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Genetic approaches for evaluating the contribution of the reserve system to fauna conservation

Animal Science

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Project Team

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Genetic approaches for evaluating the contribution of the reserve system to fauna conservation

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Context

Human-mediated landscape disturbance can affect the amount of genetic diversity present in populations of threatened species and their distribution across the landscape. One challenge facing conservation managers is understanding how management tools can be used to protect and facilitate genetic patterns and processes. For example, reserve design principles (comprehensiveness, adequacy, representativeness; single large or several small) can be just as well applied to conserve genetic diversity as species diversity. We aim to use genetic approaches to investigate patterns of contemporary and historical diversity in target species to understand how best to conserve the processes that generate these patterns.

Aims

- Determine genetic diversity and gene flow amongst quenda (*Isodon obesulus* ssp. *fusciventer*) populations in fragmented and continuous habitat in the Perth region to assess the impacts of vegetation connectivity on genetic and demographic processes.
- Identify landscape elements that are associated with high genetic diversity and gene flow in quenda populations using GIS and connectivity modelling, and how well these features are captured in the reserve system.
- Assess the genetic diversity and genetic structure of small mammal species in the Pilbara, how this relates to climate and environmental features (soils, landforms, etc.), and how well it is captured in the current reserve system.

Progress

- Genetic diversity and gene flow has been assessed amongst 42 quenda populations distributed through the Perth Hills and Swan Coastal Plain regions. Connectivity of quenda populations across the Perth metropolitan region is strongly associated with the presence of remnant vegetation, and to a lesser extent, the presence of low shrub vegetation. Quenda form four genetic clusters that are delimited by geomorphic features such as the Swan River and wetland boundaries. Populations north of the Swan River have low genetic diversity, suggesting low population sizes. A draft manuscript is well progressed.
- Genetic diversity, connectivity and generalised dissimilarity modelling analyses have been completed for three small mammal species (*Pseudomys chapmani*, *P. hermannsburgensis* and *Ningauai timealeyi*) in the Pilbara and show high genetic connectivity across the Pilbara landscape. Analysis showed that genetic diversity and genetic structure were not strongly associated with any one particular landscape element (rivers, mountains), and the reserve system did not harbor high genetic diversity relative to the surrounding landscape since genetic diversity was high across the region. A manuscript has been submitted to *Journal of Biogeography*.
- An ARC Linkage proposal was developed and successfully funded that will extend landscape genetic analyses of a suite of Pilbara small mammals using advanced genetic, genomic and spatial methods in a systematic conservation planning framework.

Management implications

- Genetic analyses of population structure of quenda across the Perth region demonstrated that landscape elements such as remnant vegetation and presence of low vegetation assist in maintaining connectivity among quenda populations. The identification of four genetic clusters that represent management units and are delimited by geomorphic features, such as the Swan River and wetland boundaries, provides information for management of the species across the Perth region.

- Analysis of genetic diversity and structure of the three small Pilbara mammals provides information to manage the broader landscape to ensure effective maintenance of these species, and demonstrates the effects of the boom-bust cycles of arid mammals and a relatively high capacity for dispersal on maintenance of spatial genetic patterns.

Future directions

- Further landscape genetic analyses will be completed for quenda that will involve landscape resistance modelling to determine connectivity pathways across the Perth metropolitan region.
- Further analyses on Pilbara small mammals will be undertaken.