TRANSLOCATION PROPOSAL

Reintroduction of the Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*) from WA Wheatbelt populations to Kalbarri National Park

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March 2016

1. INTRODUCTION

This translocation proposal forms part of the South West Fauna Recovery Project for Kalbarri National Park (KNP). In conjunction with the translocation of BFRW to KNP, integration of the Eradicat feral cat bait with existing fox baiting will be initiated in KNP in 2016/17. Monitoring of foxes and feral cats to assess the effectiveness of feral cat and fox baiting to control introduced predators in KNP will be assessed separately to the translocation.

1.1 Purpose of translocation

This proposal is for the supplementation of a newly-discovered population of Black-flanked Rock-wallabies (*Petrogale lateralis lateralis*, hereafter referred to as BFRW), in Kalbarri National Park (Western Australia) and the establishment of a further two populations of BFRW at other locations in the Park. BFRW were believed to have become extinct in Kalbarri NP around 1995 until two individuals were identified downstream of Z Bend in August 2016.

A translocation of rock-wallabies to Kalbarri National Park from the Wheatbelt was identified as an action in the Recovery Plan for a number of rock-wallabies in WA including BFRW (Pearson 2013).

The proposed sources of individuals for the translocation are populations in the WA Wheatbelt. The translocation is fundamental for the long-term management of the sub-species and critical for the Wheatbelt populations, as it will provide both an “insurance” population in Kalbarri NP and a large area of suitable habitat that can receive rock-wallabies over a long period of time when the carrying capacities of Wheatbelt sites are exceeded. A population management strategy for the Wheatbelt

populations is currently under development and other translocation options will be considered.

Reintroduction	X
Introduction	

	Main Purpose (tick one only)	Secondary Purposes (tick many if required)
Species Conservation	X	
Fauna Reconstruction		X
Education		
Salvage / Relocation		
Research		
Population or genetic reinforcement		X

Other (please explain): Protection of habitat and rare flora at the Wheatbelt source populations as high population numbers in the past have led to overgrazing and population crashes.

1.2. Goal of Translocation

To establish a robust and genetically diverse population of the threatened BFRW in Kalbarri National Park, that includes unique Kalbarri rock-wallaby genes. This national park contains a large area of previously occupied habitat. Successful re-establishment of a population in Kalbarri NP will greatly increase the total population size of this taxon and lead to the reoccupation of a considerable area of former habitat.

Following reintroduction into Kalbarri NP, BFRW should increase steadily in number from the original founders, demonstrating successful breeding and recruitment to the adult population at a rate faster than the adult replacement rate. As the population grows, rock-wallabies should spread from the release site(s) to occupy other suitable habitat in the Park. The planned small supplementation at the only known site of Kalbarri rock-wallabies should ensure the persistence of any unique Kalbarri genes.

1.3 Summary

Taxon involved: Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)

Conservation status: National- *Environment Protection and Biodiversity Conservation Act 1999:* Vulnerable

WA- WA Wildlife and Conservation Act (1950): Schedule 2 Fauna that is rare or is likely to become extinct as endangered fauna

Reasons for decline: Predation by introduced predators (fox and feral cat); clearing, isolation and degradation of habitat (goat and rabbit grazing, soil erosion, weeds); and competition for shelter sites with goats.

Number of animals to be translocated: A number of translocations are proposed. Firstly, a supplementation of three Wheatbelt females alongside the existing known Kalbarri population. Secondly and contemporaneously with the supplementation, a translocation of 20-30 Wheatbelt BFRW. The precise number will depend on the likely impact on the source populations (i.e. aiming for negligible long term impact on numbers and genetic diversity).

Two further translocations of groups of up to 20-30 animals are proposed to occur either annually or over a three year period, depending on the success of the initial translocation and the ability of source populations to sustain the offtake. After a five year period, it is envisaged that at least three populations along the Murchison Gorge system will have been established and successful recruitment of wild born young to the adult population will be occurring.

Proposed date of translocation: supplementation and initial translocation in April/May 2016, with subsequent translocations, depending on the success of the first, in April/May 2017 and April/May 2018.

Source locations: Wheatbelt rock-wallaby populations, especially the two largest populations of Mt Caroline and Nangeen Hill. At both sites habitat is degraded and a recently constructed predator-proof fence is likely to result in a steady BFRW population increase and potential over-grazing issues if rabbits are not adequately controlled. Rock-wallabies will also be sourced from other smaller Wheatbelt populations to maximize genetic variation in translocated animals. Selection of suitable animals for translocation will be done in consultation with geneticist Dr. Mark Eldridge at the Australian Museum and the Central Wheatbelt at the conclusion of the 2016 census for Mt Caroline and Nangeen Hill Nature Reserves.

Release locations: Kalbarri National Park- the Murchison River arcs through the Park and has incised a deep gorge through its sandstone, providing a vast area of suitable habitat.

The supplementation will occur alongside the only known extant Kalbarri rock-wallaby population at a site known as the “Promenade”, approximately 800 m downstream of the Z Bend Lookout (27^0 39’ 23” S, 114^0 27’ 50’ E) in April/May 2016.

The reintroduction in April/May 2016 will be to an area 500 m upstream of Four Ways (27^0 38’ 06” S, 114^0 28’ 23” E) and 2.5 km from the population above.

The reintroduction in April/May 2017 will be to an area 420 m downstream of Hawks Head Lookout (27^0 47’ 08” S, 114^0 28’ 30” E).

Justification of translocation: BFRW probably occurred along most of the rugged section of the Murchison Gorge prior to European settlement. The timing of the historical decline of the taxon in the Gorge is unknown, but it was not detected between 1995 and 2015. This reintroduction would return BFRWs to a large area of previously occupied habitat. It would establish another meta-population of the taxon in a geographic region where the taxon has declined dramatically and should lead to a profound increase in the overall numbers of the species *P. lateralis* and the subspecies *P. l. lateralis*. This would potentially result in a significant improvement in the conservation status of the species.

In addition, it provides a solution to the problem of unsustainable numbers in Wheatbelt populations. Regular translocation of animals from Wheatbelt populations could help reduce the severity or regularity of boom-bust cycles. This typically occurs as a result of good population growth due to reduced predation but insufficient forage as a consequence of drought, drier winters or uncontrolled grazing by other herbivores. In turn, a Kalbarri population in the future could provide a source of

animals (an “insurance population”) to repopulate Wheatbelt sites should any disaster befall the area (e.g. catastrophic feral animal incursion, disease or severe drought). The supplementation of the existing Kalbarri population should ensure the perpetuation of unique Kalbarri genes.

The BFRW is an iconic species (State-wide and locally) that has appeared on Kalbarri NP posters and in interpretative material. Its reintroduction and the possibility of visitors to the Park eventually observing it from lookouts, would result in valuable and rewarding interpretative opportunities as well as enhancing the overall conservation value of Kalbarri NP.

1.4. Name and Affiliation of Proponents

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2. THE TAXON

2.1 Description

Adult males of *P. l. lateralis* weigh 3.0-6.0kg and females 2.0kg-4.5kg (Pentland and Moore unpublished Central Wheatbelt trapping data). It has dark grey-brown dorsal fur, with a paler chest which grades to dark brown on the belly. There are prominent black and white lateral stripes extending from the armpit to the hip. The coat is thick especially about the rump, flanks and tail. The face is dark-grey with a prominent white cheek stripe extending to the ear and edged by a dark-brown to black stripe from the snout through the eye and to the ear. There is a variably developed dark-brown to black stripe running along the midline of the head from between the eyes and ears, down the neck and onto the back. The feet and forearms are sandy yellow, darker below with dark brown to black paws. The tail is grey-brown grading to black at the distal end with a slight terminal brush (Eldridge and Pearson 2008, Pearson 2012).

Figure 1: Remote camera photo of the female rock-wallaby and joey recently discovered in Kalbarri NP.

2.2 Taxonomy

John Gould (1842) described *Petrogale lateralis* from specimens collected by John Gilbert from the "Colony of Swan River", Western Australia (Eldridge 1997). A number of subspecies and chromosomal races have been described over subsequent years using morphological and genetic techniques and are summarised below along with their conservation status:

P. lateralis lateralis
Black-flanked rock-wallaby, warru
Environment Protection and Biodiversity Conservation (EPBC) *Act* (1999): Vulnerable
Western Australian *Wildlife Conservation Act* (1950): Endangered

P. lateralis hacketti
Recherche rock-wallaby
EPBC Act (1999): Vulnerable
WA *Wildlife Conservation Act* (1950): Vulnerable

P. lateralis pearsoni
Pearson Island rock-wallaby
EPBC Act (1999): Vulnerable
South Australian *National Parks and Wildlife Act* (1972), Schedule 8: Vulnerable

P. lateralis subsp. (ANWC CM15314) MacDonnell Ranges race
MacDonnell Range rock-wallaby
EPBC Act (1999): Vulnerable
SA *National Parks and Wildlife Act* (1972), Schedule 7: Endangered
WA *Wildlife Conservation Act* (1950): Vulnerable
Territory Parks and Wildlife Conservation Act (2000): Not listed.

P. lateralis subsp. (WAM M15135) West Kimberley race
West Kimberley rock-wallaby
EPBC Act (1999): Vulnerable
WA *Wildlife Conservation Act* (1950): Endangered

Petrogale l. lateralis and *P. l. pearsoni* share the ancestral 2n=22 karyotype, while *P.l. hacketti* and *P. l.* West Kimberley race possess 2n=20. The karyotype of *P. l.* MacDonnell Ranges race (2n=22) differs from *P. l. lateralis* by having a derived chromosomal arrangements to chromosomes 3, X and 1 (Eldridge and Close 1997).

This translocation involves only the subspecies *Petrogale lateralis lateralis.*

2.3 Conservation Status

National- *Environment Protection and Biodiversity Conservation Act 1999*- Vulnerable

WA- WA Wildlife and Conservation Act (1950): Schedule 2 Fauna that is rare or is likely to become extinctas endangered fauna

2.4 Distribution and Demographics

At the time of European settlement, *P. lateralis* was distributed patchily across much of the western half of Australia (see Fig 1). Despite this vast distribution, populations were scattered and restricted to sites where suitable rocky habitat existed. The widely disjunct current distribution suggests that there must have been intervening populations, a proposition supported by sub-fossil records from south-west WA.

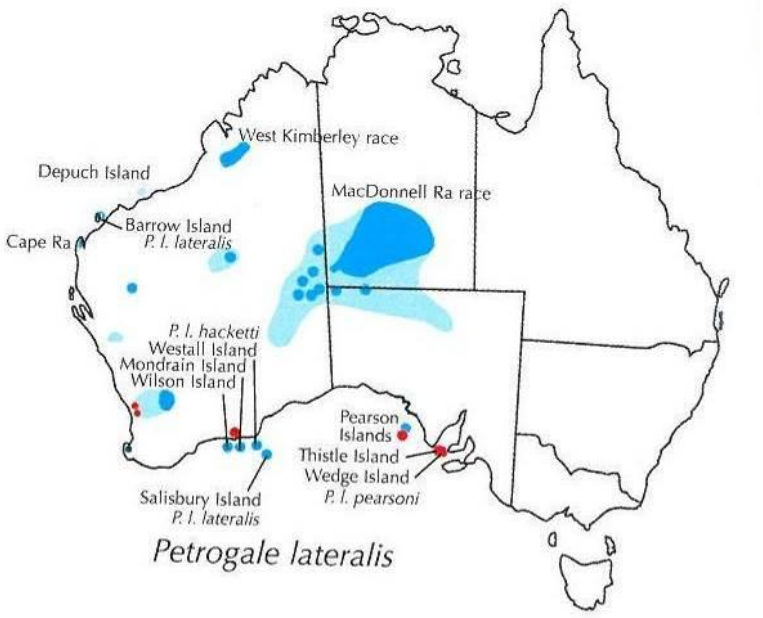

Figure 1: Current (dark blue) and former (light blue) distribution of the five morphologically or genetically distinct forms of Petrogale lateralis *and reintroduction sites (in red). Note that the recently discovered Kalbarri population is not shown as extant [Eldridge and Pearson 2008.]*

The northern-most records of this subspecies are from Depuch Island on the northern margin of the Pilbara. This population is now extinct. East of the Pilbara Region in the Little Sandy Desert, *P. l. lateralis* formerly occurred in a number of ranges including the Durba Hills (Pearson 1992), Sir Fowell Headland (Burbidge and Pearson 1989), the Carnarvon Ranges (Eldridge and Pearson 2008) and the Calvert Range (Burbidge and Pearson 1989, Hall and Kinnear 1991). They persist in the Calvert Range (Fig 1) and have been translocated to the nearby Durba Hills. There are recent records of the taxon at 6 sites in the McKay Range-Rudall River area.

A north-western outlier of *P. l. lateralis* extends south from North-west Cape through Cape Range NP, including the Learmonth Air Weapons Range and into Ningaloo Station. Extant populations occur in several gorges through this area where suitable caves and crevices exist. Little is known about the extent of the distribution of BFRW in Kalbarri, but it was probably widespread and was commonly observed at several sites in the decades prior to 1995. There is a substantial area of habitat along the lower reaches of the Murchison River, which empties into the ocean at Kalbarri township.

In the WA Wheatbelt, it is still extant at six sites: Nangeen Hill, Mount Caroline, Kokerbin Rock, Mt Stirling and Gundaring Nature Reserves and on Sales Rock. The population at Mt Stirling and Kokerbin appeared to be a critically low level, A population at Querekin Rock was translocated to Nangeen Hill and Mt Caroline NR's in 2013 when the land-owner withdrew permission to undertake fox baiting. The Central Wheatbelt meta-population had an estimated size of 185 individuals in 2014.

To the west of the Wheatbelt populations, *P. l. lateralis* formerly occurred along the Avon Valley behind Perth (where the type specimen was collected by John Gilbert). Along this valley, it has been translocated into Paruna Sanctuary and Avon and Walyunga National Parks.

Petrogale l. lateralis is known to have occurred on the southern coastline of WA (Baynes 1987) perhaps as far east as Mount Ragged (Pearson and Kinnear 1997) and there are sub-fossil records from Devil's Lair Cave near Margaret River (Dortch and 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, 35km north-west of Merredin.

This taxon is also found on Salisbury Island (368ha) in the Recherche Archipelago, and on Barrow Island (23,483ha). None are known to be kept in captivity

2.5 Ecology and Biology

BFRW in the WA Wheatbelt are found in a series of granite inselbergs separated by farmland. They shelter in caves and crevices between boulders and occasionally, when numbers are very high, in machinery sheds and other buildings of nearby farms. The vegetation in their habitat is typically York gum eucalypt woodland over acacia shrubland and areas of shrublands with native and introduced herbs and grasses providing the majority of feeding sites on the apron of colluvium around the base of the outcrops.

Along the Murchison River in Kalbarri NP, *P. l. lateralis* occupied sandstone cliffs with caves and overhangs and boulder piles created by cliff collapses. The vegetation in the gorge is primarily eucalypts and *Melaleuca* spp. with seasonal grasses and herbs and on the gorge sides, open shrubland of a mixture of species dominated by *Acacia* spp. and *Allocasuarina* spp.

Habitat critical to the survival of *P. l. lateralis* includes: rocky substrates which have extensive development of multi-entranced caves, rock-piles and crevices that provide cool refuges from extremes of heat and protection from predators.

They are primarily crepuscular and nocturnal emerging from their rocky shelters to feed on grasses, forbs, browse and occasionally seeds and fruits such as figs. Typically they forage close to their rocky refuges to allow rapid retreat from predators.(Pentland 2015) Known predators include foxes, dingoes/dogs, feral cats, eagles, pythons and large goannas (Eldridge and Pearson 2008). Body condition is linked to rainfall and females in good body condition tend to breed more frequently. In WA Wheatbelt populations, births are distributed throughout the year but with peaks in autumn and late winter/spring (Willers *et al.* 2011).Young remain in the pouch for about six months, are weaned around at 11 months and reach sexual maturity in their third year (Kinnear et al. 1988). Their longevity is clearly linked to environmental conditions but they can live up to 12 years in the Central Wheatbelt. (Kinnear, Pentland and Moore pers. comm)

BFRW are typically sedentary,. Males can wander widely in search of mates and females can also move large distances. They are known to move up to 300 m from rockpiles to forage but this only seems to occur in exceptional circumstances eg when numbers are high. The presence of feral predators has been shown to set up a predator fear behavior which restricts the animals to only forage close to their shelter sites, within 30m. (Pentland 2015). BFRW are known to disperse several kilometres, but such long range dispersal is infrequent based on the genetic structuring of populations.

The minimum area required to support a viable population is not known and is dependent on many factors. Certainly, the BFRW is able to live in relatively small rockpiles with small numbers of individuals for many years. They appear to be able to tolerate high levels of inbreeding.

2.6 Threats and Causes of Decline

The major historical reasons for the decline of BFRW are:

- Clearing and alienation of habitat for agriculture and pastoralism
- Predation by foxes, dingoes, wild dogs and feral cats
- Habitat degradation due to goats, weed invasion and rabbits (Pearson 2012)

Fox predation has been found to be a major threat to the persistence of WA Wheatbelt rock wallabies (Kinnear *et al.* 1988, 1998) and a primary factor in their disappearance from Kalbarri NP (in concert with feral goats) (Pearson and Kinnear 1997). Foxes are also surplus killers and multiple predation events can be episodic, leading to rapid declines in small rock-wallaby populations, with animals persisting only at sites that provide good predator refugia (C. Pentland 2014.).

The role of feral cats has been unclear, but there is now evidence that cats are able to take juveniles and small adults and severely limit population recruitment (J. Kinnear pers. comm.). The Nangeen predator fence appears to have removed the differential effects of cat predation on recruitment, There is now a continuum of size classes apparent in this population (which is now protected from fox and feral cat predation) that was absent in those populations managed with fox-specific baiting (C Pentland, unpub.trapping data). Cats are regularly seen on cameras in and around critical rock wallaby refugia and during site visits to the rock wallaby sites (N. Moore, pers. obs.).

The effects of past clearing and the fragmentation of natural vegetation around rock outcrops tends to isolate populations making dispersal more hazardous, reducing food resources around shelter sites and exposing rock-wallabies to increased predation. In addition, this isolation makes small individual populations more susceptible to the loss of genetic variation.

The activities of rabbits at the Wheatbelt sites (grazing pressure and selective grazing) reduces potential food plant biomass and encourages the spread and dominance of unpalatable weeds.

Feral goats are not present at Wheatbelt sites, but are present in Kalbarri NP. Goats reduce available forage for rock-wallabies and their selective grazing tends to lead to increases in woody, spiny and unpalatable plant species. There are records in Cape Range NP of goats excluding or evicting rock-wallabies from shelter sites.

Figure 2: Feral goats and a rock-wallaby at Ningaloo Station south of Cape Range NP. Note the much larger size of feral goats (Photo D. Pearson, Department of Parks and Wildlife).

The potential impact of climate change on rock-wallabies is likely to vary according to the location.

A predicted drying trend for Wheatbelt winters will reduce the productivity of vegetation on granite outcrops and in turn reduce the carrying capacity of rock-wallabies. Conversely, an apparent increase in summer rainfall and decline in the reliability of winter rainfall may lead to a shift in pastures to containing more summer growing annuals. This could then interact with other factors to make the populations more susceptible to boom-bust population cycles and genetic bottlenecks.

2.7 Translocation History

BFRW (*P. l. lateralis*) have been translocated to a number of sites using source animals from Wheatbelt populations (see Table 1).

Table 1: Translocations of Black-flanked rock-wallabies (*Petrogale lateralis lateralis*)

Year	Source population	Destination	No. BFRW`s translocated
1990	Nangeen Hill NR	Querekin Rock	10
2001	Mt. Caroline NR	Paruna Sanctuary	10
2001	Mt. Caroline NR	Avon Valley NP	37
2002	Querekin Rock	Paruna Sanctuary	12
2002	Querekin Rock	Avon Valley NP	9
2002	Mt. Caroline NR	Walyunga NP	29
2003	Mt. Caroline NR	Avon Valley NP	2
2003	Querekin Rock	Avon Valley NP	16
2003	Mt. Caroline NR	Paruna Sanctuary	1
2003	Querekin Rock	Paruna Sanctuary	20
2003	Mt. Caroline NR	Cape Le Grand NP	14
2004	Mt. Caroline NR	Walyunga NP	27
2004	Querekin Rock	Cape Le Grand NP	10
2004	Mt. Caroline NR	Cape Le Grand NP	8
2005	Querekin Rock	Paruna Sanctuary	15
2007	Mount Caroline	Paruna Sanctuary	8
2007	Querekin Rock	Paruna Sanctuary	11
2008	Querekin Rock	Avon Valley NP	5
2009	Querekin Rock	Avon Valley NP	3
2009	Mt Stirling	Querekin	1
2010	Querekin	Paruna Sanctuary	1
2010	Mt Stirling	Querekin	1
2013	Querekin	Nangeen	17
2013	Querekin	Mt Caroline	21
2013	Mt Stirling	Sales	2
TOTAL TO DATE			288

Wheatbelt populations

There have been two short distance translocations between Wheatbelt populations in response to management issues such as the inability to adequately carry out predator baiting, static low populations and the removal of land-holder permission to lay predator baits and to improve genetic diversity among populations (Querekin Rock; Mt Stirling NR).

Avon Valley, Walyunga and Paruna

Wheatbelt animals have been translocated into Avon Valley and Walyunga NPs and into adjoining Paruna Sanctuary controlled by the Australian Wildlife Conservancy (Orell 2001). The species had been absent from the Avon Valley for a considerable but unknown time, an area that Gilbert in Gould (1842) had reported the species to be “very abundant”.

Cape Le Grand NP

A translocation of rock wallabies (*P. l. lateralis*) to Cape Le Grand NP east of Esperance was carried out in 2003, with animals from Mount Caroline and Querekin Rock in the Wheatbelt (Orell 2003). Cape Le Grand NP has an area of 31,578ha and is considered to be part of the historic range of the species (Baynes 1987). It contains a large area of granite and dolerite outcrops with numerous caves. Camera trapping, begun in 2011, has confirmed this population is still extant and appears to be expanding to other habitat.

Calvert Range to the Durba Hills (Little Sandy Desert)

A translocation of 26 *P.l. lateralis* from the Calvert Range to the Durba Hills was undertaken in September 2013 by the Department of Environment and Conservation with the assistance of the local Aboriginal people and their land management agency KJ. Sixteen animals (8 males:8 females) were released in Pinpi Gorge and the remaining 10 into Jilikurru Gorge. Many of the rock-wallabies were fitted with radio-transmitters including some with Argos satellite collars.

This translocation has been successful with only one recorded mortality of a female that appears to be from misadventure when she fell into a crevice and could not escape. Monitoring of radio-telemetered animals and trail cameras has shown that the animals have expanded into areas well beyond the release site.

Other translocations

In addition, there have been a number of translocations of the related genetic race *Petrogale lateralis* MacDonnell Ranges race, including Arltunga Gorge to Simpsons Gap, NT (in the 1980s, see Pearson 2012) and Monarto Zoo captives to a predator proof pen in the north-west corner of SA with the eventual aim of wild release (Warru Recovery Team 2012).

Most of these translocations have been successful with the persistence of rock-wallabies at release sites. Difficulties in monitoring populations in remote and rugged habitats have limited knowledge on the extent of population growth and dispersal to unoccupied habitat in some of these translocations. Translocations into the Avon

Valley have been sporadically monitored and it would seem the lack of good refugia has restricted growth of populations. Overall, the success of translocations of *P. lateralis* indicates its resilience and potential for establishment if threatening factors (especially fox and feral cat predation) can be reduced.

None of the translocations above have been undertaken into areas where goats are a significant threatening factor. Goats and pigs are present in the Avon Valley at a translocation site, but at much lower densities than historically in Kalbarri NP. Uncontrolled goat populations have the potential to result in significant habitat degradation, competition for food and exclusion of BFRW from preferred shelter sites (Pearson 2012). Ongoing goat control is required in Kalbarri NP.

3. BIOLOGICAL FEASIBILITY

3.1 Justification

To establish a viable population of the threatened BFRW in Kalbarri National Park and to supplement a small existing Kalbarri population to ensure the survival of unique Kalbarri genes. Successful establishment of a population in Kalbarri NP will increase the total population size of this taxon and lead to the reoccupation of a considerable area of former habitat. The purpose of the translocation is to improve the conservation status of the BFRW by:

1. increasing the overall population size of the subspecies and maintaining known genetic diversity

2. establishing a large “insurance” population in a geographic area distant from the Wheatbelt should animals be needed for supplementation or reintroduction if an existing population has succumbed/declined due to predation or an stochastic event such as drought

3. enabling the strategic management of Wheatbelt populations and their habitats, especially the removal of excess rock-wallabies to reduce over-grazing and degradation of habitat.

The goal and purpose of this translocation proposal is consistent with the Recovery Plan for the species (Pearson 2012). It addresses the following recovery actions:

5.1 Conduct further translocations of *P. lateralis* to areas within its known range where populations have become extinct (translocation to Kalbarri NP is specifically mentioned in this action).

7 Manage habitat to maintain or improve its carrying capacity for rock-wallabies and to permit successful breeding and dispersal

8.10 Continue to develop and improve methods of captive care and translocation of rock-wallabies

9.2 Involve the community, especially Aboriginal people, in the survey and management of rock-wallabies

and the performance criteria:

- Increase the area or number of sites occupied by mainland *P. lateralis* populations

The translocation will occur in two stages. The first stage of the translocation will occur in 2016 and will involve a small supplementation of the existing BFRW population and the establishment of a trial population in close proximity to the existing population. Three adult females will be introduced to the Promenade site with the intent of providing breeding opportunities for the resident male and maintaining some of the Kalbarri genetic variation. 15-20 animals will be translocated to the Four Ways site to determine the suitability of habitat and potential for population establishment.

Stage two of the translocation will occur in 2017 and, depending on the success of stage 1, will involve a top-up translocation to the Four Ways site and the establishment of another population of around 30 animals at Hawks Head.

3.2 Source environment and population

Founders for the Stage 1 translocation will be sourced from Wheatbelt populations, predominantly the larger and more genetically diverse populations of Nangeen Hill and Mt Caroline. Decisions on the individuals used for the translocation will be guided by the principle of maximizing the genetic diversity of the founders, so they encompass as much of the overall genetic diversity of the Wheatbelt populations as possible. In addition, information on the physical condition of individuals will be available from 2016 survey data.

Good genetic data are available for most individuals currently in the Wheatbelt following analysis of recent and historical samples (Eldridge and Ottewell (2015). Wallabies for translocation will be selected using this as a guide to maximizing genetic diversity without compromising the integrity of the Wheatbelt populations and their ability to continue to be used as sources for future translocations. Other considerations in the selection of suitable animals will be their reproductive status (i.e. not translocate females with large pouch young to avoid their ejection from the pouch) and body condition (not translocate old rock-wallabies or those in poor body condition) and to avoid the translocation of large males (over 4.5kg) which may be especially important in local dominance and reproduction.

The proposed sex ratio is near to 1:1, but depends on the availability of suitable translocation candidates. A female bias would be preferable to increase the potential reproductive output of the population.

It is proposed that the initial translocation will move up to 20 individuals for the Four-ways site and three females for the Promenade site. This number is sufficient to establish a population in the short term and subsequent top-up translocations can improve the overall genetic variation. In addition, the removal of this number of rock-wallabies is unlikely to cause any long-term negative impacts on the source populations. It is proposed to source the animals for the initial translocation from Mt Caroline and Nangeen Hill populations. These are the two biggest populations and have reasonable genetic diversity. The Nangeen Hill population in 2012 numbered 9 individuals but now has a predator-proof fence around it and a number of animals from Querekin Rock were moved into it in 2013. Release from predation by foxes and cats and the addition of the Querekin animals has allowed for a steady increase in the population. Trapping data in 2014 indicated 39 individuals (26 adults – 15 males and 24 females,16 sub adults, 15 py with 71% of females breeding). Nangeen Hill will be retrapped immediately prior to the translocation but total population is expected to be approximately 50-60 individuals. Mt Caroline NR has also increased in total known population from 70 (37 males/33 females) in 2010, 80 (45 males/35 females) in 2012 and 100 (55 males/45 females) in 2014.

In subsequent translocations, it is proposed that individuals from other Wheatbelt populations will be added to the Kalbarri NP population to enhance its genetic variation. Other populations in arid areas such as Cape Range or the Calvert Ranges may be used as well, depending on how well the Wheatbelt populations recover from the removal of animals in 2016 and the logistics of translocating animals from the other sites.

Source environments

Mt Caroline and Nangeen Hill nature reserves are located within a zone of ancient drainage which is characterized by broad flat valleys of low gradient with salt lake chains in the lowest parts of the landscape; gently sloping valley sides with some rock outcrops and large areas of yellow sandplain. Both reserves contain granitic outcrops with steep slopes and outwash areas of rocky hillslopes containing red brown loams and grey loamy sands.

Vegetation communities present include a range of structural types typical of granite outcrops of the central Wheatbelt. Significant areas of bare rock with minor areas of forbs on skeletal soils are present on the rock itself, with small pockets of shrubland or low mallee woodland on deeper soils mostly in depressions. Outwash areas at the bottom of the slopes support taller vegetation due to soil depth and moisture content. Small areas of sandplain and heavier loams are present around the perimeter and support York gum woodlands, tall *Acacia acuminata* and *Allocasuarina* shrublands and open shrublands.

The areas surrounding the reserves have been extensively cleared for agriculture. Much of the remaining vegetation within the regional drainage systems has been significantly modified through grazing of sheep as well as groundwater salinity. The climate for the central Wheatbelt is described as Mediterranean, with hot dry summers and cool wet winters. The long term average rainfall for nearby Kellerberrin is recorded as 329 mm.

Selection of founders

The Mt Caroline and Nangeen Hill populations have been selected as the source of the founders for the initial translocation to Kalbarri NP on account of the size of their populations; the benefits to those reserves from the removal of some rock-wallabies; and their reasonable genetic diversity. As a general principle, an equal sex ratio is preferred.

*Figure 3: Location of source populations in the WA Wheatbelt, (*Mt Caroline NR: 31^0 47' 30" S, 117^0 37' 58" E; Nangeen Hill NR: 31^0 50' 07" S, 117^0 41' 08" E

The populations at Mt Caroline and Nangeen Hill have been trapped regularly as part of research work on the impacts of fox predation (Kinnear *et al*. 2010), the use of contraceptives to control wallaby reproduction (Willers *et al.* 2011) and behavioural studies in relation to the impact of predators on the activity patterns of rock-wallabies (Pentland 2014). Data useful for ascertaining the health of animals have been collected during those studies including body weight and reproductive status, as well as the collection of genetic samples. These data provide a valuable comparative dataset to assess any possible impact of the removal of animals for translocation to Kalbarri NP.

Camera monitoring and monthly scat monitoring plots are set up at Mt Caroline and Nangeen Hill. Regular trapping, of the populations usually occurs on an annual to every 2 years(depending on funding) so it will be possible to assess whether the removal of animals for translocation has any effect on the remaining animals.

3.3 Host environment

Habitats

The townsite of Kalbarri at the mouth of the Murchison River is the closest available meterological station to the proposed release site (approximately 35 km W). It has a similar climate to Kellerberrin (the closest weather station to the Wheatbelt

populations) with hot dry summers and cool winters with rainfall concentrated in the cooler months. The mean maximum temperature in the hottest month of February in Kellerberrin is 33.3^{0}C compared to 34.3^{0}C in Kalbarri. The winters are cooler in Kellerberrin (mean minimum for the coolest month July 5.4^{0}C versus 9.6^{0}C in Kalbarri. Both areas have similar mean annual rainfall (Kellerberrin 327.4 mm compared to 344.7 mm for Kalbarri). The Kalbarri area is more regularly affected by cyclonic cells that sporadically sweep south and may result in large falls of rain and the activation of the Murchison River.

The geology of the two sites is quite different. The Wheatbelt animals live on granitic and related igneous rocks, while the Murchison Gorge cuts through vast layers of sandstone. *Petrogale lateralis* is known to have catholic tastes in regards to the rock under its feet as with its choice of suitable forage. The species is known to occur on sandstones, limestone, granites, basalt, gabbro and a variety of metamorphic surfaces. Vegetation around such outcrops is also highly variable. The important habitat factors for rock-wallabies are the presence of deep cool shelters to escape hot daytime temperatures and predators, while being in close proximity to areas with suitable food plants (Pearson 2012).

Free water is not required by BFRWs, but they will drink if water is available. The presence of free water may enable them to occupy sub-optimal thermal shelters because they are not required to adopt such a conservative water conservation strategy (J. Kinnear pers. comm.)

Kalbarri NP has around 80 km of steeply incised gorge along the Murchison River, at times up to 130 m deep, as well as many more kilometres of subsidiary gorges. It was listed on the Register of the National Estate in 1978 largely due to its scenic beauty and geological landforms. The Tumblagooda sandstone weathers to produce overhangs, caves and cliff collapses that provide the type of sites required by rock-wallabies. Not all the gorge is suitable habitat; areas of vertical cliffs and sloping hillsides without broken outcrops lack suitable shelter or are too difficult for rock-wallabies to traverse.

Figure 4: Overview of the Kalbarri region in GoogleEarth, showing the convoluted nature of the Murchison River as it flows in an arc to the Kalbarri township

Most of the main and side gorges of the Murchison are difficult for people to access. Three designated walking tracks descend into the gorge from its rim and are popular with visitors, but provide easy access to only a few km of gorge. Some hardy walkers, rock-climbers, canyoners (and kayakers in exceptional years) travel along the bottom of the gorge, but generally the public does not venture far into most of the gorge. This is advantageous both to minimize disturbance of the establishing rock-wallabies, but also to permit 1080 baiting of predators and control of goats without the concerns associated with nearby recreation sites.

The area proposed for the supplementation of the existing Kalbarri rock-wallabies is in an area known by rock-climbers as “The Promenade”. It is located 800 m downstream of the Z Bend Lookout (at 27^0 39’ 23” S, 114^0 27’ 50” E). It is an area of steep cliffs and a massive cliff collapse that forms the boulder field currently occupied by the rock-wallabies. The release would take place in crevices near the ones currently occupied.

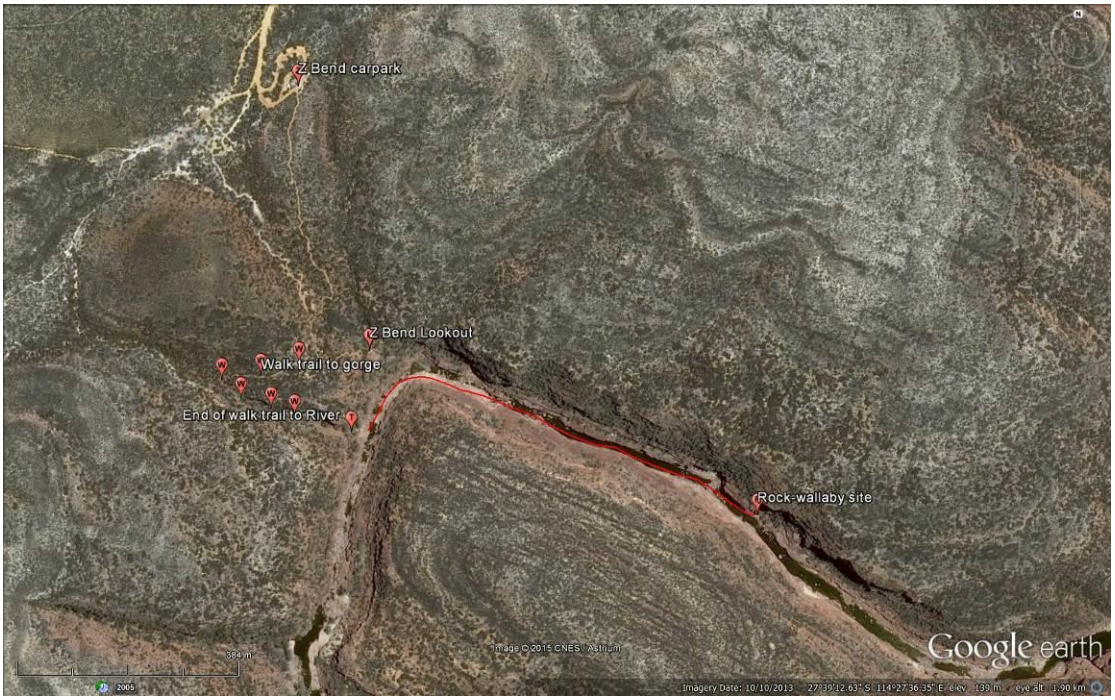

Figure 5: GoogleEarth view of the location of existing Kalbarri rock-wallaby population and its location relative to the Z Bend lookout and walk trail.

Figure 6: Habitat in the "Promenade" area currently being used by rock-wallabies and at the proposed site of a supplementation release in May 2016

The proposed site for the 2016 translocation of up to 20 BFRW is 2.5 km away to the north and 4 km downstream of “The Promenade” (27^0 38’ 06” S, 114^0 28’ 23” E) near a location known as Four Ways. Starting around 400m upstream of where the walking track meets the river at Four Ways, there are a number of cliff collapses and boulder piles that provide structurally diverse and suitable rock-wallaby habitat. Over time, the progeny of these rock-wallabies could reasonably be expected to spread from this site and occupy habitat further upstream and downstream, eventually coming into contact with the BFRW around The Promenade.

Figure 7: Location of proposed supplementation and 2016 translocation sites in the Z Bend region of Kalbarri National Park. The location of predator monitoring camera arrays are indicated by the pale green markers.

Figure 8: Proposed site for a 2016 reintroductions near Four Ways

The proposed site for the 2017 translocation is 720 m NW of Hawks Head Lookout, or around 1 km on foot along the river (27^0 47' 08" S, 114^0 28' 30" E). This is a rocky gully close to the main gorge which has rugged boulder piles, good development of shelters and a small seepage. From this site there is extensive habitat upstream around the Hawks Head area, where rock-wallabies were known to persist until 1995. If the translocation is successful and the population expands, rock-wallabies should reoccupy the habitat around the lookout and again become visible to Park visitors.

Figure 9: Proposed site for the 2017 translocation near Hawks Head Lookout

Figure 10: Habitat at the proposed reintroduction site 500 m from Hawks Head Lookout.

Figure 11: Suitable habitat upstream of Hawks Head that could be used for future translocations.

Causes of local extinction

The precise cause of the near extinction of BFRW in Kalbarri NP is not known, but based on threatening processes acting on other rock-wallabies populations, predation by feral predators (foxes and cats) and habitat degradation and competition for shelter by goats are likely to be the two most important. Fortunately, the low rainfall and sandy soils of Kalbarri NP has meant that it was never cleared for agriculture, so habitat clearing is not a threat.

Foxes are well known predators of rock-wallabies with the ability to restrict populations to small areas of habitat or cause local and regional extinctions. The role of feral cats in causing declines in rock-wallabies is less well understood, but they appear to play a significant role in reducing recruitment (see page 7). In the case of this translocation, it would be desirable to reduce mammalian predation as much as possible. The reduction of all mammalian predation (foxes, cats and dingoes) at the Calvert Range has resulted in a rapid recovery of the population (Kendrick and Pearson, unpublished data).

At present, Kalbarri NP is baited aerially twice per year using dried meat baits as part of the Western Shield program.. This baiting has been effective at reducing fox numbers and is probably responsible for the persistence of mallee fowl and reintroduced chuditch. The Park has been identified as a focus site for landscape use of Eradicat baits to control feral cats.

In addition, it is envisaged that extra hand baiting would take place around reintroduced rock-wallaby populations at least twice annually to supplement the aerial baiting and should monitoring of predators indicate that their numbers have not

been suppressed to low levels. It is important that this extra baiting is undertaken promptly if an imminent threat to the rock-wallabies is identified. Rangers, other Mid-West staff and researchers working on the project will update their skills or undertake 1080 use training so there is a pool of trained people who can undertake ground baiting at short notice if required.

Feral goats were once so abundant along the Murchison Gorge that visitors to the lookouts were able to observe by eye, ear and nose the activities of large numbers of this pest. Aerial shooting and some supplementary ground shooting has greatly reduced goat numbers in the Park. Over the last decade aerial shoots using a helicopter have run in February each year. In a five day shoot at the start of the program around 1200 would typically be shot; that number has been approximately halved in recent shoots (653 shot in February 2015, Mike Paxman pers. comm.). Goats along the Murchison Gorge are now much less abundant and are likely to be less of a threat to rock-wallabies both as a competitor for food resources and for shelter sites. Rock-wallabies are able to tolerate some goat presence as seen in Cape Range and Ningaloo Station, but usually only where the habitat is punctuated by steep gorges with a honeycomb of caves and crevices that goats cannot fully access but rock-wallabies can. Continued shooting of goats will be required to ensure that BFRW successfully establish and disperse in Kalbarri NP. The MidWest Region is supportive of ongoing goat control.

Risk of translocation to in situ flora and fauna

The risk of the translocation of BFRW on other species is negligible. While a number of threatened plants occur along the Murchison Gorge, rock-wallabies are much less destructive feeders and disturbers of the soil than feral goats. The control of goats for the benefit of rock-wallabies and other fauna and flora will be a positive for the conservation of threatened flora.

The reintroduction of BFRW is also likely to have positive impacts for a number of species including native predators (e.g. wedge-tailed eagle) as well as the spreading of seeds of native plants. Fox and cat control on behalf of rock-wallabies and other threatened taxa such as translocated chuditch and mallee fowl will likely benefit an array of small mammals, reptiles and birds.

Management environment

The rugged sandstone gorge section of the Murchison River is almost entirely within Kalbarri NP. As a consequence the vast majority of potential habitat for BFRW is within the Park and is managed by the Department of Parks and Wildlife. Should the rock-wallabies spread beyond the park into habitat to the north, the land tenure is nature sanctuary managed by the private conservation organisation, Bush Heritage. It is likely that this organisation would welcome the arrival of the species on their land. They currently work closely with Parks and Wildlife on feral animals and fire control. There is limited habitat available on Murchison River Station and BFRW are unlikely to establish there with its current goat densities and lack of feral predator control.

3.4 Disease and Parasite Considerations

There is little specific knowledge on the role of disease and parasites in affecting rock wallabies. There are a number of parasites known to occur in *Petrogale* species, however, most internal parasites do not cause serious illness unless the animals are

under stress (Pearson 2012). Toxoplasmosis, caused by infections of the protozoan *Toxoplasma gondii*, may be contracted by rock wallabies if they come into contact with infected cat faeces. The cat is the only definite known host for this parasite (Miller 2001).

As far as we are aware, no major diseases are known to be carried by BFRW in the Wheatbelt, but they have known parasites such as nematodes, tapeworms and ticks. In normal circumstances, rock-wallabies are not overly affected by their presence, however if they acquire a heavy parasite load when in poor condition, it may have more serious health impacts. Blood taken from 60 individuals from Mt Caroline did not return any positive tests for toxoplasmosis, but there were a few positive tests for salmonella (N. Moore, pers. com.)

Animals may carry a range of diseases that can be transmitted to humans (zoonoses), including toxoplasmosis, leptospirosis and salmonella (Chapman *et al.* 2008). Hygiene procedures during the translocation will be maintained at a high standard to reduce the possibility of transmission of diseases or parasites between animals and to humans according to SOP 16.2. Specific actions will include:

- Traps and handling bags will be thoroughly washed and disinfected prior to and after trapping

- Animal handlers to wash hands thoroughly prior to and at the conclusion of each handling session

- Equipment involved in taking genetic samples will be sterilized between each animal

- Experienced staff will handle and process animals.

4 SOCIAL AND ECONOMIC FEASIBILITY

This proposal will not result in any known deleterious impact on individual people or communities. Rather, it is likely to increase the tourism value of the Kalbarri NP gorges, as people come to see rock-wallabies in the future. Their visits are likely to be enhanced by sighting rock-wallabies. They are one of the few Australian mammals that may be readily observed during the day, when they emerge to bask in morning or late evening sunshine during cooler weather/ seasons.

While there are no communities in close proximity to the proposed translocation site, increased numbers of tourists are likely to benefit businesses in Kalbarri. The possible involvement of local volunteers would have major positive benefits both for the individual, but also in spreading the word about threatened species and the efforts of the Department of Parks and Wildlife and its partners to preserve rock-wallaby populations.

Indigenous people of the area are likely to be interested in conservation efforts for this rock-wallaby and there may be opportunities to employ local people to bait foxes or monitor the rock-wallabies.

There is already a strong tradition of volunteering in Kalbarri with an active group of volunteers running a local herbarium based at the Department of Parks and Wildlife office and others assisting with park management activities.

The project is likely to focus attention on Kalbarri NP and the adjoining town and so could be expected positive spin-offs such as increased tourism with associated benefits for local accommodation and service providers.

This translocation has received good support from Regional (Mid-west and Wheatbelt) staff as well as local staff and rangers at both the source populations and in Kalbarri NP. The Ranger-in-charge at Kalbarri NP, Mike Paxman has been very supportive of the project and ongoing predator and goat control.

The World Wide Fund for Nature (WWF) has indicated its support and a willingness to assist with the translocation through its annual appeal and approaches to supporters. The Northern Agricultural Catchment Council (NACC) has expressed its interest in being involved in the project and it could support predator control by working with landowners adjoining the Park.

The management of threats (goat and fox/cat control) in Kalbarri NP is seen as a high priority by Western Shield and the Mid-West region of the Department of Parks and Wildlife and they have stated their commitment to continue aerial shooting and baiting.

5 LOGISTICS OF THE TRANSLOCATION

All capture, handling, transport and release will follow Departmental Standard Operating Procedures;

- SOP 9.5 Soft cage traps for capture of macropods
- SOP 9.6 Hand capture of wildlife
- SOP 10.1 Animal handling/restraint using soft containment
- SOP 10.2 Hand restraint of wildlife
- SOP 11.1 Transport and temporary holding of wildlife
- SOP 12.1 Permanent marking of vertebrates using microchips
- SOP 12.3 Semi-permanent marking of mammals using ear tags
- SOP 14.1 Care of evicted pouch young
- SOP 14.2 First aid for animals
- SOP 16.2 Managing Disease Risk in Wildlife Management

All personnel involved in the project will be made aware of these SOPs and copies will be taken into the field.

5.1 Capture

The translocation team will include Parks and Wildlife staff from the Wheatbelt Region, Mid-West Region, Science and Nature Conservation Division and WWF and other staff that may be available and have useful skills or experience. Staff will be situated at Wheatbelt sites to capture and process the rock-wallabies and at Kalbarri NP to receive and release.

Rock-wallabies will be captured with Thomas traps set at Mt Caroline and Nangeen Hill. The traps will be put out, baited with apples and left shut for 7 nights to get the rock-wallabies familiar with the traps and bait and so increase the trapping rate when the traps are opened. Traps would then be opened mid-afternoon and checked two to three times during the night to minimise an individual's time in the trap, and to maximise the capture rate per trap. If sufficient animals are captured on the first

night, then the traps will be closed and removed. Those animals would be flown to Kalbarri that day. If insufficient numbers are captured, then trapping will extend into a second night and a second flight of rock-wallabies will be required. Two teams of four will operate at Mt Caroline and another team of four at Nangeen Hill. Depending on the census of Nangeen Hill to be conducted a few weeks prior to the translocation, up to a third of rock-wallabies may come from Nangeen Hill and the remainder from Mt Caroline. Three females (two from Mt Caroline and one from Nangeen) will be used for the supplementation of the existing Promenade animals. The remaining 20 rock-wallabies to be translocated will be selected on an approximately equal sex ratio.

Rock-wallabies will be scanned for PIT tags and identified if possible from outside the trap then removed as quickly and quietly as possible. Females will be checked for pouch young on site. Any with pouch young greater than 100mm head-body length or with young at heel will not be translocated and be released immediately. Those deemed suitable for translocation will be placed in black capture bags in a quiet place at the field headquarters for further assessment.

In the event that females eject large pouch young, the trapping team will first attempt to replace the young in the pouch and place sticky elasticised tape across the pouch. If it is not possible to replace the young in the pouch with this method, the female would be left to recover quietly alone in a bag, whilst the joey is kept warm separately and a reunion attempted prior to release. If this is also unsuccessful both the mother and joey would be placed into the same rock crevice in bags and left to reunite. If the female does not recover its joey overnight, the joey would be euthanased.

All BFRW, unless already marked, will have a PIT tag inserted for individual identification and a genetic sample (ear punch) taken. Animals will be weighed, sexed, their reproductive condition (presence of pouch young and their size) and their health assessed (extent of fat at the base of the tail and the presence and abundance of ecto-parasites).

Captured rock-wallabies will be released back at their trapping location if they are unsuitable for translocation on account of their physical condition, age, sex or the presence of advanced pouch young.

Fitting of radio-collars for the translocated animals will be conducted at the Kalbarri National Park headquarters, as the animals will be held here over the course of the day so transmitters can be fitted in an air-conditioned environment without plenty of time to conduct the task.

5.2 Transportation

Animals suitable for translocation will be held singly in black cotton capture bags and transported to the field station by air-conditioned vehicle to be held overnight in a dark quiet room for transport by air the following morning. Rock-wallabies will be placed on the floor of the vehicle on top of padding (such as an old rug) and positioned in such a way and with cushioning that they will not damage themselves or other rock-wallabies if they kick.

A fixed wing aircraft (such as an Airvan or Cessna 310) departing from Kellerberrin airstrip will be used to fly the rock-wallabies to Kalbarri NP. Two rock-wallabies would be placed in individual black bags and tied into opposite corners of a large “pet-pack”. The animals would be placed in the main passenger space of the aircraft to ensure that they are kept at a comfortable and stable temperature (i.e. what the pilot

is exposed to). The distance from Kellerberrin to Kalbarri is 555 km and would take approximately 2 (Cessna 310) to 3 hours (Airvan). The distance to transport the rock-wallabies by road is 708 km and it would take at least 9 hours. We consider that the stress of such a road trip can be largely allievated by flying the animals to Kalbarri.

Upon arrival at the Kalbarri airstrip, the rock-wallabies would be transported by air-conditioned vehicle to the ranger station. Here they will be kept in a cool, quiet room. At this time rock-wallabies will be fitted with radio-collars. Animals will be fitted with VHF radio collars once they are at the Kalbarri office. David Pearson will be fitting the collars.

We intend to use Sirtrack VHF collars (V6C 164) with weak or expandable links (heavy cotton drill insert) to monitor black-flanked rock wallabies translocated to Kalbarri National Park. The collars will be fitted to non-sedated animals. The life of the collars is intended to be 12-18months. If the weak link has not deteriorated in the 18 month period and/or there is concern for the animals welfare due to the collars (indicated by camera and sighting monitoring), intensive trapping will be undertaken at the sites to remove the collars from the animals. The collar material is leather, have a small whip aerial and weigh 38-51 g, about 2.6 % of the body weight of the smallest adult females captured in the Wheatbelt. Mature adults will be translocated as they will have limited growth in the girth of the neck compared to young animals, ensuring the collars do not become too tight. The larger males (up to 5 kg) may be fitted with collars with a longer life and hence slightly more weight, but collar weight will always be maintained below 5% of an animal's body weight. Rehydration fluids (Lectade) will be provided following collar fitting to reduce any possible capture myopathy and stress.

Should weather be unsuitable for flying the rock-wallabies, then trapping will be halted until there has been a change in the weather. If the plane is not operational for any reason, the rock-wallabies would be returned to their place of capture and released at dusk.

5.3 Release Protocols

Suitable sites for release in Kalbarri NP were determined by examination of the gorge from satellite imagery and comparison with other habitat occupied by the species. Suitable sites were then inspected on foot. In particular, translocation sites were selected on the basis of being large areas of potential habitat possessing multi-entranced deep caves and crevices below fallen boulders.

BFRW will be driven approximately 30 minutes from the Kalbarri office in air-conditioned vehicles to the Z Bend carpark. Up to 20 animals will be walked into the Four Ways site (1.5 km, 20 minutes walk) in the late afternoon/early evening in the black handling bags by DPaW staff and authorised volunteers. They will released into caves by leaving the bag weighted down and open just inside cave or crevice entrances. They will be placed in positions where they cannot roll or fall and hurt themselves. The bag will then be untied and the rock-wallaby left to leave the bag at its own pace. Three females will be walked into the Promenade site. This is a distance of approximately 1 km and will take 25 minutes. Release conditions will be the same as for Four Ways animals.

One person will be responsible for carrying two wallabies. The walking trail from Four Ways is well defined and it is a relatively short walk so staff could easily exit from the

release site in the dark if required with head-torches. Taking the females to the Promenade involves a scramble into the gorge and a walk along its rocky bed. At one point it will be necessary to pass the rock-wallabies down a small cliff.

Early the next day, bags will be relocated and checked to see if the rock-wallabies have vacated them. If a rock-wallaby is still present, it will be checked to ensure it is OK, then additional apple will be placed into the bag and left till dusk and then checked again. If a rock-wallaby is still present and physically OK, it will be gently coaxed to leave the bag. Lucerne pellets may also be placed in caves to provide the rock-wallabies with a short-term food supply.

6. Success criteria and monitoring

6.1 Success Criteria

A successful translocation would result in the persistence of founder rock-wallabies in the short term, with 75% of animals surviving the first 3 months, and no further decline at 6 months estimated from radio-telemetry, observations and remote cameras. Typically, the first few months are the most hazardous for translocated animals as they adapt to new shelter sites and food resources and they are more susceptible to predators. Successful control of predators (determined by no or few images of cats or foxes on remote cameras) would be vital during this period.

In the medium term (6 months to one year), success would be the commencement of growth of the population, especially the appearance of pouch young and young-at-foot. These cohorts of animals could be identified from remote camera images and direct observations. The particular physical characteristics of juveniles or their mothers relative to the location of cameras should allow an estimate of the number of young born. Searches of refuge sites might also find the small droppings of these young. A success criteria for this phase is that at least 75% of the founder females should be carrying young in the first year.

In the longer term (1-3 years), recruitment of young to the adult population is a critical phase for the translocation. This is most likely to be detected by the appearance on remote monitoring cameras of rock-wallabies that are not quite adult size, lack ear tags, but are independent of their mothers. Newly independent rock-wallabies are likely to be particularly susceptible to predation. These wallabies (especially juvenile males) are likely to be pushed away from the main population and so may appear on cameras that are set in suitable habitat away from the release site.

Trapping at and around the release site should provide information on the rate of recruitment of young into the adult population. The absence or low numbers of new recruits is likely to signal predation and in turn, ineffective predator control and should result in a review of predator control operations.

Dispersal away from the release site by sub-adults is another measure of translocation success, as it typically means that increased population density and social pressures are forcing rock-wallabies to seek new habitat. This can be assessed using remote cameras and searches for fresh faecal pellets. Expansion of the area of habitat being utilized would typically indicate that the population is growing.

The establishment of rock-wallabies in habitat > 500 m from the release site would be another sign of success as it would indicate the ability of the rock-wallabies to disperse effectively and be capable of reclaiming the Murchison gorge.

The translocation would be considered a failure or failing if founder rock-wallabies are unable to persist in the Murchison Gorge while threatening factors (goats, cats and foxes) are being controlled. If no or poor recruitment occurs by the second year after the translocation or and that only a small proportion (<25%) of these animals do not survive to be recruited into the adult population, then the translocation will have failed. Given the above, should the population remain static in numbers over a 3 year period then the translocation could also be deemed to have failed. In that circumstance, a decision would be required to either persevere but increase predator control efforts or to abandon the translocation, catch up the rock-wallabies and return them to their source sites in the Wheatbelt. These success indicators need to be assessed in relation to the current climatic conditions. Drought may reduce reproduction rates and hence recruitment.

6.2 Monitoring

A range of monitoring techniques are planned to ensure the success of the translocation can be tracked effectively at the release sites and at sites the rock-wallabies disperse to. Each of these techniques will provide different information that together will establish a picture of how the rock-wallabies are adapting to their new environment and the population trajectory.

Radio-telemetry will be used to follow the fate of rock-wallabies over the first 6-12 months of the translocation. VHF collars with a mortality sensor and a breakaway link will be fitted to all rock-wallabies and they will be monitored (approximate location and mortality signal or not) every two days at the start of the translocation for two weeks; weekly for the subsequent three months; and then fortnightly up to six months. If breakaway links do not function correctly on any of the collars, it may be necessary to undertake some supplementary trapping to remove collars.

At the end of 12 months, the radio-telemetry results will be reviewed and if further useful data can be obtained by tracking, then collars may be refitted to some individuals. Data on survivorship, long-distance dispersal, home range and longer term survival are the types of information that could be collected.

Twelve months after the release, trapping will be undertaken at the release site and other places where the rock-wallabies have known to disperse to, in order to determine survivorship, recruitment and to assess the condition of the animals. Any animals that have not shed their collars will be trapped and have their collars removed. Genetic material will be collected from any Kalbarri-born animals. This may inform how the founder stock contributed to reproductive output and lead to modifications to improve future translocations.

Trapping will then be conducted on an annual basis, if funds permit, to continue to collect information on the health of the population (body weight, parasites), its reproductive output and for the collection of genetic material from new born or recruits. Thomas traps baited with apples will be used for this work in accordance with animal ethics approvals and Departmental SOPs. This will be conducted by Science and regional staff with volunteers if available.

Remote cameras (5 per site) will be established in suitable crevices around the release sites to monitor the rock-wallabies and to detect any visitation from feral animals. A further six camera arrays to monitor predators and rock-wallabies will be established at each release site. These will be spaced at intervals of approximately 250 m upstream and downstream (so three upstream, three downstream). Cameras

would be placed in two locations across the gorge Additional cameras may be placed inside particular caves to monitor their use by rock-wallabies and predators.

Cameras will be activated for up to two months in advance of the translocation to provide baseline information on predator numbers and then subsequently used to monitor rock-wallabies and the presence of predators.

In the first three months the cameras will be visited on a monthly basis to retrieve SD cards to monitor predator numbers and early rock-wallaby movements. Thereafter, SD cards and batteries will be changed every 3 months. This will be carried out by the MidWest region. Through scrutiny of the images it should be possible to observe females carrying pouch young, pouch young and young-at-foot to give an idea of birth rates and early survival and be compared to trapping data about resultant recruitment rates.

While checking cameras, signs of predators in the translocation area will be recorded (droppings, tracks) to inform whether additional baiting may be required. Predator scats will be collected for dietary analysis.

Information on the dispersal of the rock-wallabies will be gathered by searching for fresh faecal material in suitable habitat away from the original release site on a 6-monthly basis. This activity could be combined with other tasks such as laying 1080 baits. GPS fixes of fresh material need to be recorded and then uploaded onto a map of the gorge to document the changing distribution of fresh scats (and hence rock-wallaby activity).

When field staff are at the release site, they will note any observations of rock-wallabies on a standard form that details the date, location and activity of the animals. If volunteers or students are available, it may be possible for people to undertake short observation periods (especially in the winter months) by sitting at the base of the outcrop with binoculars and observing where rock-wallabies are located.

This information would be collated with other forms of monitoring data to help follow the fate of individual rock-wallabies during the translocation. This monitoring work will be conducted by Science and Nature Conservation staff (David Pearson) in close association with Mid-West staff, especially ranger staff in Kalbarri NP.

Trapping data will be stored in Faunafile and remote camera images will be sorted and significant images retained using CameraBase or equivalent.

Six monthly reporting for the first two years and then annual reporting will be undertaken and reports provided to Dr Manda Page, the Parks and Wildlife Principal Zoologist, WWF and the Rock-wallaby Recovery Team.

Monitoring of source populations

The Wheatbelt source populations are regularly trapped (annually to once every 2 years) and there are faecal pellet plots at Nangeen Hill and Mt Caroline to alert management to any pronounced population fluctuations that could be linked to the removal of animals for translocation. Up to 50 Remote sensing cameras are placed in critical refugia to monitor rock wallabies and the presence of feral animals at all Wheatbelt sites and images downloaded every 2-3 months. In addition, 4 data loggers have been set up at Nangeen and Mt Caroline to monitor wallaby activity at discrete sites. These read both the chip number of the individual and its weight. Over time this remote monitoring should generate enough data to ensure that the populations are only monitored when necessary (i.e. when a percentage of triggers show no microchip – indicating new recruits needing to be processed or weight

losses of known individuals become significant to require closer investigation through a trapping program.

6.3 Contingency Plan

As previously mentioned, the translocations would be considered a failure or failing if founder rock-wallabies are unable to persist in the Murchison Gorge while threatening factors (goats, cats and foxes) are being controlled. If no, or poor, recruitment occurs in the second year after translocation and 25% of these animals do not survive to be recruited into the adult population, then the translocation will have failed. Should the population remain static in numbers over a 3 year period then the translocation could also be deemed to have failed, but consideration of prevailing climatic conditions (e.g. drought) is necessary. In that circumstance, a decision would be required to either persevere but increase predator control efforts or to abandon the translocation, catch up the rock-wallabies and return them to their source sites in the Wheatbelt.

7. DISSEMINATION OF INFORMATION

Communication between partners in the project will be regular via email and phone. There will be fieldwork between project partners in rock-wallaby trapping and monitoring which will also aid in keeping everyone informed of developments. A draft MOU has been developed between the Department and WWF.

Progress reports prepared for the project will also be circulated to partners. Results will be communicated to the Rock-wallaby recovery teams during their annual meetings or other meetings called to discuss aspects of the project.

Media releases for local, State and national media will occur from time to time, especially around the time of translocations. Media opportunities will be discussed with the Department's Media Relations Section and the WWF staff, but the capture process in the Wheatbelt and releases at Kalbarri National Park are particular opportunities for the Minister to be involved. Anthony Desmond from the Mid-West Region will liaise regularly with the Media Relations Section about possible media opportunities.

Articles will be written for the Department's magazine *Landscope* and scientific papers produced reporting on the outcomes of the translocations.

Data will be stored in Faunafile using an existing proforma where possible.

8. FUNDING AND RESPONSIBILITIES

Some of the costs associated with the translocation will be met by Departmental regional budgets and Western Shield, particularly in terms of staff time and baits for maintaining predator control operations.

Funds for cat baiting that is linked to the translocation and for aspects of the translocation will be provided by the Department of Environment through the Project: "Threatened animal recovery through feral cat control in Western Australia".

The Wheatbelt Region will need to provide staff to direct trapping operations which would involve staff from other areas, volunteers and WWF. The Wheatbelt Region would make available its Thomas traps and processing equipment for the work. The local land-holder may offer a farm house to help with accommodation needs of the trapping teams.

At the Kalbarri NP end of the translocation, the Mid-West region will need to provide staff/rangers to co-ordinate the activities of transporting the rock-wallabies to the release site from the airstrip, probably with the assistance of volunteers. Staff from Science and Nature Conservation Division would also assist with the translocation and subsequent monitoring. WWF, the regional NRM group, NACC, may also be able to provide staff and volunteers to assist with the translocation and subsequent monitoring.

WWF have undertaken fund raising to assist with the translocation through the chartering of aircraft, a contribution towards radio-collars and vehicle hire to transport volunteers and WWF staff. In addition, WWF staff and volunteers will assist with capture, release and monitoring of the translocation. A detailed budget is attached.

Responsibilities:

Overall co-ordination of translocation/monitoring- David Pearson

Animal ethics/ responsibility for trapping/ budget oversight/ liaison with Minister's office- Juanita Renwick

Cat baiting/ Western Shield operations- Michelle Drew

Capture of animals in Wheatbelt and preparation for travel- Natasha Moore

Mobilization of volunteers to help with trapping, release and monitoring/ WWF funding raising- Merril Halley

Predator control pre and post release/liaison with Park staff- Anthony Desmond

Logistics/ Media at release- Anthony Desmond

Predator and rock-wallaby monitoring with cameras- Anthony Desmond/Mike Paxman

Monitoring rock-wallabies once released- David Pearson

Data analysis and storage- David Pearson

Reporting- David Pearson/ Juanita Renwick/ Anthony Desmond

9. ANIMAL ETHICS COMMITTEE APPROVAL

The Parks and Wildlife Animal Ethics Committee approved the project (2013/28) in June 2013 and accepted an amendment to include Kalbarri National Park as an additional site in October 2015. A further amendment is currently being sought to include the addition of collars to translocated animals for monitoring purposes. The translocation will meet all specific and standard conditions stipulated by the AEC.

10. ENDORSEMENT BY PROPONENTS AND ORGANIZATIONS

_____22/03/16

David Pearson Date

_____ _____

Anthony Desmond Date

_____ _____

Natasha Moore Date

_____ _____

Craig Pentland Date

_____ _____

Merril Halley Date

_____ _____

Principal Zoologist Date

_____ _____

Greg, Durrell, Wheatbelt Regional Manager Date

_____ _____

Nigel Sercombe, Mid West Regional Manager Date

_____ _____

Director Science and Conservation Date

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