian cheesewood)


Cyathea cooperi
(Cooper's tree fern)

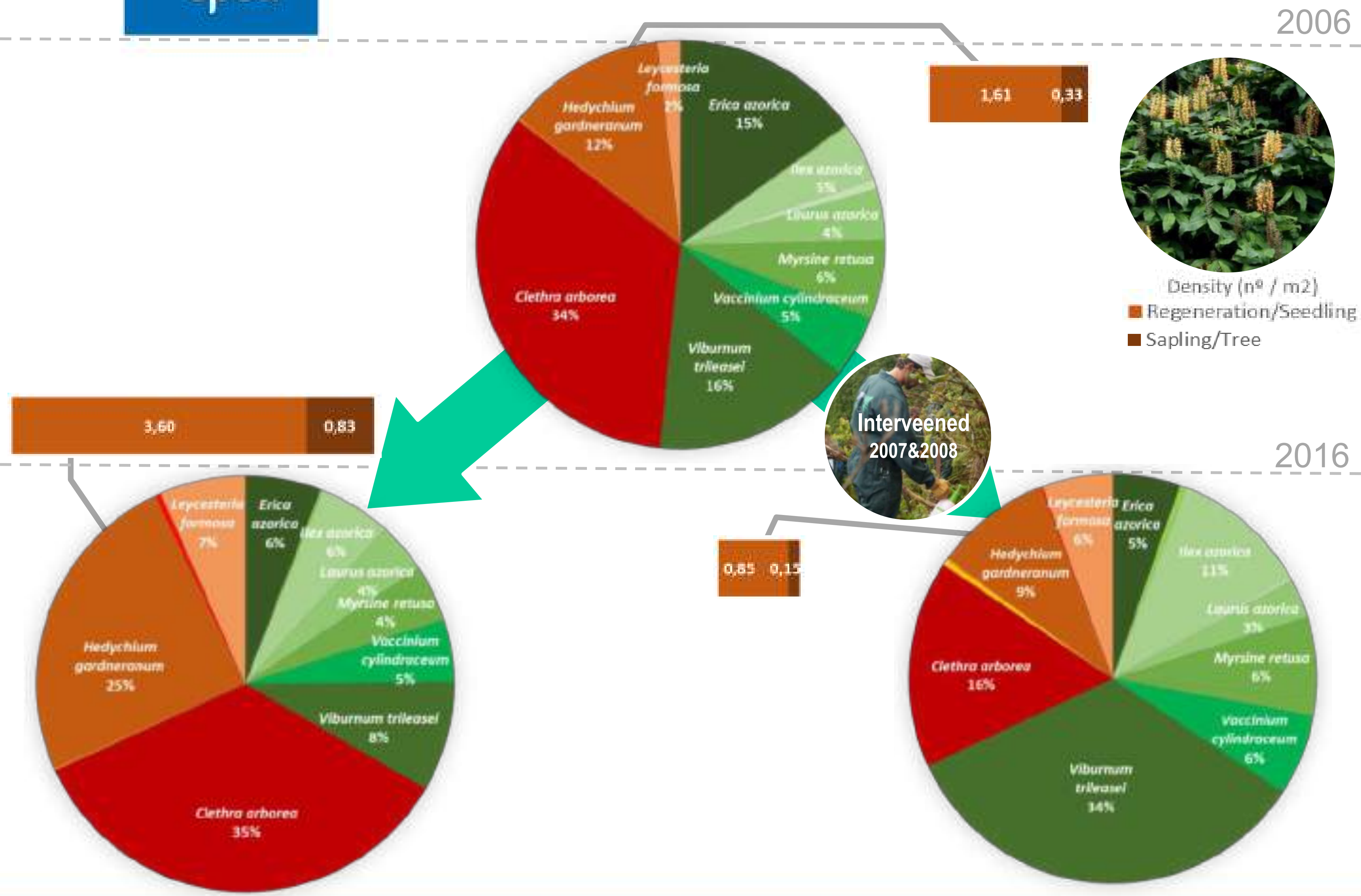

Dicksonia antartica
(Soft tree fern)


Gunnera tinctoria
(Chilean rhubarb)


Acacia melanoxylon
(Black acacia)

Global Invasive Species Database (IUCN)

Monitoring Humid Laurel Forest



Problems with high density of invasive species

Natural engineering techinques

Governo dos Açores

Slope reprofiling

Slope reprofiling with drainage ditches

Drainage ditches with plantation of native species and aplication of hydroseeding

Slope reprofiling after 3 years of implementation

Crib wall construction

Crib wall construction with slope reprofiling

Crib wall construction the base of the infrastructure

Crib wall construction

Crib wall construction with the help of the backoe

Crib wall construction and vegetation grid

Crib wall construction

Drainage ditches in the crib wall

Maintainace of the crib wall and hydrosseding

Aplication of the hydrosseding in the crib wall video

Crib wall after 3 years

Vegetation grid

Vegetation grid

Vegetacion grid

Vegetacion grid with dranaige ditches

Vegetacion grid ater 3 years

Dranaige ditches construction

Dranaige ditches

Other construcions: Micro weirs

Rolls of plant material (*Sphagunum* sp.)

Slope reprofiling with drain ditches



Peniche, 30 January of 2018 | Filipe Figueiredo| filipe.figueiredo@spea.pt

www.spea.pt



Micropropagation and seed germination of endemic plants from Berlengas Archipelago

Inês A. Franco, Teresa Mouga and Clélia Afonso
MARE – Marine and Environmental Sciences Centre, ESTM, Instituto Politécnico de Leiria, 2520-641 Peniche, Portugal

Pulicaria microcephala

Armeria berlengensis

Herniaria berlengiana

Establishment of protocols that allow the multiplication of the endemic species of Berlengas

Pulicaria microcephala

- **Vulnerable species**

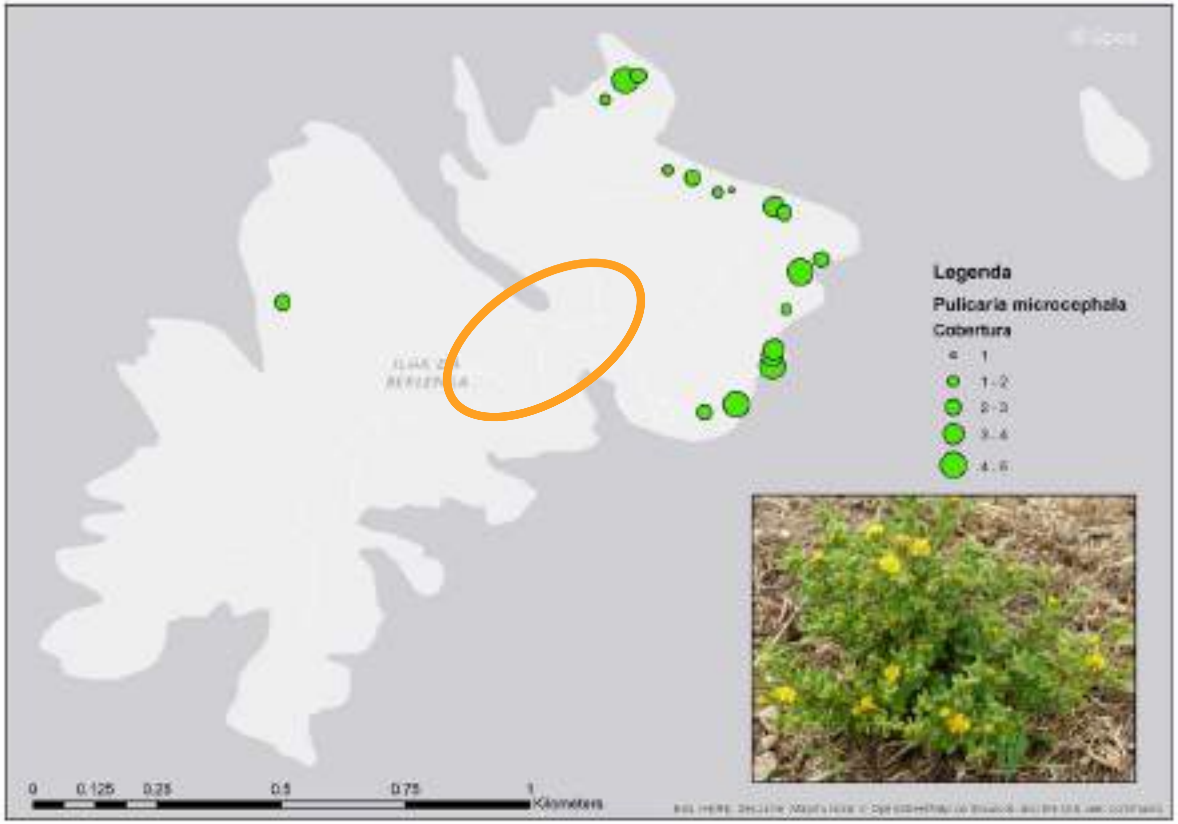


Fig. 1 Map indicating the distribution of *Pulicaria microcephala.*

Armeria berlengensis

- **Vulnerable species**

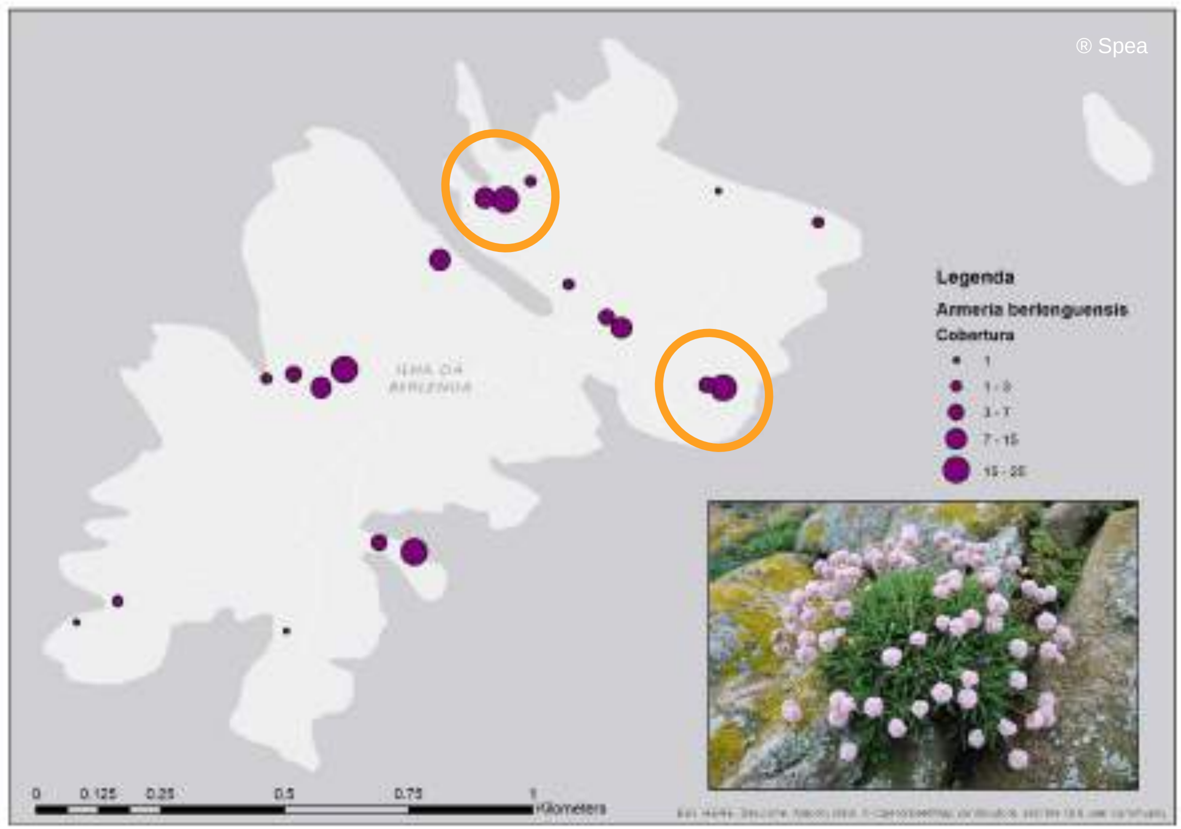


Fig. 2 Map indicating the distribution of *Armeria berlengensis.*

Herniaria berlengiana

- **Endangered species**

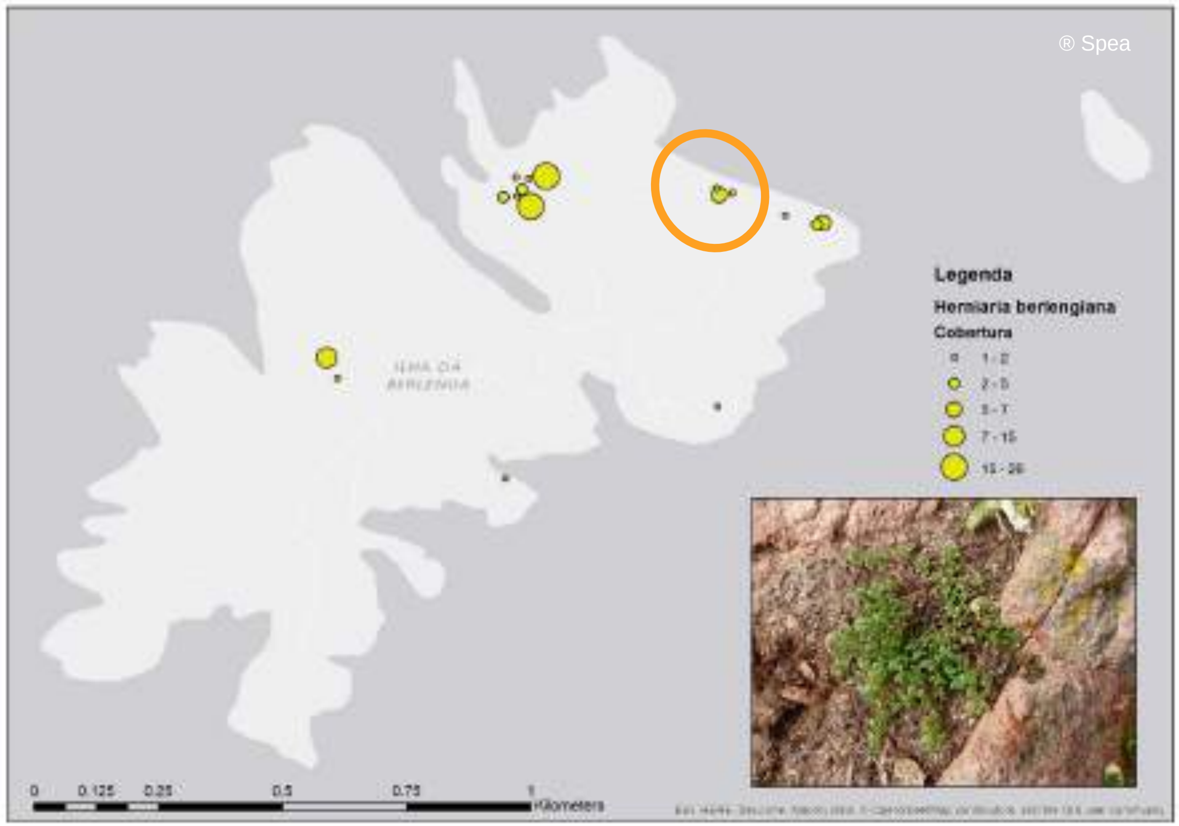
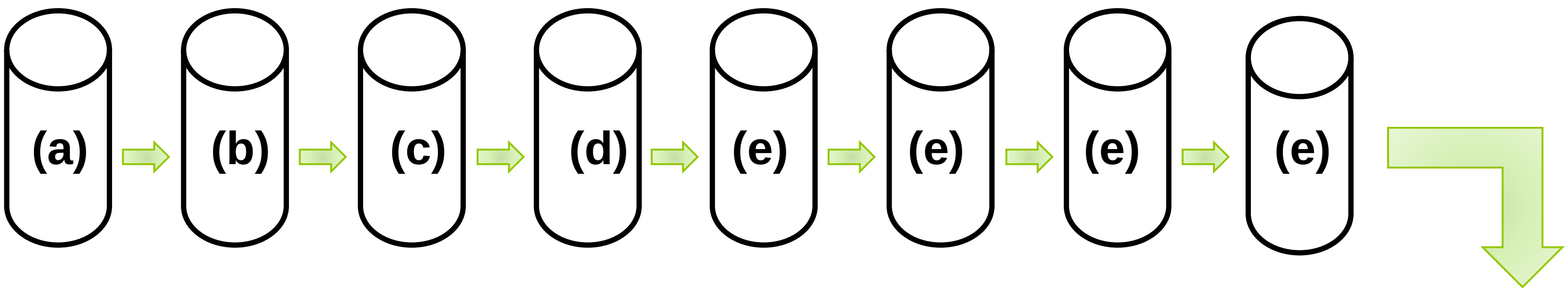


Fig. 3 Map indicating the distribution of *Herniaria berlengiana.*



Component	
(a)	distilled water
(b)	Ethanol
(c)	Sodium hypochlorite
(d)	Fungicide
(e)	4x4min Sterilized distilled water

- Table I. Best disinfection process used in *Pulicaria microcephala* seeds.

Process 6	
1min	Ethanol 96%
20min	Sodium hypochlorite <5%, 20%
1min	Mancozebe 64%, 2,5g/L
1 min	Tirame 80%, 0.2g/L
4x4min Sterilized distilled water	

Success Rate: 73.0%

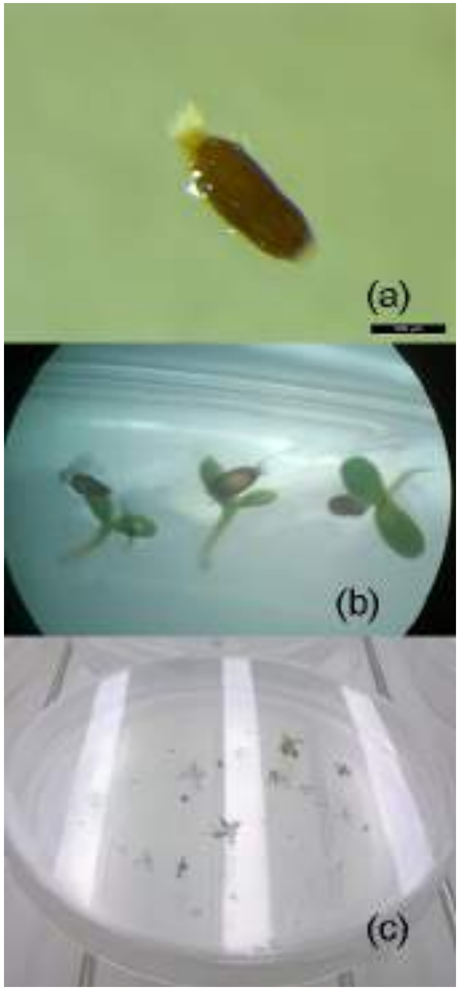


Fig. 4 *Pulicaria microcephala* seed (a) seedling and seed sowing (b) seedling two weeks after germination (c).

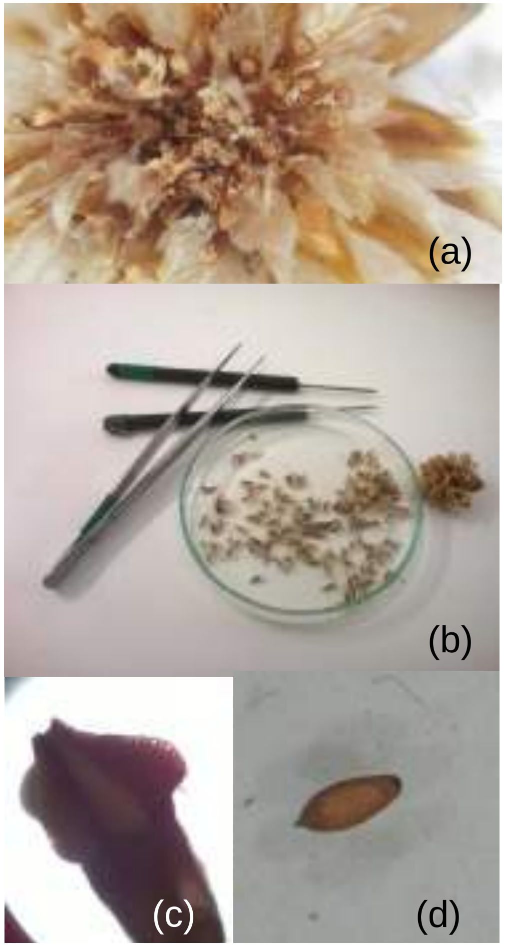


Fig. 5 Fruiting heads (a); flowers (b); Ovarie (c); Seed (d)

Table II. Total number and means for the number of fruiting heads of *Armeria berlengensis* and characterization of the flowers that compose them.

	#	mean values /fruiting head
Fuiting heads analysed	98	-
total number flowers analyzed	4721	48,173
total number seeds collected	164	1,673

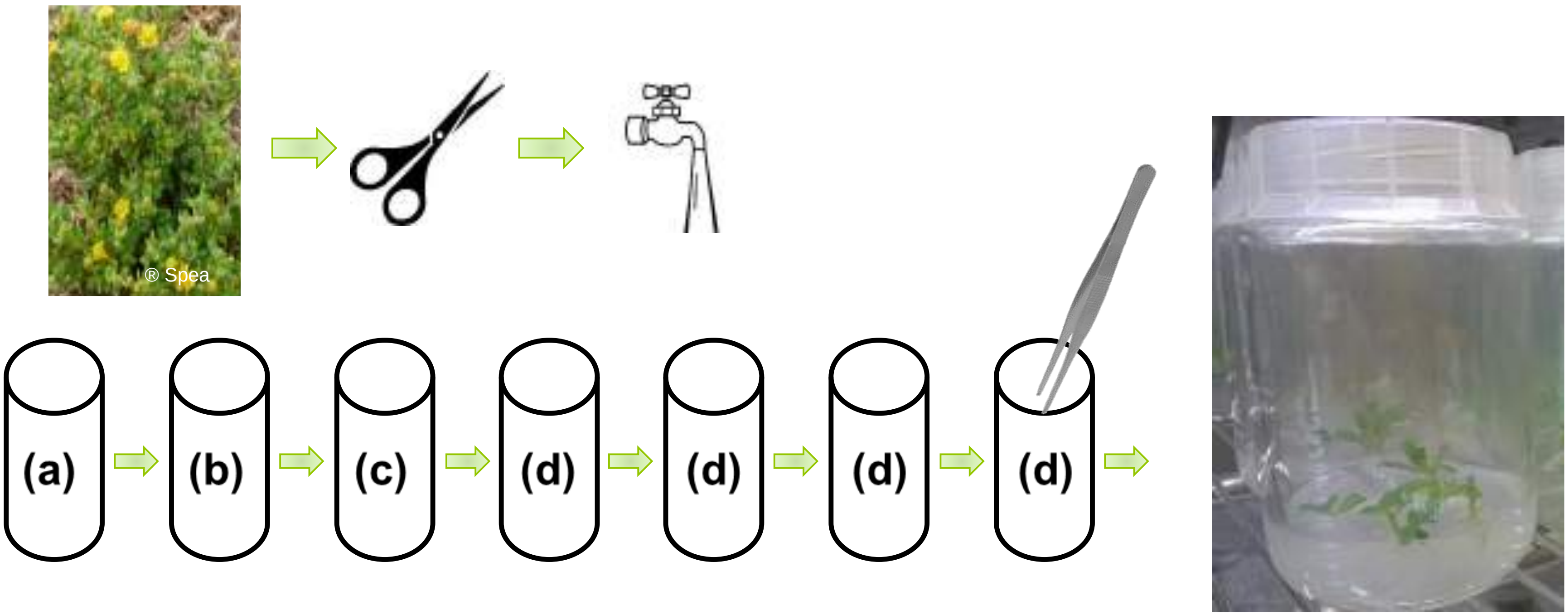
- Table III. Best disinfection process used in *Armeria bernlengensis* seeds.

Process 3		Process 5	
-		2 hours	Submerged in distilled water
1 min	Ethanol 96%	1 min	Ethanol 70%
20 min	Sodium hypochlorite <5%, 10%	5 min	Sodium hypochlorite <5%, 10%
4x4min Sterilized distilled water			

Fig. 6 Seddling of *Armeria berlengensis.*

Success Rate: 20.0%

Pulicaria microcephala



	Component
(a)	Ethanol
(b)	Sodium hypochlorite
(c)	Mancozebe
(d)	4x4min Sterilized distilled water

- Table IV. Best disinfection process used in *Pulicaria microcephala* explants.

Process 1	
1min	Ethanol 96%
20min	Sodium hypochlorite <5%, 20%
1min	Mancozebe 64%, 2,5g/L
4x4min Sterilized distilled water	

- Fig. 7 *Pulicaria microcephala* in in vitro culture.

Success Rate: 24.4%

Combination of growth regulators:

- Kinetin (Kin) and 1-Naphthaleneacetic acid (NAA)
- Kinetin and Indole-3-acetic acid (IAA)
- Kinetin and Indole-3-butyric acid (IBA)

Disinfection

Shoots with 0.5-1cm long

Different concentrations of two combined growth regulators

Control: Basal medium without the addition of any growth regulators

Control

Kin and NAA

Kin and IAA

Kin and IBA

Fig. 8 Examples of the shoot behavior under Control, Kin and NAA, Kin and IAA and also Kin ans IBA treatments after two in in-vitro culture

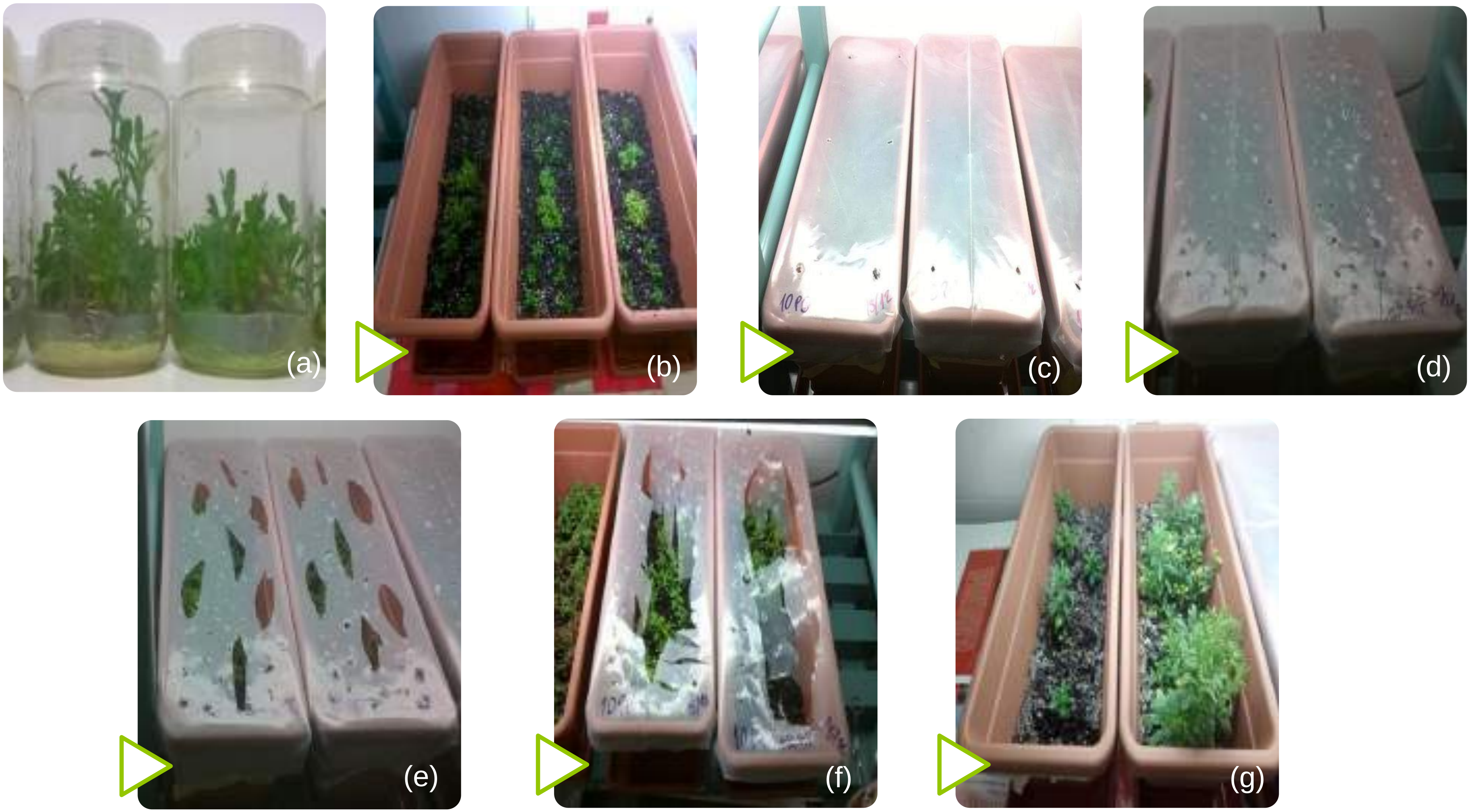


Fig. 9 Acclimatization process: one month plants (a), plants in pots (b), first six holes (c), fourth week of acclimatization (d), fifth week of acclimatization (e), final step in acclimatization with poor plastic coverage (f), acclimatized plants (g)

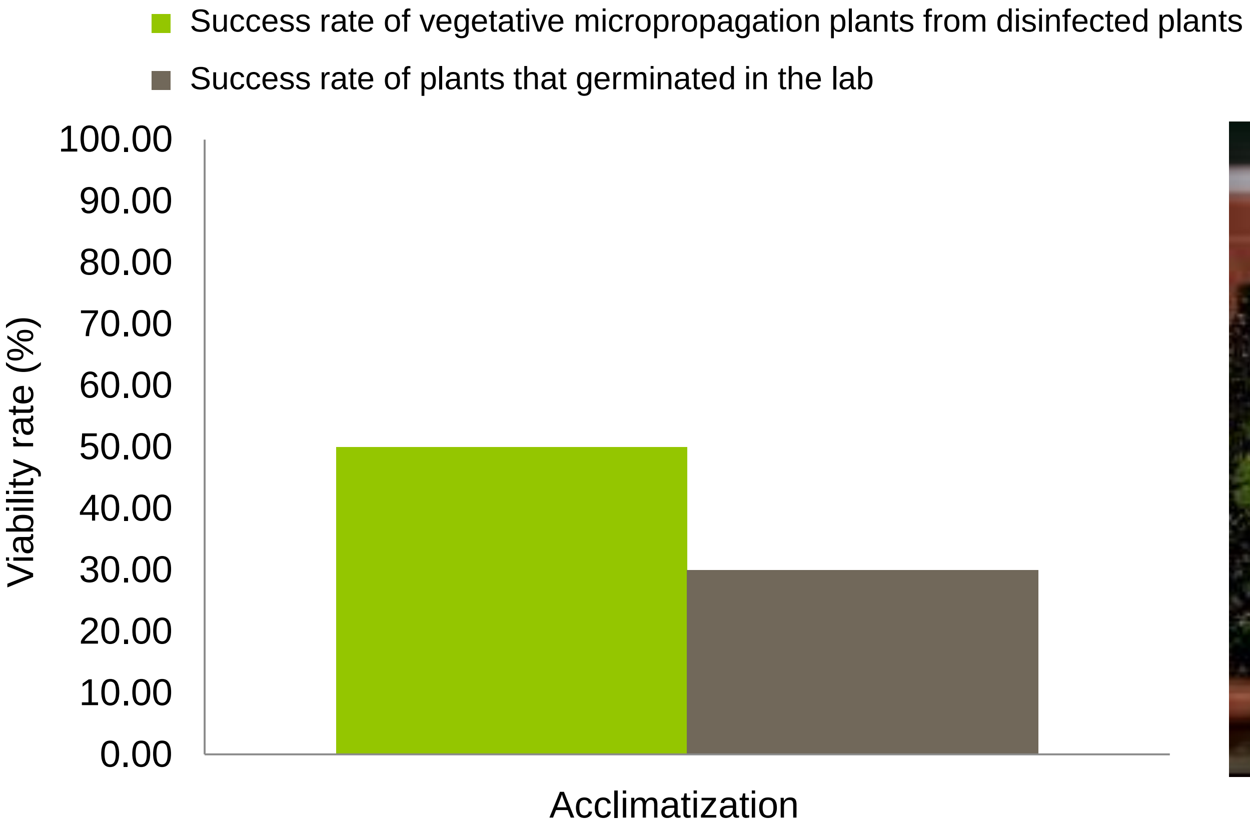


Fig. 10 Percentage values of the viability of the acclimatization process. The green bar corresponds to a pot that just contained plants from vegetative propagation of sterilized plants and initially kept in the laboratory (MV), the grey bar shows the first Seed generated plants (PGS) (germinated during the Germination trials).

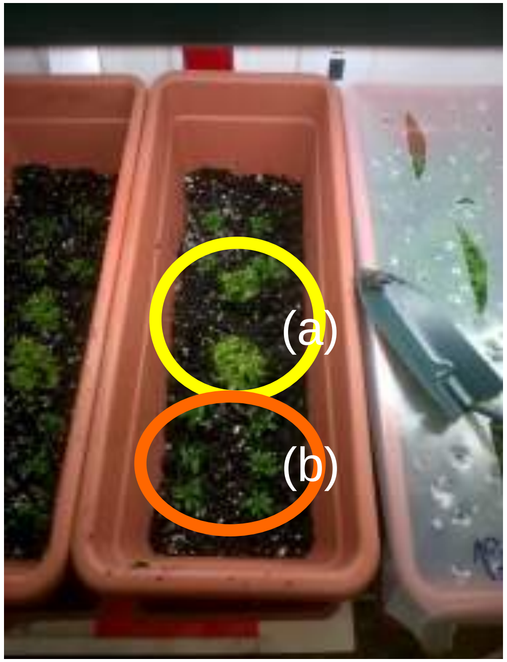


Fig. 11 Examples of the initial length of the acclimatized plants from seed germination (a) and from micropropagation of the disinfected Berlengas plants (b).

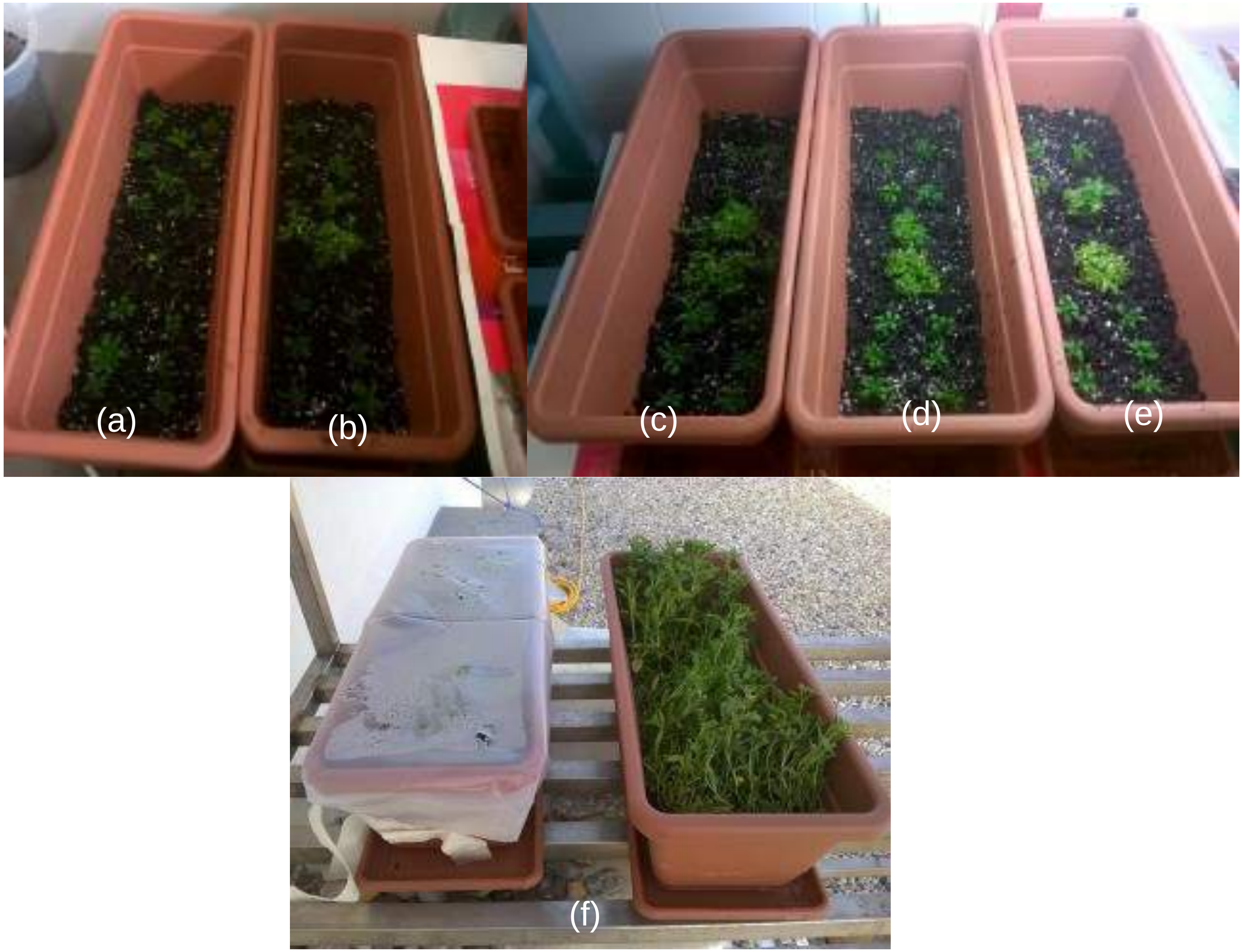
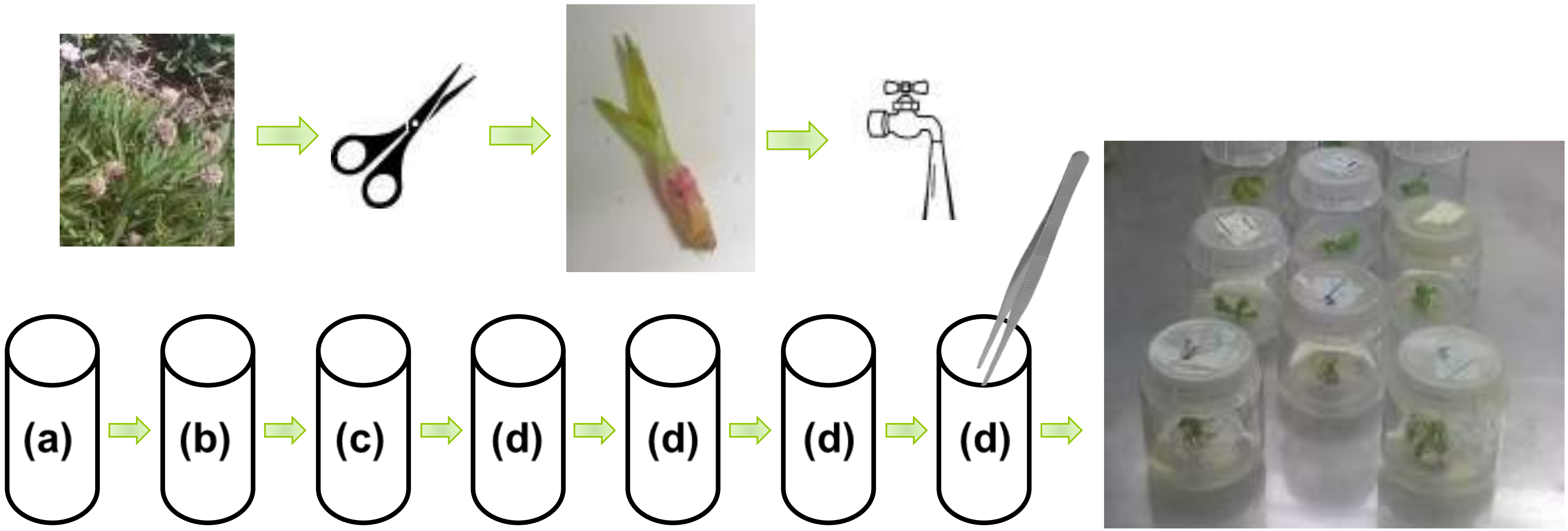


Fig. 12 Acclimatization process with differences in the value of Luminance (Lux): 789 Lux (a), 1088 Lux (b), 3650 Lux (c), 5640 Lux (d), 5790 Lux (e), No controlled luminance (f).

Fig. 13 Examples of the final length of the acclimatized plants from seed germination (a) and from micropropagation of the disinfected Berlengas plants in he lab (b) and on the rooftop (c).

Armeria berlengensis



Component	
(a)	Ethanol
(b)	Sodium hypochlorite
(c)	Mancozebe
(d)	4x4min Sterilized distilled water

- Table V. Best disinfection process used in *Armeria berlengensis* explants.

Process 2		Process 6	
1 min	Ethanol 96%	1 min	Ethanol 96%
20 min	Sodium hypochlorite <5% 20%	20 min	Sodium hypochlorite <5%, 20%
1 min	Hydrogen Peroxide 10%		-
4x4min Sterilized distilled water			

Success Rate for stems: 15.79%

Success Rate for leaf: 33.33%

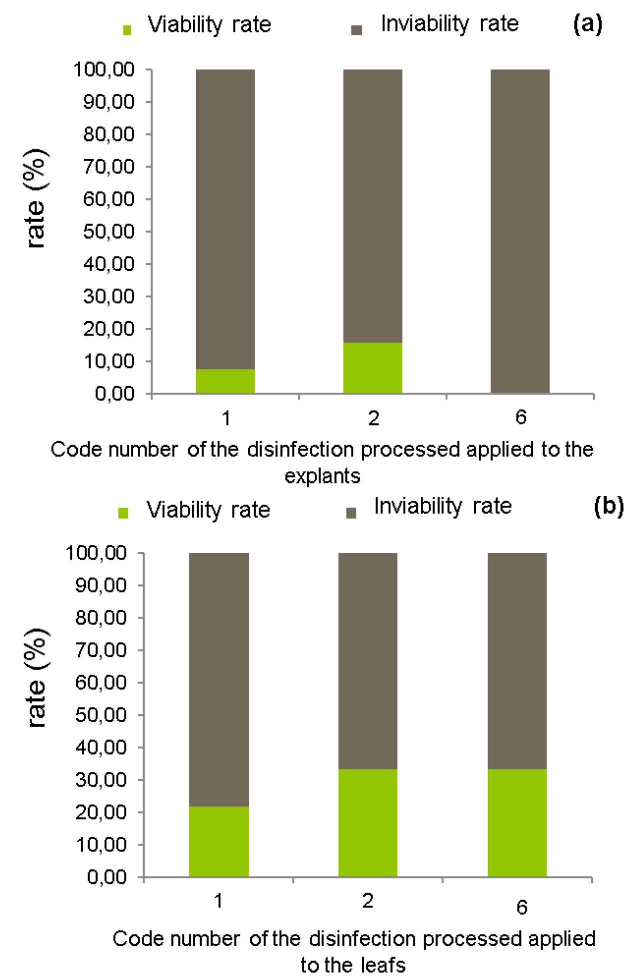


Fig. 15 Percentage values of Viability rates (green color) and Inviability rates (gray color) for the various disinfection processes applied to several *Armeria berlengensis* plants (a) and leafs (b).

Fig. 16 Big *(a)* and small *(b)* *Armeria berlengensis to aclimatize* and an acclimatized *Armeria berlengensis (c)*

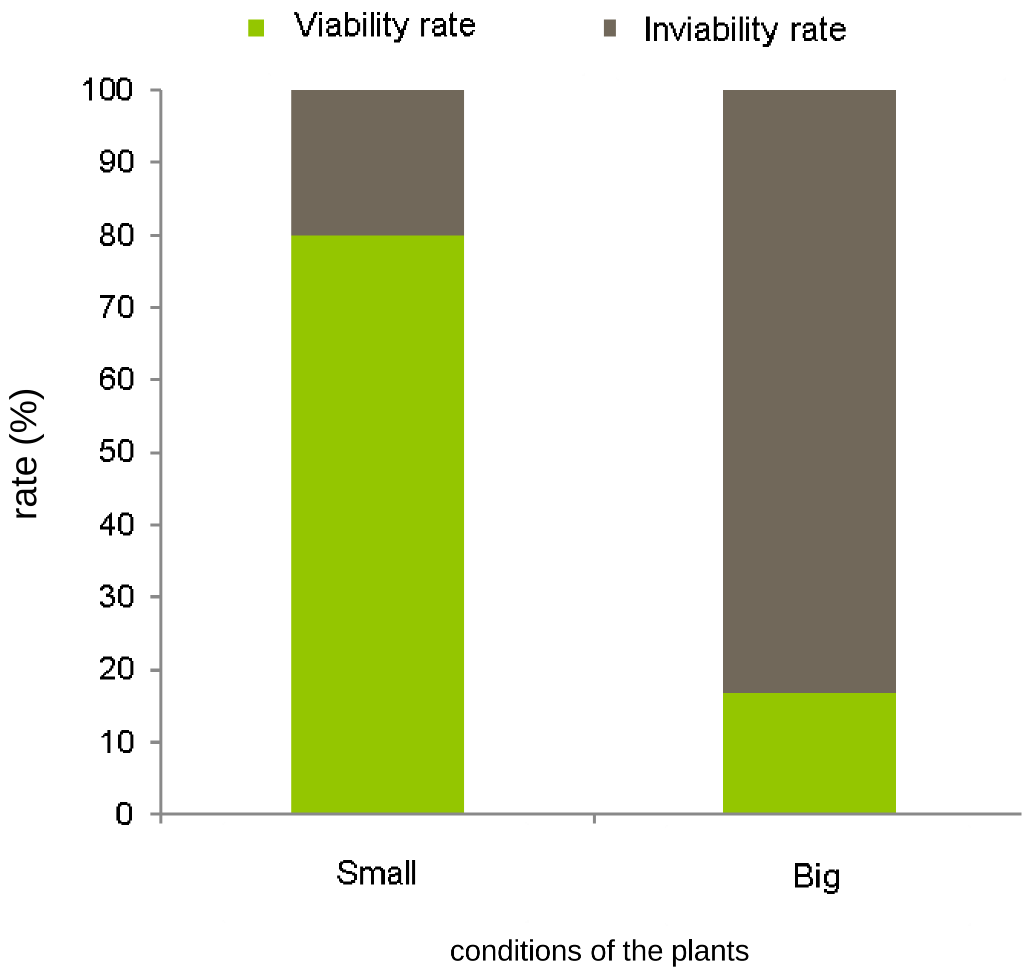
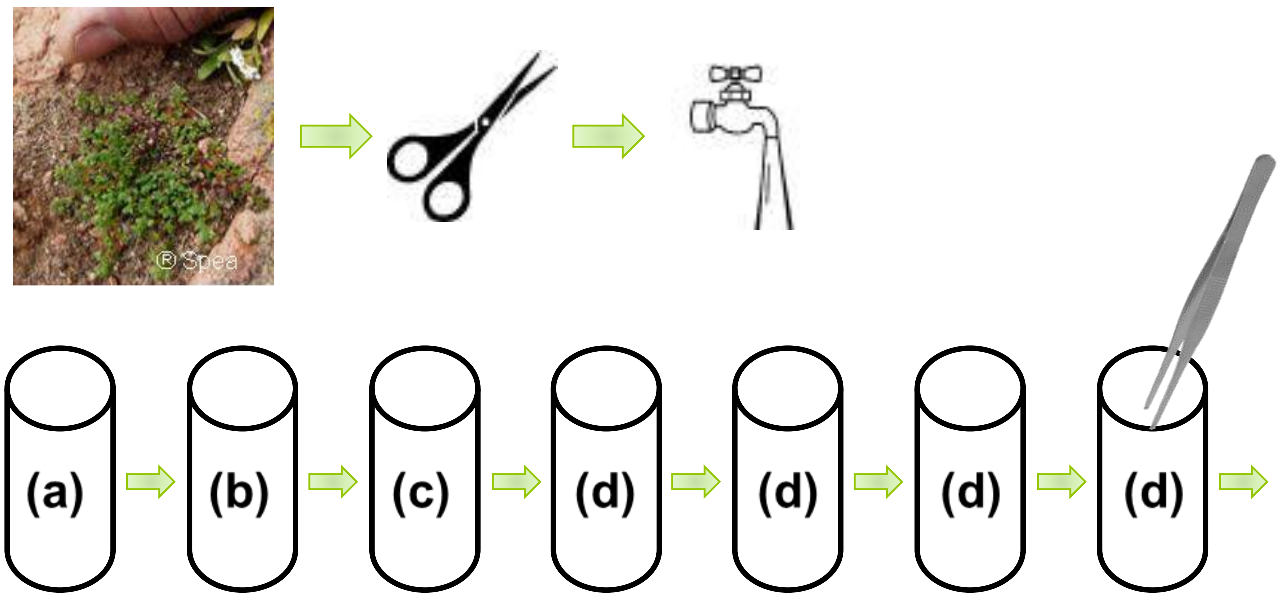
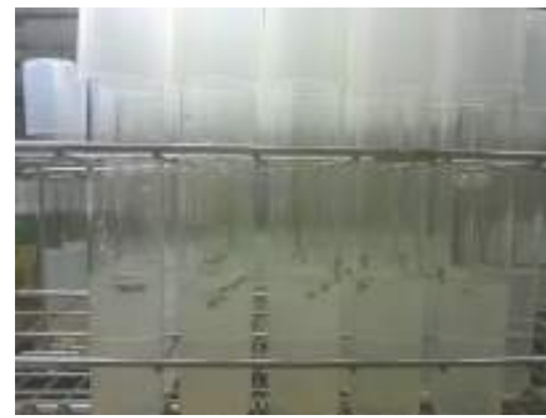


Fig. 17 Percentage values of Viability rates (green color) and Inviability rates (gray color) for the various conditions (size) of *Armeria berlengensis* that were acclimatized.

Herniaria berlengiana





	Component
(a)	Ethanol
(b)	Sodium hypochlorite
(c)	Tirame
(d)	4x4min Sterilized distilled water

- Table VI. Best disinfection process used in *Herniaria berlengiana* explants.

Process 2		Process 3	
1 min	Ethanol 96%	5 min	Ethanol 70%
20 min	Sodium hypochlorite <5%, 20%	20 min	Sodium hypochlorite <5%, 20%
-		1 min	Tirame 80% 0.2g/L
4x4min Sterilized distilled water			

Fig. 18 *Herniaria bernlengiana* in in-vitro culture.

Success Rate Process 2: 17.14%

Success Rate Process 3: 18.18%

Micropropagation is an adequate strategy to achieve the successful conservation of the three endemic species.

Seed germination

- *Pulicaria microcephala* - high success rate
- *Armeria berlengensis* - low success rate

Herniaria berlengiana is very difficult to find and to successfully adapt to *in-vitro* culture.

THANK YOU

Acknowledgments

This study had the support of Fundação para a Ciência e Tecnologia (FCT), through the strategic project UID/MAR/04292/2013 granted to MARE.

This project has financial support of LIFE+ Program LIFE13 NAT/PT/000458 - LIFE Berlengas, and had the support of Fundação para a Ciência e Tecnologia (FCT) through the strategic project UID/MAR/04292/2013 granted to MARE.

To SPEA and ICNF a special thanks for all the help and support on the travels to the island and with the plant collection in the Natural Reserve of Berlengas Archipelago.

Thanks are also due to the Portuguese Navy and to the company Julius for the transportation provided to and from Berlengas island.

The project LIFE Puffinus Tavolara

“Protection of the largest world population of *Puffinus yelkouan*”

Paolo Sposimo

F. Dell’Agnello, A. Navone, J. Primicerio, M. Putzu, V.Secchi, G. Spano

Peniche, January 2018

Background

Life Puffinus
TAVOLARA

The Marine Protected Area (MPA) Tavolara - Punta Coda Cavallo hosts 9,991-13,424 pairs of Yelkouan shearwaters (*Puffinus yelkouan*), between 1/3 and 2/3 of the global population, estimated in 15,337-30,519 pairs.

Vulnerable at global level and listed in Ann. I of EU Birds Directive. Its protection is therefore one of the main goals of the MPA

Life Puffinus TAVOLARA

Main threat: predation by Black rats *Rattus rattus* was recorded on 100 % of examined nests of Yelkouan shearwater on both islands, with the exceptions of single caves of Tavolara and of exceptional years with very low density of rat populations

Life Puffinus
TAVOLARA

Rat eradication is the solution! But the islands are large and, especially Tavolara, the topography is steep and rugged … the aerial distribution of bait appears to be the best or the only feasible option

Molara hosts 300-600 pairs of Yelkouan shearwaters, Tavolara > 10.000

2008: rat eradication with aerial distribution, the first in Italy and in Mediterranean region, had been successfully completed on Molara.

Now a new rat population (as confirmed by genetic analysis) is present, probably an intentional introduction by man

For the shearwaters, even considering rat recolonization, we believe that ours has been a significant conservation action: 3 years of high productivity, estimated cost = 100 €/chick fledged

Propedeutic for larger island eradications .... acquisition of bucket and GPS control system and experience for our staff

Life Puffinus TAVOLARA

OPTIONS FOR THE FUTURE

- New eradication on MOLARA => **important** (but opposition of one of the new owners…)
- Eradication on TAVOLARA => **difficult but by far the priority for Yelkouan shearwater conservation** at global level

A proposal submitted to the EU for the 2012 LIFE call was approved and co-financed

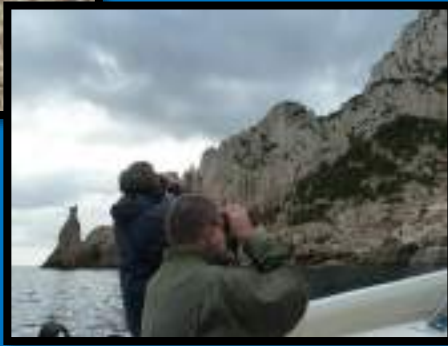
Life Puffinus TAVOLARA

The project includes:

Introduced Rodents eradication on Tavolara and surrounding islets

and other actions more or less related:

- Control of the feral goats population (capture and translocation)
- Eradication of *Carpobrotus sp.* on Tavolara
- Communication and dissemination activities
- Monitoring of effects on target and non-target species



Life Puffinus
TAVOLARA

Rodents (Black rat and House mouse) eradication

Scheduled in October 2015, delayed for 2 years due to authorization difficulties (unclear Health Ministery ordinance, now according with an EU regulation a specific authorization is needed)

Authorization obtained in March 2017!!!

Instruments, and experiences, from Molara and Montecristo

GPS-based distribution control system

Main (technical) difficulties:

- Extremely steep morphology, with caves (inhabited by rats) in high cliffs, with consequent risks that some rat habitats remain unbaited
- integration with hand distribution along parts of the island's coastline

Life Puffinus TAVOLARA

Not so easy to explore: a problem during preliminary surveys

“Lots of people have baited cliffs but I don’t think any of them have been quite like Tavolara” (Pete McClelland, Island Conservation NZ, *in litt.)*

Life Puffinus
TAVOLARA

Military base with network of cables running up to the pylons located on the area’s highest peaks (up to 400 m above ground level)

Life Puffinus TAVOLARA

Feral goats (that have an high impact on vegetation) assume pellets, increasing the risk of poisoning scavenger birds and of eradication’s failure, by removing pellets potentially from relatively large areas

House mouse!

Life Puffinus
TAVOLARA

Areas with small settlements and harbours (= reinvasion risks)

Risk of mortality for non target species

After 2 years of preliminary surveys, including rodent monitoring, field tests on bait assumption by rodents and on bait disappearance, a peer-reviewed eradication plan (collaboration with Island Conservation), shearwaters monitoring …


Puffinus

Eradication Plan of introduced Rodents on the island of Tavolara (Sardinia)

Draft

January 2015

Paolo Sposimo (NEMO srl)

Augusto Navone, Giovanna Spano (AMP Tavolara – Punta Coda Cavallo)

Nicola Baccetti (ISPRA)

LIFE12 NAT/IT/000416 - LIFE Puffinus Tavolara "Protection of the largest world population of *Puffinus yelkouan*

Città di Olbia

NEMO

… and 2 years for the authorization

ISLAND CONSERVATION

Life Puffinus
TAVOLARA

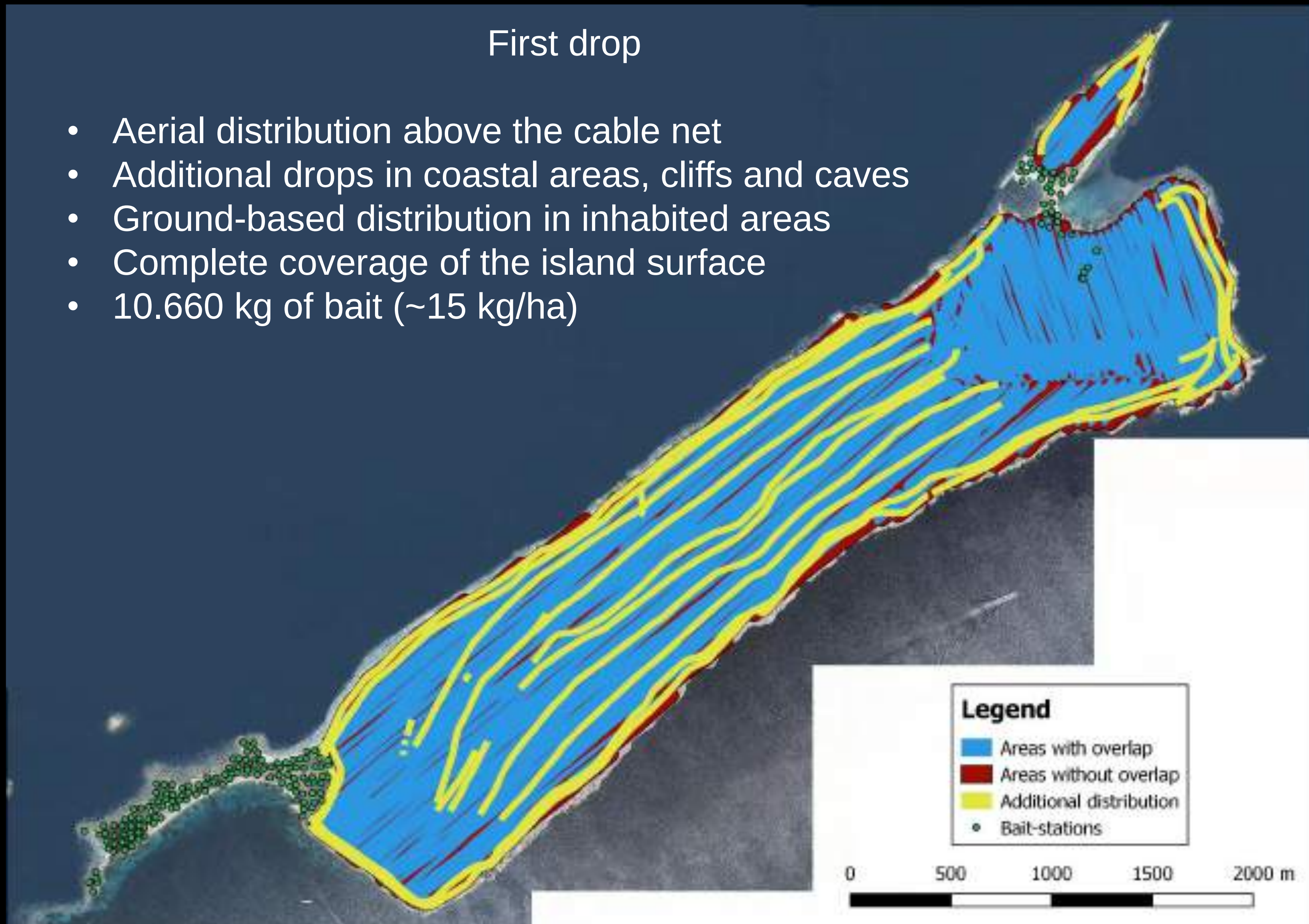
24th-25th October 2017: first aerial bait distribution

2 expert pilots from Island Conservation to support the Italian pilot, but we discovered that we had a very skilled pilot!

ISLAND CONSERVATION

First drop

- Aerial distribution above the cable net
- Additional drops in coastal areas, cliffs and caves
- Ground-based distribution in inhabited areas
- Complete coverage of the island surface
- 10.660 kg of bait (~15 kg/ha)



2nd distribution: 17th November 2017: 7060 kg (9,8 kg/ha), apparently optimal coverage of the island

Life Puffinus
TAVOLARA

Extimation of quantity of bait into the sea and monitoring of presence of brodifacoum residuals in coastal fish

Very good results: small quantities of pellets fell into the sea in 11 out of 12 points. Absence of observation of bait consumption by fish and of residuals of brodifacoum

Life Puffinus
TAVOLARA

We have done a good job and we have been lucky: good weather, great pilot and great staff, very few technical problems

The eradication of Rodents on Tavolara appeared to be one of the most effective conservation action for seabirds that could realistically be implemented in Italy and in all Mediterranean Sea

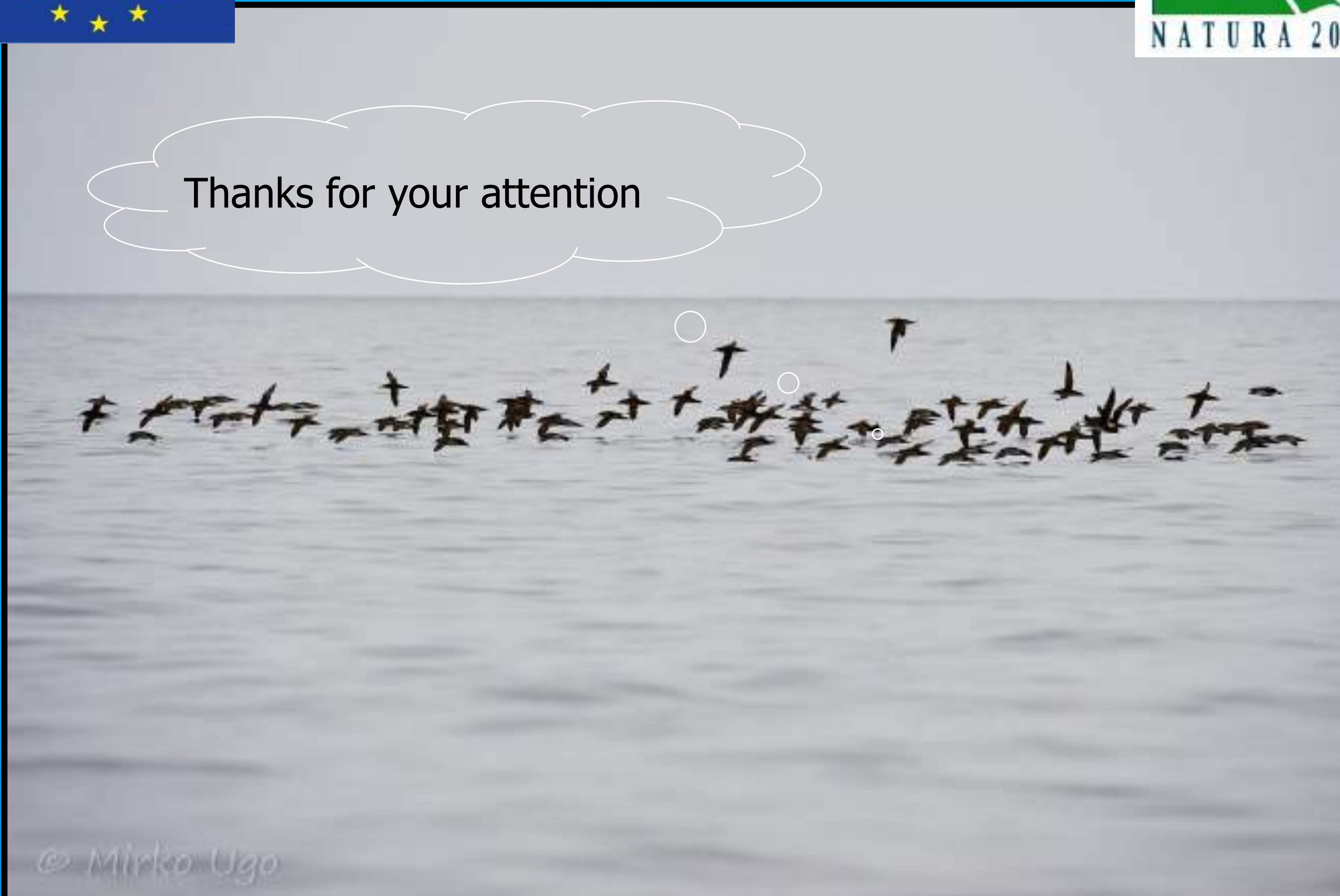
• Currently at global level there are 1000-1500 pairs of Yelkouan shearwaters breeding in islands without rats. The eradication of rats from Tavolara will increase this number up to 10 times (90 % of Italian population without rats), probably causing a substantial change in the species' conservation status (currently Vulnerable).

•Negative effects appears to be of a relevance incomparable with conservation benefits

•2 years without signs of rodents presence are necessary, in the meanwhile we have to work in bio-security activities

Life Puffinus TAVOLARA

NATURA 2000



Rodent control at seabird colonies in Malta

LIFE Arċipelagu Garnija (LIFE14 NAT/MT/991) Securing the Maltese Islands for the Yelkouan Shearwater *Puffinus yelkouan*

Paulo Lago Barreiro

J. S Santiago Cabello, Martin Austad and Karen Varnham

Restoration of Island Ecosystems Workshop

Peniche – January 2018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Greece
Attica
Peloponnisos Dytiki Ellada ke Io
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Imagery Date: 12/14/2015 36°36'26.55" N 14°51'52.98" E elev 0 m eye alt 1440.00 km


Albania
Thessalia Sterea Ellada
Greece
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Peloponnisos Dytiki Ellada ke Io
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Imagery Date: 12/14/2015 36°36'26.55" N 14°51'52.98" E elev 0 m eye alt 1440.00 km

Yelkouan Shearwater (Garnija) *Puffinus yelkouan*

- 1500-2000 pairs (7% global pop.)
- Steep cliffs and islets
- Breeding: February to July

Scopoli's Shearwater *Calonectris diomedea*

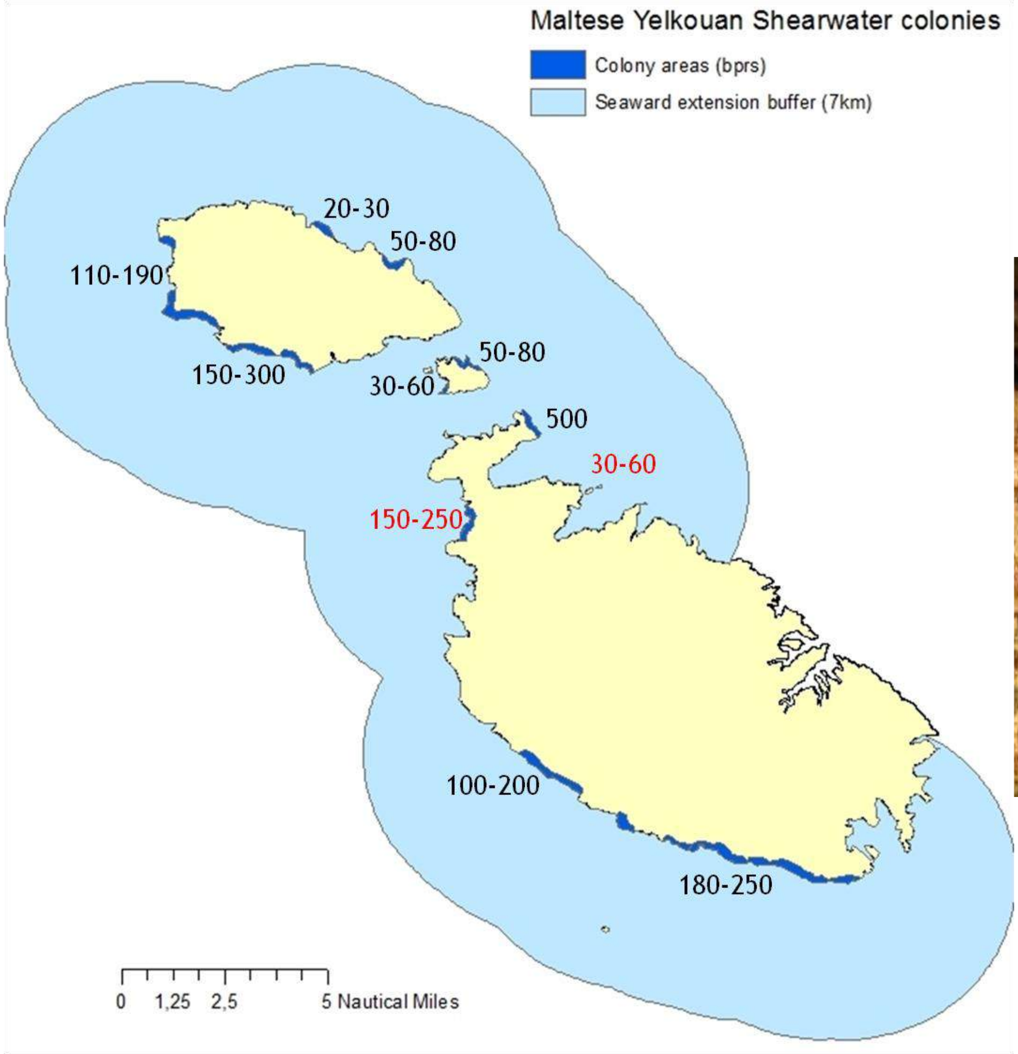
- 4500-5000 pairs
- Steep cliffs and islets
- Breeding: March to October

Mediterranean Storm Petrel

Hydrobates pelagicus melitensis

- 5000 – 8000 pairs (50% global pop.)
- On rat-free Filfla islet & a few sea caves
- Breeding: April to October

Yelkouan Shearwater (Garnija) – *Puffinus yelkouan*

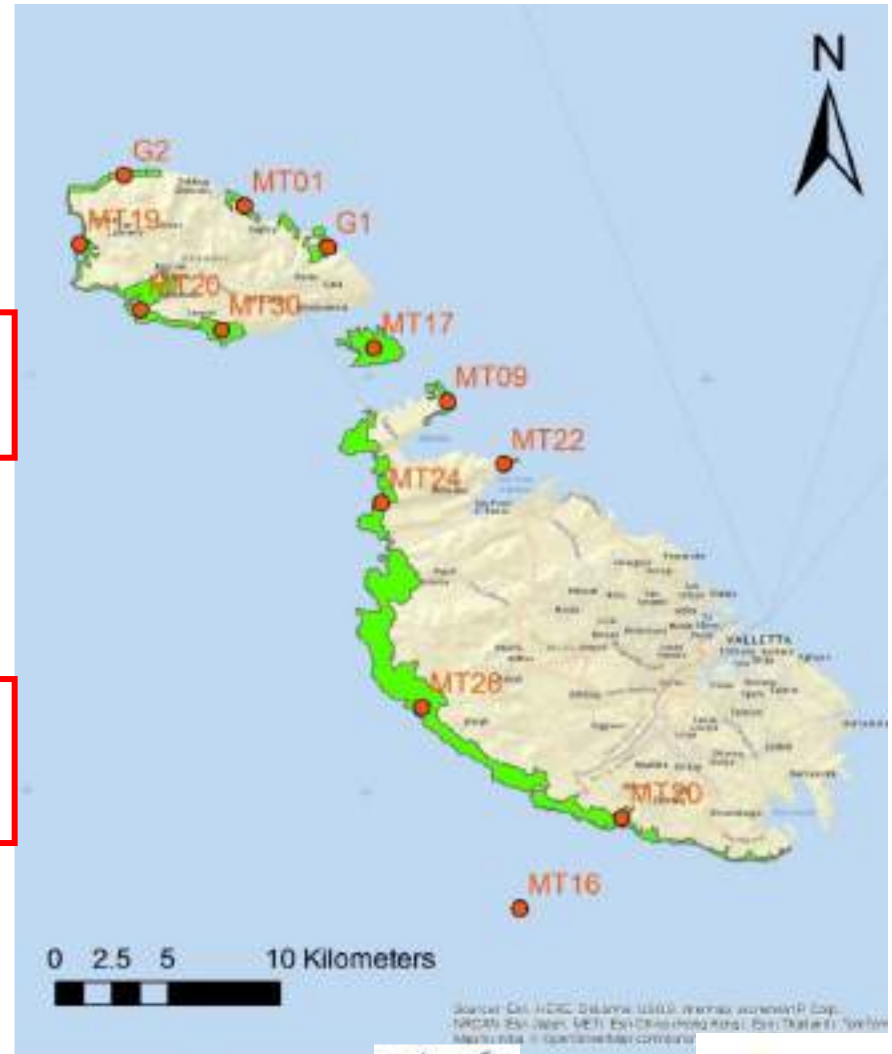


LIFE Arcipelagu Garnija project (2015-2020)

- Closing gaps on knowledge of colony sites
  - Number of breeding pairs
  - Reproductive output

- Identifying prevalent terrestrial threats
  - Predation
  - Light pollution (from land and sea)
  - Disturbance (from land and sea)

- Conservation actions
  - Managing and significantly reducing threats



Rdum tal-Madonna (RM): 11 years of rat control

- Main Yelkouan Shearwater colony in Malta: 500 pairs
- Late 1990s, early 2000s: very low breeding success – high rat predation
- 2007: a seasonal rodent control program was established
  LIFE Yelkouan shearwater project (2006-2010)
- Public awareness actions to reduce littering

Rdum tal-Madonna (RM): 11 years of rat control

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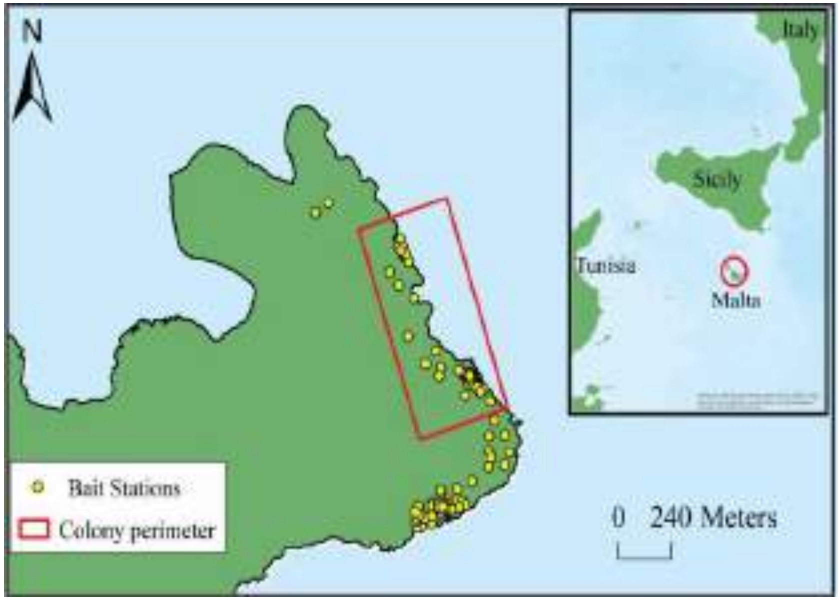
  LIFE Yelkouan shearwater project (2006-2010)
- Public awareness actions to reduce littering

Rat control program at RM

- Eradication not possible
- 90 closed plastic bait stations: two blocks of anticoagulant rodenticide each - brodifacoum 0.005% (2007-2015) and bromadiolone 0.005% (2016-2017)
- Covering around 25ha on top of cliffs and in lower parts
- Baiting 1-3 times per month between February and July
- Signs of rodents and other fauna on the bait (teeth marks) recorded every time



Rat control program at RM: Results

Yelkouan Shearwater Reproductive Success

Year	No. of nests	Reproductive success
2007	6	83%
2008	12	92%
2009	11	91%
2012	16	94%
2013	32	88%
2014	25	88%
2016	24	88%
2017	38	84%

Rat control program at RM: Results

Reproductive Success at RM compared with two other colonies with rat presence

Colony	Year	No. of nests	Reproductive success
RM	2016	24	88%
St. Paul's island	2016	9	67%
Majjistral	2016	12	33%
RM	2017	38	84%
St. Paul's Island	2017	9	11%
Majjistral	2017	11	55%

Rat control program at RM: Lessons learnt

- Seasonal rat control where eradication is not possible is effective at increasing sea bird breeding success
- Allows for establishment of other species – Mediterranean Storm Petrel now establishing at RM

- Reduce littering by visitors through raising awareness and working for efficient waste collection
- Possible to expand rat control to other seabird colonies

Rat assessment at Yelkouan Shearwater colonies 2016-2017

Direct observation

- Dead/Live rats
- Rat signs:
    - Footprints
    - Faeces

Predation:

- On eggs and/or pulli
- Other species:

  Scopoli’s Shearwater

  Storm Petrels, etc.

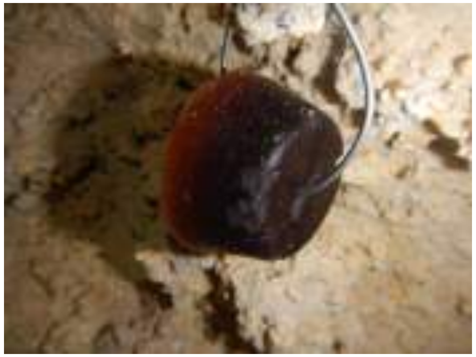
Rat assessment at Yelkouan Shearwater colonies

Trap lines

Site Code	Colony name	Trap nights	Density (captures per 100 corrected trap-nights)
MT17	Kemmuna	06-08/05/2016	60.95
MT17	Kemmunett	05/05/2016	23.26
MT26	Miġra l-Ferħa	24/05/2017	0
MT24	Majjistral NHP	16-18/05/17	5.17

Non-toxic wax blocks

Site code	Site name	Rat Marks on Wax block/s
MT19	Fungus Rock	No
MT09	L-Irdum tal-Madonna	No
MT24	Ċumnija	Yes
MT16	Filfla	No
MT27	Ħal Far	Yes



Rat assessment at Yelkouan Shearwater colonies

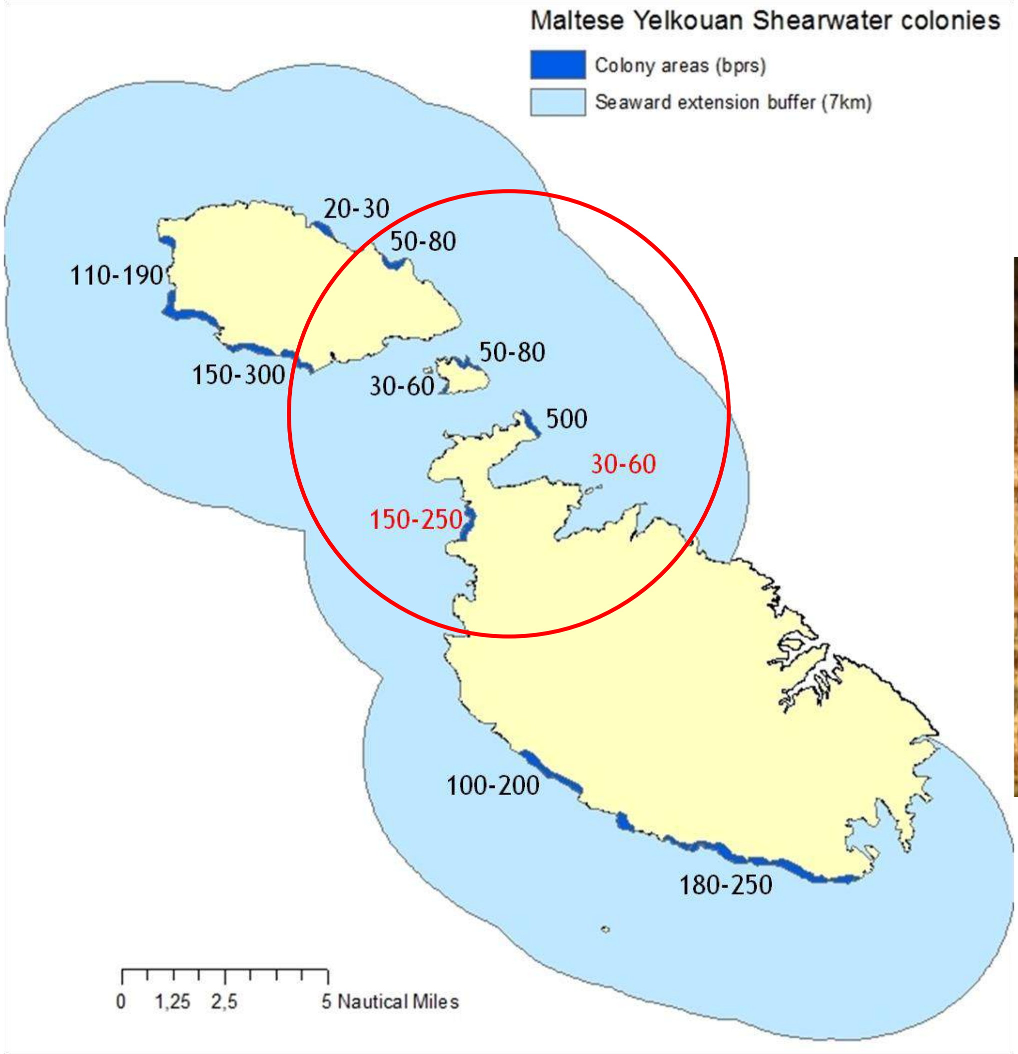
Camera traps

Site Code	Colony name	Number of Camera traps	Total Camera trap days	Rats counted	Rats/day
MT17	Comino	1	13	0	0
MT17	Cominotto	5	214	29	0.14
MT22	St. Paul's Islands	2	148	29	0.20
MT09	L-Irdum tal Madonna	16	914	3	0.00
MT24	Majjistral NHP	10	716	13	0.02
MT24	Ċumnija	1	18	0	0

Rat assessment 2016-2017: Results

- Rat presence was confirmed at 12 of the 16 colonies (and sub-colonies) that were assessed:
    - Rat-free: Filfla and probably Fungus Rock
    - Where unconfirmed, requires more monitoring, but probably low presence/impact
- Resulting in operational plans for rat control at 7 colonies chosen by:
    - colony size & impact by predation;
    - accessibility and feasibility;
    - human resources and budget.
- Biosecurity measures for Filfla and Fungus Rock

Yelkouan Shearwater (Garnija) – *Puffinus yelkouan*



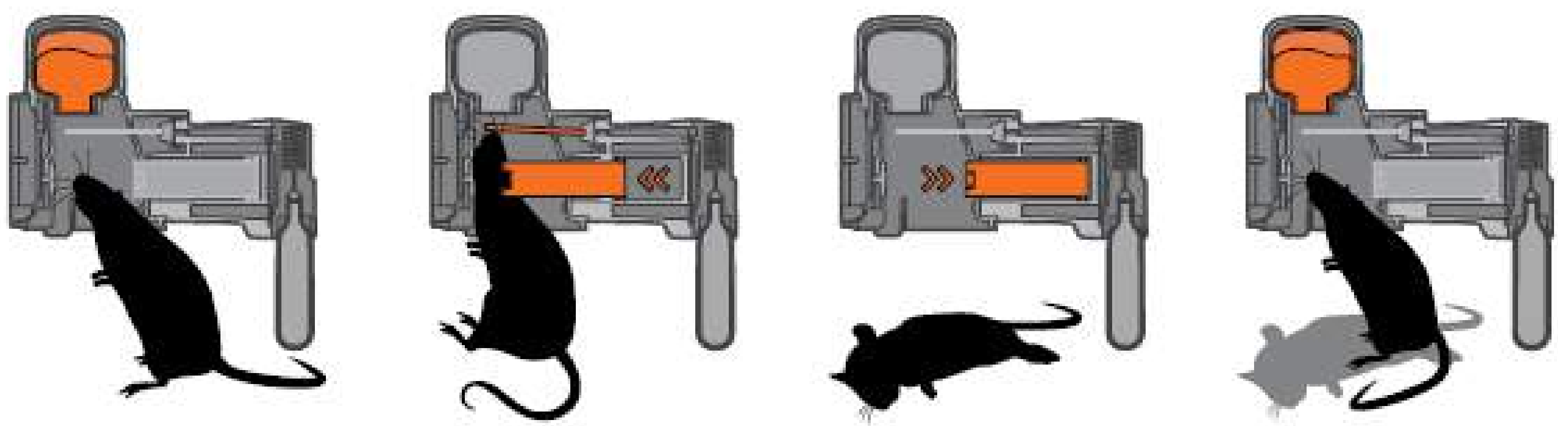
Test of ‘E2/A24 Goodnature’ traps in Yelkouan colonies (2017)

SNIFF SNIFF
Targeted long life lure attracts rats into the trap.

KAPOW!
Rats move the trigger to get to the lure firing the trap.

AUTO-RESET
The trap clears and resets immediately after an A-Class humane kill.

SNIFF SNIFF...
The long life lure continues to attract rats for constant control.



Test of ‘E2/A24 Goodnature’ traps in Yelkouan colonies (2017)

Colony	Trap	Duration (days)	Counter strikes	Rats found	Rats killed/day
Majjistral	1	39	1	1	0.026
Majjistral	2	39	1	1	0.026
St. Pauls Island	1	34	5	5	0.147
St. Pauls Island	2	34	2	2	0.059
Rdum tal-Madonna	1	40	0	0	0
Cominotto	1	41	15	1 (plus 5 skinks and 1 lizard)	0.024-0.219
Cominotto	2	41	12	2 (plus 1 lizard)	0.049-0.268
Cominotto	3	41	8	1	0.024-0.219

Test of ‘E2/A24 Goodnature’ traps: Conclusions

- Good performance
- Great for sites hard to access or dependent on sea conditions: remote edges and caves where Yelkouans nest
- Not suitable for sites with reptiles that could be attracted to ants eating the bait
- Could be use in combination with anticoagulant baiting
- Need to test for every environment

Operational plans for rat control in 2018

- Seasonal control with bait stations/A24-E2 traps
  - Low intensity baiting along cliff top
  - Baiting and/or E2 traps on nesting ledges

➢ Comino and Cominotto islands

➢ Rrdum tal-Madonna

➢ Cumnija

➢ Ta' Isopu (Gozo) AFM base

➢ Majjistral NHP

Operational plans for rat control in 2018

- Eradication on St. Paul's Islands

- 30 – 60 pairs of Yelkouan Shearwater
- 100m from mainland Malta
  - Eradicate – monitor – eradicate
  - If rats return every year – switch to annual control

Biosecurity in rat free-islands

- Filfla : 4.5km from main land Malta
  - Largest known Storm Petrel colony in the Mediterranean
- Fungus Rock: 38m from mainland Gozo
  - Scopoli’s and possibly Yelkouan Shearwater colony

1. Preventing the arrival of rodents and other non-native species
   - Checking equipment and boat before arrival
2. Early detection of invasive species: routine surveillance
   - Monitoring stations with non-toxic wax blocks
   - Inspection for visual signs of rats
3. Responding to invasive species: incursion response
   - Start baiting with anti-coagulant poison within 48hours of detection

LIFE ARĊIPELAGU GARNIJA

Muito obrigado!

NATURA 2000 · Life · BirdLife Malta · tm Transport Malta · rspb giving nature a home

Out of sight, out of mind?

Preliminary findings on the biology and control of the Argentine ant in Madeira archipelago

Mário Boieiro, Cândida Ramos,

Isamberto Silva, Nádia Coelho, Dília Menezes e Carla Rego

The Argentine ant, *Linepithema humile*

–Native species from South America;
–Introduced in all continents and in many oceanic islands;
–Associated to human activities and human-disturbed areas;
–Considered one of the 100 worst invasive species.

Adapted from Wetterer et al., 2009

The Argentine ant, reasons to its succcess

- Opportunistic and generalist;
- Polygynous species;
- Capacity to form supercolonies;
- Engage in mutualistic interactions with many hemipteran species (including other invasive species)

The impacts

–Predation and competition with native ants and other invertebrates

Attacking the Madeira endemic ground beetle *Nesarpalus gregarius*.

The impacts

–Predation of bird nestlings, nuisance and depletion of resources of vertebrates

Predation of nestlings of the Dark-eyed Junco (Suárez et al. 2005)

Population decline of the Coastal Horned Lizard (Fisher et al. 2002)

The impacts

– Interferes with native biotic interactions affecting ecological processes

POLLINATION

Lower visitation by pollinators resulted in lower fruit and seed set (Blancafort and Gómez, 2005)

SEED DISPERSAL

Low transport in invaded areas and lower seedling emergence (Gómez et al., 2003)

Brief history of the Argentine ant in Madeira

–**Detected in Madeira by the end of the 19th century (Schmitz, 1896); however present there since the 1840s.**

–Reports from the early XXth century say that the species is **“a severe nuisance in Funchal and its surroundings”.**

–Later, the Argentine ant was considered **“the most serious problem for agriculture and perhaps the most serious problem for the whole economic life of Madeira” (Schultze-Rhonhof, 1947).**

–The reports from urban areas led to speculations concerning its impact on the natural communities and some authors refered that native ants **“had been completely exterminated”.**

Brief history of the Argentine ant in Madeira

– **In 2002, two myrmecologists visited Madeira and Porto Santo and concluded that the ant is mostly restricted to disturbed places in coastal areas, occupying ~10% land surface.**

– **They hypothesized that it could have been responsible for the extinction of some terrestrial invertebrates, but concluded that is no longer a major threat.**

In recent years two important findings made us question their conclusion:

1) A study on the biodiversity of terrestrial arthropods identified areas where the Argentine ant was extremely abundant.

No or only few native ants were found there.

2) Several reports of predation on bird nestlings by the Argentine ant were reported from those areas.

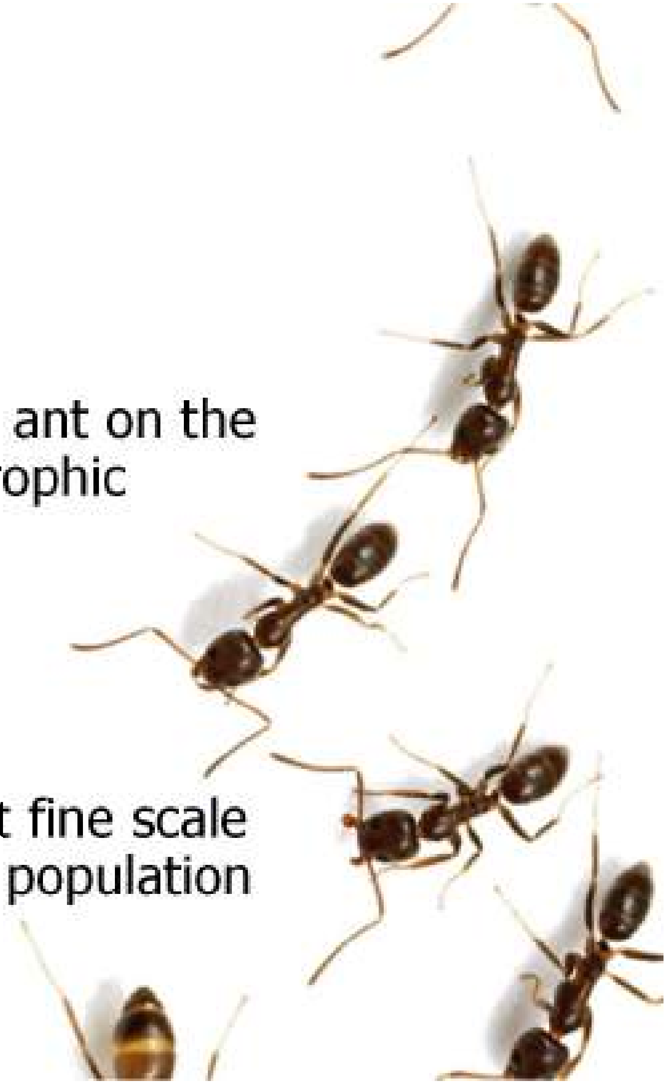
Four bird species are known to be prey of the Argentine ant:

Bulweria bulwerii, Sterna hirundo, Larus michahellis and Serinus canaria

So, our aim was to

1) Assess the potential impact of the Argentine ant on the native biodiversity by studying its diet and trophic interactions;

2) Know the distribution of the Argentine ant at fine scale and perform some preliminary assays for its population control



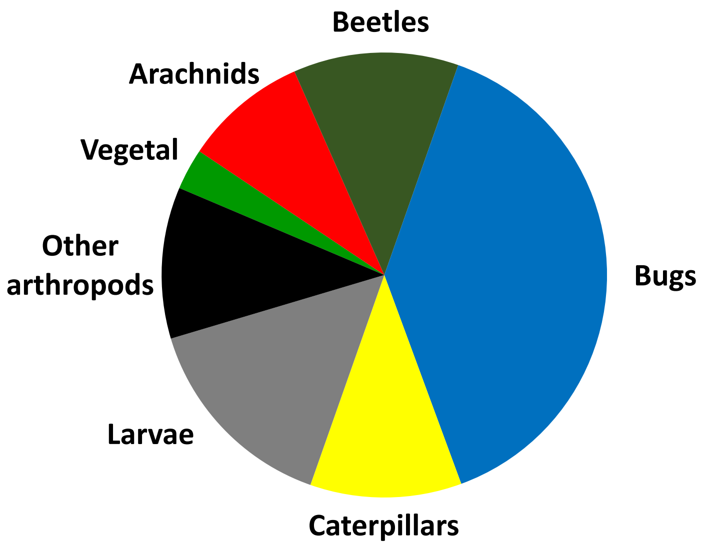
Chão islet

–**High abundance of the Argentine ant;**
–**Size, topography and vegetation-type favour the study;**
–**Natural communities have a good conservation status;**
–**Several number of endemics.**

Diet and trophic interactions

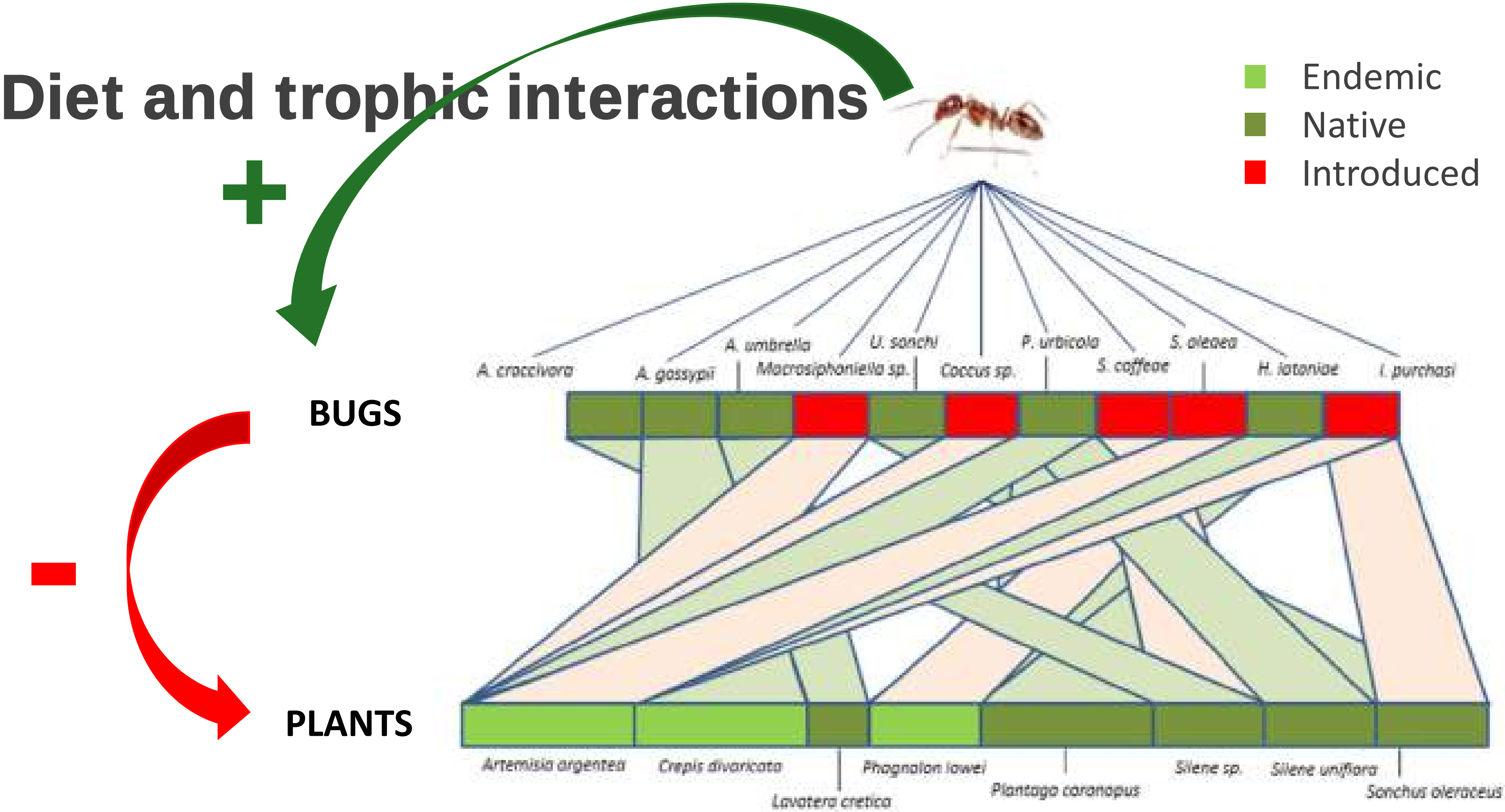
- Observations of 10 minutes at different nest entrances
- The items transported by ants were taken and ID at lab
- Most items were terrestrial arthropods

<u>Solid diet</u>



Diet and trophic interactions

Diet and trophic interactions



So, it is important to stress…

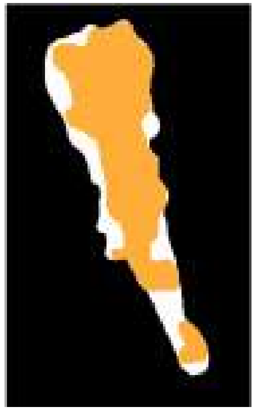
The collection of biological information on the target species and communities is critical to carry effective control and to anticipate community changes

- In Hawaii the control of an invasive ant species (*S. geminata*) led to the increase of another invasive species (*A. gracilipes*) which severely impacted the seabird fauna

Plentovich et al., 2009; 2017

Distribution

We used sugar baits (sucrose 25%) on plastic cards
Baits were set along paralel transects spaced by 10m
Baits were later checked for the presence of the ant
This (and other) data was recorded using a GPS to produce a map



Argentine ant control

Main difficulties

Small size, have many queen and larvae (hidden!), form supercolonies, ... they are everywhere !

Main advantages

We can use their well-organized social system in our benefit!

Recruitment and trophallaxis may ensure a generalised insecticide spread (delayed action).

Argentine ant control

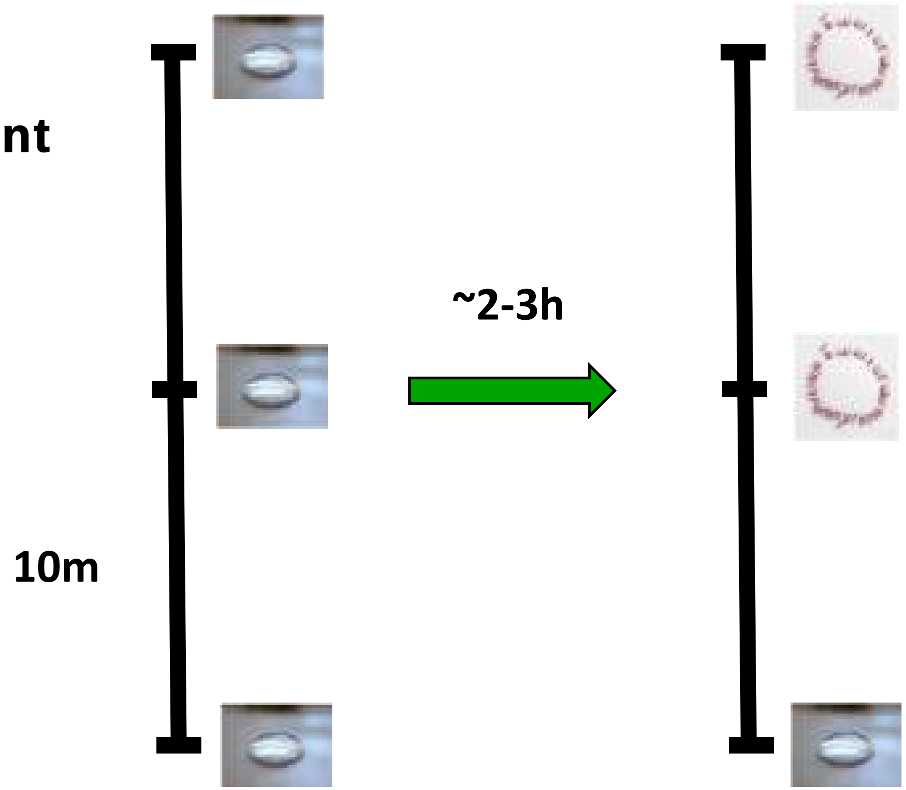
Our population control protocol consisted in four phases:

1) Baiting and check recruitment

2) Delivery of the insecticide

3) Monitoring the intake

4) Removal of the station



Conclusions

The collection of biological information at species and community level is critical to carry effective control and to anticipate community changes.

The use of specific insecticides (formicides) is crucial for ant control, but their application must be done with care.

ACKNOWLEDGEMENTS

- to projects:

- **2gether (**ref. PTDC/BIA-BIC/1013/2014**)** financed by Fundação para a Ciência e a Tecnologia (FCT)

- **LIFE Recover Natura** financed by Fundo Europeu de Desenvolvimento Regional

- to the **Instituto das Florestas e da Conservação da Natureza** (IFCN).


3. Deserta Grande
Thank you!