Domestic Cat Monitoring and Awareness In Alice Springs

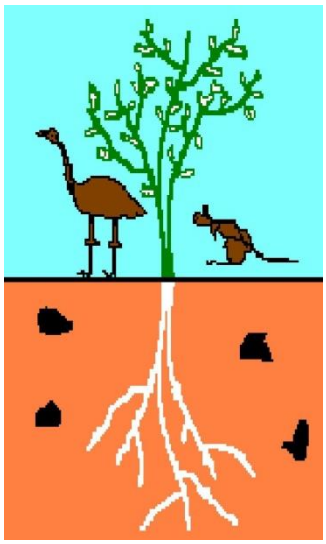
2016-2017 Report

Alice Springs and Tennant Creek

This report was released on 14th August 2017, using data obtained from July 2016 to July 2017.

The Domestic Cat Monitoring and Awareness in Alice Springs project is coordinated by Land for Wildlife Central Australia. Land for Wildlife Central Australia is a not-for-profit community engagement scheme, hosted by Low Ecological Services P/L.

This project is supported by Territory Natural Resource Management, through funding from the Australian Government's National Landcare Programme. The project is supported in-kind by Low Ecological Services P/L.



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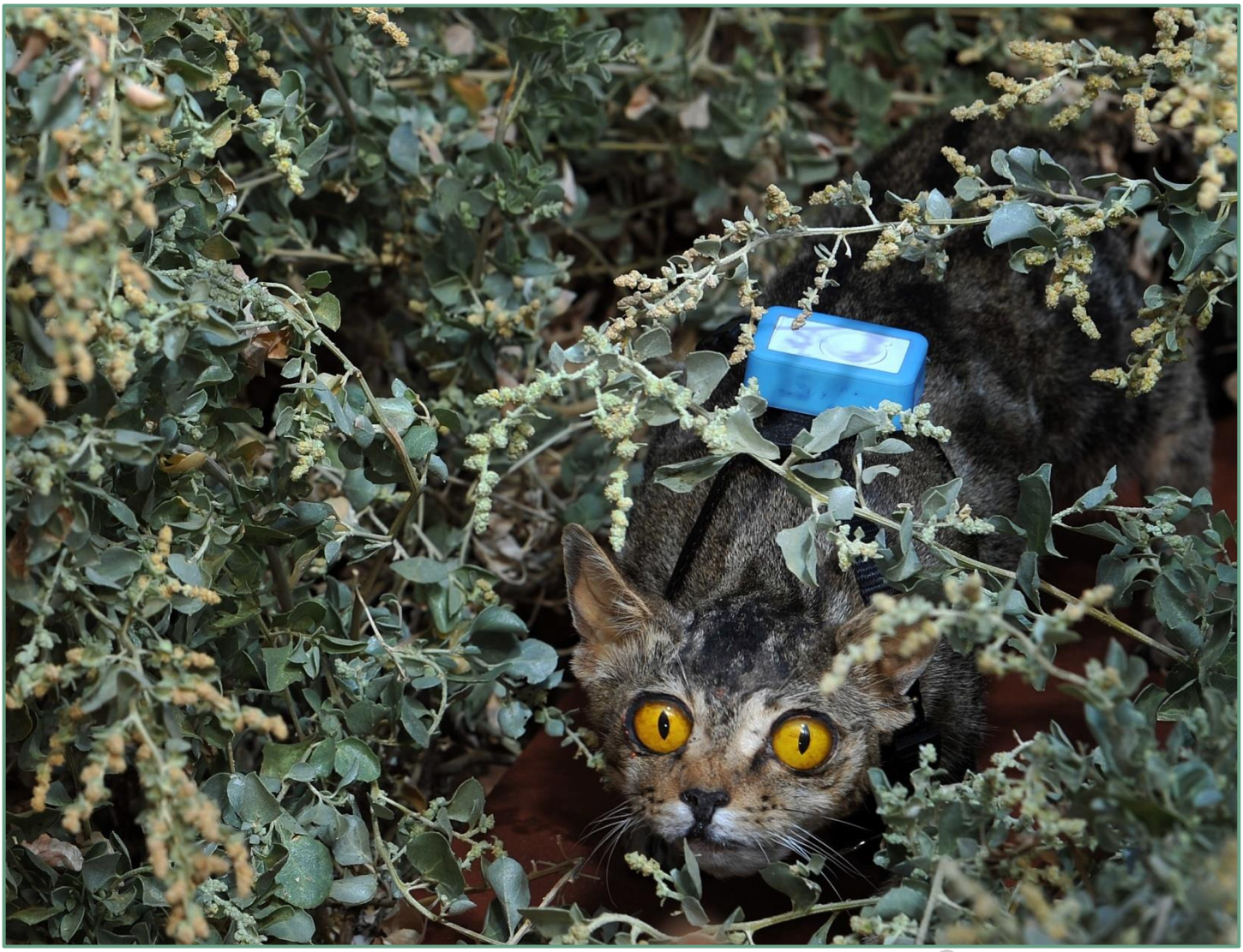
Front cover: Domestic cat owners take part in the 2015-2016 round of domestic cat monitoring and awareness. Image by Justin Kennedy.

Additional images in the document were used with permission from Justin Kennedy, Dina Indrasafitri, and the domestic cat owners involved in the project (image authors not listed to protect the privacy of the project participants).



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Project Background

The Domestic Cat Monitoring and Awareness in Alice Springs project is coordinated by Land for Wildlife Central Australia (wildlife.lowecol.com.au), a not-for-profit scheme hosted by Low Ecological Services P/L. This project is supported by Territory Natural Resource Management, through funding from the Australian Government's National Landcare Programme.

The project was launched in July 2015 under the coordination of Jen Kreusser of Land for Wildlife as part of a TNRM supported project (2015-2016), and continued under the coordination of Caragh Heenan after receiving further TNRM supported funding (2016-2017).

Similar programs are running throughout several other states of Australia, and worldwide, including a national push for 'Cat Tracker' by Dr Philip Roetman of the University of South Australia (http://www.discoverycircle.org.au/projects/cat-tracker/). The project also complements programs such as the FeralScan pest mapping.

The Domestic Cat Monitoring and Awareness project links into program 9 of the *TNRM Natural Resource Management Plan (2016-2020)* regarding increasing knowledge, capacity and engagement; but more predominantly into Program 3 concerning reducing the impacts of feral animals through trialling of domestic cat control measures. The project is relevant to the *Threat abatement plan for predation by feral cats (Department of the Environment 2015)* under objective 4.2 to 'increase public support for feral cat management and promote responsible cat ownership', which involves actions surrounding engagement of the community and the need for responsible cat ownership. *Australia's Biodiversity Conservation Strategy (2010-2030)* lists invasive species as a main threat to national biodiversity and states a national target to reduce the impacts of invasive species on ecological communities. In addition, the *Australian Pest Animal Strategy 2007* suggests further research and development regarding the impact of pest species such as feral cats.

Research Approvals

The Domestic Cat Monitoring and Awareness in Alice Springs project is conducted with approval from the Charles Darwin University Animal Ethics Committee (Project *16019 Monitoring Domestic Cats In & Around Alice Springs*).

Project Team

Ms Jennifer Kreusser: Jen led the Domestic Cat Monitoring and Awareness project in the initial stages of its development, bringing the idea to fruition and seeking funding to support the project for a one year trial. The trial was successful and gained significant interest in the community. Jen was running the program as the Land for Wildlife Central Australia Coordinator, but has since taken on a new role outside of the program.

Dr Caragh Heenan: Caragh continued the Domestic Cat Monitoring and Awareness project in the second year, shortly after taking on the Land for Wildlife Central Australia Coordinator position in 2016. Caragh has incorporated video cameras and scat analysis into the project in an attempt to gain a better understanding of the behaviour of cats when out and about. Caragh has a background in animal physiology research and data analysis, and has taken on the challenge of interpreting cat tracking data with pleasure!

Ms Candice Appleby: Candice has assisted the Land for Wildlife Coordinator for the recent round of Domestic Cat Monitoring and Awareness in the processes of community engagement. Candice brings her experience in coordinating Green Army teams to the engagement process and used her sense of humour to produce fun and engaging videos from the surveillance material.

Mr Tim Dowling: Tim assisted Jen Kreusser for the initial round of Domestic Cat Monitoring and Awareness. Tim was of great assistance; bringing his experience in project management and community engagement skills.

About Domestic Cats

Cats (*Felis catus*) were domesticated in the Middle East around 10,000 years ago (Pickrell 2013), but are related at the family level in taxonomy with other cats such as lions and tigers, as well as servals and lynx (Figure 1). Due to their ability to produce fertile offspring with wildcats (*Felis silvestris*), domestic cats are classified by some scientists to be a subspecies of the wildcat (Roetman *et. al.* 2017).

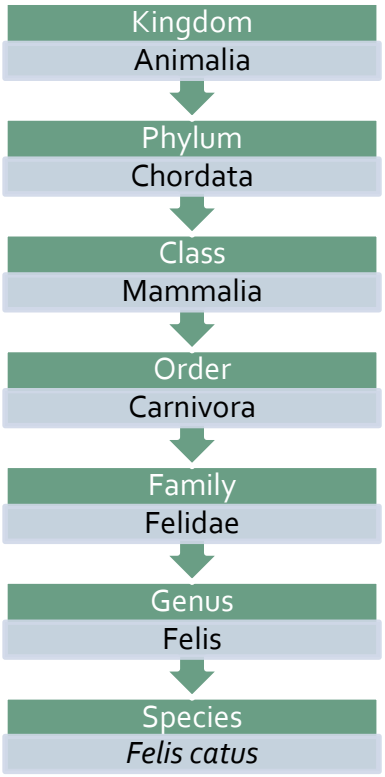


Figure 1. Taxonomic classification of domestic cats (*Felis catus*).

Cats were domesticated from wildcats, as they kept snakes and mice away from homes and grain stores (Roetman *et. al.* 2017). Cats have been used to dispose of rats and mice in postal offices in Britain and served in World War I to detect foul air in submarines and trenches. They were introduced to Australia in the 1600's by Indonesian fishermen or Dutch spice-traders, and again in 1788 with European settlers (Roetman *et. al.* 2017, Taylor 1999). The historical use of cats in Australia has largely been for feral animal control, including mice and rabbits, with thousands of cats being released as a means of controlling rabbits (Taylor 1999). Nowadays, cats are kept primarily as domestic pets, for their quality as nurturing companions. They provide joy, a feeling of parental responsibility, and a connection with nature.

Domestic cats can be classed as:

- Owned (owned and cared for, *i.e.* pets)
- Semi-owned (cats that are provided for on occasion, but are not owned by anyone in particular)
- Un-owned (not provided for, also known as feral or stray cats)

The cats involved in this project were purely owned cats, though are simply referred to in the report as domestic cats.

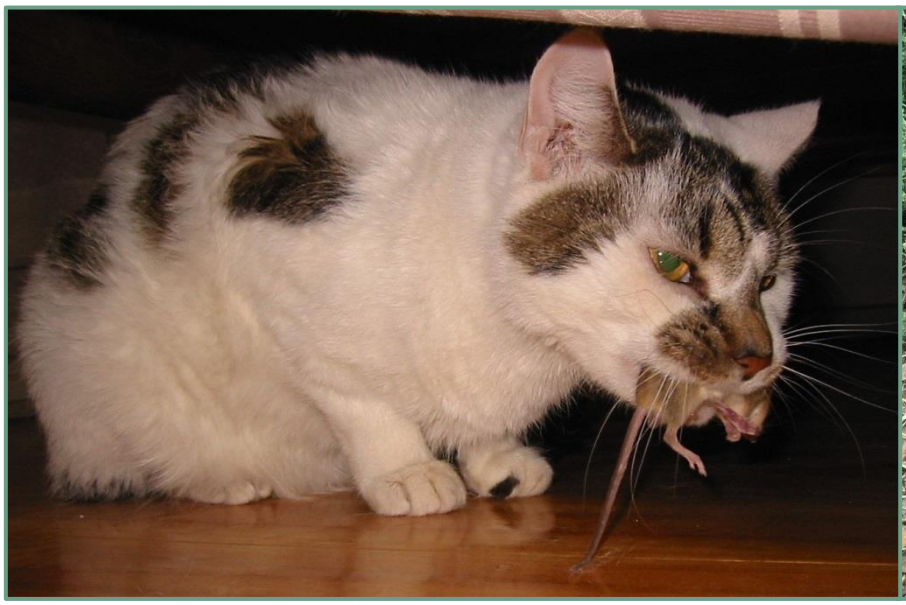
What's All The Fuss About?

The introduction of cats to Australia is considered to be one of the most significant conservation issues in Australia. There are no cats that are native to Australia and thus introduced domestic cats can impact on the native wildlife in a negative manner. Few native mammals are equipped to effectively avoid predation by cats. Cats are obligate carnivores, requiring high quantities of protein (300 g a day), including the essential amino acid Taurine (a main constituent of animal-based protein). In addition, cats will often hunt birds and reptiles through instinct, even if their dietary needs are being met. While they have been known to feed on invasive mammals such as mice and rabbits, they also prey on native wildlife.

Cats reach sexual maturity as young as four months of age and can rear up to 150 offspring over their 10 to 15 year lifespan, though the lifespan of feral and unowned cats may be as little as a few years (Roetman *et. al.* 2017). Regardless, the population for feral cats has the ability to increase rapidly. Current population estimates for cats are sitting at roughly 5 million feral cats Australia-wide (Pickrell 2013, Taylor 1999).

Since feral cats can prey on up to 5 to 30 animals a night, the total population can kill millions of native animals a day (Pickrell 2013). Not all domestic cats prey on wildlife (due to differences in pet management), so many cop a bad rap. However, in a country where 25 to 48 percent of homes own a domestic cat (Pickrell 2013, REARK Research 1994) resulting in 3 million pet cats in the country (Taylor 1999), and a third of cat owners allow their cats to roam outside (Alice Springs Town Council 2017), the number of cats potentially impacting wildlife is staggering. Domestic cats kill roughly 30 vertebrates each year according to a widely quoted study by Paton (Paton 1991, Taylor 1999, Wires 2017). A later survey by Barratt suggested that only 10 prey were caught per year by cats bordering nature reserves, with bells not proving successful at saving wildlife from capture (Barratt 1997, 1998). A Petcare Information and Advisory Service survey found that only 55 % of domestic cats catch prey, with only 4 prey caught per year (REARK Research 1994). It's therefore clear that there is much to learn about the behaviour of cats, a great deal of variation in the behaviour of cats (which comes down to differences in management) and the perception of cat owners regarding their cat's behaviour.

In Australia, the extinction of several species has been primarily linked to cats (Australian Government 2015b). In addition, cats have been implicated as a threat to 74 mammals, 40 birds, 21 reptiles and 4 amphibians. This includes 27 species on the IUCN Red List of Threatened species, 17 of which are also listed under the EPBC Act (Australian Government 2015a, b). It has been suggested that small mammals and birds



are likely to be negatively impacted by cat predation to a greater extent than other taxa (Dickman 1996). At a local scale, there are 13 extinct native species and 12 currently threatened native species (Table 1), for which cats are listed as a threatening process (Northern Territory Government 2017).

Table 1. Species whose population declines are attributed in part to introduced predators such as cats

Extinct	
Pig-footed bandicoot	*Chaeropus ecaudatus*
Western quoll / Chuditch	*Dasyurus geoffroii*
Central hare-wallaby	*Lagorchestes asomatus*
Mala / Rufous hare-wallaby	*Lagorchestes hirsutus*
Lesser stick-nest rat	*Leporillus apicalis*
Lesser bilby	*Macrotis leucura*
Short-tailed hopping-mouse	*Notomys amplus*
Fawn hopping-mouse	*Notomys cervinus*
Long-tailed hopping-mouse	*Notomys longicaudatus*
Crescent nailtail wallaby	*Onychogalea lunata*
Desert bandicoot	*Perameles eremiana*
Red-tailed phascogale	*Phascogale calura*
Shark bay mouse / Alice springs mouse	*Pseudomys fieldi*
Threatened	
Brush-tailed mulgara / Mulgara	*Dasycercus blythi*
Crest-tailed mulgara / Ampurta	*Dasycercus cristicauda*
Great desert skink / Tjakura	*Egernia kintorei*
Golden Bandicoot	*Isoodon auratus*
Malleefowl	*Leipoa ocellata*
Greater bilby	*Macrotis lagotis*
Dusky hopping-mouse	*Notomys fuscus*
Southern marsupial mole / Itjaritjari	*Notoryctes typhlops*
Night parrot	*Pezoporus occidentalis*
Pale field-rat	*Rattus tunneyi*
Long-tailed dunnart	*Sminthopsis longicaudata*
Central rock-rat	*Zyzomys pedunculatus*

Predation by feral cats is listed as a key threatening process to the survival and abundance of native species and the Commonwealth Government have developed a threat abatement plan for predation by feral cats (Australian Government 2015b). The plan aims to guide management via four key objectives: Effectively control feral cats in different landscapes, improve effectiveness of existing control options for feral cats, develop or maintain alternative strategies for threatened species recovery, and increase public support for feral cat management and promote responsible cat ownership. Land for Wildlife is working with domestic cat owners in central Australia to address responsible cat ownership.

Why is Domestic Cat Management Important?

Management of owned cats can be varied, ranging from well-cared for individuals that are maintained indoors, to outdoor cats that do not stray from home, and at the extreme scale to roaming cats that may have a negative impact on their surroundings. Poorly managed domestic cats can:

- Have a negative impact on wildlife populations through predation or altering home ranges of wildlife by their presence in the environment.
- Become a nuisance to neighbours by spraying, depositing scats, yowl, or harassing neighbouring pets. Roaming domestic cats can also be a nuisance in the neighbourhood by deterring native animals from the area (*e.g*. birds) that neighbours may wish to attract.
- Have an increased risk of catching or transmitting disease from wild or domestic animals, or humans, as well as infection from other sources.
- Secondarily add to the feral cat population by mating with feral cats (if not de-sexed) or directly contributing to the feral cat population when not returning home.
- Suffer physical abuse from unfriendly community members.
- Suffer injury as a result of roaming behaviours, interaction with other stray or neighbouring animals, or vehicular accidents. In some cases, this can result in a hefty veterinary bill or a great loss to the family.
- Be trapped when wandering off the property, resulting in impounding fees from the local shelter.

Domestic Cats in Central Australia

Cat owners in Alice Springs are legally required to:

- **Register their cat with the Alice Springs Town Council**
- **Keep their cat within the property boundaries at all hours, during both day and night**

Alice Springs Town Council

The Alice Springs Town Council ran a Cat Survey in April 2017 as part of a Roaming Cat Prevention Project, which was open to cat owners and the general public. A little over 350 participants completed the survey, of which 60 % were cat owners, and there are some interesting results (Alice Springs Town Council 2017)!

Over a third of the cat owners (roughly 80 participants) allow their cats to roam, but 95 % of all respondents have had someone else's cat enter their yard at least once. This indicates that there are a significant number of cats roaming within the Alice Springs municipality.

So why are there so many cats roaming outside of their boundaries? The survey suggests that few respondents were aware of the need to keep cats within the home boundary at night (16 %) and during the day (11 %). This suggests that many cat owners are unaware of their obligations under the council by-laws. It also highlights that several cat owners believe the rules target roaming at night alone, rather than general cat management. In fact, the Alice Springs Town Council by-laws state that a domestic cat must be registered with the council, and that a cat must be kept within the property boundary at all times of the day. Cats that are found to be at large can be impounded, with owners receiving a fee of up to $253.

ALICE SPRINGS FEES & CHARGES*

De-sexing:

$84.80 - $305.00 (Cost depends on sex and level of post-operative care, *Alice Springs Veterinary Centre*)

$175.00 - $270.00 (Cost depends on sex, *Desert Oak Veterinary Clinic*)

$170.00 - $635.00 (Cost depends on age and sex, *Alice Springs Veterinary Hospital*)

Microchipping:

Free pending registration and certification from ASTC (*Alice Springs Veterinary Hospital and Alice Springs Veterinary Centre*)

$86 (Unregistered cats, *Alice Springs Veterinary Centre*)

Registration (*Alice Springs Town Council*):

$46.50 (Sterilised Annual Registration)

$123.50 (Sterilised Lifetime Registration)

$21.00 (Sterilised Annual Pensioner Concession)

$57.50 (Sterilised Lifetime Pensioner Concession)

$128.50 (Entire Annual Registration)

$278.00 (Entire Lifetime Registration)

$61.00 (Entire Annual Pensioner Concession)

$128.50 (Entire Lifetime Pensioner Concession)

Pound Release (*Alice Springs Animal Shelter*):

$125.00 (Registered)

$253.00 (Unregistered)

While de-sexing a cat is not mandatory in Alice Springs, it is encouraged and will entitle a cat owner to discounted registration fees. Cats without a microchip are only eligible for annual registration, therefore microchipping a cat will achieve reduced registration costs in the long term. However, cats that are registered with the Alice Springs Town Council can be microchipped for free. Older cats receive a discount, with cats of ten years of age or more eligible for pensioner registration rates.

Despite the high number of roaming cats in Alice Springs, most (88 %) of the general public care about the issue of predation by cats on native wildlife. This gives hope that the management of domestic cats can be

modified with some education regarding the local bi-laws, the impact of domestic cats on local wildlife and the extent to which an individual cat can roam.

You can read more about the survey and results on the Alice Springs Town Council cat survey webpage and download the full report.

Barkly Regional Council

The Barkly Regional Council has not engaged with the community via survey methods regarding domestic cat management, and as yet, registration of cats with the council is not a requirement of ownership. There is no data regarding the proportion of cat owners that allow their feline friends to roam away from home, but anecdotal evidence from the local veterinary clinic suggests that there is a significant cat problem in the region.

Barkly Veterinary Practice in Tennant Creek receives funding to provide a free cat de-sexing service in the area for cat owners with concession cards, in an attempt to reduce the number of excess stray or owned roaming cats.

TENNANT CREEK FEES & CHARGES*

De-sexing:

$85 - $210 (Cost depends on sex, *Barkly Veterinary Practice*)
Currently free for concession card holders as part of a TNRM supported project.

Microchipping:

$60 (*Barkly Veterinary Practice*)
Currently free for concession card holders as part of a TNRM supported project.

Registration:

Cats do not need to be registered with the Barkly Regional Council

Pound Release:

Cats that are collected by council rangers are taken to the Barkly Veterinary Practice and advertised for collection on social media. Excess animals that are not collected may be euthanised.

* Fees valid June 2017

The Domestic Cat Monitoring and Awareness Project

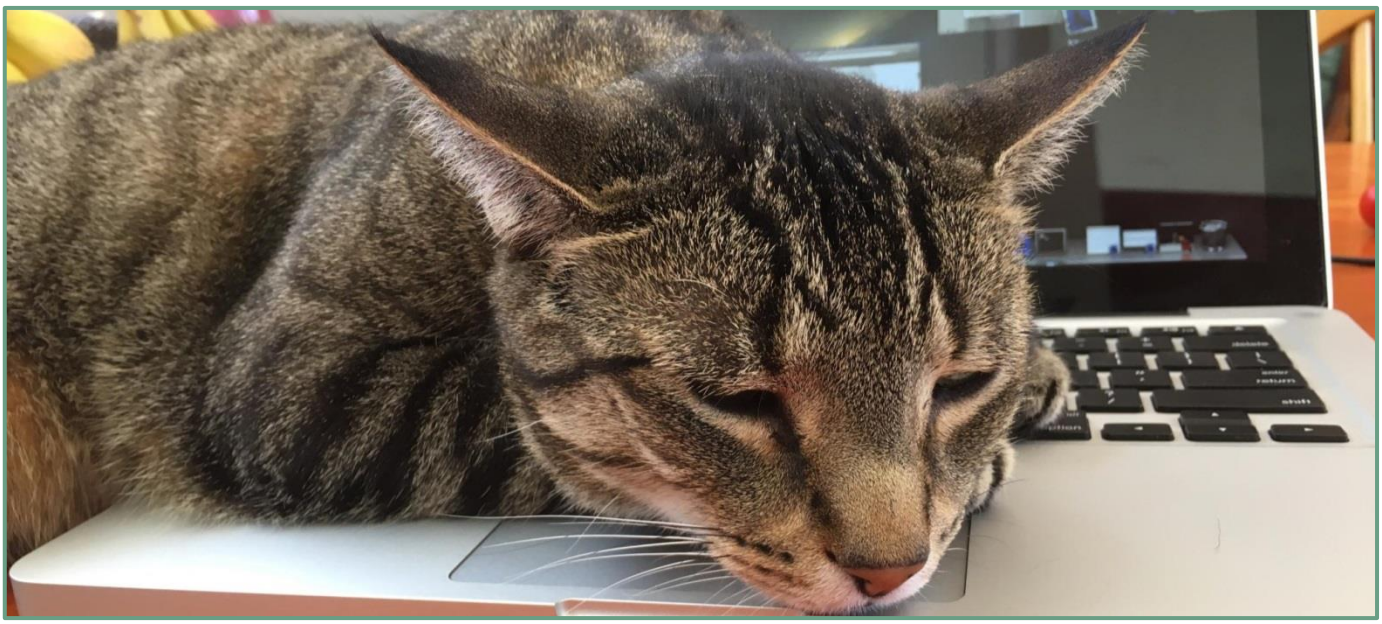
The care, welfare and management of domestic cats are hot topics in central Australia, with community members ranging widely in their opinion of domestic and feral cats and their impact on local wildlife. There is often confusion among the opinions of the community, with domestic cats copping the flak for the actions of feral and unowned cats. Not all community members are against cats, and likewise, not all cat owners have positive opinions on feral cats. But there is a variety of opinions on the scale, as any scan of the community forum on social media will show. Domestic cats can get a bad rap, but as all cat owners will attest, they are great animal companions and bring joy to the lives of their owners.

To engage the community regarding responsible domestic cat management, we first need to understand the movement of domestic cats and their impact on the local wildlife, using data collected from roaming domestic cats. The data obtained can be used to not only engage the community in general but to also help guide domestic cat owners regarding the responsible management of their cat.

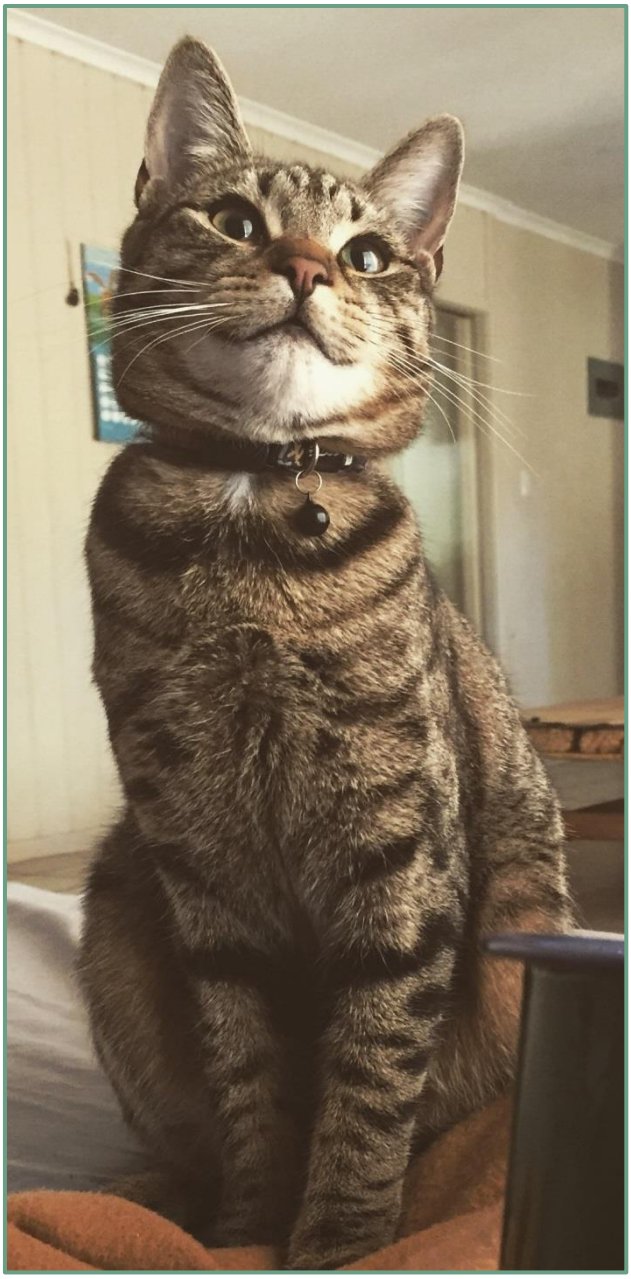
The Domestic Cat Monitoring and Awareness in Alice Springs program was established to engage domestic cat owners regarding the travelling patterns of their feline friends, to help them to make informed and responsible cat management decisions. The project focusses on the movement and behaviour of pet cats in Alice Springs and Tennant Creek.

The key research questions in the Domestic Cat Monitoring and Awareness project are:

1. What is the current domestic cat management practice of the cat owners involved in the project?
2. What is the opinion of domestic cat owners regarding the impact of their cat on the local wildlife?
3. Do the domestic cats involved in the tracking project travel outside of the property boundary?
4. How far do the domestic cats travel from home and what is their home range?
5. Are there differences in the day and night home-ranges of domestic cats?
6. What is the behaviour of domestic cats while they are outside?
7. Do the domestic cats prey on native wildlife while they are outside?
8. Given the knowledge regarding the movement and behaviour patterns of their domestic cat, would the owner consider modifying the management of the cat?



To help answer these questions and engage the community, we conducted a range of activities, including:



Pre-monitoring and post-monitoring surveys conducted by owners: To ascertain the management priorities of domestic cat owners, to gauge the opinions of domestic cat owners regarding domestic and feral cats in the community.

GPS-tracking of domestic cats: To determine the movements of domestic cats while roaming outside of the house, to develop spatial maps for engaging with domestic cat owners and the general public, to calculate home ranges and understand habitats visited by domestic cats.

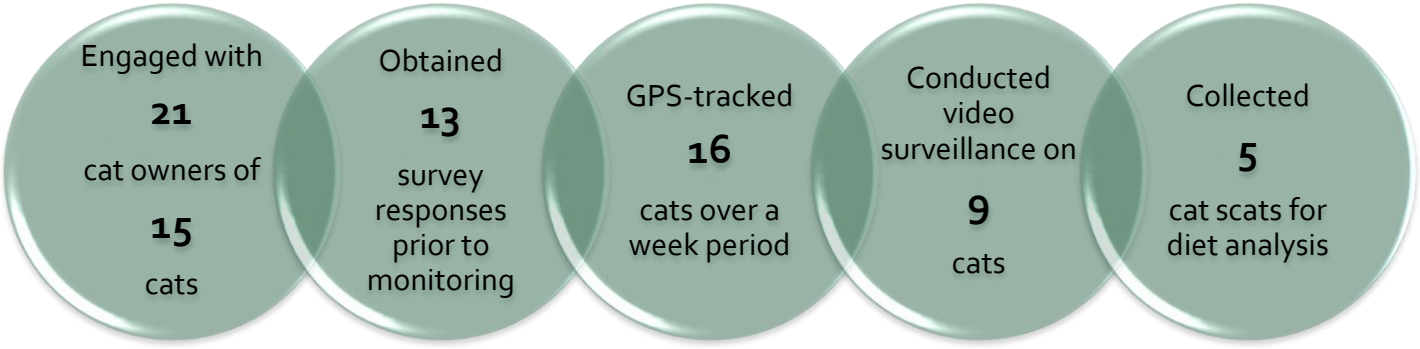
Video surveillance of domestic cats: To obtain visual footage of the travelling behaviour of roaming cats and observe cats disturbing or preying on wildlife (if occurs).

Scat analysis: To determine the diet of cats that roam outside of the house.

Training and information workshops: To engage with domestic cat owners regarding the management of their cat and help to promote dialogue regarding the impact of domestic cats on feral cat populations and native wildlife.

Community engagement: To engage the wider community through attendance at local events with the Land for Wildlife stall, such as fairs, markets and Pets on Parade. To engage with community members interested in natural resource management through attendance at forums and workshops. To network with local enterprise, such as the Alice Springs Town Council, Barkly Regional Council, Alice Springs Animal Shelter and various veterinary clinics, to help educate cat owners regarding responsible cat management.

For the 2016-2017 round of Domestic Cat Monitoring and Awareness, we:



In this report, we provide an overview of the results of the monitoring program (Round 2, 2016-2017), we well as some general information regarding domestic cats and their management in central Australia.

Program *Purrr*-ticipants

A total of fifteen cats took part in the 2016-2017 Domestic Cat Monitoring and Awareness program.

Cornelius

Cornelius was a happy-travelling resident of Alice Springs but has now had a sea-change to live the high-life on the coast. Cornelius enjoys climbing trees and visiting the neighbours while exercising.

Delphie

Delphie enjoys sun bathing in the freedom of the backyard, sniffing flowers and having a snack. Who wouldn't?!

Fausto

Fausto is a Bengal with a stoic stature. Fausto has a cat run but likes to roam free – wild at heart and wild in his outfit.

Fred

Fred is a rural cat that lives on community near Tennant Creek. Fred loves to explore local caves and sneak treats from the neighbour. Fred has a kitten friend that harasses him on a constant basis but deals with it in style like the pro he is.

Gua Bao

Gua Bao translates to hamburger. Gua Bao lives at a local hostel and enjoys spending the majority of his time in the office, as well as eluding his dog arch nemesis (not really, they're quite good friends).

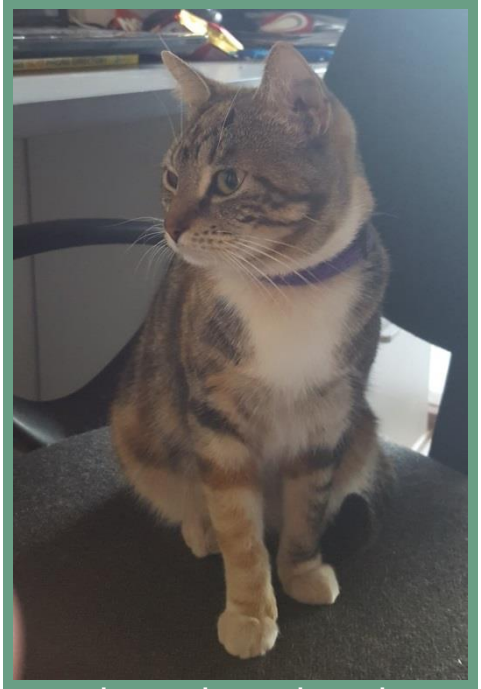
Max

Max is a delicate rural cat that spends some time outside, though his brothers and sisters stick to the catarium. Max is a bit of a softy but lacks the orientation capacity that comes naturally to so many. He often walks down the street, gets lost and needs to be rescued.

Merida Snow

Merida is a blue-eyed beauty that loves to hang in the backyard with her Maremma dog friend, and do gardening with her mum. Merida enjoys watching spotted turtle-doves, sniffing dog poo, munching on grasshoppers, and pruning the bark off a large tree looking for treats.

Mother Cat



Mother cat is an adopted cat that resides in Tennant Creek. She was found with a litter of kitties in the shed and now calls the property home. Mother cat is a generous soul that likes to advertise to the neighbourhood cats when dinner is ready.

Mr Fluffy

Mr Fluffy is a gangster, the mob boss of his hood. He is so-named as he is outrageously fluffy. He is known to ride motorbikes, hide in ute trailers to scare unsuspecting passer-by's and generally lazing around. Mr Fluffy also likes boxes.

Possum

Possum is a cowboy. He loves a solid snack, and will regularly go back for seconds. Possum has free range on his large rural property and as such, enjoys exploring the river bed and visiting as many neighbours as he can.

Queen

Queen is a feisty one. She is the mother of her domain and doesn't take any nonsense.

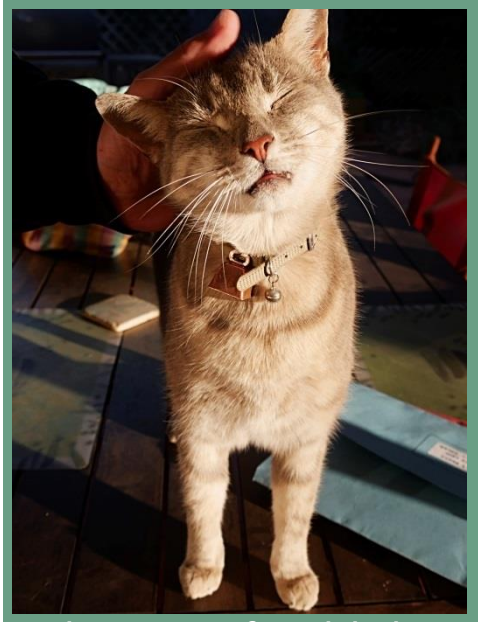
Romeo

Romeo is a smooth-talker, a cat-man among cat-men. Romeo is a solid creature with a soft heart.

Sooty

Sooty is a sweet flompy mess that refuses to wear a harness. Therefore Sooty largely stayed home during the monitoring, keeping the family company and arguing with its owners about the torment that was inflicted upon it. Sooty nearly fell off the table during the harness fitting, proving what a silly duffer he is.

Suri

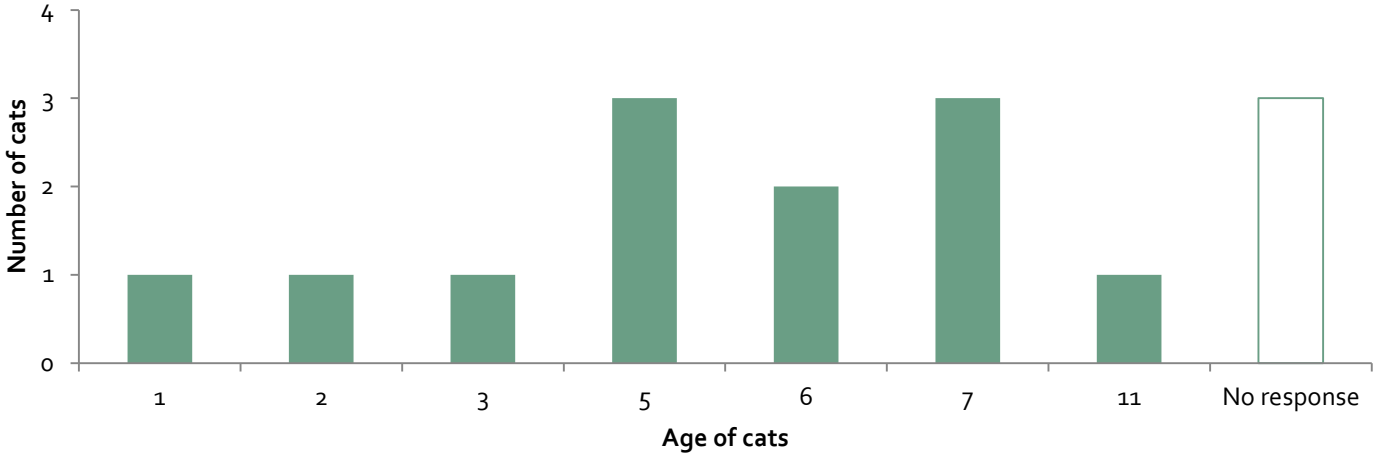


Suri's owner confessed the large distances that Suri travels, though Suri seems to be a home-body if the data is anything to go by. Suri has been seen roaming the neighbourhood by its owner, therefore is a magical mysterious cat. Suri likes to dip cat-cameras in water bowls and get pats.

Tee Gee

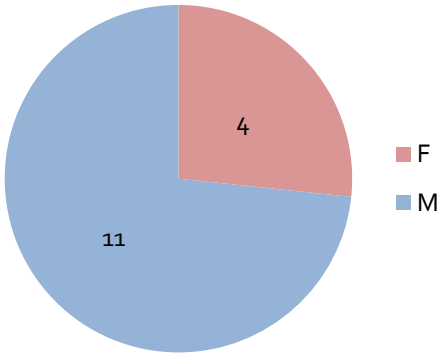
Tee Gee is a scally-wag that was adopted as a stray kitten by the pet duck. Tee Gee visits the pet chickens daily and likes to explore the hills behind the house. Tee Gee has been known to bring mice and birds as gifts to the owners.

Feline Demographics



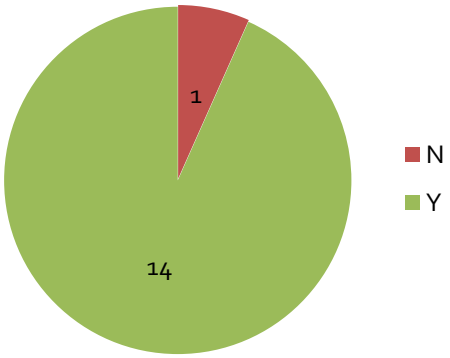
Sex

The majority of the cats involved in the program were male, with roughly a quarter of the cats being female.



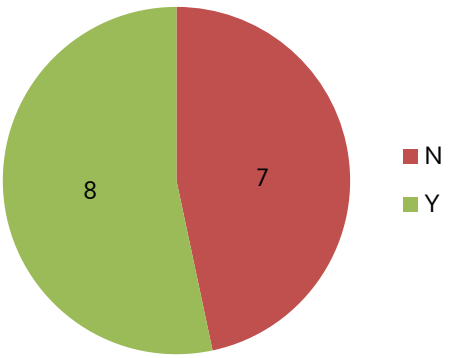
De-sexed

The majority of cats involved in the program were de-sexed, with one entire male taking part in the monitoring.



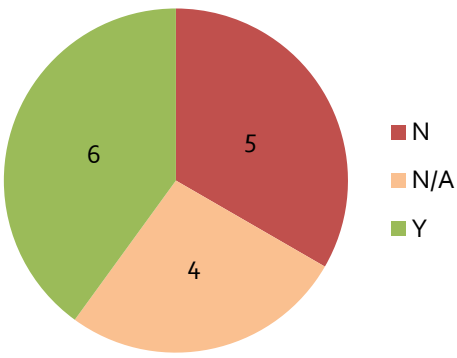
Micro-chipped

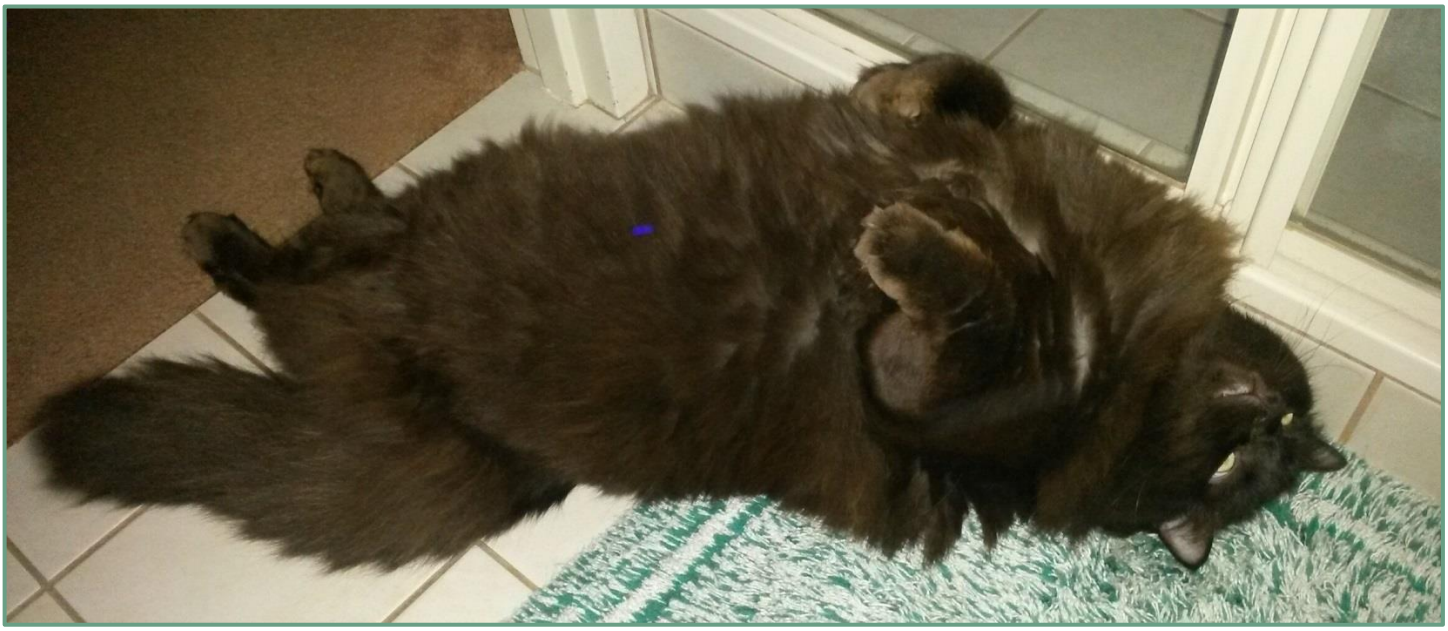
Half of the cats involved in the program were micro-chipped, with the other half having no form of identification.



Registered

Half of the cats from the Alice Springs region were registered with the Alice Springs Town Council and the other half were not. The cats from the Tennant Creek monitoring were not registered, as it is not a requirement of the Barkly Regional Council.



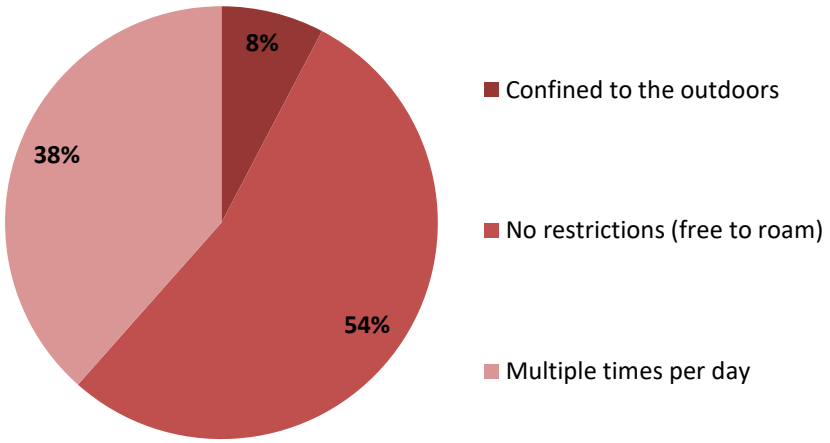


Pre-Monitoring Survey

A pre-monitoring survey was conducted to gauge the opinions of domestic cat owners regarding domestic cat management. The aim of the survey was to gather baseline information on cat management. A follow up survey (yet to be conducted) will be compared with the opinions of domestic cat owners prior to the monitoring period to ascertain whether the management of domestic cats may differ given the information obtained through the monitoring program. A total of 13 participants were surveyed prior to the program commencement (n = 13).

How frequently is your cat allowed to exit the house?

Options included: No restrictions, Multiple times per day, Once per day^, Several times per week^, Once per week^, Infrequently^, Never^. While 'Confined to the outdoors' was not originally allocated as an option in the survey, the individual response was recorded.
^ No participants selected these responses.

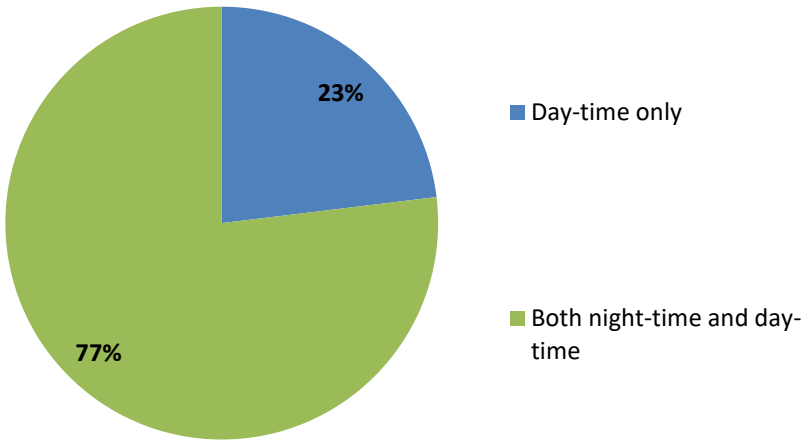


One of the cats involved in the program was confined to the outdoors (not allowed to enter the house). The remainder of the participants allowed their cat outside multiple times per day or put no restrictions on cat movement.

During which hours is your cat allowed to exit the house?

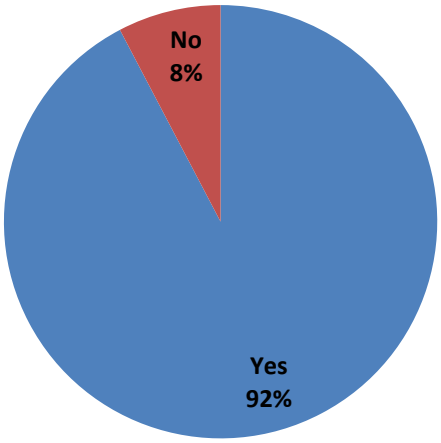
Options included: Day-time only, Night-time only^, Both night-time and day-time, Never^.
^ No participants selected these responses.

The majority of the tracked cats were allowed outside during any hour of the day. Few participants confined their cat during the night. None of the participants allowed their cats out at night only and all of the participants allowed their cat to roam outside to some extent.



To your knowledge, does your cat travel to areas outside of your property boundary?

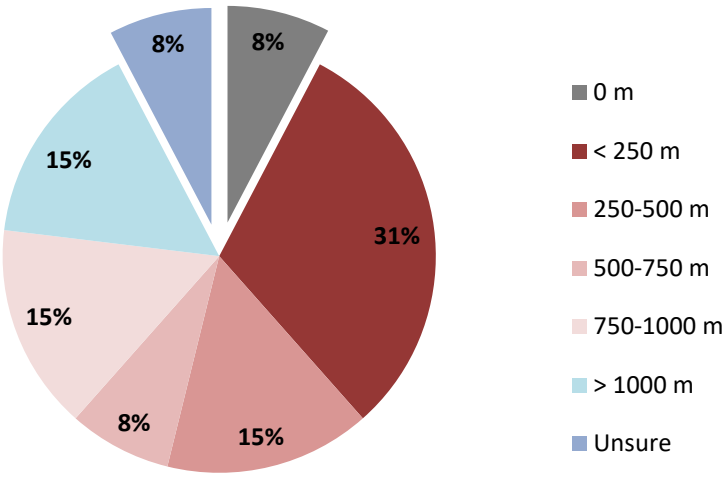
All respondents said yes, with the exception to one cat owner, who believed their cat did not roam outside of the property boundary.



How far do you think your cat travels away from your house (maximum distance)?

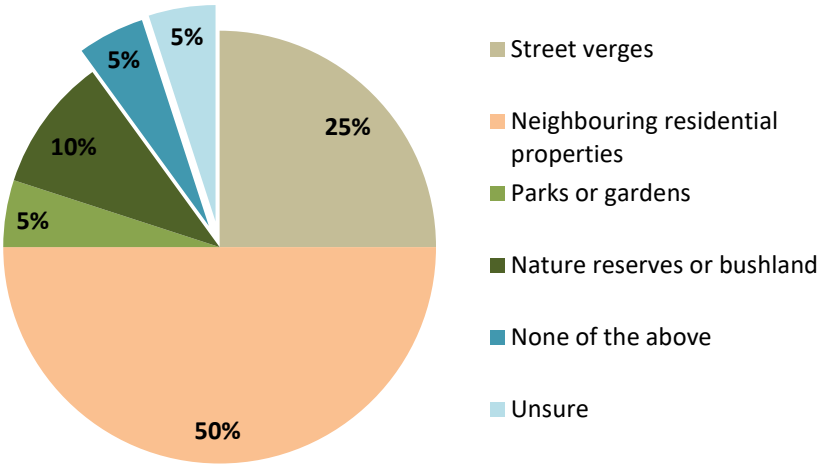
Distances offered ranged from 0 m to more than 1000 m (1 km), given in 250 m increments.

Participant responses varied widely. One participant was not sure how far their cat travelled and wasn't willing to guess, while another believed their cat did not roam outside of the property boundary (see previous question).



To your knowledge, does your cat visit any (or multiple) of the following habitat types?

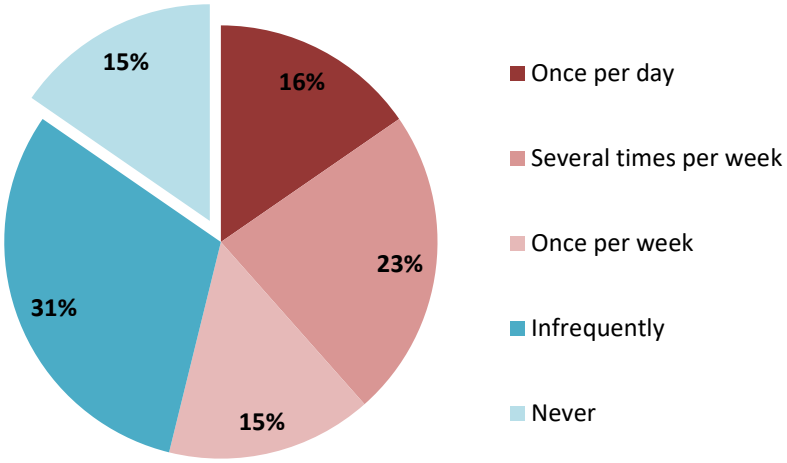
Options included: Street verges, Neighbouring residential properties, Parks or gardens, Nature reserves or bushland, None of the above, Unsure.
**** Note that some participants responded to more than one option.***



Most of the participants supposed that their cats visited neighbouring properties and travelled within street verges. Only a few participants thought that their cats might visit natural areas such as parks, gardens, nature reserves or bushland.

How often do you see stray or domestic cats other than your own pet cat on the streets or reserves near to your property?

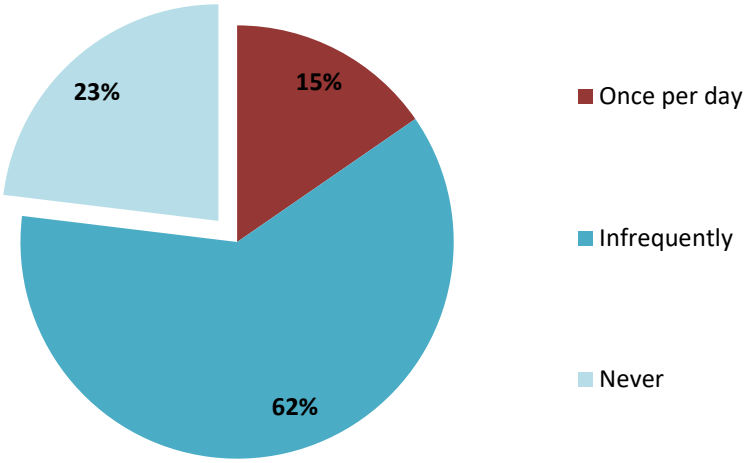
Options included: Multiple times per day^, Once per day, Several times per week, Once per week, Infrequently, Never.
^ No participants selected these responses.



Two participants stated that they did not see cats roaming near their property, while the remainder saw cats nearby at various frequencies. Infrequent sightings were "monthly" and "every few weeks". More than half of the participants saw cats roaming nearby at least once per week.

How often do you see stray or domestic cats other than your own pet cat visiting within the boundaries of your property?

Options included: Multiple times per day^, Once per day, Several times per week^, Once per week^, Infrequently, Never.
^ No participants selected these responses.

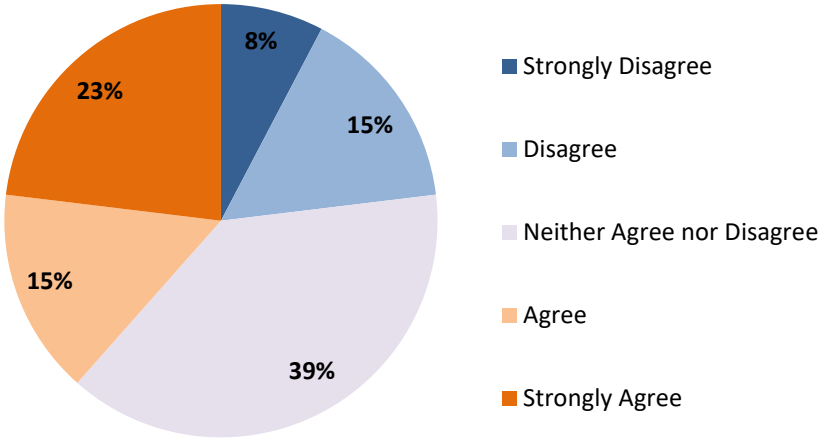


Cats were infrequently seen wandering onto the property for the majority of participants; with three participants stating that cats have never been seen to do so. Infrequent sightings were "every few weeks" and "monthly". Two participants noted that cats had been seen wandering within the property boundary on a more regular occasion (once per day).

I am concerned by the visits of other domestic and/or stray cats to my property.

Options included: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly Agree.

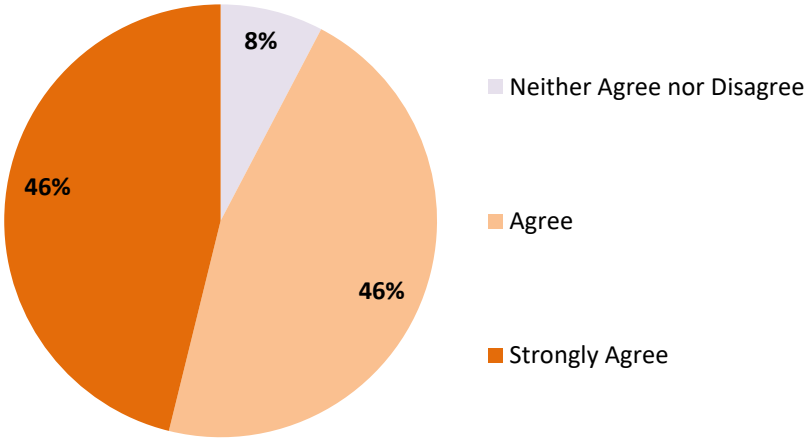
Responses varied, with no particular skew to the pro or con of cats visiting participant properties. Note that the majority of those that were concerned about the visits of other cats to their property, infrequently saw cats within their property boundary. Of those that saw cats on their property once a day, one was concerned by the visits and another was ambivalent regarding the matter.



Domestic cats hunting wildlife is an issue in central Australia.

Options included: Strongly disagree ^, Disagree^, Neither agree nor disagree, Agree, Strongly Agree.
^ No participants selected these responses.

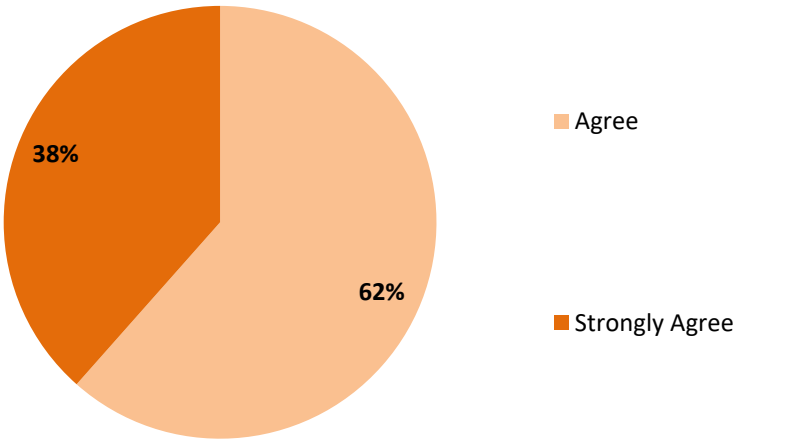
Largely, domestic cat owners involved in the monitoring project agreed that domestic cats hunting wildlife is an issue in central Australia. Only one participant was ambivalent regarding hunting of wildlife by domestic cats.



Domestic cats roaming outside of their property boundary has an impact on local native wildlife.

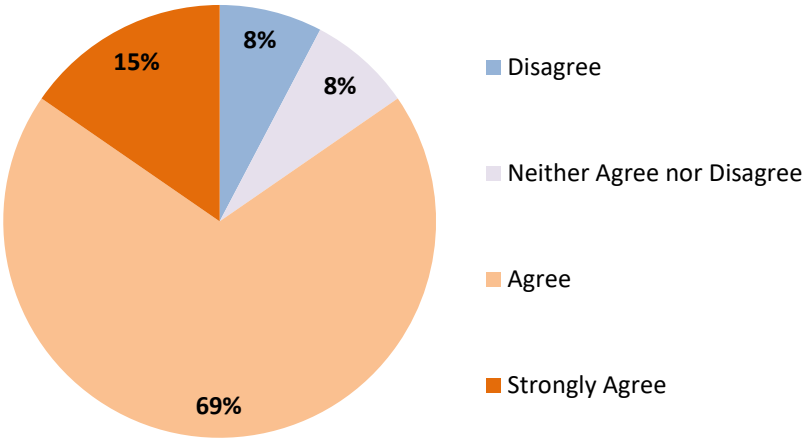
Options included: Strongly disagree^, Disagree^, Neither agree nor disagree^, Agree, Strongly Agree.
^ No participants selected these responses.

Domestic cat owners involved in the project were of the opinion that domestic cats roaming outside of their property boundary impacts local wildlife. Note that in this case, 'impact' does not specifically relate to hunting, but could refer to disturbance or other effects.



Domestic cats roaming outside but within their property boundary has an impact on local native wildlife.

Options included: Strongly disagree^, Disagree, Neither agree nor disagree, Agree, Strongly Agree.
^ No participants selected these responses.

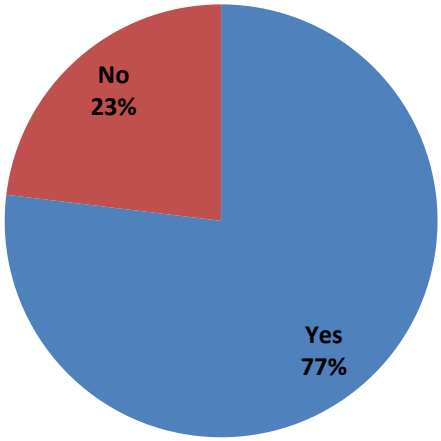


In response to the impact of domestic cats on native wildlife, fewer participants agreed that it was an issue within property boundaries compared to outside of property boundaries. On the whole, however, the majority of participants agreed that domestic cats have an impact on wildlife when outside but within the property boundary.

Do you think that your pet cat could be impacting the wildlife when outside?

> "I don't have cats that are hunters, they're too well fed"

The majority of the cat owners agreed that their pet could be impacting the wildlife when outside. Note that all of the participants that did not think that their pet cat specifically could be impacting wildlife did agree that domestic cats in general could impact wildlife. This suggests that some cat owners believe that their pet is more behaved than other domestic cats.

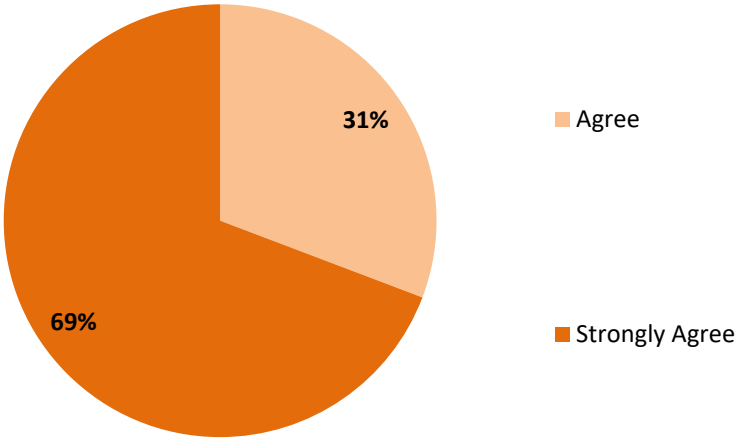


Further clarification responses from participants that responded with yes included: "Eating the wildlife", "Chasing, catching lizards and geckos, Occasional birds", "Cat will be hunting wildlife all day", "Killing mice", "Killing birds and reptiles", "Kill birds, lizards, etc.", "Eating the wildlife".

> "Although measures are taken to reduce the hunting of wildlife, [cat] is still young and tries at times to capture birds and small reptiles"

Stray cats hunting wildlife is an issue in central Australia.

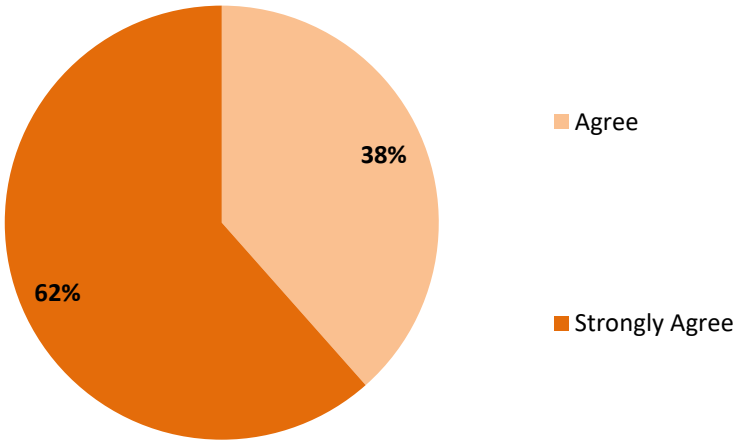
Options included: Strongly disagree^, Disagree^, Neither agree nor disagree^, Agree, Strongly Agree.
^ No participants selected these responses.



All project participants have the view that stray or feral cats hunting wildlife is an issue in central Australia. Note that more participants responded with strongly agree, than other options, for hunting of wildlife by strays than by domestic cats. This suggests that stray cats are more of a problem than domestic cats, according to participants in the monitoring program.

Stray cats have an impact on local native wildlife.

Options included: Strongly disagree^, Disagree^, Neither agree nor disagree^, Agree, Strongly Agree.
^ No participants selected these responses.



In terms of the impact of stray cats on local native wildlife, participants agreed, though not as strongly. Note that in this case, 'impact' does not specifically relate to hunting, but could refer to disturbance or other effects. More participants responded with strongly agree than agree for the question when it related to stray cats, compared to domestic cats and their impacts.

What would you like to see happen in the local community regarding domestic cat management?

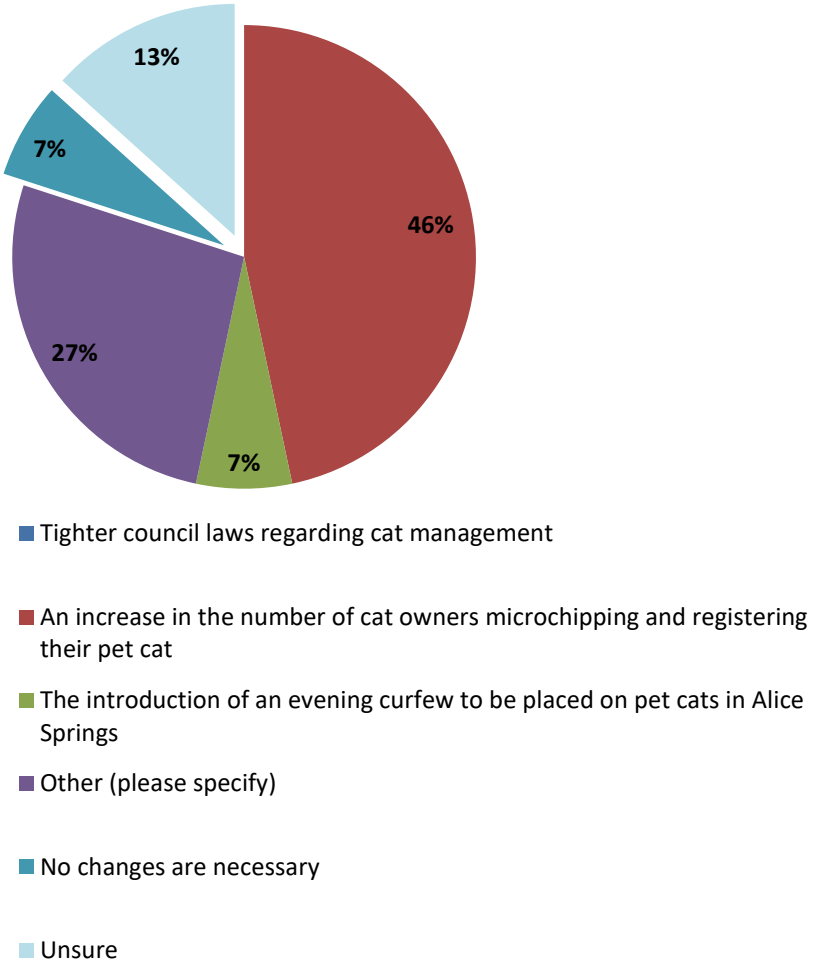
Options included: Tighter council laws regarding cat management, An increase in the number of cat owners microchipping and registering their pet cat, The introduction of an evening curfew to be placed on pet cats in Alice Springs. Other (please specify), No changes are necessary, Unsure.

**** Note that some participants responded to more than one option.***

Nearly half of the survey participants agreed that there needs to be an increase in the number of cat owners microchipping and registering their pet cat.

Several cat owners had suggestions that differed from the set responses and these included: "Compulsory sterilisation and registration of all domestic cats", "Compulsory de-sexing", "Cheaper / easier de-sexing", "Encourage more trapping of strays", "Wear a luminous collar or hair scrunchie".

A few participants were unsure if domestic cat management needs to change or did not think changes were necessary.



"Encourage more trapping of strays"

"Compulsory de-sexing"

"Cheaper de-sexing"

Cat owners within the Alice Springs Town Council area are legally required to register their cat (microchipping is encouraged), as well as contain their cat within the property boundary at all hours. De-sexing is not mandatory; however registration of entire cats is more expensive.

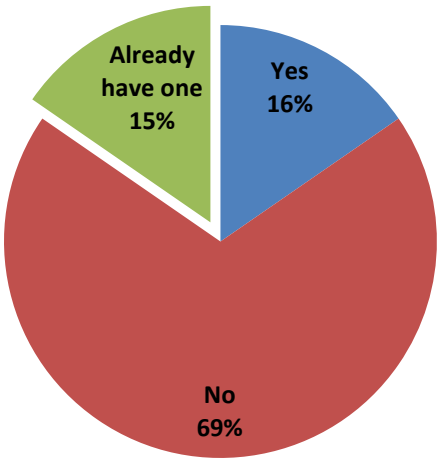
Cat owners within the Barkly Regional Council do not have any legal obligations (there are currently no council by-laws regarding cat management).

Would you consider building a contained outdoor play area for your cat (*i.e.* a cat run or catarium)?

Of the owners that did not already have a cat run, the majority stated that they would not consider building a contained outdoor play area.

All of the participants that would consider installing an outdoor cat play area or already have one, were of the view that their pet cat could impact wildlife. This suggests that a third of those that wouldn't install a catarium would not do so as they believe their cat does not impact the wildlife to begin with. In addition, it can then be inferred that half of the participants that think that their cat impacts wildlife, would not install a catarium as a result.

"All my cats hate it and view it as a big cage. But it is useful at night"



"Prefer to keep cat inside rather than building a cage"

GPS-Tracking

The CatLog (CatTraQ) is a GPS-enabled device that tracks the location of a cat using satellites. The information is then used to determine the travelling patterns of the cat over a one-week period. The tracker is the size of a matchbox and is connected to a harness, housed within a blue silicone case. The GPS tracker sat between the shoulders of the cat without hindering movement of the cat or causing discomfort.

The tracking device was turned on at the start of the monitoring period and left to operate for up to 7 days. Data on the cat's location was recorded automatically every one minute and stored in the device. The data can only be downloaded after the monitoring period – no real-time tracking is available. Tracking data was downloaded by the Land for Wildlife team upon return of the device.

Spatial maps were developed using the tracking data, which enabled us to calculate core home ranges and calculate the distances travelled away from home.

The GPS tracker was generally only effective when the cat was outside, as ceilings and other shelter blocked the signal and resulted in a lack of data or misplaced signals.

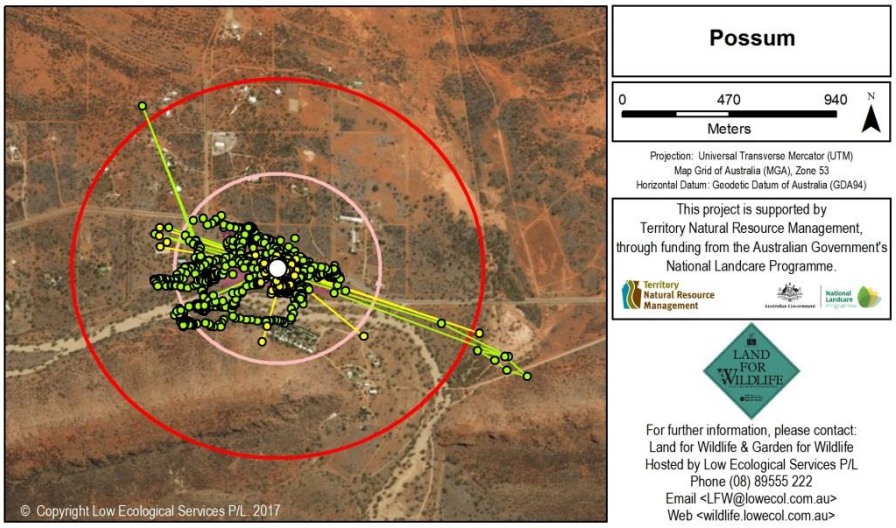
Owners were asked to avoid changing the way they managed their cat during the monitoring period to prevent changes in cat behaviour. Several cats (especially those that were not used to wearing a collar) naturally modified their behaviour when the harness was fitted, by laying still or restricting their movements to areas around the house. In cases such as this, it was not possible to gather accurate data.

Data Processing

We use Possum here as an example, a cat who spends all his time outside of the house on a large rural property. The data obtained is a good example of the information that can be obtained by using CatLog devices.

Original / raw data

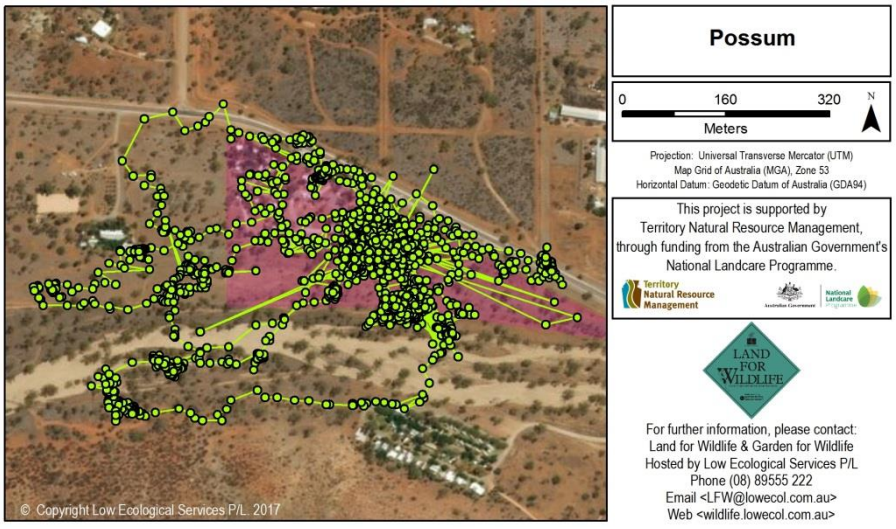
The tracker data in its raw form can have errors that result from blocked GPS signals. This usually occurs when the cat is deep within the house, under a car, or in a structure such as a shed. Two buffers are created around the data to assist us in processing the raw data. The larger red buffer is the distance that a cat can travel in one minute at a speed of 50 km/h (the speed suggested to us by several experts on the topic). Cats are more likely to travel at such speeds for short bursts, likely no longer than 30 seconds, which is represented by the smaller pink buffer. Any data that falls outside of the pink buffer was deleted, while data inside of the buffer must be retained.



The tracked data for Possum comes from 74 hours (3.1 days) of tracking, giving us 3,416 points of data.

Outliers Removed

Once all outlying points have been removed the data produces the following spatial map. In some cases, the points show a tracked point as bouncing away from the house and back again. These points may also be a result of a blocked signal; however the points are within the travel limits of a cat and therefore cannot be discounted easily. As a result, the points are retained to prevent bias in the data analysis.



From this data we can calculate the distance travelled from home, which for Possum is 500 m.

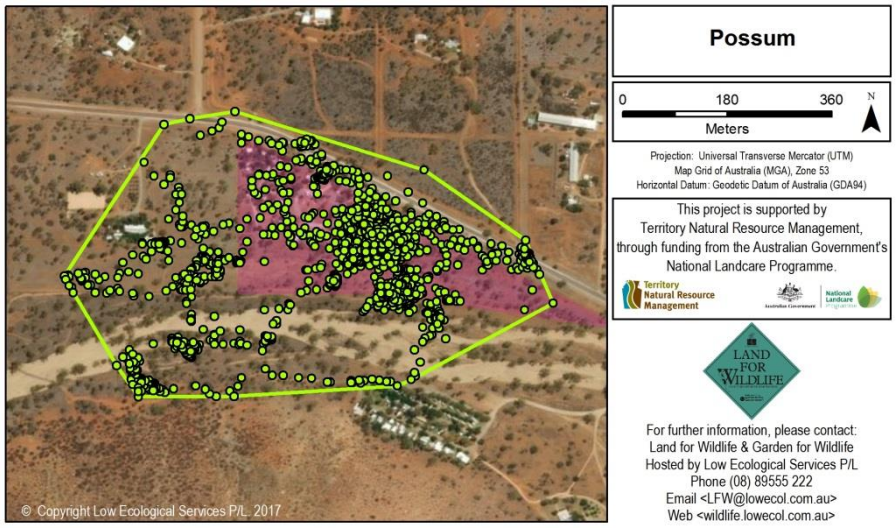
We can also determine the distance from the property boundary, which is 324 m for Possum.

The data can also tell us the proportion of fixes (GPS-location points) that were collected outside of the property boundary compared to inside of the boundary. Possum's tracker recorded 28 % of fixes outside of the property boundary, compared to 72 % of fixes inside the boundary.

Minimum Convex Polygon

Once the data has been cleaned, we can produce a minimum convex polygon (MCP) from the data. This is the result of a statistical output that calculates the home range of an animal, by fitting the tightest possible polygon to the outermost tracked points. From this polygon, we can calculate the home range area of the domestic cat.

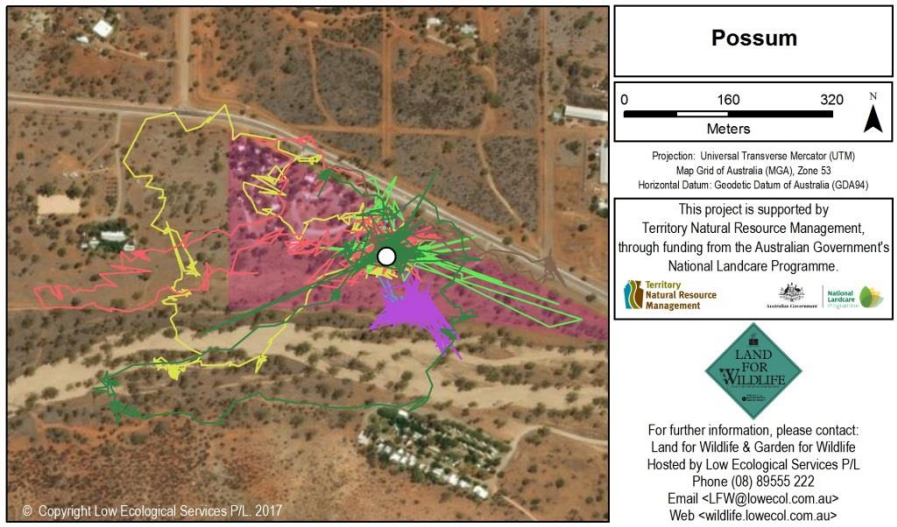
The MCP area for Possum is 263,366 m^2 or 26.3 Ha.



Half-day Splits

The data can be split into half-day travels, as morning (12 AM to 11:59 AM) and evening (12 PM to 11:59 PM) data. This helps us to see the individual travelling patterns with more clarity, as well as identify days of high activity.

We can also split the data out into day and night. This helps us to determine the travelling patterns of cats when it is dark versus light.

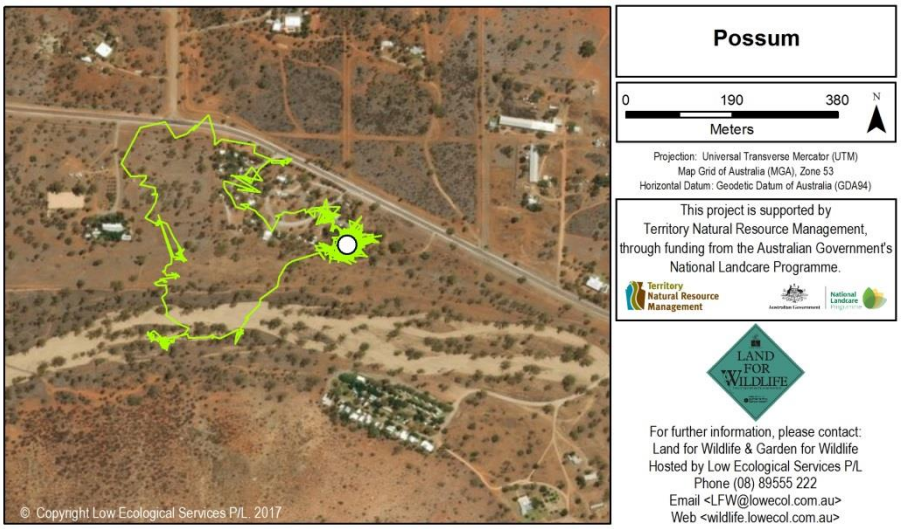


Possum travelled approximately 286 m from home during daylight hours and 500 m from home during the night.

Significant Half-day Adventure

The large deviations from home in the tracker data can cloud the view of some significant travels, making it somewhat easy to dismiss the evidence. However, viewing the tracking data from a single half-day trip can clarify movements.

On one trip, Possum travelled to locations that included: road verges, neighbouring properties, river systems and open grassland. These adventures may be impacting not only your neighbours and their pets, but also native wildlife such as birds and reptiles.



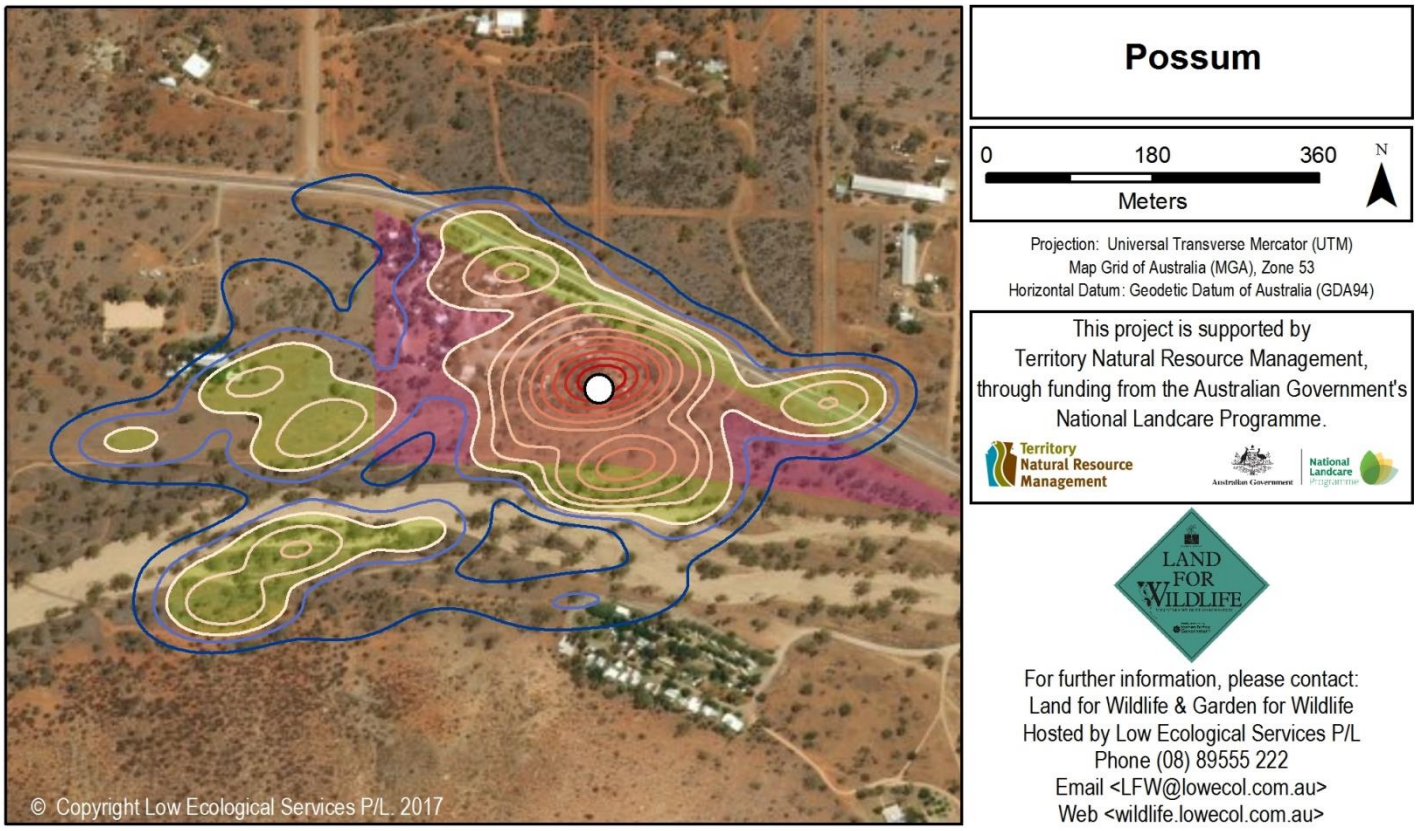
Possum crossed roads several times during its travels, putting the cat at risk of being involved in an accident with a vehicle.

Core Hotspots and Isopleths

The tracker data can also be assessed in terms of the core home range via Isopleths, which is more accurate than the minimum convex polygon (MCP) method. An isopleth is a line on a map connecting points having equal incidence of a specified feature. In this case, the blue isopleth lines indicate the 99th and 95th percentiles. The white line with yellow shaded area is the 90th percentile, with each of the increasingly smaller pink to red lines representing the 80th, 70th, 60th, 50th, etc percentiles.

For purposes of calculating core home ranges (or home range hotspots) in this project, we chose the 90th percentile to represent each cat. This means that the area contained within the 90-isopleth represents the area containing 90 % of all tracked points.

Possum had a core hotspot area of 108,218 m^2 or 10.8 Ha.



The Average Cat

The average tracking period per cat was 7 days, producing on average 3,901 GPS-tracked locations per unit (n = 15, cats = 13). Tracking statistics for one cat were not obtained as the tracker was lost during the monitoring period and tracking efforts ceased.

According to the trackers, cats were recorded outside of the property boundary on 47 % of occasions, with 53 % of the tracked points occurring on the owner's property (Table 2). This is based on tracked points only, rather than time per se, and therefore there may be time unaccounted for by the trackers during periods of signal blockage. Signal blockage is more likely to

occur when the cat is in the house or under a large structure. This suggests that time at home could be underestimated through missing data points, and likewise, tracked points away from home overestimated due to inaccurate GPS-tracked locations.

The cats in the tracking project travelled 31 m from home on average, with the furthest distance from home averaging 352 m (Table 2). One cat travelled as far as 500 m from home. The average cat did not venture further from home at night, compared to during the day, which is contrary to popular belief. Though the average maximum distance from home appears greater at night (Ave: 340 m) compared to the day (Ave: 297 m), the difference is not statistically significant ($t = -1.32$, $df = 23.87$, $p = 0.20$).

The area covered by cats during the tracking period was 14 hectares on average (ranging from 3.5 Ha to 27.1 Ha), however the core home range area was 1.4 hectares on average (ranging from 0.2 Ha to 10.8 Ha) (Table 2). Home ranges may be overestimated due to inaccurate GPS-signal readings, and thus we recommend viewing maps on a cat by cat basis for clarity regarding the likely movements of individual cats, disregarding large single-point jumps in the data. Large jumps in tracked location were removed from the data if they exceeded a speed of 50 km/h over a 30 second period, however jumps in position that were within the capability of a domestic cat could not be discounted and therefore were retained in the data analysis.

Table 2. GPS-tracking values for all cats

	Average	Minimum	Maximum
Tracked locations (%)			
Home	47	12	72
Away	53	28	88
Furthest distance from home (m)			
Irrespective of time	352	--	--
Day	297	121	410
Night	340	205	500
Average distance from home (m)			
Irrespective of time	31	16	99
Day	26	15	45
Night	36	18	134
Minimum convex polygon area (Ha)			
All	14.0	3.5	27.1
Isopleth area (Ha)			
90th percentile	1.4	0.2	10.8

Video Surveillance

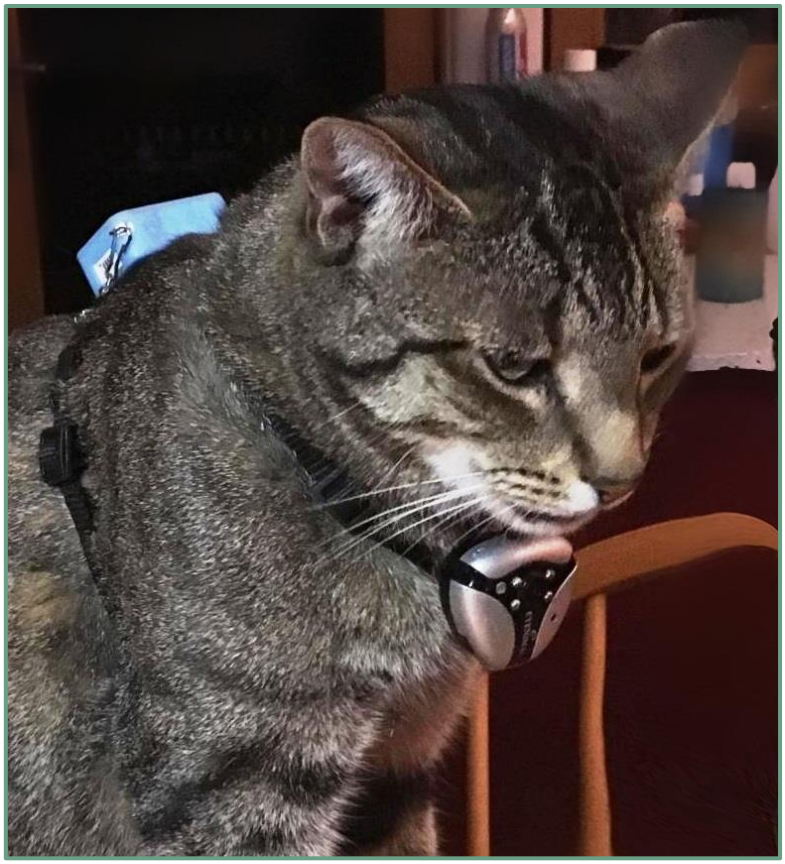
A trial of the Eyenimal Cat Camera was conducted to determine the behaviour of the cats while roaming. Recording video footage of cats while outside of the house helped to highlight what the cat was doing while roaming, by capturing periods of sleep, stalking, eating, and walking.

The small camera was mounted on the collar, below the chin. The camera was threaded onto the front of the collar and the angle adjusted for the camera to face forward.

Surveillance sessions were largely conducted for two-hour periods (the lifetime of the battery). Video surveillance was downloaded and the camera recharged after each session by the cat owner. This enabled owners to collect between two and ten hours of video surveillance footage over the monitoring period. The camera had the capacity for night vision so there was no restriction to the time of day that owners could collect footage.

As equipment numbers were limited, and to reduce the weight carried by each cat, the video surveillance was not necessarily conducted simultaneously to the GPS-tracking. Surveillance footage was collected over various time periods as a result.

The Average Cat



An interesting aspect of the Domestic Cat Monitoring and Awareness project is how the video surveillance collected (n = 7, cats = 7) compares with the data obtained from the tracker devices. Due to the obstruction of the GPS signal between tracker and satellite when a cat is indoors, some of the tracked movements surrounding the house become intertwined with 'messy' data from the cats while inside. As a result, the surveillance helps to ascertain accurate movements, as well as highlight the specific behaviours of the cat whilst outdoors.

The cats involved in the surveillance portion of the project exhibited a range of behaviours, from extensive periods of sleeping, to active roaming in nearby native habitat (see example images in Figure 2). Several cats were observed wandering along river beds and neighbouring hillsides, trailing the scent of an animal, or simply exploring. However, only one cat was observed feeding on wildlife (a grasshopper).

While we expected that many of the cats would show active roaming behaviour, due to the anecdotes provided by the owners, we were surprised to find that few of the cats were interested in roaming. One of the

cats was never observed leaving the property boundary, while others did so only to find somewhere comfortable to sleep or to find a water source.

Summary videos for each cat are available on the Land for Wildlife website. Videos for two cats are not available due to a paucity of footage obtained.

Figure 2. ***Top Left:*** **Possum struts through the yard in search of some entertainment;** ***Top Right*****: Possum loves a good feed and the bowl is a common location to hang out;** ***Bottom Right*****: Possum casts a striking shadow;** ***Bottom Left*****: Possum finds some bird feathers to sniff, though the cause of its demise is unknown.**

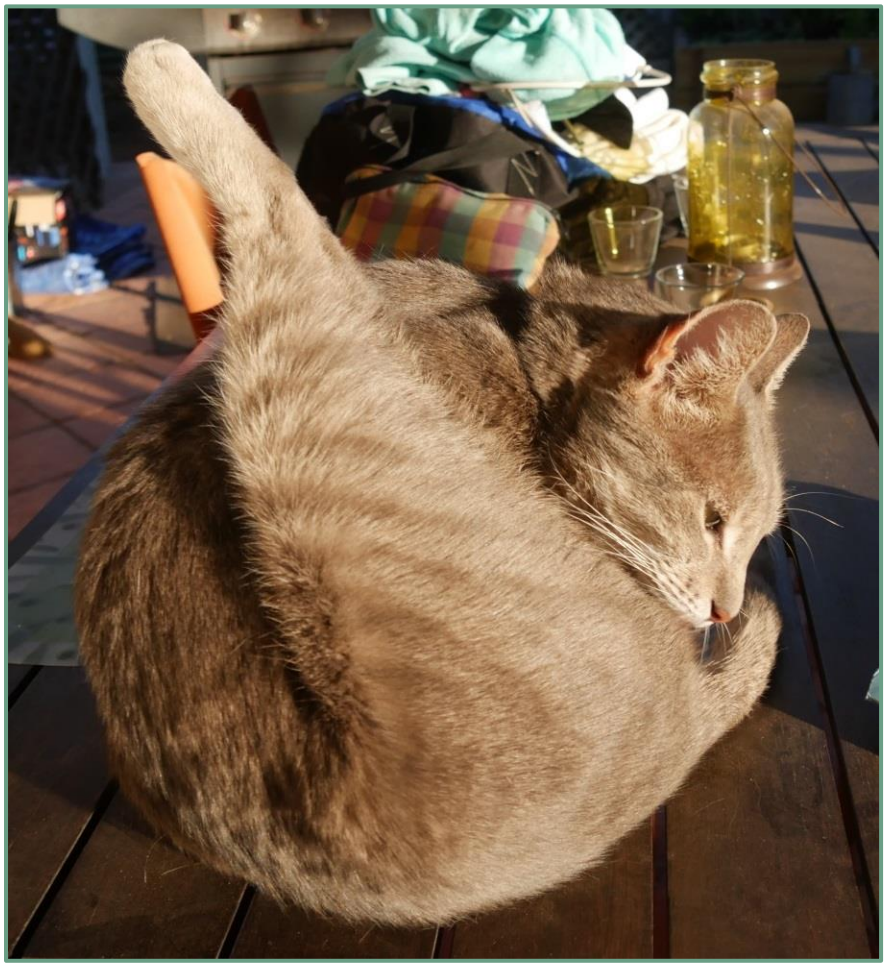
Scat Analysis

To assist us in understanding the activities of cats that are roaming outside, we aimed to analyse scats for foreign food items. Food items we were on the lookout for included components of birds, rodents, reptiles and insects. Processed commercial food was expected to break down, while other animals consumed would likely leave portions of bone, scale or fur, which could then be identified.

Owners were asked to keep an eye out for faeces deposited in the litter tray. Paper bags were provided to allow owners to note the date and time, as well as the name of the cat. Faecal samples were placed into the paper bag provided and stored in a dry location awaiting collection by the Land for Wildlife team.

While scat samples were to be collected by owners at any time over the duration of the project, many cats that roamed outside would deposit their waste elsewhere. As a result, only five scats were collected from the cats involved in the project.

Samples were sent to Barbara Triggs, a scat expert in Victoria, for analysis.



The Average Cat

A total of five scats were collected during the program (n = 5, cats = 3), with contents including insect material, Red Kangaroo (*Macropus rufus*) and Fat-tailed Dunnart (*Sminthopsis crassicaudata*). The mammal contents were confirmed via hair samples contained in the scats, as well as a fragment of lower mandible.

The findings are surprising, given that there is very little knowledge regarding the habitat preferences of *S. crassicaudata* (Figure 3) close to urban areas. While relatives in the Dasyurid family are known to enter houses elsewhere in Australia, the presence of Dunnarts in town blocks of Alice Springs is great news. This native animal is commonly found in grass, shrub or woodland in native habitat surrounding Alice Springs. The species is listed as 'Least Concern' and is therefore not threatened, despite many other native mammals becoming threatened by introduced predators, such as feral cats. The same species was detected in two domestic cats, each living on opposite sides of Alice Springs. While one of the cats is known to travel through river beds and neighbouring bushland, the other didn't leave the near vicinity of the house. This indicates that the Dunnart is capable of residing on, or travelling through, suburban town blocks. This native mammal is able to survive in extreme semi-arid environments by feeding at night (it has a nocturnal habit), employing daily torpor to reduce energy expenditure in cold weather, and sharing nests with rodent species to conserve heat.

Figure 3. Fat-tailed Dunnart (*Sminthopsis crassicaudata*). *Image Wiki Commons (Bernard Dupont).* Figure 3 Insert. *Sminthopsis crassicaudata* mandible, as found in faecal sample from a domestic cat in the program.

The finding that a scat contained remains of *M. rufus* (Figure 4) is not as surprising, given that kangaroos can be found more commonly on the outskirts of Alice Springs. Kangaroo tail is also often brought into town by Indigenous community members returning from hunting trips. The skin and small meat remains of this species can often be found near fire pits following such visits to town. Kangaroos living on the outskirts of town may also succumb to demise through other means, before being fed on by roaming cats. Commercial cat food in the fridge section of the supermarket can also contain kangaroo meat, and there is the potential that hair remains are present in this cat food source. Therefore the source of the kangaroo in the faecal matter of a domestic cat cannot be ascertained and further monitoring would be necessary (perhaps via further video surveillance of the cat in question).

Figure 4. Red Kangaroo (*Macropus rufus*). *Image Wiki Commons (firooo2).*

What can you do to manage your cat appropriately?

- ✓ De-sex your cat to prevent it from adding to the feral cat population
- ✓ Microchip and register your cat with the Alice Springs Town Council so that it can be returned to you if it goes missing
- ✓ Keep your cat indoors so that it is not a nuisance to neighbours and does not negatively impact the local wildlife
- ✓ Install an outdoor cat play area to provide your cat with environmental stimuli that won't impact on the local wildlife
- ✓ Provide toys and play options for your cat to keep it stimulated indoors
- ✓ Fit your cat with a bell, luminescent scrunchie, sonar or other device to alert wildlife to its presence
- ✓ Provide food ad libitum so that your cat has adequate access to food, to limit its dependence on wildlife as a food source. (Note: you should consult your veterinarian before feeding your cat ad libitum, or if the weight of the cat is being impacted through a modified feeding regime)
- ✓ Don't release unwanted animals into the bush.

The responsibility for managing domestic animals rests with the owner/s.
By encouraging responsible pet ownership you can ensure the welfare of all animals.

How Can We Care For Our Cats And Protect Our Wildlife?

The domestic cats involved in this study roamed to neighbouring properties, road verges, adjacent bushland and some cats were observed to impact the local wildlife. Scats collected from domestic cats in the program showed that they were feeding on native wildlife, which was backed up by owner reports and photographic evidence. This suggests that the management of the domestic cats could do with improvement.

Since 92 % of the program participants agree that hunting of wildlife by domestic cats is an issue in central Australia to be addressed, and all participants agree that roaming domestic cats impact wildlife in general, there is hope that domestic cat management can be modified to reduce the impact cats have on our wildlife.

The impact of domestic cats has been outlined earlier in this report and while both feral and domestic cats can contribute to the issues, well cared-for domestic cats tend to be less of a nuisance. Many of the issues can be avoided by confining domestic cats to the home.

> **"I reluctantly have to conclude that cats deprived of free range both day and night become very unhappy and often neurotic. Ideally, all cats should be confined from dusk till just after dawn"**
>
> ***~ Domestic Cat Owner***

When asked why the cats are allowed to venture outside the house, the domestic cat owners gave responses that included reasoning such as '[cat] cannot be contained as they get anxious and urinate everywhere' and '[cat] is allowed outside because they stay within the yard and don't hunt'.

While some cat owners may be concerned that the wellbeing of their pet would be compromised as a result of restricting it from roaming, the Cat Tracker program suggests otherwise (Roetman *et. al.* 2017). The leaders of the Discovery Circle Initiative, Cat Tracker, assessed the personality of over 300 cats in their tracking program. They found that indoor cats are friendlier than other cats.

> **"Indoor cats assessed tended to be slightly more *friendly* than cats that spent time outside… the results suggest there is no negative impact on the personality of a cat when it is kept indoors"**
>
> ***~ Cat Tracker, Discovery Circle Initiative***

An alternative to house confinement is through provision of a cat run or 'Catarium' (even 'Catio'). Domestic cats can therefore access the outside, while still being confined to the yard. Products available for cat owners include cat runs in the form of enclosures, tunnels, or netting for verandahs. You can also get creative and design your own and hire a local tradesman to build it for you.

Australian providers of Catariums and similar products that ship to central Australia include:

- Catnets: http://www.catnets.com.au/
- Cat Kingdom Enclosures: http://www.catkingdomenclosures.com/
- Secure Kat: http://www.secureakat.com.au/
- Backyard Cat Enclosures: https://www.backyardcatenclosures.com.au/

Image: Backyard cat enclosures

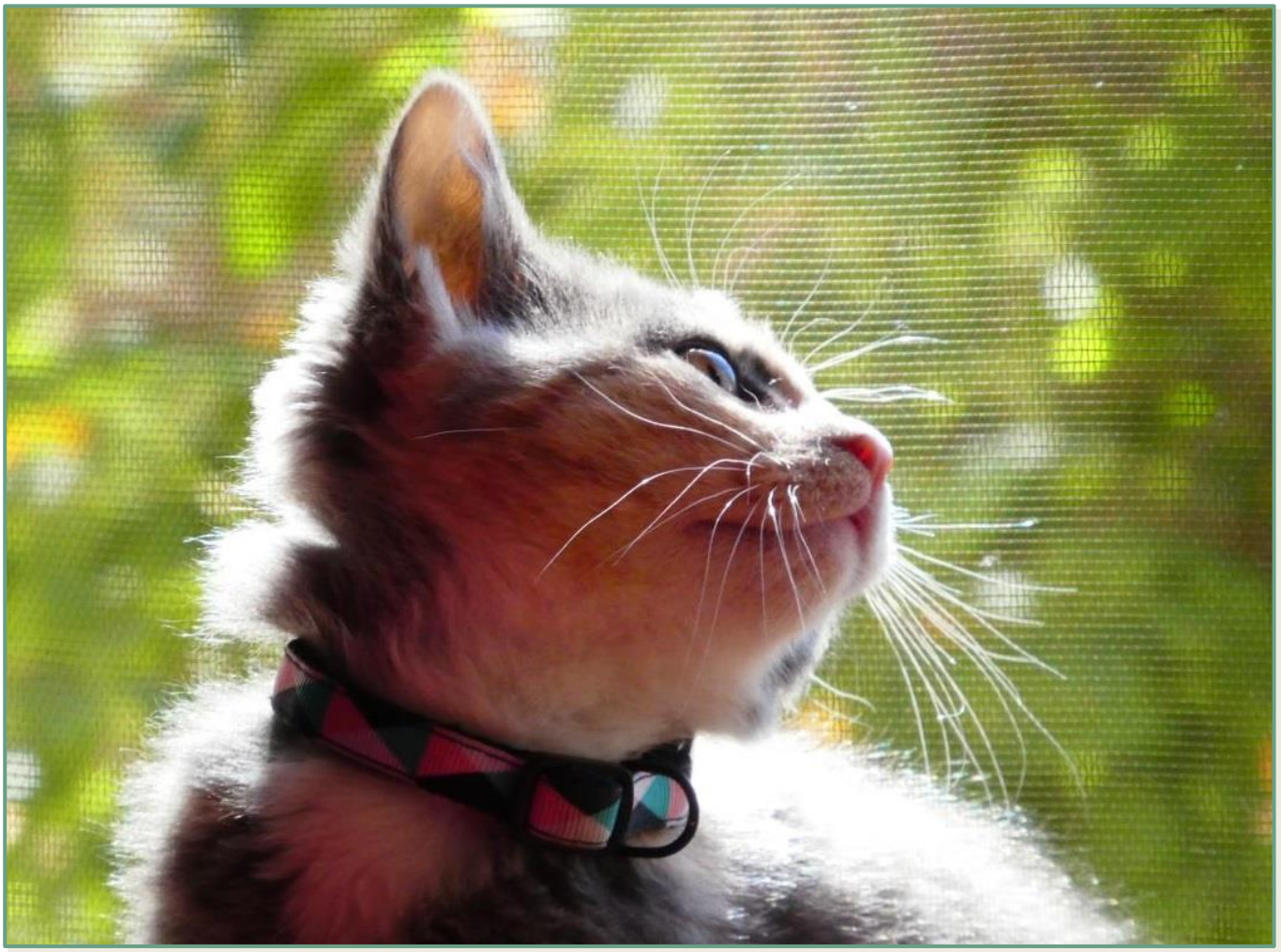
Other cat containment options include the Oscillot fencing system (https://oscillot.com.au/), which consists of aluminium paddles mounted along the top of fencelines, containing cats within a yard safely and effectively.

If owners are unwilling to contain their cats, devices to alert wildlife to its presence are recommended. Such items include fitting the cat with a bell (mixed success at alerting wildlife), luminescent scrunchie or sonar devices. Additional toys can also be provided to cats to keep them stimulated indoors.

The majority of the participants felt that more owners should be microchipping and registering their cat, which is achievable with education regarding by-laws in Alice Springs, but registration is not yet an option for cat owners residing in Tennant Creek.

Cats that have not been de-sexed can contribute to the feral cat population, and the behaviour of entire cats (especially males) can be more restless than de-sexed cats. While free de-sexing programs are available for a limited time in the Barkly area thanks to some funding from Territory Natural Resource Management, Alice Springs does not yet have such a program. It would be of a benefit to the Alice Springs community to implement a de-sexing program in the region to help increase the number of sterile domestic cats and reduce the number of unwanted kittens being released into the community or dumped in neighbouring bushland. Land for Wildlife will endeavour to liaise with the veterinary facilities and council in the Alice Springs region to encourage a de-sexing program.

We encourage all domestic cat owners to consider managing their domestic cats in a manner that will protect our native wildlife. The results of the study show that even the domestic cats that do not leave their property boundary often, still have the capacity to prey on native wildlife.



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