Assessment of Feral Cat Abundance and Control Options at Barrick, Granny Smith

May 2011

M.L. Onus, J.K Rolfe, and D. Algar

Department of Environment and Conservation, Science Division. P.O. Box 51, Wanneroo, Western Australia 6946.

ACT NOW FOR THE FUTURE

Department of Environment and Conservation

Our environment, our future

Introduction

The Australian arid zone has experienced a high rate of native mammal decline following European settlement. Since the 1920s, about 33 % of all mammals and about 90 % of medium size mammals (35 - 5 500 g adult body weight range) have either suffered dramatic range contractions or are extinct (Burbidge and McKenzie 1989). Many of these species are now restricted to several offshore islands and due to small population sizes and restricted geographic ranges are vulnerable to total extinction. A number of causes have been proposed to explain this decline. These include changed fire regimes, competition from introduced herbivores, disease, extreme variability in weather and site fertility and predation by introduced predators, specifically the fox (*Vulpes vulpes*) and the feral cat (*Felis catus*) (see Burbidge and McKenzie 1989; Johnson *et al.* 1989; Morton 1990; Dickman 1996; EA. 1999; Abbott 2002). Many of these species are now restricted to several offshore islands, others have undergone dramatic contractions in their former mainland range.

The feral cat was introduced to Australia around 1824 and spread rapidly over the continent, having colonized nearly every part of Australia by 1890 (Abbott 2002). Cats are present and abundant in almost every habitat, even in the dry, hot desert regions where other exotic predators like the fox and the dingo (*Canis lupus dingo*) are often absent due to low and unpredictable food and water supply.

Predation by feral cats also threatens the continued survival of many other native species persisting at low population densities (e.g. Smith and Quin 1996; Risbey *et al*. 2000; McKenzie *et* al. 2007) and has been identified as one of the major obstacles to the reconstruction of faunal communities as it has prevented the successful re-introduction of species to parts of their former range (Christensen and Burrows 1995; Gibson *et al*. 1995; Dickman 1996; EA. 1999).

Cats are also the hosts and reservoirs for a number of diseases such as *Toxoplasmosis* that can affect the health and well being of both humans and wildlife (Cross 1990; Dickman 1996; EA 1999; Adams *et al.* 2008). It has also been suggested that competition by feral cats with native carnivorous species (eg. some dasyurids, predatory birds and larger reptiles) may reduce their population viability (Cross 1990). However; compelling evidence for competition has not been obtained (Dickman 1996).

As a consequence of these impacts, control of feral cats is recognized as one of the most important conservation issues in Australia today. The impact of feral cats on native fauna is acknowledged by Commonwealth legislation, as outlined in Schedule 3 of the *Endangered Species Protection Act 1992*. The national 'Threat Abatement Plan for Predation by Feral Cats' (EA. 1999) lists 38 species on Schedule 1 of the above Act for which there is a known or inferred threat from feral cat populations. That is, 38 endangered species have been identified as potentially benefiting from effective feral cat control, as part of their management/recovery program. Management of introduced predators is now generally viewed as a critical component of successful reintroduction, recovery or maintenance of small to medium-sized native fauna populations (Christensen and Burrows 1995; Fischer and Lindenmayer 2000).

The Department of Environment and Conservation (DEC), formerly the Department of Conservation and Land Management (CALM), has been developing control strategies for feral cats under the umbrella program '*Western Shield'*. This research has led to the successful design and development of an effective trapping technique and also a bait that is readily consumed by feral cats and can be used over broad-scale areas for their control (Algar and Burrows 2004). *Western Shield*, which commenced in 1997, has already had significant success: three native mammals have been removed from the threatened species list and many populations of native animals have recovered or been re-established in their former ranges (Possingham *et al*. 2004). However not all species have responded so emphatically to the feral cat and fox control program and a better understanding of these main introduced predators is needed for greater success.

DEC was approached by the Environmental Department of the Granny Smith Operation, to assess feral cat numbers, commence a trapping program and review control options on site. It was decided that a feral cat trapping program would be undertaken to reduce the numbers of cats associated with the operation and around the village. Researchers visited the site from 10th May–24th May 2011 to conduct the feral cat trapping program. Documented in this report are the findings resulting from the cat-trapping program and recommendations for feral cat control at Granny Smith Operations and the village.

Methodology

Site Description

Granny Smith Operations are situated on Mt Weld Station (28.48513^0 S, 122.24.629^0 E), which, lies approximately 23 km south east of Laverton, and is surrounded by the pastoral leases (Laverton Downs, Glenorn and Edjudina,) and Lake Carey to the south. The site lies within the Austin Botanical District, Eastern Murchison sub-Region of the Murchison IBRA (Beard 1976). The vegetation units most common across the study area are Mulga (*Acacia aneura*). woodland on Gibber washplains (see Plates 1-3).

Plate 1. Mulga on wanderrie

Plate 2. Trapping track east of mine

Plate 3. Trapping track north of mine

The Trapping Program

Department researchers have developed a highly successful technique to trap feral cats. The technique, described below, in conjunction with assessment of track activity also provides a simple and effective method to assess cat abundance (Algar *et al*. 1999).

The trapping technique utilizes padded leg-hold traps, Victor 'Soft Catch'® traps No. 3 (Woodstream Corp., Lititz, Pa.; U.S.A.), a Felid Attracting Phonic (FAP) that produces a sound of a cat call, and a blended mixture of faeces and urine (Pongo). Each trap site consists of a channel slightly wider than the width of one trap and 80 cm in length, cleared into a bush to create a one-way trap set. The bush also provides shelter for the captured animal. Two traps, one in front of the other are positioned at the entrance of the blind set, at each trap site. A trap bed is made so that when lightly covered with soil, the traps are level with the surrounding ground surface. A step-over stick is placed in front of the traps to force animals to lift their foot then push down onto the pressure plate. A series of guide sticks are located around the traps to guide the animal over the plate areas. Both traps are secured in position by a chain of length 30 cm, and an anchor peg. A circular piece of inner tube rubber (12.5 cm ∅) is placed over the plate to prevent soil from falling into the trap bed and compacting. The traps are then lightly covered with soil. Typical trap sets are shown in Plates 4 and 5.

The combined lure system, (FAP + Pongo) was employed at each trap location along the trapping grid. The FAP is located at the back of the trap set, either concealed under leaf litter or hidden within the bush. The Pongo consisted of a blended mixture of cat faeces and urine in a ratio of approximately 1:1. Approximately 20 ml of this mixture is placed in a shallow depression about 30 cm from the centre of the trap plate.

Plate 4. Typical leg-hold trap set being inspected by Steve Petty

Plate 5. Typical leg-hold trap set

The area to be trapped, approximately 27 km^2, included tracks surrounding the active operation and accommodation village. The on-site refuse area was also identified as an area of interest. The trap sites were located at approximately 500 m intervals adjacent to the vehicle access tracks. All locations were recorded using a Garmin GPS 76. The trap locations and the trap number are shown in Plate 6. A total of 35 leg-hold traps, trap numbers GS 1 - 35, were located along the outer trapping grid. A further 30 wire cage traps (Sheffield traps, 60x20x20 cm) with treadle plates, baited with mulies (pilchards) were located in the village and the waste disposal site. No feral cats were reported from either the Main or Wallaby administration blocks which is why no cages were set in these areas. This provided a total of 593 trap nights during the trapping program. All traps were routinely checked following first light each day.

The dates of commissioning and decommissioning trap sets are indicated in Table 1.

Table 1. Dates of commissioning and decommissioning traps

Trap No.	Commissioned	Decommissioned	No. trap nights
GS 1-6	11.05.11	22.05.11	66
Cage 1-25 village	11.05.11	22.05.11	275
Cage 25-30 tip-site	11.05.11	22.05.11	55
GS 7-9	12.05.11	22.05.11	30
GS 10-20	15.05.11	22.05.11	77
GS 21-35	16.05.11	22.05.11	90
Total			**593**

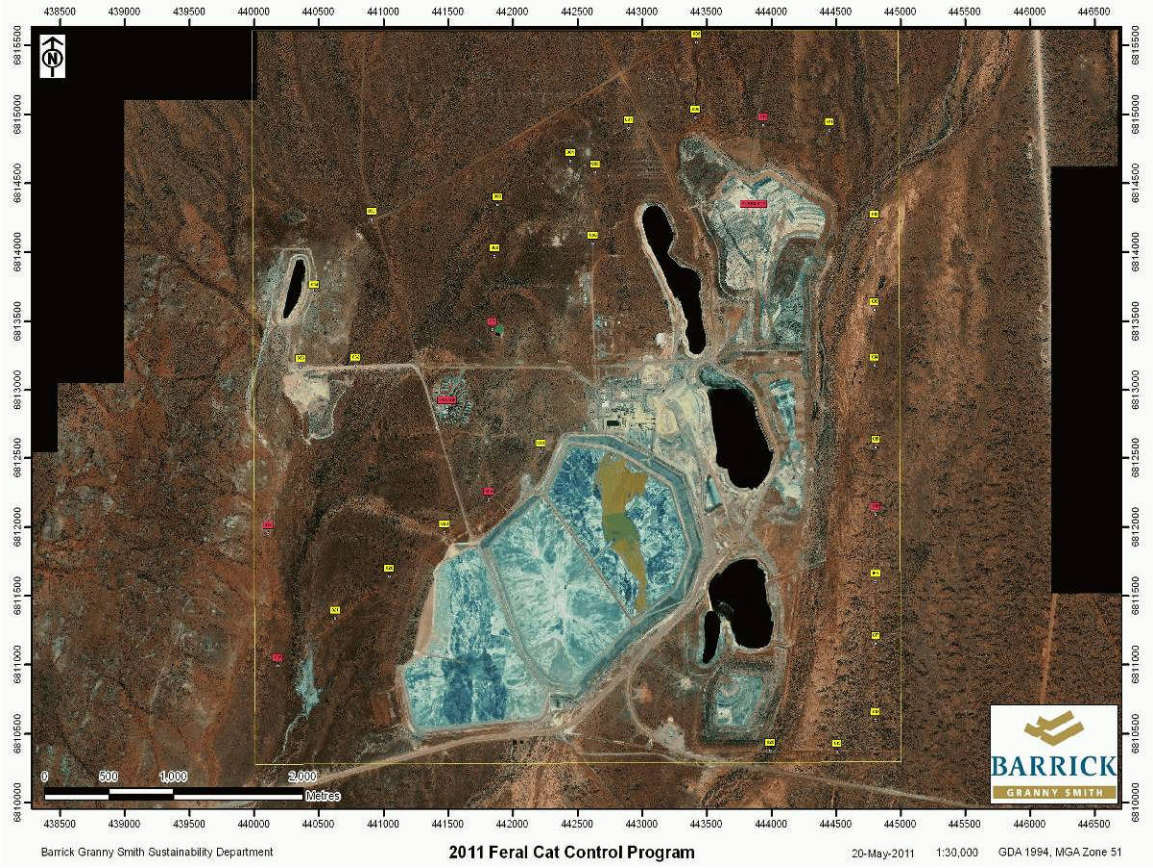

Plate 6. GPS trap sites (red marks indicate where cats were trapped)

Plate 7. Cage trapped cats from the village

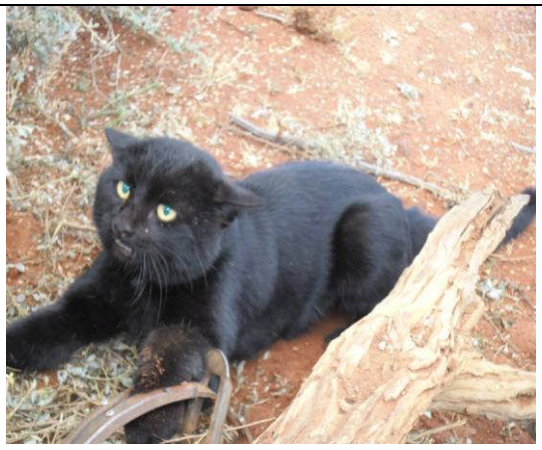

Plate 8. Leg-hold trapped cat

Necropsies and Analyses

On capture, cats were destroyed humanely using a 0.22 calibre rifle All animals captured were sexed, weighed and a broad estimation of age (as either kitten, juvenile or adult) was recorded according to their weight. The pregnancy status of females was

determined by examining the uterine tissue for embryos. Stomach contents were collected and frozen for diet analysis in the laboratory. The mammals collected in the stomach contents were identified according to hair structure as described in Brunner and Coman (1974).

Results

In total, 49 cats were trapped (e.g. Plates 7 and 8); nine in leg-hold traps and 40 in Sheffield cage traps. The capture locations and cat records are presented in Table 2.

Table 2. Capture locations and records of trapped cats, K = Kitten, J = Juvenile, A = Adult

Date	Sample No.	Trap No.	Sex (M/F)	Weight (kg)	Coat colour	Age (K/J/A)
12.05.11	GS 01	Village	M	2.7	Grey tabby	A
12.05.11	GS 02	Village	F	2.8	Grey tabby	A
12.05.11	GS 03	Village	F	2.8	Grey Tabby	A
12.05.11	GS 04	Village	M	3.2	Grey tabby	A
12.05.11	GS 05	Village	F	2.7	Grey tabby	A
12.05.11	GS 06	Village	M	3.1	Grey tabby	A
12.05.11	GS 07	Tip-site	M	3.6	Grey tabby	A
12.05.11	Gs 08	Tip-site	M	2.4	Grey tabby	A
12.05.11	GS 09	Tip-site	M	2.2	Grey tabby	J
12.05.11	GS 10	Tip-site	M	3.3	Grey tabby	A
12.05.11	GS 11	Tip-site	F	2.1	Grey tabby	J
13.05.11	GS 12	Village	F	2.6	Grey tabby	A
13.05.11	GS 13	Village	F	2.0	Grey tabby	J
13.05.11	GS 14	LH -1	F	3.6	Grey tabby	A
13.05.11	GS 15	Tip-site	F	2.6	Grey tabby	A
13.05.11	GS 16	Tip-site	M	3.4	Grey tabby	A
13.05.11	GS 17	Tip-site	F	1.0	Grey tabby	J
14.05.11	GS 18	Tip-site	M	1.6	Grey tabby	J
14.05.11	GS 19	LH-1	M	5.2	Grey tabby	A
14.05.11	GS 20	Village	F	1.8	Grey tabby	J
14.05.11	GS 21	Village	M	2.6	Grey tabby	A

14.05.11	GS 22	Village	F	1.7	Grey tabby	J
14.05.11	GS 23	Village	F	3.1	Grey tabby	A
14.05.11	GS 24	Tip-site	F	1.2	Grey tabby	J
14.05.11	GS 25	Tip-site	M	1.6	Grey tabby	J
14.05.11	GS 26	Tip-site	M	4.1	Grey tabby	A
15.05.11	GS 27	Village	F	3.0	Grey tabby	A
15.05.11	GS 28	Village	F	3.3	Grey tabby	A
15.05.11	GS 29	Village	F	2.7	Grey tabby	A
17.05.11	GS 30	LH-10	M	4.0	Grey tabby	A
17.05.11	GS 31	LH-16	M	6.1	Grey tabby	A
18.05.11	GS 32	Tip-site	F	1.4	Grey tabby	J
18.05.11	GS 33	Village	F	0.5	Grey tabby	K
18.05.11	GS 34	Village	F	0.4	Grey tabby	K
18.05.11	GS 35	Tip-site	F	4.1	Grey tabby	A
18.05.11	GS 36	Tip-site	F	2.9	Grey tabby	A
18.05.11	GS 37	Tip-site	F	3.6	Grey tabby	A
18.05.11	GS 38	Village	M	0.6	Grey tabby	K
19.05.11	GS 39	Tip-site	F	1.6	Grey tabby	J
19.05.11	GS 40	Tip-site	F	1.5	Grey tabby	J
19.05.11	GS 41	LH-30	F	3.4	Grey tabby	A
19.05.11	GS 42	LH-25	M	4.0	Black	A
20.05.11	GS 43	Village	F	3.1	Grey tabby	A
20.05.11	GS 44	Village	M	0.5	Grey tabby	K
20.05.11	GS 45	Tip-site	F	1.7	Black	J
21.05.11	GS 46	LH-26	F	3.2	Grey tabby	A
21.05.11	GS 47	Tip-site	F	1.8	Grey tabby	J
21.05.11	Gs 48	Tip-site	F	1.7	Grey tabby	J
21.05.11	GS 49	Tip-site	M		Grey tabby	A

The trapped population comprised 19 males and 30 females. The average weight of the adult males was 3.60 ± 1.0 kg (μ ± s.e.) and for females 3.0 ± 0.4 kg (μ ± s.e.).

In addition to the feral cats, several non-target species were captured in the leg-hold traps (e.g. Plate 9). The non-target species captured, their number and trap location are described in Table 3. The Echidna (*Tachyglossus aculeatus*) and Euros (*Macropus robustus*) were both released unharmed.

Plate 9. Non-target Echidna just released

Table 3. Non-target species captured, their number and trap location

Species	Number	Trap number
Euro	1	LH -29
Echidna(	1	LH -4
Wild Dog/Dingo (*Canis familiaris*)	2	LH -2,LH -12

The relative density of feral cats on the site, based on trapped animals only, was calculated as 27 cats/100 km linear transect, a figure that excludes those cats trapped around the tip-site and village areas which were reliant on provided food. Inclusion of those cats scavenging provided food gives a population estimate of or 181 cats/100 km^2, a figure that does not take into account edge-area considerations. It therefore underestimates the total number of cats as this cat density is only based on the actual trapping area.

Of the 49 cats trapped, only two had dietary items in their stomachs, other than food scavenged from the tip-site or village and are presented in Table 4.

Table 4. Stomach contents of trapped cats

Sample No.	Stomach content
GS - 42	Rabbit (*Oryctolagus cuniculus*) and Dragon *Ctenophorus* sp
GS - 46	Dunnart (*Sminthopsis macroura*)

Discussion and Recommendations

The number of cats trapped at the site was 27 cats/100 km linear transect and 181 cats/100km^2. This index of abundance is relatively high in comparison with that recorded at other mine sites (see Table 5). Ninety percent of the female cats were caught in the `artificial` environment of the waste disposal site and the village. These she cats are likely to depend on the reliable food source from the kitchen and the waste disposal site. Likewise seventy eight percent of the male cats were caught in the same area. This differs markedly from previous trapping programs where most cats were caught outside of the 'artificial' environment (see Hilmer *et al*. 2007). Necropsies on the trapped she cats showed that four females in the population at this time were lactating. Of the total trapped population thirty six percent were classed as either kittens or juveniles, a sure sign of a healthily growing population.

Table 5. Relative cat densities recorded at mine sites

Site	No. cats/100 km linear transect	No. cats/100 km^2	Reference
Argyle	80	150	Algar and Sinagra (1997)
Argyle	75	-	Sinagra and Algar (1998)
Argyle	24	-	Thomson (1999)
Mt. Keith	50	31	Algar *et al*. (2000)
Cosmos	47	34	Onus *et al*. (2001)
Bronzewing	35	33	Fuller *et al*. (2002)
Bronzewing	55	52	Onus *et al*. (2002)
Plutonic (Site 1)	31	30	Hamilton and Algar (2003)
Plutonic (Site 2)	10	13	Hamilton and Algar (2004)
Mt. Keith	23	23	Hamilton and Onus (2004)
Fortescue Marsh	27	-	Hamilton and Withnell (2005)
Jundee	34	11	Onus *et al.* (2006)

Mt Keith	30	17	Hilmer *et al.* (2007)
Granny Smith	27	181	This study

During the period of this study the main tip-site was never completely covered over. The front face of the tip was covered with soil (usually on a Sunday) but this still left over 90 percent of the rubbish exposed to scavenging (crows, kangaroos and cats). A greater effort could be made to completely cover the waste food on a regular basis. This would significantly reduce the food source available to the feral cats which would potentially reduce survival of both adults and natal recruits. There is no doubt that the tip-site acts as a local magnet for cats with 22 of the 49 cats caught in this study coming from there.

Plate 10. Tip site

Prior to our visit, the Granny Smith Operations Environmental staff conducted feral cat trapping on an *ad hoc* basis (Steve Petty pers. comm.). Maintenance of a more routine cage-trapping program in conjunction with strategic placement of leg-hold traps should prove sufficient to control cat numbers on and around the general mine area and accommodation villages, particularly if the tip-site recommendations are put in place. Anecdotal evidence that a number of cats around the kitchen area were being hand fed was confirmed. This naivety by staff is directly opposed to Barrick's no pet policy and contributes heavily towards the village cat population. Bagged rubbish including food scraps is often left overnight on the back of the rubbish truck for disposal the next day. It

was no surprise to find these bags shredded by the local village cats enjoying an easily obtained feast.

Recommendations for feral cat control across the mine lease are dependent on the level and extent of control required. Trapping programs will provide short-term control however they are labour intensive and only efficient in small-scale areas such as the general mine area and accommodation village and areas that are readily accessible by road or track. Over broad-scale areas or strategic sites, aerial baiting campaigns provide an operational and cost-effective method to control feral cat numbers. Feral cat baiting campaigns are now being conducted at a landscape scale at a number of sites in preparation for the successful reconstruction and conservation of biodiversity.

Acknowledgments

This work was made possible through the financial assistance from Barrick Granny Smith Operations. Thanks are also extended to Frances Mills (Environmental Advisor) and Steve Petty (Environmental Advisor) for their support and for facilitating this work and to the staff at Granny Smith Operations for their hospitality.

References

Abbott, I. (2002). Origin and spread of the cat, *Felis catus*, on mainland Australia, with discussion of the magnitude of its early impact on native fauna. *Wildlife Research* **29(1)**, 51-74.

Algar, D. and Burrows, N.D. (2004). A review of Western Shield: feral cat control research. *Conservation Science Western Australia* **5(2)**, 131-63.

Algar, D. and Sinagra, J.A. (1997). Feral cats: Argyle Diamonds. A report prepared for Argyle Diamond Mines Pty Ltd. Department of Conservation and Land Management, Western Australia.

Algar, D., Angus G.J. and Sinagra, J.A. (1999). Preliminary assessment of a trapping technique to measure feral cat abundance. Project ISP#11, Report to Environment Australia.

Algar, D., Angus, G.J., Adams, P.J. and Chavand O.L.A. (2000). Assessment of feral cat numbers and control options in the bait exclusion area on Mt. Keith. A Report to WMC Resources. Department of Conservation and Land Management, Western Australia.

Beard, J. (1976). Vegetation Survey of Western Australia, Sheet 6. Murchison, 1:1 000000 Map Sheet and Explanatory Notes. UWA Press, Perth.

Brunner, H. and Coman, B.J. (1974). The Identification of Mammalian Hair. (Inkata Press: Melbourne).

Burbidge A.A. and McKenzie N.L. (1989). Patterns in the modern decline of Western Australia's vertebrate fauna: causes and conservation implications. *Biological Conservation* **50**, 143-98.

Burrows, N.D., Algar, D., Robinson, A. D., Sinagra, J.A., Ward, B. and Liddelow, G. (2003). Controlling introduced predators in the Gibson Desert of Western Australia. J*ournal of Arid Environments* **55(4)**, 691-713.

Christensen, P.E.S. and Burrows, N.D. (1995). Project Desert Dreaming: the reintroduction of mammals to the Gibson Desert. In: Reintroduction Biology of Australian and New Zealand Fauna (ed. M. Serena) pp. 199-208. Surrey Beatty and Sons, Chipping Norton.

Cross, J. (1990). The feral cat – justification for its control. Report, Charles Sturt University, Wagga Wagga, NSW.

Dickman, C.R. (1996). *Overview of the impact of Feral Cats on Australian Native Fauna*. Report to Australian Nature Conservation Agency.

EA (Environment Australia) (1999) *Threat Abatement Plan for Predation by Feral Cats.* Environment Australia, Biodiversity Group, Canberra.

Fischer, J. and Lindenmayer D.B. (2000). An assessment of the published results of animal relocations. *Biological Conservation* **96(1)**, 1-11.

Fuller, P.J., Onus, M.L., Algar, D. and Angus, G.J. (2002). Assessment of Feral Cat Abundance and Control Options at the Bronzewing Operation: A Report to Newmont Australia. Department of Conservation and Land Management, Western Australia.

Gibson, D.F., Johnson, K.A., Langford, D.G., Cole, J.R., Clarke, D.E. and Willowra Community, (1995). The Rufous Hare-wallaby *Lagorchestes hirsutus*: a history of experimental reintroduction in the Tanami Desert, Northern Territory. In: Reintroduction Biology of Australian and New Zealand Fauna. (ed. M. Serena) pp.171-76. Surrey Beatty and Sons, Chipping Norton.

Hamilton, N.A. and Algar, D. (2003). Assessment of Feral Cat Abundance and Control Options at Plutonic Gold Mine: A Report to Barrick Gold of Australia Limited. Department of Conservation and Land Management, Western Australia.

Hamilton, N.A. and Algar, D. (2004). Further Assessment of Feral Cat Abundance and Control Options at Plutonic Gold Mine: A Report to Barrick Gold of Australia Limited. Department of Conservation and Land Management, Western Australia.

Hilmer, S.S., Hamilton, N.A. and Algar, D. (2007). Assessment of Feral Cat Abundance and Control Options at BHP Billiton Mt Keith operations August 2007. A report to BHP Billiton. Department of Environment and Conservation, Western Australia.

Johnson, K.A., Burbidge, A.A. and McKenzie, N.L. (1989). Australian Macropodoidea: status, causes of decline and future research and management. In: Kangaroos, Wallabies and Rat Kangaroos. (eds. G. Grigg, P. Jarman and I. Hume) Surrey Beatty.

McKenzie N. L, Burbidge A. A., Baynes A., Brereton R. N.,Dickman C. R., Gordon G., Gibson L. A., Menkhorst P. W., Robinson A. C., Williams M. R., Woinarski J. C. Z.(2007): Analysis of factors implicated in the recent decline of Australia's mammal fauna. *Journal of Biogeography* **34**, 597–611

Morton, S.R. (1990). The impact of European settlement on the vertebrate animals of arid Australia: a conceptual model. *Proceedings of the Ecological Society of Australia* **16**, 201-13.

Onus, M.L., Fuller, P.J., Angus, G.J. and Algar, D. (2001). Assessment of feral cat abundance and control options at the Sir Samuel Mines N.L., Cosmos Nickel Project. A report to Jubilee Mines N.L. Department of Conservation and Land Management, Western Australia.

Onus, M.L., Hamilton, N.A. and Algar, D. (2002). Assessment of Feral Cat Abundance and Control Options at the Bronzewing Operation: A Report to Newmont Australia. Department of Conservation and Land Management, Western Australia.

Onus, M.L., Hamilton, N.A., Hilmer, S.S. and Algar, D. (2006). Assessment of Feral Cat Abundance Newmont Jundee Operation: A Report to Newmont Australia. Department of Conservation and Land Management, Western Australia.

Possingham, H., Jarman, P. and Kearns, A. (2004). Independent review of Western Shield-February 2003. *Conservation Science W. Aust.* **5** (2), 2-18.

Risbey, D.A., Calver, M.C., Short, J., Bradley, J.S. and Wright, I.W. (2000). The impact of cats and foxes on the small vertebrate fauna of Heirisson Prong, Western Australia. II. A field experiment. *Wildlife Research* **27(3)**, 223-35.

Sinagra, J.A. and Algar, D. (1998). Feral cats: Argyle Diamonds. A report prepared for Argyle Diamond Mines Pty Ltd. Department of Conservation and Land Management, Western Australia.

Smith, A.P. and Quin, D.G., (1996). Patterns and causes of extinction and decline in Australian conilurine rodents. *Biological Conservation* **77**, 243-67.

Thomson, A. (1999). Feral cats: Argyle Diamonds. A report prepared for Argyle Diamond Mines Pty Ltd. Department of Conservation and Land Management, Western Australia.