Department of Sustainability and Environment

Assessing the effectiveness of buried baiting for the control of wild dogs in Victoria

A. Robley, L. Woodford, M. Lindeman, G. Ivone, M. Beach, I. Campbell, J. Blair, G. Lineham and W. Peters

2011

Arthur Rylah Institute for Environmental Research

Technical Report Series No. 213

Arthur Rylah Institute for environmental research

State Government Victoria

Arthur Rylah Institute for Environmental Research Technical Report Series No. 213

Assessing the effectiveness of buried baiting for the control of wild dogs in Victoria

Alan Robley, Luke Woodford, Michael Lindeman, Greg Ivone, Mathew Beach, Ian Campbell, John Blair, Glenn Lineham and Wayne Peters

Arthur Rylah Institute for Environmental Research
123 Brown Street, Heidelberg, Victoria 3084

July 2011

In partnership with:

Department of Primary Industries, Victoria

Arthur Rylah Institute for Environmental Research
Department of Sustainability and Environment
Heidelberg, Victoria

Report produced by: Arthur Rylah Institute for Environmental Research
Department of Sustainability and Environment
PO Box 137
Heidelberg, Victoria 3084
Phone (03) 9450 8600
Website: www.dse.vic.gov.au/ari

Citation: Robley, A., Woodford, L., Lindeman, M., Ivone, G., Beach, M., Campbell, I., Blair, J., Lineham, G., and Peters, W. (2011) Assessing the effectiveness of buried baiting for the control of wild dogs in Victoria. Arthur Rylah Institute Technical Report Series No. 213. Department of Sustainability and Environment, Heidelberg, Victoria

ISSN 1835-3827 (print)

ISSN 1835-3835 (online)

ISBN 978-1-74343-944-1 (print)

ISBN 978-1-74343-945-8 (online)

Front cover photo: Wild dog at bait station (Alan Robley).

Authorised by: Victorian Government, Melbourne

Printed by: PRINTROOM 77 St Georges Rd, Preston 3072

Contents

List of tables and figures

List of tables

List of figures

Acknowledgements

We thank the Department of Primary Industries (DPI) Victoria for logistical support throughout this project, particularly Andy Wernert and Vaughn Kingston, and the Gippsland and North East Wild Dog Management Groups for their continued support. This work was conducted under the Department of Sustainability and Environment (DSE) Animal Ethics Committees permit number 09/09. The project was funded by DPI. Comments by Jenny Nelson and Lindy Lumsden greatly improved earlier versions of this report.

Summary

Baits containing the poison 1080 (sodium fluoroacetate) are commonly used to reduce wild dog (feral domestic dogs *Canis familiaris familiaris,* dingoes *Canis lupus dingo* and their hybrids) numbers in Australia. In 2009 we attempted to determine the optimal number of control devices (traps and bait stations) required to achieve a given reduction in wild dogs. Despite an extensive trapping effort by wild dog controllers over several weeks at four sites, only three dogs were captured. The project was refocused to provide more generalised information on the effectiveness of buried baiting as a tool for the control of wild dogs. This project aimed to quantify the effectiveness of buried baiting during autumn and early winter by assessing dog activity before and after a poisoning operation.

Four study sites were selected: (1) Gibb Range, (2) Black Range, (3) Fumina and (4) Dargo. At each site 20–25 bait stations were established, and a heat-in-motion activated camera installed. The cameras recorded dog activity before and after baiting, as well as visitation rates to bait stations. Dargo was abandoned because of the theft of cameras, and at Fumina the number of cameras during the baiting phase was also reduced by theft.

There was no significant change in detection rates for wild dogs, foxes (*Vulpes vulpes*) or feral cats (*Felis catus*) at any site; although at Fumina there was a trend towards an increase in detection rates.

Although cameras did not record bait take by wild dogs at any site, based on inspection of bait stations controllers believed that dogs took baits on three occasions at Fumina, twice at Black Range, and not at all at Gibb Range. Cameras recorded dogs inspecting bait stations on three occasions at Black Range, but not at all at the other two sites. Foxes were recorded taking baits at all three sites by controllers and cameras. Cameras recorded foxes inspecting bait stations twice and six times as often at Fumina and Black Range than at Gibb Range. Controllers at Black Range reported 10 bait takes as unknown. Cats were not recorded at bait stations at any of the four sites.

The overall bait take and/or encounter rate was higher at Fumina and Black Range where the road and track network was closer to a random pattern, and lower at Gibb Range which tended more towards an organised pattern in the landscape.

The effectiveness of poison baiting to reduce wild dog numbers varies with location. The underlying causes of this variation remain unknown. There are a range of possible factors that may influence the success of a baiting program (e.g. degradation of 1080 in the baits over time, the removal of baits by non-target species, and/or the availability of natural prey, the frequency of bait replacement, and the duration of the program; McIlroy et al. 1986). Other factors may include the underlying density of wild dogs in relation to the density of baits, and the density of baits in the landscape in relation to the movement patterns and area of use of wild dogs.

Some of these factors cannot be controlled, but the others should be taken into consideration when designing and implementing a baiting operation.

1 Introduction

Baits containing the poison 1080 (sodium fluoroacetate) are commonly used to reduce wild dog numbers around Australia. Despite the widespread use in other parts of Australia, baiting for the control of wild dogs in Victoria has previously been limited by a lack of quantitative data under Victorian conditions resulting in a general lack of acceptance by the community of its effectiveness.

In 2008 an assessment of the effectiveness of baiting was undertaken at two sites in Victoria: one in the north-east and one in Gippsland (Robley et al. 2008). The results of that project indicated that, while baiting was effective, its effectiveness varied between sites. In 2009 we attempted to determine the optimal number of control devices (traps and bait stations) required to achieve a given reduction in wild dogs. To adequately assess the optimal strategies for the control of wild dogs we needed a meaningful *a priori* expectation of the level of population coverage achievable by differing densities of control devices (baits and/or traps). To this end we attempted to construct a spatially explicit model to simulate encounter rates between wild dogs and control devices at different forest road and control device densities.

To develop the device encounter model we planned to use data from four sites (two in the north-east and two in Gippsland) where detailed GPS location data (10-minute intervals) was to be collected from a minimum of five wild dogs fitted with GPS collars at each site. Detailed location data was required to determine the area of activity of wild dogs in relation to the placement of control devices, the probability of encounter with a control device, and the probability that a dog will interact (i.e. step in a trap or take a bait) with a device given it has encountered one. Despite extensive trapping by wild dog controllers over several weeks at four sites, only three dogs were captured. This was insufficient for the project as described above to proceed.

The project was therefore refocused to provide more generalised information on the effectiveness of buried baiting as a tool for the control of wild dogs. It builds on the previous study by undertaking work on four sites in the same season. The use of multiple sites allows for variations in dog density, road network complexity and biogeography. There is some evidence to suggest that wild dog movement behaviour changes from breeding season to non-breeding season (Lee Allen pers. comm.), which might effect the probability of encountering baits. Undertaking this work in the same season minimised any variation caused by such changes in dog behaviour.

This project aimed to quantify the effectiveness of buried baiting for the control of wild dogs in Victoria during autumn and early winter by assessing dog activity before and after a poisoning operation. We attempted this by assessing visitation rates of wild dogs to bait stations as detected by cameras activated by heat-in-motion. A significant decrease in the camera detection rate would indicate that the baiting program was effective at reducing wild dogs in the area during the period of baiting.

2 Study sites and methods

2.1 Study sites

This project was carried out at four study sites through autumn and early winter 2010. The four sites were: Gibb Range (147°37′05″ E, 36°25′54″ S), Black Range (146°35′00″ E, 36°47′00″ S), Fumina (146°08′45″ E, 37°55′44″ S) and Dargo (147°69′25″ E, 37°27’46″ S) (Figure 1).

All four sites were selected for their proximity to the private – public land interface, year-round track access, previous history of wild dog activity, and little or no control measures in the previous 12 months.

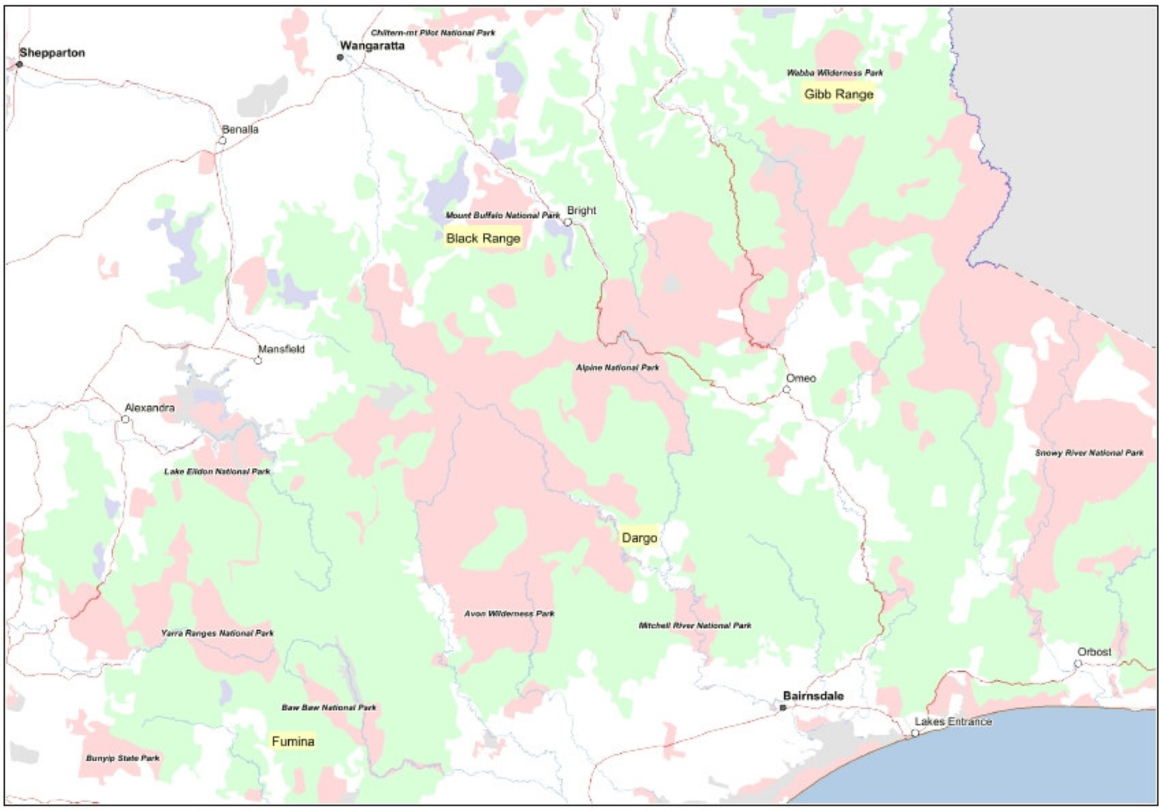


Figure 1. Location of the four study sites: Gibb Range, Black Range, Fumina and Dargo.

2.2 Methods

2.2.1 Monitoring

Pre-baiting monitoring

Heat-in-motion cameras were set at 1 km intervals along forest roads and tracks overlooking bait stations (Figure 2). At Gibb Range and Black Range, 17 and 22 cameras respectively were set from 10 March to 13 April 2010 (578 and 748 camera-days respectively). At Fumina, 24 cameras were set from 9 March to 29 April 2010 but three were stolen during this time (726 camera-days), and at Dargo 20 cameras were set from 9 March to 14 April 2010; however, this site was abandoned because of the theft of 12 cameras during this phase. The difference in camera numbers at the sites was the result of failures of cameras during the set-up phase.

Post-baiting monitoring

At Gibb Range, 17 cameras were set from 17 June to 2 July 2010 (340 camera-days) and at Black Range 22 cameras were set from 26 May to 28 June 2010 (700 camera-days). At Fumina, 22 cameras were set from 1 June to 29 June 2010, but 17 of these were stolen. Memory cards in all cameras had been changed before the theft allowing for some data retrieval from cameras subsequently stolen. This resulted in 243 camera-days of data.

Images of animals passing on the road were recorded using Reconyx RapidFire ProPC90 heat-in-motion activated digital cameras (Reconyx, LLP Wisconsin, USA) or ScoutGuard SG550V digital cameras (HCO, Norcross, Georgia, USA). These cameras record 3.1 megapixel colour images during daylight and 3.1 megapixel infra-red images at night. They were set to record three images as fast as possible once motion was detected (on average, two images every three seconds) and to keep recording images as long as motion was detected.

Camera detection rate was defined as the ratio of independent photographs to the number of camera-days (number of 24-hour periods during which cameras were operating, i.e. until memory card was full or cameras were retrieved) and multiplied by 100. Consecutive photographs of a wild dog at the same site were deemed independent if there was at least a one-hour interval between them. Camera detection rates were compared across all sites before and after baiting to assess whether there had been a reduction in wild dog activity.

Figure 2. Digital heat-in-motion camera set at bait station.

2.2.2 Poison baiting

Poison baiting, using meat baits containing 4.5 mg of 1080, was undertaken at each site after the initial monitoring period. Baits were prepared by a commercial manufacturer and deployed by DPI wild dog controllers. Baits were buried 12 cm deep in a flat earth bait station. Baits stations were checked and all baits replaced every 14 days.

At Gibb Range and Black Range, 22 bait stations were constructed and baiting conducted as described above by DPI wild dog controllers for 49 and 41 days respectively and at Fumina 24 bait stations were installed and operated for 41 days.

A 'visit' to a bait station was recorded when a wild dog was photographed inspecting a bait station but did not attempt to remove the bait. An 'encounter' was recorded if a wild dog was photographed taking a bait from a bait station. These records were compared to those made by the wild dog controllers who visually assessed bait stations to determine which species had taken bait.

To assess the minimum number of wild dogs in an area, individual dogs were identified by first grouping images by general coat colour (yellow, sable, black, brindle). Within these groups, individual dogs were identified by assessing multiple images and comparing markings (e.g. presence, location and size of socks, colouration around muzzles, chest markings), signs of age (e.g. grey muzzle, greying coat), sex (if discernible) and physical condition. Dogs that could not be assigned to an individual were not counted.

Detection rates where assessed as the number of independent detections divided by the number of camera days, and we determined the 95% confidence interval for pre- and post-control detection rates. The relative change in detection rate was determined by subtracting the post-control rate from the pre-control rate.

We determined the distribution of bait stations at each site (clumped, uniform or random) using the nearest neighbour method in ArcView 3.3. The distance of each bait station from the nearest neighbouring bait station was also recorded. For two individual stations that are each other's nearest neighbor, the distance is recorded twice, once for each station. To determine the nature of the bait stations distribution, the average distance between nearest neighbors was compared to the expected distance in the case of random distribution, to give the ratio *R*:

$$R = \frac{\text{mean distance}}{0.5\sqrt{\text{density}}}$$

An *R* value of 0 (zero), indicates an intensely clustered pattern, while an *R* value of 1 indicates a random distribution, and an *R* value of 2 (or higher) indicates strongly dispersed or organized pattern.

To determine bait station density we buffered each bait station by 1 km to provide an area within which wild dogs would be able to encounter a bait station. This is likely to be an underestimate of the effective detection area and is based on occupancy estimates of foxes around bait stations in the Great Dividing Range of Victoria (Lumsden et al. 2010).

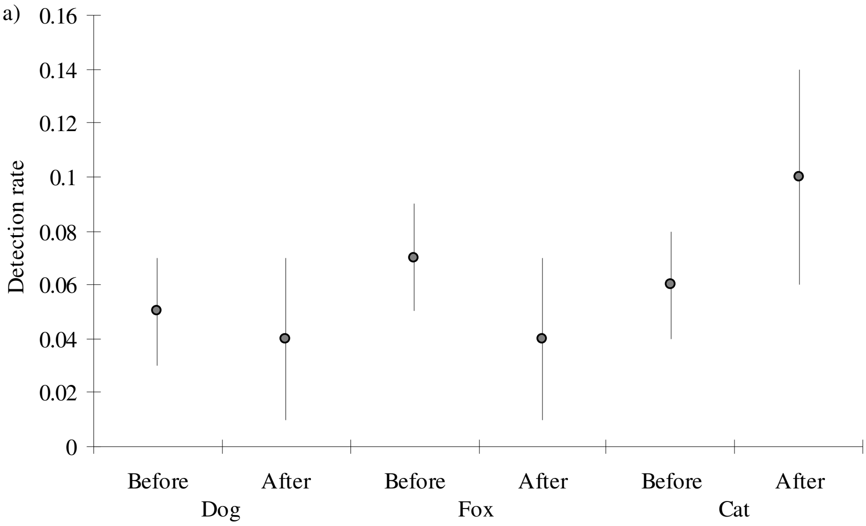
3 Results

3.1 Pre-baiting and post-baiting activity

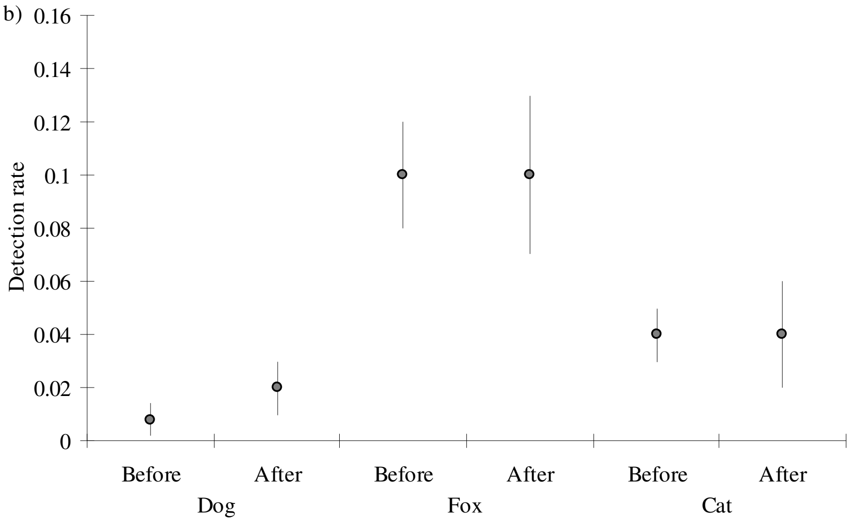
At Black Range cameras were deployed for 770 camera/days pre-control and 550 camera/days post-control, at Fumina there were 726 camera/days pre-control and 243 post-control and at Gibb Range 576 and 648 camera/days respectively. We detected wild dogs, as well as foxes and feral cats at all sites before and after control.

There was no significant change in detection rates for wild dogs, foxes or feral cats at any site as indicated by the non-overlapping 95% confidence limits. Although at Fumina confidence limits for feral cats overlapped only partially (Figure 3a-c).

a)



b)



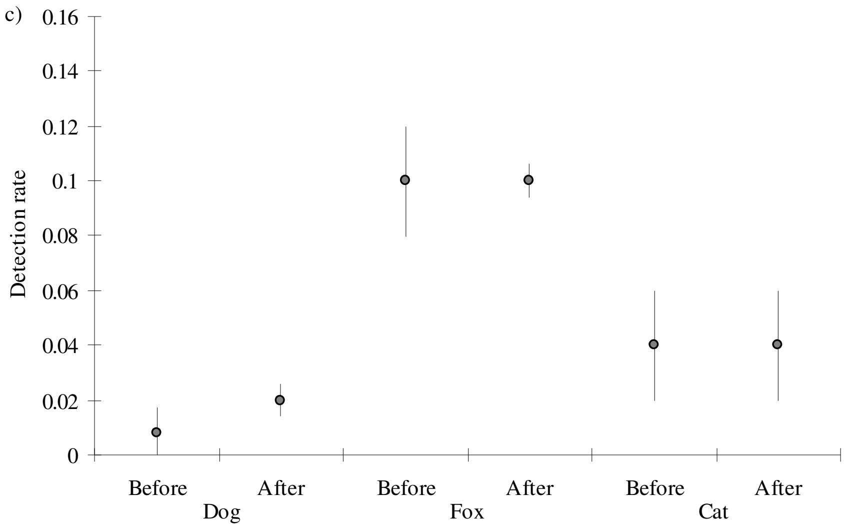


Figure 3a-c. Detection rates (number of independent images/camera days) for wild dogs, foxes and feral cats at a) Fumina, b) Black Range, and c) Gibb Range. Bars are 95% confidence limits.

The relative change in detection rate for wild dogs changed little at all sites, there was a notable negative effect on foxes at Gibb Range and Fumina and a positive effect on feral cats at Fumina (Figure 4).

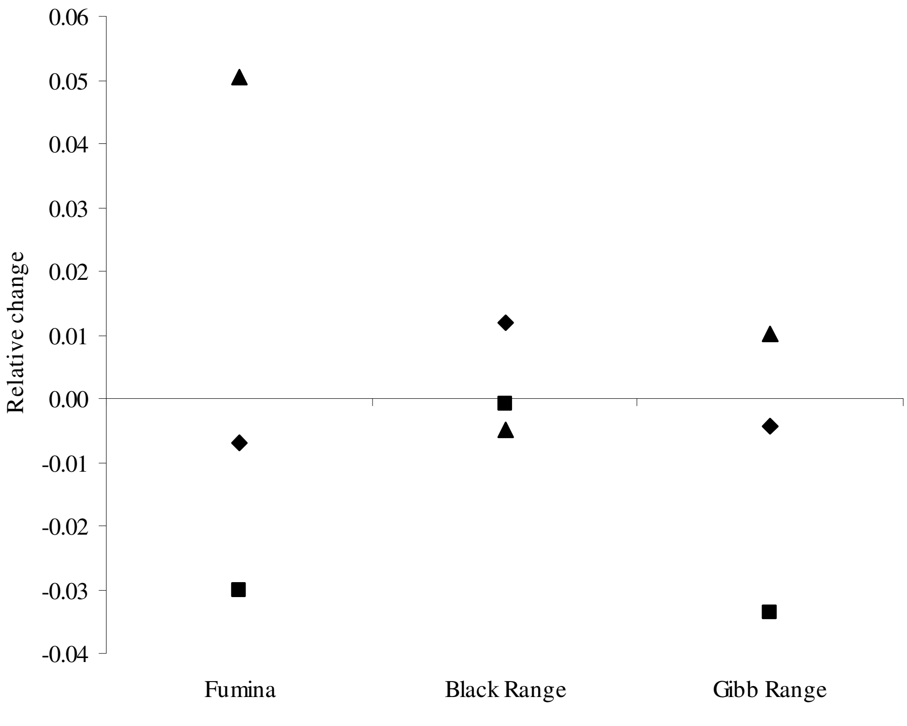


Figure 4. Relative change in detection rate of wild dogs, foxes and feral cats at the three study sites. Wild dogs – diamonds, Foxes – squares and Feral Cats – triangles.

3.2 Bait take

Camera traps did not record wild dogs taking any bait during this trial (Table 1). Wild dog controllers reported wild dog bait-take at two of the three study areas, wild dog/fox at one area and unknown at two areas. Foxes were recorded by both cameras and wild dog controllers taking baits at two study areas and inspecting bait stations at all three areas. Cameras recorded a range of non-target species near a bait station, but only one (Southern Brown Bandicoot *Isoodon obesulus*) was recorded digging at a station.

Table 1. The number of baits taken by different species as recorded by cameras and wild dog controllers at all three study areas.

	Fumina		Black Range		Gibb Range	
	WDC	Camera	WDC	Camera	WDC	Camera
Dog	3	0	2	0 (3)	0	0
Dog/fox	6	0	0	0	0	0
Fox	3	6 (6)	2	6 (18)	3	0 (3)
Unknown	0	0	10	0	3	0
Bandicoot	0	1	0	0	0	0
Total Bait Take	12	13	14	6	6	0

Notes: WDC = Wild dog controller. Numbers in parentheses are records of bait station visitations with no image of bait take.

3.3 Road and track networks

Bait stations at Black Range ($z = 0.34$, $R = 1.04$, $n = 21$) and Fumina ($z = 0.12$, $R = 0.99$, $n = 24$) were found to be randomly distributed, while those at Gibb Range ($z = 1.66$, $R = 1.2$, $n = 21$) was closer to an organised pattern. Although we discontinued monitoring bait take via cameras at the Dargo study area, the wild dog controller maintained the baiting program. At Dargo most bait stations were set along the main Cynthia Range track, and tended towards a dispersed and organised pattern along the ridge ($z = 2.56$, $R = 1.3$, $n = 23$).

The overall bait take and/or encounter rate was greatest at Fumina and Black Range where the road and track network was closer to a random pattern, and lower at Gibb Range which tended more towards an organised pattern in the landscape (Figure 5).

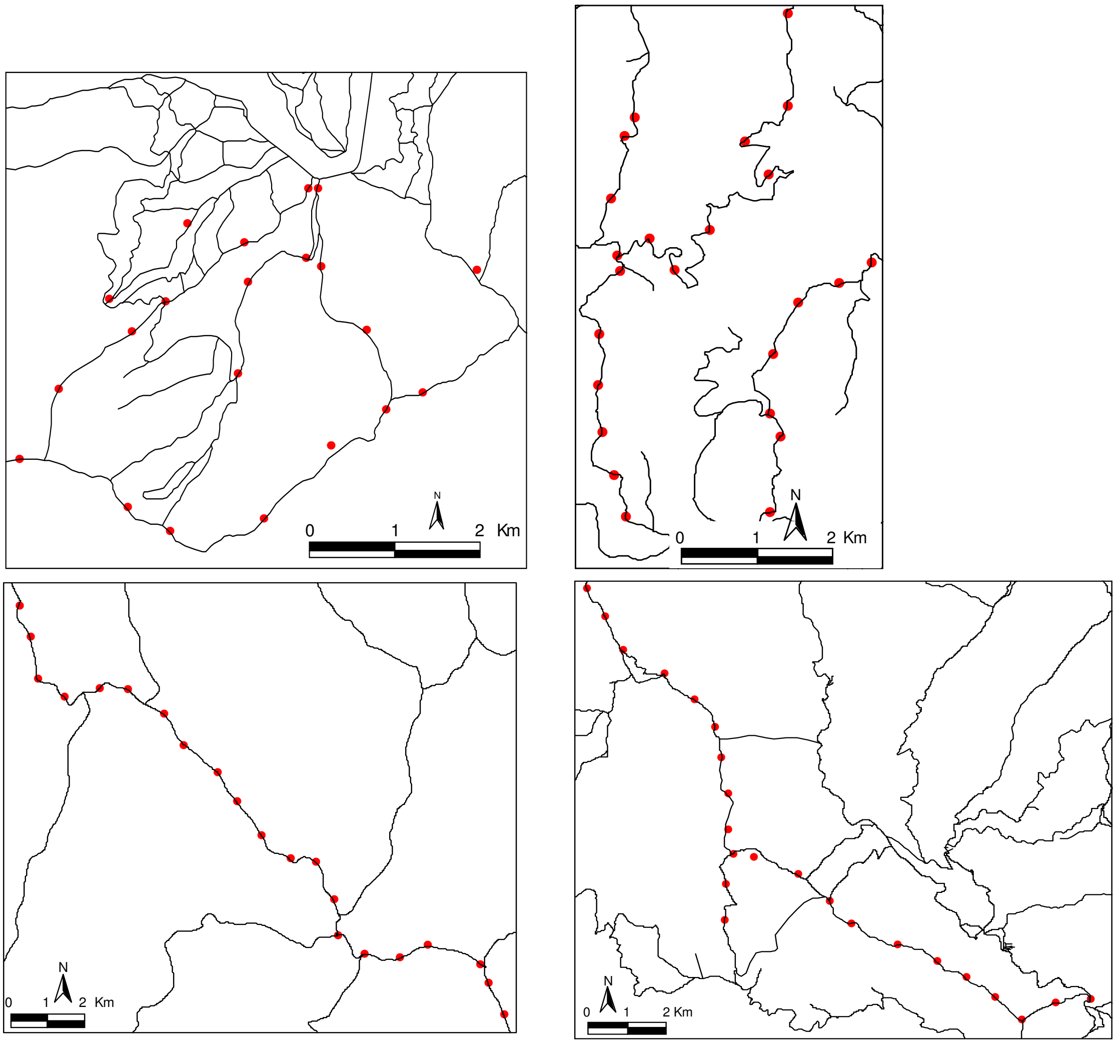


Figure 5. Track and road network in the four study areas, showing bait station placements: (clockwise, from top left) Fumina, Black Range, Gibb Range and Dargo.

4 Discussion

The project was hindered in achieving its aims because of the theft of cameras from Dargo during the pre-baiting monitoring period, resulting in that site being abandoned, and because of the theft of cameras at Fumina during the baiting phase. Despite the theft at Fumina, we were able to assess wild dog activity at this site. The effect of the consequent reduction in sampling effort on the overall result however is unknown.

We were unable to detect any statistically significant changes in wild dogs after baiting at any of the three sites. There was a trend towards a decrease at Gibb Range and Fumina and a trend towards a increase at Black Range. In similar research projects, wild dog activity was reduced by 76.1% at a site in the temperate rangelands of NSW in summer (Fleming 1996) and by 69% in central Australia (Best et al. 1974). However, McIlroy et al. (1986) in Kosciusko National Park in autumn recorded a 22% reduction from nine radio collared dogs and Bird (1994) reported a reduction in a population of 300–400 wild dogs in an arid area of South Australia of 10–13%. An earlier study investigating changes in wild dog activity before and after baiting at Merrijig in north-eastern Victoria (autumn) and Deptford in Gippsland (spring) recorded a decrease in wild dogs of 11% and 70% respectively (Robley et al. 2009). Autumn and early winter may not be the most effective time of year to undertake baiting for the control of wild dogs, because the activity of wild dogs at this time of year may be centred more on finding mates and establishing breeding sites, reducing their ranging behaviour and hence the probability of encountering bait stations.

Fleming (1996) noted that the important factor in comparing studies is the number of baits that are available per targeted animal. In the studies of McIlroy et al. (1986) and Bird (1994) this number was relatively low compared to Fleming's study. Fleming (1996) in their research project held the number of baits available to wild dogs constant by replacing baits daily for 10 days at one site and for 14 days at the other. The effect of this strategy is that, as wild dogs are removed from the population, the probability that the remaining animals will encounter bait increases exponentially. This is in contrast to the current operational approach used in Victoria, where during month long baiting program, baits are checked and replaced only once. As a result of non-target bait take (mainly foxes) the number of available baits can decline quickly. Consideration could be given to increasing the frequency of bait checking/replacement or increasing the duration of a baiting operation, which would have the effect of increasing the probability of a wild dog encountering viable bait.

Many factors are likely to influence the rate at which wild dogs and or foxes take baits such as underlying densities of competitors, the availability of alternate food sources, the condition of the bait, and the spatial distribution of baits. In this current study and in Robley et al. (2009), at sites where baits tended to be distributed randomly across an area (i.e. where a network of tracks is available) bait take and encounter rates tended to be higher. Where possible attention should be given to establishing bait stations across a network of tracks/roads rather than along single lines, e.g. ridges.

In this study, while there was no significant difference, there was a tendency for decreased fox activity at Fumina and Gibb Range. Foxes were detected by cameras taking bait on 12 occasions at two sites, and by wild dog controllers eight times at three sites. This suggests, in part, that foxes may have accessed more baits than dogs. It is possible that the wild dog controllers misidentified fox sign as wild dog sign or wild dogs visited some bait stations after foxes had removed bait from a bait station, and that any apparent difference in wild dog activity reflect background variation in activity levels and not any change in wild dog numbers.

Feral cats were not recorded taking baits at all, but camera detection rates tended towards an increase at Gibb Range, where both foxes and wild dog activity showed a tendency to decrease. It has been suggested that wild dogs may limit abundance of foxes, and that foxes may inturn limit the abundance of feral cats (Robley et al. 2004, Glen and Dickman 2005). The timeframe between pre and post baiting monitoring in this study does not allow for a numerical response in feral cats, however, it would be possible for feral cats to increase their level of activity in the absence of wild dogs and foxes. Both the degree of relative change and the near non-overlapping 95% confidence intervals at Fumina suggest that this may be the case at that site. Integrated introduced predator control needs consideration by land managers where the protection or enhancement of biodiversity is the main aim.

The effectiveness of poison baiting to reduce wild dog numbers varies with location. The underlying causes of this variation remain unknown. There are a range of possible factors that may influence the success of a baiting program (e.g. degradation of 1080 in the baits over time, the removal of baits by non-target species, and/or the availability of natural prey, the frequency of bait replacement, and the duration of the program; McIlroy et al. 1986). Other factors may include the underlying density of wild dogs in relation to the density of baits, and the density of baits in the landscape in relation to the movement patterns and area of use of wild dogs.

Some of these factors cannot be controlled, but the others should be taken into consideration when designing and implementing a baiting operation

References

Best, L.W., Corbett, L.H., Stephens, D.R. and Newsome, A.E. (1974). Baiting trials for dingoes in central Australia, with poison '1080', encapsulated strychnine, and strychnine suspended in methylcellulose. Technical Report No. 30, CSIRO Division of Wildlife Research

Bird, P. (1994). Improved electric fences and baiting techniques — a behavioural approach to integrated dingo control. Unpublished final report to the Wool Research and Development Corporation (Project DAS39)

Fleming, P. (1996). Ground-placed baits for the control of wild dogs: Evaluation of a replacement-baiting strategy in north-eastern New South Wales. *Wildlife Research* **23**, 729–40

Glen, A. S., and Dickman, C. R. (2005). Complex interactions among mammalian carnivores in Australia, and their importance for wildlife management. *Biological Review* **80**, 387-401.

Lumsden, L., Chick, R., Scroggie, M., Howard, K., Woodford, L., Douglas, A., Alexander, J. and Pascoe, C. (2010). Assessing management strategies and wildfire impact on Long-footed Potoroos in the Great Dividing Range area. 4th Progress Report. Arthur Rylah Institute for Environmental Research Unpublished Report. Department of Sustainability and Environment, Heidelberg, Victoria

McIlroy, J.C., Cooper, R.J., Gifford, E.J., Green, B.F., and Newgrain, K.W. (1986). The effect on wild dogs, *Canis f. familiaris*, of 1080-poisoning campaigns in Kosciusko National Park, N.S.W. *Wildlife Research* **15**, 535–44

Robley, A., Reddiex, B., Arthur, T., Pech, R., and Forsyth, D. (2004). Interactions between feral cats, foxes, native carnivores and rabbits in Australia. Report to the Department of the Environment and Heritage, Canberra. Arthur Rylah Institute. Department of Sustainability and Environment, Heidelberg, Victoria

Robley, A., Woodford, L., Lee, P., Kingston, V., Peters, W., Klippell D., and Gormley, A. (2009) Assessing the effectiveness of ground-based baiting for the control of wild dogs. Arthur Rylah Institute Technical Report Series No. 193. Department of Sustainability and Environment, Heidelberg, Victoria.

Tobler, M.W., Carrillo-Percastegui, S.E., Pitman, L.R., Mares, R. and Powell, G. (2008). Further notes on the analysis of mammal inventory data collected with camera traps. *Animal Conservation* **11**, 187–189

Towerton, L.A., Penman, D.T., Blake, E.M., Deane, T.A ., Kavanagh, P.R. and Dickman, R.C. (2008). The potential for remote cameras to monitor visitation by birds and predators at Malleefowl mounds. *Ecological Management & Restoration* **9**, 64–67

ISSN 1835-3827 (print)
ISSN 1835-3835 (online)
ISBN 978-1-74242-944-1 (print)
ISBN 978-1-74242-945-8 (online)