

The Values and Beliefs Regarding Pet Ownership Around Trelissick Park in Wellington, New Zealand

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Abstract

With predator-free 2050 on the horizon, urban biodiversity initiatives increase in frequency and so too does the reintroduction of native wildlife into cities across New Zealand. The role that pets, such as cats and dogs, play as predators to these newly introduced natives becomes an issue as human inhabitation and pet ownership grows. The objectives of this study were to investigate the distribution and threat of domestic cats and dogs within an inner-city park and secondly, to survey the community neighbouring this study site regarding their attitudes and beliefs about pet ownership and the threat that domestic cats and dogs pose to native wildlife. Twelve motion-detecting cameras were triggered by cats 30 times during the 30-day study period, and dogs triggered the same cameras 337 times. The online Google forms survey found that the park is highly valued for the role it plays in providing habitat for native wildlife and the open space it provides for the community. Findings show that there is substantial agreement that cats pose a threat to native wildlife. However, this differs for dogs, with more varied results. Education and advocacy on the harmful effects of cats and dogs on native wildlife may alter the behaviour of pet owners who value native biodiversity, but this alone won't be enough to persuade those who appreciate cats and dogs over the proliferation of native fauna.

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1.0 | Introduction

In all communities, open space holds significant landscape, social, ecological, recreational and cultural values, while creating an urban balance (Wellington Regional Council, 2007). As Wellington's population and environment grows and develops, it's vital to make sure that any open space within the city boundaries is well planned and managed. Formulation of a management plan for a public park includes the values and management in a way that reflects its role as an open space network. The purpose of this proposed project is to investigate the community values and usage of Trelissick Park, as well as attitudes towards pet ownership and the threat of predation by cats and dogs. Trelissick Park, Ngaio, is zoned as a Conservation Site under the Wellington City Council's District Plan and is a scenic reserve under the Reserves Act 1977 (Taylor & Smith, 1997, Council, 2007). The objectives and policies of the District Plan give direction for the development, management, and protection of this reserve.

Over millions of years, New Zealand has evolved an avifauna that now includes many endemic species. New Zealand is the last and only refuge for a wide range of bird species, and New Zealander, is renowned for its claim to be a clean and green environment to house these birds. However, do some loveable killers threaten to undermine this? Almost half of New Zealand's 1.7 million households own at least one cat (*Felis catus*), making New Zealand the world's most prominent cat owners per capita (Medina *et al.*, 2011, Stats NZ, 2017). Cats are incredibly efficient hunters with a stalking and chasing instinct bred down through their ancestors (Driscoll *et al.*, 2009), and although they may mean no harm, they may be inhibiting native avian wildlife within Trelissick Park. New Zealand is home to 57 native birds, and most of them are threatened or endangered due to the predation they endure at the hands of predators such as cats (Medina *et al.*, 2011).

Dogs (*Canis familiaris*) are man's best friend, with approximately 550,000 registered to owners throughout New Zealand (Department of Internal Affairs, 2017). Trelissick Park is Wellington's largest off-leash walking park and, therefore dogs can wander freely off-track. Reports of dogs, under no control, killing fledging native birds, such as the kaka, have been made in nearby parks in the past (McArthur *et al.*, 2015, Keenan, 2017). Communication with Peter Reimann and Bill Hester (2017) indicated that when they are working off-track, it isn't uncommon for dogs to show up. Previous studies on fledging kaka within the park found that there was a 0% survival rate. However, the cause was unknown. Hester (2017)

stated that “any bird on the ground, for whatever reason, would be in danger of an off-leash dog”. For this reason, dogs were also the area of focus for this study too.

In cities, such as Wellington, free-roaming domestic cats and dogs kill native birds faster than they can breed (van Heezik *et al.*, 2010). Statements such as, “my cat only ever bring me rodents as gifts, he'd never hurt the natives” are common, while research disagrees, with numerous studies supporting both predation of mammalian pests AND native fauna (Fitzgerald & Karl, 1979, Le Corre, 2008, Medina *et al.*, 2011). For Predator-Free 2050 to be achieved all pests need to be managed to minimise their effect on the ecosystem, this includes cats and dogs. Eradicating targeted rats, stoats and possums will only be a success if we can control the predators left once these mammals are gone. This gives this study relevance because it will highlight the management that needs to be done in a small suburban Wellington Park, to protect the fauna New Zealand as a country aims to restore.

2.0 | Aim

People are connected to nature and nature is encompassed by the biodiversity within it. By all accounts, Wellingtonians are knowledgeable and passionate towards Wellington’s biodiversity, and the push for projects such as predator-free suburbs and more green space support the claim that people want to live in a city of where nature is close by (Sandifer *et al.*, 2015).

The anticipated outcome of this study is to understand community values and usage of Trelissick Park, as well as the attitudes towards pet ownership and the threat of predation by cats and dogs within the park. Figure 1, is where I want to end up after having completed this project. I feel that it is essential to determine the beliefs of the public around the perceived threat of companion animals in parks and correlate this with measures of individual’s relationship with nature. Currently, there is a knowledge gap not only within Trelissick Park but within New Zealand’s community, which is due to the lack of scientific data produced and the fear of contributing to a controversial topic. By completing this study suspected predation by cats and dogs could be minimised, allowing the work done by organisations and volunteers within the park to remain valid and successful. It will also provide a solution to the literature gap currently present.

3.0 | Anticipated Outcome

Due to the ongoing predator and weed management operating in Trelissick Park, it is now on the road to ecological recovery, and it almost seems possible to believe that it will again become a forest where native birds can forage and nest. This project works towards understanding the public perception and then using this and raw data collected in the field to educate the public and the groups working with the park of the potential threats that need better management. This education will be carried out in the form of a written report and poster, which can be advertised both online and within the park. The assumption that cats, and potentially to a lesser extent, dogs, are wandering into the park has been made based on data collected from similar studies, and initial investigation suggests the same outcomes may be found. Anticipated outcomes include the public acknowledging a threat from pets but deem them a lesser risk. I believe that people will lean towards cats helping the native wildlife due to predation on rodents and also that non-cat owners will be in favour of proposing solutions to cat predation, while owners will be more hesitant. By sticking to a timeline prepared for this project, the goal, aims and objectives stated shall be met, and awareness of the results will hopefully help educate the public of the potential risks that pets can have on the present and future birds of the park.

4.0 | Methods

4.1 | Site description

Over the last decade, Wellington has seen a surge of endemic avifauna aided through the establishment of Zealandia, a fully-fenced urban ecosanctuary (Brockie & Duncan 2012). Zealandia is a 225-hectare wildlife sanctuary enclosed by the world's first fully enclosed fenced area which prevents the entry of mammalian pest species, except for mice. Since the fence's erection in 1999, the sanctuary has had many successful translocations including birds such as kākā, hihi (*Notiomystis cincta*), tieke (*Philesturnus rufusater*) and toutouwai (*Petroica longipes*), (Miskelly & Powesland 2013). The sanctuary, along with intensive pest control by Wellington City Council, has also promoted growth in existing native bird populations such as kererū (*Hemiphaga novaeseelandiae*) and tūī (*Prosthemadera novaeseelandiae*).

Approximately 10km away from Zealandia lays Trelissick Park, a 20-hectare park located in the centre of Wellington's North-Eastern pest-free communities. Most of the park lies on the

northern border of the Kaiwharawhara Stream and stretches down the eastern side of the Korimako Stream to Crofton Downs (WCC Council, 2007). The park forms a gorge, providing an ecological corridor between the harbour and the Outer Green Belt. The park itself is a direct neighbour to approximately 100 residential homes and contains two 3km public walking tracks (refer to fig. 2 for a full GIS map of the location).

There are numerous cross-valley links within the park between Crofton Downs, Ngaio, and Wadestown. The valley floor contains the largest off-leash dog exercise area in the Wellington region. Before development in the area began, the vegetation was a broadleaf-podocarp forest which had tawa settling in the main canopy, allowing other natives such as kahikatea, northern rata, and rimu to emerge (Wellington City Council, 2015, Hester, 2017). In the 19th century, much of the forest was milled, causing a significant change in the landscape (Hester, 2017).

Today Trelissick Park flaunts a wide variety of indigenous tree species, including mature species of kahikatea, mataī, māhoe, tawa, and tītoki. These trees entice endemic birds from locations such as Zealandia into the gorge, with sightings of kererū, tūī, and kākā becoming frequently common. Kaiwharawhara Stream holds many species of native fish including bluegill bully, kōaro, inanga and longfin eels, some of which are nationally threatened and are rarely ever found in urban streams (WCC, 2007, Wellington City Council, 2015).

The Trelissick Park Group was established in 1991 and has been tirelessly working towards the restoration of the park alongside the Wellington City Council. The group has succeeded in making significant progress to enhance the park with a set vision and management priorities that focus on the environment, recreation, culture and history of the landscape (Hester, pers comm. 2017). This focus is closely aligned with the policies of the Wellington City Council's Suburban Reserves Management Plan (2015). Members have an advocacy role, as residents and Trelissick Park supporters create more support by using social media and the predator-free suburbs databases (Wellington City Council, 2015, Hester pers. comm., 2017).

4.1.1 | Threats in Trelissick Park

Pest plants are considered to be the biggest risk acting upon Trelissick Park to date, and these are under continual control through the use of volunteers. Mammalian pest management is

also continuously administered. Wellington Regional Council has been proactive in this location in the past, working towards predator elimination and control. However, during the last ten years, they have taken a step back, allowing the Trelissick Park Group to take the lead. In early 1998 bait stations were introduced to minimise pests and since this time there has been little evidence of possum activity within the Park, when once they were a severe issue inhibiting native plant regeneration.

There are ongoing problems in Trelissick Park with rodents, rabbits, and hedgehogs, with particular emphasis on the rodents which kill native birds and eat their eggs. Trelissick Park targets these pests with the use of pellet and block baits, A24 traps and varying types of bar traps with approximately two traps per hectare (fig. 3). Something that is unexplored is how cats and dogs impact the native fauna and the detrimental impacts this may lead to.

Domestic cats have been identified as entering the park along the boundaries near residential areas. Cats are New Zealand's most common companion animals, with felines in 48% of homes (Aguilar & Farnworth, 2013). However, as highly efficient predators, they are known to be predators of New Zealand's native birds, reptiles, and insects (Miskelly *et al.*, 2008). New Zealand's indigenous species evolved in a period where mammalian predators were absent; they, therefore, lack sufficient defence mechanisms to effectively escape animals like cats (Medina *et al.*, 2011).

Communication with Peter Reimann and Bill Hester (pers. comm. 2017), members of the Trelissick Park Group indicated that they don't see cats within the park, and therefore, believe they do not enter its grounds, nor do they pose a large threat to the ecosystem within. This assumption was based on only one cat sighting on a motion detecting camera in 2012. However, this data went unpublished, and little more is known about its findings. As residential areas increase, so too does the cat population, allowing for more cats to explore their home ranges which studies indicate can be up to approximately 3 hectares (Metsers *et al.*, 2010).

A common public misconception is that our beloved cats only kill rodents, therefore reducing the number of pests within Trelissick Park. However, the Trelissick Park Group is working hard to restore the environment in this location, and as it slowly returns to an ecosystem where native New Zealand birds are returning, they are put at risk of cat and dog predation.

4.2 | Measuring the distribution of cats and dogs within Trellissick Park

Sites were haphazardly chosen based on their proximity to residential properties because this study was aimed at identifying the threat, rather than distribution. Locations were identified at either 10 m or 25 m from the nearest track, providing a set of 12 locations. On September 21st, 2017, motion detection cameras (6 Bushnell Trophy Cam HD model 119676C and 6 Bushnell Trophy Cam HD model 119736C) were installed at 12 different locations of each of the two distance combinations (fig. 4). Locations for the camera placement were based on the availability of trees for cameras to be attached to and a clear field of sight with little of vegetation. Cameras were installed horizontally, slightly tilted towards the ground, at heights of approximately 50 cm from the ground and placement of each camera model alternated. They were set to take three photos over a three second period when triggered and operated 24 hours a day until the conclusion of this study on October 21st.

On October 4th and 12th, cameras were revisited, and new SD cards and batteries were placed into each device. This was conducted so that some of the data could be analysed before the conclusion of the study and to ensure cameras wouldn't go flat in the field. It also allowed the researcher to ensure theft or device tampering had not occurred and if it had, it could be fixed.

4.3 | Evaluating community beliefs of pet ownership

Using google maps a 100m buffer was created around the outside of the park. This buffer was used to select street addresses within a 100m radius. This resulted in the selection of 132 residential addresses in the suburbs of Ngaio and Crofton Downs (fig. 5). On October 5th, flyers informing residents of an online survey, created via google forms, were delivered at all addresses where letterboxes were present (n = 130) between the hours of 12pm and 2pm. On the same day, the survey was publicised on the Trellissick Park and Predator-free Ngaio Facebook pages and on Neighbourly with the targeted areas set to Crofton Downs, Wilton, Khandallah, Northland, Kaiwharawhara, Ngaio and Wadestown, all of which are suburbs surrounding Trellissick Park. The survey was closed on the October 22nd.

Questions within the survey were based on that of Woolley's 2016 study in Polhill, categorising respondents by pet ownership status, the proximity of their home to the park and their connection to nature. It also recorded their level of agreement with 15 statements that reflected their attitudes and beliefs about pet ownership, and the threat that cats and dogs may

pose to native wildlife (fig. 6). Questions were entered through multichoice selection, by typing in an answer or on a 5 point Likert scale where 1 indicated a strong disagreement and 5 indicated strong agreeance.

4.4 | Statistical analysis

The results of camera trapping data were organised as the total number of independent trigger events capturing photos of cats and dogs per camera for the duration of the study period. Trigger events were independent of one another when they were more than 30 minutes apart. For every image capturing a cat or dog, the individuals colour and any other potentially distinguishing features were recorded.

To assess data from cameras and survey responses data was input into Microsoft Word Excel (fig. 7). Bar charts were predominantly the method selected to successfully show a visual representation of the results to a wide variety of readers. To create percentages, responses that were 4 or 5 were considered in agreeance with the statement and 1 and 2 were in disagreement. All data was deemed valid, although weakened in some areas due to lack of response to all survey questions, and three cameras in the field being turned off or formatted during the four weeks they were in the field.

5.0 | Results

5.1 | Distribution of cats and dogs in Trelissick Park

The 12 camera traps collected 35,662 images over the span of this study. However, a significant proportion of this number comes down to false triggers, resulting from movement of trees in the cameras field of vision or through birds moving in front of the cameras. The number of triggers varied from camera to camera, with a wide variety of animals triggering the cameras. Birds were the most frequently captured mammal, especially introduced species such as blackbirds (*Turdus merula*) and sparrows (*Passer* spp.) with the occasional kākā (n = 4), and fantail (n = 9). Images of mammals were less frequent than blackbirds, with 68 trigger events capturing rabbits and hares (Family: Leporidae), 56 hedgehogs (Family: Erinaceidae) and 9 rodents (mice or rats, Order: Rodentia). Humans were also occasionally captured (n = ?), most being unaware of their interaction with the cameras. Dogs were the second most frequented triggers after birds, with 337 trigger events at 10 camera locations. Due to their often-quick movements, images were generally blurry pictures of tails or heads, and therefore

no individuals were identified. The total number of cat triggers across all cameras was 30, with cats being detected at 9 of the 12 cameras. The same individuals were caught on cameras multiple times; however, identification of all individuals wasn't always possible. Four individuals were distinguished based on differences in colour, markings, hair length and presence of a collar. However, this number underestimates the total number of different cats detected.

The time of day that cats and dogs appear in the park differs entirely. The highest number of cat triggers occurred at pre-dawn between 2 am, and 6 am, closely followed by midnight between 10 pm and 2 am. No cats were sighted between the hours of 10 am and 6 pm (Fig. 8). For dogs, the highest number of triggers occurs from morning to the afternoon between 6 am and 6 pm (Fig. 9), all hours where cats are not observed. No dog triggers happened during midnight between 10 pm, and 2 am. This noticeable difference in trigger times between the two pets correlates with Barratt's (1997) study which found that cats didn't come out during the day to avoid people and dogs, whereas in this case, dogs are physically brought to the area by their owners, unlike cats who wander of their own accord.

Results suggest that there is no significant difference between distances of 25 m and 10 m off the track at which they were sighted, this is true for both cats ($p= 0.226$) and dogs ($p= 0.061$) (fig. 10). This statement is further supported by 95% confidence interval error bars overlapping. Therefore, distance from the track was not found to have a significant effect on the number of detections.

5.2 | Community beliefs about pet ownership

In total 104 people responded to the survey and of these 20 had received information flyers in their mailboxes (19.3 %). The remaining respondents reported finding out about the survey via social media (59.6 %) and word of mouth (21.2 %), particularly through community organisations. The majority of responses came from the three suburbs bordering the reserve; Ngaio, Crofton Downs and Khandallah but a few came from further afield including Hataitai, Northland, Masterton, Aro Valley, Belmont, Berhampore, Broadmeadows, Grenada Village, Island Bay, Johnsonville, Karori, Melrose, Miramar, Mt Victoria, Newlands, Newtown, Porirua, Tamatea, Thorndown, Wadestown, Wilton and Woodridge.

Thirty respondents classified themselves as living within 500 m of Trelissick Park and of these 11 owned cats, 8 owned dogs, 3 had both and 8 have neither. Other pets listed included mice, (n = 1), chickens (n = 2) and guinea pigs (n = 1). Twenty-two (28.6 %) respondents of the survey visiting the reserve at least once a week and 12 (12.2 %) had never visited the reserve (Fig. 11a). The community uses the reserve for a wide range of activities, the most popular being walking, running and dog exercise (Fig. 11b). Other uses suggested by participants included bird watching, weeding and predator control. The most frequent response to the question “What attributes do you most value about the reserve?” was that for the green space it provides (89.5 %). This was followed by the habitat it provides for native wildlife (58.9 %) and that the reserve offers a city escape (51.6%) (Fig. 11c).

Results found that neither cat nor dog owners show a high level of connectedness with nature (section 3, fig. 6) with 58.7 % of cat owners (n= 46) and 64.7 % of dog owners (n= 51) having no involvement in ecological restoration.

Perceptions of cats as a predator differed by ownership status. A significantly higher proportion of non-cat owners agreed that cats posed a threat to native wildlife in urban parks 82.2 %, compared to cat owners at 46.6 %. 73% of non-cat owners and 54% of cat owners believed that this threat was a problem.

Perceptions of dogs as predators differed again with ownership status. 42% of non-dog owners agreed that dogs posed a threat to native wildlife in urban parks, while only 18% of dog owners agreed with this statement. 38.7% of non-dog owners and 12% of dog owners admit that this threat was a problem.

Attitudes towards enforcement of stricter rules to protect wildlife differed with ownership status. 38% of dog owners agree that regulations need to be imposed, while 29% of cat owners agreed. 42% of non-cat owners agreed that cat-free zones were a good solution to the issue of cat predation, while 32.2% of cat owners agreed with this statement. In regards to the statement, “some reserves or natural areas should be dog-free”, 58.8% of dog owners and 64.5% of cat owners agree. It would seem from these results that dog owners are more open to restricting pets for the greater good of native wildlife, while cat owners are a lot more reserved.

In both cat and dog owners, over half of the respondents believed that making a cat live indoors is unethical and unfair, non-cat owners 60 % and cat owners 55 %. Ownership status differed significantly in their agreement with the statement that “Free-roaming domestic cats are beneficial to native wildlife as they reduce populations of rats and mice” with a significantly higher proportion of cat owners agreeing (48.8 %) compared to dog owners (26.5 %). Of the respondents who replied to the statement, “walking a dog on a leash reduces its threat to wildlife”, responses in both ownership status’ were very similar (cat owners 61.3 % and dog owners 68.5 %).

6.0 | Discussion

6.1 | Cat distribution in Trellissick Park

Cats were detected at 9 of the 12 camera locations in Trellissick Park, and it, therefore, seems likely that cats are not only frequent visitors to the park but also may be present (albeit at varying densities) across other areas nearby of residential areas too. The finding that cats occur more closely to these human inhabited areas is consistent with data from previous studies. In 2016, Chris Woolley found that cats in Polhill Reserve, Wellington, were five times more likely to be detected at 25 m from the reserve edge more frequently discovered close to the reserve edge compared to at distances 100 m in. Similarly, a case study of Otari-Wilton’s Bush (Greater Wellington Regional Council 2016) found a notable decrease (no specific quantified number) in cat abundance at locations 50 m to 100 m from the urban fringe. Though, there was a single cat sighting at 600m from any urban areas. These two findings show that although the initial threat from cats lies close to the fringing urbanised areas, there are still some persistent individuals who venture further off track into the bush, posing a threat to wildlife further away from human habitation.

A single cat's home range is thought to average about 3ha (Barratt 1997; Metsers *et al.*, 2010). As such a large portion of people live within 3ha of Trellissick Park, this would indicate that a significant proportion of the park falls within the home range of cats living in this vicinity. While all the cameras in this study were in the north and north-eastern side of the park, it may be that domestic cats residing within 3ha of the park on the north-western and south-western sides of the park may exhibit similar cat sighting frequencies.

6.2 | Dog distribution in Trelissick Park

Dogs were identified at 10 of the 12 camera locations in Trelissick Park, most of which were off-leash and some were off-leash and 25 m off track unattended. However, due to the park's no leads policy, this isn't breaking related bylaws. Dogs were frequently photographed on cameras near the park tracks, with past research finding similar conclusions (Beier & Loe, 1992). The number of media reports regarding dogs mauling birds in Wellington is becoming increasingly common, and people from the survey seem to believe that certain breeds present more of a risk than others (29.8 %). However, this number could be a reflection upon owners not wanting to admit that their pet may be a predator; further social research is needed to make stronger conclusions on this.

Dogs were 2.5 times more likely to be detected at 25 m from the track compared to 10 m distances. However, little literature is available to compare these findings to. As there were dog sightings deeper into the park, it seems almost acceptable to say that dogs are posing a risk to native wildlife throughout the park, at both 25 m, 10 m and potentially even deeper. More research is needed to make stronger conclusions on this statement.

6.3 | Community attitudes towards the reserve and pet ownership

The majority of residents agree that cats pose a threat to native wildlife (46.2 %) and that this threat is a problem (35.6 %). This is reinforced by the finding that the reserve is highly valued by the community for the habitat it provides for native wildlife (58.9 %). There is also a high level of agreement that pet owners should take steps to reduce the threat posed by their animal to wildlife (51.9 %).

The majority of residents moderately agreed that dogs pose a threat to native wildlife (23.1 %). However, more people believe that this threat is only a slight problem (23.1 %) compared to those who think it is a real issue (11.5 %).

7.0 | Conclusion

Seen as the majority of cat sightings highlighted in this report occur during periods where owners should be sleeping, it seems only natural to suggest that cats are kept indoors overnight. This directly eliminates the detection of cat sightings in Trelissick Park, as none were seen to occur during the day. Understandably, not everyone will accept this

recommendation and therefore collars with bells on are a secondary suggestion which can minimise predation by up to 50 %.

For dogs, the answer to the issue of predation is very simple; they must remain on leash. Detections at locations 10 m and 25 m off track will not be possible if they stay with their owners on lead during their walks. Although this may stop any predation on native wildlife, it is not the ideal solution for owners who stated that a benefit of coming to Trelissick Park is to walk their dog off leash. Instead, it may be proposed that in the wide open spaces and fields of Trelissick Park, fences are erected so that dogs have a safe environment to be off lead where they won't come in contact with wildlife residing in the bush, similar to those in the Kainui Reserve and Ian Galloway Park in Karori/Northland.

Programs and initiatives which encourage an increase of native wildlife in urban environments benefit the wildlife itself as well as the lives of urbanites; however, making these initiatives effective is another problem. The findings of this study suggest that free-roaming domestic cats are present in the urban setting of Trelissick Park, Wellington, New Zealand. This too seems to be the case for dogs. However, they are brought to the area by their owners, and the problem lies with their unmonitored roaming in the bush while they're out, unleashed on the track. A high portion of survey respondents believes free-roaming cats are a problem, however, again this differs from dogs as surveyees think canines are a lesser risk to the native wildlife. More research throughout New Zealand is needed to help identify strategies to mitigate the risk of these companion pests and the threat they impose to our native wildlife.

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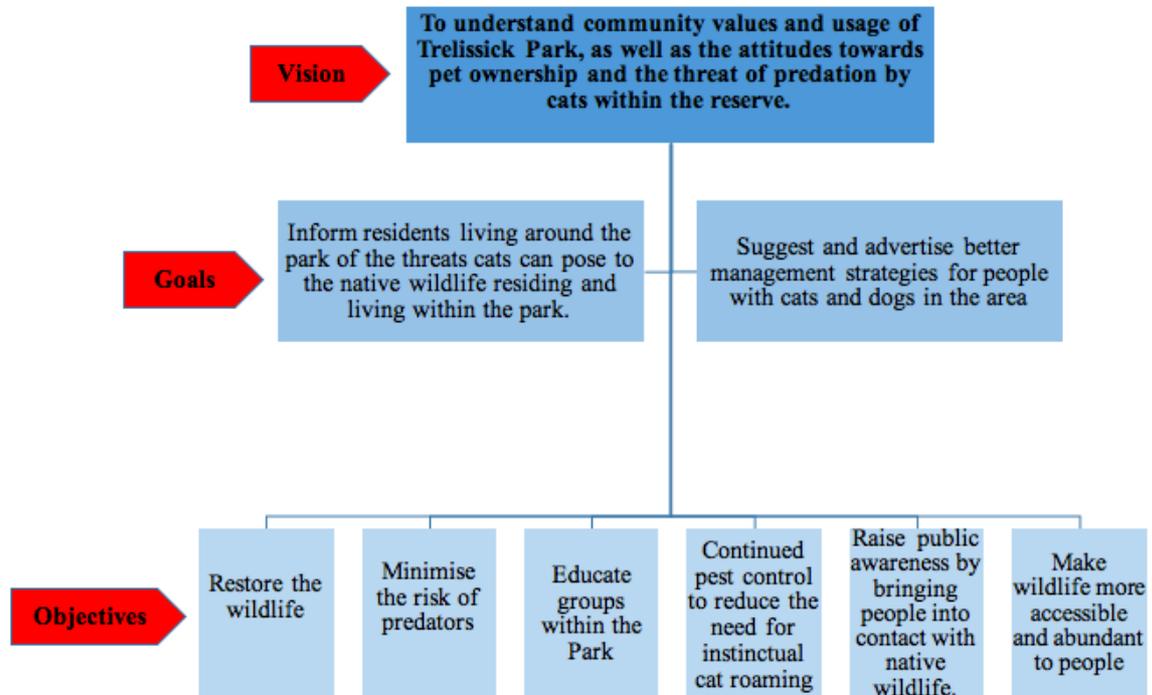
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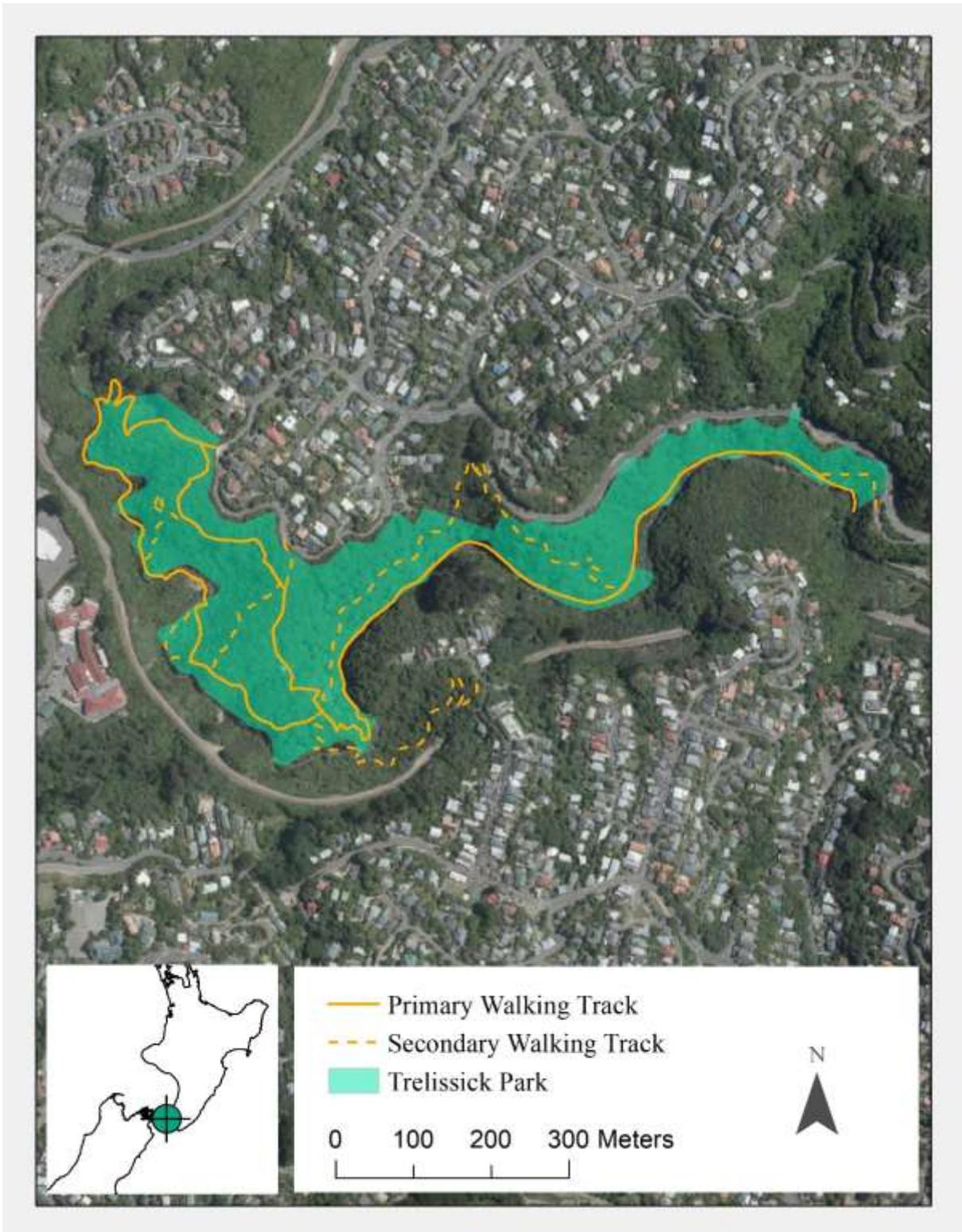
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9.0 | Figures

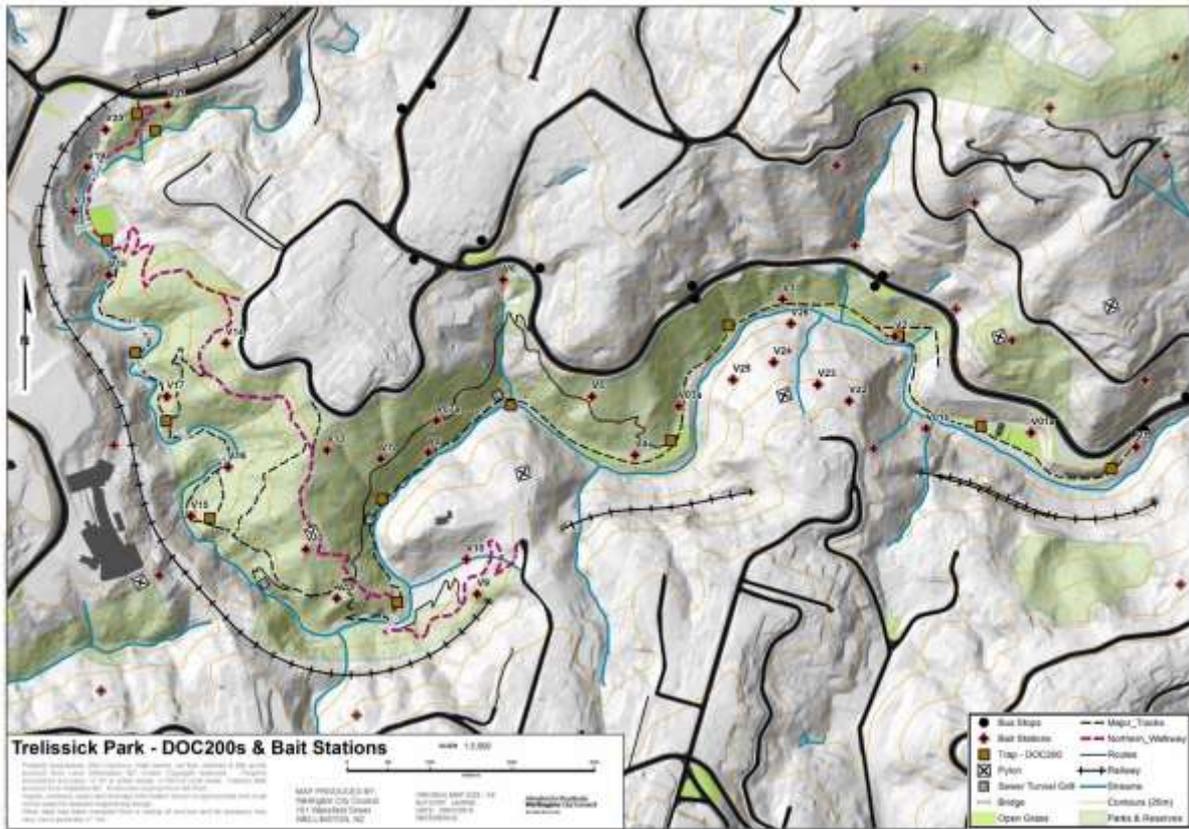
9.1 | Fig. 1 The visions, goals and objectives of the proposed project defined by the primary researcher.



9.2 | Fig. 2 A map of Trelissick Park created using satellite imagery with shape files overlaid. Highlighted in green is the park extent, with the primary and secondary walking tracks labelled in orange.



9.3 | Fig. 3 Bait stations and DOC200 trap locations within Trelessick Park. (Trelessick Park Group, 2016).



9.4 | Fig. 4 GPS coordinates, marked in the form of yellow dots, of the 12 locations haphazardly selected to place the 12 motion-sensing cameras within Trelissick Park, Wellington. Locations were mapped using ArcGIS software.



9.5 | Fig. 5 Map of Trelissick Park showing park edge (yellow line). Addresses within 100m of park are shown as black dots and these were where flyers were delivered. *Satellite image: ArcGIS*



9.6 | Fig. 6 Survey Questions (For survey format access the google form: <https://goo.gl/evda2v>)

Section 1:

As part of a research project at Victoria University, this survey will be used to help answer questions about how people use and value Trelissick Park, as well as their views towards pet ownership. Cats and dogs are common family pets, however, as predators they can be harmful to native birds. The issue of pet ownership around urban reserves such as Trelissick is a complex and sometimes controversial one.

If you have any questions regarding the survey or wish to contact someone regarding this research, please do so via the contact details below:

Olivia Carson

Victoria University of Wellington

School of Biological Science

Email: carsonoliv@myvuw.ac.nz

Section 2:

Please indicate pet ownership:

- I do not own a pet
- Cat
- Dog
- Other

Section 3:

Are you involved in any community ecological restoration groups (e.g. planting native trees, trapping, stream monitoring, etc.)? Involvement does not have to be at Trelissick Park.

- Yes
- No

If yes, what is the name of that group?

Do you regularly donate or volunteer with a conservation, environmental or otherwise nature-focused organisation?

- Yes
- No

If yes, what is the name of that organisation?

How did you find out about this survey?

- Flyer in mailbox
- Social media
- Word of mouth
- Other

Section 4:

In which suburb do you live?

How far from Trelissick Park do you live? (If you are unsure please consult google maps: <https://www.google.co.nz/maps/place/Trelissick+Park> and click on the 'directions' button).

- Less than 500km
- Between 500 and 2km
- Between 2 and 3km
- Between 3 and 4km
- More than 4km
- In a city other than Wellington

If you live in a city other than Wellington, please specify.

Section 5:

Cats pose a threat to native wildlife in urban reserves.

1 strongly disagree – 5 strongly agree

Dogs pose a threat to native wildlife in urban reserves.

1 strongly disagree – 5 strongly agree

The threat of predation by cats on native wildlife is a problem.

1 strongly disagree – 5 strongly agree

The threat of predation by dogs on native wildlife is a problem.

1 strongly disagree – 5 strongly agree

Pet owners should take steps to reduce the threat posed by their animals to wildlife (e.g. keeping dogs on leashes, belled collars on cats).

1 strongly disagree – 5 strongly agree

Local government should enforce stricter regulations on pet owners to protect wildlife.

1 strongly disagree – 5 strongly agree

Section 6:

Keeping all cats inside or on an owner's property is a good solution to the issue of cat predation on wildlife.

1 strongly disagree – 5 strongly agree

Making a cat live indoors is unethical and unfair on the cat.

1 strongly disagree – 5 strongly agree

Having a cat wear a collar with a bell reduces its threat to wildlife.

1 strongly disagree – 5 strongly agree

‘Cat-free zones’ are a good solution to the issue of cat predation.

1 strongly disagree – 5 strongly agree

Free-roaming domestic cats are beneficial to native wildlife as they reduce populations of the rats and mice.

1 strongly disagree – 5 strongly agree

If you own a cat: I would feel comfortable reporting to Wellington City Council that my cat brought in a native bird or lizard.

1 strongly disagree – 5 strongly agree

Section 7:

Some reserves or natural areas should be dog free.

1 strongly disagree – 5 strongly agree

Walking a dog on a leash reduces its threat to wildlife.

1 strongly disagree – 5 strongly agree

Walking dogs off-leash should be at the owner's discretion.

1 strongly disagree – 5 strongly agree

Certain breeds of dog present no threat to wildlife.

1 strongly disagree – 5 strongly agree

If you own a dog: I would feel comfortable reporting to Wellington City Council that my dog killed/injured a native animal.

1 strongly disagree – 5 strongly agree

Section 8:

I visit Trelissick Park on average...Choose.

- I have never visited the park
- Less than once a month
- Once a fortnight
- Once a week
- Multiple times a week

I use the park for the following activities... (you may select multiple options)

- Running
- Walking
- Dog exercise
- Bird watching
- Other

What attributes do you value most about the park?

- The green space it provides
- Provides habitat for native wildlife
- Escape the city
- Opportunity to participate in community activities
- Other

Section 9:

Bird identification



Please indicate the level of confidence with which you can identify each of the above birds by name.

Bird 1

1 very low – 5 very high

Bird 2

1 very low – 5 very high

Bird 3

1 very low – 5 very high

Bird 4

1 very low – 5 very high

Bird 5

1 very low – 5 very high

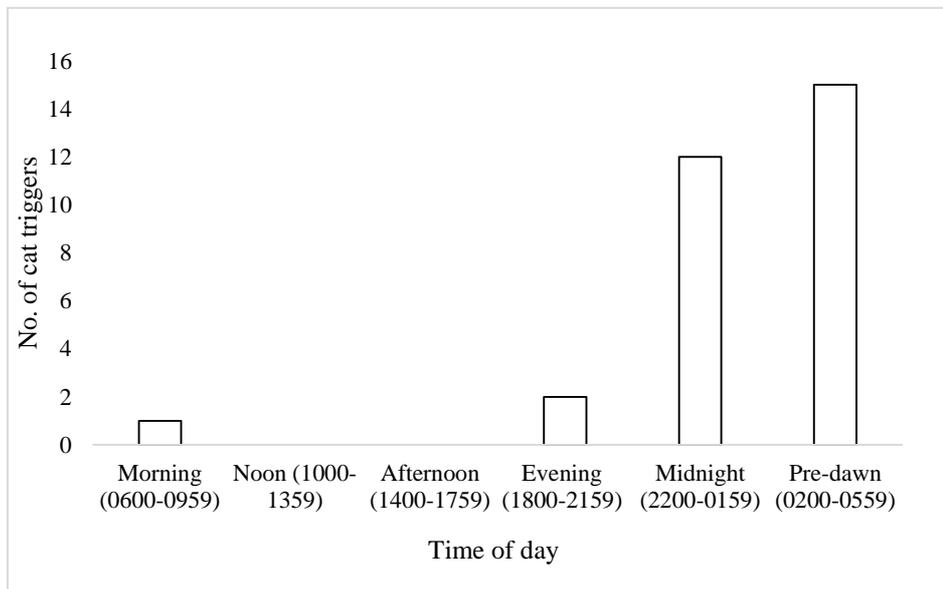
Bird 6

1 very low – 5 very high

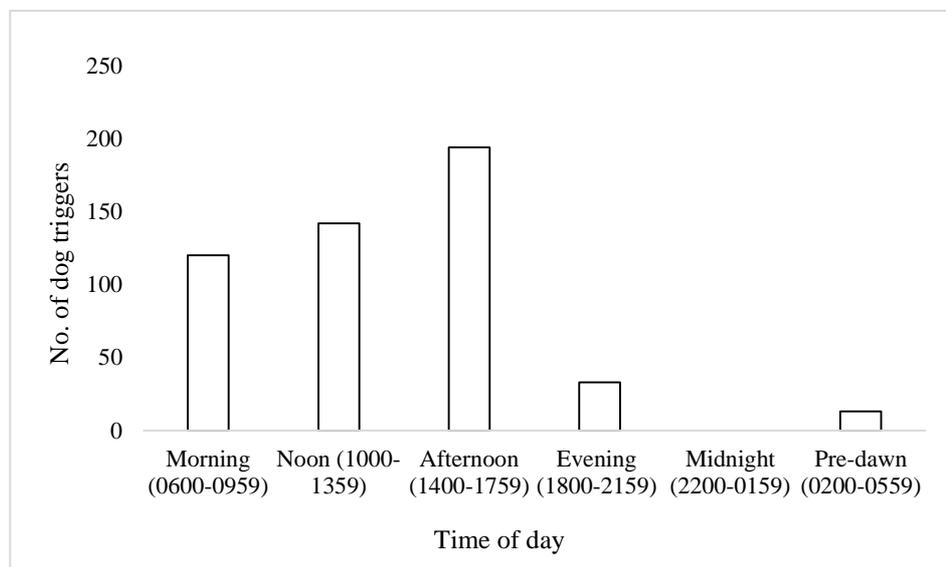
9.7 | Fig. 7 Physical raw data collected off the 12 cameras, including triggers numbers and location details.

Stop number	Camera number/Camera make	GPS Long	GPS Lat	Meters off the track	Physical markers	Data Collection (Cats	Rabitats/Hares	Hedgehogs	Dogs	Rodents
1	HD 5	174.7690	-41.2571	25	Near pre-marked pink tags	1494	1	29	3	5	0
2	Trophy 6	174.7681	-41.2565	10	Off to the left of the grass patch	518	2	14	11	18	0
3	HD 4	174.7680	-41.2560	25	Up by the house with the rubbish under it, on the other side of stream	235	2	4	7	0	0
4	Trophy 3	174.7677	-41.2559	10	By the wooden pegs, further down than the previous camera	466	0	2	13	3	0
5	HD 3	174.7672	-41.2558	25	Off the track down the man-made path, on a small tree in the clearing by the log seats	9417	1	0	0	228	0
6	Trophy 2	174.7712	-41.2577	10	Off road near car park	10899	0	0	0	39	1
7	HD 6	174.7699	-41.2592	10	5m from the power tower	459	0	0	0	25	0
8	Trophy 5	174.7704	-41.2580	10	Directly opposite number -- Trellissick Crescent (out of flagging tape)	1038	7	4	13	3	4
9	HD 1	174.7690	-41.2570	25	Directly opposite number -- Trellissick Crescent (out of flagging tape)	1029	2	6	7	10	3
10	Trophy 1	174.7669	-41.2552	25	New location. Before the big bridge in the ferns (flagging tape again)	1344	1	5	0	2	1
11	HD 2	174.7681	-41.2547	25	Where I saw the spider, on the left on the unmarked track	8158	5	1	2	4	0
12	Trophy 4	174.7682	-41.2546	10	10m to the left of the power pole marked 1016	505	9	3	0	0	0
						35662	30	68	56	337	9

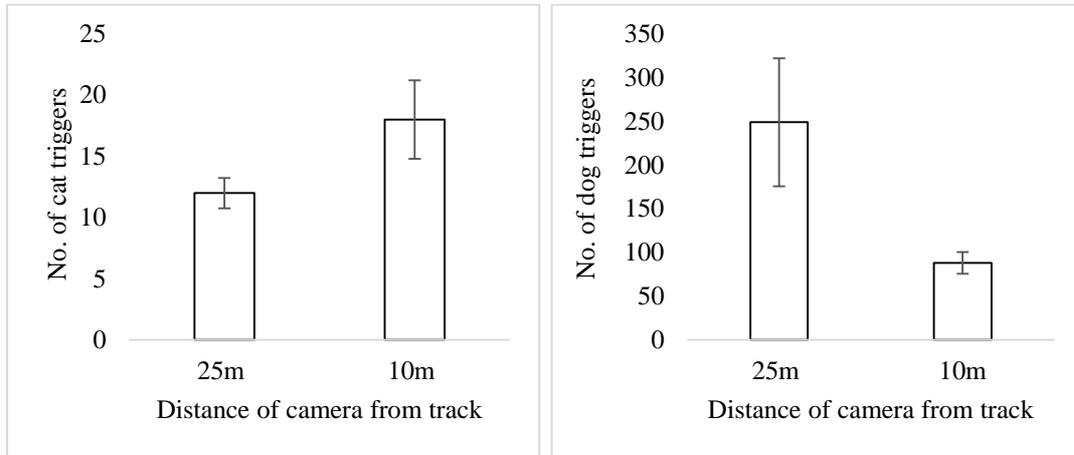
9.8 | Fig. 8 Number of cat triggers by time of day. Periods of time are divided into six categories of four hours each: morning (6-10am), noon (10am-2pm), afternoon (2-6pm), evening (6-10pm), midnight (10pm-2am) and pre-dawn (2-6am). (n = 30)



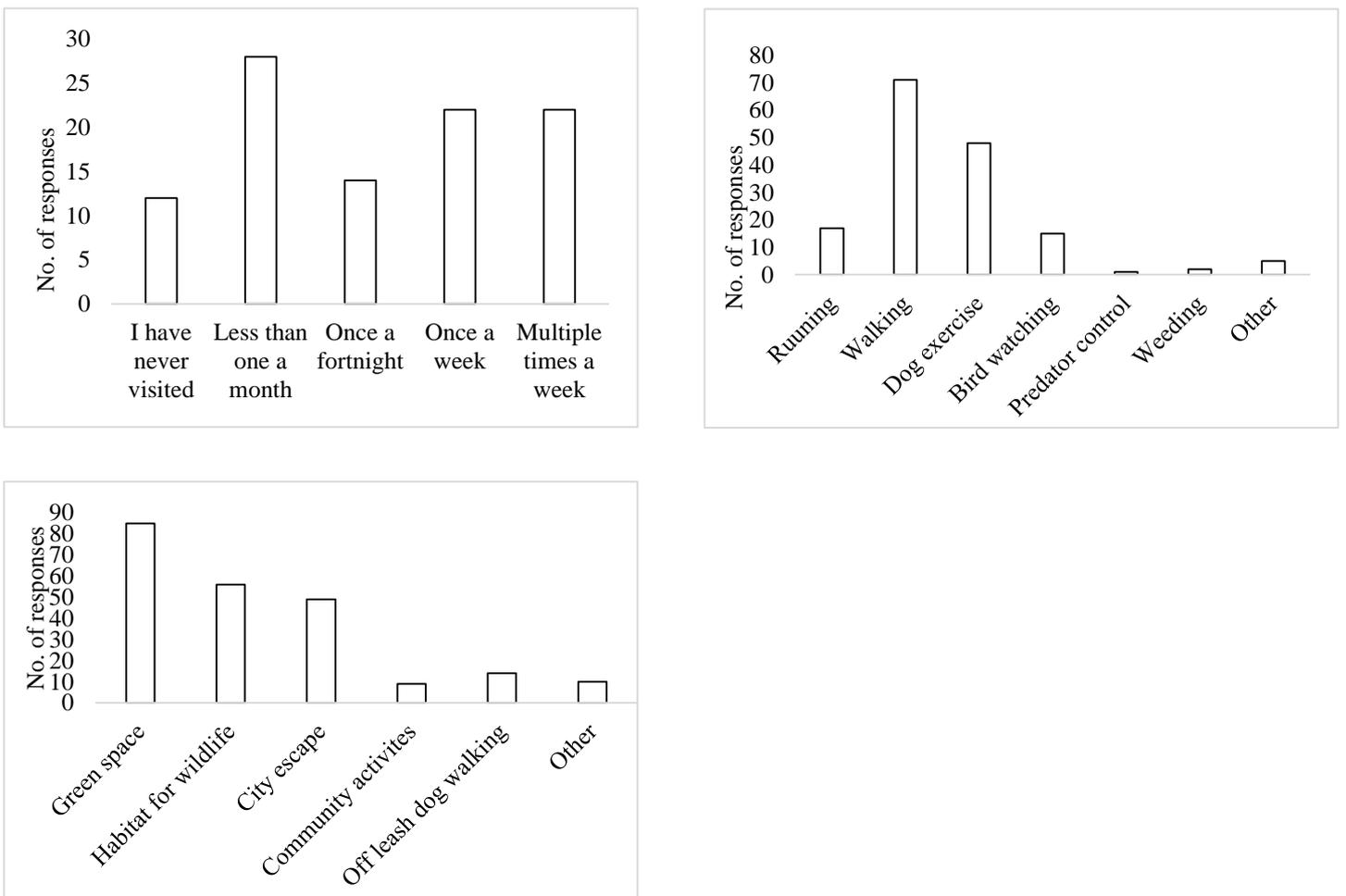
9.9 | Fig. 9 Number of dog triggers by time of day. Periods of time are divided into six categories of four hours each: morning (6-10am), noon (10am-2pm), afternoon (2-6pm), evening (6-10pm), midnight (10pm-2am) and pre-dawn (2-6am). (n = 337)



9.10 | Fig. 10 Number of cat and dog triggers at 25 m and 10 m camera locations. Error bars created based off 95% confidence intervals.



9.11 | Fig. 11 Summary of survey responses. a. frequency of reserve visitation (n = 98); b. frequency of each of the park uses (n = 90); and c. number of responses for each values of the park (n = 95)



Supplementary Material

S1: Facebook, email and Neighbourly survey advertisement



The Values and Beliefs Regarding Cat Ownership Around Trelissick Park, Wellington

INFORMATION FOR PARTICIPANTS

You are invited to take part in this research. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Kia Ora Trelissick Park community.

I am doing a research project within Trelissick Park for a masters course in conservation biology at Victoria University. As part of my project, I am using a survey to help answer questions about how people use and value Trelissick Park, as well as the community's views towards pet ownership. Cats and dogs are common family pets, however, as predators, they can be harmful to native birds. The issue of pet ownership around urban parks is a complex and sometimes controversial issue.

If you are interested in participating in the survey, you can do so by following this link <https://goo.gl/evda2v>

I am interested in getting a broad range of perspectives, and no answer is right or wrong, so please feel free to share with anyone you feel might be interested. The survey isn't limited to pet owner or users of the park.

Results of the survey will be reported in late October/early November.

Many thanks.

Olivia