

The impacts of feral cats on Australian wildlife



National Environmental Science Programme

WA feral cat symposium 31 May 2018, Mandurah

John Woinarski

& Sarah Legge, Brett Murphy, Russell Palmer,
and many colleagues

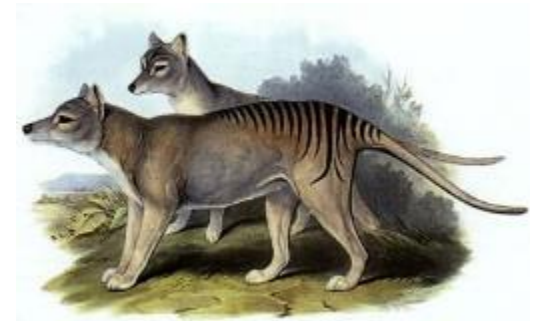


Continental context



European colonisation of **north America** from the 16th century

- Loss of traditional Indigenous management;
- Much clearing, and introduction of new plants and animals;
- Intensive hunting of very many species;
- Human population increase to >350 million (USA+Canada)
- **Of land mammal species, only one extinction (across continental USA+Canada): the highly localised Sea Mink**



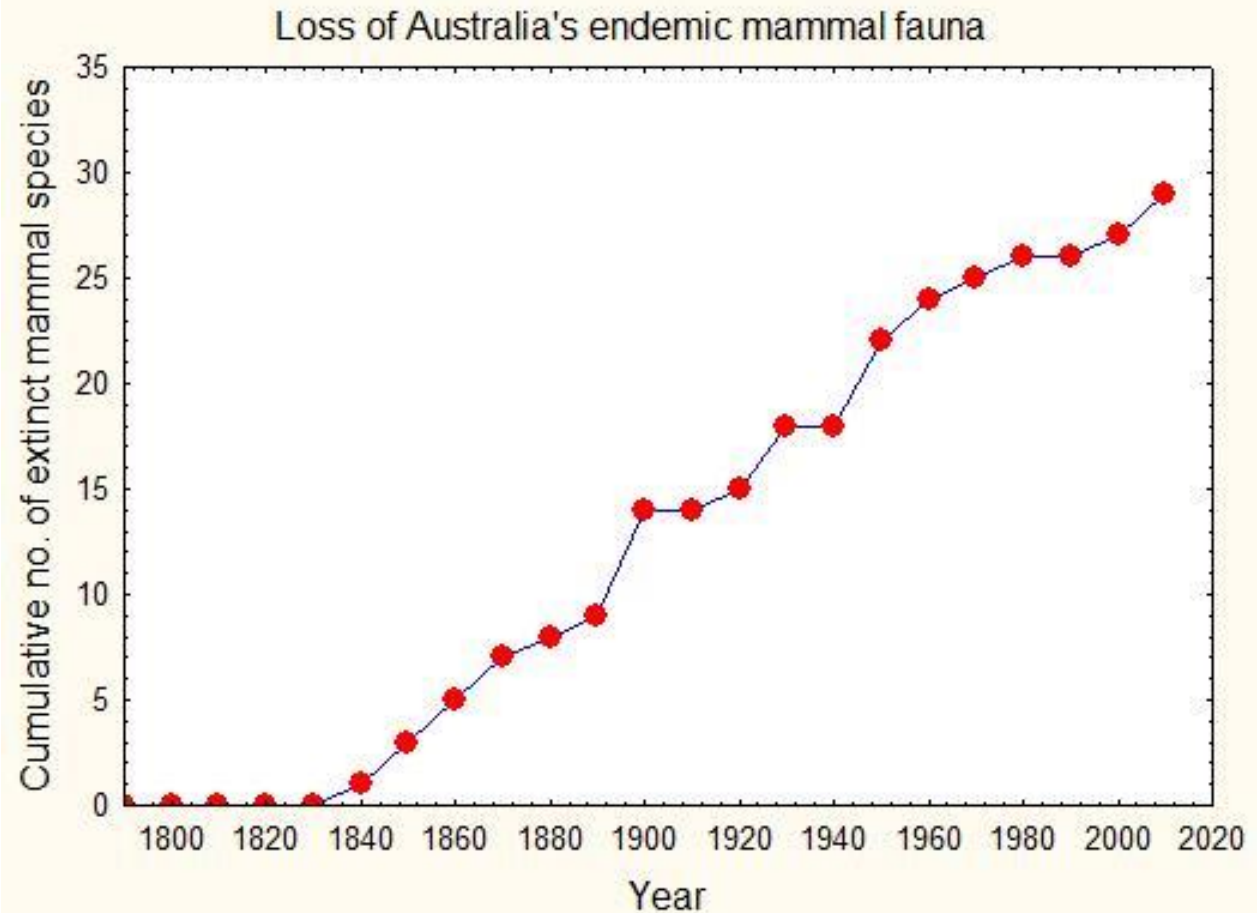


'The old Australia is passing. The environment which moulded the most remarkable fauna in the world is beset on all sides by influences which are reducing it to a medley of semi-artificial environments, in which the original plan is lost and the final outcome of which no man may predict.'

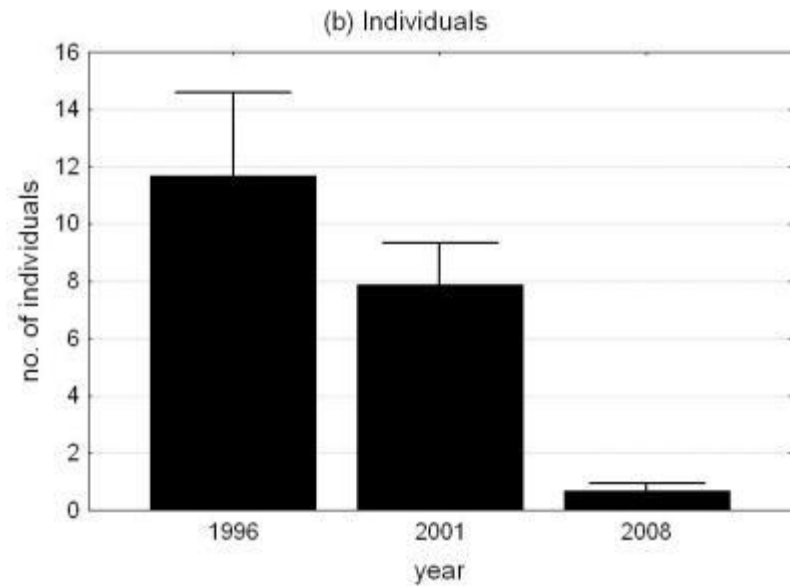
Hedley Finlayson (1935)
The Red Centre



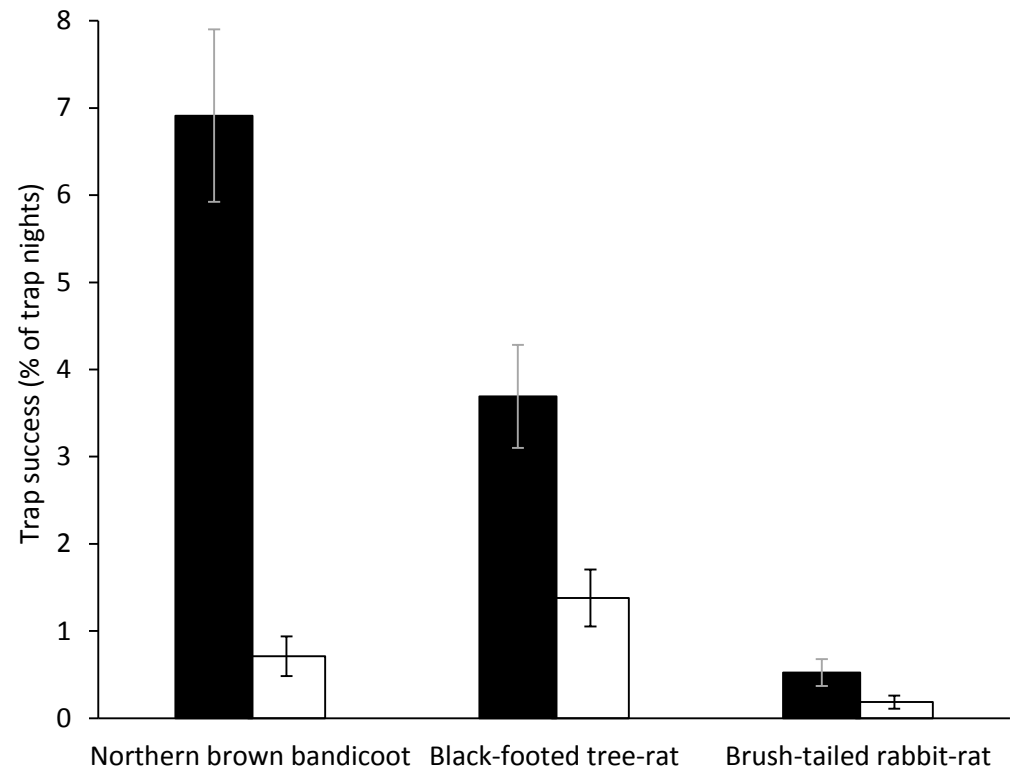
For Australian endemic land mammals loss has been extreme and is ongoing ...



- extinction has been largely continuous since *ca.* 1840s;
- (1-2 mammal species lost per decade)
- >10% of Australia's endemic land mammals are now extinct



Kakadu mammals (1990s-2008)
[Woinarski *et al.* 2010]



Tiwi Islands mammals (2000-15)
[Davies *et al.* (2017)]

Evidence of cat impacts in these mammal losses and declines

- Temporal and spatial correlation of cat expansion and native species' decline and loss
- Persistence on cat-free islands but loss from nearby mainland areas;
- Reintroduction success to predator-proof exclosures;
- Reintroduction failures (or impaired success) at sites where cats/foxes not adequately controlled

“One animal, the quite recent extermination of which we must greatly regret, is the small unknown creature which used to live in great numbers on St. Francis Island. Mr. Lloyd ... described them as very small wallabies, creatures which used to hop into the homestead and eat scraps thrown to them from the table.



Cats were liberated in order to destroy it, and they have done their work with thoroughness.”

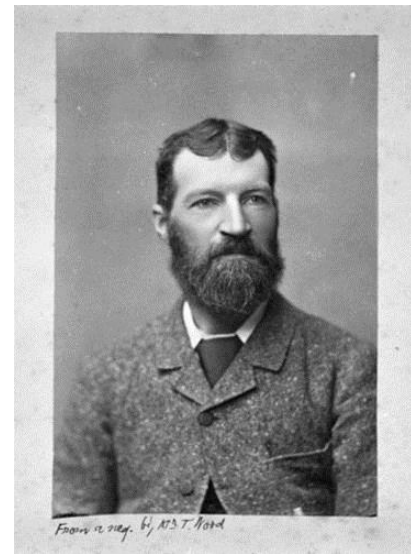
F. Wood Jones (1923). *Trans. R. Soc. S.A.* **47**, 94.

* subsequently described (from but one skull fragment) as the island-endemic *Bettongia penicillata francisca*



Long-running concern about cats

... “If we are in earnest about the proper protection of our native birds – some of them the wonders of the world – we should face the wild cat pest now, ere it be too late, and before unique species, like the Night Parrot, Scrub-bird, and other ground-loving birds, have passed out forever” (Campbell 1924)

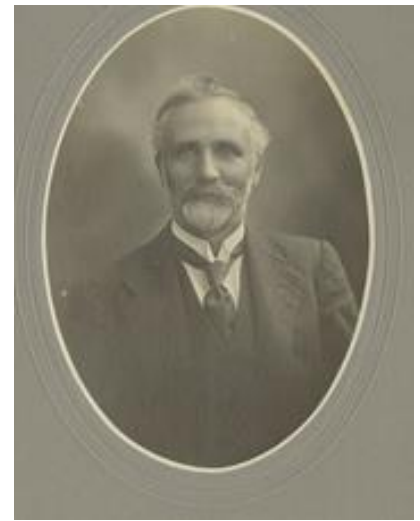


[Campbell AJ (1906) Domestic wild-cats v. native birds. *Emu* **5**, 201-202.

Campbell AJ (1915) Missing birds. *Emu* **14**, 167-168.

Campbell AJ (1924) Domestic cats gone wild *versus* bird protection. *Emu* **23**, 175-177.]

Long-running debate

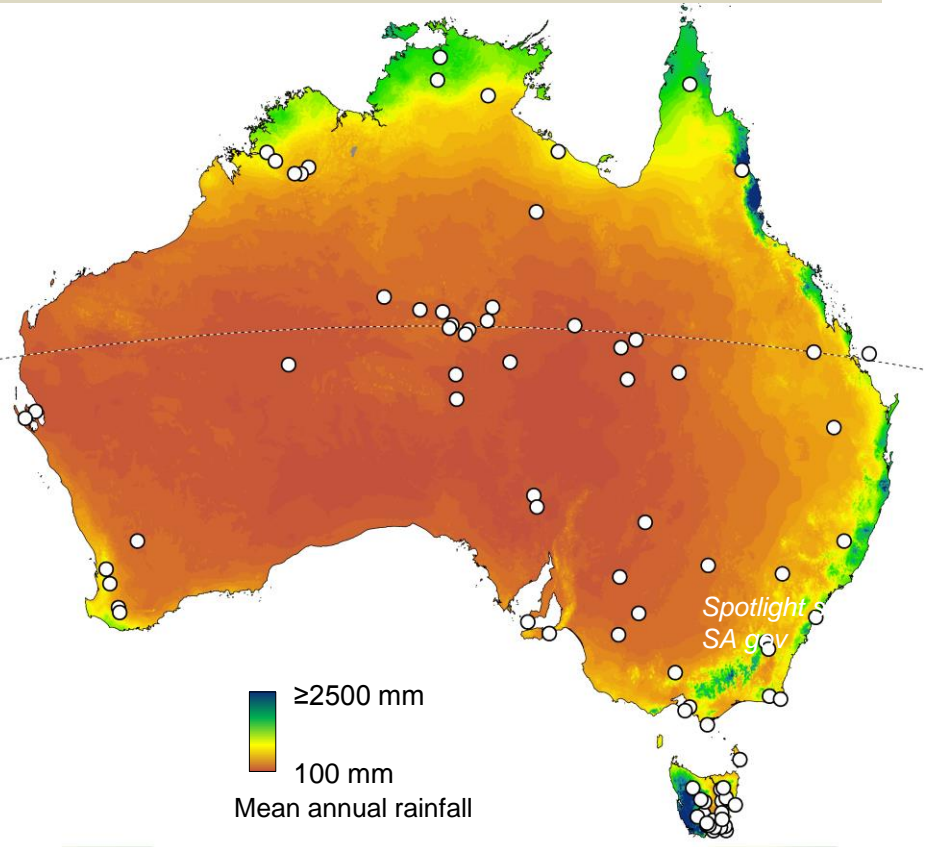


“the following may, *in a minor degree* be considered contributing factors, but I consider that *undue emphasis has been placed upon them* because the natural fecundity of our native birds has, in the main, been sufficient to meet the wastage from these sources.

These factors are: ... destruction by introduced predators such as cats, foxes, rats, etc. – these latter, except on ... islands, do not, in my opinion, seriously count.”

[Ashby E (1924) Notes on extinct or rare Australian birds, with suggestions as to some of the causes of their disappearance. Part I. *Emu* **23**, 178-183.]

So, how many cats are there in Australia? [and where are they?]



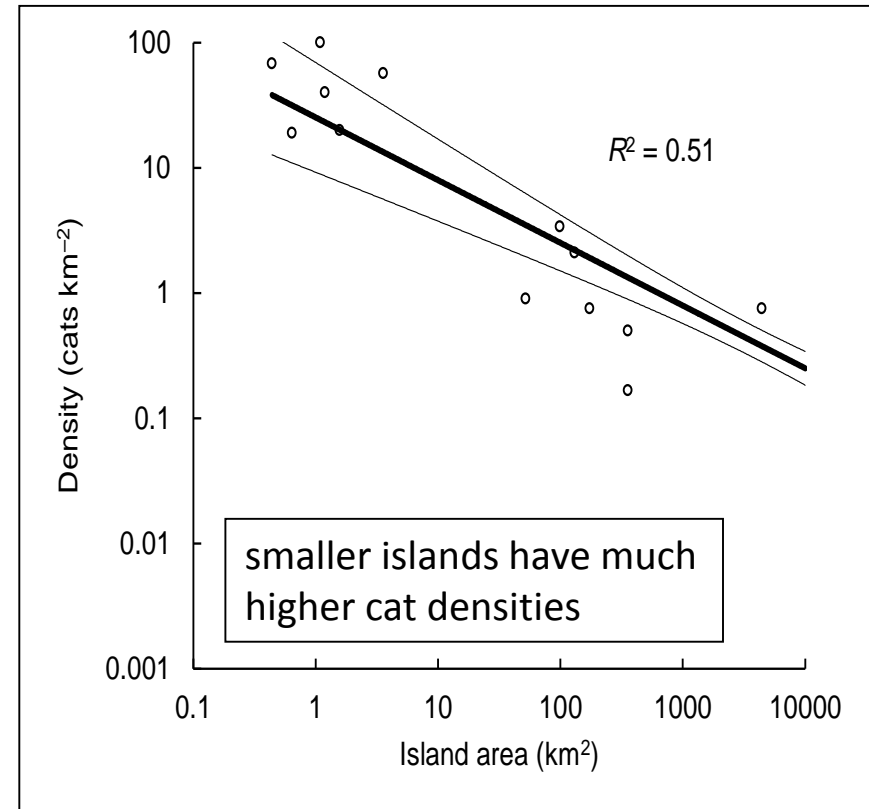
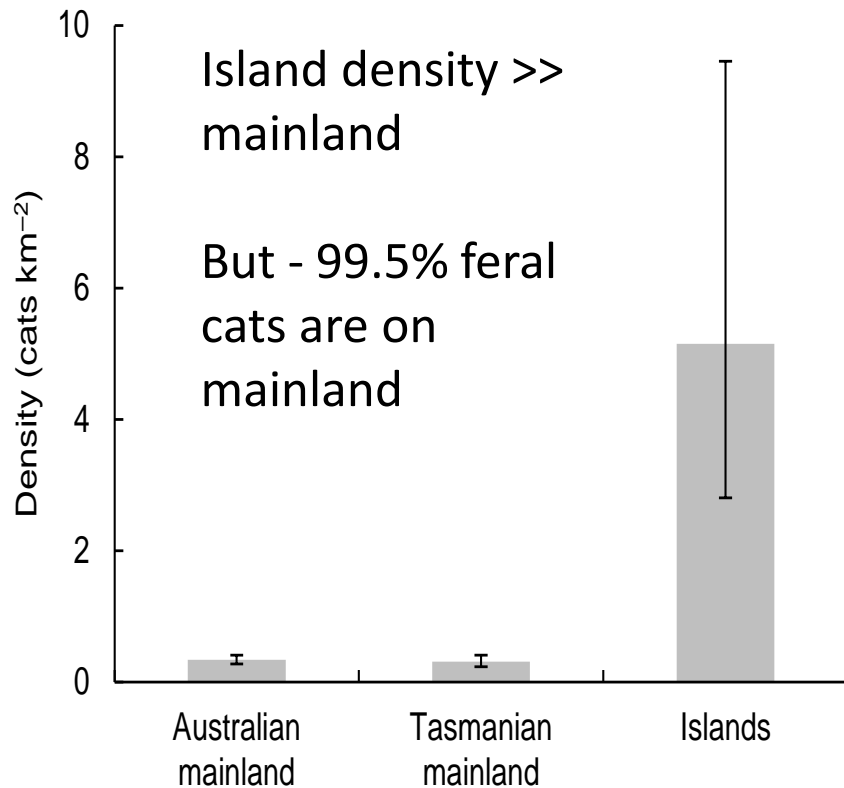
We aggregated and modelled >90 local estimates of cat density, to derive a spatial layer of density of feral cats

Legge *et al.* (2017) *Biol. Cons.* **206**, 293-303

Cat density is higher on islands

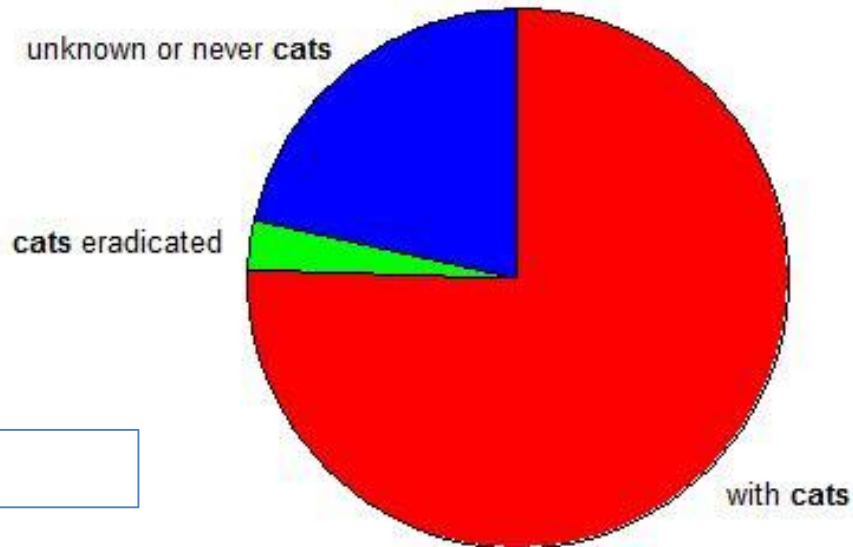
Why?

- Seabird colonies
- Shoreline flotsam
- No larger predators



Cats on Australian islands

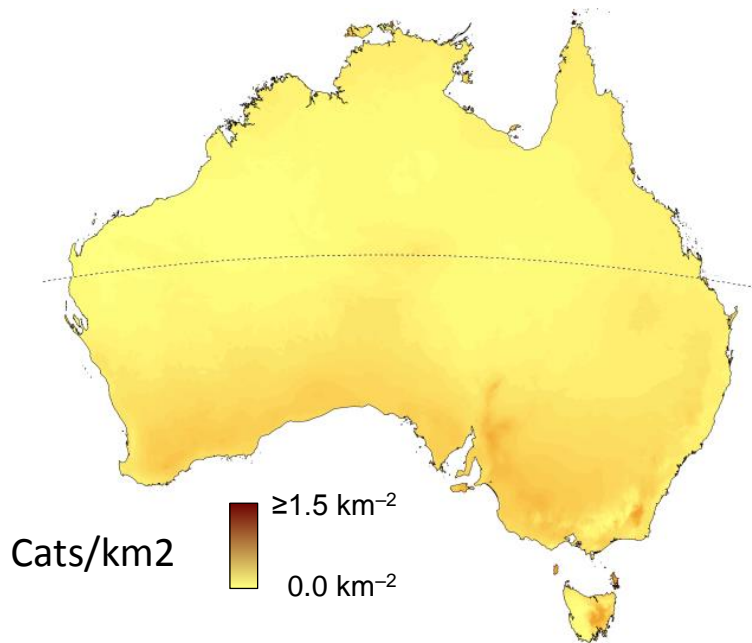
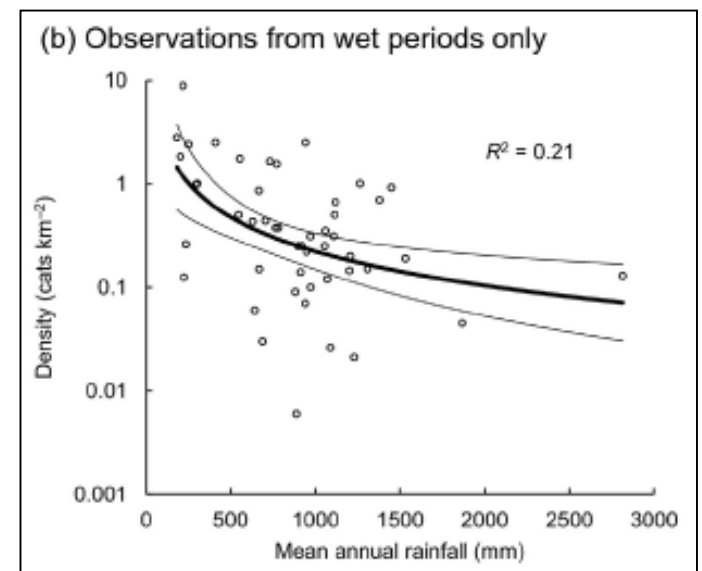
Cats are on 95-100 islands, comprising 77% of the area of all Australian islands (those smaller than Tasmania)



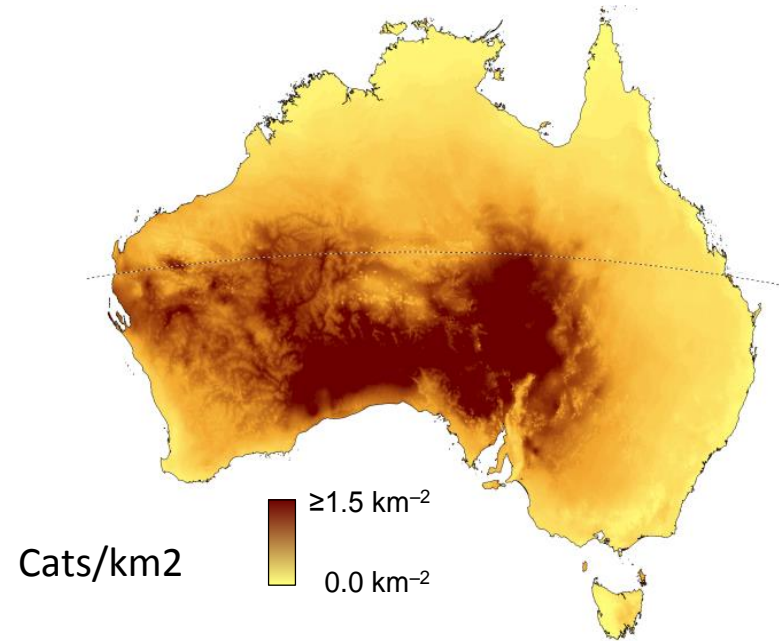
ca. 31 islands with cats eradicated

Total island area (excluding Tasmania)

Cat density is higher in low rainfall areas, but only after extensive rain



Observations from dry periods



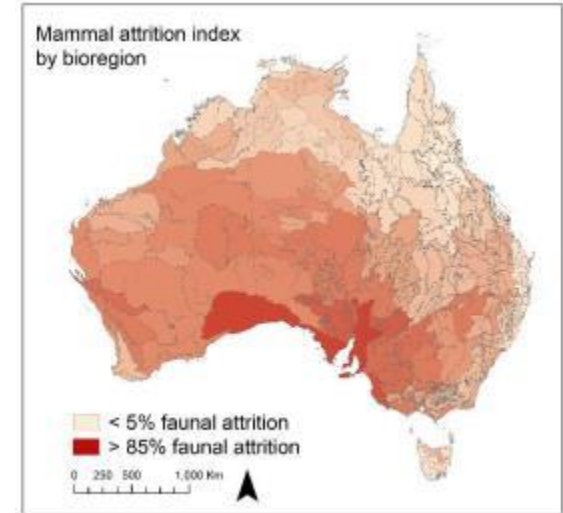
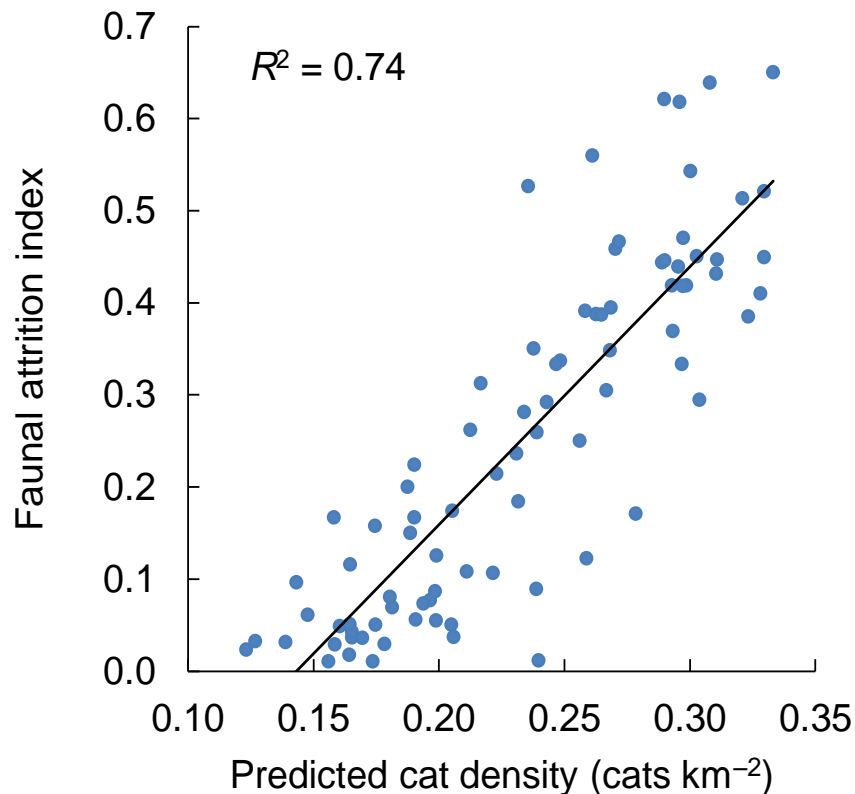
Observations from wet periods

Total numbers

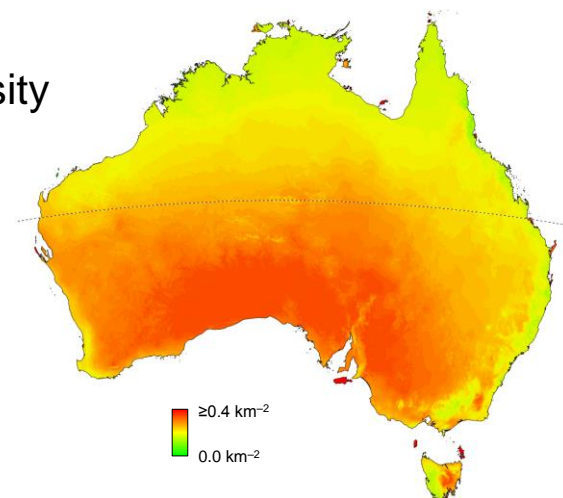
- Feral cats in largely natural environments
 - 1.4 million (in dry years) to 5.6 million (in wet years)
- Feral cats in highly modified environments (rubbish tips etc.)
 - 0.7 million
- Pet cats
 - 3.88 million



An aside: spatial variation in cat density is eerily similar to spatial variation in loss of native mammals



Cat density



How many animals do cats kill?

Again, we aggregated and modelled information from nearly 100 local studies of cat diet (totalling ca. 10,000 cat stomachs, scats)

Spatial model for variation in the number of birds, reptiles and mammals killed

Cat density (spatial variation) x no. birds (reptiles, mammals) inside a cat at any time



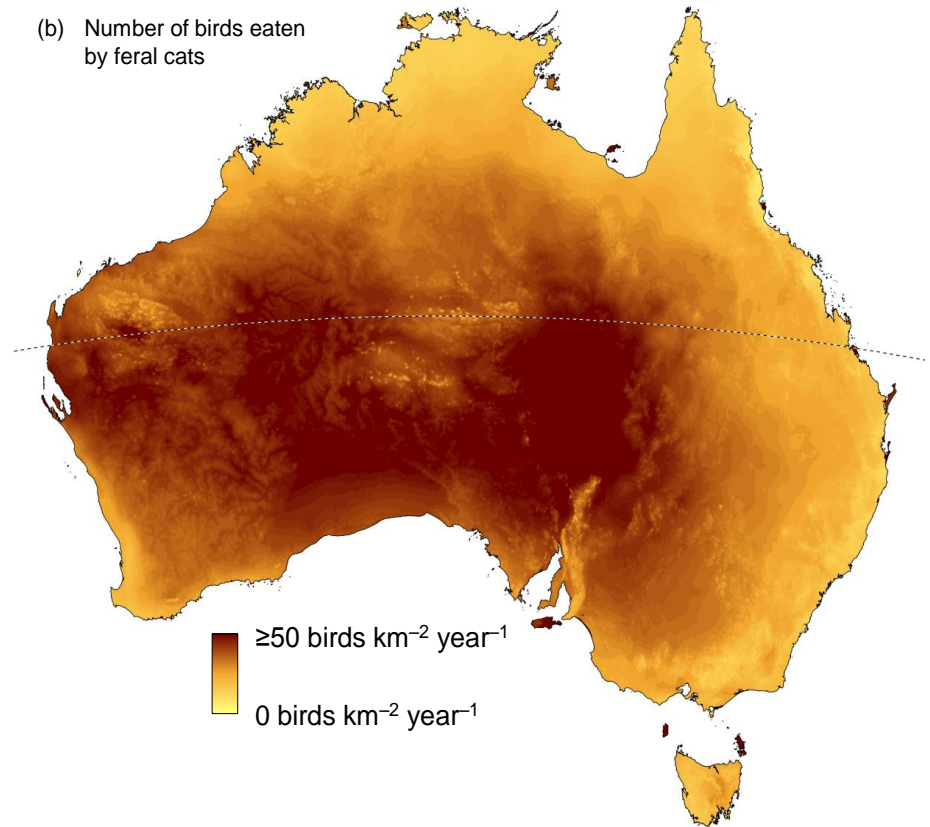
The no. of **birds** killed by feral cats in the bush

The average feral cat kills 129 birds/yr

Total of 272 million birds/yr killed by feral cats in natural environments

Average no. birds killed by cats: 35.5/km²/yr

(b) Number of birds eaten by feral cats



Islands: 107 birds/km²/yr

The no. of Australian birds killed by cats

Total of 272 million birds/yr killed by feral cats in natural environments

Another 44 million birds/yr killed by feral cats in modified environments

Another 81 million birds/yr killed by pet cats:

So, cats kill ca. 390 million birds/yr

or > 1 million Australian birds killed by cats per day



*Cat, blue-winged kookaburra.
J. Heathcote*

The no. of Australian birds killed by cats

Average no. birds killed by feral cats: 35.5/km²/year

Typical densities of birds in Australia 5-30 birds/ha

So, Australia's total bird population is 9-13 billion:
[cats kill ca. 390 million/year]

So, cats take about 3-4% of total Australian bird population per year

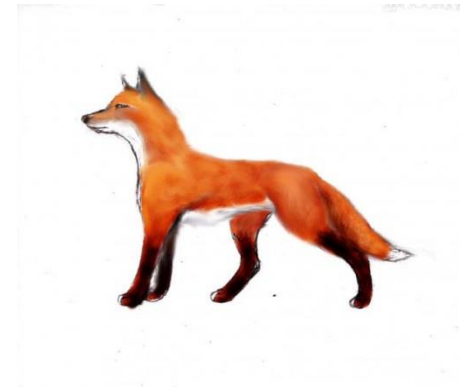


Comparisons are invidious, but the total no. of birds killed annually by vegetation clearance in Australia is ca. 9 million
[cf. ca. 390 million by cats]

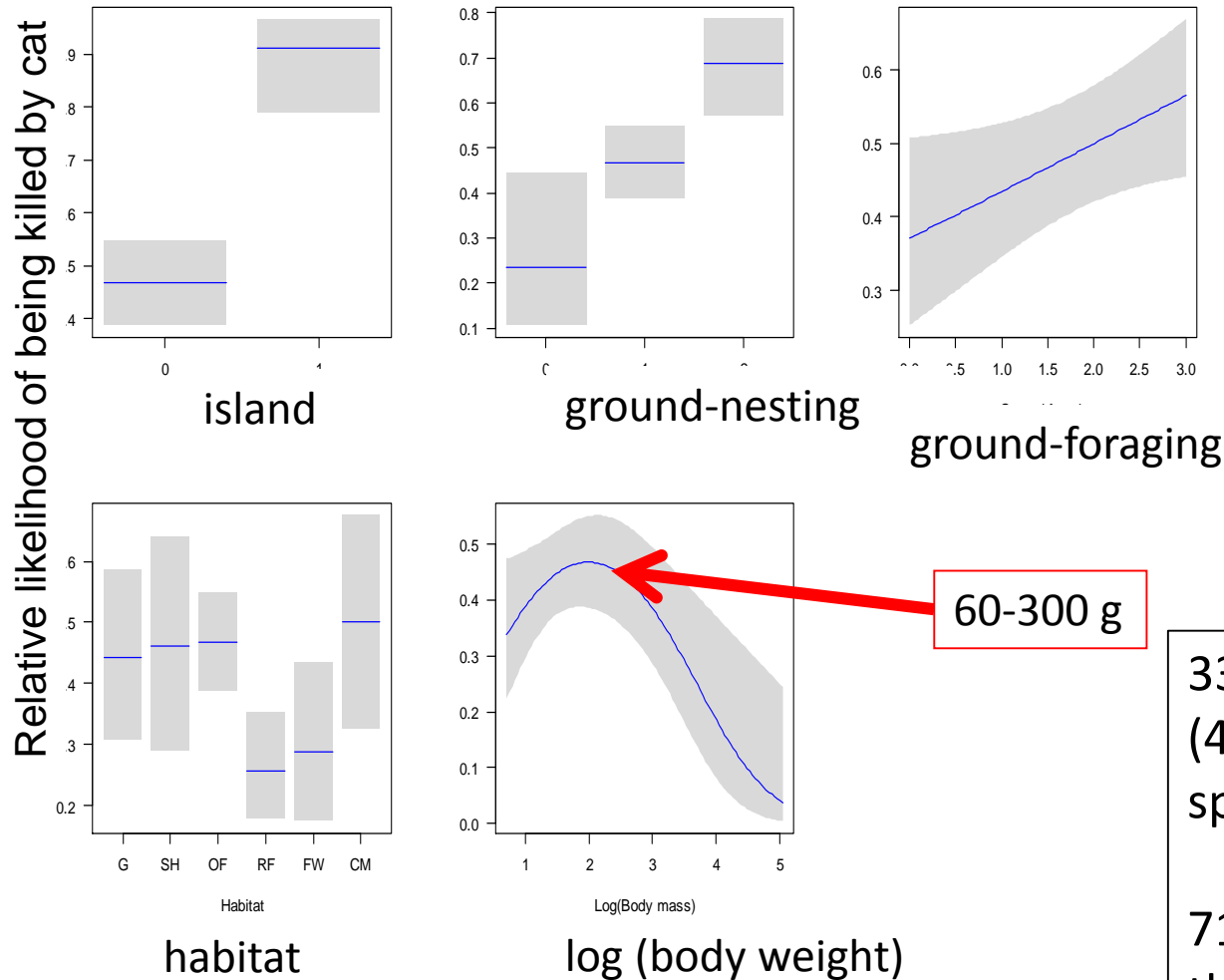
Cats kill more Australian birds than do other mammalian predators

The incidence of birds in feral cat diet is:

- much higher than for **foxes** (mean 29.1% for cats, 17.3% for foxes: $p < 0.002$);
- much higher than for **dingos/dogs** (mean 33.4% for cats, 14.2% for dingo-dogs: $p < 0.001$);
- much higher than for spotted-tailed **quolls** (mean 22.6% for cats, 9.3% for quolls)



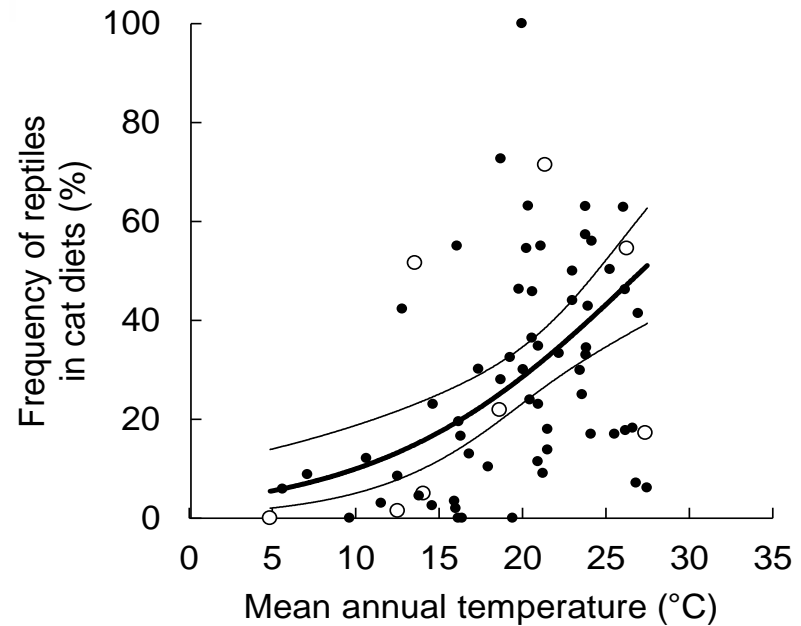
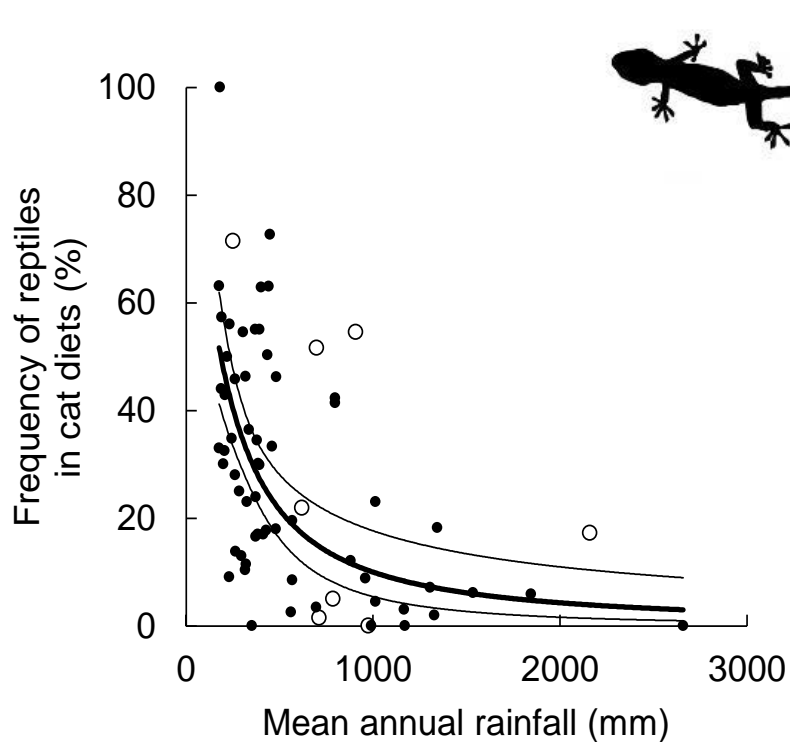
Bird species killed by cats



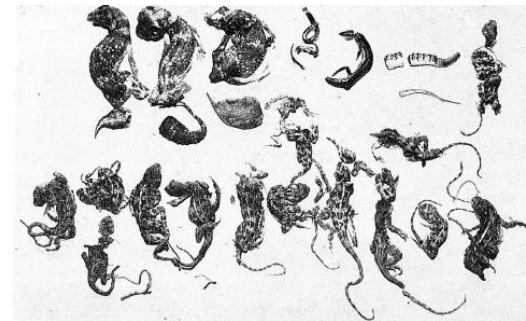
338 native bird species
(46% of Australian bird
species)

71 bird species listed as
threatened (61% of 117
threatened bird species)

Numbers of Australian **reptiles** killed by cats



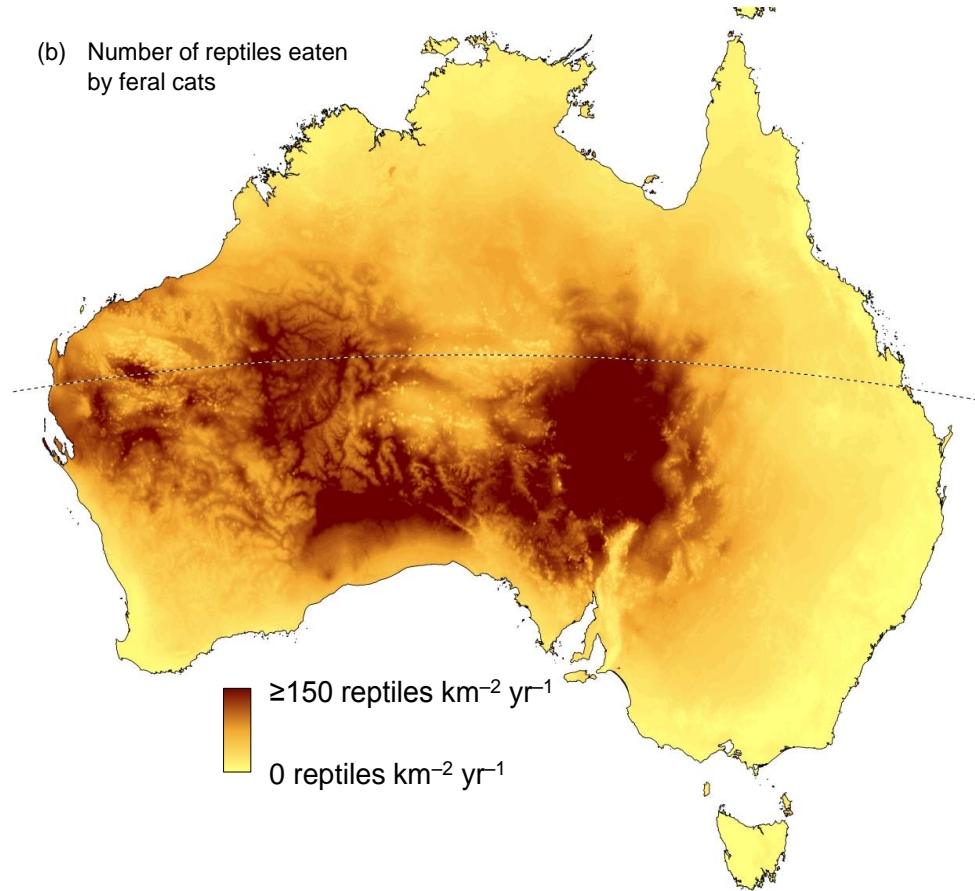
Woinarski *et al.* in press *Wildlife Research*



Reptiles killed by cats

- on average, a feral cat kills 238 reptiles yr^{-1}
- feral cats kill 596 million reptiles yr^{-1}
- pet cats kill 53 million reptiles yr^{-1}
- so, total numbers of reptiles killed by cats is 649 million yr^{-1} , or *1.8 million reptile individuals per day*

(b) Number of reptiles eaten by feral cats



Number of reptiles eaten by cats per km^2 per year

Impacts of cat predation on reptiles

Impacts of cat predation are likely to be largest for reptiles that are moderate sized, ground-dwelling, with 'slow' life histories (e.g. *Tiliqua*, *Egernia*, *Liopholis* etc.)



1. Of course, cats aren't the only problem

2. Cat impacts compound, and are compounded by, other factors

3. So, management of cats needs to also consider these other factors

Interactions of cat predation with

- Fire
- Habitat fragmentation
- Rabbits
- Developments in remote areas
- Urbanisation
- Dingo 'management'
- fox management



Acknowledgements

Dozens of colleagues who have tenderly pulled apart cat shits, pored over cat guts, laboured through thousands of remote camera images, undertaken countless hours of systematic spotlight transects; and then generously provided their hard-won data.

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