The Minister approved this conservation and transferred this species from the Endangered to Vulnerable category, effective from 07/12/2016

# Conservation Advice

# *Phascogale calura*

red-tailed phascogale

*Note: The information contained in this conservation advice was primarily sourced from the Western Australian Department of Parks and Wildlife (WA DPaW) and 'The Action Plan for Australian Mammals 2012' (Woinarski et al., 2014). Any substantive additions obtained during the consultation on the draft have been 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 *Phascogale calura* (Gould 1844). Other common names include the red-tailed wambenger, and kenngoor (Noongar). No subspecies are recognised.

## Summary of assessment

### Conservation status

Vulnerable: Criterion 2 B2 (a),(b)(iii)(iv)

*Phascogale calura* was listed as Endangered under the predecessor to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Endangered Species Protection Act 1992* (ESP Act), and transferred to the EPBC Act in July 2000. For a species to be considered as Endangered under the ESP Act, the Minister must have been satisfied that the species was likely to become extinct, was in immediate danger of extinction, or might already be extinct but is not presumed extinct.

Following a formal review of the listing status of *Phascogale calura*, the Threatened Species Scientific Committee (the Committee) has determined that there is sufficient evidence to support a change of status of the species under the EPBC Act from Endangered to Vulnerable.

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

### Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of new information provided to the Committee to change the listing status of *Phascogale calura*.

### Public Consultation

Notice of the proposed amendment and a consultation document were made available for public comment for 32 business days between 4 May 2016 and 17 June 2016. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

## Species Information

### Description

The red-tailed phascogale is a small, arboreal, carnivorous marsupial with ash-grey fur above and cream fur below. Its distinctive tail grows up to 14.5 cm long, with half (the portion nearer the body) colored reddish-brown, and the other half comprising a brush of long black hairs. It also has large, thin, reddish ears. This species is highly sexually dimorphic (Foster et al., 2006) with males growing to 12.2 cm long and weighing up to 68 grams, and females growing to 10.5 cm and weighing up to 48 grams (Bradley et al., 2008; Cronin 1991).

### Cultural Significance

The red-tailed phascogale is known as kenngoor by the Noongar Indigenous people of south-western Australia. The species is also named by the Kukatja, Pintupi and Warlpiri Indigenous people of the central and western deserts of the Northern Territory and Western Australia, reflecting its historical range (Burbidge et al., 1988). The species may not have been eaten, and it has been described as 'bad meat' (Burbidge et al., 1988). Indigenous knowledge of this species has been sourced from the Great Sandy Desert, Little Sandy Desert, Gibson Desert, Central Ranges and Tanami Desert (Short & Hide 2012).

### Distribution

The red-tailed phascogale occurs in remnant vegetation in the southern wheatbelt of Western Australia, less than one percent of its former range, where annual mean rainfall is 400−500 mm (Short & Hide 2012). Most of the records are concentrated in an area about 150 km long in a north-south direction from Brookton to Katanning, and about 80 km wide from Williams to Dumbleyung (Short & Hide 2012). Sparse records extend to the west to the margin of the Jarrah Forest and to the east to Hyden and Newdegate and to the south to Bremer Bay (Short & Hide 2012). There are outlying records along the east of the species range, at Marvel Loch (south of Southern Cross) and Jerdacuttup, and at Dwellingup in the Jarrah Forest region (Short & Hide 2012). It occurs within the Avon Wheatbelt, Jarrah Forest, Mallee and Esperance Plains IBRA Bioregions and the Avon, Northern Agricultural, Rangelands, South Coast, South West and Swan Natural Resource Management Regions.

Historically, the species had a wide distribution in arid and semi-arid Australia, including the MacDonnell Ranges near Alice Springs, near Adelaide, near the junction of the Murray and Darling Rivers in New South Wales (Short & Hide 2012) and parts of the western deserts (Burbidge et al., 1988), with subfossil remains known from arid areas of South Australia (Short & Hide 2012). Burbidge et al. (2009), using modern, historical and subfossil data, found that the species formerly occurred in 24 of Australia's 85 bioregions and that it was extinct in 20 and had declined or seriously declined in two.

The species has suffered a large contraction in range which continued into the late 20$^{th}$ century. Populations have been lost from the central and eastern wheatbelt of Western Australia since the mid-1970s (Short & Hide 2012). The distribution has been extensively cleared for agriculture and remaining bushland is highly fragmented (Short & Hide 2012). Trapping of 84 remnant areas between 2005 and 2009 found that the species was present on 64% of 45 remnants on private property (Short et al., 2011). The species occurs in many protected areas, and has been recorded at least once in 40 nature reserves and 19 other Crown reserves (Short & Hide 2012). However, since 1990 the species appears to have disappeared from several reserves, while some sites may have gained populations (Short & Hide 2012). The red-tailed phascogale was reintroduced to Wadderin Sanctuary (near Narembeen) in 2009, and to an unfenced reserve of 389 ha controlled by Australian Bush Heritage at Kojonup in 2010 (Short & Stone 2009).

## Relevant Biology/Ecology

The red-tailed phascogale is largely confined to woodlands with old-growth hollow-producing eucalypts, particularly Wandoo (*Eucalyptus wandoo*) and York gum (*E. loxophleba*), often with associated rock sheoak (*Allocasuarina huegeliana*), but has also been recorded in shrublands and various mosaics of woodland, shrubland and scrub-heath (Short & Hide, 2012). It does not appear to extend into unfragmented habitat in either the Jarrah Forest to the west or the Mallee Bioregion to the east (Short & Hide, 2012); at the same time it avoids relatively open areas and rocky ridges which are devoid of vegetation (Bradley 1997). The species prefers long unburnt (more than 50 years) patches (Friend & Friend 1993).

The species is mainly nocturnal and largely arboreal, and can leap across gaps of up to two metres in the canopy, but also feeds extensively on the ground. Home ranges vary from 1.5 ha to 8 ha, depending upon the breeding season. Recorded nesting sites include hollow logs, tree hollows (Kitchener 1981; Bradley 1997), and the skirts and stumps of grass trees (*Xanthorrhoea* spp.) (Maxwell et al., 1996).

It is an opportunistic feeder, taking a wide range of insects and spiders as well as small birds and mammals (Bradley et al., 2008). The best habitat has numerous tree hollows for shelter and a semi-continuous canopy – this probably provides some protection against predation by feral cats and foxes. In the western desert it occurred in sand dune country and sheltered in hollows in sand-dune bloodwood (*Corymbia chippendalei*) (Burbidge et al., 1988).

It has a semelparous breeding system, where males die each year at the end of the breeding season at the end of July (Bradley 1997). In addition, although females can breed in their second or third year, a substantial number die after weaning their first litter (Bradley 1987; Bradley et al., 2008). Friend and Scanlon (1996) found that only 14-30% of females in a wild population survived into their second year and 3-4% into their third season.

Juveniles breed in their first year. Longevity is three years (Jones et al., 2009) and captive males can survive up to five years (Bradley et al., 2008). However, most breeding adults are one year old or slightly less (Bradley et al., 2008) and generation length is assumed to be one year.

## Threats

Threats to the red-tailed phascogale are outlined in the table below (Woinarski et al., 2014).

| Threat factor | Consequence rating | Distributional extent over which threat may operate | Evidence base |
|---|---|---|---|
| Predation by feral cats (*Felis catus*) | Severe | Entire | Feral cats are abundant within the known range and many museum specimens of red-tailed phascogales were obtained from domestic cats. Feral cats are known to prey upon *P. calura* in Western Australia (Short & Hide 2012) and *P. tapoatafa* in eastern Australia (Soderquist 1994), but the population level impact is unknown. |

| | | | |
|---|---|---|---|
| Habitat loss and fragmentation | Severe | Entire | Extensive land clearing in the southern wheatbelt has left few woodland remnants. While land clearing has ceased, degradation of remnants and the linkages between them continues (Short et al., 2011). Fragmentation of habitat is likely to greatly increase the risks associated with dispersal, and a shortage of suitable nesting hollows in many vegetation associations is likely to limit persistence (Short & Hide 2012).<br><br>The frequent use by phascogales of next boxes and man-made structures around farm houses, and the strong association between the presence of phascogales and tree species with a high frequency of hollows, suggest that tree hollows may be a scarce resource (Short et al., 2011).<br><br>The semelparous breeding system and significant female die off increase susceptibility to local extinction (Bradley 1987, 1997). |
| Climate change | Severe | Entire | The red-tailed phascogale is known to be vulnerable to drought and there has been a significant trend to lower rainfall in south west Australia since the mid-1970s (3-4% per decade) with a further decline expected in coming years. Despite its original distribution in the arid zone, most sites from which it has disappeared in recent decades have an annual mean rainfall of <400 mm (Short & Hide 2012).<br><br>It experiences fluctuations due to climatic conditions and life history characteristics (annual male die-off). As such, if recruitment fails in any one year due to climatic conditions, it can have a large impact on the population. With the populations being relatively isolated, re-colonisation of sites could be challenging (WA DPaW 2016a). |
| Frequent, intense fires | Moderate | Entire | Many breeding sites are fire prone; if an entire remnant patch is burnt the species may become locally extinct. Frequent, hot fires can destroy nesting hollows and protective canopy, but fire is infrequent in wheatbelt remnants (Friend & Scanlon 1996). However, fire is more frequent in the uncleared areas beyond the eastern boundary of the wheatbelt and may limit the persistence of phascogales in woodland east of the wheatbelt (Short & Hide 2012). |

| | | | |
|---|---|---|---|
| Predation by foxes | Minor-moderate | Entire | Foxes are abundant within the range; however, the species' semi-arboreal behaviour probably makes them less vulnerable to foxes. Friend and Scanlon (1996) found that the effects of fox predation were less than those of drought; fox reduction experiments resulted in only a minor increase in phascogale numbers, but numbers declined on the unbaited plots. |

## How judged by the Committee in relation to the EPBC Act Criteria and Regulations

**Criterion 1. Population size reduction (reduction in total numbers)**
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

| | Critically Endangered Very severe reduction | Endangered Severe reduction | Vulnerable Substantial reduction |
|---|---|---|---|
| **A1** | **≥ 90%** | **≥ 70%** | **≥ 50%** |
| **A2, A3, A4** | **≥ 80%** | **≥ 50%** | **≥ 30%** |

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

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.

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*]

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.

*based on any of the following:*

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

**Evidence:**

**Insufficient data to determine eligibility**

The red-tailed phascogale has historically suffered a major decline and contraction in range. However, that decline appears to have largely ceased more than 10 years ago (Short & Hide 2012). The most recent decline in range has been associated with the clearing of woodland vegetation surrounding remaining reserves in the central eastern wheatbelt in the 1960s and 1970s; it is unclear whether such clearing is continuing (Short & Hide 2012). Trapping in Bendering, North Karlgarin, Roe and Dragon Rocks Nature Reserves over 1998−2001 has confirmed widespread absence of phascogales from the central and eastern wheatbelt (Orell 2004). However, there have been several community sightings in the eastern wheatbelt, suggesting that scattered populations may persist in this region (Short & Hide 2012).

Phascogales were historically reported at sites along the south coast, and may still occur in very isolated locations in this region but in very low numbers (Short & Hide 2012). Trapping over a 4−5 year period at sites along the south coast did not reveal the presence of this species, with only a single individual captured within Fitzgerald River National Park in 1999 (Orell 2004). Extensive trapping (around 4500 trap-nights) within the Esperance Plains bioregion in the 1990s

and early 2000s caught only a single individual (Sanders pers. comm., cited in Short & Hide 2012).

There has been no robust estimate of population size. Numbers fluctuate greatly with rainfall; numbers caught at three annual trapping sessions were 125 (1994), 94 (1995) and 129 (1996) with the low numbers in 1995 correlated with low rainfall in the previous year (Friend & Scanlon 1996). At individual trapping grids, numbers caught fluctuated by up to 19 individuals (and up to five-fold) between consecutive years (Friend & Scanlon 1996). Remnant, isolated subpopulations are vulnerable to drought and a run of low rainfall years.

Semi-regular monitoring on nine wheatbelt sites widely distributed (in the north to south direction) across the current range, as part of a project to determine the effect of fox control on populations, shows an apparent population decline between 2003 and 2012, particularly in those populations that occur in areas without fox control (Table 1). However, the changes in numbers are within the range of natural fluctuation for the species. All monitored populations have persisted since the early 1990s despite some being in small isolated reserves (Friend pers. comm., cited in WA DPaW 2016a), and the numbers of individuals trapped have increased at some sites. Thus clear conclusions about population trends are difficult to draw.

**Table 1. Latest subpopulation information for 9 wheatbelt sites, obtained via targeted surveys (WA DPaW 2016a).**

| Location | No. of mature individuals trapped | | Condition of subpopulation |
|---|---|---|---|
| | 2003 | 2012 | |
| Dryandra State Forest | 1 | 3 | Numbers are always low on these monitoring grids. |
| Tutanning Nature Reserve | 19 | 4 | Currently doing well. |
| Boyagin | 7 | 8 | Stable despite extensive wind damage to one of the two grids. |
| Jaloran | 16 | 5 | Senescing. Fox control ceased since 2003. Open vegetation community. |
| Dongolocking | 15 | 12 | Unknown. Fox control ceased since 2003. |
| Pingeculling | 9 | 14 | Unknown. Fox control ceased since 2003. |
| East Yomaning | 26 | 17 | Unknown. Fox control ceased since 2003. |
| West Ashyby | 30 | 5 | Site always subject to large fluctuations, with no obvious change in vegetation (no fox control). |
| Boundain | 17 | 27 | Unknown. No fox control. |
| TOTAL | 140 | 95 | |

Following assessment of the data, the Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

| 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 km²** | **< 5,000 km²** | **< 20,000 km²** |
| B2. | Area of occupancy (AOO) | **< 10 km²** | **< 500 km²** | **< 2,000 km²** |
| AND at least 2 of the following 3 conditions: | | | | |
| (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:**

**Eligible under Criterion 2 B2 (a),(b)(iii)(iv) for listing as Vulnerable**

The extent of occurrence is estimated to be 50 500 km$^2$, calculated using a minimum convex polygon around post-2004 database records (WA DPaW 2016a). The area of occupancy is estimated at 244 - 260 km$^2$ using 2x2 km grids on post-2004 record points (WA DPaW 2016a). Woinarski et al. (2014), which estimated the AOO at 280 km$^2$, considered this to be a significant underestimate due to limited sampling across the occupied range, and that the AOO was likely to be greater than 2000 km$^2$. Short & Hide (2012), based on the percentage of the post-1990 distribution which has been cleared for agriculture and the proportion of likely remaining suitable habitat, estimated the AOO to be 3000−3500 km$^2$.

The species has been recorded from 142 locations post-1990 (Short & Hide 2012). Records were identified as being from a single location if they were associated with a discrete patch of remnant vegetation, or were within 2 km of another record or remnant known to contain the phascogale. Most reserves where the species has been recorded are small and less than 500 ha, and the distribution is highly fragmented (Short & Hide 2012).

A continuing decline is inferred in the quality of habitat, with degradation of both bushland remnants and linkages between remnants, and in the number of locations. The number of mature individuals fluctuates by up to five-fold in response to rainfall (Friend & Scanlon 1996), and due to annual male die-off and varying annual juvenile recruitment (Bradley 1997); however, these fluctuations are not considered extreme.

The Committee considers that, based on the information available, the AOO is likely to be somewhere between 244 km$^2$ and 2000 km$^2$ with a severely fragmented distribution and an inferred continuing decline. The listing status therefore falls in the range of Vulnerable to Endangered. Given the limited monitoring undertaken across the species' distribution, it is more likely that the species meets the eligibility criteria for Vulnerable.

| 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) | **Very high rate 25% in 3 years or 1 generation (whichever is longer)** | **High rate 20% in 5 years or 2 generation (whichever is longer)** | **Substantial rate 10% in 10 years or 3 generations (whichever is longer)** |
| 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 | **≤ 50** | **≤ 250** | **≤ 1,000** |
| | (ii) % of mature individuals in one subpopulation = | **90 – 100%** | **95 – 100%** | **100%** |
| (b) | Extreme fluctuations in the number of mature individuals | | | |

**Evidence:**

**Insufficient data to determine eligibility**

There are currently no population estimates for this species. Assuming an AOO of 260 km$^2$, a home range of 5 ha and two adults per home range, this gives a rough estimate of 10 4000 mature individuals. Woinarski et al. (2014) consider that the number of mature individuals is 'possibly' fewer than 10 000. However, there are no data to demonstrate that the population size is clearly more or less than 10 000.

The Committee considers that there is insufficient information to determine the eligibility of the species for listing in any category under this criterion.

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

**Evidence:**

**Not eligible**

There are currently no population estimates for this species. However, the population size is very likely to be greater than 1000 mature individuals (see Criterion 3).

The Committee considers that the species is not eligible for listing under this criterion.

| 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:**

**Insufficient data to determine eligibility**

Population viability analysis has not been undertaken.

## Conservation Actions

### Recovery Plan

There is no recovery plan currently in place for the species. A recovery plan is not recommended, as an approved Conservation Advice provides sufficient direction to implement priority actions, mitigate against key threats and enable recovery.

### Primary Conservation Actions

1. Maintain ongoing feral cat and fox control across the species' distribution.
2. Manage and rehabilitate woodlands within remnant vegetation.
3. Develop woodland corridors between small remnants.
4. Encourage participation by local landholders in programs to re-establish woodland linkages, establish nest boxes at sites where suitable nesting hollows are lacking, and to control feral cats and foxes.

### Conservation and Management Priorities

The species is a target species for protection under the Western Shield program, which is aimed at controlling introduced predators such as feral cats and foxes (WA DPaW 2016b). Protected areas are also managed to limit the impacts of fire. Some farming communities are developing programs to establish nest boxes for the red-tailed phascogale in areas where old-growth eucalypts are in short supply from past selective clearing of woodland. In areas where phascogales are known to occur, there is a developing program to encourage local rural shires to trap feral cats at their rubbish tips in an attempt to reduce cat numbers. There have been two re-introductions to the Western Australian wheatbelt, one to a cat- and fox- free area and one to an area with fox control (Short & Stone 2009). The long-term outcome of these is yet to be determined.

Existing plans that are relevant to the species include:

- Threat abatement plan and background document for predation by the European red fox (DEWHA 2008a,b).
- Threat abatement plan and background document for predation by feral cats (DotE 2015 a,b).
- Western Shield program (WA DPaW 2012).
- Red-tailed phascogale conservation plan for the Wheatbelt populations (DEC 2009).

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

| Theme | Specific actions | Priority |
|---|---|---|
| Active mitigation of threats | Manage fire in protected areas to maintain old growth Wandoo and York gum woodlands. | High |
| | Implement broad-scale predator control, and/or high intensity control at important subpopulations. | Medium-high |
| | Restore habitat connectivity. | Medium |
| Captive breeding | N/a | |
| Quarantining isolated populations | N/a | |
| Translocation | Reintroduce to large woodland protected areas combined with cat control. | Low |
| Monitoring | Monitor representative subpopulations in protected areas. | Medium |
| Community engagement | Involve local communities in managing remnant vegetation and phascogales. | Medium |
| | Seek conservation covenants on private or leasehold lands holding important subpopulations. | Medium |

**Survey and Monitoring priorities**

| Theme | Specific actions | Priority |
|---|---|---|
| Survey to better define distribution | More precisely delineate subpopulations, and estimate their population sizes. | Medium |
| Establish or enhance monitoring program | Design and implement a monitoring system that is representative of the species' range and habitat variation, and link to the assessment of management effectiveness. | Medium |

**Information and Research priorities**

| Theme | Specific actions | Priority |
|---|---|---|
| Assess impacts of threats on species | Assess impacts of a range of fire regimes, and identify an optimal regime to maintain an appropriate vegetation structure/ composition. | Medium |
| | Assess population-level impacts of cat predation. | Medium |
| | Assess population-level impacts of fox predation. | Medium |
| | Assess use of and viability in fragments of varying sizes, and identify threshold sizes for population viability. | Medium |
| | Determine the structure of metapopulations, movement patterns, and the impact of barriers to recolonisation following drought | Low-Medium |
| Assess effectiveness of threat mitigation options | Assess responses to fire and predator management. | High |
| Resolve taxonomic uncertainties | N/a | |
| Assess habitat requirements | Assess the ecology of populations in non-wandoo vegetation associations | Low-Medium |

| | | |
|---|---|---|
| Assess diet, life history | N/a | |
| Undertake research to develop new or enhance existing management mechanisms | Develop broad-scale, targeted feral cat eradication technology. | High |

## Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **transferring** from the Endangered category to the Vulnerable category:

*Phascogale calura*

(ii) The Committee recommends that there should not be a recovery plan for the species.

Threatened Species Scientific Committee

06/09/2016

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