Photo: Kate Rick

Genetic mixing in conservation translocations recovers diversity of a keystone threatened species, *Bettongia lesueur*

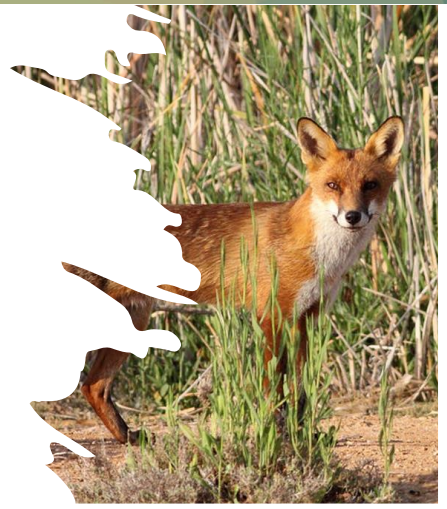
H.M. Nistelberger, E. Roycroft, A.J. Macdonald, S. McArthur, L. White, P.G.S. Grady, J. Pierson, C. Sims, S. Cowen, K. Moseby, K. Tuft, C. Moritz, M. D.B. Eldridge, M. Byrne, K. Ottewell

Australian National University
AUSTRALIAN MUSEUM
ARID RECOVERY
australian wildlife conservancy
Arthur Rylah Institute for environmental research
UCONN UNIVERSITY OF CONNECTICUT
UNSW SYDNEY

Mammal extinction hotspot

Terrestrial mammals 35g – 5.5kg most impacted (critical weight range)

Feral predators, habitat fragmentation, fire – complex & synergistic



Conservation safe havens protect 38 threatened mammal species

Feral predator-free islands, fenced exclosures

Managing genetic diversity in Australia's threatened mammals is critical

Bettongia lesueur

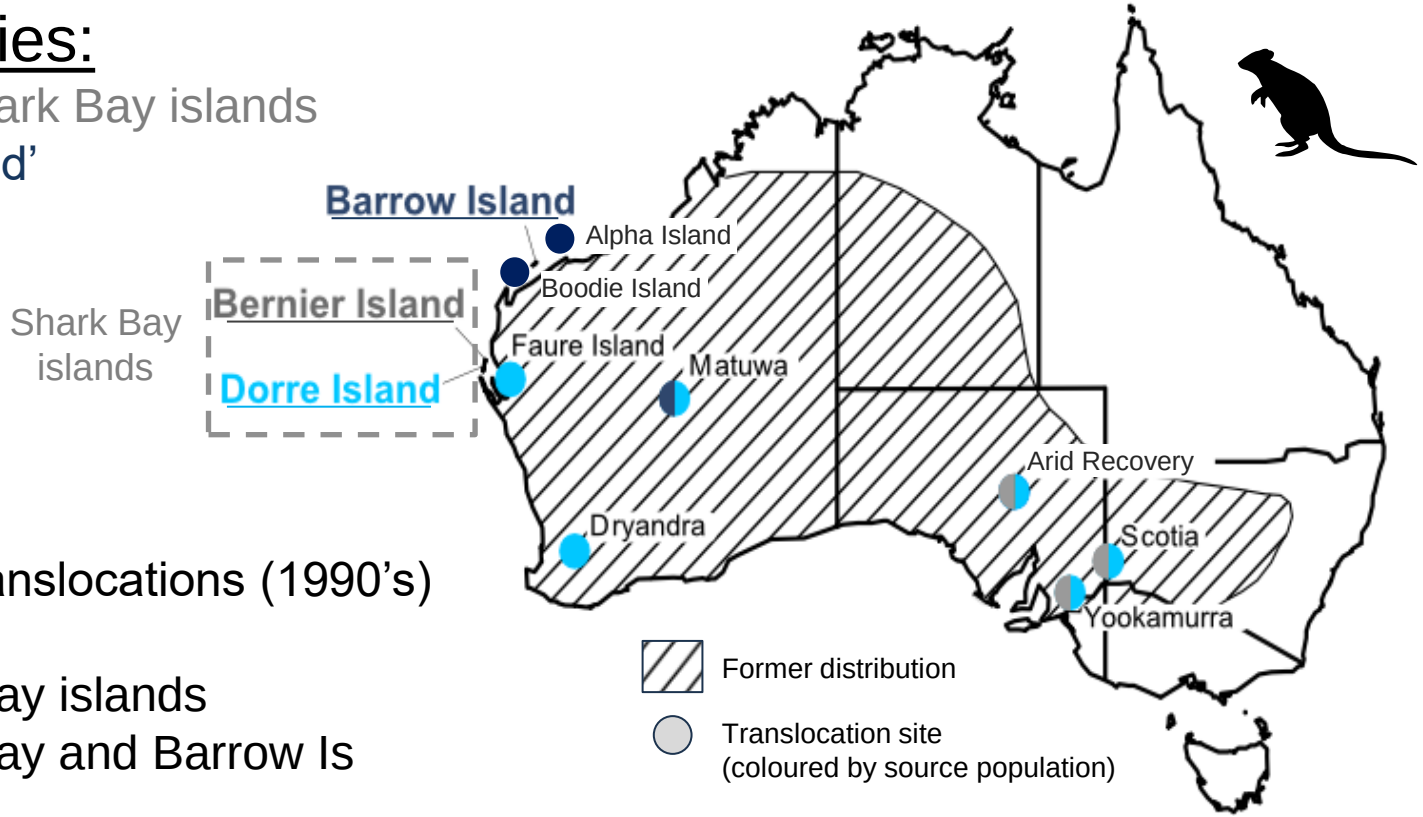
Burrowing bettong, boodie

Keystone species
'Ecosystem engineer'

Two subspecies:

ssp. *lesueur* – Shark Bay islands

ssp. 'Barrow Island'



Long history of translocations (1990's)

- single source
- mixed Shark Bay islands
- mixed Shark Bay and Barrow Is

Adapted from: Rick et al., 2019

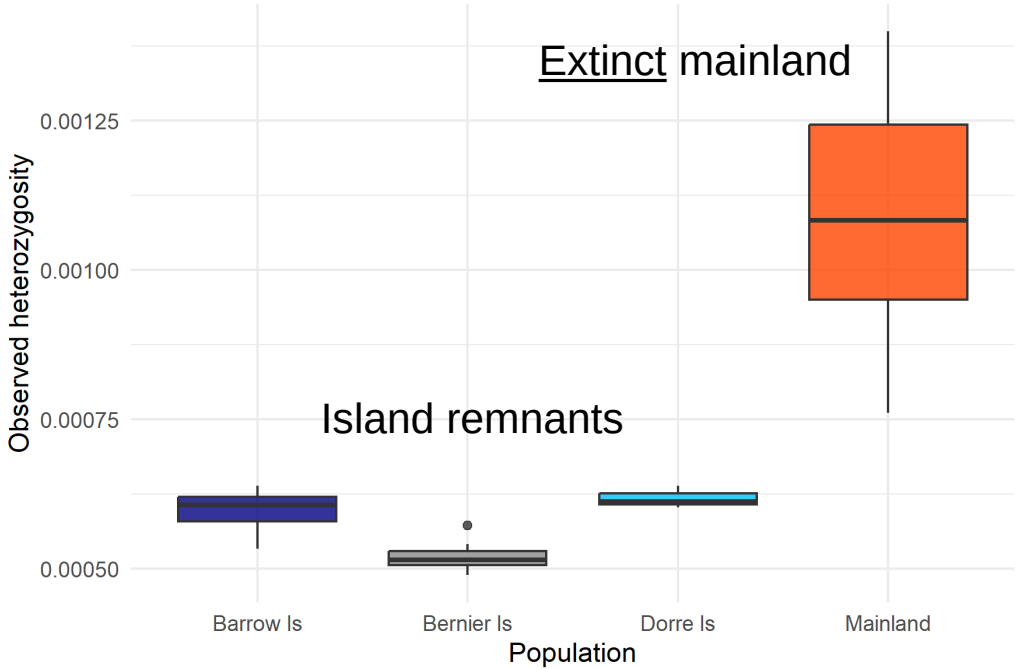
- What can we learn about the historical genetic diversity of extinct mainland boodies?
- How has the boodie translocation strategy impacted conservation of genetic diversity?
- How can we best manage genetic diversity in the future?

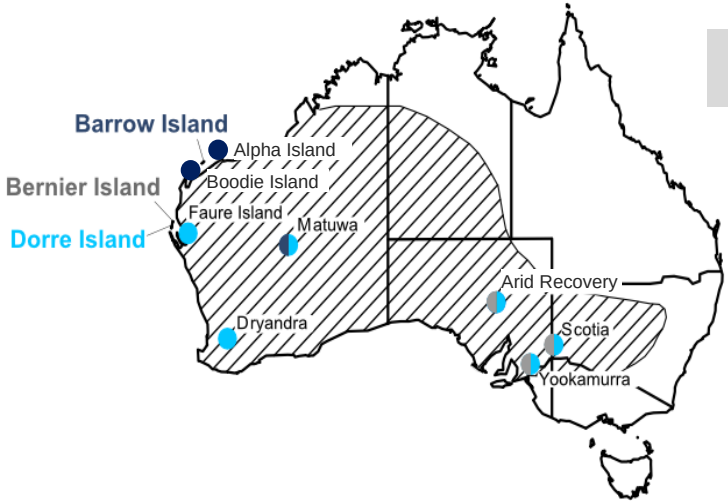
Museum skins
NHM, AM, WAM

Exon capture

7 historical samples
Contemporary island samples
Mean #SNPs/indv 1,144,520

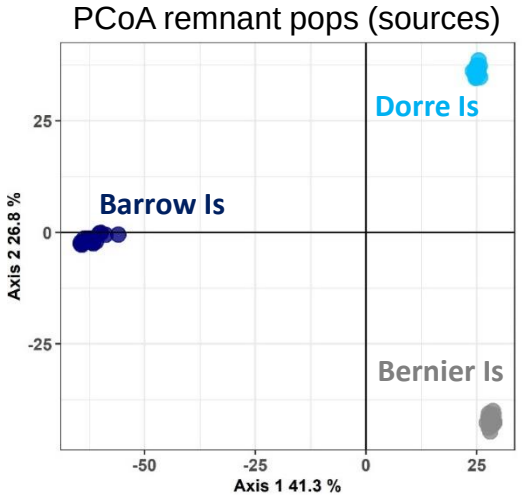
Historical analyses

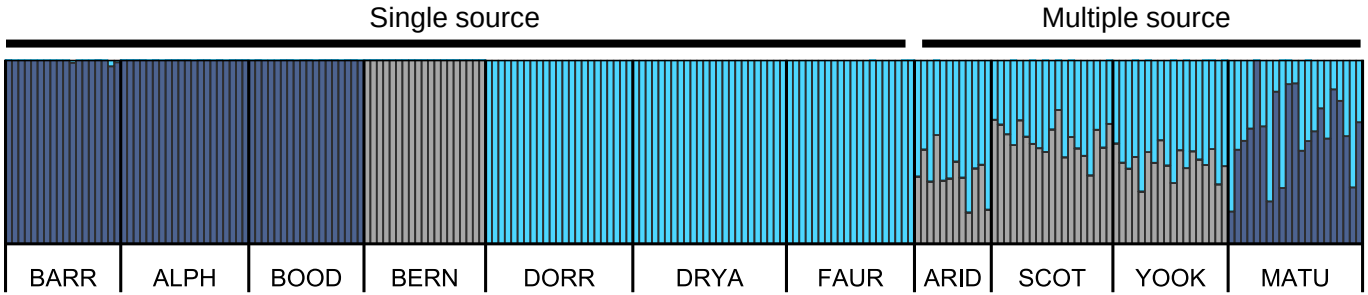




Contemporary analyses

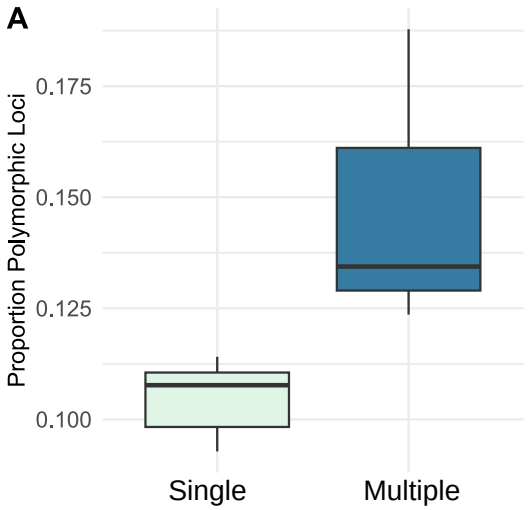
ddRAD
212 samples
Remnant and translocated pops
#SNPs 8,076

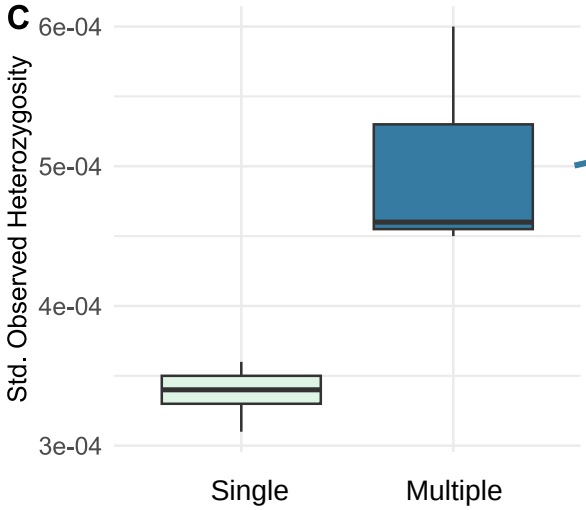


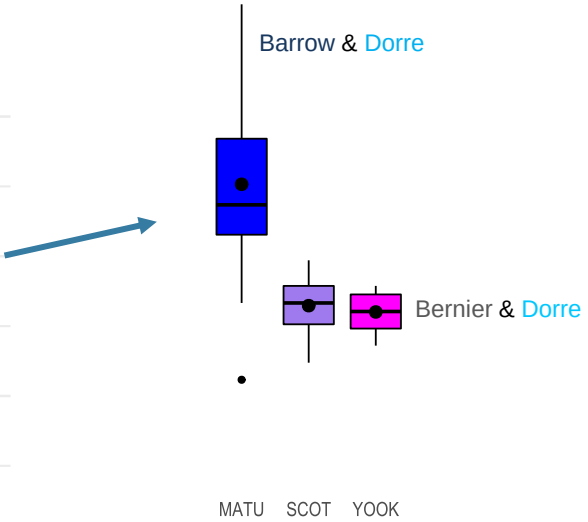


Admixture in translocated populations from multiple sources

Multiple source translocations have significantly higher genetic diversity



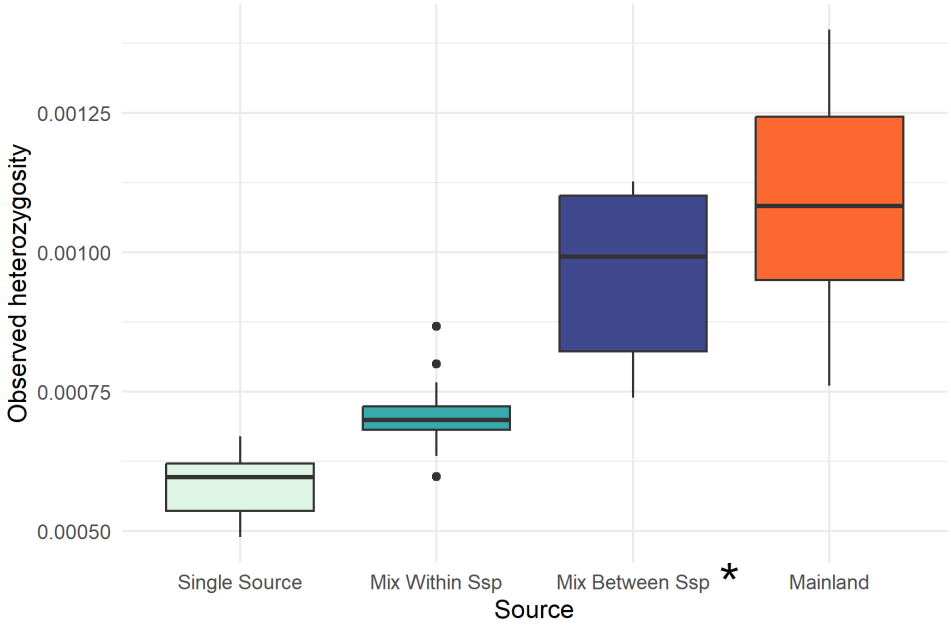


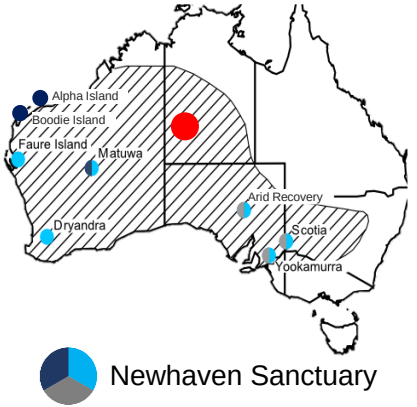


More divergent source >> genetic improvement

ddRAD #SNPs 8,076

Genetic admixture restores genetic diversity to historical range





*No evidence of outbreeding depression, see Rick et al. (2019). Genes, 10(11), 851.

Exon capture #SNPs 1,144,520

- Historical samples provide conservation context
- Remnant populations on islands genetically depauperate
- Genetic admixture as translocation strategy improves adaptive capacity – meets restoration target
- More divergent sources leads to greater gain

Thanks to:

RETURN TO 1616
DIRK HARTOG ISLAND NATIONAL PARK

PARKS AND WILDLIFE SERVICE

Australian National University

AUSTRALIAN MUSEUM

OMG
OZ MAMMALS GENOMICS

australian wildlife conservancy

ARID RECOVERY

NATURAL HISTORY MUSEUM

THE UNIVERSITY OF SYDNEY

THE UNIVERSITY OF WESTERN AUSTRALIA

BIOPLATFORMS AUSTRALIA

agrf

PAWSEY supercomputing centre

WESTERN AUSTRALIAN MUSEUM

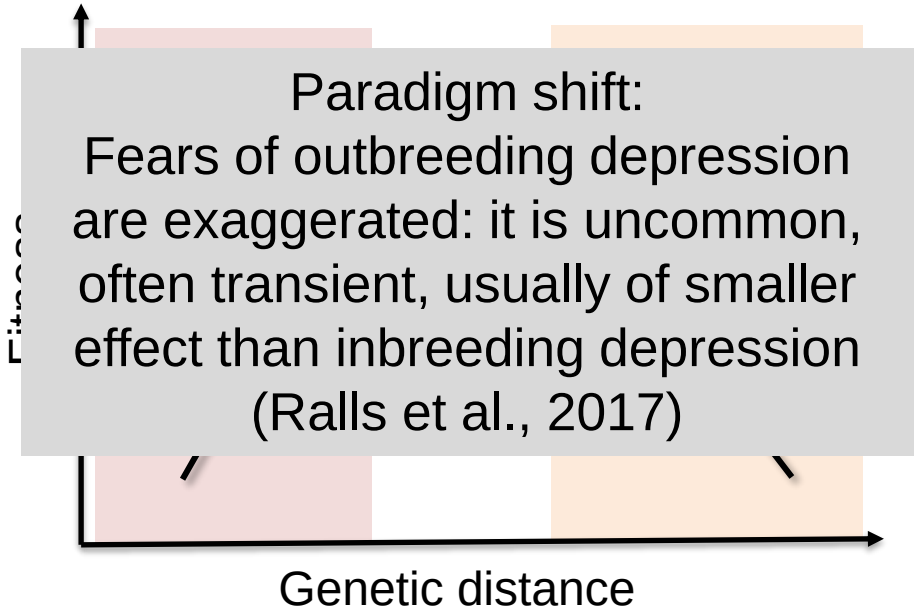
THE UNIVERSITY OF ADELAIDE AUSTRALIA

Genetic admixture as a conservation strategy

Evolutionary rescue
- Increase adaptive potential

Genetic rescue
- Alleviate inbreeding depression

Outbreeding depression
- Genetic incompatibility
- Loss of local adaptation



Paradigm shift:
Fears of outbreeding depression are exaggerated: it is uncommon, often transient, usually of smaller effect than inbreeding depression (Ralls et al., 2017)