The Sustainable Management of Canada Geese

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GEOG309: Research for Resilient Environments and Communities

17 October 2025

4299 Words

Muhammad Azim Muhamad Ridzuan, Saskia Munden, Maisie Foreman, Matthew Grijns, 2025, The Sustainable Management of Canada Geese. Report prepared part of the GEOG309 Research for Resilient Communities and Environments course, University of Canterbury, 2025.

Contents

Executive Summary: 3

Introduction: 4

Literature Review: 6

Methods: 11

Results: 12

Discussion: 17

Conclusion: 19

Acknowledgements: 20

References 20

Executive Summary:

- Canada Geese were introduced to Aotearoa in the early 1900s and now inhibit much of the country.
- Christchurch City Council conduct annual culls with 356 geese culled in 2025.
- There are concerns about the environmental impacts of Geese.
- Our research aim was to investigate what impacts Canada Geese have on the New Brighton environment.
- Our other research aim was to investigate if there is a more humane and sustainable way to manage them.
- Conducted in collaboration with Danette Wereta from the Animal Justice Party Aotearoa.
- Fieldwork was conducted along the Avon River red zone using transect and quadrant sampling to estimate Goose dropping density.
- Canada Geese population counts were conducted over three observation days using visual and photographic surveys.
- Average population within the study site was 70 geese.
- Data was analysed using inferential statistics to extrapolate results from the sample transects to the wider study area.
- Estimated 718,000 droppings per year, producing 4,000 kg of waste annually.
- Lethal control offers immediate reduction but is expensive and raises ethical issues.
- Non-lethal control options such as habitat modification, hazing and reproductive control are more human but require long-term commitment.

Introduction

Our project in partnership with Danette Wereta from the Animal Justice Party focuses on the sustainable management of Canada Geese (*Branta canadensis*) in Ōtautahi, Christchurch. Canada Geese were introduced into New Zealand in 1905 and 1920 with a founding population of just 60 birds and have quickly spread throughout the entire country (Imber & Williams, 2015). The population increased rapidly, being declared a game species in 1925 to attempt population control (Imber & Williams, 2015). This status was retracted in 1931 due to complains from farmers, reinstated again 1973 and finally dropped 2011 (Imber & Williams, 2015). Canada geese are currently classified as schedule 5, meaning there are no protections surrounding them and are not formally a pest species (Fish&GameNZ, n.d.).

This leaves Canada goose population control to be conducted by individual organisations. Currently in Christchurch there are two organisations controlling population, the Christchurch airport, and the Christchurch city council.

The main method being currently conducted by the Christchurch city council is an annual cull. This is conducted during the moulting period to prevent the birds from flying away. The birds are herding into a funnel, where a trained veterinarian is waiting to dose the geese with a lethal injection (Figure 1). This process is expensive, widely reported to cost $20,000 in 2025 to kill 356 geese (Gibbs, 2025).

Our mission is to determine what impacts the Canada Geese are having on Christchurch, and why this cull is occurring. Our project narrowed our focus to just the new Brighton environment near the redzone, as this area has a substantial population of geese, as well as being a key culling location. Our project followed two research questions, the first being "What impacts do Canada Geese have on the New Brighton environment?" and the second being "Is there a more humane and sustainable way to manage them?".

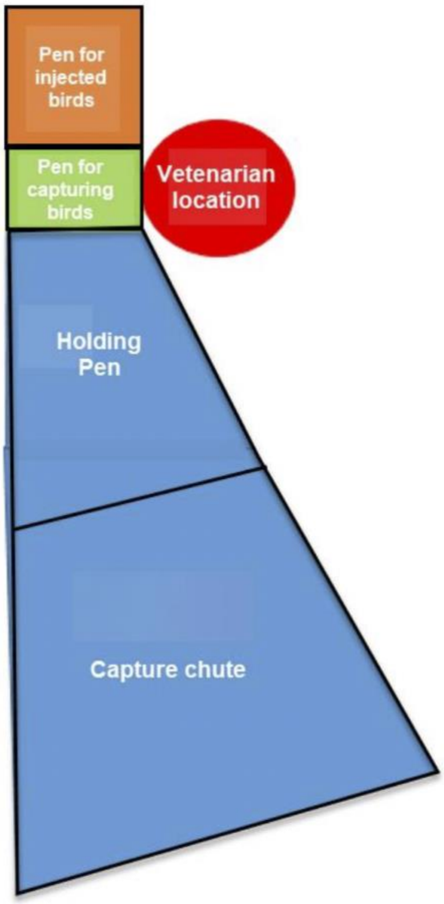

Figure 1. Image showing the stages Canada Geese travel through during the culling process, the Geese enter through the blue zone, get injected with the lethal agent by the veterinarian in the green zone, and placed into the orange zone afterwards. Image taken from Moult Cull Plan for Control of Canada Geese on the Christchurch Avon/Heathcote Estuary.

Literature Review:

Water Quality

Canada Geese have been widely associated with potential impacts on water quality. This is primarily due to the large number of droppings they deposit in and around aquatic environments. Their droppings contain high concentrations of nutrients, particularly nitrogen and phosphorus (Gorham & Lee, 2016). When goose populations are dense, these nutrients can alter water chemistry and contribute to eutrophication and algae blooms. In addition to increased nutrients entering waterways, pathogen presence (*C. parvum and C. hominis*) has been identified within goose droppings (Jellison, 2010).

The extent to which Canada Geese presence degrades water quality is uncertain. Unckless and Makarewicz (2007) found that the majority of dropping nutrients settle into the sedimentary layer of lakes and rivers instead of remaining in the water column, limiting increased nutrients immediate effects on water quality. However, storm events or sediment disturbances can release stored nutrients. This suggests Canada Geese influence on water quality is context-dependent and may vary seasonally or with hydrological conditions.

Management practices appear to play a role in reducing these impacts. Swallow, Huffman, Van Why, and D'Angelo (2010) observed that sites with active goose management strategies, including egg oiling and harassment, significantly lowered dropping contamination and nutrient levels compared to unmanaged sites. Vegetative buffers and site characteristics, such as bank slope, have also been found to lower contamination levels. Highlighting that water quality degradation can be influenced by goose density and management approaches.

While there is a consensus that Canada Geese contribute additional nutrients and bacteria to waterways, the degree of impact varies between studies. Evidence suggests that higher goose densities increase water quality decline, particularly where management is limited, or sediment disturbance is frequent.

Flora and Fauna

Canada Geese are increasingly recognized as influential in shaping local ecosystems, mainly through their interactions with vegetation and broader ecological dynamics. The literature reviewed within this theme proved to be quite lacking, especially in terms of any regarding New Zealand, therefore all literature was sourced overseas.

Rivers and Short (2007) provide an analysis of goose herbivory in an intertidal eelgrass meadow, where intense winter grazing led to near-total loss of vegetation. The geese consumed not only leaves but also the meristems which are critical for regrowth, resulting in little recovery months later. Their use of long-term monitoring and attention to belowground biomass emphasizes the importance of measuring both surface and subsurface plant structures, a principle that informed our decision to use dropping counts to infer grazing intensity. Lane et al. (2024) researched tidal marshes, showing that passive recovery following goose exclusion often results in the dominance of invasive species rather than the return of native flora. Their decade-long use of fenced exclosures reveals that long-term monitoring is essential to distinguish between temporary and persistent ecological shifts, supporting our plan for revisiting New Brighton for repeated sampling to strengthen temporal reliability.

Radtke and Dieter (2011) focus on agricultural damage, using GPS mapping and field surveys to quantify vegetation loss in soybean fields. Their emphasis on early intervention and spatial tracking suggests that location-specific sampling, like the use of transect and quadrat methods, is crucial for capturing localized impacts and guiding management responses. Whilst Toth et al. (2023) explored the geese's role in seed dispersal, analyzing 250 dropping samples to identify plant traits associated with dispersal. Their findings highlighted the need to consider biases in plant traits when interpreting results.

Clancy (2023) added a socio-ecological perspective, examining how geese shape urban vegetation through territorial behaviour and grazing preferences. Ethnographic and spatial analysis methods reveal how management strategies, such as fencing and landscaping, can keep geese in check, raising ethical questions about conservation design.

Non-lethal methods

A key focus of this project is the non-lethal management options for Canada Geese. There are many different methods for non-lethal management of Canada geese, varying in effectiveness, cost, and ethics. Non-lethal management options fall into four main categories: habitat modification, Hazing, reproductive control, and removal (Smith et al., 2000).

Habitat modification involves altering the habitats of goose populations to dissuade goose presence and lessen the impacts on humans. Geese tend to live in areas with access to both land and water, so creating a barrier between the water and the bank makes the habitat unappealing, discouraging geese populations (Gosser et al., 1997). Another way that habitat modification can be implemented to reduce the impacts of geese is by modifying the environment in a way that dissuades breeding. The ideal habitat for Geese during the mating season is bodies of water surrounding small islands (Cooper, 1998). Modifying habitat to remove small islands or redirect water dissuades geese from settling in an area; however, this also impacts other waterfowl species in the area (Cooper, 1998).

Hazing can be conducted in various forms, with differing levels of cost and effectiveness. Effective hazing methods need to cause the geese to take flight away from the target habitat, while also preventing acclimation over time (Gosser et al. 1997). The most common way to trigger geese to take flight is through Remote-Controlled Vehicles (RCV) (Preusser et al. 2008). Successful hazing uses both on-land methods, such as RCV cars or trained dogs, as well as in-water methods through RCV boats (Preusser et al. 2008). These need to be used in conjunction, as geese will often retreat into water when scared (Preusser et al. 2008).
While this method may be effective, it is labour-intensive and also costly. This method only disperses the geese within 2km, meaning a target relocation site should be selected beforehand (Preusser et al. 2008).

Reproductive control agents are seen as an effective solution for managing population long term (Bynum et al. 2007). One reproductive control agent known as OvoControl G has an average of 36% reduction in the hatchability of eggs (Bynum et al. 2007). There was also a 93% increase in nest sites with 0% hatchability (Bynum et al. 2007). When studying reproductive control agents, it is difficult to measure the number of eggs not laid at all;

however, this is likely to be the main result from using this method (Bynum et al. 2007). There is also the possibility that the biocontrol agents will be consumed by the non-target bird species (Bynum et al. 2007). This has significant implications for New Zealand, as our many native and endemic birds need reproductive support. If this control method is to be implemented in Christchurch, a way to dose the geese without impacting non-target bird species is needed.

Removal or relocation moves geese away from areas facing severe negative impacts to better-suited habitats. This technique provides immediate relief; however, Canada geese have high site fidelity and will try to return to the initial location if possible. Carefully selecting a relocation site is also needed, as geese should not be relocated to an area that will also face severe negative impacts.

Lethal Methods

Lethal methods are used as a primary approach to Canada Goose management worldwide and include egg pricking or oiling, culling, and translocation to hunting areas (Beston et al., 2016; Spurr et al., 2005). These methods are applied in both rural and urban environments to control population growth. In rural settings, Canada Geese threaten the agricultural sector by damaging crops, polluting waterways, and defecating on grazing pastures, with potential risks to livestock health through diseases associated with their droppings. In urban environments, geese contribute to both social and environmental challenges (Spurr et al., 2005). Populations are often perceived negatively by humans, and when left unmanaged, they dominate waterways and the surrounding areas (Gosser et al., 1997). This issue is compounded by hunting restrictions that limit recreational culling within city limits, allowing geese to reproduce with little disturbance (Beston et al., 2016). This is exacerbated in the New Zealand environment where they have no natural predators.

Egg pricking and oiling involves in-nest treatment of the eggs through the roosting season. This method is considered less controversial than culls but requires large amounts of effort. One study suggests that 62% of Canada Goose eggs within urban environments would need to be treated annually to sufficiently control the population (Beston et al., 2016). Although this method is effective, it could potentially be more costly than the current cull method.

Within Christchurch, annual culls conducted by the Christchurch City Council resulted in the removal of 356 geese in 2025 through lethal injection (Gibbs, 2025). The research area is one of the sites where culls are performed. The overall population size within the greater Christchurch area remains unknown, making it difficult to determine the effectiveness of the current cull rate.

Canada Geese are classified under the fifth schedule of New Zealand's Wildlife Act 1953 (Fish&GameNZ, n.d.). A change in classification could enable expanded management efforts by Fish & Game and recreational hunters. Literature suggests that culls are the primary method of management and prove most affective at reducing populations (Beston et al., 2016; Lynch & D'Angelo, 2012; Spurr et al., 2005). Culls affect family cohesion and increase vulnerability to hunting, this suggests that if Canada geese are translocated from the research area to hunting areas, it could be more efficient at population control than the current method (Beston et al., 2016; Lynch & D'Angelo, 2012).

Translocation to areas with higher hunting pressure has been considered a viable option, as moving nuisance geese from urban environments to hunting locations can reduce local populations (Holevinski et al., 2006). This is not without issue, as translocations can be ineffective if there is little hunting pressure at the moved location, often resulting in the same environmental effects moving from location to location (Spurr et al., 2005). Translocation studies in the US and Canada have demonstrated partial success in reducing breeding pairs. Removal of only the female goose achieved an 83% success rate, with recolonization occurring at one of six sites within 27 days. Removal of both members of a pair achieved a 75% success rate, with recolonization at one of four sites within 14 days. In these cases, removed geese were culled and processed for human consumption, resulting in 37 pounds of meat donated (Lynch & D'Angelo, 2012).

Methods:

Observations were conducted over 3 days along a section of the Avon River in New Brighton, Christchurch where Canada geese are frequently observed. The study site is an urban coastal area that includes grasslands and estuarine zones.

Five 30m transect lines were laid out along the river. Three transects were randomly positioned along one side of the river but at similar heights above the waterline. A fourth transect was located lower down on the same bank, closer to the water. The fifth transect was positioned on the opposite side of the river to provide a cross-river comparison. It was noted that the opposite side of the river had a smaller, steeper bank. GPS coordinates were recorded at the beginning and end of each transect to ensure accurate location referencing as seen in Figure 2. To measure the density of goose droppings, a random number generator was used to select ten sampling points along each transect. At each selected meter mark a 1 x 1 meter quadrant was placed, and all visible goose droppings with the quadrant were recorded.

Goose presence was measured visually and through photographs taken at different times each observation day to account for daily movement and feeding patterns. Observation times varying between approximately 1:00pm – 2:00pm on the first day, 2:30pm – 3:00pm on the second and 3:30pm – 4pm on the third. Initially, one observer took photographs using the same mobile camera to maintain consistency in data collection. In later sessions, observers were positioned on both sides of river to reduce the chance of double-counting geese or missing them altogether due to them moving behind the raised bar feature within the river. Geese were also counted in person while the pictures were taken and cross – checked to verify field counts and reduce limitations from mobile camera quality.

Inferential statistics were used to estimate goose dropping density for the entire research area, and to estimate annual droppings production from our population counts. Statistical calculations were completed in Python. Results are reported as point estimates with 95% confidence intervals.

Figure 2. Map of study site showing the location of transects along the Ōtākaro/ Avon River. Three transects were surveyed over consecutive field days. Orange outlines show the approximate study boundary along both riverbanks. Image sourced from Google Earth (2025).

Results

Counts and Estimations

The counts from the photographs give an estimation of the population of Canada geese within the research area, with day one consisting of 53, day two 77, and day three 79 geese. A mean population of the sample was calculated resulting in 70.33 or 70 geese at one given time. Using the photographs and visual estimations it appears that Canada Geese approximately use 10% of the research area, with Swans, ducks and other waterfowl also occupying this area.

Kite Diagrams

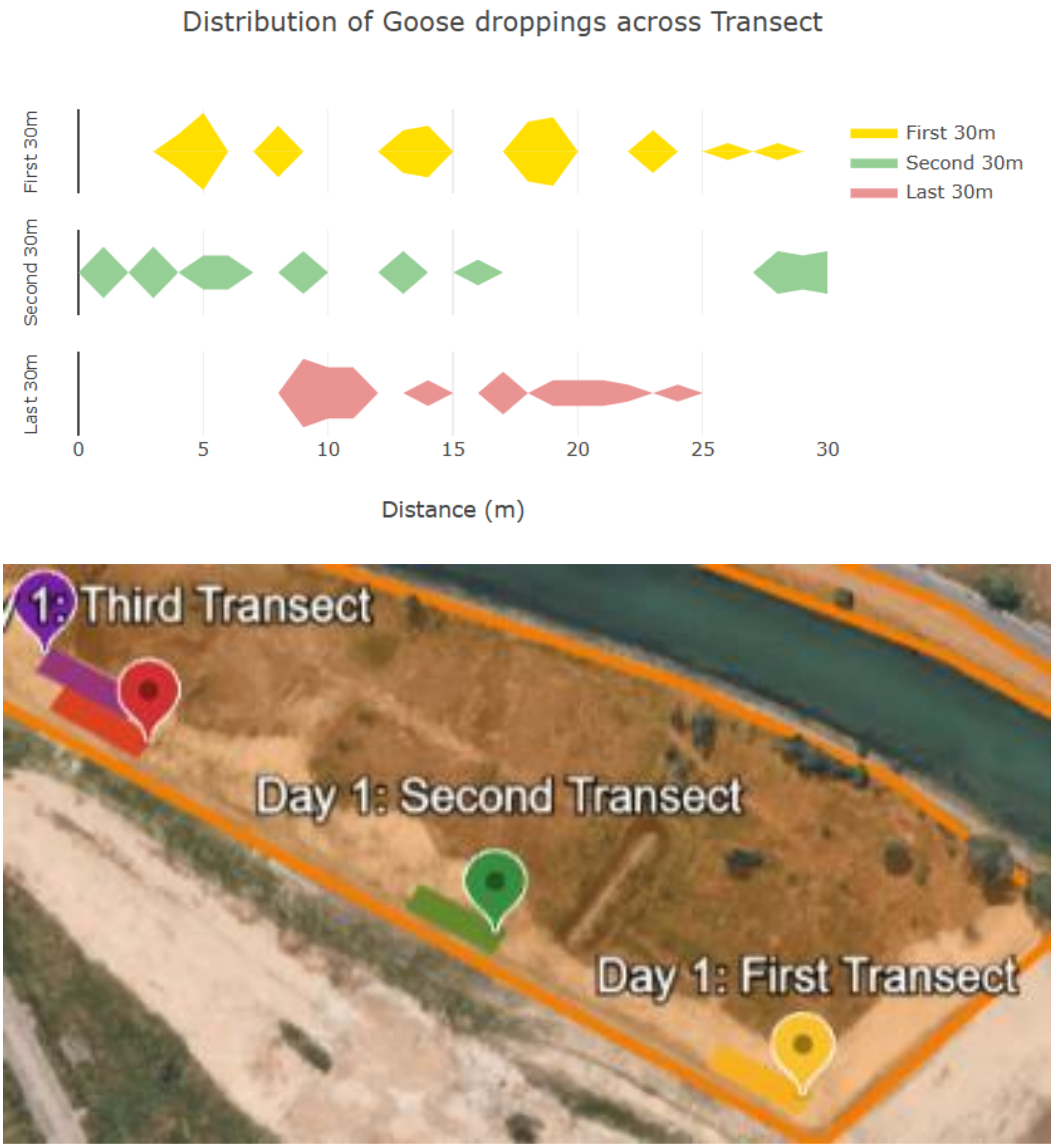

Figure 3. Kite diagram showing transects from day one, with close-up of area shown in figure 2 for cross-referencing.

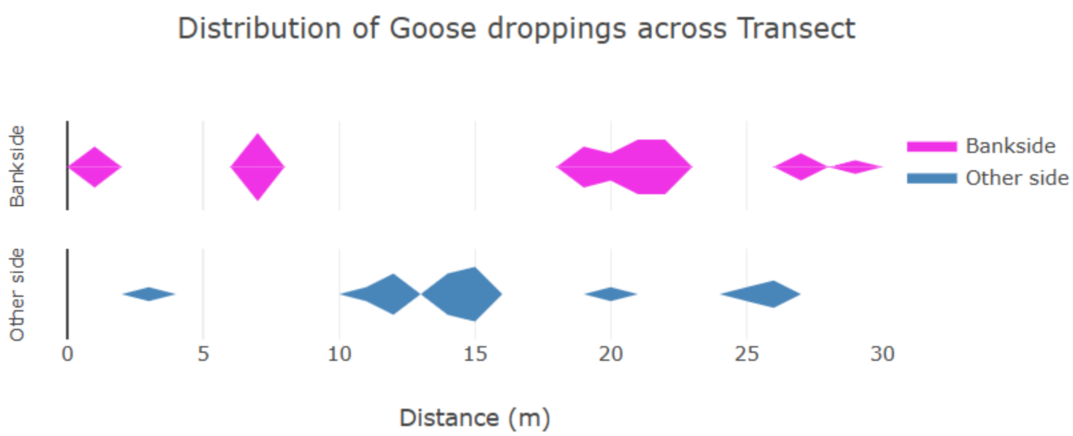

Figure 4. Kite diagram showing transects from day two and three, with close-up of area shown in figure 2 for cross-referencing.

As stated previously, a transect and quadrat method was used to gather data. The results of this were translated into kite diagrams, figures 3 and 4, to better relate the spatial correlation within the transects. Each kite corresponds to a quadrat, with its size illustrating the number of droppings observed.

Figure 3 shows dropping distribution across three consecutive 30-meter segments of a single transect, relative to figure 2, all located within the New Brighton estuary. The diagram reveals a non-uniform pattern of goose activity, with the green segment showing the highest concentration of droppings. This spatial variation suggests localised habitat preferences or behavioural clustering, which is consistent with findings from Rivers and Short (2007), who observed concentrated herbivory due to feeding selectivity.

Figure 4 compares dropping density between two opposing riverbanks by purple (bankside) and blue transects (opposite bank), relative to figure 2. The bankside consistently shows higher dropping counts, indicating a spatial preference for one side of the river. This pattern aligns with field observations and supports the decision to focus sampling efforts on the more active side. It also reflects insights from Radtke and Dieter (2011), who highlighted the importance of spatial tracking in understanding goose foraging behaviour and its ecological consequences.

Figures 3 and 4 both visualise the spatial distribution of goose activity and reinforce the methodological robustness of the sampling strategy. By integrating randomised quadrat placement with repeated transect sampling across varied locations, the study captures both spatial and temporal variability.

Total Quadrants Data Analysis

Table 1. depicts the total sum of area measured and total sum of counts from each quadrant

	Droppings	Area
Transect 1	54	10 x 1m^2
Transect 2	47	10 x 1m^2
Transect 3	41	10 x 1m^2
Transect 4	27	10 x 1m^2
Transect 5	19	10 x 1m^2
Total	188	50m^2

The total Canada geese droppings per quadrat across the 50m^2 of our sample equated to 188 (Table 1). This is significant for the next step of analysis; t This number might have inaccuracies as it was difficult to identify the source of the droppings when degraded droppings were counted.

Droppings Analysis

Table 2. depicts inferred and extrapolated estimates from the sample data with a 95% confidence interval.

Metric	Value
Mean density (droppings/m^2)	3.76
95% CI for density (droppings/m^2)	(3.17, 4.35)
Estimated total droppings	148,378
95% CI for total droppings	(125,098, 171,657)
Adjusted estimate (10% coverage)	14,838
Adjusted 95% CI (10% coverage)	(12,510, 17,166)
Total droppings per year (sample population)	718,772.60
Total wet mass per year (sample population, kg)	352,303,840.00
Total dry mass per year (sample population, kg)	74,135,880.00

Using Google Colab's Python 3 environment, inferential statistical analysis was performed on 188 samples collected from the quadrants across the study area (Table 1). From the total sampled area of 50m^2, a mean density of 3.76 droppings/m^2 was calculated. Extrapolating the density to the research area of 39 km^2, using a 95% confidence level resulted in an estimate between 12,510 and 17,166 with a mean of 14,838 droppings (Table 2). Typically, Canada goose waste physically biodegrades within 30 days leaving no physical trace, however the nutrients enter the soil and sediment where they are placed (Unckless & Makarewicz, 2007). Canada Geese defecate 28 droppings per day (Gosser et al., 1997), applying our sample population mean to this estimation, it was calculated that the sample population would contribute to 718,772.60 droppings per year. The mass of these droppings differs between wet and dry, in its wet form this would equate to 3,996.38 kg, and in its dry form it would equate to 840.96 kg (Unckless & Makarewicz, 2007). Dividing the dropping density from the quadrant sampling area by the number of droppings estimated annually and multiplying that by 365 days resulted in the sample data showing 7.53 days of droppings. The results of the statistical analysis do not include the factor of migratory behaviour and waste being distributed in other local areas such as within water sources, as it is likely that the droppings are not entirely done on land.

Discussion:

With ethical, public and financial concerns in mind, Canada Geese must be sustainably managed. An increase in population will have long term negative effects on local flora and fauna as well as many environmental effects. The sample population alone can provide a large quantity of increased nutrients to sediment and waterbodies (Table 1). If the population growth is left unchecked, then these negative effects will increase and potentially leave irreparable environmental changes to the research area.

The research conducted has limitations as our research only highlights the population we estimated in our research area. Most of the literature provided are overseas examples and are not perfectly applicable to New Zealand. Differences in flora and fauna drastically change how management approaches should be addressed. As New Zealand has many endemic bird species, it is critical that the decision for management embrace kaitiakitanga for our native species. A true population count of Canada geese would be needed to fully understand the ecological effects of Canada geese, as our sample is not a perfect representation of the wider population (Table 3). Densities of Canada Geese will differ site to site and further research is needed to understand the effects in each environment they inhabit.

All literature reviewed on lethal management emphasizes that such methods are financially costly and require significant effort from both government agencies and local communities to provide desired outcomes. However, lethal methods are the most effective solution to over population. In conjunction with the lethal methods provided, non-lethal methods such as habitat modification, deterrents and reproductive control could be used to improve efficiencies. Habitat modification such as movement of pathways and installation of barriers would help with public opinions of Canada Geese, as public interaction with geese and waste would be reduced. Reproductive control would help control the population with less culls being needed, however there is potential risk of non-target native species being affected. Unless this method is managed well, it is unlikely to be a good option in this setting. Deterrents are needed long term and prove costly, as Canada Geese either move to another local area or become adjusted to the deterrents and will eventually return to the research area. It would be challenging and expensive to facilitate these methods to the research area and furthermore, the rest of Christchurch.

If culls are continued as a management option, it is more ethical to make use of the carcass postmortem. As mentioned before, culled meat is donated in overseas examples (Lynch & D'Angelo, 2012). The current cull method could be used as a source of kai. The use of the culled geese to provide food to local markets or community members could prove a more sustainable practice. The current cull method of lethal injection may not be food safe however the carcasses could also be used for fertilizer. More research on this is required to understand the legalities and health procedures needed to be undertaken for this option to be viable.

The research area is located within the redzone (Figure 2) that is semi urban New Brighton, this area provides an environment for the Canada geese that already has little interaction with the residents of New Brighton. The physical assessment of Canada goose droppings in this area showed that limited droppings on the pathways and little disturbance to the public was present during our research. This area should be assessed further to determine whether this environment is currently the best suited are for Canada geese populations. Environmental improvements could be made to this area to better support waterfowl life, as many other species including natives were present in the area. Potentially modifying the current walkway to avoid the riverbank would reduce the impacts geese are having on the public and create a safer space for native species too.

Presenting management options to the public in an easily digestible form could play a critical role in providing the best outcome ethically, financially and environmentally (Table 3). Transparent communication about why they need to be culled, its intended outcomes, other management options available, and environmental benefits to the research area are integral to provide the best solution for the residents of New Brighton.

Table 3. depicts the management options provided within this report with metrics based upon literature sources, estimations, and ethical concerns of public.

Method	Cost	Effectiveness	Ethical	Effort
Environment modification	High	Medium	High	High
Pathway modification	Medium	Medium	High	High
Deterrents	High	Low	Medium	High
Reproductive control	Medium	Medium	Medium	Medium
Translocation	High	Medium	Medium	High
Egg pricking	Low	High	Medium	High
Culls	High	High	Low	Medium

It was estimated during our research that some of the management options would be more financially viable, cost effective, efficient and ethical based upon the information used within the literature. Ethical concerns on when Canada geese are culled are often mentioned, as culls at time of moult are deemed unethical to some members of the public (Spurr et al., 2005). Smith et al., (2000) presents an in-depth evaluation of each caveat to the management methods presented in this report, and states that public opinions and relations are important to the success of management strategies. The limitations on ethical standards set by the readings and by our group are that ethics can be subjective, and there are good arguments for what is or is not ethical. These opinions include literature review and personal opinions.

Conclusion:

In conclusion, our project aimed to understand what impacts Canada geese are having on New Brighton and are there other methods to manage the population than the current culling. This process first began with our literature review, which aimed to give us an overview on what impacts the Canada geese are having on water quality, flora and fauna near their habitats. We then researched population control methods through both lethal and non-lethal means.

This overview of literature then helped us understand what our goal for conducting research will be. We decided on tracking dropping counts as well as population, as that provides information on how many geese there are, and the impacts they are having. Our data collection occurred on three separate instances, where 30m transect lines were drawn and 10 randomly sampled meters were counted. At each data collection instance, the goose population was also counted through photographs.

Once the data was collected it was then processed and displayed into graphs to better convey our findings. These were then analysed to estimate the amount of Canada geese waste within our sample and extrapolated to include the entire research area.

Finally, we accumulated our findings to support the reasoning behind the cost, effectiveness, effort needed to conduct each method, as well as whether the method is ethical. This provides and overview and supplemental findings to help support alternate methods of Canada Goose population control in Christchurch, New Zealand.

To help further support decision making regarding Canada Goose management options in Christchurch, further research should be ongoing. Data collection on public opinion regarding geese droppings, as well as views on ethics and management options for Christchurch should be considered.
Our results should also be discussed among the public to understand varied views regarding ethics, budgeting, and humanity during the management process.

Acknowledgements:

We would like to thank Danette Wereta from the Animal Justice Party Aotearoa for collaborating on this project with us.

We would also like to thank Robert Cruickshank from the University of Canterbury for his supervision and advice during this project. Thank you for all the support and the many off topic insightful conversations.
We would also like to thank Sara Kross for advising us on data collection methodology best suited for our aims.
We would also like to Acknowledge Simon Kingham and Sophie Horton for varied advice and many jokes along the way.

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