



## **Consultation Document on Listing Eligibility and Conservation Actions**

### ***Petrogale lateralis lateralis* (black-flanked rock-wallaby)**

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Petrogale lateralis lateralis* (black-flanked rock-wallaby) for inclusion on the EPBC Act threatened species list in the Endangered category; and
- 2) the necessary conservation actions for the above subspecies.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing either by email to:  
[species.consultation@environment.gov.au](mailto:species.consultation@environment.gov.au)

or by mail to:

The Director  
Marine and Freshwater Species Conservation Section  
Wildlife, Heritage and Marine Division  
Department of the Environment  
PO Box 787  
Canberra ACT 2601

**Responses are required to be submitted by 17 June 2016.**

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## **General background information about listing threatened species**

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

## **Information about this consultation process**

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

# *Petrogale lateralis lateralis*

black-flanked rock-wallaby

*Note: The information contained in this Conservation Advice was primarily sourced from 'The Action Plan for Australian Mammals 2012' (Woinarski et al., 2014) and the Western Australia Department of Parks and Wildlife (WA DPaW 2016). Any substantive additions obtained during the consultation on the draft will be cited within the advice. Readers may note that Conservation Advices resulting from the Action Plan for Australian Mammals show minor differences in formatting relative to other Conservation Advices. These reflect the desire to efficiently prepare a large number of advices by adopting the presentation approach of the Action Plan for Australian Mammals, and do not reflect any difference in the evidence used to develop the recommendation.*

## **Taxonomy**

Conventionally accepted as *Petrogale lateralis lateralis* (Gould 1842). Other common names include the black-footed rock-wallaby or warru. Four other subspecies are recognised: *P. l. hacketti*, *P. l. pearsoni*, *P. l. subsp.* (MacDonnell Ranges) and *P. l. subsp.* (west Kimberley).

## **Species/Subspecies Information**

### **Description**

The black-flanked rock-wallaby is dark grey-brown in colour with a distinct white to sandy cheek-stripe. A white side-stripe also extends from below the shoulders to the thigh, and a dark-brown to black dorsal stripe is visible from between the ears to beyond the shoulders. There are light brown patches at the base of the ears, and the upper forearms are sandy. The coat is thick and woolly; the tail is brownish-grey with a black tip. In summer the fur color becomes lighter and browner. The head and body length is 497–529 mm in males and 446–486 mm in females. Individuals weigh between 3.1 and 5.0 kg. The long tail, up to 605 mm long, is important for balance when hopping among rocks, and the rock-wallaby can also climb trees with sloping trunks (Eldridge & Pearson 2008; WA DPaW 2012).

### **Distribution**

The black-flanked rock-wallaby is endemic to Western Australia. It was formerly widespread, though patchily distributed, throughout most of the state south of the Kimberley (Burbidge et al., 1988; Pearson & Kinnear 1997). It is known to have occurred on the southern coastline of Western Australia (Baynes 1987), perhaps as far east as Mount Ragged (Pearson & Kinnear 1997). There are subfossil records from Devil's Lair Cave near Margaret River (Dortch & Merrilees 1971; Merrilees 1979), although there are no records from this area since European settlement. There is also evidence (old scats) from several wheatbelt rocks near Mukinbudin and at Knungajin Hill, 35 km north-west of Merredin (Pearson 2013).

However, its distribution greatly declined and it became confined to small patches of suitable habitat in central and southern Western Australia including Depuch, Barrow and Salisbury Islands. It became extinct on Depuch Island (11.2 km<sup>2</sup>) after incursion of foxes (*Vulpes vulpes*) (Kinnear et al., 1984; Pearson & Kinnear 1997). The identification of the extinct Depuch Island subpopulation has been confirmed through ancient DNA analysis (Haoucher et al., 2012).

Current subpopulations are restricted to the best habitat in: the Barlee Range (Ashburton; however, there is some doubt as to whether these are *P. lateralis* or *P. rothschildi* or hybrids, M. Eldridge pers. comm., cited in Woinarski et al., 2014); Kaalpi (Calvert Range, Little Sandy Desert); parts of Cape Range; granite rocks in the Avon Wheatbelt (Nangeen Hill, Mount Caroline, Mount Stirling, Sales Rock, Tutakin Rock (Gundaring Nature Reserve)); Barrow Island; and Salisbury Island. In recent decades, subpopulations at Durba Hills, some Wheatbelt granites (Gardiner's Rock, Mount Shackleton, Mokenby) and the Murchison River Gorge at

Kalbarri have been lost (Pearson 2013). It has been reintroduced to Querekin Rock (1990, 2009, 2010), Paruna Sanctuary (2001, 2002, 2003, 2005, 2006, 2007, 2010), Avon Valley National Park (2001, 2002, 2003, 2008, 2009, 2010), Walyunga National Park (2002, 2004) and Cape Le Grande National Park (2003, 2004) (Mawson 2004; Davies et al., 2007; Pearson 2013). A subpopulation at Kokerbin Nature Reserve in the Avon Wheatbelt was thought to be extinct, but then self-introduced from Gundaring Nature Reserve across 8 km of farmland (Freegard & Orell 2005).

### Relevant Biology/Ecology

Black-flanked rock-wallabies occur where suitable shelter and food co-exist. During the daytime they shelter under deep shade in rocky areas such as caves, cliffs, screes and rockpiles, and emerge at dusk to feed on grasses, forbs, shrubs and occasionally seeds and fruits. Feeding occurs as near to shelter as possible, especially where exotic predators are present; however, if food is unavailable near shelter they will move up to several hundred metres away to obtain it (Eldridge & Pearson 2008). They do not need to drink, and conserve water by sheltering from the hot day-time temperatures in caves (WA DPaW 2012).

Breeding can occur throughout the year, but with two peaks – autumn and late winter/spring – in southern subpopulations (Willers et al., 2011). Breeding varies in response to seasonal rainfall, and the species exhibits embryonic diapause where the embryo becomes dormant until suitable conditions occur for it to develop (WA DPaW 2012). Research in the south-west of Western Australia showed that breeding commences at 18–24 months and that some individuals may live longer than 12 years (Kinnear et al., 1988). However, due partly to predation, few live that long and generation time is assumed to be 4 years (Woinarski et al., 2014).

### Threats

Threats to the black-flanked rock-wallaby are outlined in the table below (Woinarski et al., 2014; WA DPaW 2016).

Threat factor	Consequence rating	Extent over which threat may operate	Evidence base
Predation by foxes	Catastrophic for many subpopulations, severe for others	Large (entire mainland range; medium-risk for Nangeen which has predator proof fence)	<p>Experimental studies have demonstrated impacts (Kinnear et al., 1988, 1998, 2002, 2010). Individual or small groups of foxes can kill large numbers of rock-wallabies in short periods of time, which is a serious threat if populations are already small. Fox predation is likely to be more severe on juveniles and the smaller females. The presence of foxes also alters the behaviour of rock-wallabies, resulting in a reduction in time spent foraging and a confined foraging range from their rocky refuge habitats.</p> <p>After baiting programs were suspended at the Kokerbin Rock Nature Reserve (NR) subpopulation due to the presence of a camp site, rock-wallaby numbers fell to very low levels (WA DPaW 2016).</p> <p>Following the cessation of 1080 baiting programs at Querekin</p>

			<p>Rock in 2013, numbers of rock-wallabies dropped and remaining animals were salvaged in 2014. Sixteen previously micro-chipped animals were not captured or detected on camera images, suggesting up to a 43% population decline with the cessation of baiting (WA DPaW 2016).</p> <p>An incursion of red foxes onto Depuch Island caused extinction of this subpopulation (Kinnear et al., 1984). There is risk of establishment of foxes on islands.</p>
Predation by feral cats	Severe	Large (entire mainland range; medium-risk for Nangeen which has predator proof fence)	<p>The impact of feral cats on black-flanked rock-wallabies is unknown. However, they are thought to kill juvenile and sub-adult rock-wallabies, and thereby reduce recruitment.</p> <p>Predation by feral cats probably contributed to declines at Nangeen Hill and Mt Caroline, and there is risk of establishment of feral cats on islands.</p> <p>Long term baiting for cats at Calvert Range (Kaalpi) has resulted in a steady increase in the subpopulation (P. Kendrick pers. comm., cited in WADPaW 2016).</p>
Habitat degradation	High	All subpopulations	<p>Drought combined with grazing impacts of rabbits, euros and livestock have reduced native grass cover and carrying capacity of rocky habitat for rock-wallabies. This has also led to weed invasion, which is a major issue at some wheatbelt granite rocks.</p> <p>Supplementary feeding has been required at Nangeen Hill Nature Reserve to prevent starvation of rock-wallabies. Exclusion cages at this site have indicated that weed spraying and relaxation of grazing pressure results in increased germination of native grasses.</p>
Competition for food and shelter from introduced	High	All subpopulations	All mainland unfenced subpopulations co-occur with exotic herbivores in or adjacent

and native herbivores			<p>to their habitats. These herbivores reduce available forage and cause habitat degradation.</p> <p><i>Rabbits</i></p> <p>Rabbits reduce the amount of potential forage and their selective grazing and burrowing encourage weed infestations. They may limit the carrying capacity and support higher predator numbers. They particularly compete for food in the Western Australian wheatbelt.</p> <p><i>Feral goats</i></p> <p>In Kalbarri NP, goat grazing has resulted in vegetation communities along the Murchison River cliffs being dominated by unpalatable species with reduced forage for rock-wallabies. In Cape Range NP, boat operators on Yardie Creek have reported occasional aggressive behaviour by goats, forcing rock-wallabies to abandon caves during daylight hours.</p> <p><i>Domestic stock and feral camels</i></p> <p>These have the ability to limit vegetation cover and forage around rock outcrops. This either confines foraging activities to areas close to the refuge site or causes rock-wallabies to travel further to forage, exposing them to increased predation risk.</p> <p><i>Euro</i></p> <p>Competition with the euro (<i>Macropus robustus</i>) for feeding sources and shelter has been noted in South Australia (Ward et al., 2011), but the extent of competition with rock-wallabies elsewhere is unknown.</p>
Small population sizes and population fragmentation	High	All subpopulations	<p>As almost all the rock-wallaby subpopulations are effectively closed populations, they are at risk from the effects of genetic erosion. Ottewell et. al. (2014) noted that translocations of effectively closed populations</p>

			<p>might be susceptible to genetic erosion, and indicated that periodic supplementation of animals may be an ongoing action that is a necessary part of translocation programs. Rock-wallabies appear to be tolerant to high levels of inbreeding and population bottlenecks and persist with reduced genetic diversity.</p> <p>Subpopulations that have a large effective population size are resistant to loss of genetic diversity through genetic drift and inbreeding. It is hypothesised that effective population sizes of ~1000 individuals maintain quantitative variation to the same extent as an infinite large population (Lynch &amp; Lande 1998). Small subpopulations of black-flanked rock-wallabies are vulnerable to rapid erosion of genetic diversity especially in the Wheatbelt if the effective population size is not increased and there is genetic mixing and supplementation.</p> <p>The impact of genetics for rock-wallabies is currently being investigated by Kym Ottewell (WA DPaW) and Mark Eldridge (Australian Museum).</p>
Drought and the effects of climate change	Medium-low	All subpopulations (future threat)	<p>Fragmented populations and reduced genetic variability limit possible evolutionary responses to climate change, such as <i>in situ</i> adaptation of populations and dispersal to other habitat</p> <p>Predictions indicate that a decline in rainfall, higher summer temperatures and more variable weather patterns in the WA Wheatbelt will increase the likelihood of habitat degradation, with impacts on survivorship of black-flanked rock-wallabies.</p>
Clearing and habitat fragmentation	Medium-low	Only subpopulations on land not managed for conservation	<p>The clearing of habitat is not a high current threat to this subspecies, because most extant subpopulations are located on land that is being managed for conservation.</p>

Large, intense, or frequent fires	Unknown	Moderate (some mainland subpopulations)	Fire may lead to a lack of food for small isolated subpopulations.
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### **Assessment of available information in relation to the EPBC Act Criteria and Regulations**

<b>Criterion 1. Population size reduction (reduction in total numbers)</b> Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	<b>Critically Endangered Very severe reduction</b>	<b>Endangered Severe reduction</b>	<b>Vulnerable Substantial reduction</b>
<b>A1</b>	<b>≥ 90%</b>	<b>≥ 70%</b>	<b>≥ 50%</b>
<b>A2, A3, A4</b>	<b>≥ 80%</b>	<b>≥ 50%</b>	<b>≥ 30%</b>
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p> </div> <div style="width: 45%; text-align: center;"> <p><i>based on any of the following</i></p> <ul style="list-style-type: none"> <li>(a) direct observation [except A3]</li> <li>(b) an index of abundance appropriate to the taxon</li> <li>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</li> <li>(d) actual or potential levels of exploitation</li> <li>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</li> </ul> </div> </div>			

#### **Evidence:**

Available information indicates that the population has declined and is continuing to decline. However, there are limited data on the rate of decline. The number of individuals present at a site varies with available habitat and the effectiveness of fox and feral cat control. Some subpopulations are relatively stable due to predator control. However, some are declining even with fox baiting, and any cessation of baiting, even for a short time, can lead to significant decline. Remote subpopulations are difficult to manage and have a high risk of local extinction. Woinarski et al. (2014) consider that the population decline is unlikely to be greater than 30 percent in the past 12 year (three generation) period.

Monitoring has been undertaken at the regions listed in Table 1.

**Table 1. Regions where monitoring has been undertaken**

Region	Monitoring activities
Western Australian wheatbelt	Regularly monitored by the Western Australia Department of Parks and Wildlife (DPaW) via trapping. The Shire of Kellerberrin and World Wildlife Fund – Australia coordinate a regular community scat-based monitoring program.
Paruna Sanctuary	Australian Wildlife Conservancy
Kaalpi (Calvert Range)	DPaW, Kanyirninpa Jukurrpa and the Martu traditional owners
Cape Range National Park	DPaW and the Cape Conservation Group.

#### **Wheatbelt region**

Pioneering experiments by J. Kinnear and colleagues since 1982 have provided accurate estimates of numbers on granite rocks in the Western Australian wheatbelt, and demonstrated



the deleterious effects of fox predation on these subpopulations (Kinnear et al., 1988, 1998, 2002). In the 1980s, sites with limited shelter and no fox control, e.g. Tutakin Rock, had as few as six or seven animals (Kinnear et al., 2010). Following fox control via baiting with dried meat baits containing 1080, remnant subpopulations at Nangeen Hill, Mount Caroline and Mt Stirling all showed dramatic increase, and some nearby rocks (Kokerbin Rock and Gardiner's Rock) were colonised by natural dispersal. Rock-wallabies at control sites with no fox baiting either remained at low numbers or became locally extinct.

However, in 2010 a dramatic decline in the Nangeen Hill subpopulation was detected, initially by scat counts and then confirmed by a trapping census in early 2011, which recorded 14 animals. A follow-up survey in early 2012 detected nine animals, but a later survey in 2014 recorded 39 (WA DPaW 2016). Mt Caroline suffered a similar decline from greater than 300 individuals in 2009 (N. Willers, cited in Kinnear et al., 2010) to approximately 70 (2011) and 80 individuals (early 2012) (C. Pentland pers. comm., cited in Woinarski et al., 2014), but a survey in 2014 recorded 100 individuals (WA DPaW 2016). A survey at Mt Stirling in late 2014 record zero individuals (WA DPaW 2016).

At Querekin, black-flanked rock-wallabies originally numbered up to 100 before the arrival of foxes in the 1920s, but declined to extinction by 1990. Following fox control and the reintroduction of 10 animals in 1990, the subpopulation expanded to a level that the local landholder considered them to be at pest status and, in 2002, 98 rock-wallabies were removed to establish new subpopulations.

Since 2007, three wheatbelt subpopulation sites have been lost (WA DPaW 2016). The last remaining animals from these sites were used to re-stock the remaining subpopulations. One of these subpopulations disappeared because the landowner withdrew permission to undertake ongoing fox baiting (D. Pearson pers. comm., cited in WA DPaW 2016). There are concerns that some of the other wheatbelt subpopulations are susceptible to loss due to low numbers and may experience future declines. However, there are no current data indicating declines in other subpopulations. The wheatbelt subpopulations are estimated to constitute approximately 25 percent of the total population (WA DPaW 2016).

### Other regions

In Kaalpi, following a decline in black-flanked rock-wallaby numbers from 1985 to 1991, fox control was implemented in 1992, and an intensive aerial and ground baiting program was conducted from 1994 to 2002. During this period low numbers of rock-wallabies were trapped and observed. Kinnear et al. (2002) concluded that cat predation was a major factor in suppression of the rock-wallaby population at Kaalpi. Whilst there was little evidence of foxes and wild dogs at the range and in the surrounding sand plain, cats continued to elude the standard fox bait. Aerial and ground cat baiting commenced in June 2003 using the experimental 1080 cat bait *Eradicat*. Although rock-wallaby trapping effort has varied due to the remoteness of the site, trapping records since 2005 indicate an increase in the subpopulation. In 2012, 45 individuals were trapped across 600 m of the range (58% female), with 83% of the trapped mature females having pouch young. In 2013, suitable animals were translocated from Kaalpi to Pinpi (Durba Hills), a large sandstone range approximately 35 km to the west of Kaalpi (A. McGilvray pers. comm., cited in Woinarski et al., 2014).

In Cape Range National Park, monitoring shows that the species is regularly observed at Yardie Creek, Mandu Mandu and Pilgonaman Gorges.

### Conclusions

The data presented above appear to be insufficient to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

### Evidence:

The extent of occurrence is estimated to be 1 438 000 km<sup>2</sup>, calculated using a minimum convex polygon around post-2004 database records (WA DPaW 2016). The area of occupancy is estimated at 212–224 km<sup>2</sup> using 2x2 km grids on post-2000 record points, and estimated at 172–180 km<sup>2</sup> using the sum of reserves or outcrops where the subspecies has been recorded. The latter AOO estimate excludes areas on the Cape Range where they have been recorded outside of the conservation estate, and may overestimate the areas where they are only found in a small proportion of the reserve such as Cape Le Grand (WA DPaW 2016).

The distribution is severely fragmented. Isolated subpopulations occur throughout Western Australia, with little or no dispersal between them. Some are on offshore islands in the Pilbara and South Coast, while mainland subpopulations are scattered from the Kimberley to the South Coast regions (WA DPaW 2016). Around 19 locations (Table 2), and 7–19 subpopulations, are thought to occur (WA DPaW 2016).

There has been an observed decline in the wheatbelt region in the number of locations, subpopulations and mature individuals, due to the loss of three locations within the last 12 years. There are concerns that some of the other wheatbelt subpopulations are susceptible to loss due to low numbers and may experience future declines. However, there is no evidence of declines in any other subpopulations (WA DPaW 2016).

In summary, the area of occupancy is <500 km<sup>2</sup> with a severely fragmented distribution, and an inferred continuing decline in the AOO, number of mature individuals and number of subpopulations primarily due to impacts from foxes and feral cats (see Criterion 1 for further information on declines).

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3. Population size and decline			
	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000

AND either (C1) or (C2) is true				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	<b>Very high rate 25% in 3 years or 1 generation (whichever is longer)</b>	<b>High rate 20% in 5 years or 2 generation (whichever is longer)</b>	<b>Substantial rate 10% in 10 years or 3 generations (whichever is longer)</b>
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	<b>≤ 50</b>	<b>≤ 250</b>	<b>≤ 1,000</b>
	(ii) % of mature individuals in one subpopulation =	<b>90 – 100%</b>	<b>95 – 100%</b>	<b>100%</b>
(b)	Extreme fluctuations in the number of mature individuals			

### Evidence:

There are no robust estimates of total population size. The species has a severely fragmented distribution with small, isolated subpopulations, and the number of individuals present at a site varies with available habitat and effectiveness of fox and feral cat control measures. However, based on available data, the number of mature individuals is likely to be fewer than 2500.

Pearson (2012) provided the following 'rough' estimates of the number of individuals in some subpopulations, with some figures updated by Woinarski et al. (2014): Barrow Island 150–200, Cape Range 200–250, Calvert Range (Kaalpi) <50, seven wheatbelt populations 300–500, Salisbury Island 500, and translocated subpopulations: Cape Le Grand <50, Avon Valley <50, Paruna Sanctuary <50. This gives a total population size in the range of 1350–1650.

The size of the Barrow Island subpopulation is difficult to estimate because of its linear distribution along 13 km of cliffs on the west coast, difficulties associated with spotlighting due to the rugged terrain, and the propensity of possums and bandicoots to fill traps set for rock-wallabies. Hall and Kinnear (1991) estimated 150–200 animals. Burbidge (2008) counted 37 and 43 during two early morning counts in different seasons and considered that while no accurate estimate of the total population was possible, it was clearly very small, consistent with previous research showing unprecedented low levels of genetic variation on Barrow Island (Eldridge et al., 1999).

Woinarski et al. (2014) estimate the total population size to be around 1500 mature individuals, with no subpopulation having more than 1000 mature individuals. The population is inferred to be declining (see Criterion 1).

WA DPaW (2016) estimate the total number of mature individuals to be fewer than 1000, with each subpopulation having fewer than 250 mature individuals (Table 2). This population estimate is based on different methods employed at different sites including direct counts, mark-recapture survey population estimates and maximum carrying-capacity estimates. However, it doesn't include the Avon Valley, Cape le Grand and Walylunga national parks where population estimates are unknown.

New populations were discovered on several rock outcrops in the McKay Range and Karlamilyi (Rudall River) National Park in August 2014. The abundance and overall distribution of these populations is currently unknown, but further survey work is proposed (WA DPaW 2016).

**Table 2. Latest population estimates (WA DPaW 2016)**

Location	Survey date (T=targeted survey)	Number of mature individuals
Mt Caroline	Nov 2014 (T)	100
Nangeen hill (fenced)	Oct 2014 (T)	39
Sales rock	Dec 2014 (T)	27
Gundaring Nature Reserve	Dec 2014 (T)	15
Kokerbin Rock Nature Reserve	2012 (T)	7
Avon Valley National Park		Present
Walyunga National Park	2014 ((T)	Present
Paruna Sanctuary	2014 (T)	8
Cape le Grand	2013	Present
Barrow Island	2004	150
Salisbury Island	2004	200
Cape Range and surrounding area	2012	Estimated maximum 200-250
Calvert Range (Kaalpi)	2013 (T)	65
Mt Stirling Nature Reserve	Dec 2014	0
Bilgunmarina, Karlamilyi National Park	August 2014 (T)	Estimated to be <20
Parngurr East, Karlamilyi National Park	August 2014 (T) (camera survey)	Estimated to be <15
South Purngurr area	August 2014 (T) (camera survey)	Estimated to be <20
South East Purngurr area	July 2014 (T) (camera survey)	Estimated to be <20
Jilikurru Translocated Population	2014	17 individuals known to be alive
TOTAL		953

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered** under this criterion, as the estimated number of mature individuals is <2500 and the number of mature individuals in each subpopulation is <250. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

#### **Evidence:**

There are no robust estimates of population size to demonstrate that the subspecies meets the threshold in this criterion. Woinarski et al. (2014) estimate the population size to be around 1500

mature individuals, while DPaW estimates the population to have fewer than 1000 mature individuals.

The data presented above appear to be insufficient to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

#### Evidence:

Population viability analysis appears not to have been undertaken. Therefore, there are insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

### Conservation Actions

#### Recovery Plan

A decision about whether there should be a recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

A recovery plan is currently in place for five species of rock-wallabies, including the black-flanked rock-wallaby (Pearson 2013). The plan was developed by the Western Australian government and adopted as a national recovery plan by the Commonwealth in 2014. It is due to be reviewed in 2019.

#### Primary Conservation Actions

1. Continue to protect all subpopulations, including the control of foxes and feral cats.
2. Translocate to additional protected sites.

#### Conservation and Management Priorities

The Western Australian Department of Parks and Wildlife manages subpopulations in the Avon wheatbelt via fox control. Fox control and feral goat control is also under way at Cape Range and Cape Le Grande. Cat control, fire management and feral herbivore control is conducted at the Calvert Range. Barrow Island has a high-quality quarantine management system. Salisbury Island is remote and difficult to access and there is no specific management for this species.

Recommended management actions are outlined in the table below (Woinarski et al., 2014).

Theme	Specific actions	Priority
Active mitigation of threats	Maintain effective fox and feral cat control at all mainland subpopulations.	High

	Reduce the incidence of weed invasion at selected locations.	Medium
	Maintain effective goat control in Kalbarri, Cape Range and Avon Valley National Parks.	Medium
	Maintain effective rabbit control on WA wheatbelt sites with rock-wallaby subpopulations.	Medium
Captive breeding	N/a	
Quarantining isolated populations	Plan and implement biosecurity measures for Salisbury Island.	Medium
Translocation	Translocate to additional sites (e.g. Durba hills, Kalbarri National Park, Knungajin Rocks; reintroduce to Depuch Island), but only with ongoing fox and cat control.	Medium
Community engagement	Consult and involve farmers who live near subpopulations; involve Aboriginal rangers in the management of remote subpopulations.	Medium

### Survey and Monitoring priorities

Theme	Specific actions	Priority
Survey to better define distribution	Additional surveys required at Cape Range (especially the eastern side of the range), and at McKay Range in the Little Sandy Desert.	Medium
Establish or enhance monitoring program	Enhance monitoring of all subpopulations, including translocations.	High

### Information and Research priorities

Theme	Specific actions	Priority
Assess impacts of threats on species	Assess the impact of feral cats.	High
	Assess the impacts of feral goats at Cape Range National Park.	Medium
	Assess the relative contribution of euros to total grazing pressure on rock-wallaby habitat.	Low
	Investigate the impacts of different fire regimes.	Medium
Assess effectiveness of threat mitigation options	Assess the effectiveness of control measures for introduced predators and herbivores.	High
Resolve taxonomic uncertainties	N/a	
Assess habitat requirements	N/a	
Assess diet, life history	N/a	
Undertake research to develop new, or enhance existing, management mechanisms	Develop broad-scale, targeted feral cat eradication methods.	High

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#### **Consultation questions**

1. Do you agree with the current taxonomic position of the Australian Faunal Directory for this taxon (as identified in the draft conservation advice)?
2. Can you provide any additional references, information or estimates on longevity, age of maturity, average life span and generation length?
3. Has the survey effort for this taxon been adequate to determine its national distribution and adult population size?
4. Do you accept the estimate provided in the nomination for the current population size of the taxon?
5. For any population with which you are familiar, do you agree with the population estimate provided? If not, are you able to provide a plausible estimate based on your own knowledge? If so, please provide in the form:  
Lower bound (estimated minimum):  
Upper bound (estimated maximum):  
Best Estimate:  
Estimated level of Confidence: %
6. Can you provide any additional data, not contained in the current nomination, on declines in population numbers over the past or next 10 years or 3 generations, whichever is the longer?
7. Is the distribution as described in the nomination valid? Can you provide an estimate of the current geographic distribution (extent of occurrence or area of occupancy in km<sup>2</sup>) of this taxon?



8. Has this geographic distribution declined and if so by how much and over what period of time?
9. Do you agree that the taxon is eligible for inclusion on the threatened species list, in the category listed in the nomination?
10. Do you agree that the threats listed are correct and that their effects on the taxon are significant?
11. To what degree are the identified threats likely to impact on the taxon in the future?
12. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this taxon at any stage of its life cycle?
13. In seeking to facilitate the recovery of this taxon, can you provide management advice for the following:
  - What individuals or organisations are currently, or need to be, involved in planning to abate threats and any other relevant planning issues?
  - What threats are impacting on different populations, how variable are the threats and what is the relative importance of the different populations?
  - What recovery actions are currently in place, and can you suggest other actions that would help recover the taxon? Please provide evidence and background information.
14. Can you provide additional data or information relevant to this assessment?
15. Can you advise as to whether this species is of cultural significance to Indigenous Australians?