West Cape Howe National Park

2019 Fox and Feral Cat Monitoring and Control Program Report

For Torbay Catchment Group

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Prepared by
M. Butcher[A] & R. Rand
Animal Pest Management Services
2/171 Estuary Drive, Pelican Point WA 6230
Ph: (08) 97262537
www.animalpest.com.au

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[A] Corresponding author. mike@animalpest.com.au

Introduction

West Cape Howe National Park (WCHNP) situated in the Torbay Catchment area of South West Western Australia provides an important refuge for the Western Ringtailed Possum (*Pseudocheirus occidentalis)* (WRTP) whose population are fragmented in small areas of occupancy through the South West Region (LandCorp 2010). WRTP's are currently classified as Critically Endangered on the International Union for Conservation of Nature (IUCN) Red List, with a population decline of >80% in 10 years (Burbidge and Zichy-Woinarski 2017). One of the leading factors in the continued decline of the WRTP population is the threatening processes caused by exotic species such as the introduced Red Foxes (*Vulpes vulpes*) and Feral Cats (*Felis catus*) (Thompson *et al.* 2009; Burbidge and Zichy-Woinarski 2017). Torbay Catchment Group (TCG) has been undertaking Fox and Feral Cat control for several years throughout the catchment area (TCG n.d.). WCHNP is currently considered a source of Foxes and Feral Cats within the catchment area that previously wasn't being controlled and may negatively impact on the control efforts currently being undertaken throughout the catchment area.

Foxes and Feral Cats have a strong negative effect on native fauna populations in Australia through competition, disease transmission and most notably via predation and are known to predate upon WRTP's (Thompson *et al.* 2009; Saunders *et al.* 2010). Predation by Foxes and Feral Cats can have a very strong impact on small isolated populations of native animals as seen in a study by Short in 2016 wherein major population declines of the native Western Barred Bandicoot (*Perameles bougainville)* on Heirisson Prong in Shark Bay Western Australia coincided with increased Feral Cat numbers in the vicinity. In this study the local extinction of Western Barred Bandicoots within a predator proof sanctuary was attributed to a breach of the sanctuary by a single Feral Cat. A 1996 relocation study by Augee et al. of Common Ringtail Possums (*Pseudocheirus peregrinus*) near Sydney New South Wales resulted in a loss of 52% of the study population to Fox predation and a further 29% to Feral Cats. Foxes are believed to be the main predator to WRTP's in WCHNP due to the species falling into its preferred prey weight range of 0.035-5.5kg where Feral Cats generally prefer smaller prey <220g (Dickman 1996; Anon n.d.).

TCG has now put forth a new 3 year integrated feral animal control program to address the status of WRTP in WCHNP (TCG n.d.). The first year of this project as detailed below was conducted by Animal Pest Management Services and involved monitoring the Fox and Feral Cat population in WCHNP, using camera traps and sand plots, followed by periods of baiting and trapping. The program ran from the 1st of May 2019 until the 8th of September 2019. Monitoring and data collection took place from the 1st to the 10th of May, the 9th to the 16th of August and the 2nd to the 8th of September. Bait distribution occurred during the 16th to the 19th of May and from the 4th of September until 6th of September. Trapping was conducted at the same time as the baiting period in May. The Department of Biodiversity Conservation and Attractions approved the baiting and trapping of Foxes and Feral Cats within WCHNP for the TCG. Camera data from monitoring periods was used to calculate a Relative Abundance Index RAI of Foxes and Feral Cats which was compared between periods of baiting and trapping to determine population trends and the effectiveness of the program as

has been used on other studies to determine the efficiency of feral animal control programs such as the 2018 study of Feral Cats in Fortescue Marsh in Western Australia by Comer et al.

Results

Camera Trap Results

Species captured on camera traps over the course of all three monitoring periods included; Red Foxes, Feral Cats, Western Grey Kangaroos (*Macropus fuliginosus*), Australian Magpie (*Gymnorhina tibicen*) and the Australian Raven (*Corvus coronoides*) as seen in Figure 1. Of all images captured of foxes only one was during daylight.

Figure 1. All species captured on camera traps. Invasive Red Fox (A) and Feral Cat (B), native Raven (C) Magpie (D) and Western Grey Kangaroo (E).

Figure 2. Only Fox captured on camera trap during daylight.

Table 1. Number of Foxes and Feral Cats captured on Camera Traps at each camera for every survey day in May 2019. Black numbers represent Foxes captured. Red numbers represent Feral Cats captured.

Camera Trap Number	1st May	2nd May	3rd May	4th May	5th May	6th of May	7th May	8th May	9th May	10th May
13	0	0	0	0	0	0	0	0	0	0
15	1	0	1	1	0	0	0	1	2	0
17	1	1	1	2	1	0	0	0	2	-
18	0	0	0	0	1	0	0	1	1	1
28	-	0	1	1	0	1	0	1	1 1	0
29	-	1	0	0	0	0	0	1	1	-
31	-	-	0	0	0	0	0	0	0	0
33	-	-	-	-	-	-	-	-	-	1
35	-	-	-	-	-	-	0	2	0	-
36	-	0	0	1	0	1	0	0	0	0
38	-	-	-	-	-	-	-	1	1	-
40	-	0	0	0	0	0	0	0	0	0
Total	2	2	1 2	4 1	2	2	0	4 3	7 2	2
Mean	0.5	0.25	0.11 0.22	0.44 0.11	0.22	0.22	0	0.36 0.27	0.63 0.18	0.22

Of all 12 camera traps set during the May monitoring period only three failed to capture any images of Foxes or Feral Cats. Cameras 13, 31 and 40 were located on the western end of WCHNP.

Table 2. Number of Foxes and Feral Cats captured on Camera Traps at each camera for every survey day in August 2019. Black numbers represent Foxes captured. Red numbers represent Feral Cats captured.

Camera Trap Number	9th August	10th August	11th August	12th August	13th August	14th August	15th August	16th August
18	-	1	1	0	0	0	1	0
34	-	-	-	0	1	0	0	0
36	1	0	0	0	1	2	0	0
Total	1	1	1	0	2	2	1	0
Mean	1	0.66	0.5	0	0.66	0.66	0.33	0

All three camera traps recorded images of Foxes or Feral Cats in the August monitoring period.

Table 3. Number of Foxes and Feral Cats captured on Camera Traps at each camera for every survey day in September 2019. Black numbers represent Foxes captured. Red numbers represent Feral Cats captured.

Camera Trap Number	2nd September	3rd September	4th September	5th September	6th September	7th September	8th September
18	-	-	1	0	0	0	0
26	-	1	0	0	0	0	0
36	-	-	-	-	-	-	
38	-	1	0	0	0	0	0
Total	-	1 1	1	0	0	0	0
Mean	-	0.5 0.5	0.33	0	0	0	0

All four cameras recorded images of Foxes or Feral Cats for the September monitoring period.

Camera Traps did on occasion engage the animals attention possibly due to the audibility of the camera capturing an image, as suggested in Meek *et al.* 2015 or by appearing conspicuous. Fortunately this did not appear to cause flight or avoidance responses but merely garnered the animals notice. Examples of this behaviour are show in Figure 3.

Figure 3. Fox (A), Feral Cat (B) and Western Grey Kangaroo (C) notice camera trap as it take their photo.

Table 4. Relative Abundance Index (RAI) of Foxes and Feral Cats for the last 17 camera trap nights of each survey month based on photographic rate.

	May	August	September
Foxes	0.412	0.294	0.118
Cats	0.118	0.059	0.059

The RAI's of Foxes over the three monitoring periods show a 0.118 (29%) decrease in Foxes per camera trap night between May and August after the first baiting period, with a further 0.176 (60%) decrease in Foxes per camera trap night between August and September. There was an overall decline in Foxes per camera trap night of 0.294 (71%) from the beginning of the survey period in May to the end of the baiting program in September.

Between May and August there was a decrease in Feral Cats per Camera trap night of 0.059 (50%). There was no significant change in the RAI of Feral Cats between August and September.

Sand Plots vs Camera Traps

Table 5. Number of Locations Exhibiting Fox Presence.

		Sand Plots	Camera Traps
May	2nd	4	2
	3rd	6	1
	4th	5	3
August	10th	2	1
	11th	2	0
	12th	2	0
September	3rd	2	1
	7th	0	0
	8th	0	0

T-test two samples assuming unequal variances statistical analysis comparing the ability of sand plots and camera traps to detect the presence of Foxes yielded the following for each month. May: $t= 3.67$ $\alpha=0.05$, August: $t= 5.00$ $\alpha=0.05$, September: $t= 0.447$ $\alpha=0.05$.

Table 6. Number of Locations Exhibiting Feral Cat Presence.

		Sand Plots	Camera Traps
May	2nd	2	0
	3rd	3	2
	4th	3	1
August	10th	1	0
	11th	0	1
	12th	0	0
September	3rd	2	1
	7th	0	0
	8th	1	0

T-test two samples assuming unequal variances statistical analysis comparing the ability of sand plots and camera traps to detect the presence of Feral Cats yielded the following for each month. May: $t= 2.50$ $\alpha=0.05$, August: $t= 0.00$ $\alpha=0.05$, September: $t= 1.00$ $\alpha=0.05$.

The t-test results show that rather than being equal in capability to determine the presence of Foxes and Feral Cats at multiple places in a reserve, sand plots have a far greater ability to determine presence or absence than camera traps. The only occasion that the two methods

proved equal in ability detect Feral Cats occurred in August when both survey methods achieved the same result.

Trapping Results

No Foxes or Feral Cats were caught within WCHNP during the trapping period using raised platform sets. A total of 7 foxes were trapped on the City of Albany reserve adjacent to WCHNP which was trapped simultaneously with WCHNP using standard APMS trap sets. No non-target animals were trapped on WCHNP or City of Albany land.

Methods

Site description

WCHNP covers approximately 3200ha of land and is situated in the Torbay catchment area approximately 25km from Albany. It contains approximately 23km of coastline and the park extends from the low tide mark inland for near on 6km. The park is predominately vegetated by Karri forest, Coastal Heath and wetlands. There are three fresh water lakes in the northern section of the park and small watercourses run year round (Herford *et al.* 1995; Australian Heritage Database n.d.).

Monitoring

Camera traps were used over the course of all three monitoring periods to detect Foxes and other species of interest, such as Feral Cats, that passed in front of them during the day and night. Three types of camera were used during the monitoring periods; Moultrie (Model M-1100i), Browning (Model BTC-5PDX) and Reconyx (Model HC 600 Hyperfyre). A total of 14 cameras were set at 18 locations. The most camera traps active at any given time in the monitoring periods was 13. Several cameras were swapped or moved during this study for varying reasons such as fire events.

Cameras were set to take images at high resolution in order to minimise captures that could not be attributed to a certain species as can occur when low quality images are taken (Bengsen *et al.* 2011; Meek *et al.* 2015). Cameras were secured to trees, shrubs and picket stakes, and set between the average feet and head height of a Fox in order to capture full body images. Branches, grass and leaves directly in front of cameras were removed in order to minimise false trigger events.

Images captured by camera traps were collected and examined to determine the number of capture events that occurred for each camera for each day of the monitoring periods. All images taken were date and time stamped. Capture events were determined by the number of individual Foxes or Feral Cats that were photographed at a particular camera trap on a particular day. Due to uniformity in coat colour of Foxes and the fact the most images captured of Foxes were taken during the night and were therefore monochromatic, identifying individuals was not possible when multiple captures occurred at the same camera trap in a

night. This was rectified by assuming that individuals that disappeared from camera view and reappeared after a period of 5 minutes were different animals.

Sand plots were used during all three monitoring periods as a way to passively assess the presence or absence of Foxes and Feral Cats at multiple locations in the WCHNP. A total of 20 sand plots were set for each of the three monitoring periods and set on roads and tracks running through the WCHNP. Sand plots were approximately 1 m in width across the whole track and consisted of lightly raked sand or dirt that would hold an identifiable impression of an animals footprint. Plots were checked over three consecutive days and footprints were identified and recorded as a presence or absence score for the location.

Cameras and sand plots were placed at random intervals spaced at least 1 km apart or on separate tracks if closer than 1 km. Cameras and sand plots were placed on tracks to help increase the detection probability of Foxes in the area, as Foxes are known to frequently traverse tracks and paths (Mahon *et al.* 1998a).

Baiting

Baiting was undertaken using dried meat baits injected with 3.0mg of 1080. Baits were laid at a maximum rate of 5 baits/km2 as recommended by Thomson and Algar 2000, with baits placed at strategic locations to increase uptake. Baits were located across the whole WCHNP, although Shelly Beach Road, Shelley Beach, Dunsky Beach and the Bibbulmun Track were not baited.

Trapping

Traps used were Victor 1.5 Soft Catch traps within the WCHNP and Victor 1.5, #1.75 and #3 within the City of Albany reserves. Trapping in WCHNP consisted of using raised platform traps due to the requirements of DBCA to minimise captures of non-target fauna. A total of 12 traps were used with a total of 92 trap nights using fox specific lures. Trapping was undertaken simultaneously on approximately 100ha of the City of Albany reserve adjacent to WCHNP (R 24547 and R 24548) with 6 traps used (48 trap nights), set using typical Animal Pest Management Services methods and proprietary fox lures.

Data Analysis

Fox and Feral Cat numbers were calculated as Relative Abundance Indices (RAI). RAI's are often used to track changes in abundance, habitat use variation , species interactions, activity patterns and can be used to track population size changes if individual identification of animals is not viable (Burton *et al.* 2015; Kämmerle *et al.* 2018). Camera traps can be used to calculate RAI's given the assumption that photographic rates are lineally related to animal abundance (Jenks *et al.* 2011). Analysis of photographic rates of capture is a promising way of deriving RAI's and is calculated as the number of captures per camera trap night (Palmer *et al.* 2018). Camera trap nights were calculated by examining capture images to determine periods when the camera was not operational as per Kämmerle *et al.* 2018.

Due to the removal and swapping of cameras, each monitoring period had a differing number of camera trap nights (May 87, August 20, September 17). To standardise the resulting RAI's across the monitoring periods the last 17 camera trap nights for each monitoring period were used to calculate the corresponding RAI's. The last 17 camera trap nights were used for the data analysis as it was the minimum maximum number of trap nights available for analysis. It also meant that enough time was allowed to ensure that any technical problems with the cameras had been solved and animals had enough time to adjust to their presence, as camera traps have been known to alter animal behaviour in previous studies (Meek *et al.* 2015).

Sand plot presence and absence data was compared against camera trap data which was transformed from count data to presence and absence for the corresponding days in which both survey methods were used. Two tailed t-test assuming unequal variance was used to compare the two methods ability to detect the presence of Fox and Feral Cat activity in multiple locations.

Discussion

A review of baiting trials across Australia in 2007 indicated that Fox reduction after poison baiting varied between 50-97% (Saunders and Mcleod 2007). There are a variety of reasons that some baiting programs may be less successful than others. Some bait types may be more palatable to Foxes than others, depending on the season preferred prey species may be more abundant leading Foxes to be less inclined to take a bait, or other species may also take baits limiting those available to the target species. Also if a target area has been the subject of a long term baiting program using the same baits at each distribution, Foxes may become bait shy and bait avoidance may occur (Thomson and Algar 2000). Caching can be problematic as well during baiting programs, this is especially prevalent in vixens when pregnant or with young (Fleming 1997; Macdonald 2010). Bait palatability can also effect caching by Foxes with less favoured baits more likely to be cached (van Polanen Petel *et al.* 2001). Improving bait palatability and focusing on bait placement in areas more likely for a fox to encounter baits may help to alleviate these issues (Thomson and Algar 2000) which occurred in this control program at WCHNP.

The difference in apparent reduction of fox numbers after the May baiting (29%) and August/September (60%) may be the result of two differing phenomena. Firstly, young foxes generally disperse in Autumn (Thomson *et al.* 2000) and this may have lead to an increase in fox numbers after baiting once resident foxes have been removed. Secondly, movement is a dynamic characteristic of fox behaviour that changes in response to population density (Trewhella *et al.* 1988), with foxes more mobile at lower population densities (Berry *et al*. 2014). This may show as changes to the number of events on cameras or sand plots leading to the assumption that fox numbers are higher than what they really are.

Feral Cat numbers during this program did not follow the same trend as Fox numbers; this may be the result of two reasons. Feral Cats being less habitual than Foxes can make them

harder to monitor. Feral Cats for example do not follow roads as Foxes do making them difficult to detect using sand plot surveys (Mahon *et al.* 1998b; Edwards *et al.* 2000). Many camera trap surveys of Feral Cats such as that by Bengsen *et al.* 2011 rely on the use of lure to attract them to the camera detection zones. As our sand plots and the majority of our camera traps were not lured and were placed on roads to help detect Foxes they were not set to optimally capture presence or absence of Feral Cats in the area and thereby may not provide a true representation of population trend. Feral Cats also tend to be less responsive to baiting programs than most canid species, Dried Meat Baits in particular may have little effect on Feral Cats primarily due to the species jaw and tooth morphology which is designed for biting and tearing fresh meat rather than chewing as is required to consume this type of bait (Risbey *et al.* 1997). Using poison baits during the winter may improve the uptake of baits by Feral Cats as food sources are lower (Algar and Brazell 2008) and baits that are not dried as much will increase uptake of the by cats. Although Feral Cats may not be the primary predator of WRTP's in WCHNP the park still houses multiple native species that may be negatively affected by the presence of Feral Cats in the area such as Southern Brown Bandicoot (*Isoodon obesulus*), Dibbler (*Parantechinas apicalis*) and a number of bird and reptile species (Herford *et al.* 1995; DBCA 2017).

To further enhance the efficiency of a monitoring program it is recommended to expand the program both temporally and spatially. RAI precision has been seen to improve with increased coverage and duration of survey periods (Palmer *et al.* 2018). RAI's are sensitive to changes in detection probability particularly related to location and site. These changes need to be accounted for (Kämmerle *et al.* 2018). As seen above sand plots proved more effective in detecting the presence and absence of both Foxes and feral Cats in multiple locations during the monitoring periods but are as a passive tracking method limited in the information that they can provide. Camera trap data has the advantage of being less open to interpretation (Glen and Dickman 2003). Based on the above it can be assumed that setting sand plots before a monitoring period of camera traps to determine placement of said cameras would increase detection probability and therefore the precision of the RAI. Monitoring using sand plots would also prove useful to determine optimal bait placement locations.

In some locations, bait removal or take by non-target species can be very high (Dundas *et al.* 2014). We also recommend that baits be placed at camera sites to improve knowledge of bait take by non-target species and effects of baiting efficiency.

In some areas of WCHNP, there are significant populations of rabbits. Poisoning of rabbits with 1080 is likely to improve regeneration of native plants (Lowe *et al*. 2003) and can also lead to a decrease of foxes by as much as 75% (McIlroy and Gifford 1991). Incorporating the baiting of rabbits with 1080 into the fox baiting program should be considered.

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