



Environmental associations of small ground-dwelling mammals in the Pilbara

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Background

The diversity of ground-dwelling mammal fauna of the Pilbara biogeographical region in Western Australia during the period of early European settlement was high, with 41 species recorded from the region. However, this fauna has collapsed during the last 150 years and is now dominated by species with mean adult body weights of less than 50g. Although known losses of Australian mammals have been confined to species with a mean adult body weight greater than 25g, the magnitude of this loss far exceeds that reported for any other component of the biota. This highlights the particular sensitivity of mammals to the changes that have accompanied European settlement in Australia and the consequent need to focus attention on the conservation of the remaining species.

Regional conservation planning requires knowledge of biogeographic patterning of biodiversity across the landscape, as well as an understanding of the factors that define those patterns, including the habitat requirements of each species. In interpreting these relationships, better resolution can be achieved by associating environmental attributes with the occurrence (or abundance) of individual species. The derived models can be used to predict potential distributions and assist in delineating the specific habitat requirements of each species.

Data on the occurrence of small (<50g) ground-dwelling mammals were collected as a part of a larger study documenting biodiversity patterns in the Pilbara. Subsequently, environmental variables influencing the occurrence of individual small ground-dwelling mammal species in the region were identified using a complex modelling approach called multivariate adaptive regression splines (MARS). Co-occurrence patterns based on known habitat associations throughout wider ranges in the Pilbara and/or elsewhere in Australia were also examined.



Pilbara ningai (*Ningai timealeyi*)

Findings

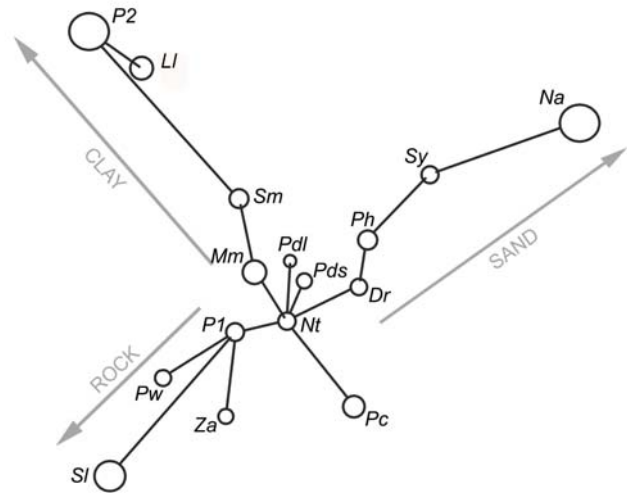
Eighteen species of small, ground-dwelling mammals were recorded during the study: ten dasyurid marsupials, seven native rodents and an introduced rodent (*Mus musculus*) (see Gibson and McKenzie 2009). The most widely caught species were the near-endemic dasyurids, the Pilbara ningai (*Ningai timealeyi*) and an undescribed planigale (*Planigale* sp. 1). Both these species have distributions centred on the Pilbara, but also extend into the margins of the adjacent biogeographic regions. Other frequently recorded species include the stripe-faced dunnart (*Sminthopsis macroura*) and the sandy inland mouse (*Pseudomys hermannsburgensis*), with distributions that extend across the Australian arid zone, and the little red kaluta (*Dasykaluta rosamondae*) another species virtually endemic to the Pilbara.

Variables describing the substrate, such as percent clay and silt in the soil, and estimates of rockiness and/or ruggedness, strongly influenced species' occurrence for most of the species modelled. Climate attributes added little information to the models, although distance to the coast, a surrogate for a range of climatic influences, was important for some species. Species co-occurrence patterns also appeared to be best explained by substrate with three alignments linking species that tend to occur on increasingly sandy, clayey and rocky substrates. As such, it appears that the small ground-dwelling mammals largely partition Pilbara landscapes on substrate-type.

Three-dimensional ordination of the small ground-dwelling mammals according to their co-occurrences at the survey sites (stress = 0.097), with a Minimum Spanning Tree superimposed. The third dimension is indicated by circle diameters. Clay/sand/rock alignments are also shown.

Species codes:

Pdl: *Pseudomys delicatulus*; *Pds*: *P. desertor*; *Nt*: *Ningai timealyi*; *Dr*: *Dasykaluta rosamondae*; *Ph*: *P. hermannsburgensis*; *Sy*: *Sminthopsis youngsoni*; *Na*: *Notomys alexis*; *Pc*: *P. chapmani*; *Mm*: *Mus musculus*; *Sm*: *S. macroura*; *P2*: *Planigale* sp 2; *Ll*: *Leggadina lakedownensis*; *P1*: *Planigale* sp1; *Pw*: *Pseudantechinus woolleyae*; *Za*: *Zyzomys argurus*; *Sl*: *S. longicaudata*.



Management Implications

All species previously known to occur in this region were recorded in the current study suggesting that this fauna is still intact, despite a variety of factors (e.g. pastoralism, weed invasion, altered fire regimes and mining) that have been transforming the region's ecology for more than a century. This component of the region's fauna shows clear relationships with environmental attributes, especially soil texture and geomorphology. These habitat associations provide the best available basis for conservation planning.

The existing conservation reserve system encompasses substantial areas in three of the four Pilbara sub-regions. These conservation reserves include examples of a wide variety of the sandy, clayey and rocky substrates and geomorphic units that characterise the Pilbara and, consequently, populations of virtually all the small ground-dwelling mammals.

Sixteen of the 18 small ground-dwelling mammals recorded during this study are known to be extant in Pilbara conservation reserves. The only exceptions were the long-tailed dunnart (*Sminthopsis longicaudata*) and Ooldea dunnart (*S. ooldea*). However, suitable habitat for the long-tailed dunnart is present in one of the reserves, Karijini National Park, and it is known from several locations near the town of Tom Price on the park's western periphery. Also, the geographical range of the Ooldea dunnart is centred on regions east and south of the Pilbara, only overlapping the Pilbara in the south-eastern corner. If the reserves are managed to maintain the integrity of the plant and invertebrate communities associated with the above surfaces, they should be adequate to allow the relevant species to persist in the region.

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Planigale sp.
(*Planigale* sp 1)

Woolley's false antechinus
(*Pseudantechinus woolleyae*)

Stripe-faced dunnart
(*Sminthopsis macroura*)

Little red kaluta
(*Dasykaluta rosamondae*)