Genetic diversity and conservation planning: a Western Australian perspective



Dr Saul Cowen

Animal Science Program, Biodiversity and Conservation Science

- DBCA's objective for the conservation of threatened species and ecological community biodiversity is:

to conserve the biodiversity associated with threatened species and threatened ecological communities throughout Western Australia.

Conservation of biodiversity associated with threatened species refers to maintenance or restoration of the following biological and ecological attributes, and the processes that maintain them:

- Extent of occurrence or area of occupancy of the population;
- Absolute or relative abundance (including rate and trajectory of change, as appropriate) of the population;
- Reproductive or regeneration potential of the population;
- Genetic or functional connectivity (frequency and quantity of dispersal) between subpopulations or other population components;
- Genetic diversity (evolutionary potential) of the population; and
- Other species attributes.

Corporate Guideline 37: Assessing risks to the conservation of biodiversity associated with threatened species and threatened ecological communities

Conservation translocations

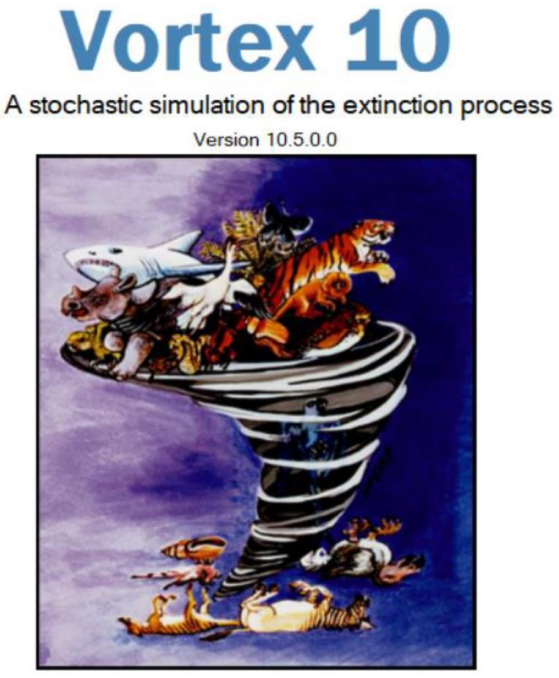
- **Corporate Guideline 36: Conservation of species through translocation, captive breeding and seed production areas** states:

  "Translocation, captive breeding and seed production area proposals should…aim to establish populations with conservation values similar to source populations, including maximising evolutionary potential (genetic diversity)…"

- How do we go about achieving this?
- Trade offs between maximising genetic diversity and negative impacts on source populations
- Population Viability Analysis is a useful predictive tool for conservation planning
  - Now a requirement for new translocation proposals

Population Viability Analysis

- Species-specific simulation of future population trajectories
- Incorporates range of parameters e.g.
  - Life history traits
  - Demographics
  - Genetic data
  - Stochasticity (e.g. environment)
- Useful to test outcomes of different scenarios
  - Not a crystal ball
  - Only as good as what you put in



'Return to 1616' – Dirk Hartog Island

- Landscape-scale ecological restoration project on WA's largest island (630km²)
- Eradications of sheep, goats and feral cats – completed by 2018
- Reconstruction of fauna assemblage underway
  - Translocations of 13 species of native fauna
  - Commenced in 2017
  - Seven species translocated so far
  - Project due for completion by 2030

Greater stick-nest rat (*Leporillus conditor*) & Shark Bay mouse (*Pseudomys gouldii*)

- Large former distributions – reduced to single island populations
- Successful translocations – but just as many failures
- Low genetic diversity but highest in original natural populations
- Maximise likelihood of successful translocation outcome
  - Representative genetic diversity in recipient population
- Minimise risk to source population viability

Greater stick-nest rat (*Leporillus conditor*) & Shark Bay mouse (*Pseudomys gouldii*)

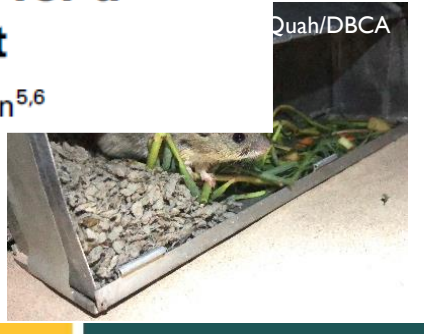
- Population Viability Analyses
  - SBM – Rebecca Quah (UWA) (manuscript in prep)
  - GSNR – Isabelle Onley (Uni of Adelaide) (Onley et al. 2022)

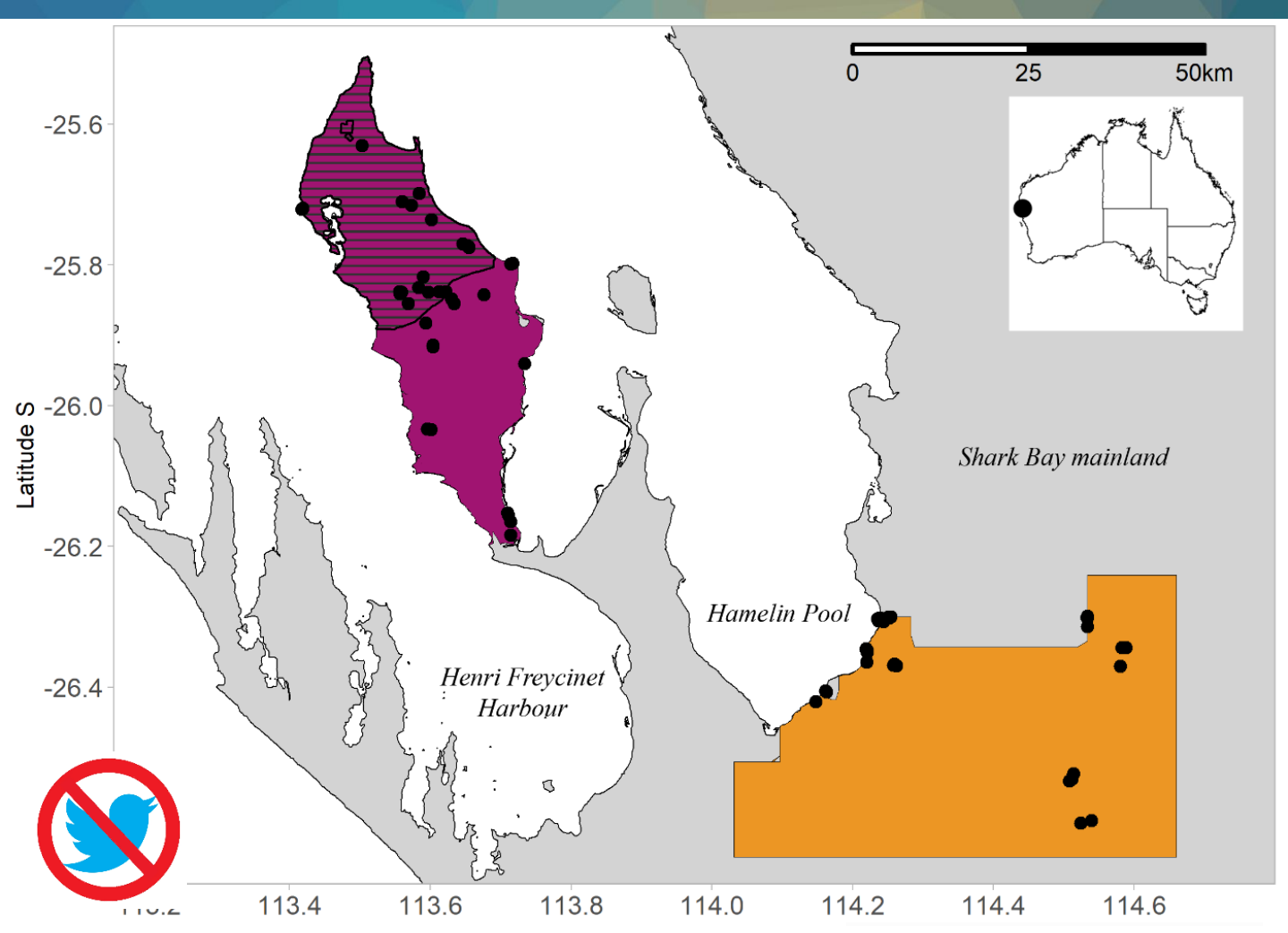
Animal Conservation
ZSL LET'S WORK FOR WILDLIFE
Animal Conservation. Print ISSN 1367-9430

Disproportionate admixture improves reintroduction outcomes despite the use of low-diversity source populations: population viability analysis for a translocation of the greater stick-nest rat

I. R. Onley[1], L. C. White[2], K. E. Moseby[3], P. Copley[4] & S. Cowen[5,6]

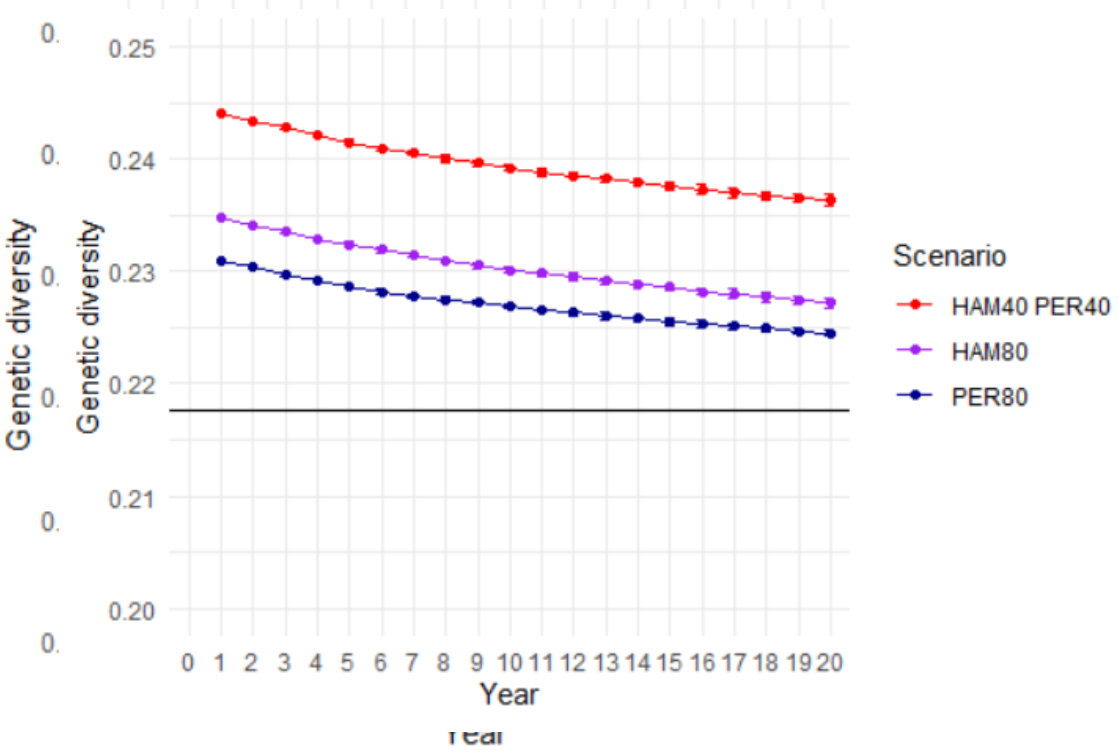
- All PVA have limitations – just a tool!




0
25
50km
Latitude S
-25.6
-25.8
-26.0
-26.2
-26.4
Shark Bay mainland
Hamelin Pool
Henri Freycinet Harbour
113.4
113.6
113.8
114.0
114.2
114.4
114.6

Western Grasswren (*Amytornis textilis*)

- Doe
  dive
- Doe
  dive
- How
  impa
- Wha
  tran
- Wha
  achi
- Wha
  on p
- Wha
  sour
- Wha
  mod



nsure

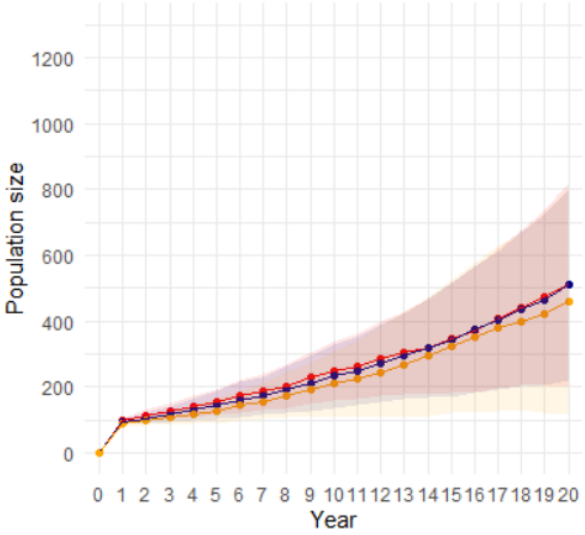
s 1:1

stics
ce

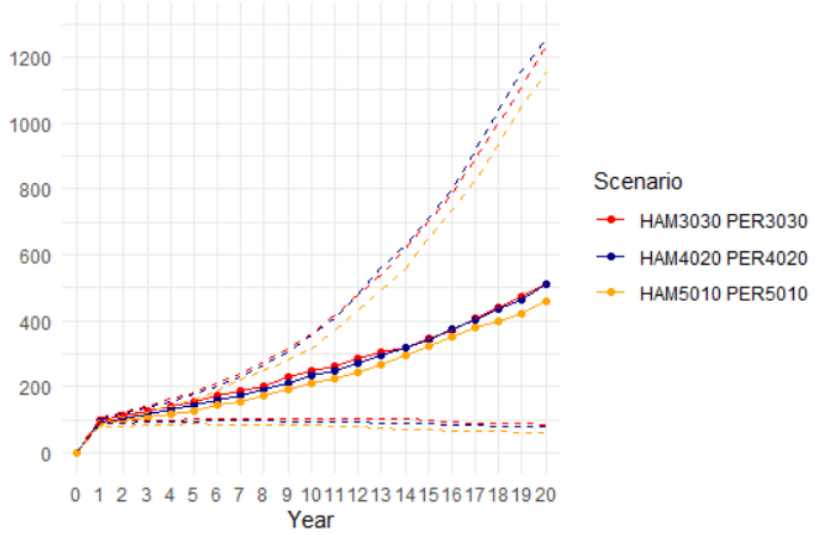
quotas
dicted
20

Western Grasswren (*Amytornis textilis*)

Model uncertainty



Adult mortality uncertainty



Next steps:

Short-term

- PVAs for remaining species to be translocated
    - Need for useful genomic data

Medium- to long-term

- Validation of PVAs – how did they/we perform?
    - Genetic monitoring and 'audits'
    - Reinforcement if necessary
- Need understanding of how DHI might fit into broader population management strategies for threatened species


Steve Reynolds/DBCA

Acknowledgements

- Aline Gibson Vega, Isabelle Onley and Rebecca Quah
- Allan Burbidge and Kym Ottewell (DBCA)
- Jason Kennington, Nicki Mitchell, Mandy Ridley, Dan White (UWA)
- Jeremy Austin, Katherine Moseby, Lauren White (Uni of Adelaide)
- Peter Copley (DEW)
- Michelle Hall (Bush Heritage Australia)
- DBCA Regional/District and Animal Science Program staff and volunteers

DIRK HARTOG ISLAND
RETURN TO 1616

Gorgon Barrow Island
Net Conservation Benefits Fund