Threatened Species Recovery Hub

National Environmental Science Programme

Moving mammals – looking backwards, looking forward

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Moving mammals – looking backwards, looking forward

Looking backwards:

- Brief history of translocations
- Why do we need to move mammals?
- Development of the ‘ark’ or ‘haven’ concept for threatened mammals

Looking forwards: Strategic planning for future translocations to havens

- Which species need havens?
- How well are they currently protected?
- Where should the next havens go?

Comparisons between plant and animal translocations

Animal translocations

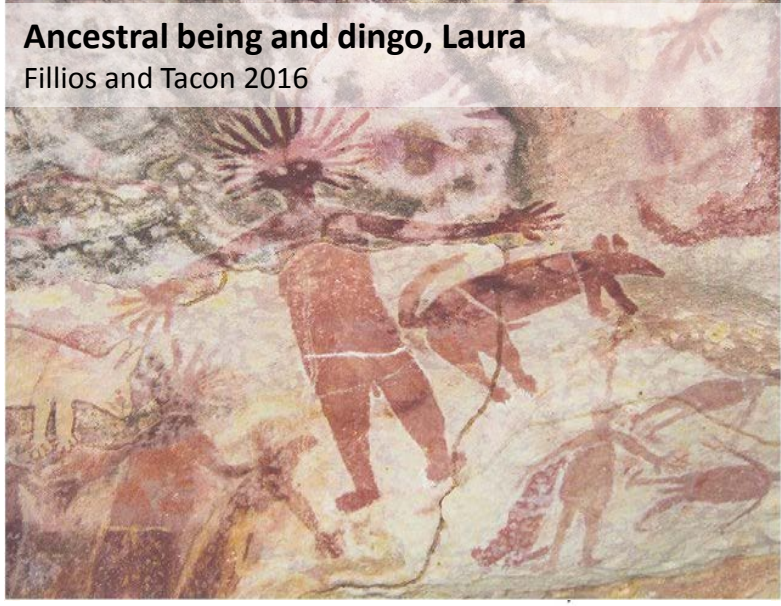
- Translocations is an ancient practice (eg cuscus, dingo); for food, ceremony, medicine, mind-altering…hunting aid and companionship

- Colonising Europeans also moved animals around (eg rabbits, foxes, cats)

- Early settlers formalised this tradition with acclimatisation societies (eg kookaburras:

  …“*merit, as vermin-destroying animals*”…

  …“*robust, jovial humour of their merry pleasant notes and quaint manners*”…)



Ancestral being and dingo, Laura
Fillios and Tacon 2016

The Snake Destroyer, the Laughing Jackass
Illustrated Australian News, 27 December 1876.

Animal translocations for conservation

Conservation translocations to islands began late 1800s:

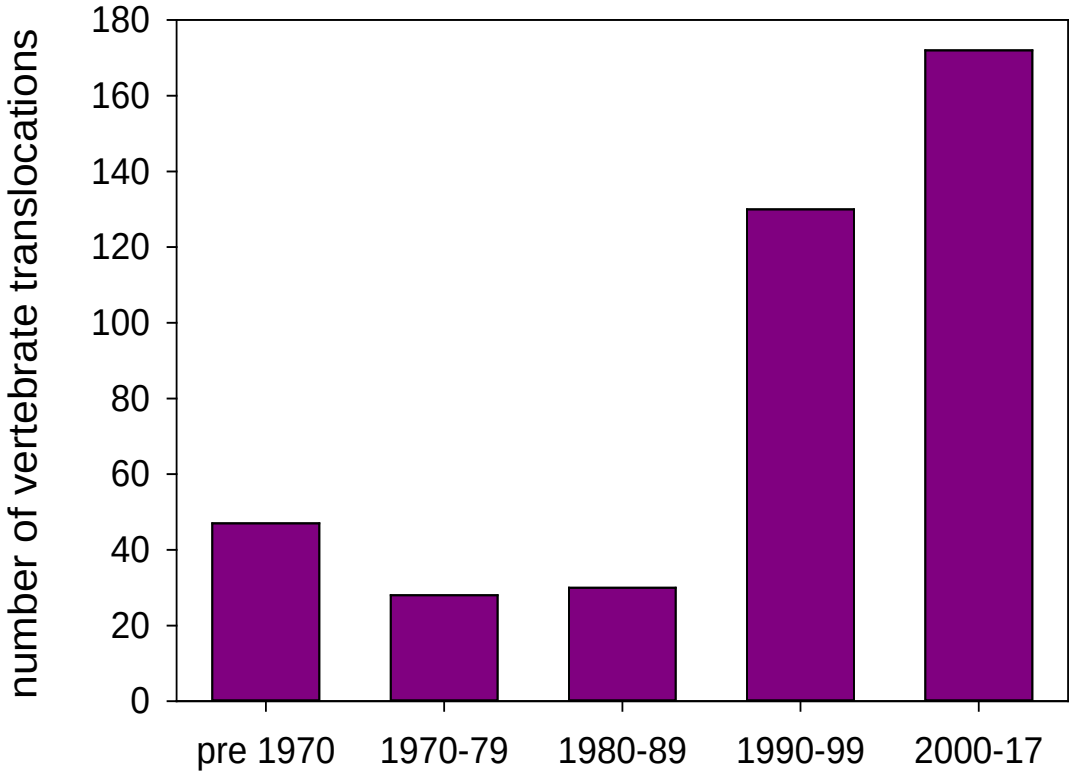
- Koalas to French Is; late 1800s
- Tammars to Greenly Is, SA; 1905
- Red-bellied Pademelon to Wilsons Prom; 1911
- Lyrebirds to Tasmania; 1934-49

Conservation translocations increased from c. 1960s

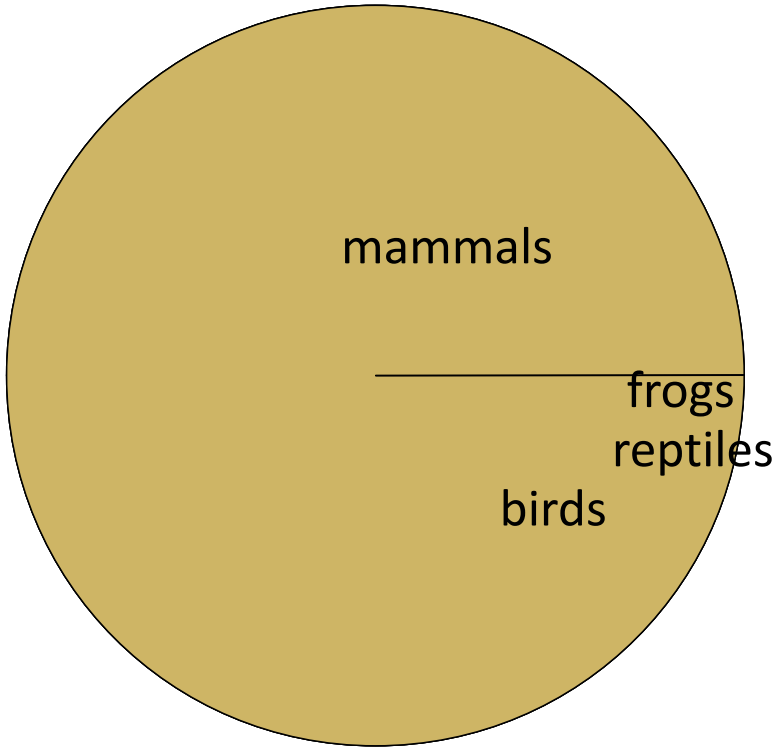
Lyrebird; Gould
British Museum

Animal translocations for conservation

Translocations have increased over time



Most animal translocations involve mammals

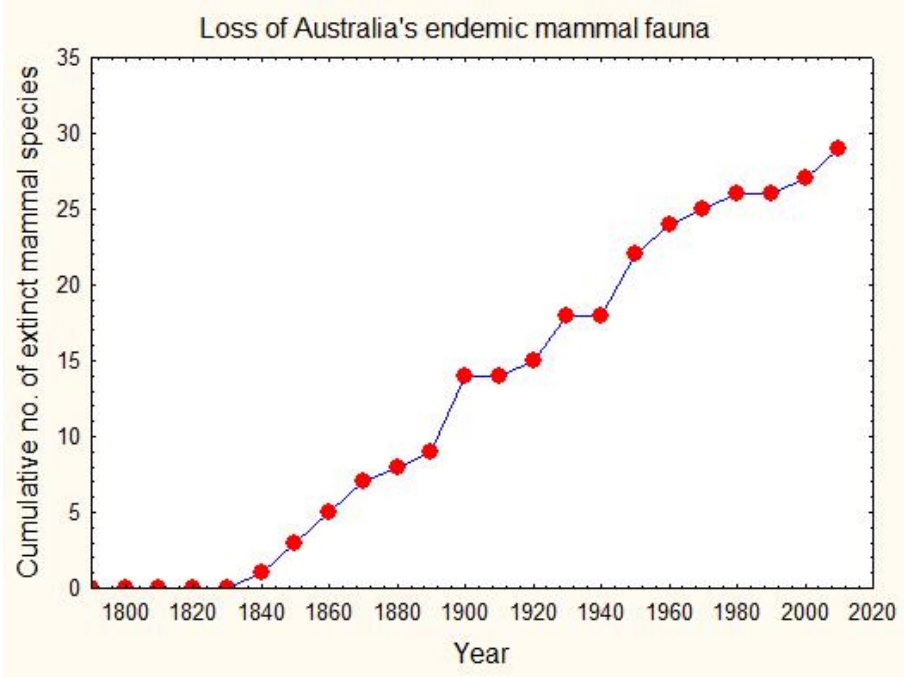


Short 2009 'The characteristics and success of vertebrate translocations within Australia'
Legge et al 2018 Wildlife Research

Why do we need to move mammals?

Australian mammal extinction rate worst in world

- >35 taxa extinct, representing
- 35% of all global mammalian extinctions since 1500



- Woinarski JCZ, Burbidge AA, Harrison PL (2015) *PNAS* 112, 4531-40.
- Johnson C (2006) *Australia's Mammal Extinctions*. Cambridge University Press, New York.

Cats and foxes are main drivers, exacerbated by habitat change from fire, grazing, other ferals (eg. rabbits)

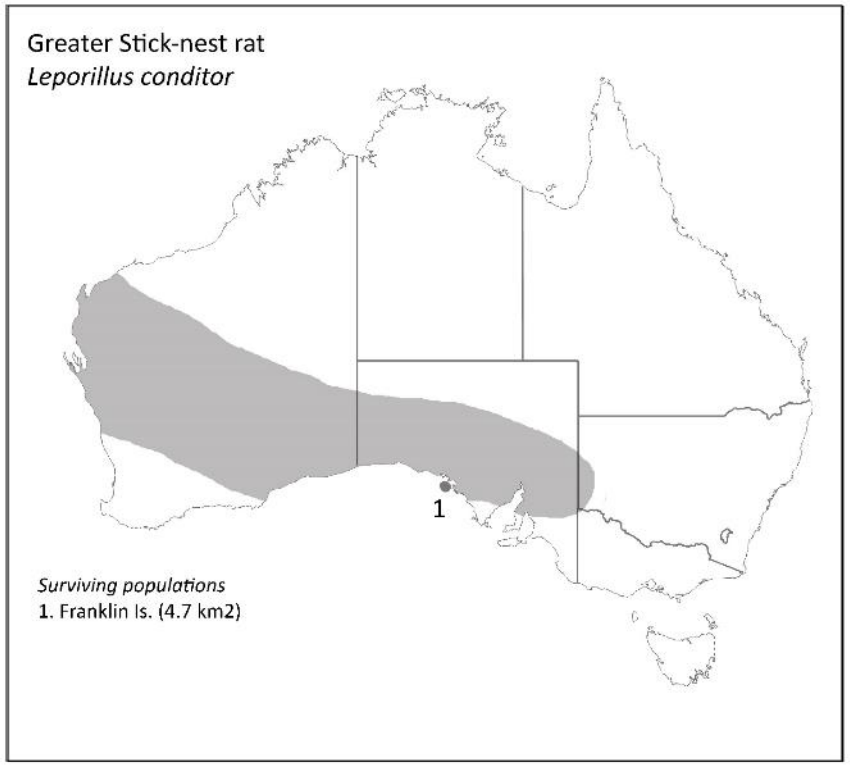
Evidence

- The timing of fox/cat arrival vs population decline
- Correspondence between cat/fox prey with severity of population decline
- Correspondence of ecological and life history attributes with severity of decline
- Contrast in translocation success to sites with/without cats/foxes
- **Some pops of some species only survived where cats/foxes remained absent**

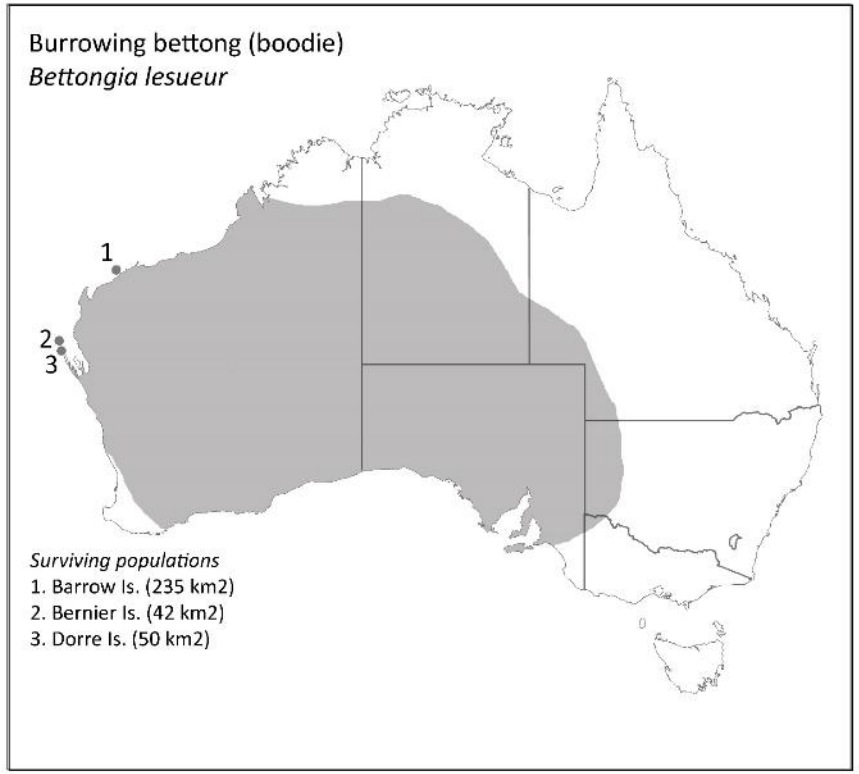
Some species only survived because they occurred on islands that remained free of cats/foxes

Greater stick-nest rats became extinct on the mainland, surviving only on the Franklin Islands

Boodies were extirpated on the mainland, surviving only on three islands off the WA coast

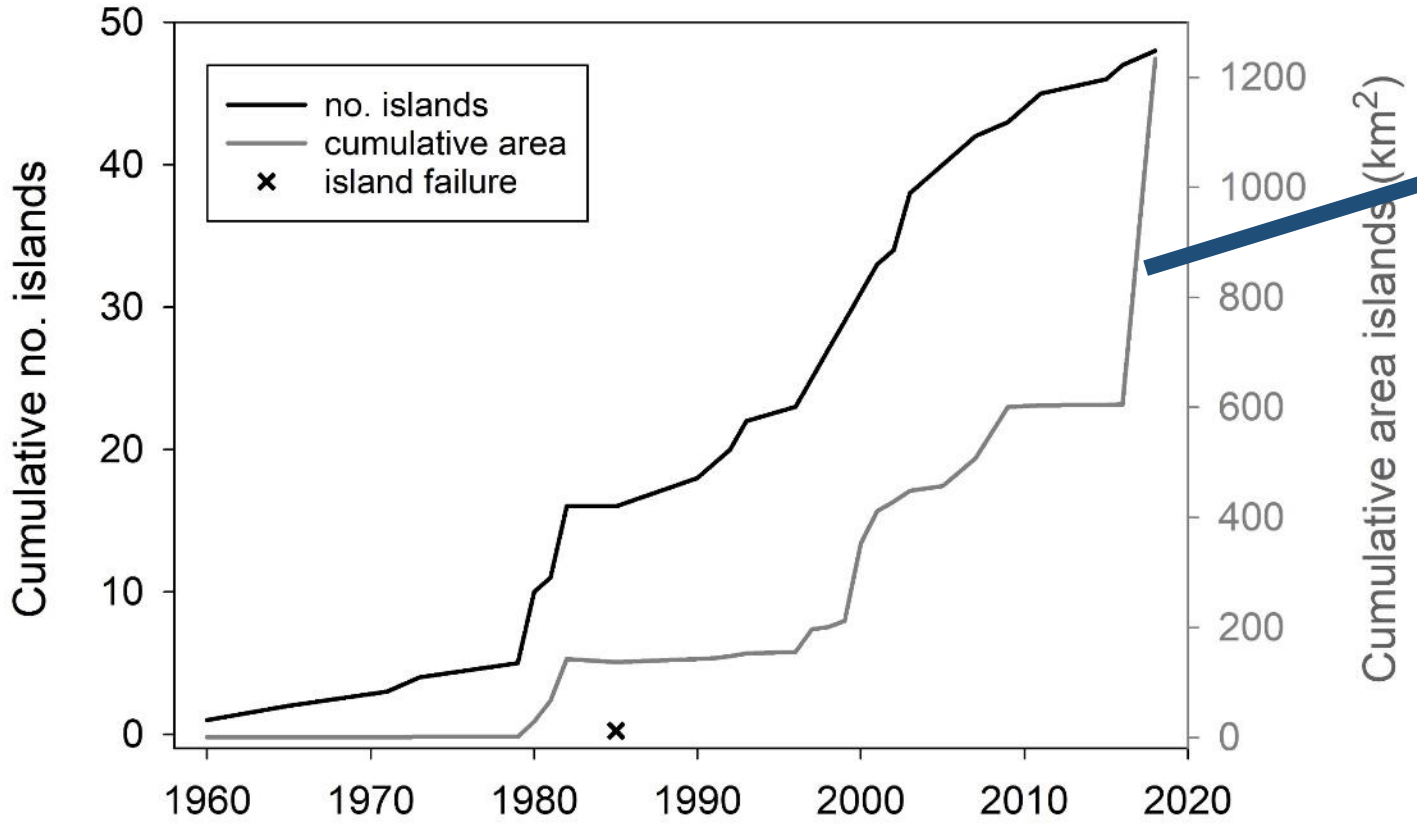


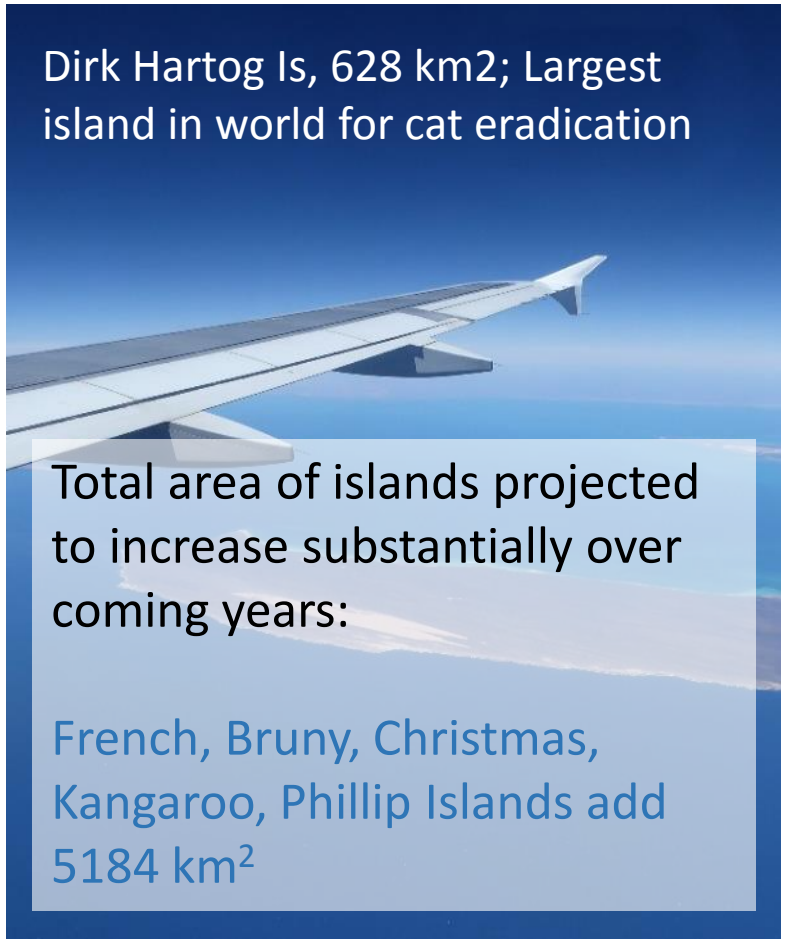
Natural Island Arks



Natural island arks were augmented by deliberate translocations to islands…

…first using islands that were naturally cat and fox free, and later using islands from which cats/foxes were eradicated





Cumulative increase in island number and area used for mammal translocations

Extending the island concept - **mainland islands**

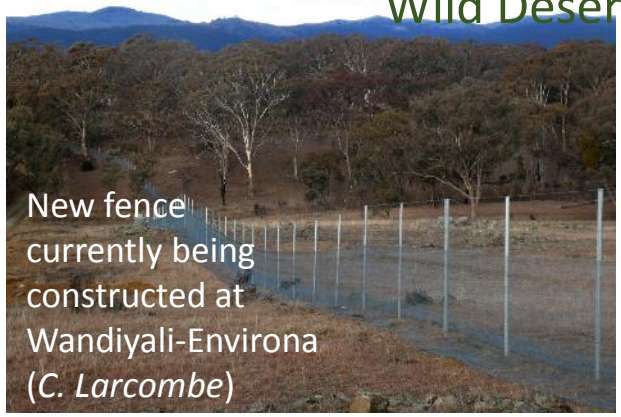
First mainland islands created by Earth Sanctuaries Limited (Wamsley) from 1980s

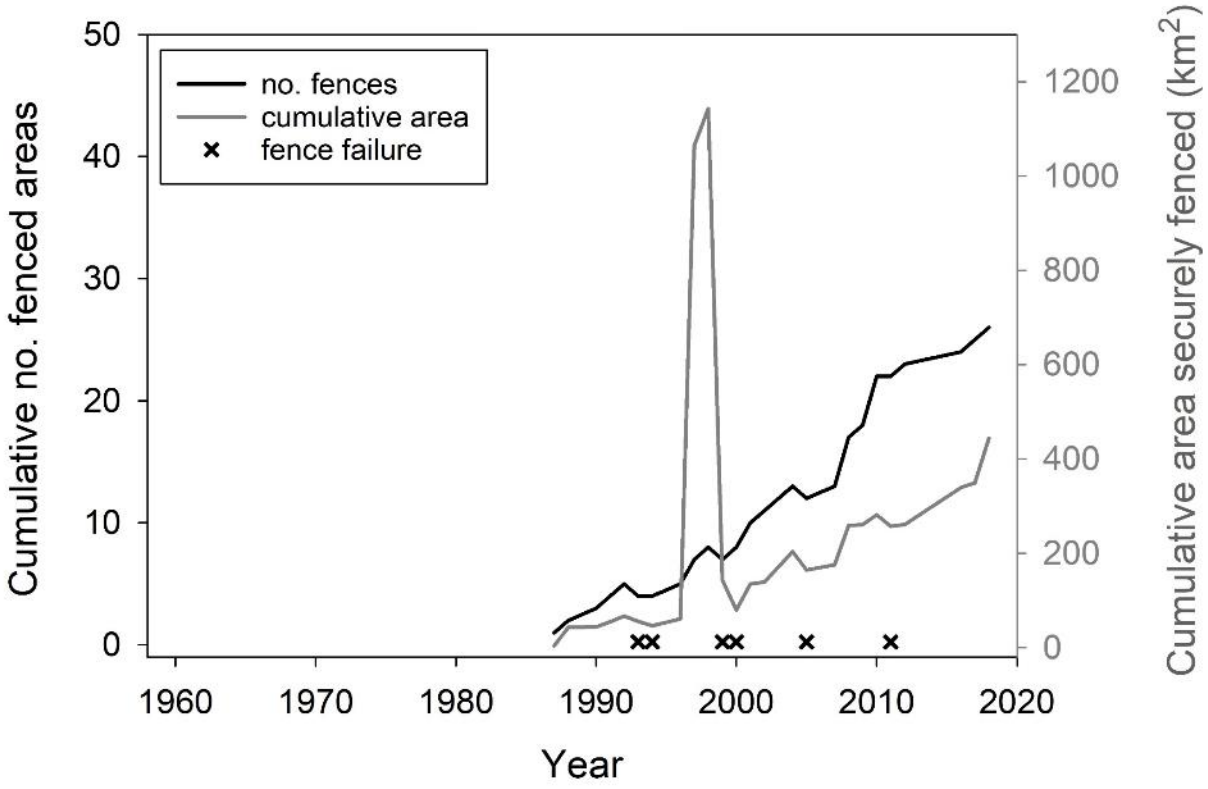
Cat/fox fence at Mulligan's Flat, Canberra (*A. Manning)*

Extending the island concept - **mainland islands**

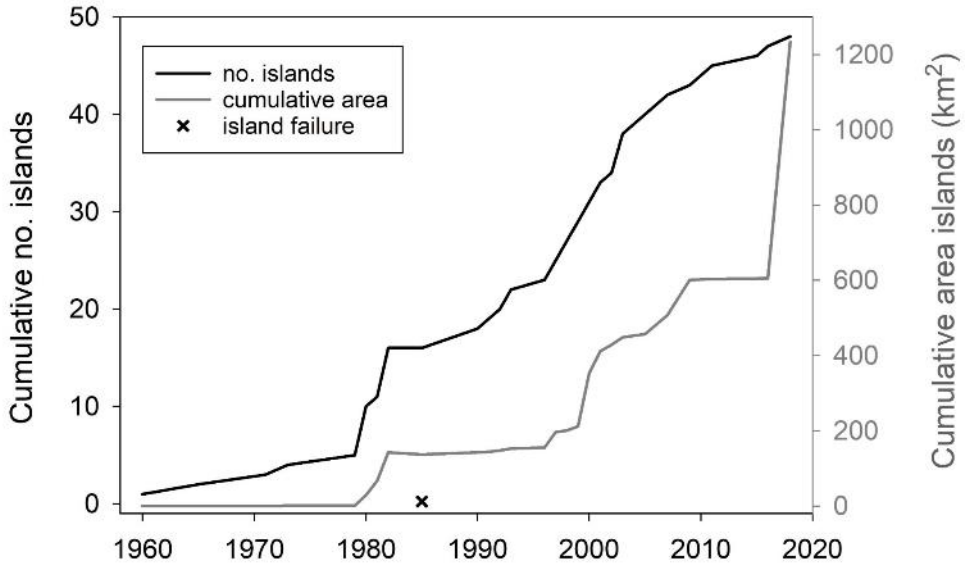
Total areas of fences projected to increase substantially over coming years

Wandiyali-Environa, Tiverton, Mallee Refuge, Pilliga, Goorooyarroo, Newhaven, Mallee Cliffs, Wild Desert add 914 km^2





Cumulative increase in number and area of fenced exclosures used for mammal translocations



Strategic planning for mammal translocations

1. Which species need complete protection from cats and foxes?
2. Where are the existing island and fenced havens?
3. Which species do they protect?
4. Where should the next island and fenced havens go?


H. McGregor/Arid Recovery


Wildlife Centre

1. Which species need protection from cats and foxes?

- Assessed 246 mammal taxa (excluding bats)
- Categorised by ~30 experts according to susceptibility to cats/foxes

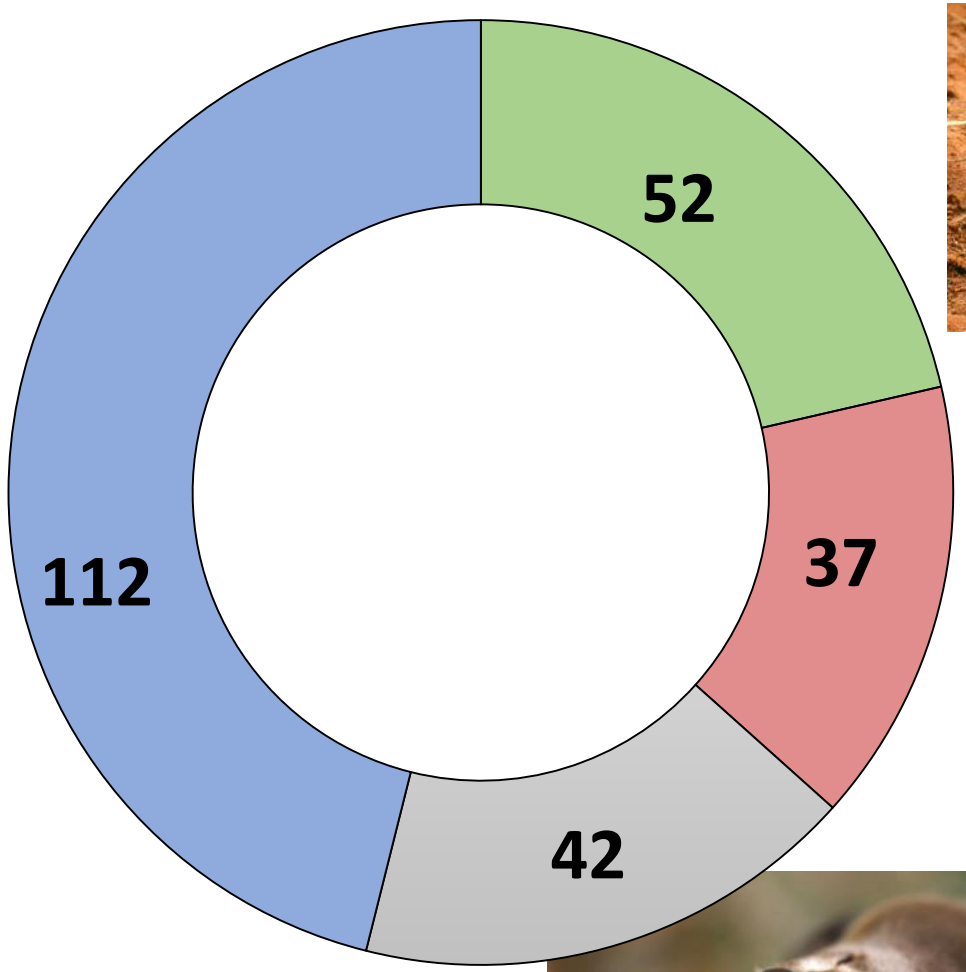
EXTREME = Don't persist with cats/foxes

HIGH = May just persist, but heavily reduced pop size or viability; or only if cat/fox density is much reduced

LOW = persists, but with some reduction in pop size or viability

NO = pop size and/or viability unaffected by cats/foxes

Predator susceptibility of all terrestrial mammal species



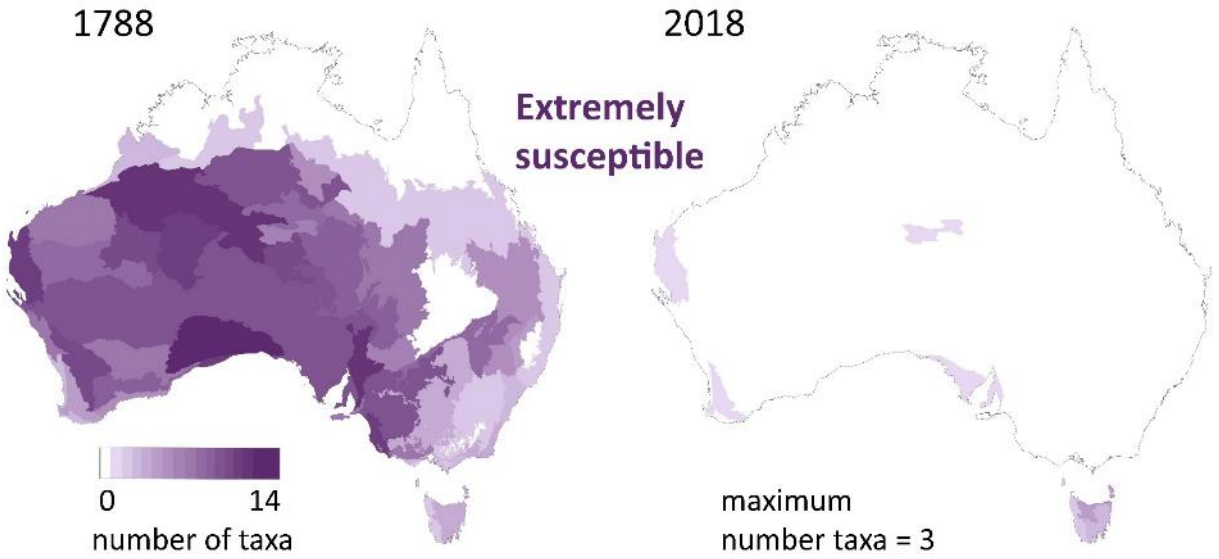
High

Extreme

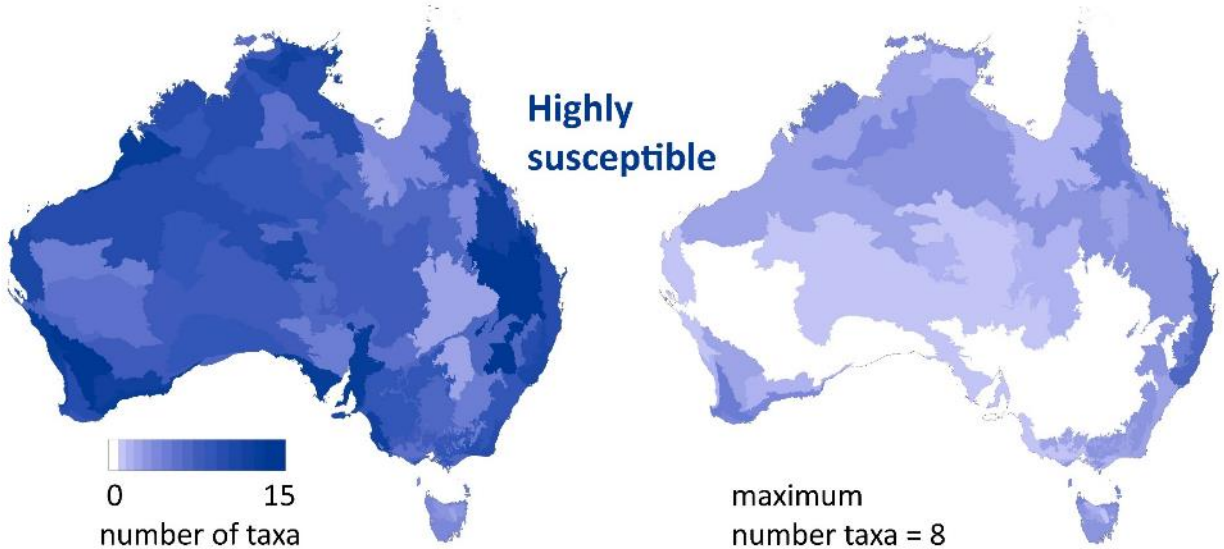
Low

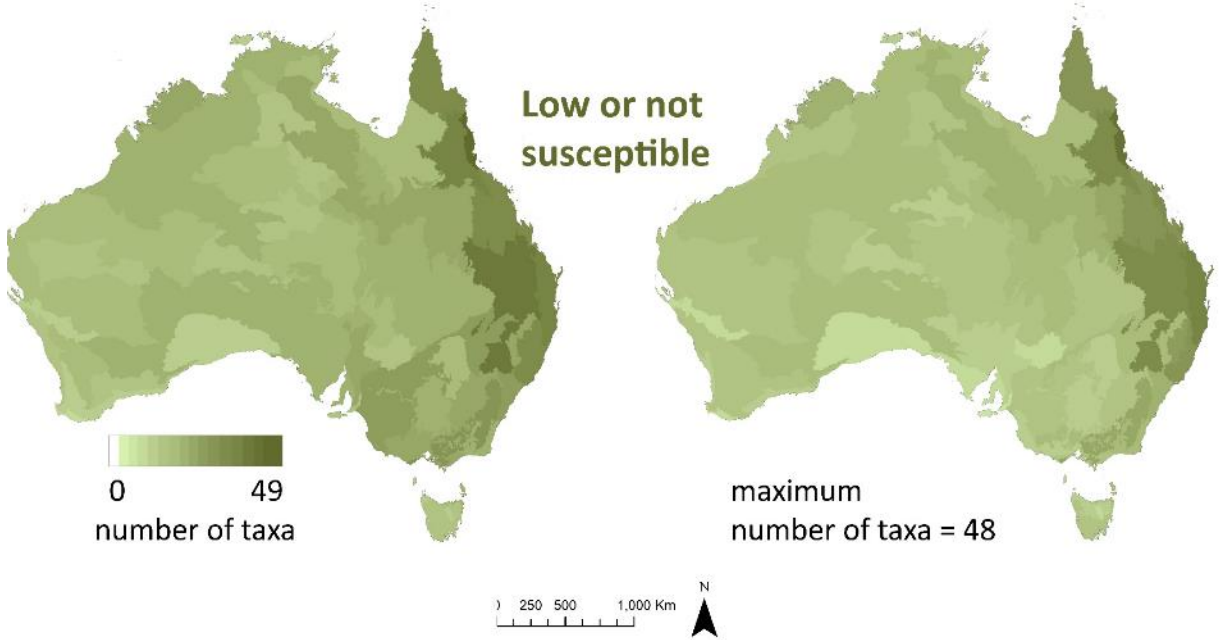
Not susceptible

Radford *et al*. (2018) *Wildlife Research*



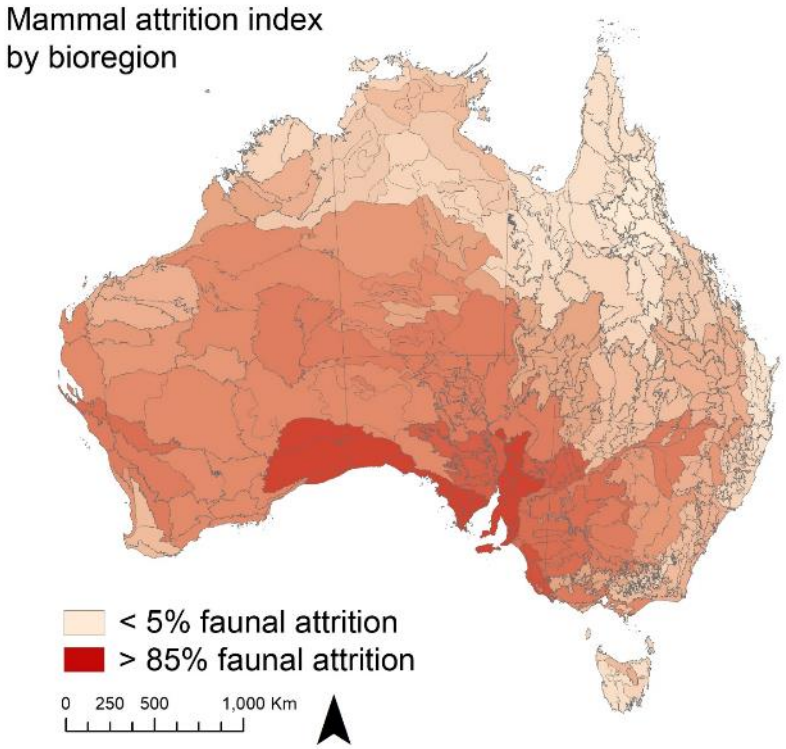
Taxa that are more susceptible to cats and foxes show the greatest level of decline

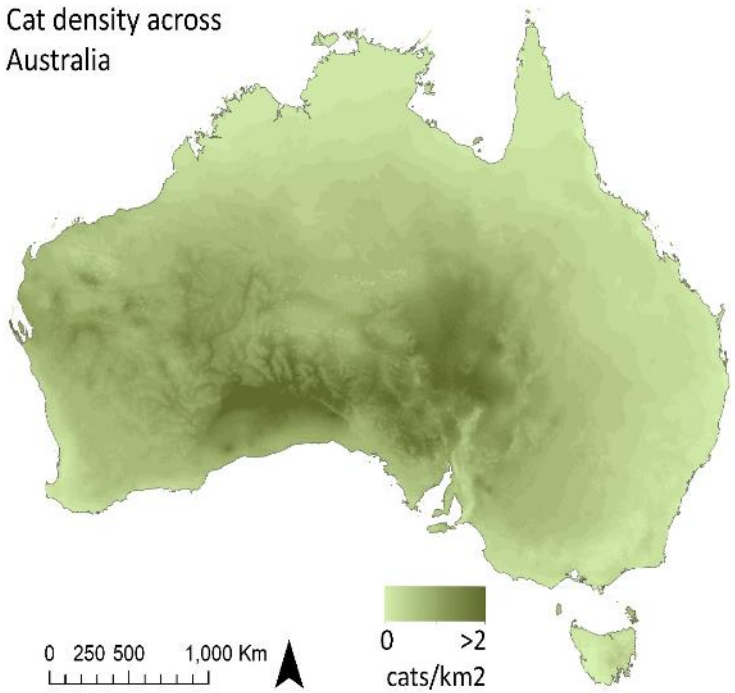


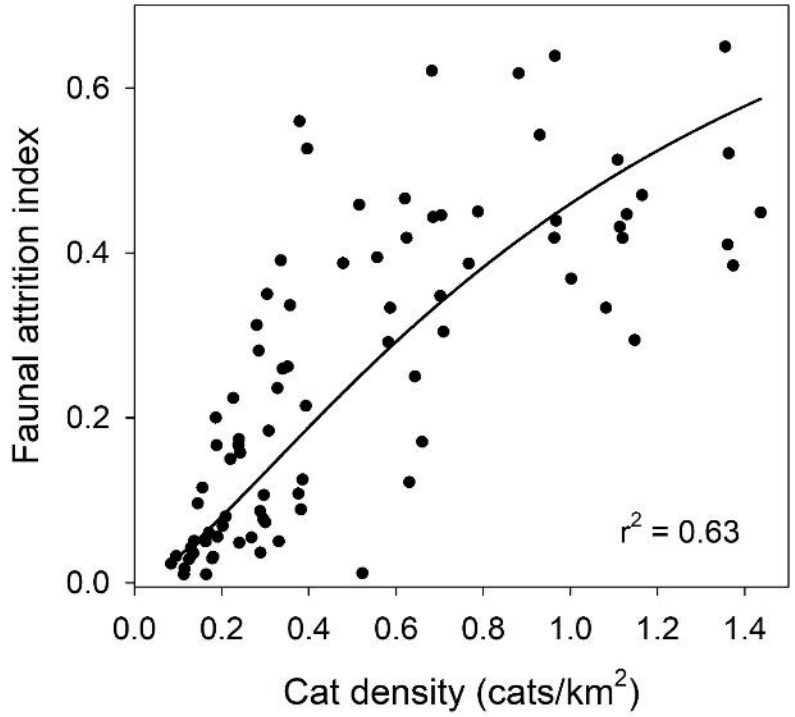


Radford *et al*. (2018) *Wildlife Research*

Digression – cats and faunal attrition

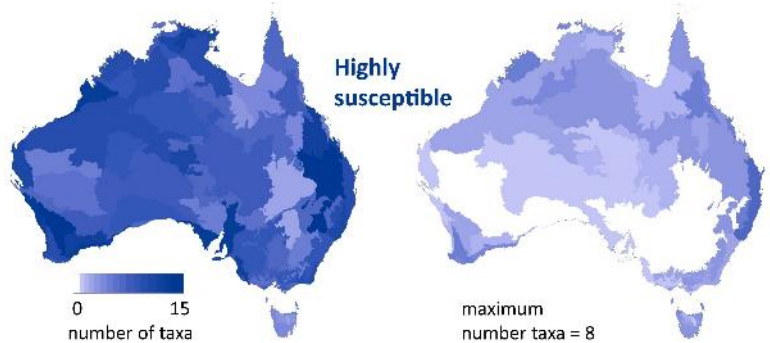


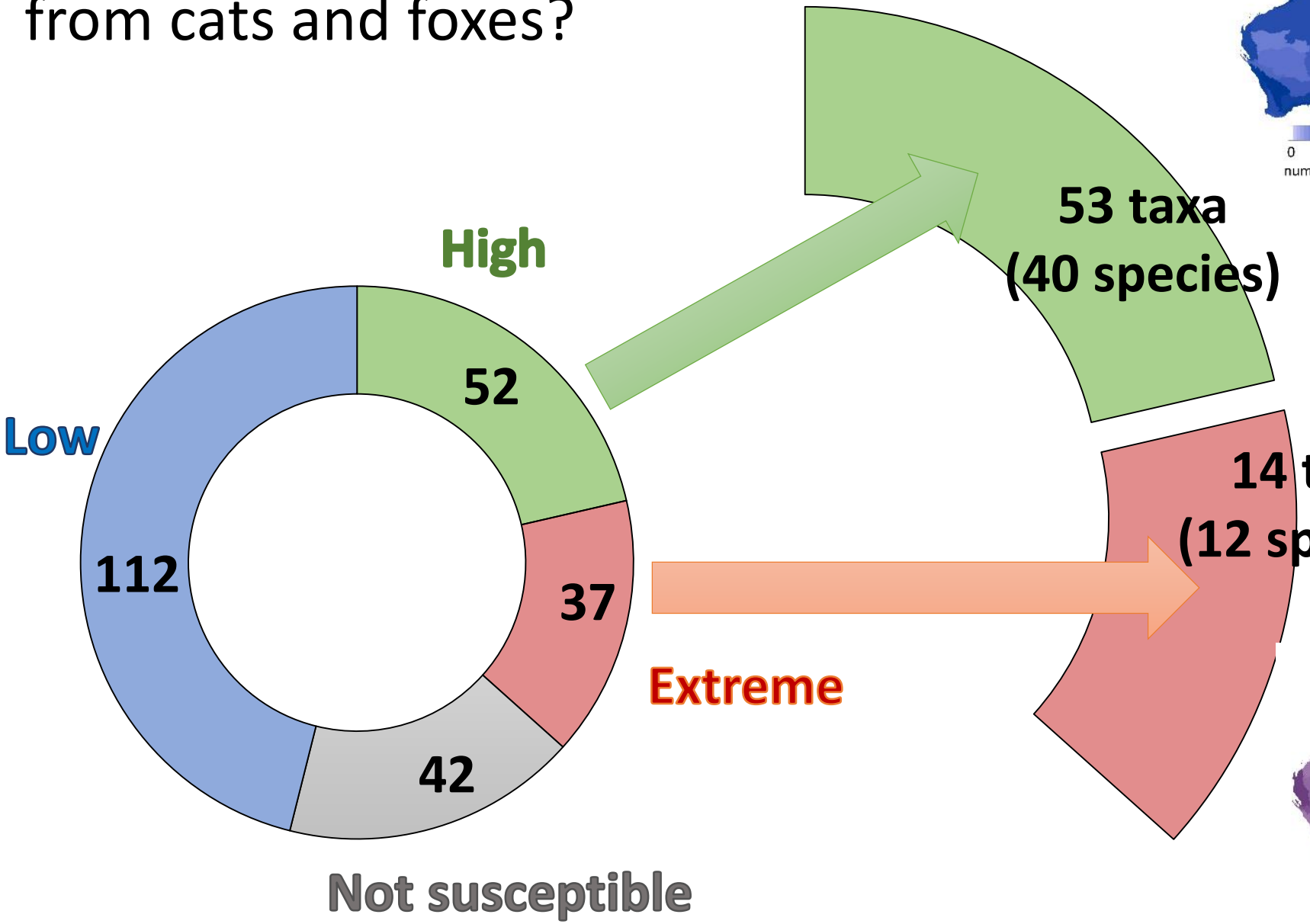


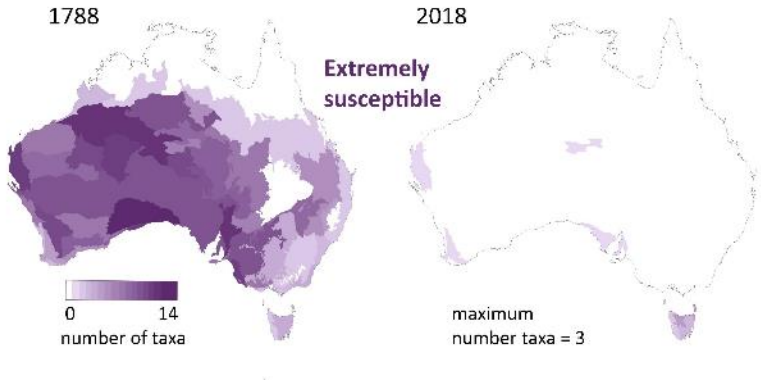


McKenzie et al 2007
Legge et al (2017) Bio Cons

1. Which mammals need protection from cats and foxes?







Strategic planning for mammal translocations

1. Which species need complete protection from cats and foxes?
2. Where are the existing island and fenced havens?
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Kimberley islands, Wiki CC

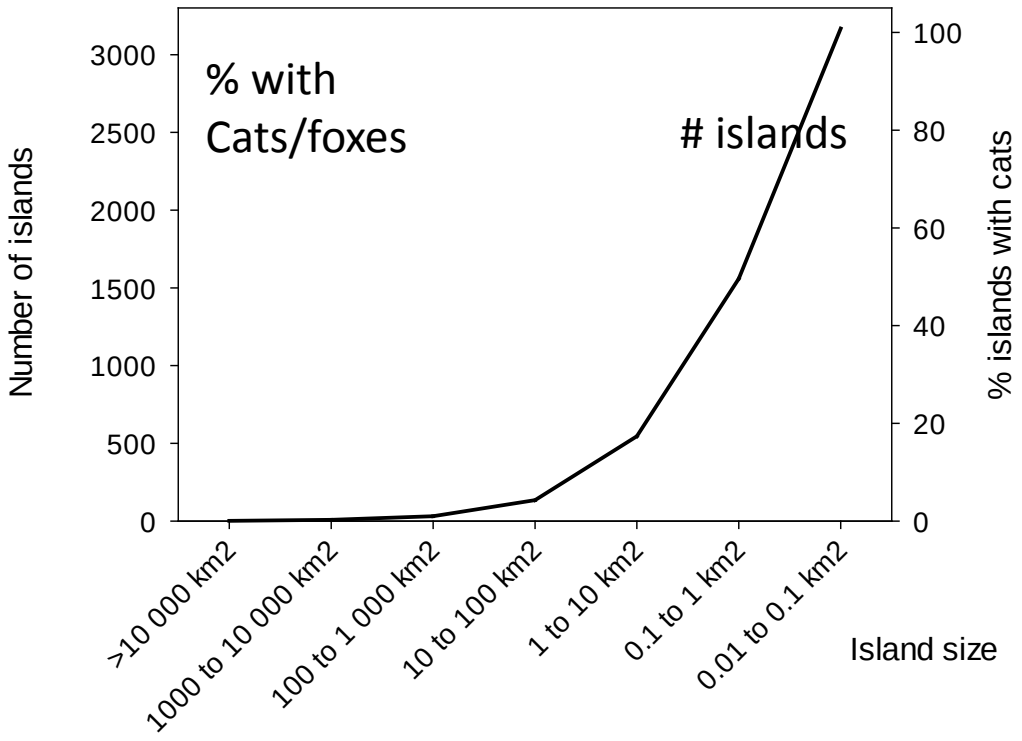

H. McGregor, Arid Recovery

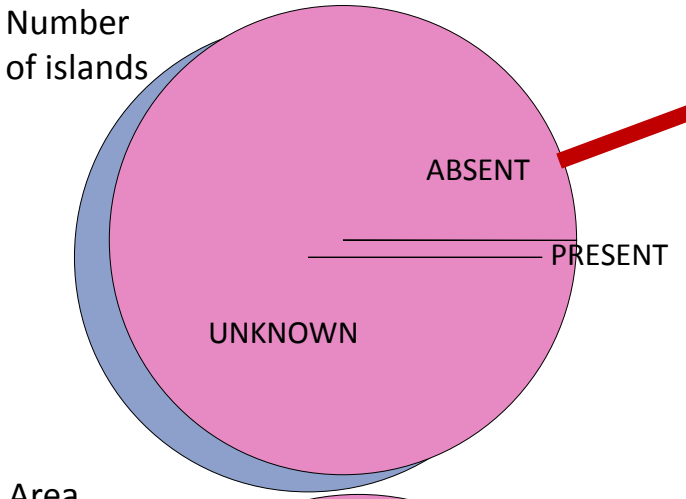
Used ERIN Island database, DEWHA feral animals on islands database, Mammal Action Plan, additional references, pers comms from agencies, NGOs

Where are the existing island and fenced havens?

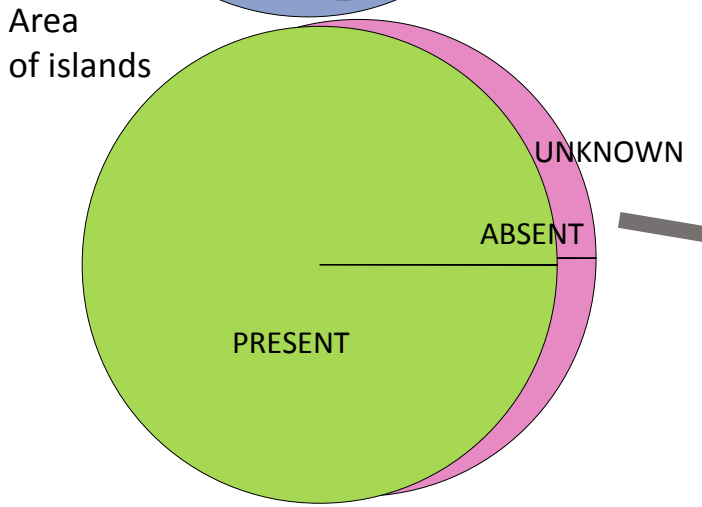
Island havens – cat/fox-free

5442 islands > 1 ha (32,969 km^2)



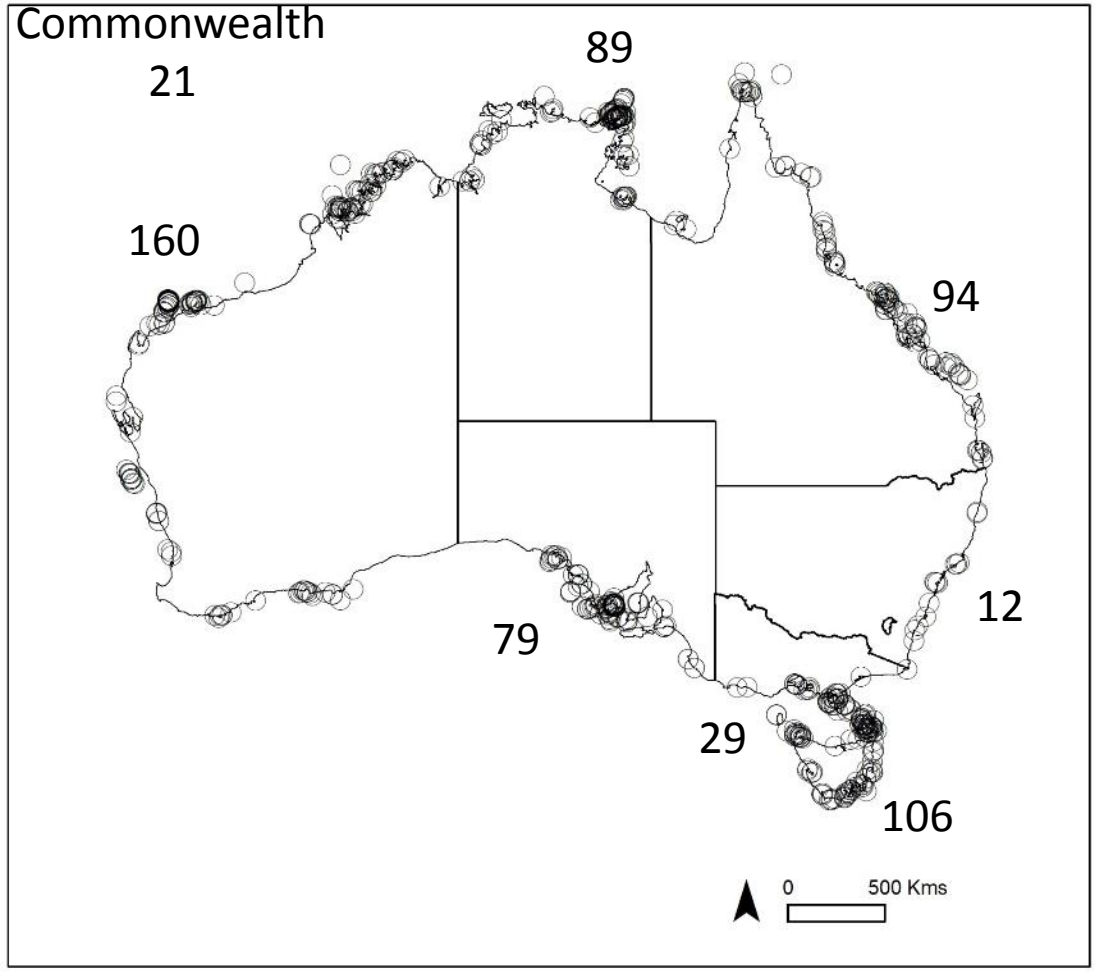


590 islands cat/fox-free

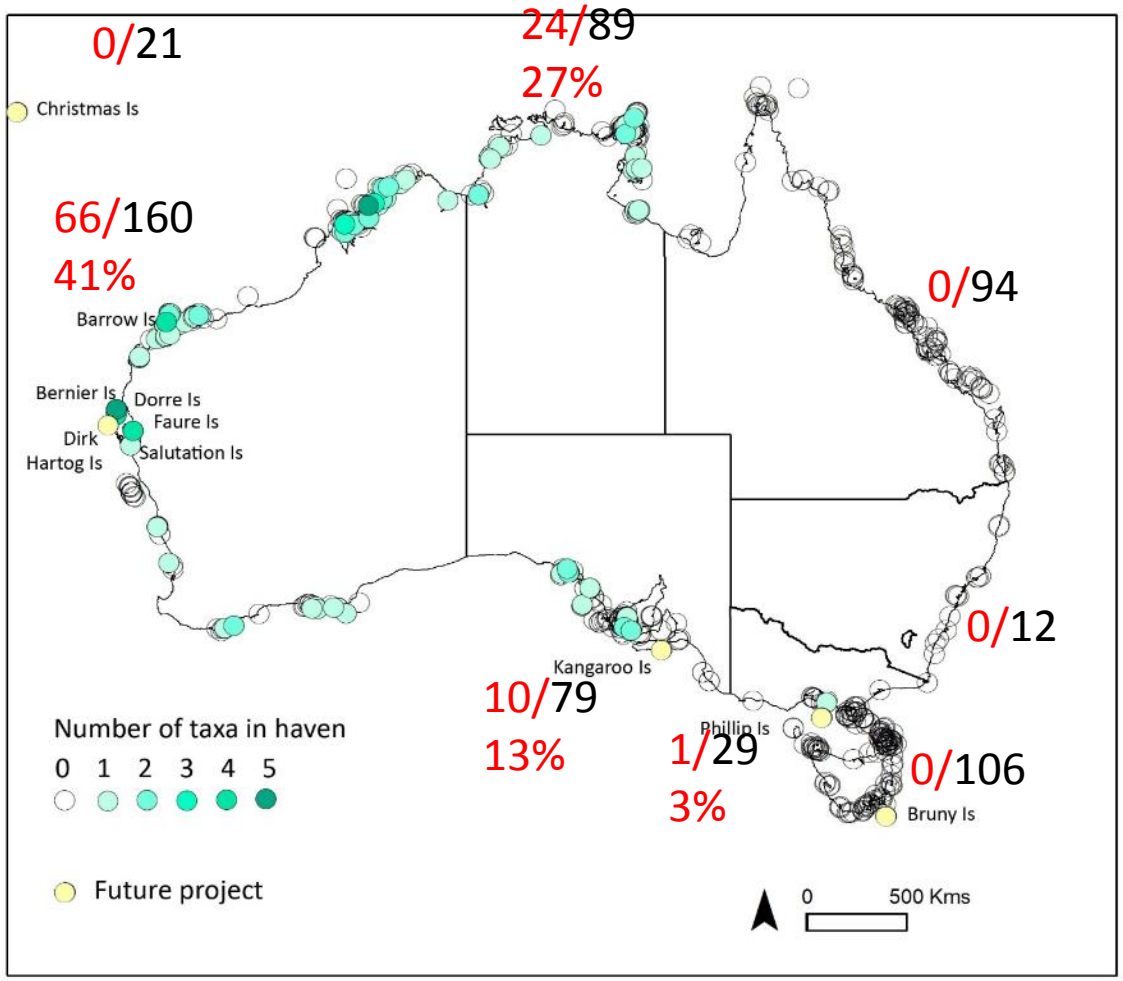


Covering 5468 km^2, or 16% island area, or 0.06% of Australia's land area
(range 1 ha – 628 km^2)

Cat and fox-free islands

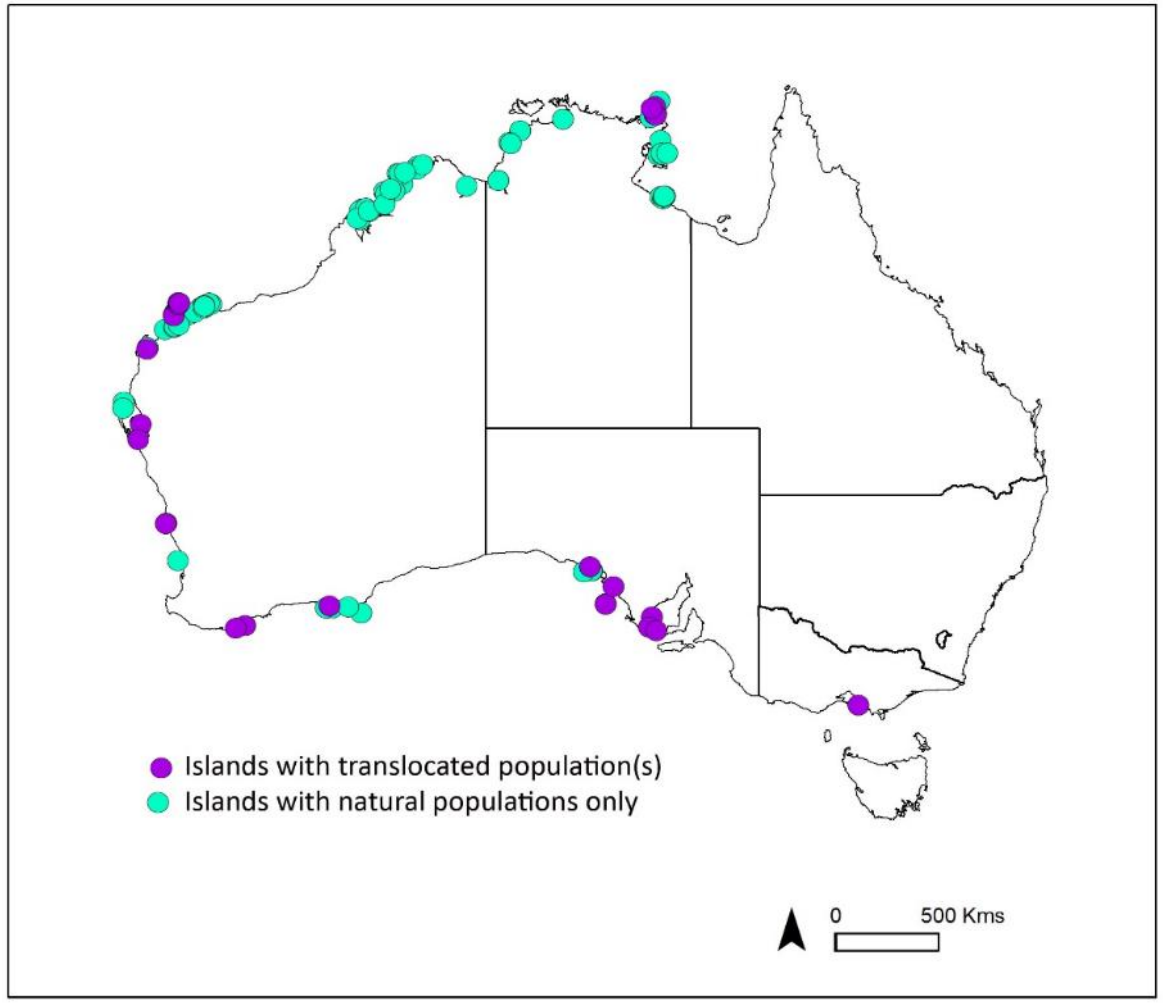


Cat/fox-free with susceptible taxa



- 101 islands, covering 2152 km^2
- Range 1 ha – 235 km^2 (Barrow) and now 628 km^2 (DHI)
- Median = 6 km^2

In situ, or natural pops vs translocated island pops



‘Natural’ havens

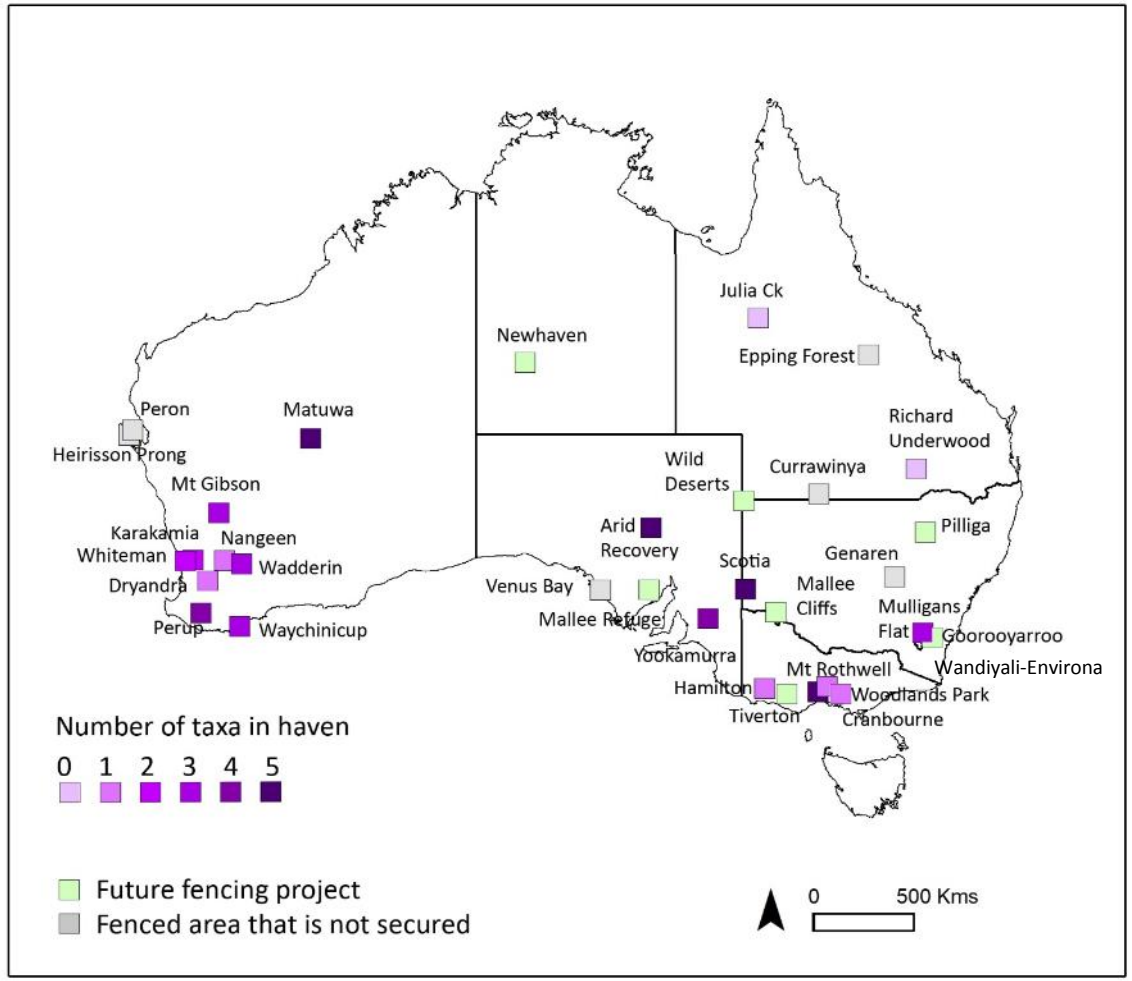
- Concentrated in the north

Havens by translocation

- More common south of tropics
- WA and SA govs most active
- 22 islands; 30 translocations

Golden-backed tree-rats occur on at least 10 islands (*A. Hartsthorne)*

Mainland havens (fenced areas)

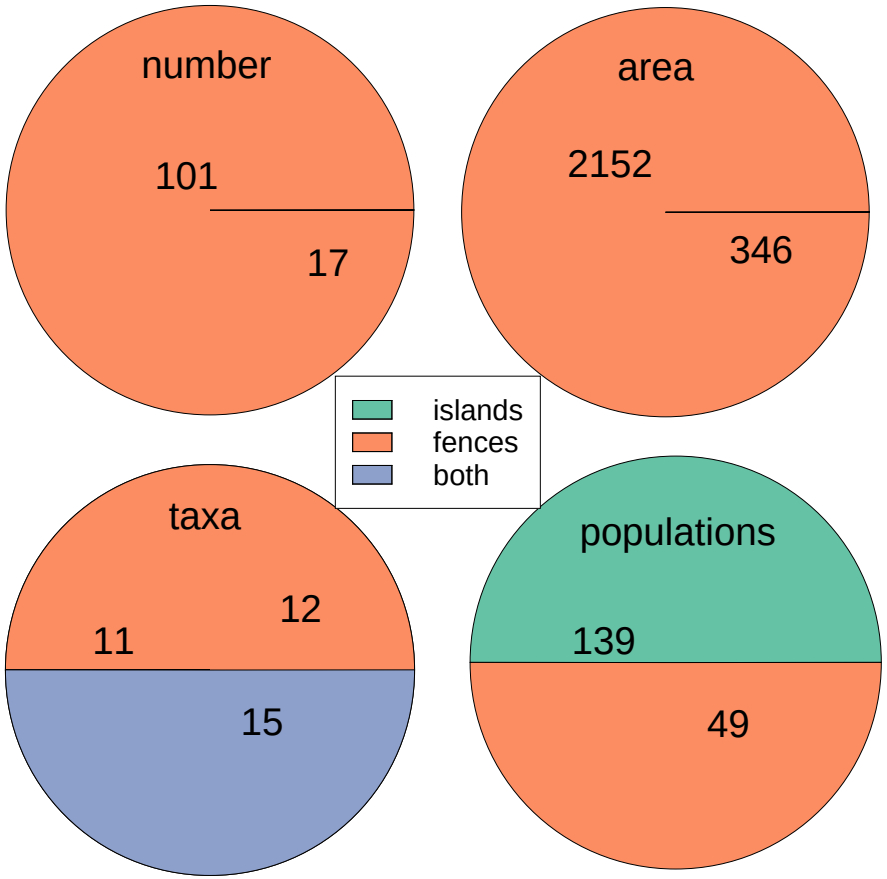


- 19 fenced areas
- 17 with threatened mammal taxa susceptible to cats/foxes
- Cover 346 km^2
- Range 0.5-123 km^2
- Median 4 km^2

Woylie release at Perup fenced reserve, WA. (*O'Rourkes/Dept. Biodiversity, Conservation, Attractions)*

Excludes small fenced areas with pops maintained by supplementary feeding, or constant restocking

Islands and fences – some vital stats



Islands reach much larger areas:

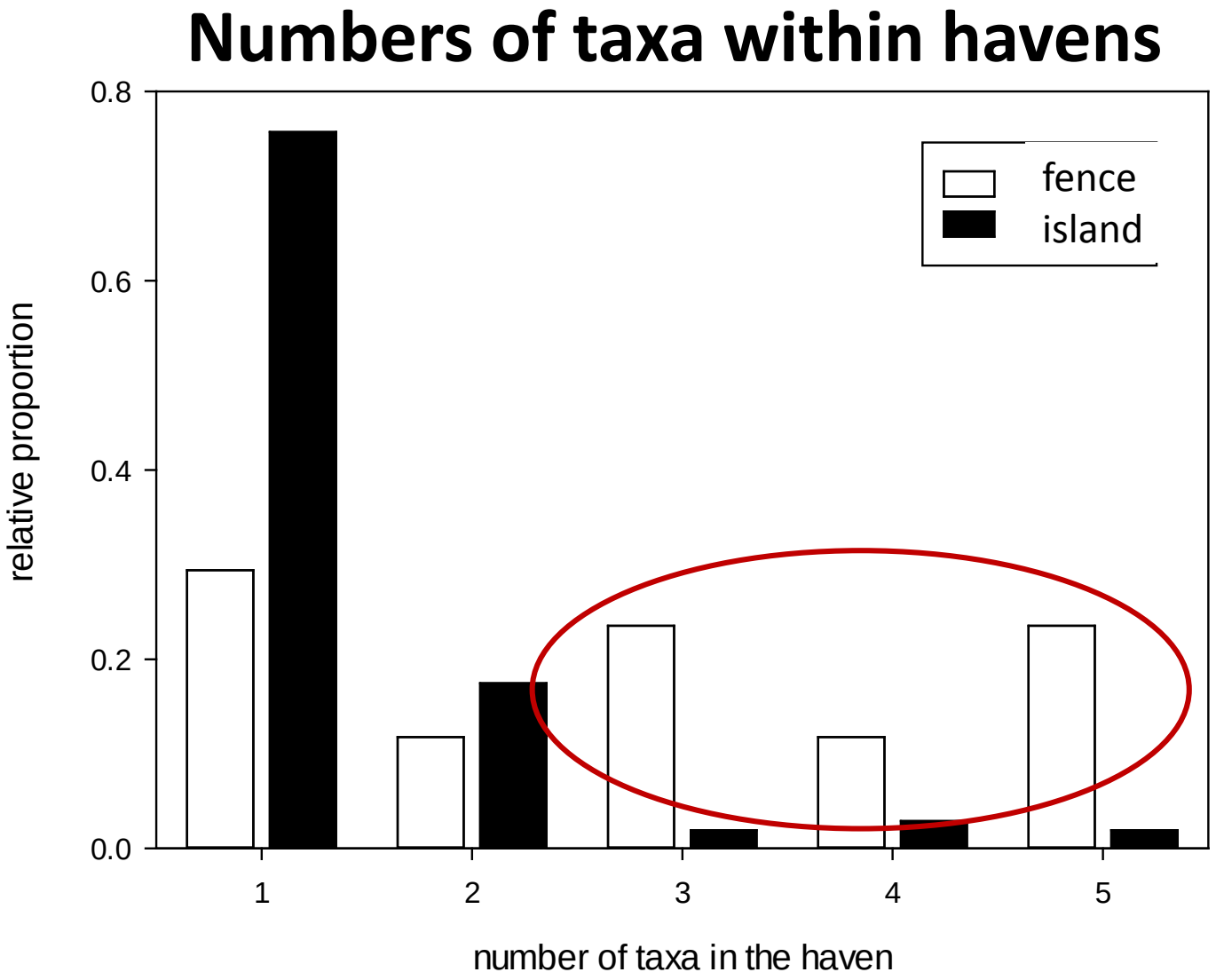
- Median fence area = 4 km^2, max = 123 km^2
- Median island area = 6 km^2, max = 628 km^2

Island havens outnumber fences, and cover much larger total area

Islands protect more populations, but not more taxa…

Greater redundancy of pops (per taxa) across islands

Islands and fences – some vital stats

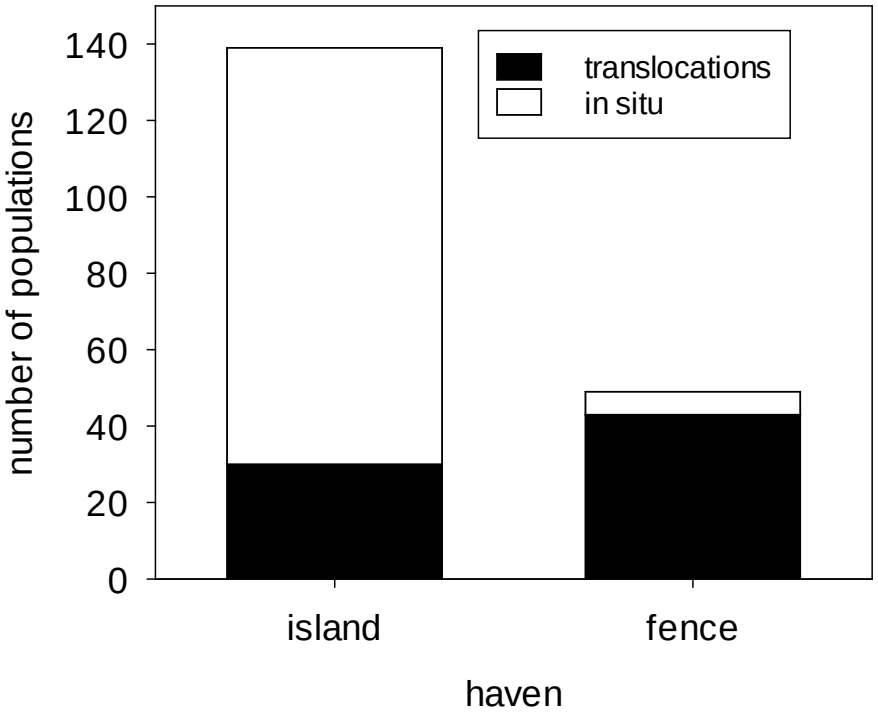


Compared to islands, fenced areas are more likely to have multiple taxa

Islands and fences – some vital stats

In situ pops vs translocated populations

- Islands have played an important role in protecting in situ pops
- Fenced areas are important havens for translocated pops



The eastern barred bandicoot exists only within three fenced areas and two islands *Photo: Wiki CC*

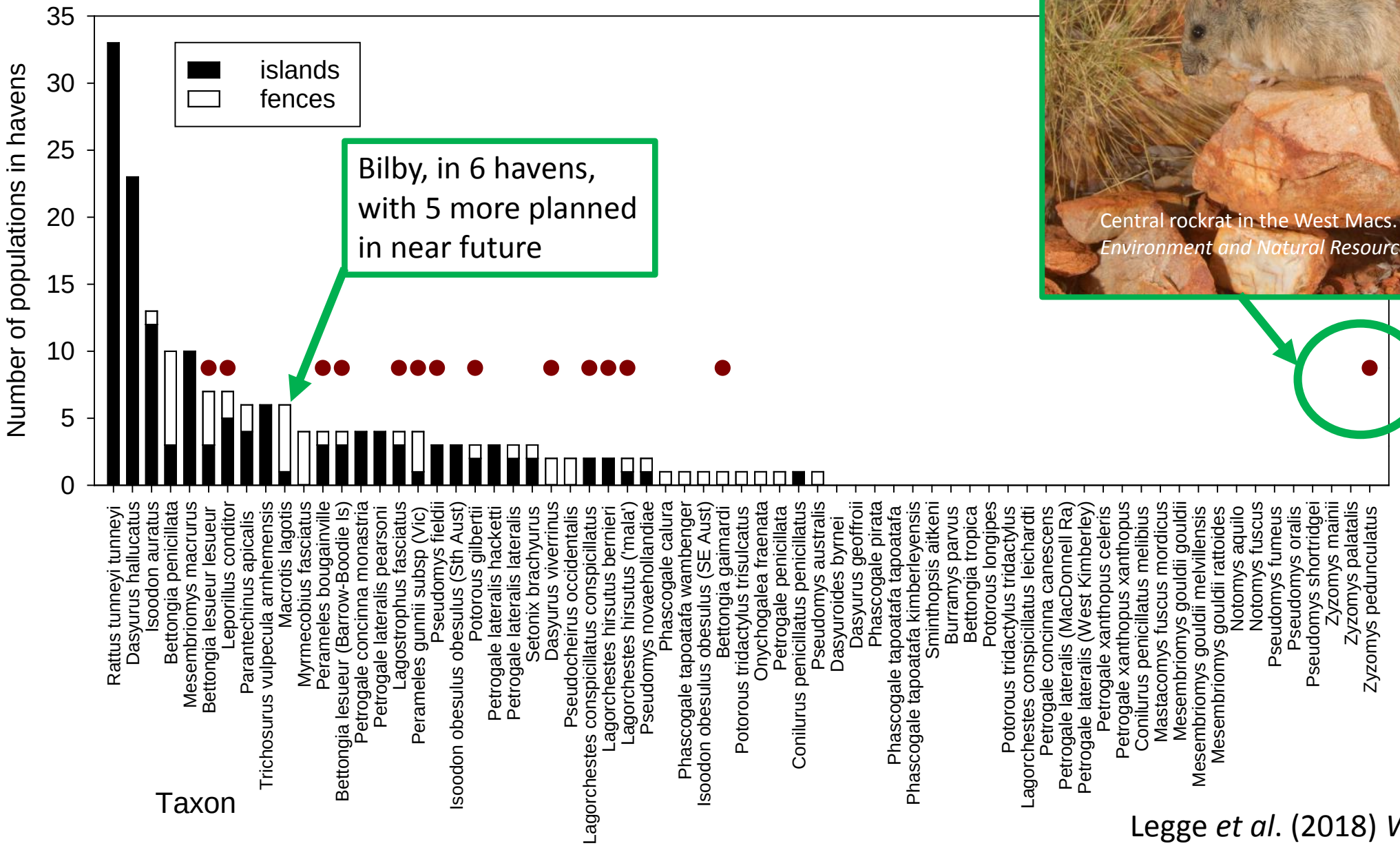
Islands and fences - success rates

Haven	Short 2009	Legge et al 2018
Open site	Ranges from 0% to <<50%	
Island	82% (n = 17)	86% (n = 35)
Fence	59% (n = 41)	70% (n = 60)
Time periods	1880-2009	1980-2017

- Success rates are probably increasing; island translocations more successful than to fences
- Translocation success overwhelming influenced by cat/fox predation (habitat quality, disease, animal husbandry, small founder number much less important)
- Most failures to fenced areas were from cat/fox incursion, but also small area in some cases
- Without adequate investment in construction & ongoing maintenance, security of fenced areas is inevitably compromised

Short J (2009) The characteristics and success of vertebrate translocations within Australia.
Legge et al (2018) Wildlife Research

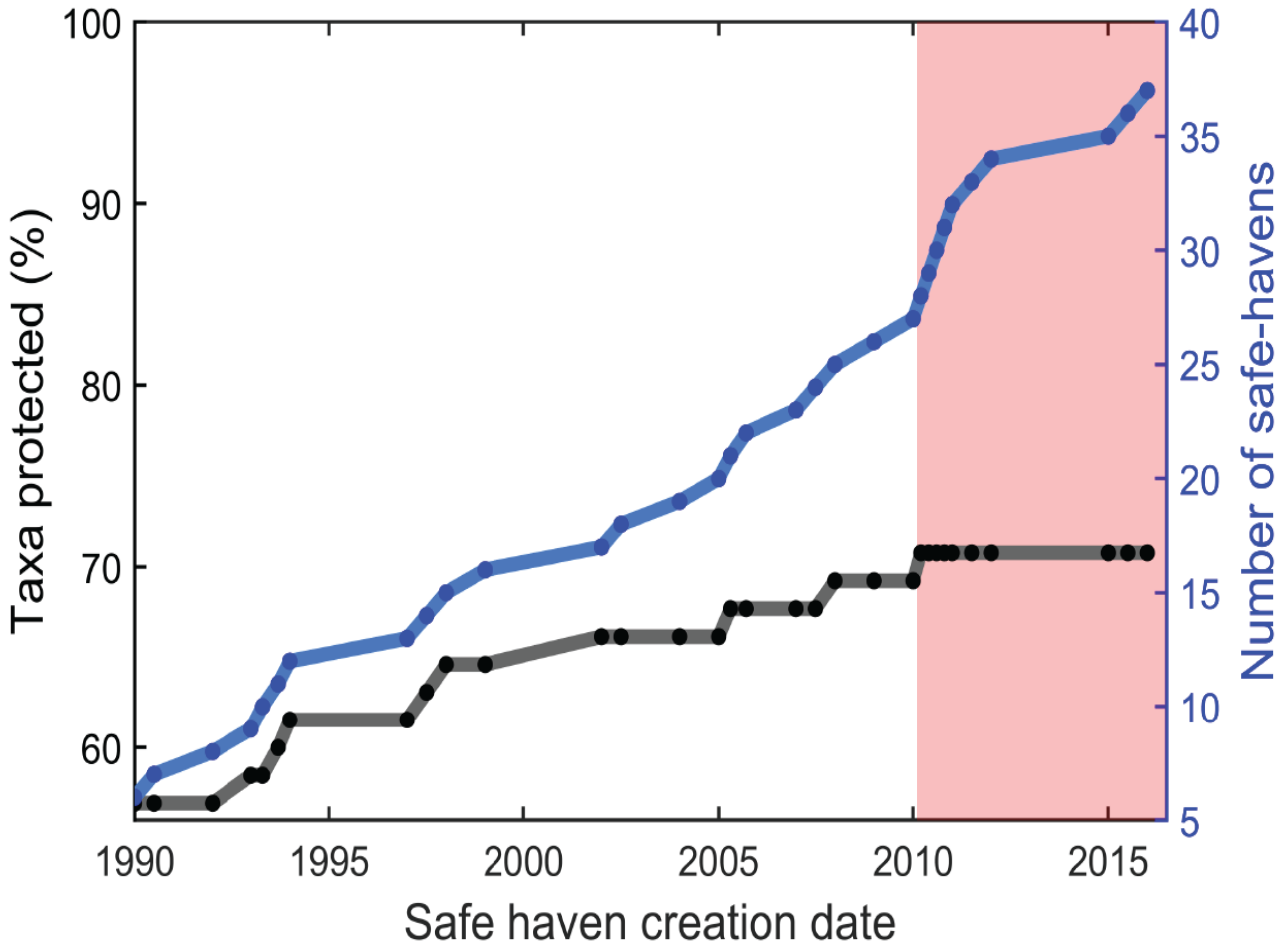
Progress so far - representation across havens




Central rockrat in the West Macs. (*P. McDonald/NT Dept Environment and Natural Resources)*

Legge *et al*. (2018) *Wildlife Research*

Progress so far - representation across havens



The last 10 haven areas have increased protection for some species, **but have not added any new species to the haven network**

Many players create havens (state gov, local gov, NGO, community groups, private individuals).
Decentralisation:

- Creates resilience
- Improves community buy-in
- Challenges national coordination

Ringma *et al*. (2017), *Nature Ecol Evol* 2: 410-411

Strategic planning for mammal translocations

1. Which species need complete protection from cats and foxes?
2. Where are the existing island and fenced havens?
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Kimberley islands, Wiki CC


H. McGregor, Arid Recovery

Systematic planning for future havens

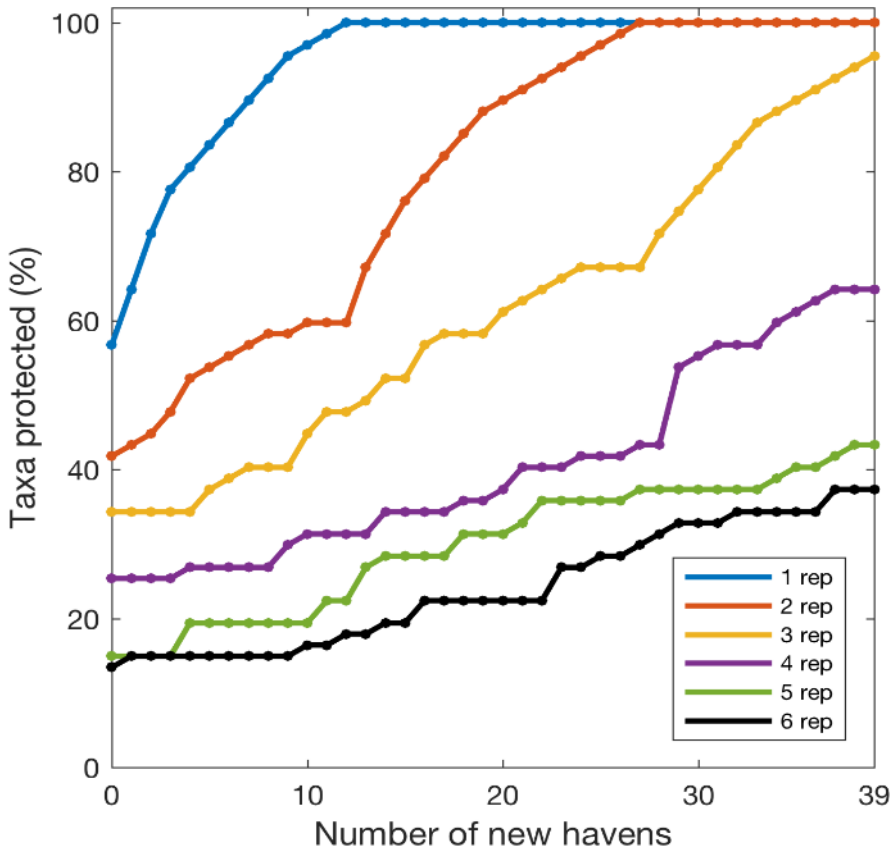
Aim: How should we expand the haven network to reduce extinction riak for mammal taxa threatened by cats and foxes

- 67 taxa
- Historical distribution to guide where each taxon could be protected
- Weighted taxa according to their existing protection
- Prioritised subregions by iteratively re-weighted taxa

Compared performance of this approach with

- ‘Random’ – subregions selected at random
- ‘Business as usual’ - extrapolate from past network growth

Systematic planning for future havens



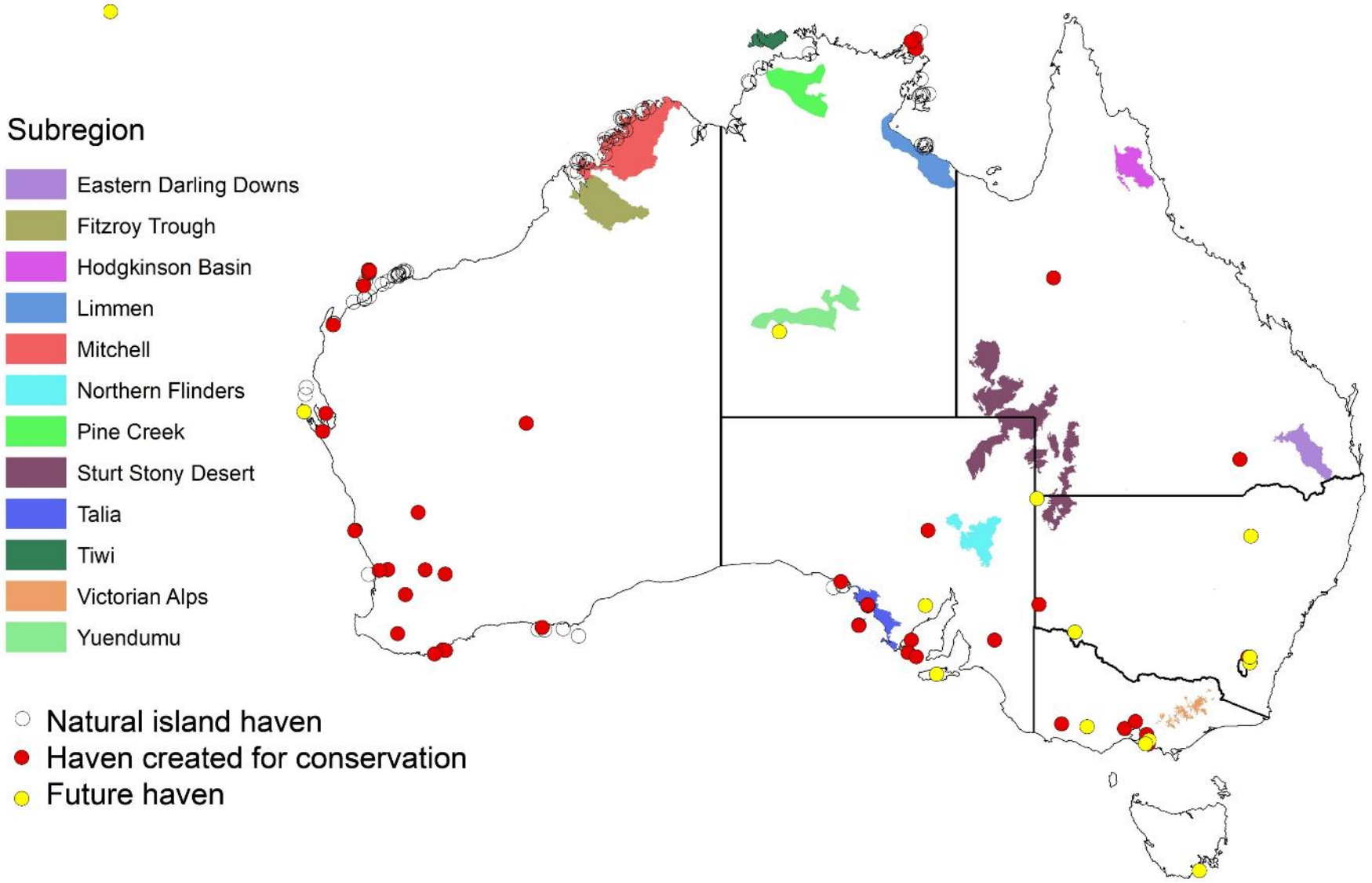
Determined the minimum number of new havens required for different levels of population redundancy

- At least one pop of every taxa
- To at least 6 pops of every taxa

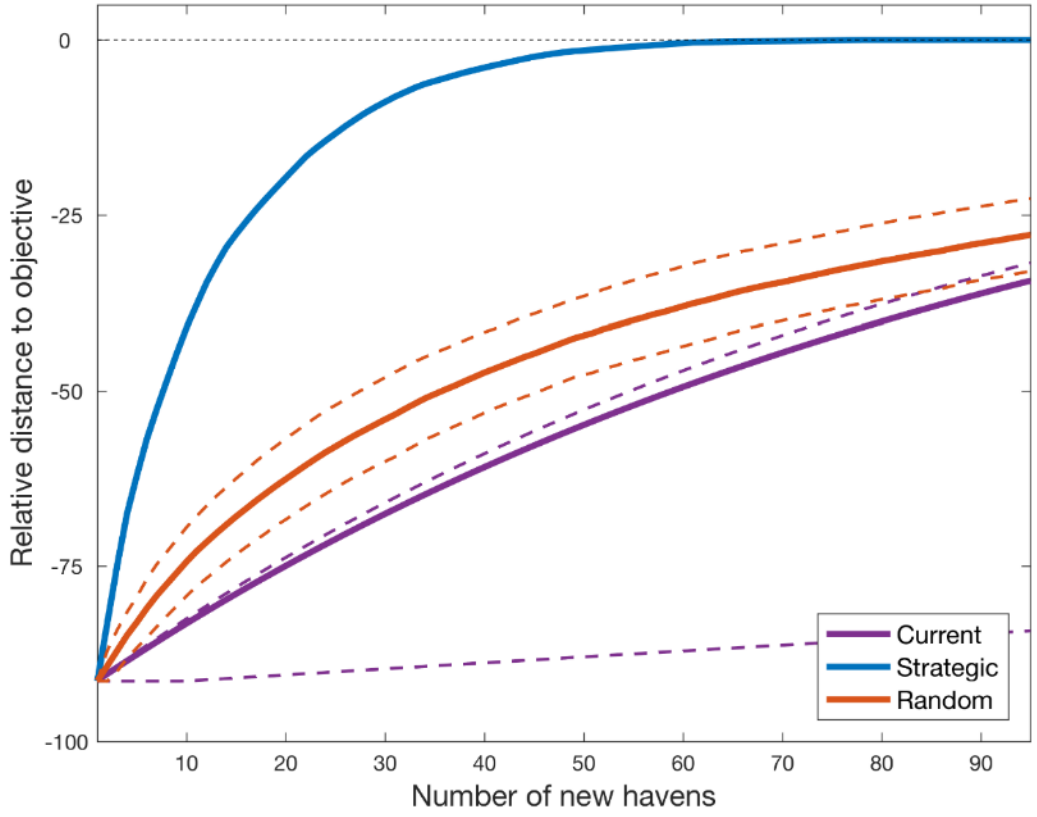
To achieve one or more pops…we need as few as 12 new havens.

Ringma *et al*. (2018) *Cons Letts* "Systematic planning can rapidly close the protection gap in Australian mammal havens."

The next 12 havens…to achieve protection for at least one pop of every mammal taxon susceptible to cat/fox predation



Performance with systematic planning



Objective: to reduce extinction risk across all 67 taxa susceptible to predation by cats and foxes

Strategic planning outperforms other approaches.

Random selection of future sites outperforms Business-As-Usual

Ringma *et al*. (2018) *Cons Letts* "Systematic planning can rapidly close the protection gap in Australian mammal havens."

Supporting national coordination for future haven expansion

Support partnerships:

- Funded species, even multi-species, recovery teams
- Brokered partnerships, even tied to government investment

Whilst recognising that locally-focussed groups have immense value!

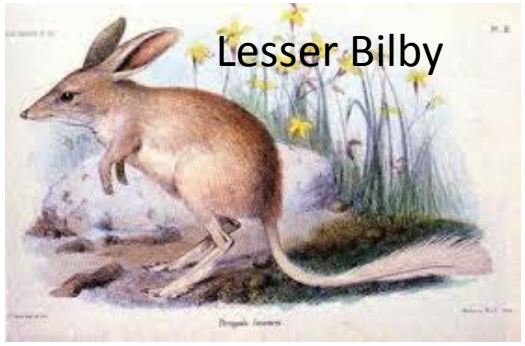
Desert rat-kangaroo

Broad-faced potoroo

White-footed rabbit-rat

Lesser Stick-nest rat

Lesser Bilby



Pig-footed Bandicoot

Crescent nailtail wallaby

Long-tailed Hopping Mouse

Eastern Hare-wallaby

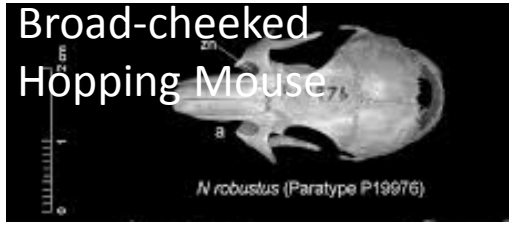
Short-tailed Hopping Mouse

Large-eared Hopping Mouse

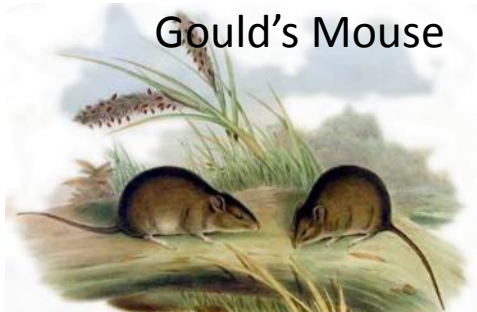
Darling Downs Hopping Mouse

Some of the mammals sent extinct by cats and foxes

Broad-cheeked Hopping Mouse



Gould's Mouse



Desert bandicoot

13 taxa have avoided extinction because of natural or ‘created’ havens

Boodie (2 subspecies)

Banded Hare-wallaby

Spectacled Hare-wallaby (Barrow Is)

Rufous Hare-wallaby (2 subspecies)

Rock-wallaby (2 island subspecies)

Gilbert’s Potoroo

Shark Bay Mouse

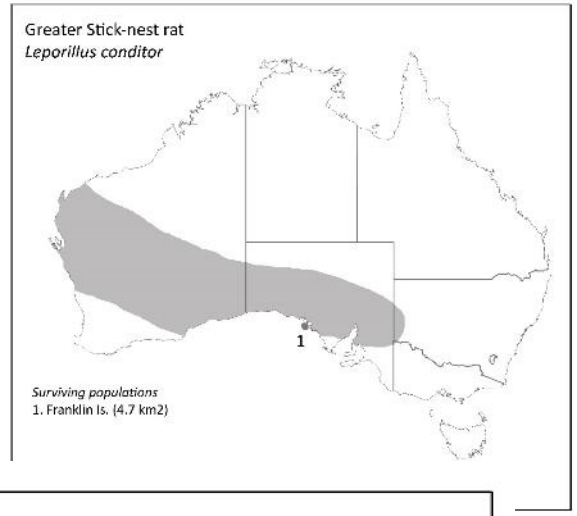
Eastern Barred Bandicoot

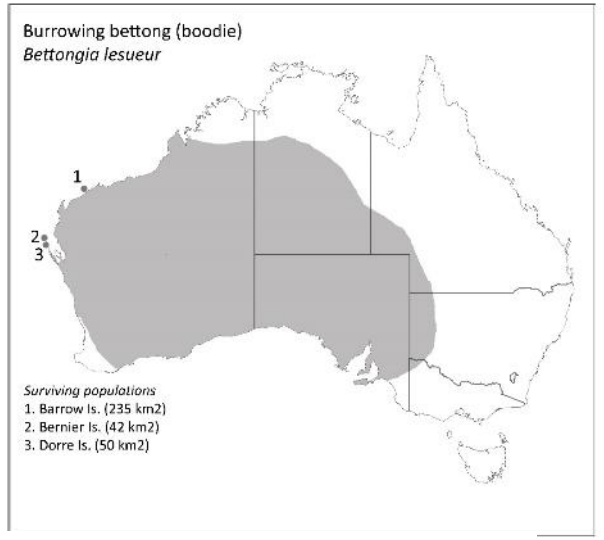
Greater Stick-nest rat

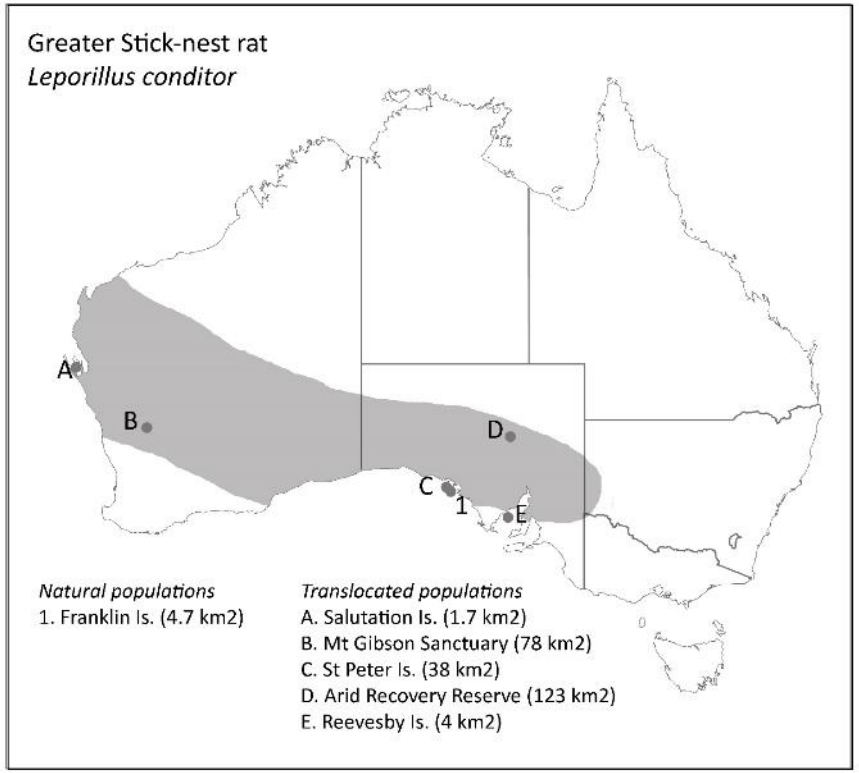
Western Barred Bandicoot

Photos: H. McGregor; Wiki CC; R. Francis; D. Walker; Parks Australia; DBCA; J. Lochman

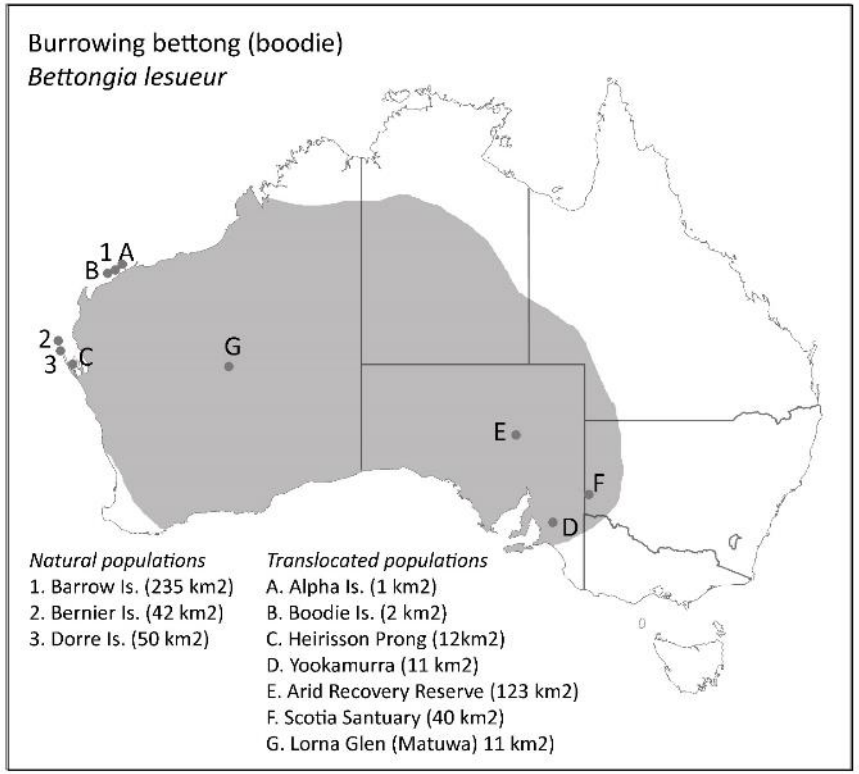
This is what avoided extinction looks like ….







Even with multiple havens, distribution and ecological roles have collapsed



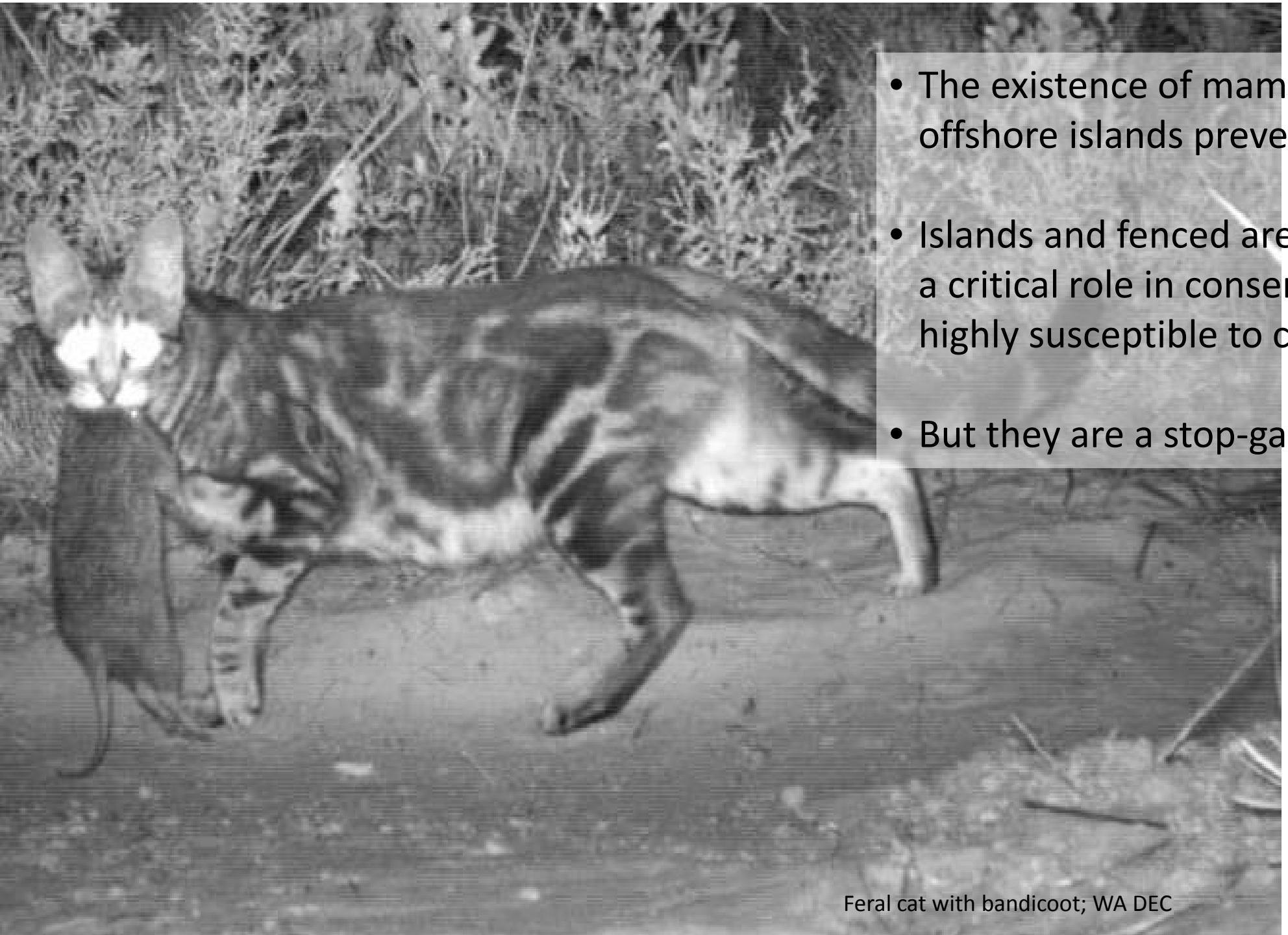
….and could make return to open landscapes harder

- Loss of local adaptation
- Loss of predator recognition and response

- Northern quolls translocated in 2003 to NT island without cats or dingoes
- After 13 generations, island quolls and their captive born offspring lost recognition of cats/dingoes, compared with mainland quolls and their captive-born offspring

Jonno Webb

Jolly et al 2018 Biol Letters 14: 20180222

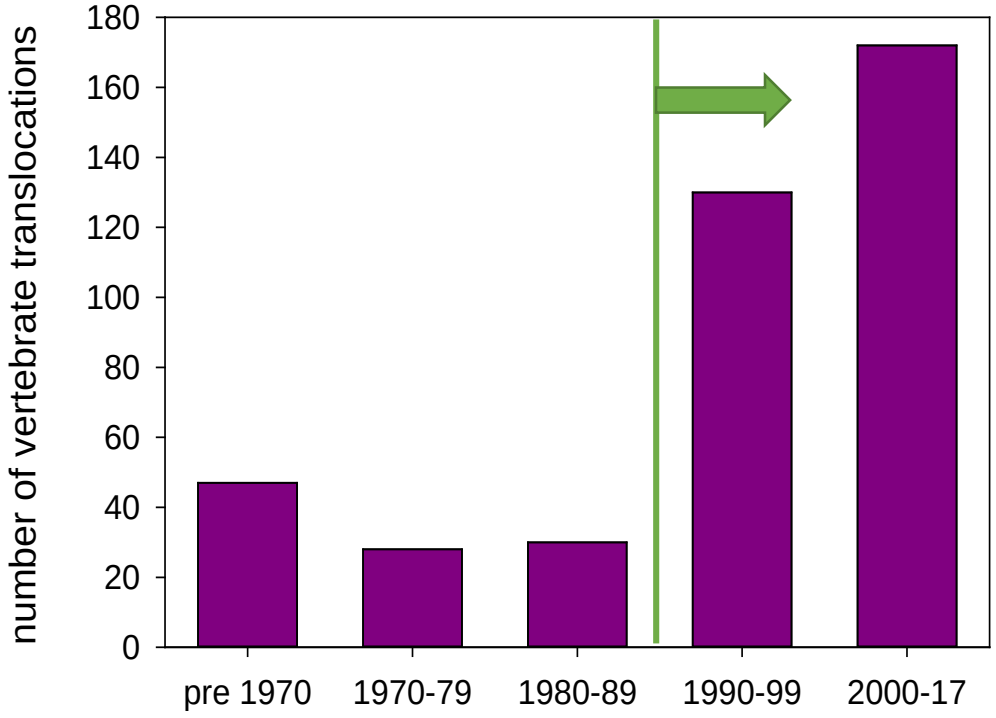


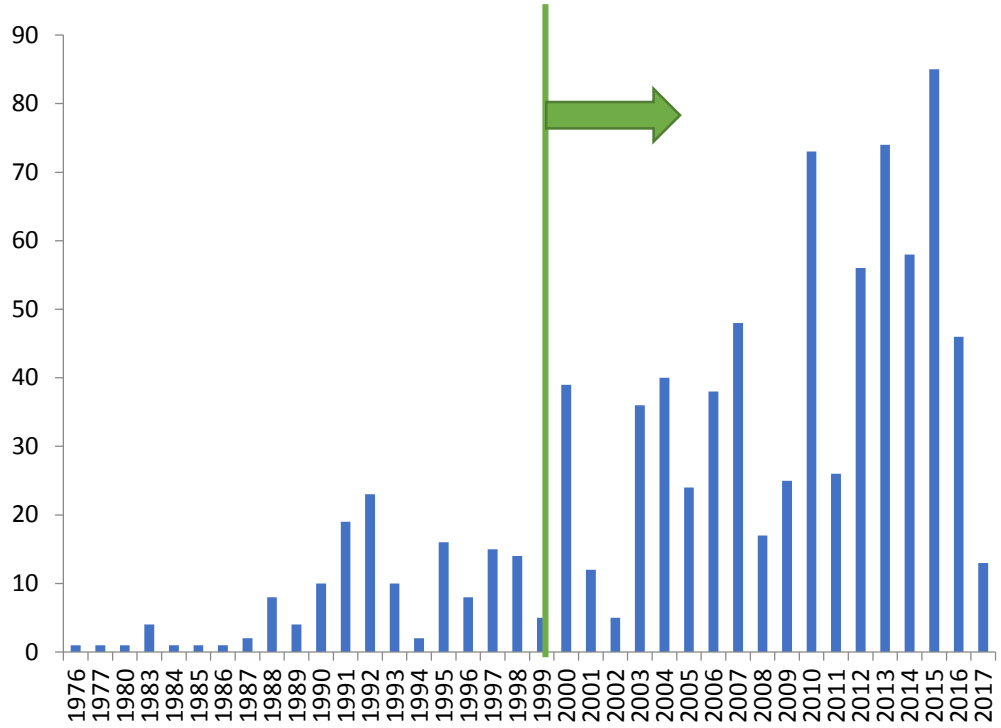
- The existence of mammal pops on offshore islands prevented extinctions
- Islands and fenced areas continue to play a critical role in conservation of mammals highly susceptible to cats/foxes
- But they are a stop-gap…

Feral cat with bandicoot; WA DEC

Mammal versus plant translocations (*Courtesy Jen Silcock et al*)

Animals translocations began ramping up about a decade earlier than plants, but are fewer, and involve fewer species

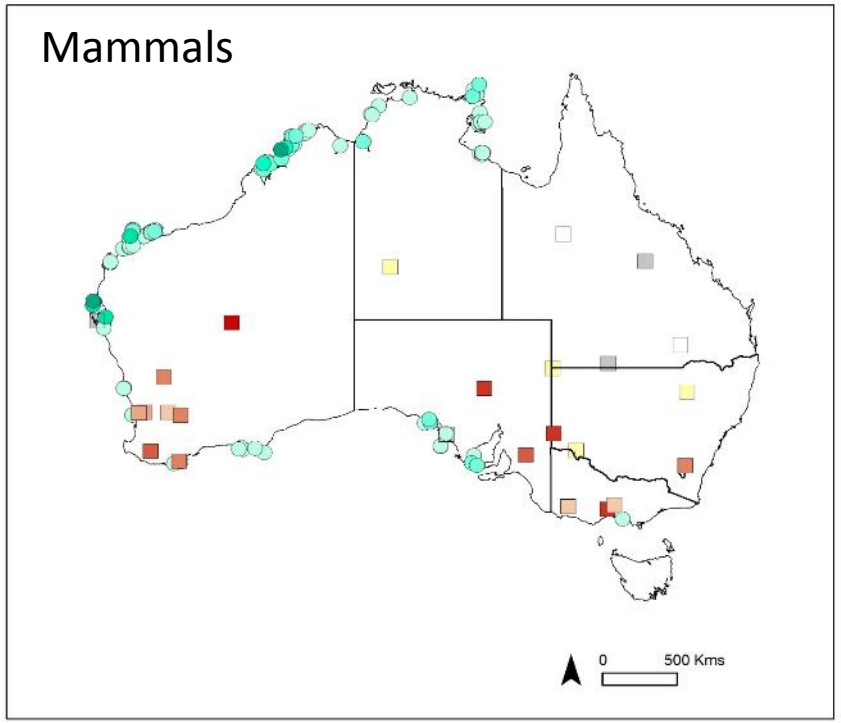


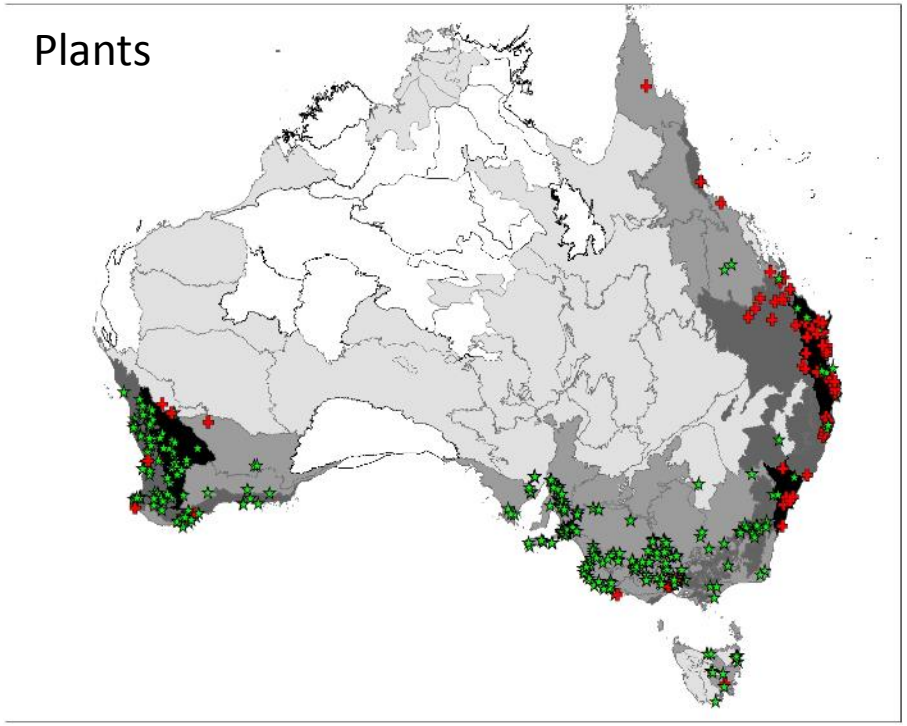


All animals: >400 translocations involving >230 taxa
Mammals: >310 translocations involving > 50 taxa

>1000 translocations involving >375 taxa

Mammal versus plant translocations (*Courtesy Jen Silcock et al*)





Green Stars = conservation translocations

Red Crosses = development mitigation translocations

Mostly to **less populated** areas

Mostly **reintroductions** (within known range) 65%

DRIVER = PREDATION FROM CATS/FOXES

Main reason for failure = predation

Mostly near **most populated** areas

Mostly **introductions** (but within known range) 80%

DRIVER = HABITAT LOSS FROM DEVELOPMENT

Main reason for failure = small founder size





Threatened Species Recovery Hub

National Environmental Science Programme

Moving mammals – looking backwards, looking forward

Sarah Legge, Uni Qld and ANU; on behalf of large author team

Mike Bode, Andrew Burbidge, Nicki Mitchell, Jim Radford, Jeremy Ringma, Brendan Wintle, John Woinarski



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