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The value of granite outcrops for mammal conservation in Western Australia

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Abstract

Granite outcrops in Western Australia contribute significantly to the conservation of several species of mammal. In the arid zone and wheatbelt, granite outcrops are particularly important for *Petrogale* spp and the euro *Macropus robustus.* Other species such as brushtail possums and chuditch also take advantage of the extra shelter provided by granite outcrops. The many granite islands off the south coast support remnant populations of threatened terrestrial and marine mammals. Granite rocks provide mammals with refuge from heat and introduced predators, and they are capable of modifying fire and moisture regimes to the benefit of some species. Many of the larger wheatbelt nature reserves contain granite outcrops and these will be important as mammal reintroduction sites for the Western Shield fauna recovery program. Fox control has been shown to be important for medium-sized mammal conservation on granite outcrops. Rock-wallabies in particular increase in abundance and this offers opportunities for nature based tourism. Appropriate management of granite outcrops, including islands, will contribute significantly towards the enhancement of mammal diversity in Western Australia.

Keywords: granite outcrops, mammals, conservation

Introduction

Granite outcrops are a conspicuous feature of Western Australia, particularly in the south-west of the State (Myers 1997). In the wheatbelt, only two percent of the former vegetation remains uncleared and most of this is now in conservation reserve. Many of these reserves contain granite outcrops as this land was considered unsuitable for agriculture and also because of the value of granite outcrops for water harvesting and catchment (Laing & Hauck 1997). Granite outcrops, particularly the larger, more complex outcrops are also valuable to mammal conservation. In the wheatbelt, most medium-sized mammal species have disappeared (Burbidge & McKenzie 1989) and the remaining smaller species are largely confined to the "islands" of remnant vegetation, many of which contain granite outcrops. Many of the most valuable wheatbelt nature reserves, such as Mt Caroline, Tarin Rock, Dragon Rocks and Boyagin, contain granite outcrops. True granite islands off the south coast of WA also support several terrestrial and marine mammal species.

The value of granite outcrops to mammal conservation lies not only in their special characteristics, but also their relationship to the surrounding remnant bushland. While no mammal species is restricted to granite outcrops, several utilise the refuges created in the rock piles and caves. Granite outcrops are also of value because they can create moist refuges in a dry landscape and can modify fire behaviour that may suit some species. They are also important as re-introduction sites for mammals and offer potential for nature based tourism experiences.

This paper reviews the use of granite outcrops by mammals in Western Australia and discusses management options that will enhance these areas for mammal conservation.

Mammals on mainland granite outcrops

Granite outcrops, particularly those containing caves, large boulders and rock piles, offer valuable refuge sites for several, mostly threatened, mammals in Western Australia. Withers & Edward (1997) concluded that no mammals are restricted to granite rocks, although several are rock specialists. Perhaps the most dependent are the black-footed rock wallaby *Petrogale lateralis lateralis* and Rothschild's rock-wallaby *P. rothschildi* which are found only on rocky habitats, including granite outcrops. In the wheatbelt, *P. lateralis* is now restricted to five granite outcrop remnants (Kinnear *et al.* 1998) after once being "fairly plentiful on low rock hills around Beverley and York" (Shortridge 1909). The black-footed rock-wallaby was described by Gould in 1842 from a specimen taken by John Gilbert in the Toodyay area, where it was reported to be "very abundant in rocky districts in the Swan River" (probably on granite outcrops along the Avon Valley) (Eldridge & Close 1995). It is no longer found in this area, although there is a proposal to re-introduce the species to the Avon Valley (Barry Wilson, Paruna Sanctuary, personal communication). Until the 1980's, rock-wallabies and brushtail possums occurred among the well known granite outcrops, Uluru and Kata Tjuta (Baynes & Baird 1992), and it is likely that many of the other 22 species of ground mammal that once occurred in the Uluru-KataTjuta National Park also used these and other granite outcrops for shelter (Reid 2000). Shortridge (1909) recorded the chuditch *Dasyurus geoffroii*

sheltering in crevices among rocks in the south-west. The euro *Macropus robustus* is usually also found on wheatbelt reserves that have granite outcrops (*e.g.* Billyacatting Hill Nature Reserve; Chapman *et al.* 1981), on granite outcrops in the Darling Scarp near Perth (Morris & Bromilow 1990), the Pilbara (Ealey 1967) and in the deserts (Burbidge & Fuller 1979). In the goldfields, nests of the stick-nest rat *Leporillus* sp have been found in granite outcrops such as Peak Charles (How *et al.* 1988). How *et al.* (1991) reported seven species, either from or immediately adjacent to granite outcrops in the Pilbara; Rothschild's rock-wallaby *P. rothschildi*, euro *M. robustus*, northern quoll *Dasyurus hallucatus*, Woolley's pseudantechinus *Pseudantechinus woolleyae*, little red kaluta *Dasykaluta rosamodae*, common rock rat *Zyzomys argurus*, and ghost bat *Macroderma gigas*.

Mammals on granite islands

Burbidge (1999) reviewed the importance of islands to the conservation of mammals in Australia. Seven terrestrial and two marine mammals are known from the 200 or so islands along the south coast of Western Australia; most of these are granite outcrops. These islands are of particular value to mammal conservation because they have not been cleared, and the fox and feral cat have not become established on any, although goats, black rats and rabbits occur on some. Several mammals are known from the granite islands of the Recherche Archipelago. The tammar wallaby *Macropus eugenii* occurs on five islands off the Western Australian coast, including North Twin and Middle Islands in the Recherche Archipelago (Smith & Hinds 1995). The Recherche Archipelago also supports two sub-species of the black-footed rock-wallaby. *P. lateralis hacketti* occurs only on Mondrain, Wilson and Coombe Islands, while *P. l. lateralis* occurs on Salisbury Island. The quenda *Isoodon obesulus* occurs on Daw Island and the bush rat *Rattus fuscipes fuscipes* is known from seven islands in the archipelago (Abbott & Burbidge 1995). There is a record of a native rodent from Woody Island (in addition to the bush rat), initially identified as the ash-grey mouse *Pseudomys albocinereus* (Goodsell *et al.* 1976) but possibly the western mouse *Pseudomys occidentalis* . Unfortunately, no specimen was taken and the identification was not confirmed and searches for this species in 1991 failed to find it. It is possible that predation and/or competition with black rats led to the disappearance of this species. The quokka *Setonix brachyurus* is found on another granite outcrop, Bald Island, as well as Rottnest Island and approximately 20 restricted sites on the mainland (Sinclair & Morris 1996; P de Tores, CALM, personal communication). The Australian sea-lion *Neophoca cinerea* and the New Zealand fur-seal *Arctocephalus forsteri* also use granite islands along the south coast to haul out on and to breed (Gales *et al.* 1994; Shaughnessy *et al.* 1994).

Values of granite outcrops as refugia

Burbidge & McKenzie (1989) identified the value of rocky outcrops and rock piles to medium-sized mammals as refuges from fox predation, and Kinnear *et al.* (1988, 1998) has demonstrated the value of fox control around granite rocks to the conservation of *P. lateralis*. Mares (1997) points to the value of granite rocks in modifying micro and macro habitats for plants and animals and their role in providing cooler, moister refugia in times of drought, a characteristic of WA. Morton (1990) identifies the destruction of moist refugia (often around rocky outcrops and waterholes) through overgrazing by rabbits, as one of the major factors in the decline of medium sized mammals in the arid zone. In the wheatbelt, water pools on granite outcrops are used by the ten or so species of bat in the region. The better watered vegetation surrounding granite outcrops in seasonally dry areas often provides refuge for species that are normally distributed in moister areas, such as the bush rat which occurs around granite complexes at Frank Hann National Park, to the east of the wheatbelt.

Because of the patchiness of vegetation and the non-flammability of bare rock, vegetation on granite outcrops is often protected from frequent fires, creating a heterogeneous habitat (Bayly 1999). It is possible that the critically endangered Gilbert's potoroo survives only on Mt Gardner at Two Peoples Bay because no single fire has burnt the entire granite mountain. The vegetation surrounding large granite outcrops may also be protected from frequent fire and this may benefit other species that are not necessarily dependent on granite outcrops for shelter such as the little long-tailed dunnart *Sminthopsis dolichura*, ash-grey mouse, and western mouse (Whisson & Kitchener 1995), as well as larger macropods such as tammar wallaby and brush wallaby *Macropus irma.* With many of the wheatbelt woodlands now cleared, those around granite rocks are important for arboreal species such as brushtail possums and red-tailed phascogale *Phascogale calura*.

Management of granite outcrops to enhance mammal conservation

Granite outcrops and the surrounding bushland offer great opportunities for enhancing mammal conservation in the wheatbelt and provide opportunities for nature based tourism experiences for the public. However some management is required to ensure this occurs.

Fox control and re-introductions

Since European settlement, fourteen species of mammal have become extinct in the wheatbelt and another 12 have declined (Burbidge & McKenzie 1989). Fox predation of the medium sized species has been identified as a major factor in this decline (Kinnear *et al.* 1998, 2000). CALM's Western Shield fauna recovery program aims to recover the mammal fauna of the wheatbelt through a broadscale fox control program and re-introductions (Bailey 1996). Because so many of the wheatbelt reserves contain granite outcrops, these areas will play an important role in this program. Numbats have already been re-introduced to Dragon Rocks Nature Reserve (Tony Friend, CALM, personal communication), and woylies to Boyagin Nature Reserve (Kinnear *et al.* 2000). Rock-wallabies have been reintroduced to a granite rock on private property near Querekin. It is proposed to re-introduce at least 12 species of mammal to the wheatbelt. Fox control around mainland granite outcrops, and the prevention of foxes and feral cats from becoming established on islands, will also assist in the conservation of existing mammal populations. Even smaller granite

outcrops could have value as refuge sites for wider ranging species such as chuditch. Re-introductions of several species of medium-sized mammals are proposed for Uluru-Kata Tjuta National Park, including rock wallabies and brushtail possums to the Uluru and Kata Tjuta granites (Gillen *et al*. 2000).

Nature-based tourism

Most mammal translocations to granite rocks and their surrounds, at least in the near future, will focus on threatened species and be undertaken to areas with nature conservation as a priority. However in time there will be opportunities to move mammals to areas where viewing by the public will also be an objective. Once established, populations of some mammals lend themselves for interaction with the public, for example brushtail possums, quenda and rock-wallabies. However once native mammal populations have established, the future management of the vegetation around such granite rocks will need to take their conservation into account. Management issues that would need to be addressed include fox baiting in areas where the public have access, frequency of fire, and clearing of vegetation. The loss of habitat through increasing salinity in the wheatbelt is another problem. Another important issue would be the impact of any reintroduced mammal population on the existing native biota and surrounding farmland. Attracting more tourists to focal points such as granite rocks could detrimentally impact on other values such as rock pool flora and fauna. Also once mammals have increased in abundance, species such as tammar wallaby and quenda will readily venture into crops, and chuditch are well known for their liking of poultry.

Rock wallabies in particular, have good potential as subjects for nature-based tourism. Following fox control they rapidly increase in abundance and are a relatively visible species. They are often seen during daylight hours, particularly in the winter months. At Yardie Creek in Cape Range National Park, tour operators have been taking tourists to view rock wallabies for several years and have participated in sighting surveys. Rock-wallabies are also visible to tourists in the MacDonnell Ranges near Alice Springs. In the wheatbelt, rock-wallabies formerly occurred at Kokerbin Rock, a recreation reserve. There is potential to reintroduce rock-wallabies to this site providing fox control was implemented and recreation controlled to a greater extent. Other wheatbelt granite rocks are presently being surveyed as potential for rock-wallaby reintroductions (Michelle Davies, personal communication).

Several mammal species are associated with granite outcrops and islands in Western Australia and these areas play a significant role in maintaining and increasing mammal diversity, particularly in the wheatbelt. The management of these areas needs to take this into consideration. As mammal recovery programs develop there will also be opportunities for increasing public interaction with native mammals. Providing the habitat is kept relatively intact and not degraded through frequent fires, weed invasion and vandalism, fox control is probably the most important management tool available for mammal conservation, not only around granite outcrops, but throughout Western Australia. Preventing the establishment of foxes and other introduced species onto granite islands is essential to maintaining the value of these to mammal conservation in the State.

References

Abbott I & Burbidge A A 1995 The occurrence of mammal species on the islands of Australia: a summary of existing knowledge. CALMScience 1:259-324.

Bailey C 1996 Western Shield – bringing wildlife back from the brink of extinction. Landscope 11(4):41-48.

Bayly I A E 1999 Rock of Ages: Human Use and Natural History of Granite Outcrops. Tuart House, Nedlands, WA.

Baynes A & Baird R F 1992 The original mammal fauna and some information on the original bird fauna of Uluru National Park, Northern Territory. Rangeland Journal 14 (2): 92-106.

Burbidge A A & Fuller P J 1979 Mammals of the Warburton region, Western Australia. Records of the Western Australian Museum. 8:57-73.

Burbidge, A A. 1999. Conservation values and management of Australian islands for non-volant mammal conservation. Journal of Mammalogy 21: 67-74.

Burbidge A A & McKenzie N L 1989 Patterns in the modern decline of Western Australia's vertebrate fauna: causes and conservation implications. Biological Conservation 50:143-198.

Chapman A, Dell J, Kitchener D J & Muir B G 1981 Biological survey of the Western Australian wheatbelt. Part 13: Billycatting Hill Nature Reserve. Records of the Western Australian Museum, Supplement 13.

Ealey E H M 1967 Ecology of the euro, *Macropus robustus* (Gould) in north-western Australia. 1. The environment and changes in euro and sheep populations. CSIRO Wildlife Research 12:9-25.

Eldridge M D B & Close R L 1995 Black-footed Rock-wallaby *Petrogale lateralis* (Gould 1842). In: Australian Museum Complete Book of Australian Mammals (ed R Strahan). Reed Books, Chatswood, NSW, 377-381

Gales N J, Shaughnessy P D, & Dennis T E 1994 Distribution, abundance and breeding cycle of the Australian Sea-lion *Neophoca cinerea* (Mammalia: Pinnipedia). Journal of Zoology:234: 353-70

Gillen J S, Hamilton R, Low W A & Creagh C 2000 Biodiversity and the re-introduction of native fauna at Uluru-Kata Tjuta National Park. Proceedings of a Cross-culture Workshop on Fauna Re-introductions, Yulara, NT. Bureau of Rural Sciences, Canberra.

Goodsell J, Tingay A & Tingay S R 1976 A resource survey of Woody Island, Archipelago of the Recherche. Report. 21. Department of Fisheries and Wildlife , Perth.

How R A, Dell J & Cooper N K 1991 Vertebrate fauna. In: Ecological Survey of Abydos-Woodstock Reserve, Western Australia. Records of the Western Australian Museum, Supplement 37.

How R A, Newbey K R, Dell J, Muir B G & Hnatiuk R J 1988 The biological survey of the eastern Goldfields of Western Australia: Part 4 Lake Johnson-Hyden study area. Records of the Western Australian Museum, Supplement 30.

Kinnear J E, Onus M L & Bromilow R N 1988 Fox control and rock-wallaby dynamics. Australian Wildlife Research 15:435-450.

Kinnear J E, Onus M L & Sumner N R 1998 Fox control and rock-wallaby dynamics – an update. Wildlife Research 25:81-88.

Kinnear J E, Sumner N R, & Onus M L 2000 The biological control of a large subset of Australia's native mammal species by an introduced predator, the European red fox (*Vulpes vulpes*): a review and synthesis with recommendations regarding research and management of affected fauna. Pacific Conservation Biology: in press.

Kitchener D J & Vicker E 1981 Catalogue of modern mammals in the Western Australian Museum 1895-1981. West Australian Museum Publication, Perth.

Laing I A F & Hauck E J 1997 Water harvesting from granite outcrops in Western Australia. Journal of the Royal Society of Western Australia. 80:181-184.

Mares M A 1997 The geobiological interface: Granitic outcrops as a selective force in mammalian evolution. Journal of the Royal Society of Western Australia. 80: 131-140.

Morris D & Bromilow B R 1990 A record of the euro (*Macropus robustus*) in John Forrest National Park. West Australian Naturalist 18:166-167.

Morton S R 1990 The impact of European settlement on the vertebrate animals of arid Australia: a conceptual model. Proceedings of the Ecological Society of Australia 16:201-213.

Myers J S 1997 Geology of granite. Journal of the Royal Society of Western Australia. 80:87-100.

Reid J 2000 Setting the scene: general faunal ecology of Uluru-Kata Tjuta National Park, past and present. In: Biodiversity and the Re-introduction of Native Fauna at Uluru-Kata Tjuta National Park (eds J S Gillen, R Hamilton, W A Low & C Creagh). Bureau of Rural Resources, Canberra, 22-27.

Shaughnessy P D, Gales N J, Dennis T E & Goldsworthy S D 1994. Distribution and abundance of the New Zealand Fur-seal *Arctocephalus forsteri* in South Australia and Western Australia. Wildlife Research 21:667-695.

Shortridge G C 1909 An account of the geographical distribution of the marsupials and monotremes of south-west Australia, having special reference to the specimens colected during the Balston Expedition of 1904-1907. Proceedings of the Zoological Society 1909, LV:803-848.

Sinclair E & Morris K 1995 Where have all the Quokka's gone? Landscope 11:49-53.

Smith M J & Hinds L 1995 Tammar Wallaby *Macropus eugenii* (Desmarest 1817). In: Australian Museum Complete Book of Australian Mammals (ed R Strahan). Reed Books, Chatswood, NSW, 329-331.

Whisson L & Kitchener D J 1995 Western Mouse (*Pseudomys occidentalis* Tate 1951). In: Australian Museum Complete Book of Australian Mammals (ed R Strahan). Reed Books, Chatswood, NSW, 613-614.

Withers P C & Edward D H 1997 Terrestrial fauna of granite outcrops in Western Australia. Journal of the Royal Society of Western Australia. 80:159-166.

Australia has a reputation of being a carefree kind of place, â€œwhere beer does flow and men chunderâ€ in the immortal words of music heroes Men at Work. While, in my experience, this is certainly true of the people, the governments, both state and federal, can be extraordinarily strict.Â Victoria, and Melbourne in particular, has the highest rates of Covid-19 in Australia, this is true, but they are still vanishingly small with an even lower fatality rate. Government is not supposed to panic, and public officials should have worried far more about abolishing freedoms, regardless of the reasons behind the measures. Especially when those reasons backed up with facts like four million tests having been carried out across Australia, with less than one per cent coming back positive. The value of granite outcrops for mammal conservation in Western Australia. Article. Jan 2000. J Roy Soc West Aust. Keith Morris.Â Many of the larger wheatbelt nature reserves contain granite outcrops and these will be important as mammal reintroduction sites for the Western Shield fauna recovery program. Fox control has been shown to be important for medium-sized mammal conservation on granite outcrops. Rock-wallabies in particular increase in abundance and this offers opportunities for nature based tourism. Appropriate management of granite outcrops, including islands, will contribute significantly towards the enhancement of mammal diversity in Western Australia. View. Show abstract. Keywords: granite outcrops, mammals, conservation Introduction This paper reviews the use of granite outcrops by mammals in Western Australia and discusses management options that will enhance these areas for mammal conservation. Granite outcrops are a conspicuous feature of Western Australia, particularly in the south-west of the State (Myers 1997). In the wheatbelt, only two percent of the former vegetation remains uncleared and most of this is now in conservation reserve. Many of these reserves contain granite outcrops as this land was considered unsuitable for agriculture and also because