RECOVERY PLAN FOR THE BLACK-FLANKED ROCK-WALLABY, *PETROGALE LATERALIS LATERALIS* (GOULD)

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SUMMARY

Current species status: Vulnerable (ANZECC 1991). Threatened (WA Wildlife Conservation Act). A subspecies restricted to Western Australia. Formerly abundant and widespread but now restricted to 2 island and 9 mainland populations. Primary threat is predation by foxes and cats.

Habitat requirements and limiting factors: Habitat is still intact to support populations, provided exotic predators are controlled. Additional populations can be established if foxes are controlled.

Recovery Plan objective: Downlisting to rare within 10 years. Indefinite protection of populations will still be required.

Recovery criteria:
2 years - Establish exotic predator control. Complete surveys of all populations to determine abundance and initial genetic diversity. Erect goat-proof fence.
5 years - Sufficient population increase at Calvert Range to allow translocations of 50 animals to Depuch Island.
10 years - Expansion of mainland populations until the total number of adults exceeds 5000.

Actions needed:
The following actions will be overseen by a Recovery Team composed of people from CALM, ANPWS and other organisations relevant to the recovery process.
1. Exotic predator control in mainland populations
2. Survey all populations to determine abundance
3. Genetic analysis of all populations
4. Translocation - from Calvert Range to Depuch Island
5. Goat-proof fence on Ningaloo Station

Total estimated cost of recovery (1991 prices in $000's/year)

ACTION	1		2		3		4		5		Totals	
YEAR	TC	ESP	TC	ESP	TC	ESP	TC	ESP	TC	ESP	TC	ESP
1992	41.5	17.3	67.6	32.4	18.0	18.0	-	-	7.6	7.6	134.7	75.3
1993	41.5	17.3	28.3	13.0	-	-	-	-	-	-	69.8	30.3
1994	41.5	17.3	28.3	13.0	-	-	-	-	-	-	69.8	30.3
1995	41.5	17.3	28.3	13.0	-	-	-	-	-	-	69.8	30.3
1996	41.5	17.3	40.8	20.2	11.5	11.5	24.3	15.8	-	-	118.1	64.8
1997	18.7	8.9	28.3	13.0	-	-	-	-	-	-	47.0	21.9
1998	18.7	8.9	20.9	9.4	-	-	-	-	-	-	39.6	18.3
1999	18.7	8.9	28.3	13.0	-	-	-	-	-	-	47.0	21.9
2000	18.7	8.9	20.9	9.4	-	-	-	-	-	-	39.6	18.3
2001	18.7	8.9	40.8	20.2	11.5	11.5	-	-	-	-	71.0	40.6
TOTAL	310.0	131.0	~~178.5~~ 332.5	~~151.6~~ 156.6	41.0	41.0	24.3	15.8	7.6	7.6	715.4	352.0

Total cost (TC) and Endangered Species Program (ESP) contribution.

Biodiversity benefits: Exotic predator control will aid the recovery of a further 3 endangered species. Genetic analysis will permit measurement of bottlenecking on genetic variability. This is a unique opportunity to quantify some of the theoretical aspects of conservation genetics.

1. INTRODUCTION

1.1 Species Definition

Rock-wallabies are found only in Australia and off-shore islands, and are not present in Tasmania or Papua New Guinea (Sharman and Maynes 1983). Recent research (Sharman *et al.* 1990) has revealed that rock-wallabies are a taxonomically diverse group and that speciation is primarily a response to environment. A. Newsome (pers. comm.) has hypothesized that predation by dingos on dispersing rock-wallabies may have curtailed gene flow between populations and thus accelerated speciation.

Currently 21 taxa of rock-wallabies are recognised as species or subspecies and various chromosomal races are recognized. The ancestral karyotype is characterized by having 22 chromosomes and derived species have arisen through chromosomal fusions and other karyotypic changes.

The type specimen for *Petrogale lateralis lateralis* (Gould) was described from Western Australia in 1842 (Sharman and Maynes 1983). Common names for this species include black-footed and black-flanked rock-wallaby. The latter name is preferred as this distinctive feature is more evident in the field.

1.2 Distribution

P. l. lateralis is discontinuously distributed within Western Australia from the western Pilbara, east to the Little Sandy Desert and south to Salisbury Island in the Southern Ocean near Esperance. Fig. 1 illustrates the known sites where populations have been recently confirmed.

1.3 Habitat Requirements and Preferences

P. l. lateralis does not favor any particular rock formation or type. It is found on rockpiles which are sufficiently weathered or fractured to provide access to shelter in the form of caves, crevices or fissures.

Rock-wallabies typically retreat to their shelter to avoid climatic extremes. They may be found near or along water sources, but they are also found on sites where there is no permanent source of free water.

1.4 Food

The wide distribution of *P. l. lateralis* implies that it is an adaptable species with a broad nutritional niche. A wide range of grasses are eaten: e.g., *Triodia pungens* in the Pilbara and Calvert Range to *Poa* sp. on Salisbury Island where, additionally, animals browse on *Acacia* sp. Since it is a sedentary species, it is obliged to eat what is available; these restrictions coupled with its wide-ranging distribution would compel the species to be a dietary generalist.

1.5 Former abundance

There is little documentation regarding former abundance. However, Gould reported that rock-wallabies were `very numerous along the Swan River especially near Toodyay' (Sharman and Maynes 1983). In the wheatbelt of W.A., near Shackelton, the Beaton family established a homestead in the early 1900s adjacent to a colony of *P. lateralis*. An interview with Mr. Nigel Beaton (now deceased) revealed that the rock-

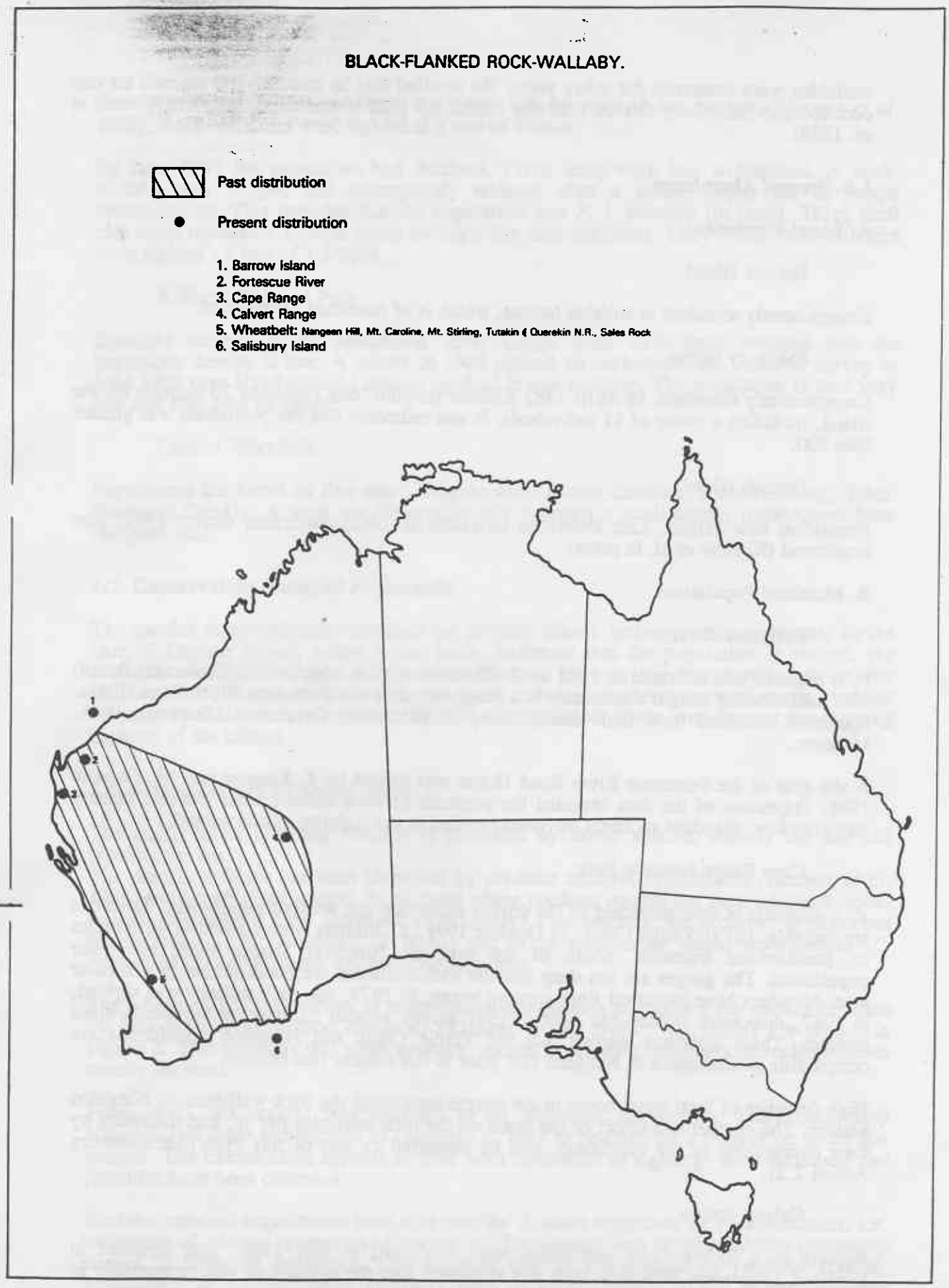


Figure 1. Distribution of the Black-flanked Rock-wallaby *(Petrogale lateralis lateralis)* in Western Australia.

wallabies were numerous for many years. He recalled that he counted 100 animals on one occasion and the colony thrived until the 1930s. By 1986 it was nearly extinct (Kinnear *et al.* 1988).

1.6 Present Abundance

A. Island Populations

Barrow Island

Conspicuously abundant in suitable habitat, which is of restricted distribution.

Salisbury Island

Conspicuously abundant. In April 1982 Kinnear (unpubl. obs.) counted 70 animals on the island, including a group of 11 individuals. It was estimated that the population was greater than 200.

Depuch Island

Population now extinct. Last known to be extant in 1962; confirmed extinct 1982. Fox implicated (Kinnear *et al.* in press).

B. Mainland Populations

Fortescue River

P. l. lateralis was collected in 1985 by P. Thompson (W.A. Agriculture Protection Board) who inadvertently caught a specimen in a dingo trap near the Fortescue River Road House. Specimen identified from skull characters by D. Kitchener, Curator of Mammals, W.A. Museum.

A site east of the Fortescue River Road House was visited by J. Kinnear and M. Onus in 1986. Inspection of the area revealed the presence of rock-wallaby scats but scat density was very low. Standard spotlight traverses resulted in the sighting of one animal.

Cape Range National Park

P. l. lateralis is now restricted to the gorges dissecting the western escarpment. Densities are variable, but at Yardie Creek, in October 1991, 17 animals were sighted in 40 minutes on standardised transects. South of the park on Ningaloo Station there are other populations. The gorges are not deep and the rock-wallabies are concentrated in a smaller area. Numbers have increased since surveys began. In 1979, one rock-wallaby was sighted; in 1987, nine were sighted per hour; a 1991 survey yielded 22/hour on the standardised transect. These sightings suggest that the Yardie Creek and Ningaloo populations are comparable in abundance to Nangeen Hill prior to fox control (see below).

High densities of feral goats occur in the gorges containing the rock-wallabies on Ningaloo Station. The competitive effect of the goats on the rock-wallabies *per se*, and indirectly by their overgrazing of the vegetation, will be measured as part of this Plan (see Recovery Action 2.2).

Calvert Range

Reports of a rock-wallaby population were confirmed in July 1985. Scat densities in localized areas were relatively high and suggested that the population was comparable in

density to Nangeen Hill and Sales Rock (see below) prior to fox control (Kinnear *et al.* 1988). Rock-wallabies were sighted at a rate of 4/hour.

By June 1991 the population had declined. Fresh scats were less widespread. A rock-wallaby was trapped and subsequently released after a minor biopsy for karyotype determination. This revealed that the population was *P. l. lateralis* (in prep). Three feral cats were repeatedly sighted living amongst the rock-wallabies. Only three rock wallabies were sighted - a rate of 1.5/hour.

Kalbarri National Park

Spotlight surveys in the Murchison River Gorge since 1979 have revealed that the population density is low. A survey in 1985 sighted no rock-wallabies. Another survey in June 1988 near Hawkeshead Lookout resulted in one sighting. The population is thus very low and may now be extinct.

Central Wheatbelt

Populations are found on five sites: Nangeen Hill; Mount Caroline; Mount Stirling; Sales' Rock and Tutakin. A sixth site (Querekin) now supports a small colony translocated from Nangeen Hill.

1.7 Conservation Status of *P.l.lateralis*

The species is conspicously abundant on pristine islands lacking exotic predators. In the case of Depuch Island, where it has been confirmed that the population is extinct, the available evidence indicates that it was abundant prior to the introduction of the fox (Kinnear *et al.* in press). Elsewhere, or on the mainland in the absence of exotic predator control, *P. l. lateralis* is rare or it exists at population levels well below the carrying capacity of the habitat.

1.8 Major Factors Affecting Survival

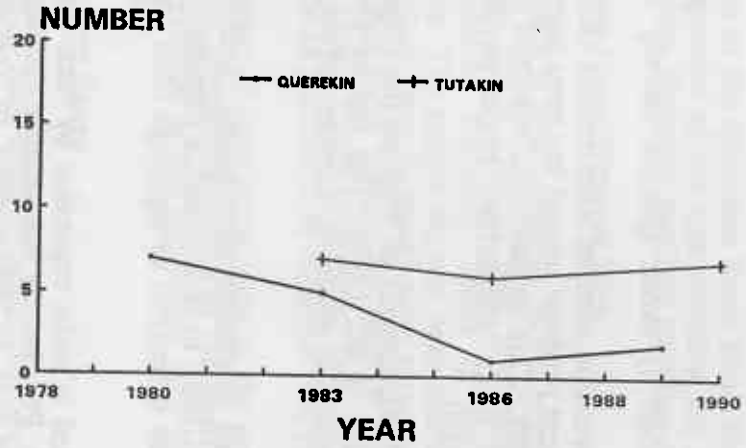
The major factor affecting viability is predation by exotic species, namely the fox and possibly the cat.
The predation factor has been identified by predator removal experiments (Kinnear *et al.* 1988; and unpublished works). In all cases where predator control has been adequate, rock-wallaby populations have increased significantly. This increase has occurred in disturbed environments (e.g., wheatbelt of W.A.) and in an undisturbed island environment (*P. rothschildi;* Dolphin Island, Dampier Archipeligo).

The wheatbelt colonies served as experimental populations to measure the impact of foxes on rock-wallaby population dynamics (Kinnear *et al.* 1988). The results are shown in Figure 2. This indicates that when predator control is effective, numbers of rock-wallabies rapidly increase.

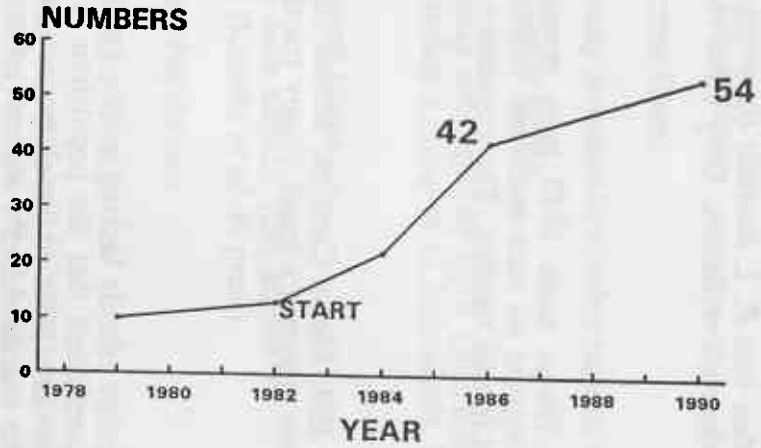
From 1990, fox control was extended to all wheatbelt populations. Individuals from Nangeen Hill were translocated to Querekin in 1987 to re-establish a population under fox control. The translocation appears to have been successful as sightings have increased and juveniles have been observed.

Predator removal experiments have also resulted in niche expansion by rock-wallabies, i.e. utilization of a larger proportion of the habitat. Populations now occupy habitats previously denied to them by predators. This signifies that in the absence of predator control, populations of rock-wallabies currently exist in refugia which afford protection from predation.

Rock Wallaby Census
No Fox Control

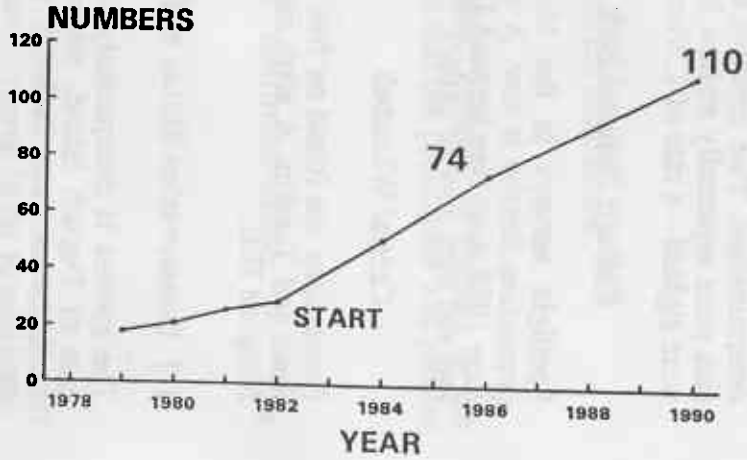


Mount Caroline Census
Fox Control From 1982



Sales Rock Census
No Fox Control

Nangeen Hill Census
Fox Control From 1982



Unfortunately, these refuges do not provide enough security to allow rock-wallabies to maintain viable populations. It is reasonable to infer that fox predation would bottleneck populations. This in turn would promote inbreeding and the loss of genetic variability.

Of equal significance is the realization that populations are maintained at such levels regardless of the environmental conditions. Thus, even under conditions favouring population growth, there would little or no increase in numbers _ a situation that would increase the risk of extinction due to the intervention of demographic and stochastic environmental factors.

2. RECOVERY OBJECTIVES AND CRITERIA

The management of the long-term survivial of *P. l. lateralis* will be overseen by a Recovery Team composed of personnel from CALM, ANPWS and other organisations with relevent expertise. The recovery team will report to the Executive Director annually.

2.1 Recovery Plan Objective

Downlisting to rare within 10 years. Indefinite protection of populations will still be required.

2.2 Recovery Criteria

2 years - Establish exotic predator control. Complete surveys of all populations to determine abundance and initial genetic diversity. Erect goat-proof fence.
5 years - Sufficient population increase at Calvert Range to allow translocations of 50 animals to Depuch Island.
10 years - Expansion of mainland populations until the total number of adults exceeds 5000.

It is our view that sufficient rock-wallaby habitat is still intact and therefore not a limiting factor to their recovery. Supporting evidence is that wherever rock-wallabies have been protected from predators, they have increased. This response signifies that their niche has not been seriously degraded or damaged.

3. RECOVERY ACTIONS

3.1 Exotic predator control

3.1.1 Island populations

The populations on Barrow and Salisbury Islands are not judged to be at risk; management efforts will be concerned with minimising human intrusions, the preservation of the habitat and the ongoing exclusion of exotic predators.

3.1.2 Cape Range populations

At present predator control is limited to 1 baiting/year, but this is unlikely to be adequate (D. Algar *et al.* pers. comm.). Therefore the baiting will be extended to a minimum of 2 occasions/year.(August-September and March-April) over 500 km^2 around the populations.

Some local residents are opposed to baiting because they believe that it is affecting varanid viability. This possibility is currently being investigated.

3.1.3 Fortescue Population

The feasibility of dingo and fox control in conjunction with the Agricultural Protection Board will be considered.

3.1.4 Calvert Range Population

D. Pearson (in prep.) has shown that the desert populations of rock-wallabies have undergone a steady decline. In the last 40-50 years more than 80% of populations have become extinct.

There has been much speculation about reasons for this decline, but little hard evidence exists (Pearson, in prep). The exotic predator factor has not been tested, but could be evaluated and tested in the manner proposed below.

The Calvert Range and surrounds should be baited for 5 years and the rock-wallaby population monitored. Given that a sizable population response is observed, 50 animals will be translocated to Depuch Island (which formerly carried the species) for safe-keeping.

The translocation step is necessary because of the cost and logistics of sustained predator control in such a remote setting. Depuch I. would require exotic predator management periodically.

Given the successful implementation of biocontrol of exotic predators, the Depuch Island population would provide a source population for recolonising the western desert regions. This project would assure the future survival of this species for the region. Additionally, the experiment would document the effects of predator control and thus enhance our understanding of this subject.

3.1.5 Wheatbelt Populations

Maintain baiting programs over all populations.

Costs of predator control (in 1991 $000s)

Year	1	2	3	4	5	6	7	8	9	10	Total
Cape Range	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	50.0
Fortescue	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	88.0
Calvert Range	22.8	22.8	22.8	22.8	22.8	-	-	-	-	-	114.0
Wheatbelt	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	49.0
	41.5	**41.5**	**41.5**	**41.5**	**41.5**	**18.7**	**18.7**	**18.7**	**18.7**	**18.7**	**310.0**

3.2 Population assessment

All populations will be surveyed to obtain abundance data. These data will be invaluable as an indicator of successful predator control and population recovery.

The populations at Cape Range and Fortescue could be assessed on the same trip. However separate trips will be required for the Salisbury and Barrow Islands, Calvert Range and wheatbelt populations.

All mainland populations will be assessed annually. The Calvert Range population will be assessed every 2 years after year 6. Island populations will be surveyed every five years.

Costs of population assessment (in 1991 $000s)

Year	1	2	3	4	5	6	7	8	9	10	Total
Barrow Island; 2 people, 7 days plus airfares											
	5.9	-	-	-	5.9	-	-	-	-	5.9	17.7
Salisbury Island; 2 people, 10 days plus helicopter hire											
	6.6	-	-	-	6.6	-	-	-	-	6.6	19.8
Cape Range; 2 people, 20 days.											
	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	110.0
Fortescue; 2 people, 7 days.											
	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	45.0
Calvert Range; 4 people, 30 days, year 1. 2 people, 12 days, years 2,3,4,5,6,8 and 10.											
	34.2	7.4	7.4	7.4	7.4	7.4	-	7.4	-	7.4	86.0
Wheatbelt; 2 people, 10 days.											
	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	54.0
	67.6	**28.3**	**28.3**	**28.3**	**40.8**	**28.3**	**20.9**	**28.3**	**20.9**	**40.8**	**332.5**

3.3 Genetic analysis

Preliminary data (D. Groth and G. Hall unpubl.) indicate that it is possible to reliably generate DNA fingerprints from rock-wallaby blood samples. Therefore each population will be subject to a thorough analysis of intra- and inter-population genetic variation initially and then after 5 and 10 years.

3.3.1 Island populations

The genetic diversity of these populations will be investigated for comparative purposes. These populations have evolved a genotype adapted to a fragmented and isolated existence. They would be excellent colonizing stock in the absence of exotic predators.

The level of diversity should be investigated and used as a benchmark for mainland populations.

3.3.2 Cape Range

The Cape Range and Ningaloo populations will be genetically asssessed in association with the population monitoring (1.2 above).

3.3.3 Fortescue population

Genetic variability will be assessed during the survey of the species abundance.

3.3.4 Calvert Range population

The relatedness of individuals in the Calvert Range should be determined since this is the most isolated extant population. Such an analysis could be concurrent with the population monitoring (see 1.2 above).

3.3.5 Wheatbelt populations

These populations are now recovering from very low numbers. This is an ideal opportunity to examine the effects of small population size on genetic heterogeneity and whether the postulated lack of variability has any detrimental effects on population persistence.

Costs of genetic analysis (in 1991 $000s)

Year 1		
Genetic testing; 12 populations x 20 animals/population x $50/sample		12.0
Cages; 20 @ $100 each	2.0	
Consumables; needles, liquid nitrogen,etc	4.0	
		18.0
Years 5 and 10		
Genetic testing; 13 populations x 10 animals/population x $50/sample	6.5	
Trap maintenance	1.0	
Consumables	4.0	
		11.5 x 2
Total cost of genetic analysis		**41.0**

Costs associated with capturing the animals, labour, vehicle hire, etc included under population assessment (see 1.2 above).

3.4 Translocation

To Depuch Island from Calvert Range - see 1.1 above.

Radio telemetry equipment will have to be purchased to track the translocated animals as a guide to their establishment.

Costs associated with translocations (in 1991 $000s)
Labour, vehicle, etc to Calvert Range
(budgeted in 1.2 above)

Aircraft hire; Calvert Range to Depuch Island	2.2
Labour, vehicle, etc to Depuch Island; 2 people , 12 days	7.1
Radio telemetry equipment	15.0
Total cost for translocations	**24.3**

3.5 Goat-proof fence on Ningaloo Station

There is a substantial number of feral goats on Ningaloo Station and many animals use the rock-wallaby gorges as overnight camps. This is causing severe overgrazing and habitat destruction from dung accumulation. The owner of Ningaloo is willing to provide labour to erect a fence around one of the main rock-wallaby gorges. A nearby gorge, also containing rock-wallabies, will remain accessible to goats. This is an ideal opportunity to quantify the interactions between goats and rock-wallabies. The cost of a fence is $7.6K. Measuring the impact of goats on the rock-wallaby populations will be undertaken during the survey of Cape Range populations (see 1.2 above).

4. IMPLEMENTATION SCHEDULE

Task#	Task Description	Priority	Feasibility	Responsible Party
3.1	Predator control	1	85%	CALM
3.2	Population Assessment	1	100%	CALM
3.3	Genetic assessment	1	100%	CALM/Curtin University
3.4	Translocation	2	85%	CALM
3.5	Goat-proof fence	2	100%	CALM/ Private landowner

5. BUDGET

1991 prices in $000's/year

Item#	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL	
3.1		41.5	41.5	41.5	41.5	41.5	18.7	18.7	18.7	18.7	18.7	310.0
3.2		67.6	28.3	28.3	28.3	40.8	28.3	20.9	28.3	20.9	40.8	332.5
3.3		18.0	-	-	-	11.5	-	-	-	-	11.5	41.0
3.4		-	-	-	-	24.3	-	-	-	-	-	24.3
3.5		7.6	-	-	-	-	-	-	-	-	-	7.6
TOTAL		134.7	69.8	69.8	69.8	118.1	47.0	39.6	47.0	39.6	71.0	715.4

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