Short Communication

Extant population of the Critically Endangered central rock-rat *Zyzomys pedunculatus* located in the Northern territory, Australia

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Abstract The central rock-rat *Zyzomys pedunculatus* is categorized as Critically Endangered on the IUCN Red List. Over the last 50 years the species had only been recorded from 14 sites within a 600 km^2 area of the West MacDonnell National Park and immediate surroundings in the Northern Territory, Australia. The central rock-rat disappeared from monitoring sites in 2002, coincident with the onset of drought conditions and extensive wildfires. With concern growing for the survival of the species, we sought to locate an extant population. During 2009–2012 we surveyed sites throughout the western sector of the West MacDonnell National Park, including sites where rock-rats had previously been recorded. From a total of 55 sites and 5,000 trap nights we located eight central rock-rats from only five sites (overall detection rate = 0.16 rock-rats per 100 trap nights). All sites were on two mountain-top locations, both of which are over 1,250 m altitude. Evidence of reproductive activity was observed at both locations but the subpopulations were relatively localized and no individuals were captured at any of the sites from which the species was known previous to these surveys. Although the rugged mountains may provide the central rock-rat with some refuge from predation and wildfires, more research is needed to understand better the factors suppressing and constraining the species at the population and landscape scales. Immediate management priorities are prescribed burning to limit the extent and severity of wildfires and trialling a baiting programme with 1080 to target feral cats in the mountains.

Keywords Arid-zone, central rock-rat, MacDonnell Ranges bioregion, West MacDonnell National Park, *Zyzomys pedunculatus*

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There are five known species of rock-rats in the genus *Zyzomys*, three of which are categorized as threatened. The central rock-rat *Zyzomys pedunculatus* is the only arid-dwelling representative of the genus and is categorized as Critically Endangered on the IUCN Red List, primarily based on its history of range contraction and its disappearance from long-term monitoring sites in 2002 (Woinarski & Morris, 2008). The central rock-rat is a small rat-sized (70–150 g) granivorous rodent that once occurred in rocky areas throughout a large area of inland Australia. However, it is one of a suite of small-to medium-sized mammals in arid Australia (Johnson, 2006) to have undergone massive range contractions or become extinct in the last 100 years (Fig. 1; Wurst, 1995; Nano et al., 2003). Although the cause of these declines is not conclusively established, predation by introduced predators (the feral house cat *Felis catus* and European red fox *Vulpes vulpes*) and changed fire regimes are considered the most likely factors (Nano, 2008).

No records of the species were made from 1960 until 1996 when a population was located in the rugged West MacDonnell National Park in the southern Northern Territory (Nano, 2008). This rediscovery followed an extensive search for the species in 1995 that found no individuals (Wurst, 1995). Between 1996 and 2001 the central rock-rat was located at 13 sites within a 600 km^2 area of the National Park and one site on a neighbouring cattle station (Nano, 2008). Monitoring sites were established in the hills around the Ormiston Gorge ranger station in 1999 and a boom in population numbers was recorded that peaked following high rainfall in 2000 (Nano, 2008; Edwards, 2012a). In 2002 conditions dried and massive wildfires burnt approximately 60% of the National Park (McDonald et al., 2012). Although the majority of monitoring sites escaped wildfire, the rock-rat population crashed and had disappeared from all sites by the end of the year (Edwards, 2012a). These monitoring sites were surveyed at least annually during 2003–2008, without any rock-rat captures (Edwards, 2012a; Northern Territory Parks and Wildlife Commission, unpubl. data). Although monitoring around Ormiston Gorge continued until 2008, remote and difficult access sites were not surveyed during this period.

Following 7 years without a confirmed record of the species, we undertook intensive surveys between 2009 and

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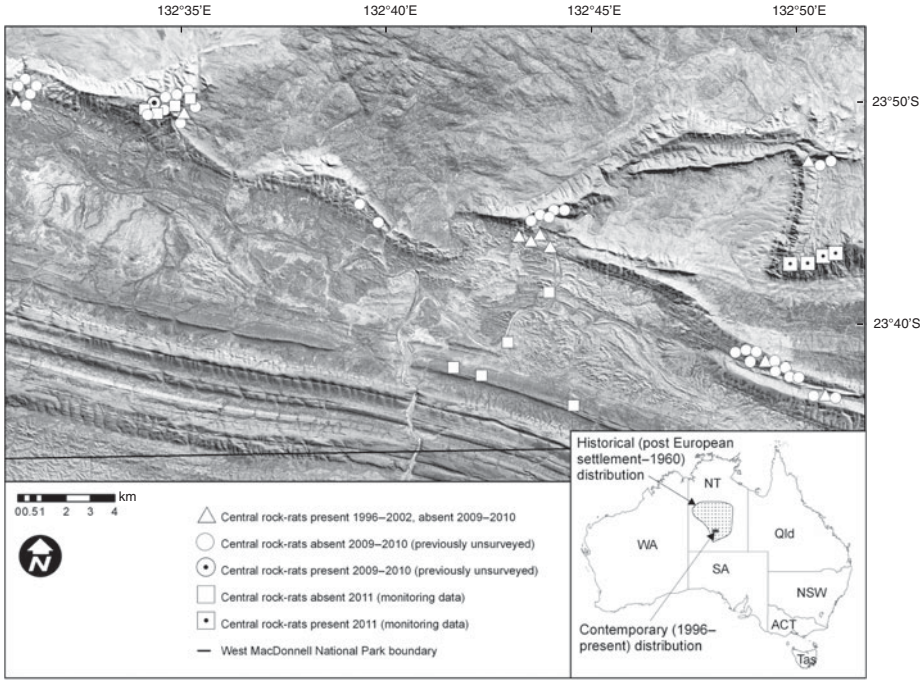

FIG. 1 The contemporary distribution of the central rock-rat *Zyzomys pedunculatus,* including all sites surveyed during 2009–2011. The inset denotes the historical (post European settlement to 1960) and contemporary (post 1996) distributions of this rock-rat in the Northern Territory, Australia.

2011, with the primary goal of locating an extant population. We began by surveying sites and areas where rock-rats had been caught during 1996–2002, then expanded into nearby areas that we believed may have good refuge qualities (i.e. rugged, rocky, old-growth (>15 years without fire) vegetation). In total, we surveyed 42 sites within the contemporary (1996–2002) known distribution of the species (all the sites we refer to in this paper were separated from the nearest site by ⩾ 500 m). Because of the rugged nature of the terrain and the limited road infrastructure in the National Park, we used helicopters to gain access to most areas. At each site we established a linear transect of 25 aluminium box traps (Elliott Scientific Co., Upwey, Australia) spaced 10 m apart and baited with a peanut butter and oats mixture. Traps were opened for three or four consecutive nights and checked within 4 hours of sunrise.

In 2011–2012 we surveyed a further 13 potentially suitable, rocky sites within this part of the National Park during a broader and ongoing fauna and flora monitoring programme. At each site we established a grid of aluminium box traps, with five traps spaced 20 m apart in five parallel rows to produce an 80 × 80 m grid of 25 traps. Traps were opened for three consecutive nights and checked within 4 hours of sunrise. Four of these sites were in areas previously trapped as part of the 2009–2011 surveys.

During 2009–2011, with a combined trapping effort of 4,025 trap nights, we located four rock-rats (3 female, 1 male) from one of the 42 sites surveyed (Fig. 1). This capture site, surveyed in June 2010, was near the summit of Mt Sonder (1,380 m altitude at summit). No animals were captured from any of the 1996–2002 capture sites. Of the 13 monitoring sites surveyed during 2011–2012 (975 trap nights) we located four rock-rats (1 female, 3 males) from four sites (one at each site), all located in an area near the summit of Mt Giles (1,389 m at summit; Fig. 1). At the same time, no rock-rats were found at the 2010 capture location on Mt Sonder or at any of the monitoring sites established nearby. The overall detection rate, calculated from the combined survey and monitoring work, was 0.16 rock-rats per 100 trap nights. All five of the sites where rock-rats were located during 2009–2012 were on rugged quartzite mountains at altitudes > 1,250 m. Evidence of reproductive activity, including pregnant or lactating females and the occurrence of juveniles, was observed at both the Mt Sonder and Mt Giles locations.

The small number of sites where central rock-rats were found to be present prevents us testing for any associations with environmental variables (a range of variables were recorded at each site) but data indicate a potential association with rugged high-altitude quartzite mountains. The western portion of the West MacDonnell National Park encompasses three of the four highest mountains in arid Australia (including the two mountains where we caught rock-rats) and the height and extent of these mountains distinguishes this area from all of the historical sites where the central rock-rat once occurred. We believe enough survey work has been undertaken at lower altitude rocky sites, both during this and prior surveys, to indicate that these areas are not inhabited by central rock-rats most of the time. We suggest that the increases in seed production associated with successive years of above average rainfall from 1997 to 2001 allowed central rock-rats to irrupt across this landscape, including into the area around Ormiston Gorge where they have not been recorded since 2002.

The high-altitude quartzite peaks and ridges of the West MacDonnell National Park may enable persistence of central rock-rat populations because they act as a refuge from predation and fire events. Although feral cats were recorded on Mt Giles during the 2011 surveys the ruggedness and extensive rock-outcropping may afford increased protection to the rock-rats and it is likely that cats occur at lower densities here than on the more fertile plains and valleys. Foxes, which are known to be important predators of rodents in arid Australia (Pavey et al., 2008), are rare throughout the National Park (P. McDonald, unpubl. data). Dingoes, which are common in most regions of the park, are infrequent visitors to these rugged mountains and are therefore not likely to be important predators in these areas (P. McDonald, unpubl. data). No other introduced predators occur in the region.

Although the ecological relationship between central rock-rats and fire is poorly understood, a study has demonstrated crashes in the populations of another rodent species following fire events in arid Australia (Letnic, 2003; Letnic et al., 2005). The two obvious impacts of fire are the removal of an ongoing food source (seed or leaf, Nano et al., 2003; Edwards, 2012b), and a reduction or complete removal of vegetative cover that may have offered some protection from predation. Should a fire be quickly followed by rainfall then vegetation may regrow relatively quickly. However, in the case of the massive 2002 wildfires, drought conditions followed and this resulted in only slow recovery of vegetation. The extent of these fires and the slow post-fire succession may partly explain why the rock-rats failed to irrupt across the landscape after the high rainfall events of 2010–2011, as they did earlier in the decade (Fig. 2).

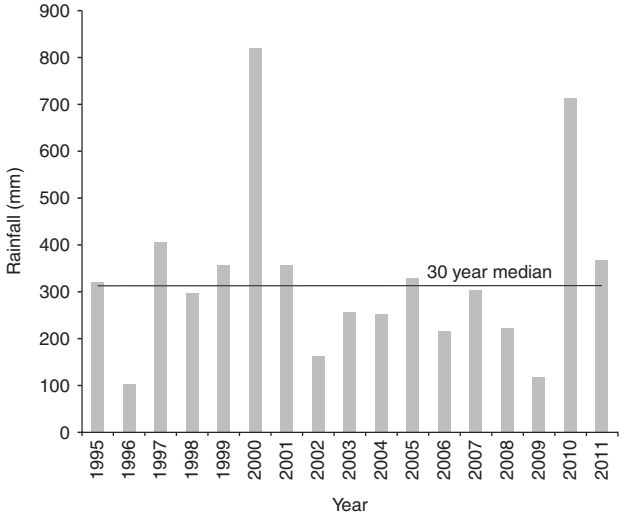

FIG. 2 Annual rainfall (mm) at Ormiston Gorge ranger station in the West MacDonnell National Park (weather station no. 15667, Australian Bureau of Meteorology climate data) and the 30-year median annual rainfall.

The encouraging confirmation of the continuing survival of this species is balanced by the mounting evidence that the size of existing subpopulations is very low and that the species did not undergo a population irruption in response to good rain in 2010–2011. Other threatened rodents in the region did respond to higher rainfall (C.R. Pavey et al., unpubl. data). Targeted research and effective conservation strategies therefore need to be implemented. The most urgent research priority is to understand better the factors suppressing the species at both the population and landscape scales. In the meantime we support the existing prescribed burning programme, which aims to reduce the extent and severity of wildfire events. In terms of the threat from predators, feral cats are likely to be the most important predator of this species in the West MacDonnell National Park. Although effective landscape-scale control of cats has yet to be developed, appropriately timed 1080 baiting at higher altitudes may offer some potential and would be unlikely to affect the dingo population (Burrows et al., 2003). The failure of the central rock-rat to irrupt across the landscape in recent years, together with our failure to detect them on Mt Sonder in 2011, highlights the difficulties associated with monitoring a rare and cryptic species that inhabits rugged and remote areas. Therefore locating further extant subpopulations of this species and incorporating these areas into the existing monitoring programme should also be a high priority. For these purposes, the use of baited camera traps is showing some potential as a monitoring alternative to labour-intensive live trapping (P. McDonald, unpubl. data).

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Biographical sketches

Peter McDonald is a field ecologist currently working on several threatened species projects as well as broad-scale biological inventory and monitoring. Chris Pavey is a wildlife ecologist whose research interests include the recovery of threatened species and conservation and monitoring of mammals with irruptive population dynamics. Kelly Knights is a park ranger who has worked on the rock-rat surveys as well as several other biodiversity programmes in the West MacDonnell National Park. Deon Grantham is a park ranger based at Ormiston Gorge and has a commitment to biodiversity management on parks estate. Simon Ward is an ecologist who coordinates threatened species work across the Northern Territory and manages a small scientific team in Alice Springs. Catherine Nano is an arid land plant ecologist; she is currently involved in a number of monitoring projects addressing the impacts of changing disturbance frequency and climate on threatened species in central Australia.