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Adaptive Experimental Management of Foxes

Annual Report: July 2002-2003

Authors: A. Robley and J. Wright
September 2003

Parks
VICTORIA

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Adaptive Experimental Management of Foxes

Annual Report: July 2002-2003

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Executive Summary

This is the annual report for the year 2002/03 of the Fox Adaptive Experimental Management (AEM) project being conducted in partnership by Parks Victoria and the Arthur Rylah Institute for Environmental Research (ARIER), Department of Sustainability and Environment.

This report presents a summary of the design of the Fox AEM project and the process of implementation, as well as results from the first 2 years of the fox control programs, the initial prey species surveys, outcomes from the second annual meeting, actions for resolving issues arising from the second year and directions for 2003/04.

In 2002/03, Parks Victoria undertook fox control at approximately 70 sites across the state. These fox control programs mainly involved baiting at a range of spatial and temporal intensities. However at present, Parks Victoria's understanding of the relative efficiency and effectiveness of the different strategies is limited. The range of sites at which fox control is undertaken, and the range of strategies implemented across these sites provides an ideal opportunity for applying an AEM approach.

The main objectives of the Fox AEM project are to:

- Measure the effect of different combinations of control intensity and timing on densities of foxes and on the responses of selected prey species.

- Measure the costs of each strategy and ultimately compare the costs and benefits of the different strategies.

- Assess the effectiveness of the AEM approach for large-scale pest management.

Six parks are involved in the project:

- Coopracambra National Park

- Discovery Bay Coastal Park

- Grampians National Park

- Hattah-Kulkyne National Park

- Little Desert National Park

- Wilsons Promontory National Park

At each of these parks a unique combination of timing (the period of baiting) and intensity (the number of baits per kilometre) is being applied. There are several non-treatment (experimental control) sites within these parks.

A vital component to the success of any AEM project is the ability to monitor changes in the managed system that are caused by management actions. Monitoring changes in bait take and fox activity is being conducted in each of the parks involved in the project.

Changes in the abundance in prey species will also be monitored. Detailed monitoring protocols for species at risk from fox predation were developed in 2002/03 and will be implemented in 2003/04. During the development of these protocols this project has established for the first time, the presence of the Southern Brown Bandicoot and the Long-nosed Potoroo at Coopracambra National Park, and confirmed the presence of the Little Pygmy Possum at the Little Desert National Park, which is an extension of the known range for the species.

Results from the fox baiting programs indicate that continuous control operations over large areas are more likely to suppress fox numbers (as measured by bait take and activity indices) than seasonal or short-term operations over small areas. The degree to which the various intensities of annual baiting programs suppress fox numbers remains to be seen. While the results form the initial 2 years of the project are encouraging, it is too early to draw any robust conclusions about the relative effectiveness or efficiency of different fox management regimes. To make any evaluation, the fox management regimes and associated monitoring programs that underpin the AEM process need to be maintained for long enough that we might reasonably expect to see a response in prey populations. Experience tells us it will be at least 3-5 years until medium-sized mammals might be expected to show a cohesive response to fox control. We will have a greater appreciation of the relationship between bait take and fox activity by the end of next year. This may lead to the program having less reliance on the use of sand pads for fox activity monitoring.

While results suggest continuous large-scale baiting appears to be the most effective strategy, there are potential long-term implications of this approach. These include the development of bait aversion and/or tolerance to 1080 poison. Further investigations are required to provide information on the consequences of long-term baiting operations that rely on 1080 poison.

Two administrative structures have been put in place to assist in the management of the Fox AEM. A Steering Committee will provide strategic direction and cross-organisational co-

ordination of the program, while two Regional Working Groups (East/West) will facilitate intra-regional coordination and resourcing of the program and implementation of key recommendations made by the Steering Committee.

Data storage has been facilitated by the development of site-specific databases to capture changes in bait take, fox activity and the effort expended on management activities. The databases were redesigned to improve the ease with which data can be entered and transferred to the Parks Victoria Environmental Information System.

The development and implementation of spatial models representing the expected outcomes of fox control for each park, both in terms of changes in the fox population and the prey species abundance is under way. An initial model for an individual park (the Grampians National Park), has been developed and the experience and knowledge gained will be used to implement model development for the remaining five parks.

The AEM approach has not been applied widely to pest animal management. The limited numbers of examples that are available worldwide indicate the approach can be successful. This project is leading the implementation of AEM for pest animal management in Australia. The project cannot answer all the questions regarding the control of foxes on Parks Victoria estate. It needs to be seen as a template or pilot project demonstrating the processes of AEM that if successful, could be expanded to build a greater understanding of the best ways to deliver effective and efficient fox control.

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Introduction

In 2001, Parks Victoria instigated a project in partnership with the Arthur Rylah Research Institute for Environmental Research (ARIER) to measure the costs and benefits of a range of fox control strategies using an Adaptive Experimental Management (AEM) approach. A detailed explanation of the Fox AEM project is presented in the 2001/02 annual report (Robley and Wright 2001), for further information on adaptive management see Walters 1997.

Parks Victoria undertakes fox control in 70 parks and reserves across the State. These fox control programs mainly involve poison baiting at a range of spatial and temporal intensities. The Fox AEM project arose from a recognition by Parks Victoria of the need to increase its understanding of the relative efficiency and effectiveness of the different strategies used to control foxes. The range of sites at which fox control is undertaken, and the range of strategies implemented across these sites provides an ideal opportunity for applying an AEM approach.

This project will not answer all the questions regarding the control of foxes on the Parks Victoria estate. It needs to be seen as a template or pilot project demonstrating the processes of AEM that if successful, could be expanded to build a greater understanding of the best ways to deliver effective and efficient fox control.

This document is the annual report for the second year of the project and provides data and information on the first two years of this project. Results are presented in terms of the effectiveness of the fox control programs in reducing fox activity for each park and the initial results of prey species monitoring protocol development. Detailed prey response monitoring protocols are presented in a separate document (Robley *et al.* in prep.). Information on the efficiency of each program is also presented and evaluated. The implementation and outcomes of the AEM approach are also discussed. This report also identifies issues with the AEM approach and suggests actions for the further implementation and improvement of the AEM project.

Objective

The objective of the Fox AEM project is to determine the relative costs and benefits of different fox control strategies by implementing a program that will:

- Measure the effects of different combinations of spatial and temporal intensities of fox control on fox activity and on the responses of prey species;

- Measure the costs of each fox control strategy and ultimately compare the costs and benefits of the different strategies; and

- Assess the effectiveness of the AEM approach to landscape-scale pest management.

Methods

Detailed descriptions of the project development and design, the parks involved and the fox control strategies and monitoring programs being used in this project are provided in the proceedings of two workshops held in August 2001 (Choquenot and Robley 2001). These workshops were held as part of the development of the Fox AEM project. This section provides a summary of the project design and methods.

STUDY SITES

Six parks are involved in the Fox AEM project. These parks either had existing fox control operations or had a new program designed to suit this AEM project. The parks are:

- Coopracambra National Park;
- Discovery Bay Coastal Park;
- Grampians National Park;
- Hattah-Kulkyne National Park;
- Little Desert National Park; and
- Wilsons Promontory National Park

The Fox AEM project will also take advantage of a large-scale fox control project known as Project Deliverance, which has been operating in eastern Victoria for the past 4 years. This project will offer results from additional spatial and temporal intensities of control operation and provide a control site for Coopracambra National Park.

TREATMENTS

At each of the parks involved in the project, a unique combination of timing and intensity of fox control using 1080 poisoned baits is being implemented. The timing of baiting operations has been divided into three categories:

1. **Continuous – annual programs.** Baits are laid every two to three weeks throughout the year.

2. **Continuous - seasonal programs**. These programs bait on a regular basis but the baiting occurs within a specific period each year. The period during which baiting occurs is dictated by a number of factors including the timing of available resources, seasonal access to areas, or the period a prey species is thought to be most at risk from predation.

3. **Pulsed programs.** This strategy is specific to Wilsons Promontory National Park. Baiting is continuous for a specific period with a break of several weeks between 'pulses' of baiting.

4. Intensity of baiting is measured by the number of baits laid per square kilometre and is also divided into three categories,

    High = >0.6 baits/km^2

    Medium = $0.2 - 0.6$ baits/km^2

    Low = <0.2 baits/km^2

These intensities are relative to the parks involved in the project and reflect the range of control activities in place across the Parks Victoria estate at the beginning of the Fox AEM project. A full description of the fox control strategies undertaken on each park is given in Appendix 1. Data from Project Deliverance will be used to supplement the outcomes from the Fox AEM project and increase our understanding of fox control. Results from Project Deliverance are summarised in Appendix 2. Table 1 summarises the project design indicating the various timings and intensity of fox control programs being implemented in each of the participating parks.

Table 1. The fox control strategies being implemented in the Fox AEM project.

	Timing		
Intensity	*Continuous – annual*	*Continuous – seasonal*	*Pulsed*
High	Deliverance West Coast Hattah-Kulkyne National Park *Grampians National Park – Red Rock	*Discovery Bay Coastal Park	Wilsons Promontory National Park – Isthmus
Medium	Deliverance East Coast Deliverance Stony Peak	Little Desert National Park - East Block	Wilsons Promontory National Park – Central
Low	Coopracambra National Park	Little Desert National Park – Central Block *Grampians National Park – Perimeter	Wilsons Promontory National Park – South

* these programs are currently under review.

NON-TREATMENT SITES

Fox activity patterns and prey response can show year to year variation making interpretation of changes in fox activity and prey response difficult in the short term. To

improve the ability of the project to infer change related to fox control, a number of non-treatment (no baiting) sites have been established. These will act as reference points against which changes in fox activity and potential prey responses can be measured. Measuring changes on the non-treatment sites will aid in the interpretation of the variation in fox and prey responses from year to year due to factors other than effects of fox control.

It was not possible to establish non-treatment sites for each treatment or at each park due to logistic constraints. Non-treatment sites have been established at Hattah-Kulkyne for both changes in fox and prey species abundance and Little Desert and Grampians National Park (changes in fox abundance only) as well as the pre-existing sites that are part of Project Deliverance (Table 2).

The Stony Peak site in the Deliverance program will provide a control site for the Coopracambra program (for changes in fox and prey species abundance). The Stony Peak site is similar to Coopracambra National Park in terms of location, geography, geology and topography as well as the dominant vegetation communities. There is potential to implement a non-treatment site in the north-east section of Wilsons Promontory National Park however difficult and unreliable access is problematic at this location. It would also be possible to establish a prey species control site at the Grampians, however financial and logistical constraints are significant factors limiting the establishment of this control site.

Table 2. Parks with areas that are designated non-treatment sites.

Park	Location of non-treatment (control) sites	Baiting programs non-treatment sites provide control for
Hattah-Kulkyne National Park	Eastern section of park	For western section annual High intensity baiting program
Grampians National Park	Central Heathland	For Red Rock seasonal High intensity program
Little Desert National Park	Western Block	For seasonal eastern (High) and central (Medium) blocks baiting
Project Deliverance	East Coast West Coast Stony Peak	For West Coast annual High intensity, and East Coast and Stony Peak annual Medium intensity baiting

EVALUATING SUCCESS

Changes in bait take

The percentage of baits taken over time is often used to measure the effectiveness of a control program. This is calculated by dividing the number of baits taken by the number of

days between checks. This daily bait take is then divided by the number of baits laid for that period, excluding those taken by the other species (if known). This takes into account that some bait was not available and that the time baits were available varies between checks. The advantage of using percentage bait take is in its operational efficiency. This measure is particularly useful where there has been a period of free feeding prior to fox control operations (Saunders *et al.* 1995). However, caching of baits, multiple bait takes by foxes and bait take by non-target species can influence this measure of success (Saunders *et al.* 1999). Hence an independent measure of changes to fox activity is also required to assess the usefulness of bait take as an index of fox activity (see fox activity below).

While data being collected from each site are beginning to build a picture of the relative effectiveness of the various baiting strategies, data are still sparse and insufficient to conduct robust statistical analyse. At parks that have conducted free feeding prior to poison baiting (Coopracambra and Hattah-Kulkyne) we compare the percentage bait take before and after poison baiting began by assessing the mean and standard error and present 95% confidence limits. These data allow for changes in bait take to be compared while taking into account the degree of variability in the data. In cases where the confidence intervals do not overlap we can be reasonably confident that a change has taken place.

Parks that have undertaken seasonal programs (Little Desert and Discovery Bay) are assessed in the same manner, with comparison in bait take between years. Again the mean and standard error inform us about the magnitude of change and the variation around bait take, while non-overlapping confidence limits indicate that a real change has occurred between years.

The Grampians baiting program is unique in that the perimeter program has 5 years of data available for analysis and the Red Rock program has 8 years of data. The data for Wilsons Promontory is structured differently and also allows a more robust investigation. For these parks we used an ANOVA design. For the Grampians we looked at the difference in bait take between years of the baiting program. At Wilsons Promontory we examined the interaction between area and pulse. This allows us to explore the differences between baiting intensity, and changes through time. In these analysis all data was arcsine transformed before analysis to normalise the distribution.

Changes in fox activity

Fox activity monitoring using sand pads is being done to measure the effectiveness of control operations independent of bait take. Fox activity is monitored before and after

seasonal control operations or periodically during continuous programs by recording the presence of fox prints on sand pads. Sand pad monitoring involves laying sand across low use vehicle and walking tracks and checking the sand pads periodically to record the presence of species prints. The number of sets of fox prints on a sand pad is used to calculate a relative index of activity. Details of this method are provided in the second workshop report (Choquenot and Robley 2001b).

In addition to fox activity, the activity or presence of other predators (dogs and feral cats) and native species are also recorded using this method. Changes in the levels of activity of these species can also be monitored using this technique. The advantage of this approach is that it is independent of bait take, and may more closely reflect true changes in fox activity. Results from this project will be used to investigate the relationship between changes in fox activity as measured by sand pads and through percentage bait take. It is hoped that we will be able to determine a meaningful relationship, allowing us to rely solely on bait take to monitor activity in future, which is operationally more efficient than sand pad monitoring.

Changes in potential prey species abundance

There are a number of reasons why Parks Victoria undertakes fox control, however the primary purpose identified through the workshops was to gain environmental outcomes, especially the protection of endangered species. Other consideration, such as Good Neighbour obligations, promoting a public perception of Parks Victoria as a responsible land manager, and legislative or planning obligations underpinned this overall goal.

To determine which of the combinations of timing and intensity of fox control being tested in the Fox AEM project produce a positive biodiversity gain, a set of monitoring protocols for species considered as being at risk from fox predation has been developed (Robley *et al.* in prep.). The first step in developing these protocols was to identify which species were most likely to be at risk from fox predation and where on the Parks Victoria estate they occur. This was undertaken as part of a separate project commissioned by Parks Victoria and conducted by ARIER (Robley *et al.* 2002). This process ranked species at potential risk from fox predation and identified a range of species that could be used as indicators for the effectiveness of the various control programs being implemented as part of the project. The next step was to determine which of these species are present in the parks involved in the Fox AEM project, and to collect that information in way that allowed the level of effort required to detect changes in species abundance to be determined. This information was used to develop the monitoring protocols, specifying the level of effort required to detect a

prescribed change with a prescribed amount of confidence that a change had actually occurred.

These protocols will determine if the abundance or occurrence of a species has changed over time at any or all of the fox control sites. Prey species monitoring protocols are being formalised at the time of writing and will be presented in a separate document (Robley *et al.* in prep.).

Site Selection for prey species monitoring

Sites for prey species response monitoring within each park were selected based either on previous known locations as recorded in the Atlas of Victorian Wildlife, suitability of habitat based on descriptions in the literature of species habitat requirements, local knowledge provided by Parks Victoria staff, or a combination of all three.

Within in each park, three or four sites were selected. At each site a combination of techniques was applied (Table 3). The number of sites selected was based on the size of the park, the diversity of habitats within the park, and the capacity of staff to service sites in a timely fashion. The techniques chosen to detect a particular species were based on knowledge of which techniques were know to be effective for that species. A variety of techniques were used to help determine which would be the most efficient in detecting changes in abundance.

Table 3. Detection techniques used at each park, the number of sites selected and the nominal target species for each park.

Park	Detection Technique	Number of sites	Target Species
Hattah Kulkyne National Park	Pitfall Bucket Traps	3	Mallee Ningaui
	Elliott Traps	3	Mitchell's Hopping Mouse
	Hair Tubes	3	Common Brushtail Possum
Little Desert National Park	Pitfall Bucket Traps	3	Silky Mouse
	Elliott Traps	3	Pygmy Possum
Grampians National Park	Hair Tubes	4	Long-nosed Potoroo
	Elliott Traps	4	Southern Brown Bandicoot
	Cage Traps	4	Smoky Mouse
			Heath Mouse
Discovery Bay Coastal Park	Nest Survival	20 km coast line	Hooded Plover
Wilsons Promontory National Park	Cage Traps	3	Long-nosed Potoroos
	Hair Tubes	3	Southern Brown Bandicoots

Coopracambra National Park	Cage Traps	4	Long-nosed Bandicoot
	Hair Tubes	4	Ringtail Possums
			Long-nosed Potoroos
			Southern Brown Bandicoots

Survey Methods

The following section provides details of the survey techniques used. These are standard survey techniques that have been applied to the targeted species previously.

Pitfall trapping (small mammals and reptiles) – Little Desert and Hattah National Parks.

At each of these parks three sites were selected to represent a wide range of habitat types. At each site, two lines of 20 buckets (290 mm diameter x 400 mm deep) were placed 10 metres apart. Each bucket was individually numbered. A 'Y' shaped fibreglass flywire drift-fence, held erect by steel pegs, was placed over each bucket. The arm of each section of the 'Y' extended 2 m from the centre of the bucket. Buckets were not baited and were monitored daily for several nights. Animals were individually marked to facilitate data analysis.

Elliott trapping – Little Desert, Hattah-Kulkyne and Grampians National Parks

At Hattah-Kulkyne and the Little Desert three sites were selected, and at the Grampians National Park four sites. At each site, 20 Elliott traps were positioned on the ground and spaced at 25 metre intervals in two lines of ten traps. Lines were separated by 50 metres. Traps were be baited with a blend of honey, peanut butter and oats and monitored for five nights. Animals were individually marked to facilitate data analysis.

Cage Trapping – Grampians, Wilsons Promontory and Coopracambra National Parks

Three sites were selected at Wilsons Promontory and Coopracambra and four at the Grampians. At each site, 30 wire cage traps were positioned on the ground and spaced 25 metres apart in three lines of 10 traps, separated by 50 m. Traps were baited with a blend of honey, peanut butter and oats and monitored daily for 5 nights. Animals were marked individually to facilitate data analysis.

Hair tubes – *Hattah-Kulkyne, Grampians, Wilsons Promontory and Coopracambra National Park*

Four sites were selected at the Grampians and Coopracambra and three at the remaining parks. At each site, two lines of 10 hair tubes (handy glaze) spaced at 25 m intervals were installed. Lines were separated by 50 metres. Tubes were baited with a blend of honey, peanut butter and oats and left *in situ* for several nights.

Nest Survival – *Discovery Bay Coastal Park*

The protocol for monitoring Hooded Plovers was developed by Weston and Morrow (2000) and is detailed in their report, *Managing the Hooded Plover in Western Victoria*, and in Monitoring Hooded Plovers on the Codrington Coast, Western Victoria, Ressom, R. (2001).

The basic method used to survey Hooded Plover nest success at Discovery Bay was:

- In each month of the monitoring period, searching for and rechecking nests was done weekly, covering as much of the area covered by fox baiting as feasible (breeding season Aug – Mar, bating Aug/Sep - Dec) . Monitoring at Mornington Peninsula National Parks covered 28 km and Weston and Morrow (2000) covered 20 km at Codrington, western Victoria. Similar coverage was achieved at Discovery Bay.

- Searches were standardised as much as possible, ie. the same time and duration each month.

- Two approaches were adopted to locate nests, 1) observing the behaviour of adult birds, and 2) methodical searches of suitable habitat.

- Once a nest had been located its location was recorded on a Global Positioning System to allow the nest to be quickly rechecked at a later date. Flagging tape was used to mark the general location of the nest, but was several metres away from the nest.

Results

FOX CONTROL AND ACTIVITY

This section presents the results from the previous two years of fox control and fox activity monitoring on the parks involved in the Fox AEM project. We present fox control and activity indices for each park.

Coopracambra National Park

Fox Control

The daily percentage bait take for both foxes and wild dogs declined a month after free feeding ceased and poison baiting began and has not returned to pre-baiting levels 12 months later (Figure 1). The mean daily percentage bait take for foxes and dogs over the free feed period was 0.62 and 2.09 respectively and for the following 12 months, during the poisoning period, it was 0.29 and 0.45 respectively (Table 3). The high degree of variability and the overlap in the confidence intervals indicate that for foxes a real change in bait take could not be detected. However, this is largely due to the high degree of variability in the data from the free feed period. Provided bait take remains consistent and low, on-going data collection from the poison operation should enable detection of a reduction in activity. The data for dogs indicate that the level of bait take has declined in real terms in the 12 months of the poison baiting operation compared to the free feed period.

The concurrent decline in wild dog bait take is of interest as this indicates that a baiting program essentially aimed at reducing fox abundance has also had a significant impact on wild dogs. This is an area of ongoing debate and interest amongst ecologists and land managers as wild dogs fulfil an ecological niche as a top order predator and they may serve to maintain some ecosystem system processes, although further investigations are required to understand this.
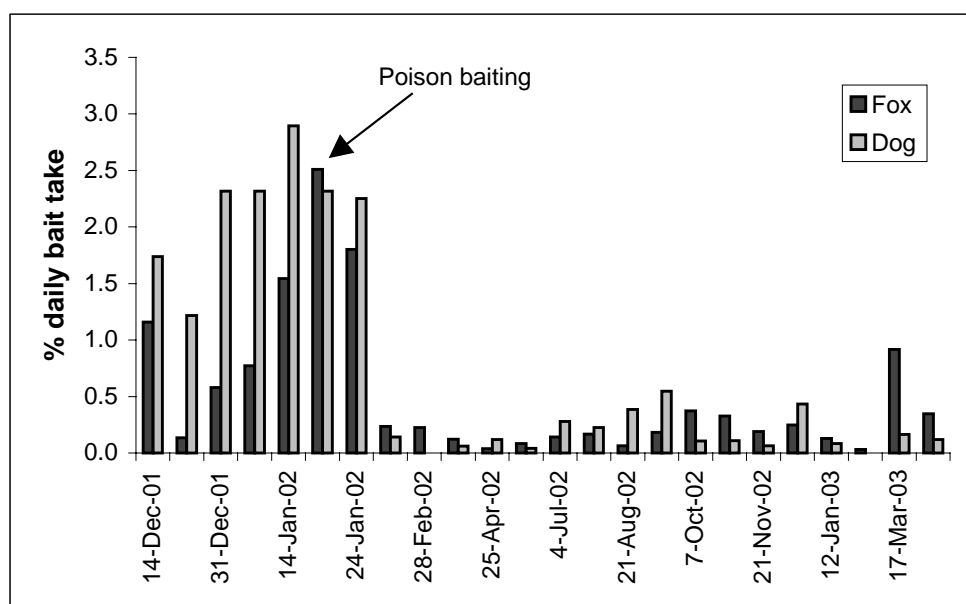
Figure 1. The daily percentage of baits taken by dogs and foxes before and after poisoning began at Coopracambra National Park December 2002 to February 2003.

Table 3. Mean daily percentage bait take for foxes and wild dogs before and after poison baiting began at Coopracambra National Park.

Species	No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
Fox					
Before	5	0.84	0.17	0.4	1.3
After	17	0.43	0.12	0.1	0.7
Dog					
Before	5	2.10	0.28	1.5	2.7
After	16	0.39	0.18	0.1	0.8

Sand Pad Activity

Fox activity has been consistently lower during the poison baiting period than during the free feed (Figure 2). Wild dog activity has been variable throughout the monitoring period with no detectable difference since poison baiting began. This is contrary to the clear picture gained from the bait take information. Further investigation into the reason for this difference between patterns in bait take and sand pad activity needs to be undertaken. It may be that sand pad activity monitoring is not sensitive enough to detect a change in wild dog levels, or that there is some confusion in identifying fox and dog prints on sand pads, or that bait take is being assigned to wild dogs incorrectly.
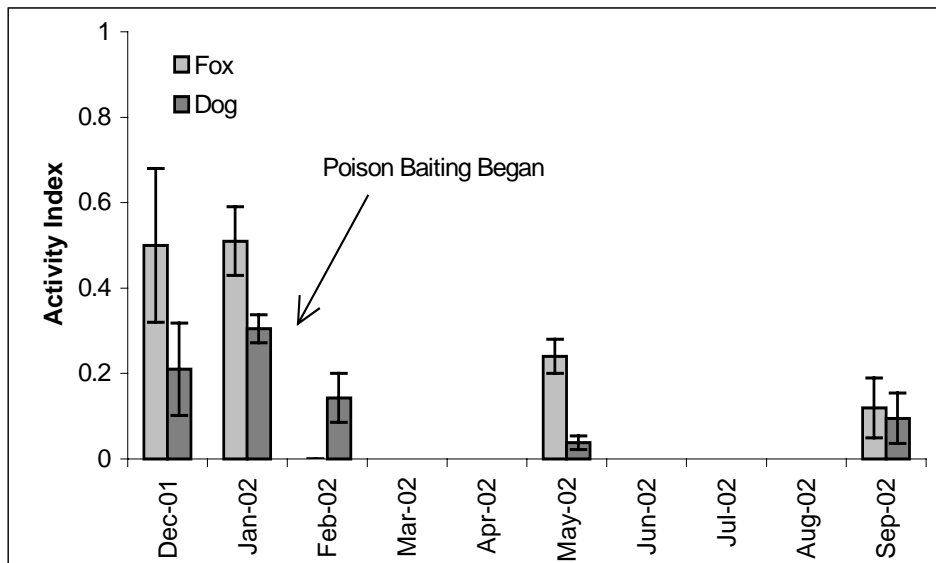
Figure 2. Fox and Wild Dog activity index Coopracambra National Park.

Bars indicate standard errors. Nil fox activity recorded in Feb-02. Monitoring changed to quarterly after poisoning began.

Discovery Bay Coastal Park

Fox Control

In year one of the fox control program there were some difficulties encountered in the establishment of the program that resulted in a staged implementation of the baiting program. Bait stations were established in lots as the season passed with only a few operating in the first months, and progressively more stations added as time passed. This resulted in the data being highly variable in the first year (Figure 3).
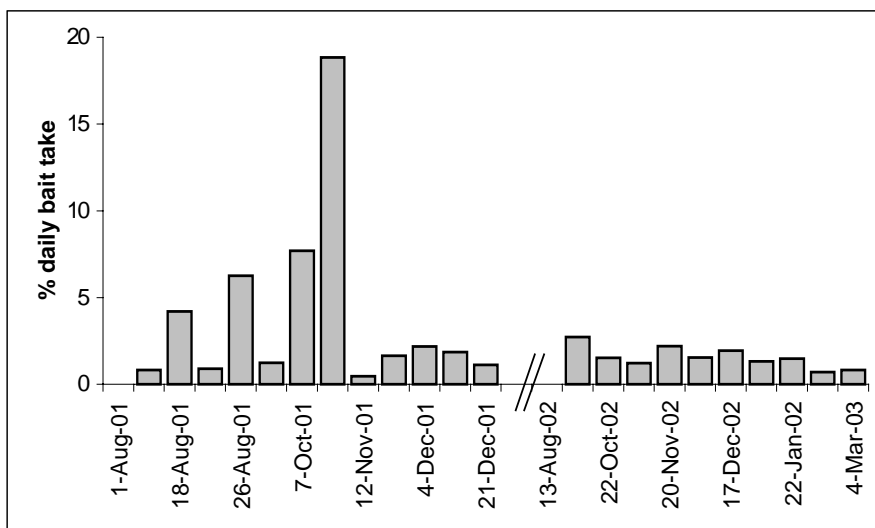
Figure 3. The daily percentage bait take for Discovery Bay 2001/02 and 2002/03 seasons.

In the second year all bait stations were operated from the beginning of the program. The average daily bait take in year 1 was 3.6% and in year 2 the average was 1.3% (Table 4). While it may appear that there has been a substantial decline in the average bait take between the years there is significant overlap in the confidence limits due to the high degree of variability in the first year. In reality it is extremely unlikely that this program has had an impact on fox abundance over the past two seasons.

Table 4. Mean percentage daily bait take for foxes at Discovery Bay Coastal Park.

Year	No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
2001	12	3.6	1.42	0.5	6.7
2002	10	1.3	0.23	0.7	1.8

Sand Pad Activity

In 2002/03 sand pads were established on the northern (inland) boundary of the park as well as along the beach. There was no detectable difference in fox activity before, during or after the baiting program commenced on the northern boundary. There was some indication that activity may have increased on the beach in March. However, as a result of a misunderstanding, sand pads were only checked on two mornings instead of the prescribed three. This decreases the number of samples used to calculate the activity index and reduces the likelihood of detecting a difference if one was there (Figure 4). There was no variance associated with the northern boundary in Sept-02 and Dec-02 because the index values were identical on both days incursions were monitoring.
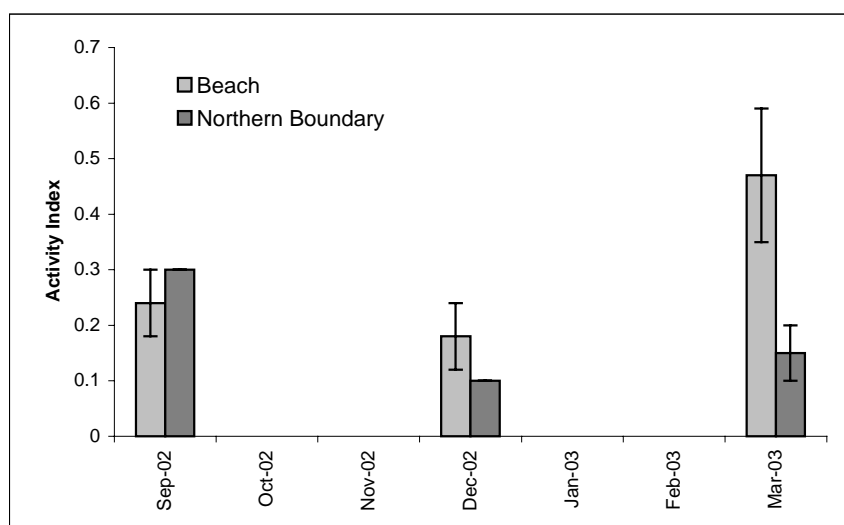
Figure 4. Fox activity index for Discovery Bay Coastal Park 02/03.
Bars indicate standard errors.

Grampians National Park

Fox Control

Fox control at the Grampians consists of two distinct operations; the Red Rock program and the Perimeter program. The baiting data for the Perimeter program is collected over two sections, the eastern section and the western section (Appendix 1). The data from these two sections have been combined and considered as a single perimeter-baiting program. Data from the Red Rock baiting program have been considered separately. This was done to recognise the differences between the Perimeter and Red Rock program.

Analysis of Variance of the arsine transformed mean percentage daily bait take from the perimeter baiting program for each year for the past 6 years indicates that there was a significant differences among individual years ($F_{1,5} = 3.46$, $p < 0.05$). Bait take was higher in 1998 than in 2000, all other year combinations show no significant difference.
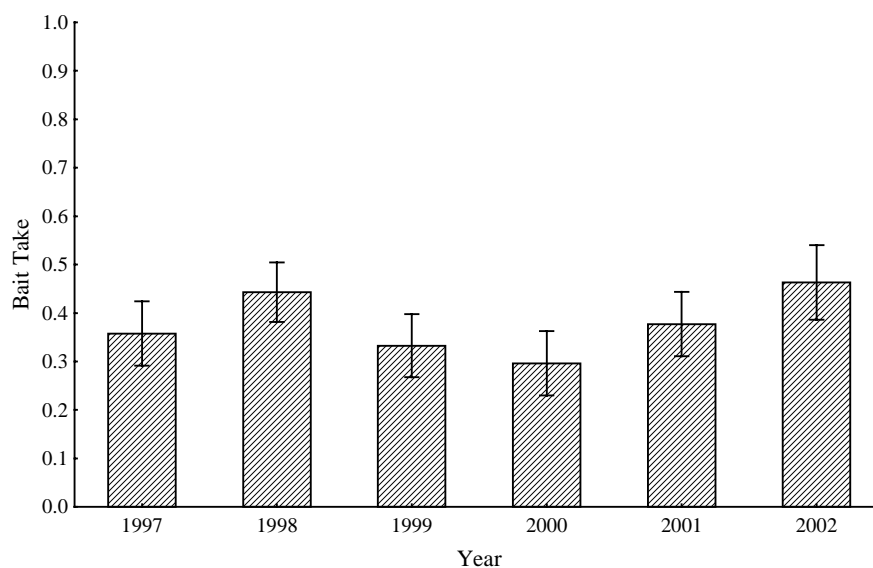
Figure 5. Percentage bait take Grampians perimeter baiting program (Western and Eastern sections combined).
Bars indicate standard errors.

Red Rock Baiting Program

The Red Rock baiting program was an annual program from April 1996 to the end of 1998, with regular bait checks (mean number of days between checks was 10). In 1999 the baiting program ran for 12 months but the frequency of bait checks decreased to a mean of 20 days between checks. In 2000 and 2001 the program either ran only for the first several months of the year or the data were lost. The mean number of days between checks for these two

years was 21. In 2002 the program ran over the whole year, however bait checks were widely spaced with an average of 50 days between checks. The inconsistency in data collection means cautious interpretation of the trends in bait take is required. In broad terms, the initial baiting program in 1996 appears to have reduced bait take, however in recent years bait take has increased, suggesting an increase in fox numbers (Figure 6).
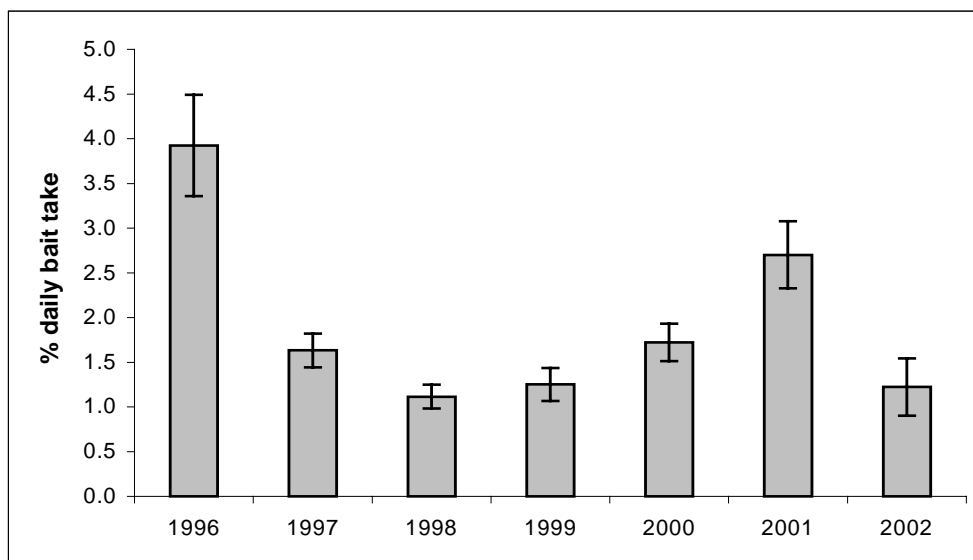
Figure 6. The daily percentage bait take at Red Rock for years where data were available. Bars indicate standard errors.

Bait take in 1996 was generally higher than all years other than 2001 (Table 6). The high level of bait take in 1996 is due to a short period in February, when bait take was around 10% per day. For the remainder of 1996, bait take was considerably lower. This resulted in a large degree of variation in the 1996 data, making more formal analysis problematic, therefore we have not undertaken further analysis of the data.

Table 6. Mean percentage daily bait take for foxes in the Red Rock baiting program, Grampians National Park.

Year	No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
1996	52	3.92	0.57	2.81	5.03
1997	30	1.63	0.19	1.26	2.00
1998	30	1.11	0.13	0.85	1.38
1999	19	1.25	0.18	0.89	1.61
2000	15	1.72	0.21	1.31	2.13
2001	12	2.70	0.37	1.97	3.44
2002	11	1.22	0.32	0.59	1.85

Sand Pad Activity

The sand pad activity monitoring was delayed in its implementation in the first year and as a result only one sampling session was undertaken at the end of the first year (July 2002). Results from sand pad activity monitoring at the end of the first year show that there was no detectable difference in fox activity among the three locations at that time. However, as we do not have data for the beginning of the first year's program, nothing can be inferred about the changes in fox activity as a result of the control program. One session has been completed for this year (2002/03). Results from this session indicate that there was no difference in activity among the Perimeter and Red Rock programs, while fox activity was considerably higher in the central areas of the park, considered to be unbaited. Two more data collection sessions are planed for this year and will give a clearer indication of changes in fox activity.

The marked increase in activity from the end of last year to the beginning of this year's monitoring suggests the baiting program is not having any significant long-term impact on fox activity (Figure 7).
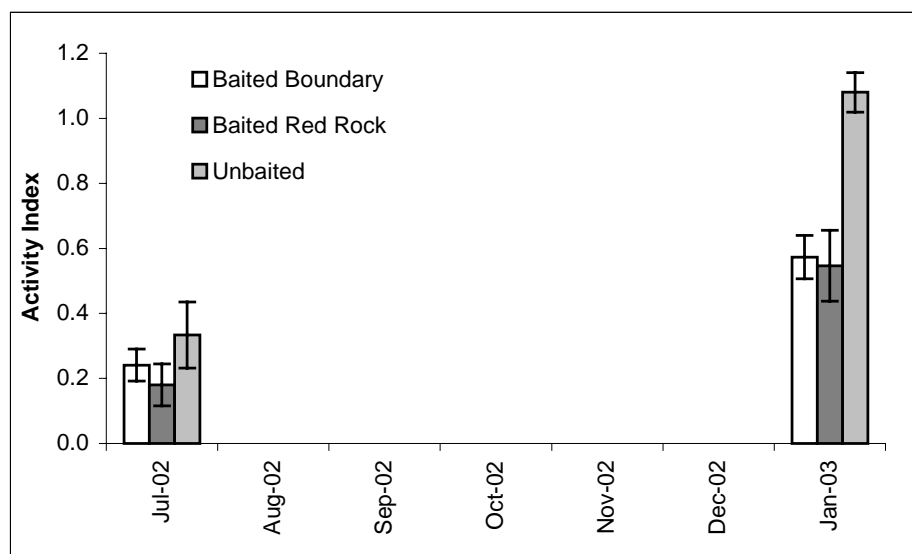
Figure 7. Activity index for the Grampians National Park.

Bars indicate standard errors.

Hattah-Kulkyne National Park

Fox Control

Free feed (non-poisoned baits) were laid for the first three months between February 2002 and May 2002, poisoned baits were laid over the nine months to February-03. Bait take

declined following the addition of poison baits to the bait stations (Figure 8) and has remained relatively low. There was a slight increase in bait take through October and November 2002. This may be due to dispersing individuals and animals exploring newly vacated territories. The mean daily bait take during the poisoning period (15.8%) was lower than it was during the free feed period (40.9%; Table 7) and confidence intervals do not overlap, suggesting this difference is likely to be real.
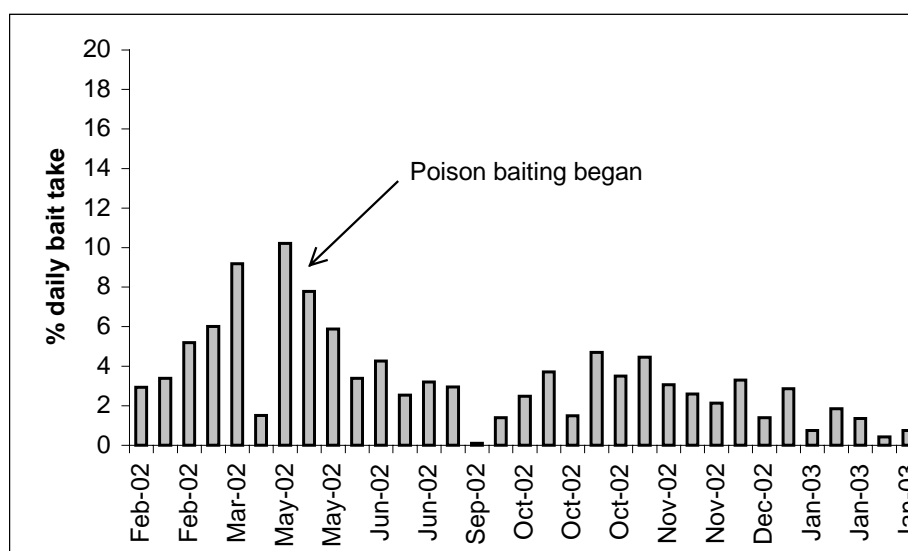
Figure 8. The daily percentage bait take for Hattah-Kulkyne National Park

Table 7. Mean percentage daily bait take for foxes at Hattah-Kulkyne National Park.

Treatment	#No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
Before	14	40.9	6.2	27.5	54.3
After	19	15.8	1.7	12.1	19.4

Sand Pad Activity

The activity index results suggest that the baiting program at Hattah-Kulkyne may be reducing fox abundance (Figure 9). For the two sessions prior to poison baits being laid there was a difference in activity among the treated and non-treated sites. Activity declined markedly on both the treated and non-treated sites since poison baiting began in May-02. However, in January 2003 there was still a difference between the treated and non-treated sites. One explanation for this is that while other factors may influence the abundance of the fox population, the baiting program is assisting by suppressing fox numbers on the treated site. Another explanation is that environmental factors have suppressed fox numbers and

that the baiting program has had no effect on the fox population. Parks Victoria undertakes rabbit and kangaroo control activities across the park. This herbivore control, coupled with the drought may have acted to reduce the fox population (rabbit and carrion being the staple of the foxes diet, Saunders et al. 1995). The magnitude of the differences between baited and non-baited sites is larger since baiting began. This result supports the hypothesis that fox control activities are suppressing foxes. The bait take information above also suggests that the baiting program may be having an impact on the fox population over and above the environmental conditions. Continued monitoring as the environmental conditions change across time will assist in determining whether fox control actions are affecting the fox population (Figure 9).
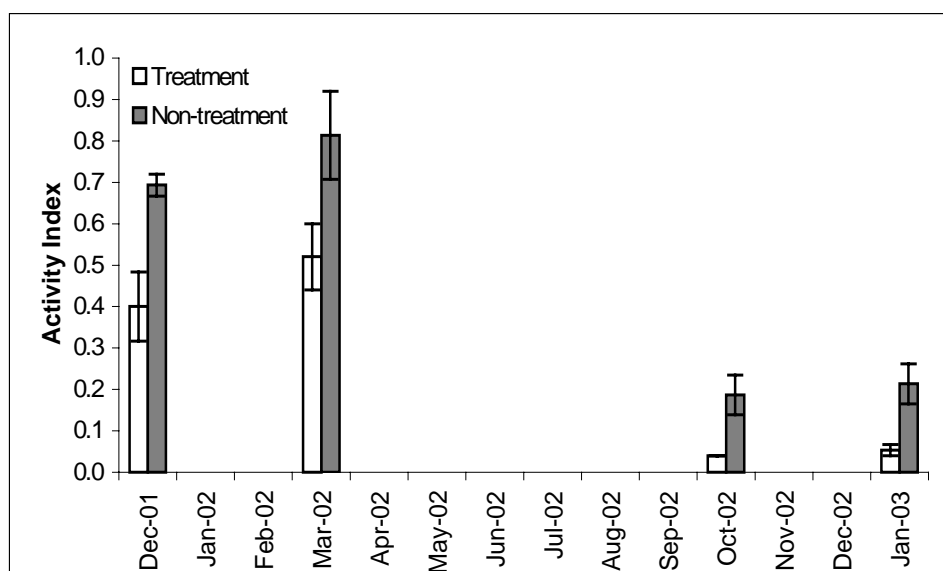
Figure 9. Fox activity index for Hattah-Kulkyne National Park 2001/02 and 2002/03. Bars indicate standard errors.

Little Desert National Park

Fox Control

There are two areas within the Little Desert National Park where fox control is being undertaken; the Central Block, which is a low intensity control site with baits laid around the perimeter of the block and the Eastern Block, which is a high intensity control site, with baits laid throughout the block. The Western Block is unbaited and acts as a control area.

The Central Block

Bait take has remained constant between seasons (Figure 10). The average daily percentage bait take in 2001-02 was 3.2% and in 02-03 it was 2.8% (Table 8). However, the data for the 2002-03 season were not complete at the time of writing and interpretation should be conservative.

Table 8. Mean percentage daily bait take for foxes at the Central Block – Little Desert National Park.

Year	No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
2001/02	10	3.2	0.94	1.1	5.4
2002/03	7	2.8	0.32	2.0	3.6
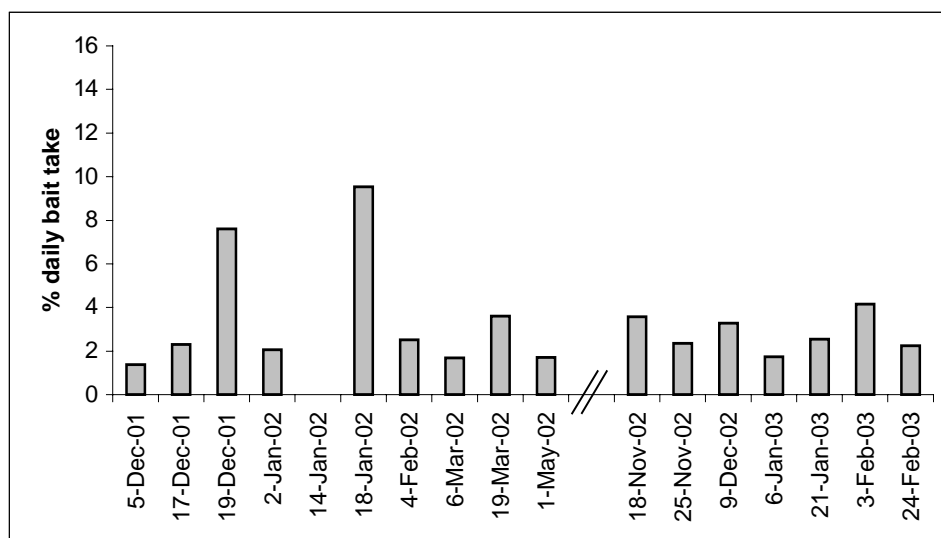
Figure 10. The daily percentage of baits taken in the Central Block of Little Desert National Park 2001/02 and 2002/03.

The Eastern Block

There was no detectable difference in the percentage of baits taken on a daily basis between years in the Eastern Block (Figure 11). Average bait take in 2001-02 was 4.3% and in 2002-03 it was 3.6% (Table 9). Again, at the time of writing, data for the second half of this year's control program were not available and results need to be interpreted carefully.
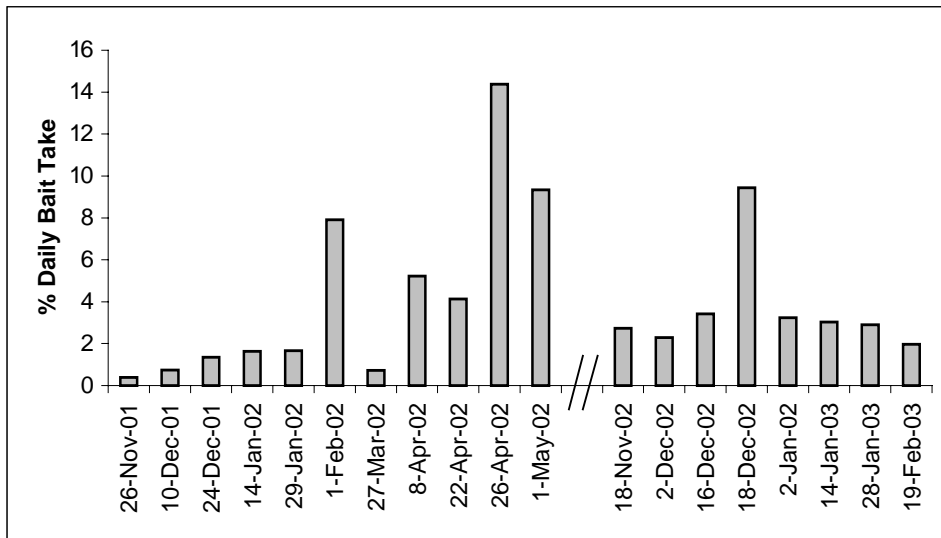
Figure 11. The daily percentage of baits taken in the Eastern Block of Little Desert National Park 01/02 and 02/03.

Table 9. Mean percentage daily bait take for foxes at the Eastern Block – Little Desert National Park.

Year	No. of Checks	Mean % Daily Bait Take	Standard Error	Lower 95% Confidence Limit	Upper 95% Confidence Limit
2001/02	11	4.3	1.36	1.2	7.3
2002/03	8	3.6	0.84	1.6	5.6

Sand Pad Activity

Due to delays in setting up the program, only two monitoring sessions were conducted in 2001/02, and each of these were spread over two months, the third monitoring session for 2002/03 was being conducted at the time of writing.

There was no detectable difference in fox activity from the middle of the 2001/02-control program to after the program had finished in April 2002 for any of the blocks. Similarly, no difference in fox activity was detected from the start of this year's program in November 2002 to the middle in January 2003, across any of the blocks.

Figure 12 shows that there was no change in activity from last year to this year on the West and Central Blocks, but that there has been an increase in the activity on the East Block from last year to this year.
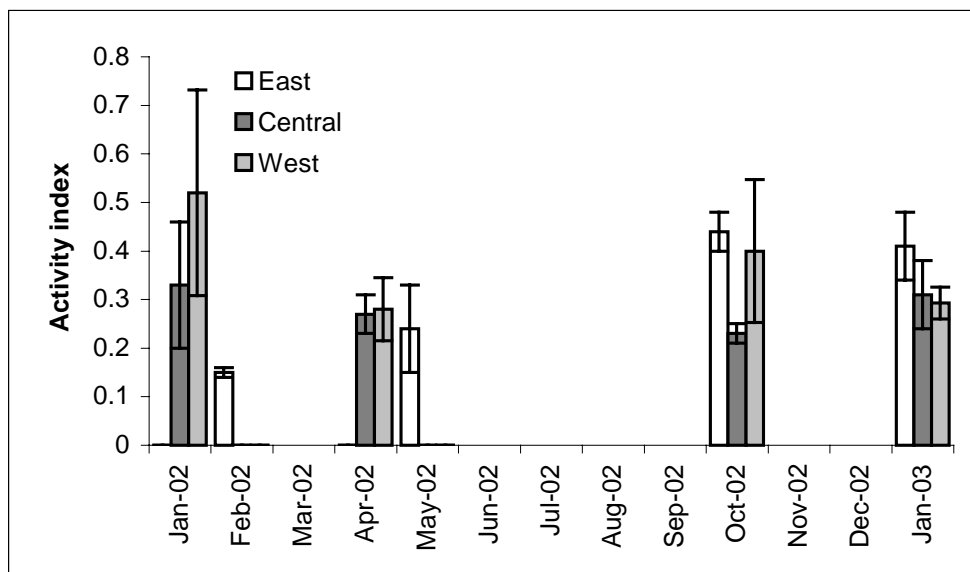
Figure 12. Activity index for the East, Central and Western Blocks at Little Desert National Park 2001/02 and 2002/03.

Bars indicate standard errors.

Wilsons Promontory National Park

Fox Control

Appendix 1 describes the pulsed baiting program at Wilsons Promontory National Park. The results of the ANOVA indicates that the pattern of bait take between areas was generally the same (Figure 13), but there was a significant difference in bait take between baiting pulses ($F_{1,6} = 11.3$, $p = <0.001$).

We then combined the bait take for all three control areas (Figure 14) to show that bait take was significantly higher in the April-01 pulse than in any other subsequent pulse.
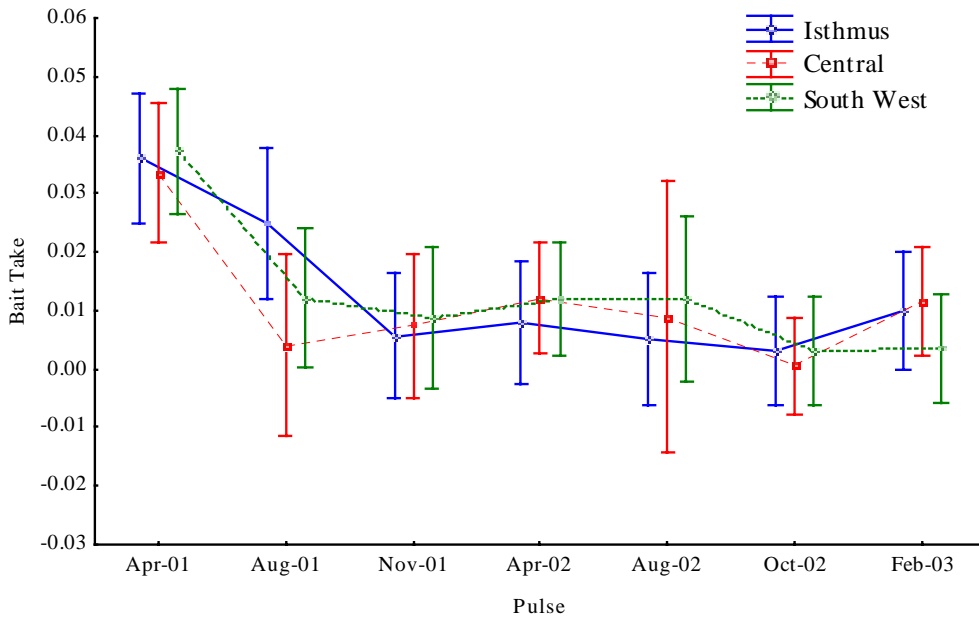
Figure 13. Bait take in each of the control areas per pulse at Wilsons Promontory National Park. Bars indicate 95 % Confidence Limits.
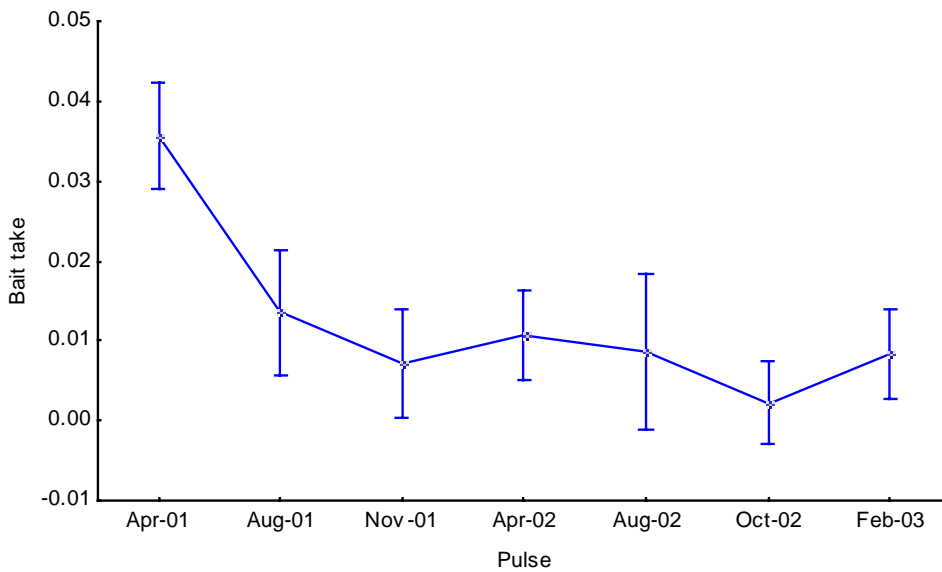
Figure 14. Bait takes per pulse (three areas combined) at Wilsons Promontory National Park. Bars indicate 95 % Confidence Limits.

Sand Pad Activity

The pattern of fox activity was highly variable during all pulses (Figure 15). In most instances, activity was lower at the end of a pulse than at the beginning. However, there are

a few exceptions to this general trend. On the Isthmus in April 2002, activity was greater at the end of the pulse and during October 2002 activity was no different from the beginning of the pulse to the end for any area. The increase in fox activity in the Isthmus from October 2002 to February 2003 may be due to immigration into the Park through the Isthmus.
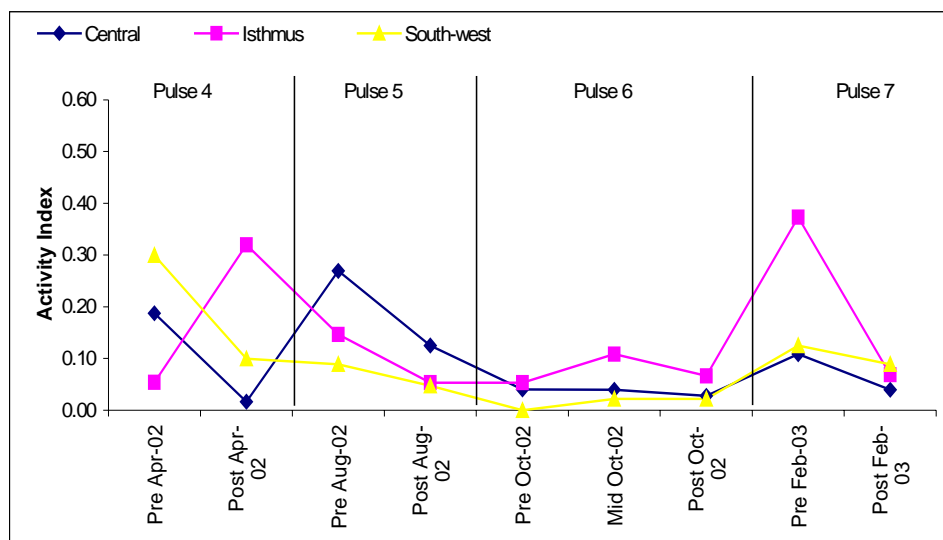
Figure 15. Activity index for the three management sections at Wilsons Promontory National Park 01/02 and 02/03.

INITIAL PREY SPECIES MONITORING

This section presents results of the initial prey species monitoring programs for each park and highlights those species or groups of species that will be used as indicators of the effectiveness of the fox control programs and be used to model prey species responses to fox control operations. Detailed species monitoring protocols are presented in Robley *et al.* (in prep.).

Coopracambra National Park

Due the 2002/03 fires in north-eastern Victoria, the implementation of the initial prey species monitoring program was delayed significantly. Survey results for cage trapping are presented below. Cage trapping confirmed the presence of three of the key species selected for monitoring and established for the first time the presence of the Long-nosed Potoroo and Southern Brown Bandicoot in the park (Table 10). Four locations were surveyed during this trial, however only one produced results indicating the presence of the selected species. This is despite careful site selection based on habitat descriptions for these species. Hair tube results were not available at the time of writing.

Table 10 Species recorded at Coopracambra National Park.

Cage = number of animals caught in wire cage traps. Status = Conservation Status based on Threatened Vertebrate Fauna of Victoria. C = common, LR-NT = Low Risk, near threatened. Intro = introduced species.

Species	Common Name	Cage	Status
Antechinus agilis	Agile Antechinus	80	C
Antechinus swainsonii	Dusky Antechinus	95	C
Psophodes olivaceus	Eastern Whipbird	3	C
Isoodon obesulus	Southern Brown Bandicoot	9	LR
Perameles nasuta	Long-nosed Bandicoot	8	C
Potorous tridactylus	Long-nosed Potoroo	2	E
Rattus fuscipes	Bush Rat	168	C
Rattus rattus	Black Rat	3	Intro

Discovery Bay Coastal Park

Thirty-five one-day surveys were conducted over approximately 20 kilometres of coast line at Discovery Bay Coastal Park between October 2002 and March 2003. At the time of writing the data were being analysed.

During the survey, 831 sightings of adult Hooded Plovers and 8 sightings of juveniles were made. Only 2 nests with 3 eggs each and two chicks were observed. Numerous records of fox tracks and other threats including illegal dune buggies and trail bikes were also made.

There were no observations of successful fledging. Locating nests was difficult. This difficulty in locating nests may be a result of nesting behaviour by Hooded Plovers at Discovery Bay. Surveys focused on the open beach, but some people now believe that at Discovery Bay, Hooded Plovers nest in the primary dune system rather than on the open beach nesting as observed at other locations including nearby at Codrington. This behaviour may be a response to the highly volatile nature of the coast at Discovery Bay.

Grampians National Park

Two of the three species identified as at potential risk from fox predation and targeted in the initial survey were detected; the Southern Brown Bandicoot and the Heath Mouse. Neither the Smoky Mouse nor Long-nosed Potoroos were recorded in this survey (Table 11).

The Heath Mouse was recorded most frequently in Elliott traps and the Southern Brown Bandicoot was caught in wire cage traps. Surprisingly, hair tubes returned only 18 records of the Southern Brown Bandicoot. In the second session, bandicoots were detected by one hair

tube, while 13 were captured in cage traps. In the final session bandicoots were detected in 17 hair tubes, while cage traps detected them 10 times. All of these records came from one site. It was initially thought that hair tubes would detect targeted species at a rate sufficient to be used to determine changes in population levels however this was not the case.

Table 11. Species recorded at Grampians National Park.

Elliott = the number of animals caught in Elliott traps over the three sessions. Cage = number of animals caught in wire cage traps over the three sessions. Tube = the number of tubes that the species was recorded in. Status = Conservation Status based on Threatened Vertebrate Fauna of Victoria. C= common, LR-NT = Low Risk, near threatened. Intro = introduced species.

Species	Common Name	Elliott	Cage	Tube	Status
Antechinus agilis	Agile Antechinus	283	0	0	C
Antechinus flavipes	Yellow-footed Antechinus	34	1	0	C
Antechinus sp.	Antechinus sp.	0	0	32	C
Pseudomys shortridegii	Heath Mouse	92	11	1	LR-NT
Rattus lutreolus	Swamp Rat	13	26	1	C
Isoodon obesulus	Southern Brown Bandicoot	4	23	18	C
Rattus rattus	Black Rat	1	1	1	C
	Skink	17	0	0	C
Cercartetus nanus	Eastern Pygmy Possum	3	0	0	C
Trichosurus vulpecula	Common Brushtail Possum	0	15	20	C
Wallabia bicolor	Swamp Wallaby	0	0	69	
Tiliqua rugosa	Stumpy-tailed Lizard	0	5	0	C

Hattah-Kulkyne National Park

Pitfall bucket traps caught 22 species (125 captures) compared to three species (24 captures) in the Elliott traps (Table 12). Of the target species that were considered as suitable for monitoring the success of fox control only Mitchell's Hopping Mouse was captured, and this species was only captured in pitfall bucket traps.

Due to a constraint on available resources resulting in the need to survey AEM parks sequentially in 2002/03, trapping was conducted in the middle of summer in hot and dry conditions. These conditions were likely to produce less than optimal survey results and it is difficult to interpret them for the purpose of developing monitoring protocols.

Other species captured that will be useful to monitor are the Silky Mouse, House Mouse, Mallee Dragon, gecko species and the legless lizards. The reptiles, while not identified as being at high risk from fox predation, have low reproductive rates, are nocturnal, and are of a

size that would not exclude them from fox diet. As such, these species may also be reasonable indicators of the success in reducing fox abundance.

Table 12. Species recorded at Hattah-Kulkyne National Park

Pit = number of animals caught over the three sessions in Pitfall bucket traps. Elliott = number of animals caught over three sessions in Elliott traps. Status = Conservation Status based on Threatened Vertebrate Fauna of Victoria. C= common, LR-NT = Low Risk, near threatened. Intro = introduced species.

Species	Common Name	Pit	Elliott	Status
Amphibolurus nobbi	Nobbi Dragon	7	0	C
Cercartetus lepidus	Little Pygmy Possum	1	0	LR-NR
Cryptoblepharus carnabyi	Carnaby's Wall Skink	4	0	C
Ctenophorus fordi	Mallee Dragon	25	0	C
Ctenotus brachyonyx	Murray Striped Skink	5	1	C
Ctenotus reguis	Regal Stripped Skink	0	12	C
Delma australis	Southern Legless Lizard	2	0	C
Diplodactylus damaeus	Beaded Gecko	22	0	C
Diplodactylus intermedius	Eastern Spiny-tailed Gecko	2	0	C
Diplodactylus tessellatus	Tessellated Gecko	4	0	LR-NR
Gehyra variegata	Tree Dtella	10	0	C
Lerista bougainvillii	Bougainville's Skink	1	0	C
Lerista punctatovittata	Spotted Burrowing Skink	11	0	C
Menetia greyii	Grey's Skink	4	0	C
Morethia boulengeri	Boulenger's Skink	12	0	C
Mus musculus	House Mouse	11	2	Intro
Notomys mitchelli	Mitchell's Hopping Mouse	4	0	LR-NR
Pogona vitticeps	Central Bearded Dragon	1	0	C
Ramphotyphlops bituberculatus	Peter's Blind Snake	6	0	C
Sminthopsis murina	Silky Mouse	1	0	LR-NR
Suta nigriceps	Mitchell's Short-tailed Snake	1	0	C
Varanus gouldii	Gould's Goanna	1	0	C

Little Desert National Park

Before the initial survey it was unclear which of the species identified as potentially at risk from fox predation still occurred in the park. Of the three species that were considered possibilities for monitoring, two were captured (Table 13). These were the Silky Mouse (63 captures in Pitfall Buckets, 47 in Elliott traps) and the Fat-tailed Dunnart (three captures in Pitfall buckets). We also recorded Western and Little Pygmy Possums (27 and 16 captures

respectively) but these were recorded only in pitfall buckets. This is the first confirmed record of the Little Pygmy Possum in the Little Desert and constitutes a range extension for the species.

As in the Hattah-Kulkyne National Park, other species not identified as at high risk from predation, but that may be a useful indicator will be the dragons, geckos and legless lizards. There are two advantages to including these species in the monitoring program; first, they are all collectable in pitfall bucket traps, and second, having similar species across Hattah-Kulkyne and Little Desert Parks will enable a more robust comparison of the effectiveness of those two fox control programs.

Table 13. Species recorded at Little Desert National Park

Pit = number of animals caught over the three sessions in Pitfall bucket traps. Elliott = number of animals caught over three sessions in Elliott traps. Status = Conservation Status based on Threatened Vertebrate Fauna of Victoria. C= common, LR-NT = Low Risk, near threatened. Intro = introduced species.

Scientific Name	Common Name	Pit	Elliott	Status
Amphibolurus norrisi	Norris's Dragon	5	0	C
Cercartetus concinnus	Western Pygmy Possum	27	0	C
Cercartetus lepidus	Little Pygmy Possum	16	0	LR-NT
Cercartetus sp.	Pygmy Possum sp.	43	0	-
Phyllodactylus marmoratus	Marbled Gecko	13	0	C
Ctenophorus pictus	Painted Dragon	30	0	C
Ctenotus orientalis	Eastern Striped Skink	5	0	C
Diplodactylus vittatus	Wood Gecko	13	0	C
Echiopsis curta	Bardick	1	0	V
Lampropholis delicata	Delicate Skink	5	0	C
Lerista bougainvillii	Bougainville's Skink	11	0	C
Morethia boulengeri	Boulenger's Skink	4	0	C
Morethia obscura	Obscure Skink	110	0	C
Mus musculus	House Mouse	7	10	Intro
Neobatrachus sp	Spadefoot Toad	36	0	C
Pogona barbata	Eastern Bearded Dragon	1	0	C
Pseudomys apodemoides	Silky Mouse	63	47	LR-NT
Pygopus lepidopodus	Common Scaly-foot	6	0	C
Sminthopsis crassicaudata	Fat-tailed Dunnart	3	0	DD
Suta nigriceps	Mitchell's Short-tailed Snake	12	0	C
Tiliqua rugosa	Stumpy-tailed Lizard	1	8	C

Wilsons Promontory National Park

The surveys resulted in 351 captures of seven species from the cage traps and we detected 8 species with the hair tubes (Table 14). However, of the three target species we only detected one, the Long-nosed Potoroo (64 captures in wire cage traps and 25 contacts on hair tubes). Other indicators to be incorporated into the assessment of the effectiveness of the program will be rabbit and kangaroo abundance, collected through on-going monitoring at the park, and possibly hog deer numbers (protocols for the assessment of hog deer are being developed).

The other two species that were identified for monitoring, the Long-nosed and Southern Brown Bandicoots, are known to occur in the park. It is envisaged that the expanded monitoring required for the assessment of the effectiveness of the fox control program will detect these species and that a review of the monitoring protocols suggested in Robley *et al*. (*in prep*) will be undertaken in 2004/05.

Table 14. Species recorded at Wilsons Promontory National Park

Cage = number of animals caught over the three sessions in wire cage. Tube = number of tubes that the species was recorded in. Status = Conservation Status based on Threatened Vertebrate Fauna of Victoria. C= common, LR-NT = Low Risk, near threatened. Intro = introduced species.

Scientific Name	Common Name	Cage	Tube	Status
Antechinus agilis	Agile Antechinus	5	0	C
Antechinus minimus	Swamp Antechinus	6	4	LR-NT
Antechinus sp.	Antechinus sp.	0	5	-
Gallirallus philippensis	Buff-banded Rail	2	0	C
Potorous tridactylus	Long-nosed Potoroo	64	25	LR-NT
Rattus fuscipes	Bush Rat	134	4	C
Rattus lutreolus	Swamp Rat	135	7	C
Rattus sp.	Rat	0	12	-
Sminthopsis leucopus	Yellow-footed Antechinus	5	0	C
Vombatus ursinus	Common Wombat	0	2	C
Wallabia bicolor	Swamp wallaby	0	17	C

SPATIALLY EXPLICIT MODELS OF FOX POPULATIONS AND CONTROL

An important component of any AEM process is the ability to predict the potential outcomes from the various management strategies being tested and to explore potential alternative management options and the relative efficiencies of these approaches.

This is achieved through the development of spatial models for each park representing the expected outcomes of fox control, both in terms of changes in the fox population and the prey species under different fox control scenarios.

While in a traditional adaptive management approach these predictive models would have been used to select the most suitable alternative management strategies prior to their implementation, we will use then to compare the predicted and measured outcomes. We can then manipulate the modelled outcomes to explore the parameters that most influence the effectiveness and efficiency of the best control operation.

The development of these models is progressing in a number of stages. The initial stage, which has been completed, is the development of a generic fox population model that will be linked to the Grampians National Park. This model incorporates a basic fox population model (see below) and the current spatial arrangement of control measures. The Grampians was chosen because it is a large park and offers a diverse range of physical features, a number of which are potential barriers to fox movement. These characteristics will enable us to learn more in the developmental phase than from parks with potentially less challenging features.

We will use this single park application to identify and resolve the technical issues before advancing to the second stage, which will be to implement the models across the remaining five parks. The third stage will be the incorporation of selected prey species responses to each of the fox control strategies. This will also be implemented in a staged format in the following years.

Fox Population Model

The basic population model we used divides the park into cells of uniform size (5 km^2). The model predicts changes in the density of foxes within each of these cells by estimating the level of intrinsic recruitment and emigration within each cell, and the degree of immigration from other cells. In any given cell, *potential* intrinsic recruitment and *potential* emigration will be linked to the basic productivity of the animal population inhabiting that cell.

The maximum density within a given cell will reflect the quality of its composite habitats. Cell productivity will be corrected for any *in-situ* mortality and partitioned into a density of animals that can potentially recruit into that cell. Emigrant animals will potentially settle in other cells according to a geometric 'map' of dispersal. This map is based on a geometric distribution of dispersal probabilities. For example, if the density of dispersers for a given cell was 5 and the cell size was 5x5 km, 50% of dispersers ($2.5 \text{ animals km}^{-2}$) would potentially settle in 8

cells immediately adjacent to the cell of origin (i.e. 2.5 / 8 = 0.3125 animals km^{-2}), 30% of animals (1.5 animals km^{-2}) would potentially settle in to 16 cells adjacent to those (i.e. 1.5 / 16 = 0.09375 animals km^{-2}), and so forth.

Incorporating this model into a geographic information system (GIS) allows for a terrain model to be generated and the habitat features within and adjacent to a cell to be considered, eg slope, water bodies and other physical features that act as barriers to dispersal. The proportion of a cell that contains habitat features that restrict dispersal is used to modify the level of recruitment to that cell.

Implementing this process into a GIS also allows for control operations to be considered in a spatially explicit manner, rather than a blanket reduction in survival. Lines of control (or polygons – to simulate aerial baiting, or points – to simulate bait stations) can be used to represent control operations. A distance decay function is used to generate a surface prior to running the population model. The decay function decreases the growth rate of any given cell. This is calculated as a percentage, based on the distance that cell is away from the control line, polygon, or point.

An example of the basic model showing output for the Grampians with and without fox control over several decades is in Appendix 3.

FOX AEM PROGRAM OPERATION

Substantial effort has gone into implementing the AEM project on the ground. Table 15 lists the approximate time spent by park staff and contractors in servicing bait stations and monitoring fox activity in each of the parks. This excludes establishment of bait stations and sand pads, and time spent at meetings planning the project.

Direct comparisons of the person-hours expended on fox control and monitoring among sites need to be interpreted with care as different scales and different costs are associated with each park.

Table 15. The comparative effort of baiting and activity monitoring in each program.

Person days are an approximation based on average time taken to service bait stations or sand pads. Actual times will vary due to season/access constraints and additional workloads. Numbers of bait stations and sand pads are in parentheses. A baiting session is the number of times bait stations are checked. A sand pad session consists of three consecutive days monitoring.

Park	Baiting			Activity Monitoring		
	Person days	Number of sessions	Person days / session	Person days	Number of sessions	Person days / session
Coopracambra National Park	80	9 (74)	9.0	55	3 (35)	18.0
Discovery Bay Coastal Park	20	13 (44)	1.5	2.5	3 (25)	0.8
*Grampians National Park	122	30 (1784)	4.0	60	3 (80)	20.0
Hattah-Kulkyne National Park	38	8 (137)	4.7	6	3 (25)	2.0
Little Desert National Park	50	5 (225)	10	15	3 (75)	5.0
Wilsons Promontory National Park	96	3 (164)	32	144	15 (75)	9.6
TOTAL	**406**	**68 (2428)**	**48.4**	**282.5**	**11 (310)**	**55.4**

*Combines Red Rock and the perimeter baiting program

Discussion of Results

EFFECTIVE FOX CONTROL

Results from the two sites with broad scale annual baiting programs (Coopracambra and Hattah-Kulkyne National Park) suggest that this strategy may be suppressing fox abundance (as measured through bait take and sand pad activity). This is supported by the Project Deliverance bait take and sand pad results (Appendix 1). Sites that are running seasonal programs appear to be having short term impacts only, with bait take and/or sand pad activity returning to previous levels at the beginning of each season.

While data from continuous baiting programs are encouraging, it needs to be remembered that most actions do not simply change a managed system from one state to another, they often induce transient responses that may be quite complex (delays, sharp increases followed by slow declines, cycles etc.). For example, foxes that survive a control operation may experience increased adult and juvenile survival, increases in home range size (activity levels), increased fitness leading to increased breeding success as a result of an increase in the availability of food supplies, less competition etc. Hence, on-going monitoring is required to understand the long-term effectiveness.

While the data are as yet too sparse to make definitive recommendations for the design of bating programs, the trends in available data suggest that if the aim of the control operation is the long term or continual suppression of fox abundance, then short-term, seasonal programs over relatively small areas are unlikely to achieve that outcome. This is a good example of the potential of developing predictive models. With these, it would be possible to explore the potential costs and benefits of various alternative management strategies and select our best estimate before altering the current programs.

INITIAL PREY SPECIES MONITORING

The initial surveys provided data that enabled monitoring protocols to be developed for species that will act as indicators of the success of the Fox AEM (Robley *et al.* in prep.). In the case of Hattah-Kulkyne and Little Desert, the species that will be nominally targeted are not those that we initially thought would be possible to monitor. However, it needs to be remembered that the monitoring programs are designed to provide management with a clear indication of the effectiveness of a control operation. This may be determined by responses in threatened species, but is equally valid through detecting changes in species that are less threatened but easier to monitor, or that are considered pests, eg feral cats.

The monitoring program we implemented at Discovery Bay Coastal Park was unable to detect enough nests of Hooded Plovers to be able to estimate nest success. This is due primarily to the highly active nature of the coastline at Discovery Bay. This is thought to result in Hooded Plovers nesting in the primary dune system, away from the beaches, making detection extremely difficult. The volatile nature of the beach also makes the survey of the few beach nests very difficult, with access restricted to a short period of low tides.

Parks Victoria staff at all parks that participated in the initial prey monitoring were provided with training on how to implement the various survey techniques, identify a range of species, and record the appropriate data. In some cases staff already had these skills. In a number of cases this was the first time staff had been involved in this type of activity. A range of volunteers also participated, increasing the awareness of the general public, and in the case of the Grampians, with visiting rangers from Sweden, of the activities undertaken by Parks Victoria.

FOX POPULATION MODELS

The basic proof of concept application only allows for the Grampians to be modelled, with lines of control around the perimeter of the park, and control operations on a yearly time step. Further development of the model is required, and would include:

- Enhancement of the growth model to better handle negative growth and increased flexibility on the recruitment range;

- Development of the habitat model to incorporate other key environmental variables;

- Introduction of greater flexibility in the control module to allow control prescriptions to vary in severity and timing;

- Investigate the feasibility of distributing the results from a growth scenario run (population scale) down to the habitat scale to better link habitat management to the modelling process; and

- Development of a visualisation module that provides a targeted set of information products that could suit either research or management applications.

These developments are beyond the scope of the current budget and will require resources in future years.

Review of Implementation Process

OUTCOMES FROM THE 02/03 ANNUAL MEETING

The annual meeting was held at Brimbank Park on the 30th April 2003 and was attended by representatives from all the participating parks, regional Chief Rangers – Environmental Programs and Environmental Planers (Appendix 4). Representatives from each of the parks gave a brief overview of the implementation of the program in 02/03 and general discussions were held on issues arising from this year's program. Alan Robley (Arthur Rylah Institute for Environmental Research) reported on the preliminary assessment of the effort required to implement the prey species monitoring program, and the current status of the fox population models.

General issues that arose from the broad ranging discussions held on the day fell into two general categories:

A.

1. Concern about the level of resources required for the project (baiting and sand padding); and

2. Concern about the level of resources required to meet the projected level of staff time for the prey species monitoring.

B.

1. Concern about bait type, including the longevity of bait in the field and the frequency of caching of baits;

2. Concern about non-target bait take, and the ability to detect this;

3. Concern about bait station construction and the impact of bait longevity;

4. Concern about data storage and the ease of use of the AEM data base; and

5. Concern about access to new bait types through DSE, and the longevity of permits and reporting arrangements.

AGREED ACTIONS

The concerns raised by the participants fall into two broad categories, a) institutional capacity to resource and support the project and b) technical issues that are essentially outside the direct aims of the AEM project.

To address the first groups of concerns it was agreed that the project would benefit from some structures to co-ordinate resources and communicate strategic direction to all stakeholders. As a result, the meeting endorsed the proposal to establish two administrative structures; a Statewide Steering Committee (SSC), whose function is to provide strategic direction and cross-organisational co-ordination of the Fox AEM program, and two Regional Working Groups (RWG), whose primary function is to facilitate intra-regional co-ordination and resourcing of the Fox AEM program, and implement key recommendations and decisions made by the Steering Committee in consultation with the RWGs. The terms of reference for these two structures are attached in Appendices 5 and 6.

To address the concerns relating to technical aspects of the program, the project manager/s will co-ordinate with individual parks to alter bait types and bait station construction to gather information on the effectiveness of these alternate approaches. Support will also be provided to determine non-target bait station visitation (through the use of remotely activated disposable cameras), and to redesign the database to make data entry more efficient (see below).

DATA STORAGE

Data recording has been facilitated by the development of site-specific, stand-alone databases. The roll-out of these databases has involved progressive updates and modifications to suit each park's individual requirements. Some difficulty has arisen with the input of data as a result of the updates. The data recording requirements of the AEM have been made available to the Environmental Information System (EIS) development team within Parks Victoria and may be incorporated into the EIS in the future.

Timely data entry by field staff is essential to the success of the project as it allows analysis and implementation of the most up-to-date information. This is an area that will require monitoring to ensure timely provision of data. In some cases delays in entering the data have resulted in resource conflicts within individual parks.

COMMUNICATIONS

Effective and timely communications with on ground staff were achieved in the majority of cases. As a general rule staff involved have been enthusiastic, patient, and accommodating. In the instances that have arisen where the AEM project is in conflict with site specific requirements or capabilities these have been referred to the Chief Ranger Environmental

Programs, Ranger in Charge and / or the Parks Victoria project manager. The establishment of the RWGs will aid in resolving future issues.

FUTURE DIRECTIONS AND OPTIONS

An inevitable outcome of the Fox AEM is that at some stage individual park managers will become aware that they are managing in a sub-optimal manner. In fact this is built into the design of the Fox AEM and allows meaningful comparisons to be made. At what point in time these managers alter their current management strategy in light of information gathered by the AEM process, is difficult to answer. The data collected on the timing and intensity of baiting operations to date suggest that seasonal or short term baiting operations, or operations that are not spatially extensive, no matter how intense have little long-term impact on reducing fox activity and therefore abundance. This applies to the Little Desert, Grampians and Discovery Bay. Each of these parks has a unique set of issues that have been addressed by the Statewide Steering Committee. This committee has recommended that:

1. Little Desert National Park continues with its current management operations for at least one more year. This program has been in operation only for two years and the data are not yet sufficient to recommend a change.

2. Grampians National Park investigates reallocating the current effort to gain a more spatially intensive baiting program. This park has the advantage of having had its baiting program in operation since 1996. Data over these periods clearly indicate that the current perimeter-baiting program has had no lasting effect on fox activity.

3. Discovery Bay is reviewed as a location for inclusion in the Fox AEM, and that an alternative location be investigated. The volatile nature of the coastal dune system and the associated difficulty in locating sufficient numbers of hooded plovers have resulted in extremely poor results over the past two years. Relocating to another coastal site that will allow proper assessment of the impact of fox control on hooded plover nest success will provide valuable information that could later be applied at Discovery Bay.

At the time of writing, the Statewide Steering Committee had recommended to the Regional Working Groups that each park investigate their capacity to resource the recommended prey species monitoring protocols. The level of resources required to undertake the prey species monitoring are outlined in the following section.

If the Grampians National Park is to redesign its baiting program to a more spatially intensive operation one possibility is to use pulsed baiting in the same way as Wilsons Promontory.

This would provide replication of this strategy. The advantage in replicating this strategy is that the results can be interpreted in a more general context than results from a specific site would allow, i.e. Wilsons Promontory. One draw-back of this arrangement would be that neither park currently has a non-treatment control site as a point of reference. It would be possible to establish one in either the north-east of Wilsons Promontory and outside the baited area at the Grampians. This may be a possibility in 2004/05.

Future Resources

PERSONNEL

This section provides a guide to the estimated number of Parks Victoria person days that will be required in the second year of the project (Table 16).

Personnel will be required to maintain the existing fox control and monitoring programs. In addition, personnel will be required to implement the prey species monitoring component of the project.

Table 16. Estimate of person days required for year 3 of the AEM project.

A person day = 7.36 hours and has been rounded up to the nearest day. Number of baiting and sand pad sessions is based on the agreed upon design. A break down of the prey species monitoring is provided in Robley *et al*. in prep.

Park	Task				
	Fox control	Activity monitoring	Sub-Total person days	Prey species monitoring	Total person days
Hattah-Kulkyne National Park	64	16	80	72	152
Little Desert National Park	53	32	85	128	213
Discovery Bay Coastal Park	30	24	54	30	84
Grampians National Park	122	60	182	78	260
Wilsons Prom National Park	96	144	240	54	290
Coopracambra National Park	80	55	135	54	189

Estimates of person days for baiting and activity monitoring are based on tasks being conducted separately, in some instances it may be possible to double up on these tasks.

Person days for prey species monitoring are based on two full-time staff. It is possible to use volunteers or casual staff working with an experienced operator, and in some instances a single operator can undertake monitoring (eg hair tube placement and collection).

PROPOSED BUDGET

The initial budget has been revised and a new projected budget proposed for the next year of the AEM project (Table 17). The financial contributions for the next year of the AEM project include funding needed to cover implementation of the prey-monitoring component.

These resources are required to ensure adequate time and resources are provided to cover the setting up, training of personnel and implementation of the initial prey monitoring programs for each park. The total contributions of Parks Victoria and ARIER to this project are shown below.

Table 17. Proposed budget for year 3 of the AEM project.

*Approximate values only. Actual time taken to implement control and monitoring and costs to do this may vary. Figures are exclusive of GST

Contributions From Parks Victoria		Contributions From ARIER	
Financial contribution (direct)		Financial contribution (indirect)	
Project coordination, data analysis, reporting, compliance monitoring.	$ 42,550	Project Deliverance (knowledge, data, infrastructure, staff time) Southern Arc (knowledge, data, infrastructure)	*$25,000
Fox control budget across all sites (excluding staff time and vehicles)	$152,500		
Total	**$255,050**	**Total**	**$25,000**
Staff time:			
Fox control and activity monitoring	689 days		
Prey response monitoring	400 days		

NB

1. Due to financial constraints in 2003/04, ARIER is unable to support this project with an in-kind or cash contribution and Parks Victoria is unable to fund compliance monitoring of the prey species monitoring program or further development of the fox and prey species models.

2. Staff time to undertake fox control and activity monitoring is based on 02/03 data supplied by each park. Prey species monitoring is based on proposed monitoring (see Robley *et al.* 2003 for details).

3. * This indirect contribution does not include co-operative arrangements that may be reached in relation to ongoing baiting programs at Coopracambra.

Acknowledgments

PROJECT PARTICIPANTS

Many people have contributed to the design and implementation of the AEM project including:

Sally Troy	Manager National Parks and Conservation Research	
Ian Walker	Manager, National Parks and Conservation Programs	
John Wright	Team Leader, Research Co-ordination	
Kate Millar	Chief Ranger Environmental Programs (East Region)	
Jonathon Stevenson	Environmental Planner	
Phil Pegler	Program Co-ordinator	
Alison Marion	Environmental Planning Officer	
Alan Braithwaite	Ranger-In-Charge	Little Desert National Park
Bruce Taylor	Field Services Officer	Little Desert National Park
Mal Pye	Field Services Officer	Little Desert National Park
Damien Skurrie	Ranger	Little Desert National Park
Dave Ryan	Ranger	Discovery Bay Coastal Park
Don McCarthy	Ranger	Discovery Bay Coastal Park
Phil Murdoch	Ranger-In-Charge	Hattah-Kulkyne National Park
Jeremy Tscharke	Ranger	Hattah- Kulkyne National Park
Anthony Stasiak		Hattah- Kulkyne National Park
Robyn Korn	Ranger	Coopracambra National Park
Elaine Thomas	Ranger	Wilsons Promontory National Park
Matt Hoskins	Ranger	Wilsons Promontory National Park
Mick Keenan	Ranger	Wilsons PromontoryNational Park

Graham Parks   Ranger-In-Charge   Grampians National Park

Susan Hansen   Ranger   Grampians National Park

Andrew Dennis   Ranger   Grampians National Park

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Appendix 1

SUMMARIES OF FOX CONTROL STRATEGIES UNDERTAKEN ON EACH PARK IN THE FOX AEM

Coopracambra National Park

The focus of this program is the broad scale suppression of foxes for the protection of a wide range of potential prey species. Prior to the establishment of the Fox AEM project, there was no fox control undertaken in the park. The program covers 118 km of track with 74 bait stations spaced at 1.2 – 1.5 km intervals. Foxoff baits are being utilised and the program runs on a continuous annual basis.

Establishment of the baiting program was facilitated via an external contractor. The seventy-four bait stations were established in December 2001. Poison Foxoff baits were first buried in the bait stations on the 21st January 2002 after a six to eight week free feed program. Bait stations were checked every two weeks during the free feed period then every two days for the first two weeks of poisoning. Following this checking has occurred every 3 – 4 weeks.

Thirty-five sand pads were also established throughout the park in mid-December 2001. These are checked 4 times a year.

Discovery Bay Coastal Park

The baiting program at Discovery Bay was in operation prior to the AEM project but was redesigned to gain more intense coverage. The focus of the baiting program at Discovery Bay has been the protection of nesting shorebirds (Hooded Plovers and Little Terns). A seasonal baiting program using 1080 poisoned Foxoff baits, runs between August / September and November / December each year. In year one bait stations were located along the northern (inland) boundary and at an internal site named Swan Lake. Bait stations are spaced at 1-km intervals covering approximately 44 kilometres and these were checked every two weeks with all baits being replaced at the time of checking. New bait stations were established progressively from early August 2001, with up to 44 bait stations being progressively used throughout the baiting program. The operation of each bait station varied as the resources required to complete the task were underestimated. In 2002/03 the program was adjusted, with an additional 40 bait stations included along the beach. Sand pads are checked before, during and after the seasonal baiting program.

Fox activity monitoring was not undertaken in the first year because as with bait stations, resources required were underestimated. However, these difficulties were overcome and in 2002/03 both baiting and activity monitoring were conducted for this site.

Grampians National Park

The focus of the Grampians baiting program has been the protection of the previous Brush-tailed Rock-wallaby colony, Heath and Smoky Mouse populations and involvement with good neighbour programs on the boundary of the Park.

The program at Red Rock covers 58 km of track with bait stations every 200 metres. This program is annual, with baits checked every two to three weeks throughout the year, at which time all baits are replaced. This program also covers areas of heath where the Heath Mouse is known to occur (evidence exists of fox predation on this species; Eddy Meullmen pers. comm.).

The perimeter-baiting program surrounds the Grampians National Park, with bait stations spaced every 200m. Baiting of the 1784 bait stations occurs between February and June, with bait stations checked approximately every two weeks. Poisoned 1080 Foxoff baits are used in all bait stations.

Both the Red Rock and the perimeter baiting programs were existing control operations prior to the commencement of the AEM project.

In total 80 sand pads have been established in the Grampians to monitor fox activity. There are 6 transects around the perimeter of the Park, five at Red Rock and five in an area considered to be unbaited, and that act as a control. This area is located centrally. These are checked quarterly.

Hattah-Kulkyne National Park

There has been no fox control in this park prior to the establishment of the Fox AEM project. The AEM program covers approximately 60% of the park, with the remaining 40% acting as the experimental control, or non-treatment site. Baiting, using free feeds and 1080 poisoned liver, is carried out on a continuous, annual basis with bait stations spaced at 1 km intervals and stations checked every two to three weeks. Baits are changed over at the time of inspection. Bait stations were established at Hattah-Kulkyne between October 2001 and February 2002. A five-week free feeding period then commenced. A total of 137 bait stations are in place.

The construction of 25 sand pads commenced in late November 2001 after the sand had been confirmed as being free of soil pathogens. These were established to coincide with the establishment of the free feeding period and were checked twice during the free feed and quarterly thereafter. The first sand pad monitoring occurred in December 2001.

Little Desert National Park

The general aim of the fox control program in the Little Desert has been for the protection of Mallee Fowl and general biodiversity. The Little Desert National Park's baiting program was established prior to the AEM project. The AEM design altered the program in a minor way by increasing the distances between bait stations. The Little Desert has been divided into three discrete sites;

1. The East Block is 477.8 km^2 containing 220 km of internal and perimeter tracks. Bait stations are spaced at approximately 1.5-km intervals resulting in 137 bait stations.

2. The Central Block is 451.2 km^2 with 132 km of track. Bait stations are 1.5 km apart resulting in 88 bait stations.

3. The West Block is 374.1 km^2 and acts as a non-treatment site.

The new program commenced in November 2001 and the first season of baiting finished in February 2002. The baiting program runs from approximately October/November to March/April with bait stations checked and baits replaced every three to four weeks.

Sand pad transects were established in each of the three blocks. Activity monitoring commenced in October 2001. Sand pads are checked before, during and after the seasonal program.

Wilsons Promontory National Park

The baiting program for the AEM project at Wilsons Promontory is a continuation of an existing program. The focus of the fox control program has been on the broad scale suppression of foxes to protect a wide range of potential prey species. Wilsons Promontory has been divided into four management areas. The Isthmus forms area 1 and is a high intensity baiting area, the Central section forms area 2 and is a low intensity baiting area, the Southern section forms area 3 and is a low intensity baiting area. The North-east section of the park forms area 4. Fox control is not currently done in Area 4. The baiting program consists of pulsed baiting using poisoned 1080 Foxoff baits, with bait stations at 1-km intervals. A pulse of baiting lasts for 6 – 8 weeks. At the end all untaken baits are retrieved and replaced at the beginning of the next pulse serval weeks later. A total of 164 bait

stations are operated within the park. There is no free feeding, and liver bait will be used on beaches when increased amounts of beach-wash are available. Baits are checked every week with taken baits replaced.

Fox activity monitoring is undertaken using five-sand pad transects. These have been established in each of the three fox control areas. Sand pads are operated before, during and after each pulse.

Appendix 2

PROJECT DELIVERANCE – SUMMARY OF RESULTS

DSE Gippsland Region initiated project Deliverance in July 1998. Project Deliverance provides an infrastructure within which the effectiveness of 'best practice' fox baiting is evaluated at a number of different levels. The project uses four study areas, with a baited (treatment) and un-baited (non-treatment) site at each. Treatment and non-treatment sites range in size from 7000 to 14000 ha. Fox baiting on treatment sites involves deployment of 1080 poisoned Foxoff®. Bait stations are placed along roads and trails at 1 km intervals and are constructed specifically to minimise non-target bait take, which is monitored using tracks and other sign. Unpoisoned Foxoff baits are deployed on non-treatment sites using identical bait stations. The relative intensity of each baiting program is listed on Table 1. The response of medium-sized native mammals is monitored on treatment and non-treatment sites four times per year.

Results to Date

Bait take

Non-poisoned baits were placed in all bait stations on the treatment and non-treatment sites for 10 months prior to poison bait being deployed on the treatment sites. Bait take declined markedly on the treatment sites following the introduction of poisoned baits while remaining consistently high on non-treatment sites (60-90%). This is consistent with baiting substantially reducing fox activity on all treatment sites and continuing to hold fox activity at low levels.

Fox Activity

To verify the changes in fox abundance as indicated by the reduction in bait take, we undertook sand pad activity monitoring on both the treated and non-treated sites. Sand plots between 30 and 40 metres wide were established at 1-kilometre intervals and monitored for three consecutive days and an activity index calculated. The results indicate there are significant differences in the levels of fox activity on the treated sites compared to the non-treated sites (see figures below). This provides independent verification that the baiting program has reduced the level of fox activity on the treated sites.

Nowa Nowa Forest Sites

Cape Conran Sites

Stony Peak Sites
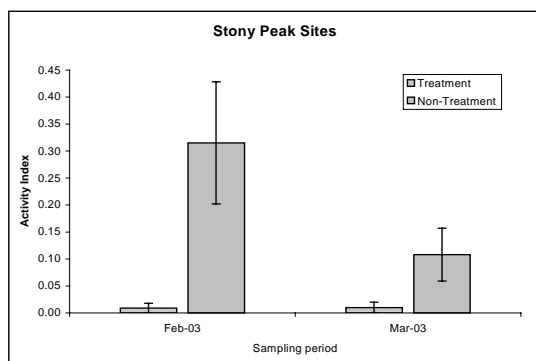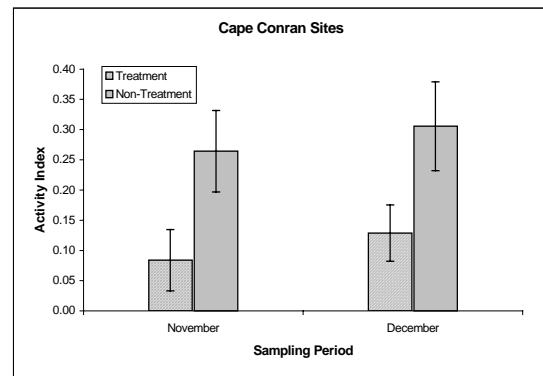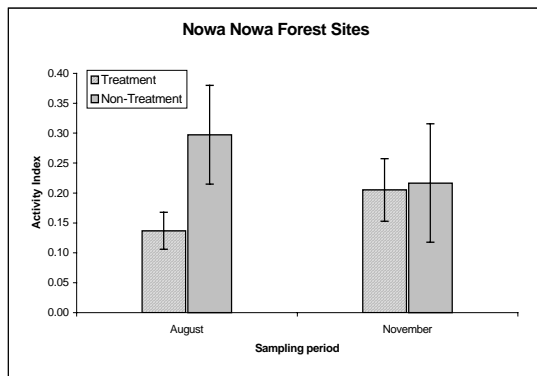
Prey responses

There has been a significantly greater increase in the capture of all medium-sized mammals (< 5 kg) on the treated sites than on the non-treated sites over the past 4.5 years. This provides strong evidence that the control of foxes is having a positive effect over and above any underlying environmental conditions. This response is most pronounced at one of the four sites (Cape Conran Study Site). The response at the other three sites is more complex, and will require more time to separate out from background environmental noise.

Long-nosed Potoroos have shown the most significant response on sections of the Cape Conran and Stony Peak treatment sites. This species has also been caught for the first time on the Nowa Nowa treatment site in the most recent monitoring session. Other species that have been recorded include the Long-nosed Bandicoot, Southern Brown Bandicoot, and Common Brushtail possums. These species are displaying mixed, more complex responses.

Cape Conran Total Mammal Captures
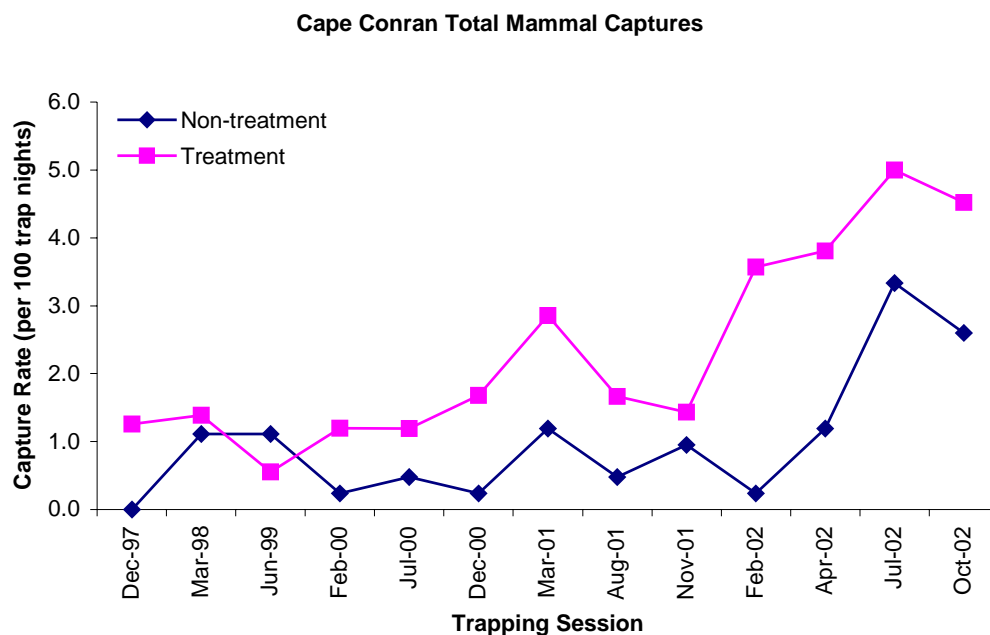
Summary and implications for broad acre fox control in East Gippsland

Project Deliverance is nearing completion and the results it has achieved so far are encouraging. The baiting methodology employed is capable of substantially reducing fox activity, without apparent risks to populations of non-target species. At the baiting intensities used (1 km separation between bait stations, with a 4-5 week baiting cycle), costs per hectare are low (~30 cents/ha) and there are opportunities to further reduce these costs by (1) increasing the distance between bait stations, and (2) extending the period between baiting cycles. However, the effect that either of these modifications has on baiting efficacy should be investigated before they are adopted for any broad acre baiting program.

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Appendix 3

OUTCOMES FOR THE PROOF OF CONCEPT FOX POPULATION MODEL FOR THE GRAMPIANS NATIONAL PARK

The following section outlines the results from the proof of concept phase modelling changes in fox density through time at the Grampians National Park. The first figure shows the seed cells with arbitrary starting densities. The following figures show changes at 5, 15, 25 and 40 years with and without control. Control is based on the current perimeter-baiting program.
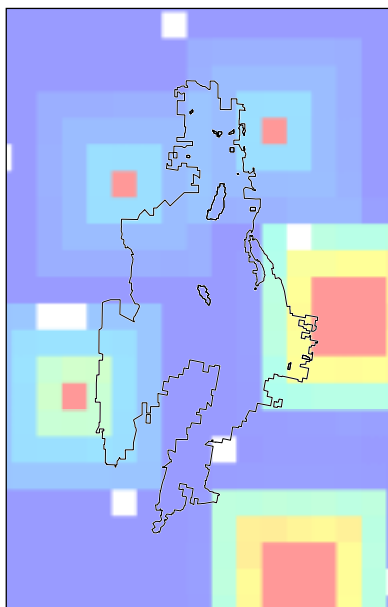
No Control
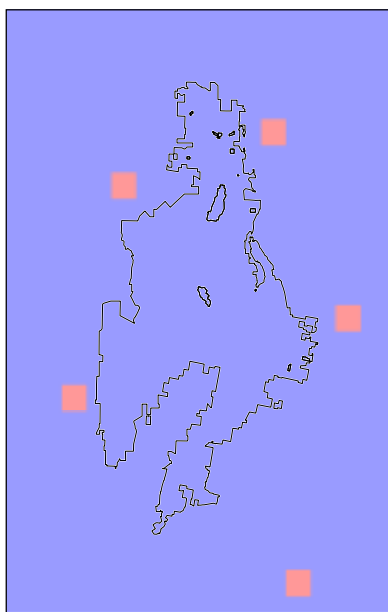
Legend
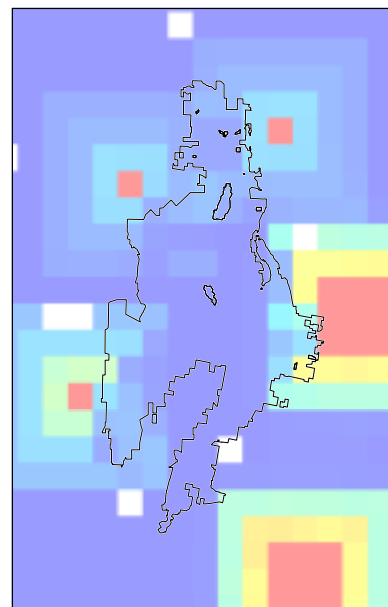
☐ Grampians National Park

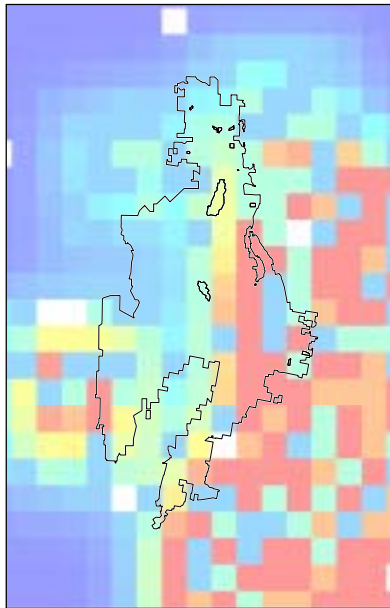**Value**

High Density

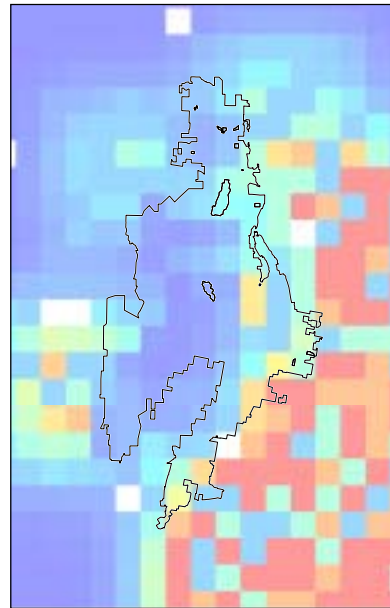Low Density

5 Years No Control

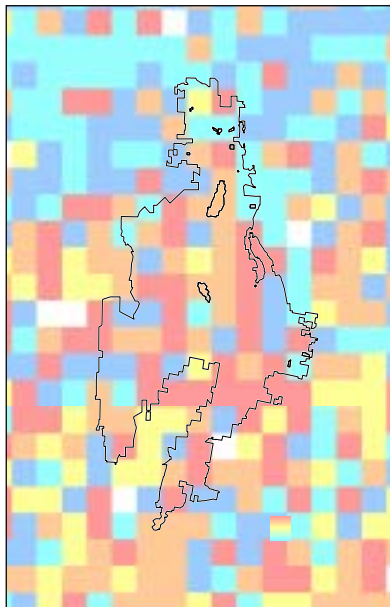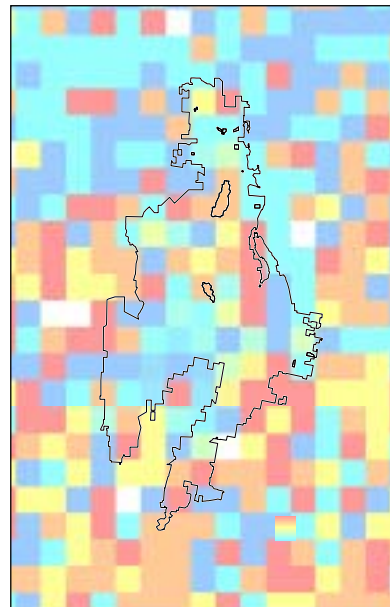5 Years With Control

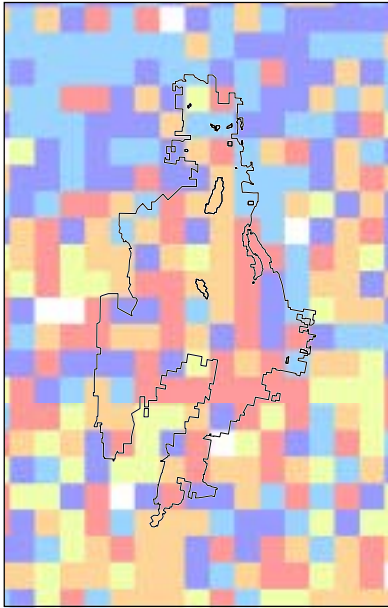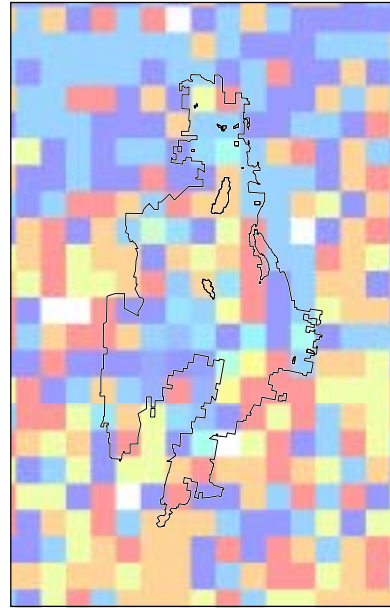15 Years No Control   15 Years with Control

25 Years No Control   25 Years With Control

40 Years No Control   40 Years With Control

Appendix 4

ATTENDEES FOR THE FOX AEM PROJECT ANNUAL MEETING HELD AT BRIMBANK PARK ON THE 30TH APRIL 2003

Person	Region	Representing
Alan Robley		DSE (ARI)
Allison Marion	East	Chief Ranger – Environment East Region
Andrew Dennis	West	Grampians National Park
Anthony Stasiak	West	Hattah-Kulkyne National Park
Bree Roffey	East	Foster
Bruce Taylor	West	Little Desert National Park
Elaine Thomas	East	Wilsons Promontory National Park
Jonathon Stevenson	East	Environmental Planner East Region
Matt Hoskins	East	Wilsons Promontory National Park
Mick Keenan	East	Wilsons Promontory National Park
Mike Stevens	West	Grampians National Park
Peter Sandel	West	Environmental Planner West Region
Phil Murdoch	West	Hattah National Park
Phil Pegler	West	Chief Ranger – Environment West Region
Robyn Korn	East	Coopracambra National Park
Ailsa Morris	West	Discovery Bay Coastal Park

Appendix 5

FOX ADAPTIVE EXPERIEMENTAL MANAGEMENT STEERING COMMITTEE

TERMS OF REFERENCE

Membership: Ian Walker (PV), Phil Pegler (PV), Kate Millar (PV), John Wright (PV), Alan Robley (DSE-ARI)

1. To provide strategic direction and cross-organisational co-ordination of the Fox AEM program. In particular, ensure that the three major elements of the Fox AEM project are fully implemented *viz*:

- The establishment and maintenance of ongoing fox control programs, based on the agreed upon design (Robley and Choquenot 2001);

- The establishment and maintenance of a monitoring and evaluation program that will demonstrate the success of the various strategic control programs by measuring changes in the abundance of native species and declines in fox activity in response to the control programs; and

- The establishment of a Communications Strategy to engage stakeholder and community groups in the overall program and to help explain the long-term operational and biodiversity benefits of the Fox AEM project specifically, and fox control more generally.

2. To facilitate cross-organisational co-ordination and resourcing of the Fox AEM program and ratify key recommendations and resourcing decisions;

3. To provide strategic advocacy of the broader program including the science principles underpinning the work;

4. To ensure that effective communication regarding the project is maintained between the participating Regions represented on the Steering Committee, as well as Government, external agencies, stakeholders and the community;

5. To formalise reporting protocols and milestones against which the Project Manager/s will report; and

6. To develop key linkages with other agencies, businesses and community groups to further enhance the scope and funding of the broader program.

Appendix 6

FOX ADAPTIVE EXPERIEMENTAL MANAGEMENT REGIONAL WORKING GROUP

TERMS OF REFERENCE

Membership: Environmental Program Managers, Environmental Planners, and Representatives from each park.

1. To facilitate intra-regional co-ordination and resourcing of the Fox AEM program and implement key recommendations and decisions made by the Steering Committee in consultation with the RWGs;

2. Facilitate effective communication regarding the project within the Region, as well as external agencies, stakeholders and the community;

3. To formalise reporting protocols and milestones against which the operational staff will report;

4. Oversee the timely collation of data required by the Fox AEM project for the effective reporting and communication of results; and

5. Provide a forum for the exchange of information between participating parks and other programs.

Parks Victoria is responsible for managing the Victorian protected area network, which ranges from wilderness areas to metropolitan parks and includes both marine and terrestrial components.

Our role is to protect the natural and cultural values of the parks and other assets we manage, while providing a great range of outdoor opportunities for all Victorians and visitors.

A broad range of environmental research and monitoring activities supported by Parks Victoria provides information to enhance park management decisions. This Technical Series highlights some of the environmental research and monitoring activities done within Victoria's protected area network.

Healthy Parks Healthy People

For more information contact the **Parks Victoria Information Centre** on **13 1963**, or visit **www.parkweb.vic.gov.au**

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