Targeted survey of northern quolls and black-flanked rock-wallabies in Karlamilyi National Park

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Summary

Two Endangered mammal species, one of which was not previously found in Karlamilyi National Park, have been recorded in recent years at Desert Queen Baths. These species: the northern quoll (known to Martu as *Wiminji*) and black-flanked rock-wallabies (known as *Warru*) both inhabit complex rocky habitat and are capable of dispersing long distances. Rock wallabies were detected via scats collected in 2012, and later confirmed on remote camera between November 2014 and January 2015. Single northern quolls had previously been detected via scats and remote camera at Desert Queen Baths in 2012 and 2014.

Kanyirninpa Jukurrpa (KJ) Martu Rangers and Parks and Wildlife undertook a targeted fauna survey at Desert Queen Baths in September 2016 to better describe the distribution of these two threatened species. The survey used a combination of scat searches and trapping in the Broadhurst Range, centred around Desert Queen Baths.

One old rock-wallaby scat was found in a cave next to Pool 2 within Desert Queen Baths, and one in a cave approximately 5km to the south-east, but no animals were captured. Northern quoll scats were also found in the cave next to Pool 2, and one individual male quoll was captured on the fourth morning of trapping. The animal was weighed and measured, microchipped and a DNA sample was taken for further research into the relatedness of this individual to other northern quoll subpopulations.

Martu elders talked about both species being historically common in rocky areas, and important species in the landscape. Black-flanked rock wallabies were more common than euros, and a popular food item. Northern quolls were commonly seen in rocky breakaways through what is now Karlamilyi National Park.

Recommendations include searching other likely habitat (steep, complex, rocky habitat, preferably nearby to permanent or semi-permanent water) to enhance the knowledge of both of these species in the Martu Determination Area. KJ Martu Rangers spend considerable time out on country and will continue to collect evidence of presence through opportunistic scat searches. Management actions should be developed based on species occurrence, and should aim to protect and enhance these populations. Mosaic burning to prevent homogenising hot wildfires will benefit several threatened species existing in Karlamilyi National Park. Other management actions such as control of feral cats and foxes will require discussions with the Traditional Owners and should be progressed at every opportunity.

1 Introduction

Karlamilyi National Park (formerly Rudall River National Park) lies between the Great Sandy and Little Sandy Deserts approximately 350km east of Newman, Western Australia. It is Western Australia's largest and most remote national park. The Park is entirely surrounded by the Martu Native Title Determination, a 13.6 million hectare parcel of exclusive possession native title land. While legally native title is extinguished by the National Park, Martu are recognised as the traditional owners and occupiers of the Park. Karlamilyi River (also known as Rudall River) runs through the area, with many permanent pools and other features of significance to Martu.

Several threatened vertebrate species have been identified to exist within the National Park, although management actions for their persistence are currently limited. Species identified to occur, or likely to occur, include the brush-tailed mulgara (*Dasycercus blythi*), great desert skink (*Liopholis kintorei*), bilby (*Macrotis lagotis*), woma python (*Aspidites ramsayi*), marsupial mole (*Notoryctes caurinus*) and potentially the night parrot (*Pezoporus occidentalis*) (Kendrick, 2001). Martu rangers, with the assistance of elders, have identified a number of populations of black-flanked rock wallaby (*Petrogale lateralis*) within the National Park. Black flanked rock-wallabies were elevated from Vulnerable to Endangered status in December 2016. Recently, the Endangered northern quoll (*Dasyurus hallucatus*) was added to the species list for the park from scats and photos from remote camera traps set around Desert Queen Baths (DQB). This record represented a range extension of approximately 200km at that time. The remote cameras at DQB also recorded an additional record for black-flanked rock-wallaby. Both records were of one individual, so required follow up work to determine the population size and distribution within the area.

The aim of this trip was to work with Martu rangers from the nearby communities of Parnngurr and Punmu to enhance our collective knowledge of northern quolls and rock wallabies in Karlamilyi National Park. Our searches centred on the DQB area where the remote camera image records originated.

Northern Quolls

Bamford Consulting Ecologists discovered the first modern record of northern quolls in Karlamilyi National Park in August 2012, from camera trap images (Figure 1) and scats collected at the cave at Pool 2 at DQB (Turpin and Bamford, 2014).

They also collected northern quoll scats from a small gorge in the Throssell Ranges approximately 30 km away, just north of the park boundary. At this time, the nearest northern quoll records were from Blue Spec Mine, Bonney Downs Station and Nullagine, between 230 and 250 km west of DQB. Since 2012, northern quoll records have also been documented in the vicinity of Nifty mine, approximately 100km north of DQB.

In October 2014, KJ Martu rangers set eight camera traps (Reconyx HC600, Holmen WI) in DQB. Cameras were collected in March 2015, representing approximately 1200 camera nights. A single northern quoll individual was recorded on two cameras on 19 October 2014 (Figure 2). Parks and Wildlife staff and KJ Martu rangers attempted to trap quolls at DQB in

April 2015 without success. Thirty cage traps (17 x 17 x 46 cm,Sheffield Wire Products, Welshpool, WA) were set for four nights throughout the gorge from Pools 1-3 and in several side gullies. The only capture from 120 trap nights was one house mouse (*Mus musculus*).

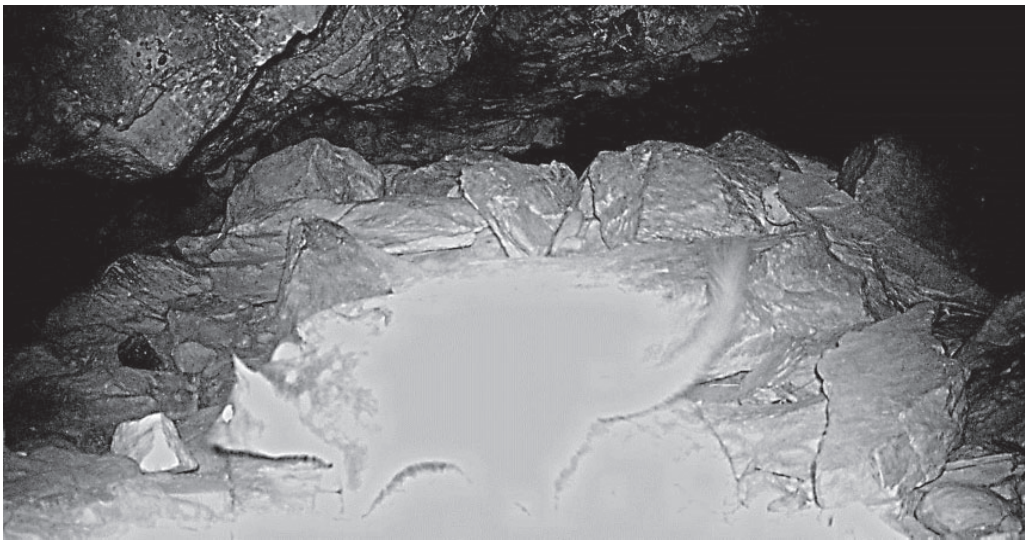

Figure 1. Camera trap image of a northern quoll from the cave by Pool 2, August 2012. Photo from Turpin and Bamford, (2014)

Figure 2. Camera trap image of a northern quoll by Pool 1 from October 2014. Camera set by KJ Martu Rangers.

Black-flanked rock-wallabies

The camera traps set from October 2014 to March 2015 (as above) also detected a rock-wallaby identified as a black-flanked rock-wallaby (*Petrogale lateralis lateralis*). Images of a single rock-wallaby were collected on seven different nights, on two cameras, between October 2014 and January 2015 (Figure 3.). These records were from cameras close to Pool 2, and show the distinctive white side stripe bordered below by broad dark brown flanks, and shorter, uniformly coloured ears characteristic of *P. lateralis lateralis* (Fig.2). The congeneric Rothschild's rock-wallaby *P. rothschildi* also occurs in rocky Pilbara habitats, but does not have the distinctive white side stripe.

Martu Rangers have been documenting evidence of black-flanked rock-wallabies within Karlamilyi National Park and the surrounding Martu determination. Three populations of black flank rock wallabies have been recently documented on the National Park using knowledge of the elders regarding the historic distribution of the species. These populations occur to the east of Parnngurr with the closest and highest density population 35 km south east from the DQB site (Whittington, unpublished).

*Figure 3. Black-flanked rock-wallaby (*Petrogale lateralis*) captured on a camera trap. The species is distinguishable from congeneric* P. rothschildi *by the white and dark side stripe.*

2 Methods

For the survey undertaken in September 2016 a combination of scat searches and trapping was employed. Small cage traps (450 x 170 x 170 mm, Sheffield Wire Co, Welshpool WA) were used to target northern quolls and Thomas soft traps (480 x 360 x 800 mm, Sheffield Wire Co, Welshpool WA) were used for rock wallabies. In total, the trapping effort at DQB was 203 trap nights (133 quoll, 70 rock-wallaby) over six nights. Traps were placed on the ridge either side of DQB and within the gorge area. For cultural reasons, we did not proceed further into the gorge than Pool 2.

We searched for quoll and rock-wallaby scats in areas of rocky breakaways, ledges, gorges and caves in areas of the Broadhurst Range surrounding DQB. GPS coordinates were recorded for each scat and they were stored in paper envelopes for later dietary analysis.

Table 1. Traps set in the vicinity of Desert Queen Baths in September 2016.

Date	Quoll traps	Wallaby traps
1/09/16	10	0
2/09/16	18	14
3/09/16	24	14
4/09/16	24	14
5/09/16	29	14
6/09/16	28	14
Total	133	70

3 Results

One large adult male northern quoll was captured three times over the six-day period near Pool 1. The animal was first captured on 4/9/2016, the fourth morning of trapping. No other species were captured in the traps, but a list of other species detected from sightings, tracks, scats or calls are provided in Table 2 and Table 3.

Fresh quoll scats and old rock-wallaby scats were found in the cave at Pool 2. An old rock-wallaby scat was also found in a cave 5km, south-east of DQB.

The male northern quoll captured at DQB weighed 990 g, considerably larger than the average male Pilbara northern quoll (570g ±16 g, n = 109). Based on teeth wear (incisors worn, slightly translucent rather than bright white, and several back teeth missing), we estimate this animal to be in its second year. Fewer than 10% of male northern quolls are estimated to survive to their second year; the majority of males die during October to December following a frenetic breeding season (Fisher *et al.*, 2013).

Table 2. Frog, reptile and mammal species recorded within Karlamilyi National Park from 31 August to 7 September 2016.

Common name	Scientific name	Location
FROGS		
Little red tree frog	*Litoria rubella*	DQB
Northwest toadlet	*Uperolia* sp. (probably *ruselli*)	DQB
REPTILES		
Marbled velvet-gecko	*Oedura fimbria*	DQB
Dtella	*Gehyra* sp.	DQB
Striped skink	*Ctenotus* sp.	DQB
Snake-eyed skink	*Cryptoblepharus* sp.	DQB
Fire-tailed skink	*Morethia ruficauda*	DQB
Ring-tailed dragon	*Ctenophorus caudicinctus*	DQB
Thorny devil	*Moloch horridus*	Track near Parnngurr
Yellow-spotted monitor	*Varanus panoptes*	DQB
Yellow-faced whipsnake	*Demansia psammophis*	DQB
Mulga snake	*Pseudechis australia*	DQB
Orange-naped snake	*Furina ornata*	DQB
MAMMALS		
Northern quoll	*Dasyurus hallucatus*	Scats, one capture at DQB
Pseudantechinus	*Pseudantechinus* sp.	Scats in caves at DQB
Euro	*Macropus robustus*	Several seen in rocky areas
Dingo	*Canis dingo*	Tracks, scats
Feral cat	*Felis catus*	One seen, several tracks in sandy areas
Camel	*Camelus dromedarius*	Several seen, multiple locations
Donkey	*Equus asinus*	Several seen on E-W track through Park

Table 3. Bird species recorded within Karlamilyi NP from 31 August to 7 September 2016.

Species	Location
Emu	Adult with young on E-W track through Park
Pacific Black Duck	in permanent pool E of DQB
Hardhead	in permanent pool E of DQB
Australasian Grebe	in Pool 1 at DQB
Common Bronzewing	DQB
Crested Pigeon	Camp Tracy Rd
Spinifex Pigeon	DQB
Diamond Dove	DQB
Peaceful Dove	Parnngurr
White-necked Heron	in permanent pool E of DQB
Black-breasted Buzzard	Camp Tracy Rd
Spotted Harrier	Camp Tracy Rd
Wedge-tailed Eagle	Camp Tracy Rd
Nankeen Kestrel	DQB
Brown Falcon	Miles Ridge
Australian Hobby	DQB
Peregrine Falcon	Miles Ridge
Eurasian Coot	in permanent pool E of DQB
Australian Bustard	Camp Tracy Rd
Little Button-quail	DQB
Galah	DQB
Cockatiel	DQB
Pheasant Coucal	Cotton Creek
Horsfield's Bronze-Cuckoo	DQB
Blue-winged Kookaburra	DQB
Red-backed Kingfisher	DQB
Rainbow Bee-eater	DQB
White-winged Fairy-wren	E-W track through Park
Weebill	DQB
Western Gerygone	DQB
Red-browed Pardalote	DQB
White-plumed Honeyeater	DQB
Grey-headed Honeyeater	DQB
Yellow-throated Miner	DQB
Crimson Chat	Camp Tracy Rd
Black-faced Cuckoo-shrike	DQB
White-winged Triller	Camp Tracy Rd
Grey Shrike-thrush	DQB
Black-faced Woodswallow	DQB
Dusky Woodswallow	DQB
Pied Butcherbird	DQB
Willie Wagtail	Camp Tracy Rd
Torresian Crow	DQB
Magpie-lark	DQB
Spinifexbird	DQB
White-backed Swallow	DQB
Fairy Martin	DQB
Zebra Finch	DQB
Painted Finch	DQB

4 Discussion

The capture of a northern quoll in Karlamilyi National Park is a significant record for the park, and for the species. Discussions with the Martu elders who grew up on country indicates that the species used to be common in rocky habitat throughout this area. Elders from Punmu and Parnngurr referenced *wiminji* as being widespread throughout the Karlamilyi catchment. There was also discussion of *wiminji* being found in areas that are large distances from rocky outcrops. It was not clear from discussions that Martu made any distinction between western (chuditch) and northern quolls and the possibility remains that some of those records from elders represent the western quoll that previously occurred in the area (Burbidge *et al.*, 1988; Start *et al.*, 2013). There have been very few records east of Nullagine in recent times.

Recent examinations of northern quoll population genetics have identified the existence of four genetic lineages: Queensland; Northern Territory (including the Gulf Islands); the Kimberley; and the Pilbara region (Woolley *et al.*, 2015). Genetic profiles demonstrate that the Pilbara population is a single genetic cluster throughout, suggesting high levels of annual male dispersal occurring between localities across the region. It is notable that Pilbara and Kimberley populations are genetically distinct with no evidence of movement between populations. Analysis of DNA collected from the Karlamilyi quoll will provide information about the region this animal originated from (i.e. Pilbara or Kimberley), and potentially correlate it with a finer scale origin location within the region. Mainland Pilbara northern quolls retain moderate genetic diversity, and show no evidence of recent or long-term population bottleneck (Spencer *et al.*, 2013). This result contradicts current opinions that the Pilbara population has undergone significant, recent population decline (Hill and Ward, 2010; Woinarski *et al.*, 2014b).

Modelling of northern quoll habitat by Molloy *et al.* (2015) indicates that the potential habitat of northern quolls will shift inland under climate change scenarios. These models showed that rocky habitat in the eastern Pilbara is likely to become more suitable for northern quolls under medium and high greenhouse gas emission scenarios of climate change. Furthermore, it is predicted that the toxic cane toad *Rhinella marina* will invade the Pilbara region in the next 10-45 years (Tingley *et al.*, 2013), further endangering northern quolls in coastal Pilbara regions. Northern quolls have declined at a rapid rate in association with the spread of cane toads in Queensland and the Northern Territory (Oakwood, 2004), as toads poison quolls in their predation attempts. The predicted distribution of cane toads in the Pilbara relies on permanent pools, overlapping substantially with complex rocky habitats inhabited by northern quolls. Drier rocky habitats in the eastern Pilbara, such as those in Karlamilyi National Park, may present a toad-free refuge for northern quolls in the future.

Predation by the introduced feral cat and red fox is a primary threatening process for both of these endangered species, with catastrophic consequences for subpopulations (Pearson, 2012; Woinarski *et al.*, 2014a). Feral cats are present across the majority of Australia, so present a threat throughout the entire range of northern quolls and black-flanked rock-wallabies (Doherty *et al.*, 2016). Large, homogenising wildfires exacerbate the negative impacts of introduced predators as well as reducing suitable foraging habitat and shelter for dispersing animals (Legge *et al.*, 2008). In this habitat, we expect that the interactive impact

of inappropriate fire regimes and introduced predators are the primary threats to the persistence of the species.

5 Management recommendations

Martu elders indicated that quolls and rock wallabies were historically (up to the 1960s) common throughout rocky parts of Karlamilyi. At that time, rock wallabies were more common than they currently are and represented a significant food item for Martu. Until recently Parks and Wildlife were only aware of one population of black flanked rock-wallaby in the Western Desert despite survey efforts to identify additional populations. Strong collaboration between Parks and Wildlife and KJ has resulted in the identification of additional populations based on the knowledge of Martu elders. Through this collaboration, evidence of rock-wallabies have been confirmed at five additional areas within the National Park and surrounding Martu determination. Continued searches for scats and detection via remote cameras should continue with areas prioritized based on Martu elders knowledge of past distributions. Targeted trapping should be carried out on once populations have been confirmed to gain further insight into the density, distribution and dispersal.

Future work on northern quolls in the Martu determination area should focus on collection of additional presence records in surrounding areas, to better understand the extent and size of this population. It is currently unknown whether there is a consistent presence of northern quolls in this fringe habitat, or if requirements for persistence are only met in good seasons. Habitat modeling for northern quolls shows habitat complexity (elevation, slope and geology) and distance to watercourses to be good indicators of northern quoll presence, so future work in determining this species' presence should therefore target areas of the Throssell and Broadhurst Ranges with steep or complex breakaways, habitat connectivity and access to permanent or seasonal water. Searches for scats or detection via long-term camera traps are currently the most cost-effective methods for detection.

Records of individual northern quolls present at DQB over three separate years (2012, 2014, 2016) indicate that this is probably a consistently low density population utilising the permanent waterholes. Male northern quolls live a maximum of two years, and females have been recorded to live three years, so these records represent successive generations or separate dispersal events into the area. Successful collection of DNA via a tissue sample is valuable in revealing the relatedness of this individual to Kimberley and Pilbara subpopulations, and to provide information about dispersal ability. This sample will be analysed in 2017 and compared to more than 500 Pilbara northern quoll samples already collected.

Management actions in Karlamilyi National Park will only be successful if there is strong collaboration with the Traditional Owners and Martu ranger teams. The park is remote and currently has no dedicated on-ground Parks and Wildlife staff. There are however two Aboriginal communities within the boundary of the park with KJ Martu rangers currently operating from both communities. The KJ Martu rangers currently undertake a variety of land management activities on determined lands including fire management, threatened species monitoring, weed control and water monitoring. Currently the KJ Martu rangers are not funded to undertake these activites on the National Park, though some land management activities occur. Intensive activities such as feral cat control are feasible through joint collaboration with the KJ Martu rangers. We suggest that management actions such as improvement of the fire regime for the prevention of homogenous hot fires will be the most

cost-effective way to benefit several threatened species existing in Karlamilyi National Park. Management actions such as baiting to control cats and foxes will require discussions with the Traditional Owners and should be progressed at every opportunity.

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