



# Wellington Green Gecko Advocacy: Assessing Awareness & Willingness

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**WPI**



# Wellington Green Gecko Advocacy: Assessing Awareness & Willingness

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in cooperation with Wellington Zoo.  
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*This report represents the work of four WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects, please see <http://www.wpi.edu/Academics/Project>*

## **Abstract**

Due to the large proportion of native lizard species currently considered at risk or threatened, Wellington Zoo aimed to better understand public attitudes and awareness regarding the Wellington Green Gecko and New Zealand lizards in general. To assist the zoo, we surveyed the general public and interviewed both herpetological and conservation experts. Through these methods, we determined that the public lacks awareness of native lizards but has a high willingness to engage in conservation regarding geckos. From this data, we developed a public service announcement and a series of recommendations, focused on improving the public's knowledge of native lizards, which Wellington Zoo can implement to foster gecko conservation in Wellington.

## Executive summary

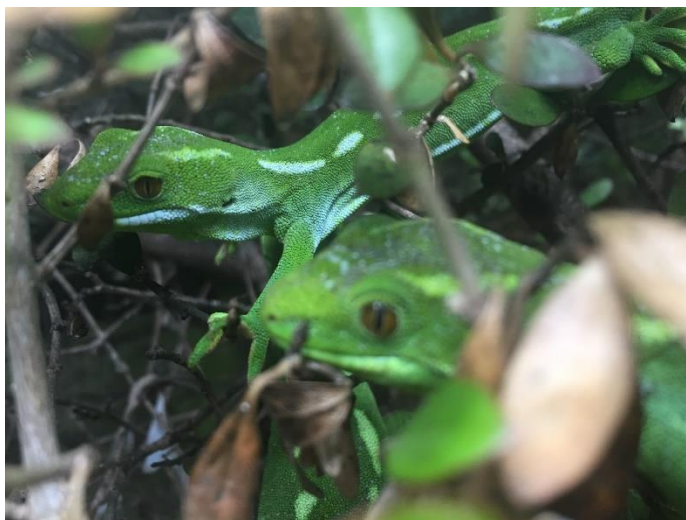


Figure A: The Wellington Green Gecko (Doty, 2017)

The Wellington Green Gecko (shown in Figure A), *Naultinus Elegans Punctatus*, is a medium sized lizard that can measure up to approximately 200 mm in length and can be identified by its bright green back, white or yellow spots along its dorsal region and a vivid blue mouth lining (Manaaki Whenua Landcare Research, n.d.). When provoked the gecko displays aggressive behavior and is known to bark, hence its recent renaming as the Barking Gecko (New Zealand Herpetological Society Inc., 2011). As a small lizard, the Wellington Green Gecko is susceptible to predation by and competition with various invasive species such as mice and rats. Habitat loss due to urbanization, agricultural development and wildfires have had an adverse impact on the green gecko population.

General conservation goals for the Wellington Green Gecko have been laid out in the Department of Conservation's *Lizard Action Plan for Poneke Area, Wellington Conservancy 2009-2014* and the Wellington Regional Lizard Network's (WRLN) *Lizard strategy for the Wellington region 2012-20*. The Wellington Regional Lizard Network is a group of agencies and organizations that have been working on gecko conservation for several years. The WRLN's and DOC's primary goals include educating communities on lizard habitat enhancement in gardens, and recording all lizard sightings on DOC's Herpetofauna Database (Adams, 2009).

Wellington Zoo has played a major role in conservation efforts in New Zealand. In addition to being the nation's oldest zoo, Wellington Zoo is the city's oldest conservation organization, having been established in 1906 (Wellington Zoo, n.d.). A big component in the organization's work centers on spreading awareness of conservation efforts. In an effort to gauge this awareness level and to educate the public, Wellington Zoo has targeted the Wellington Green Gecko in a public outreach campaign. The zoo aims to eventually extend this campaign to encompass all New Zealand geckos.

Figure B lays out the framework for our project. We surveyed the public to assess public awareness and willingness to engage in conservation efforts. We also reviewed existing programs and interviewed experts to identify gaps in current public-involved conservation plans and innovative approaches for future public outreach projects.



*Figure B: Research objectives and approach*

### **Results and Discussion:**

We obtained 165 general public survey responses from seven different locations throughout the Wellington region and 69 gardener-specific survey responses, not all of which were fully completed. Additionally, we interviewed 10 experts involved in conservation and gecko research.

The results from our survey generally showed that a majority of the public lacks awareness of not only the Wellington Green Gecko specifically but also lizards in general. As we expected, 82% of the respondents to our survey had never heard of the Wellington Green Gecko. Among respondents from Wellington, 20% had heard of the Wellington Green Gecko. Interestingly, 50% of respondents aged 60 or above had heard of the Wellington Green Gecko while 17% of respondents age 45 to 59 and 17% of respondents age 30 to 44 had heard of it. Only 7% of respondents aged 18 to 29 had ever heard of the species.

While many respondents had seen lizards, 72% of respondents said they knew the names of native lizards and 28% did not know the names of any native lizards. Of the participants that claimed to know the names of native lizards, 63% of the respondents named the tuatara which is



not a lizard. Only one person named the Wellington Green Gecko unprompted. It is good to note that the tuatara might easily be mistaken for a lizard but in fact is listed under the Rhynchocephalia order.

We asked what words came to mind when the respondents thought of geckos, and the answers ranged from cute to creepy. We used the word clouds below to show these responses as well as participant's perceptions of the risks that lizards face in New Zealand. The most commonly named threats were cats, stoats, and humans. The words are scaled by the frequency with which they appear in responses. The larger the word, the more respondents said it.



Figure C: Responses to ‘What words come to mind when you think of geckos?’ (Left) and ‘What do you think are some of the threats native lizards face?’ (Right)

Twenty-seven percent of respondents said they would be very interested in helping save New Zealand’s geckos. Thirty-three percent said they were interested, 30% were neutral, 9% were uninterested and 1% said they were not interested at all. We then asked respondents who answered neutral, interested or very interested what they would be willing to do out of the list we provided. Eighty-four percent of respondents said they were willing to report lizard sightings, 84% were willing to donate money or sign a petition, 71% were willing to maintain a lizard friendly section of their garden or yard, 58% were willing to set up or support predator pest control and 2% were not willing to do anything. Figure D below details this distribution.

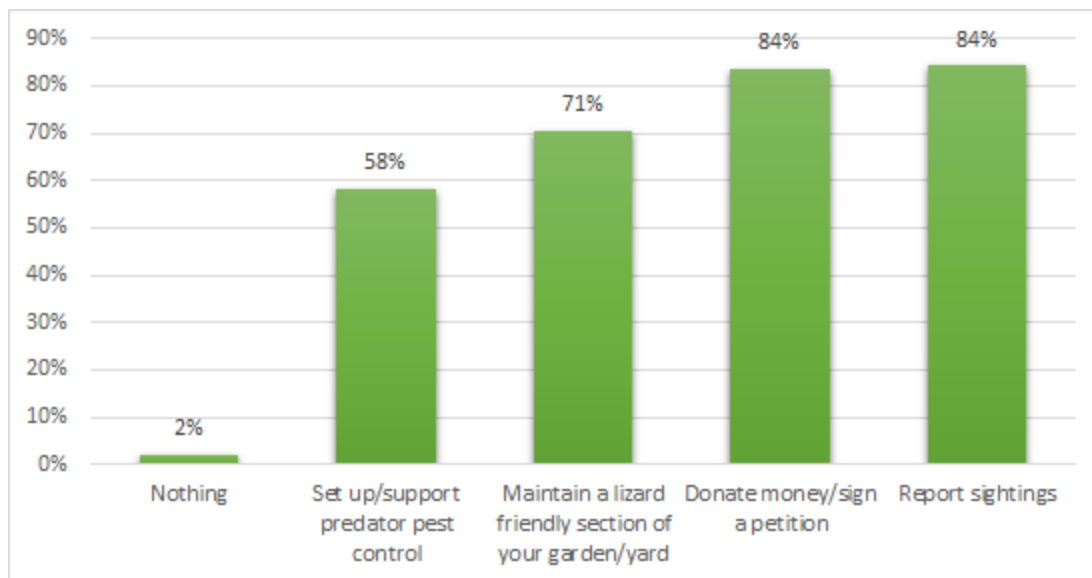


Figure D: What would you be willing to try in order to help the Wellington Green Gecko? (n = 146)

The gardener survey asked respondents if they would enjoy seeing geckos in their garden. Ninety-eight percent of the respondents replied yes, while 2% replied no. As a follow up to that question, we asked if gardeners would be keen to make their gardens more gecko friendly to which 94% of people responded yes and 6% responded no.

We asked interview subjects to consider one thing that they believe the community should do to save lizards and why they believe it would be effective. In response, multiple experts mentioned pest control or setting up traps to control non-native predator populations. Gecko conservation experts emphasized that close personal exposure to lizards can lead to greater feelings of appreciation and connectedness among members of the public. Without such connections it is likely the public would not notice if gecko populations were thriving and failing. Thus, effective public outreach efforts must strive to make these kinds of personal connections.

We determined that spreading awareness of native geckos and their conservation should take priority over raising public interest to aid in native gecko conservation. Participants seemed to already have a positive valuation of geckos as part of native biodiversity, and many appeared to have some willingness to aid in their conservation. Few respondents described geckos negatively, and the overwhelming majority described them charismatically. The primary issue with gecko conservation appears to be that few members of the general public have detailed knowledge of their biodiversity, their current ecological status, or the conservation efforts aimed at them. Wellington Zoo can therefore aim to target its campaign at spreading awareness of geckos and their conservation, as well as supporting simple, effective means for the public to become involved in gecko conservation.

### **Recommendations:**

Through the results of our project we created the following list of recommendations for Wellington Zoo in order to engage the public in gecko conservation. As DOC and WRLN already have a long list of ongoing and planned strategies involving the general public, we focused our recommendations on filling any gaps left by these plans as well as adapting some of these strategies to what the zoo in particular could do. Accordingly, we recommend that the zoo

continues to work in close collaboration with DOC and WRLN; more specifically we suggest the implementation of the following within the zoo itself:

1. Continue to survey the Wellington region to help obtain stronger, more accurate data, aim to target suburban areas and strive to better understand the Māori perspective of native lizards
2. Devote a section of the Wellington Zoo website to native gecko conservation work
3. Create an informative pamphlet including images and descriptions for each of the Wellington region's seven species of geckos, along with general information about the conservation status of New Zealand's geckos
4. Establish a zoo talk time for native lizards
5. Organize a native gecko close encounter program
6. Establish a native lizard exhibit including lizard cages, informative signs, and an example of a lizard friendly garden. Creation of an exhibit would open the opportunity to hold a naming poll for the lizards.
7. Host school programs with the specific aim of connecting and educating children from around the region with native lizard species
8. Increase gecko related merchandise in the Wellington Zoo gift shop

Our research and data collection also pointed to multiple recommendations that could be implemented throughout the entire Wellington region. These efforts could be initiated by Wellington Zoo, but would require the cooperation of the WRLN and other agencies.

1. Advertise a public service announcement about creating lizard friendly sections of their garden and yards
2. Advocate for the design of a mobile application and pocket sized notebook to replace the current ARDS cards
3. Support the development a children's book and educational television program about New Zealand reptiles, similar to those created by Eyewitness Books
4. Support the filming of a New Zealand lizard documentary



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## Authorship

The following report was written and edited by all members of the team. This authorship table shows which members of the team took the lead for each section of the report. The entire team then edited and revised each section to ensure the highest quality work.

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<b>Chapter 2: Background Research</b>	
2.1 The Wellington Green Gecko	Michael Eaton
2.2 Threats Facing the Wellington Green Gecko	Derrick Naugler
2.3 Public Attitudes and Opinions	Calvin Chen/Derrick Naugler
2.4 Actionable Plans and Challenges	All
2.5 Relevant Case Studies	Calvin Chen/James Doty/Derrick Naugler
2.6 Summary	All
<b>Chapter 3: Methodology</b>	
3.1 Gauging public awareness and willingness to engage in conservation of the Wellington Green Gecko	All
3.2 Identify Feasible directions for community driven involvement	Calvin Chen/James Doty/Michael Eaton
<b>Chapter 4: Results and Discussion</b>	
4.1 Results	Derrick Naugler
4.2 Discussion	Calvin Chen/James Doty
<b>Chapter 5: Recommendations and Conclusion</b>	
5.1 Recommendations	Calvin Chen/James Doty
5.2 Conclusion	Michael Eaton

## Table of contents

Abstract.....	i
Executive summary.....	ii
Acknowledgements .....	vii
Authorship.....	viii
Table of contents .....	ix
Table of figures.....	x
Table of tables .....	xi
<b>1 Introduction.....</b>	<b>1</b>
<b>2 Literature review .....</b>	<b>3</b>
2.1 The Wellington Green Gecko.....	3
2.2 Threats facing the Wellington Green Gecko .....	5
2.3 Public attitudes and opinions .....	6
2.4 Actionable plans and challenges .....	7
2.5 Relevant case studies in animal conservation:.....	11
<b>3 Methodology .....</b>	<b>15</b>
3.1 Gauging public awareness, and willingness to engage in conservation of the Wellington Green Gecko .....	15
3.2 Identify feasible directions for future community involvement.....	20
<b>4 Results and discussion .....</b>	<b>23</b>
4.1 Results .....	23
4.2 Discussion.....	42
<b>5 Recommendations and conclusion.....</b>	<b>46</b>
5.1 Recommendations .....	46
5.2 Conclusion .....	55
<b>Bibliography .....</b>	<b>56</b>
<b>Appendix A: Survey for general public .....</b>	<b>60</b>
<b>Appendix B: Survey for gardeners.....</b>	<b>66</b>
<b>Appendix C: Interview for experts.....</b>	<b>73</b>
<b>Appendix D: Summary of cases used in section 2.6 .....</b>	<b>74</b>
<b>Appendix E: Gecko pamphlet.....</b>	<b>77</b>
<b>Appendix F: ARDS application .....</b>	<b>79</b>

## Table of figures

Figure 2.1: The Wellington Green Gecko .....	3
Figure 2.2: English (left) and Te Reo Māori (right) versions of Go, Green Gecko! .....	6
Figure 2.3: DOC Amphibian and Reptile Distribution Scheme card .....	8
Figure 3.1: Wellington Zoo map and talk times .....	18
Figure 4.1: What native New Zealand lizards do you know? (n = 119) .....	24
Figure 4.2: What words come to mind when you think of geckos?.....	25
Figure 4.3: What do you think are some of the threats native lizards face? .....	26
Figure 4.4: Rank this statement: conserving native ____ is worth investing funds, time and resources. (n = 165) .....	27
Figure 4.5: What would you be willing to try in order to help the Wellington Green Gecko? (n = 146)...	28
Figure 4.6: Involvement in conservation vs. willingness to help (n = 165).....	29
Figure 4.7: Age vs. willingness to help. (n = 146).....	29
Figure 4.8: What words come to mind when you think of geckos?.....	31
Figure 4.9: Rank this statement: conserving native lizards is worth investing funds, time and resources. (n = 56) .....	32
Figure 4.10: Rank this statement: conserving native birds is worth investing funds, time and resources. (n = 56) .....	32
Figure 4.11: Native plants vs lizard sightings (n = 29).....	34
Figure 4.12: Garden features vs. frequency of lizard sightings. (n = 29).....	35
Figure 4.13: How frequently have you seen them? (n = 29).....	36
Figure 4.14: Dennis Keall’s native lizard enclosures .....	38
Figure 4.15: One of our team members establishing a connection with one of Wellington Zoo’s Auckland Green Geckos .....	39
Figure 5.1: Regional gecko pamphlet – displaying the cover, general native gecko information, and how to help sections.....	48
Figure 5.2: ARDS application mock-up .....	52

## Table of tables

Table 3.1: List of interviewed experts .....	21
Table 4.1: What would you be keen to do to make your garden gecko friendly? (n = 50).....	33
Table 4.2: DOC strategies for lizard conservation.....	41
Table 4.3: WRLN strategies for lizard conservation .....	41

# 1 Introduction

Birds, tuatara, skinks, and geckos dominated the evolutionary history of New Zealand, but these native species came under attack with the introduction of foreign predators (Craig, Anderson, Clout, Creese, Mitchell, Ogden, & Ussher, 2000). Invasive mammals combined with ongoing habitat loss have put one of the world's unique and diverse fauna populations in danger (Hitchmough, Adams, Reardon, & Monks, 2016). New Zealand has taken numerous steps in recent years to protect indigenous species of flora and fauna and maintain biodiversity. These measures include protecting over 30% of the country's natural habitat through the creation of reserves and preservation laws, as well as through the implementation of successful single species recovery programs (Craig et al, 2000).

Wellington Zoo has played a major role in conservation efforts in New Zealand. In addition to being the nation's oldest zoo, Wellington Zoo is the city's oldest conservation organization, having been established in 1906. The zoo works carefully to preserve the nation's flora and fauna, including assisting with restoring at-risk native species (Wellington Zoo, n.d.). A big component in the organization's work centers on spreading awareness of conservation efforts.

While public awareness to certain endangered species is high, awareness of at-risk and endangered indigenous geckos is relatively limited. Wellington Zoo, in an effort to gauge this awareness level and to educate the public, has targeted the Wellington Green Gecko in a public outreach campaign. The zoo aims to eventually extend this campaign to encompass all New Zealand geckos. The Wellington Green Gecko, *Naultinus Elegans Punctatus*, is a lizard indigenous to the region that can be uniquely identified by its lime green skin, white or yellow spotted back, and blue mouth. The green gecko is increasingly at risk of being placed on the endangered species list. In 2012, the New Zealand Department of Conservation (DOC) estimated that the green gecko population could fall by as much as 70% in the coming years (Wellington Green Gecko, n.d.). Efforts to protect this lizard species are hampered by its excellent camouflage and nocturnal habits, which make tracking and monitoring population numbers and species' vitality more difficult.

New Zealand is known as a nation with many ongoing conservation efforts, but the public may lack awareness of certain at-risk species like the gecko. While there has been a push



for the support of native New Zealand flora and fauna from the Department of Conservation and various NGO's, recent efforts have largely focused on removing non-indigenous species. Public debates about household cats and their impact on native bird populations have captured media attention, while less noticeable indigenous species such as the gecko remain 'under the radar.' As the Wellington Green Gecko has an important role in the reproduction cycle of many plant species, the adverse effects of losing this lizard could ripple through the rest of the ecosystem.

Wellington Zoo is strengthening its connection with regional residents to advance awareness and conservation strategies. This project assisted Wellington Zoo in its efforts to conserve the Wellington Green Gecko. The team gauged public awareness of the gecko and its environmental status. We also determined Wellingtonians' willingness to aid in gecko conservation efforts. This information was used to identify viable directions for Wellington Zoo's future efforts to spread awareness and engage the public in native lizard conservation. We hope the recommendations we provided for the zoo will inspire residents to act on behalf of gecko populations.

## 2 Literature review

The goal of this chapter is to summarize our preliminary research of the Wellington Green Gecko and its environment, and to identify known challenges to the conservation of the gecko. We began by studying the Wellington Green Gecko, and identified some key causes linked to its population decline. We then delved into Wellington Zoo's background and current mission. We also described the other organizations and agencies involved in gecko conservation, as well as other groups that are critical in the conservation movement's success. Finally, we outlined conservation efforts referencing gecko-specific efforts and cases with similar goals to that of our project.

### 2.1 The Wellington Green Gecko

The Wellington Green Gecko, *Naultinus Elegans Punctatus*, is one of nine species of lizards that reside in the Wellington region of New Zealand (WWF, n.d.). The green gecko is a medium sized lizard that can measure up to approximately 200 mm in length (Manaaki Whenua Landcare Research, n.d.). Being a member of the Naultinus genus of geckos, the Wellington Green Gecko is characterized by its bright green back, as shown below in Figure 2.1. In addition, the gecko possesses white or yellow spots along its dorsal region and a vivid blue mouth lining that is unique to the species (Wellington Green Gecko, n.d.). Yellow coloration on its soles and toes also distinguish the green gecko from other Naultinus species (Manaaki Whenua Landcare Research, n.d.).



Figure 2.1: The Wellington Green Gecko (Morrison, 2016)

Solely found in the southern region of New Zealand's North Island, the Wellington Green Gecko is arboreal, meaning that they spend a majority of their life in forest canopies. They can be found in kanuka and manuka forests throughout the Wellington region (Manaaki Whenua Landcare Research, n.d.). Green geckos utilize setae, hair like structures on their toe pads, and a flexible tail to grip onto various surfaces, allowing them to scale through the forest effortlessly (Wellington Green Gecko, n.d.). The gecko exhibits both nocturnal and diurnal habits. It sunbathes during the day and hunts at night for moths and flies using its tongue. The gecko employs a hunting strategy of sitting in the same spot each night waiting for prey to come within range (Wellington Green Gecko, n.d.). When provoked the gecko displays aggressive behavior and is known to bark, hence the nickname barking gecko (New Zealand Herpetological Society Inc., 2011).

As a whole, New Zealand geckos display distinct characteristics that distinguish them from the rest of the world's gecko species. For example, most gecko species do not exist in climate zones as temperate as those found in New Zealand. The New Zealand geckos, including the Wellington Green, are all known to give birth to live young, a trait exhibited by only one other gecko species outside of New Zealand (Hitchmough, 1997). Hitchmough also states in his *A Systematic Revision of the New Zealand Gekkonidae* that New Zealand geckos generally have atypically bright colors.

Geckos in New Zealand face various ecological pressures (discussed in the next section) causing most species to be classified as at-risk or threatened. The Department of Conservation (DOC) lists the Wellington Green Gecko as one of 49 at-risk species of native lizards. A further 32 species are listed as threatened, and 12 are considered to be not-threatened (Anderson et al, 2013). Unfortunately, poor population data has hampered the classification process (discussed in section 2.4).

According to DOC, geckos in general are important pollinators and seed dispersers for native plants (Skinks and Geckos, 2006). As omnivores, Wellington Green Geckos consume insects as well as plant matter. They can disperse seeds up to 20 meters and carry pollen upwards of 50 meters away from the parent plant (Chapple, 2016). In some locations the geckos provide the primary means of seed dispersal and pollination. During flower blooms, the density of geckos per area of flowering plants can reach five to eight geckos per meter squared (Whitaker, 2011).

Due to the low numbers of many gecko species, their pollination of plants can only be effectively measured on remote, pest free islands (Olesen & Valido, 2003).

## **2.2 Threats facing the Wellington Green Gecko**

As a small lizard, the Wellington Green Gecko is susceptible to predation by and competition with various invasive species. Non-native species such as mice, cats, and weasels have decimated gecko populations in the Wellington area and have caused the localized extinction of native species such as the Northland Skink and Kawekaweau (WWF, n.d.). The green gecko populations have also suffered decline due to competition with introduced animals, predominantly the non-native Rainbow Skink, and Argentine Ant, and both common and German wasps. Originally from Australia, the Rainbow Skink has spread throughout New Zealand via accidental transportation and has overtaken some native lizard habitats (Adams, 2009). The Argentine Ant, originally from South America, is an extremely invasive and aggressive ant. The immense number of ants in New Zealand, particularly in the Wellington region, have been known to compete with Wellington Green Geckos for food, and there have even been reported cases of ants killing small native animals (Adams, 2009). Wasp populations have dramatically since introduction in the 20th century, and affect lizard populations by consuming large quantities of honeydew and native insects. General effects of wasp populations have been well documented, however the exact impact on native lizards species remains relatively unknown (R. Hitchmough, personal communication, February 20, 2017).

Habitat loss has also had a major adverse impact on the green gecko population. Agricultural development has led to the clearing of “indigenous forests from the North Island lowlands [which] has led to the extinction of many local lizard populations” (Skinks and Geckos, 2006). Wildfires are another source of habitat destruction that threatens the green gecko, as fires can destroy many resources that the gecko relies on to survive (WWF, n.d.). Humans are the most frequent known culprits for starting these fires, most often for agricultural, land-clearing purposes (Anderson, 2008). Urbanization also adversely impacts the gecko’s habitat and populations. As humans clear native vegetation to make way for infrastructure, the Wellington Green Gecko is forced to adapt to its new environment and can now be found in Wellingtonians’ gardens and urban areas. (Prosser, Hudson, & Thompson, 2006). Fortunately, most New Zealand lizards can adapt to these new conditions. Habitat loss certainly does not benefit green geckos; however, according to local captive breeder Dennis Keall, they should have little trouble

persisting in the region due to the habitat loss caused by urbanization. Unfortunately, the pests that thrive in urban settings, like mice and rats, pose the primary threat to the gecko's well-being (D. Keall, personal communication, February 14, 2017).

### 2.3 Public attitudes and opinions

The general public opinion of geckos in New Zealand has been poorly documented. Although 39 species of gecko live in New Zealand, only 50% of these species have been formally documented by DOC (New Zealand Department of Conservation, n.d.). However, the public has recently shown an increased interest in the well-being of geckos. Gecko conservation originally addressed the handling of geckos but has adapted over time. Since the early 1990's, New Zealand has moved beyond the conservation tactic of relying on laws and instead started to target the issues relating to declining gecko populations (Towns, Daugherty, & Cree, 2001). Images of both the Wellington Green Gecko and geckos in general have recently appeared in New Zealand literature, advertisements, and logos. For example the green gecko has appeared in DOC newsletters, ZEALANDIA advertisements, and the Wellington Walks brochure put out by DOC and Wellington City Council. The gecko appears also in the company logo of Gecko Press, a children's book publisher based in Wellington and founded in 2005 (Gecko Press, n.d.). In 2015, a children's book titled *Go Green Gecko!* was published that describes the green gecko in its natural habitat. The English and Te Reo Māori book covers shown in the Figure 2.2 below.



Figure 2.2: English (left) and Te Reo Māori (right) versions of *Go, Green Gecko!* (Anne, 2015)

Lending further importance, geckos have a spiritual significance in Māori culture, despite carrying a dark image. Some Māori believe that lizards represent Whiro, the god of darkness and death, and are wardens of the underworld (New Zealand Department of Conservation, n.d.).

Geckos and lizards in general are viewed as guardians of not only Miru, the ruler of the underworld, but also of important Māori locations. It is common to see geckos released near burial grounds and important buildings as protection. Along with being guardians, lizards are viewed as caretakers. The Department of Conservation describes lizards in Māori culture as recognized “social mechanism[s] of restriction in that they indicate a need for caution, or convey messages of warning. Traits of the gecko, such as its bark, are viewed as a harbinger of bad news or events to come” (New Zealand Department of Conservation, n.d., p.1). Other than Māori views on geckos and lizards in general, there are very few documented preconceptions regarding the Wellington Green Gecko.

## **2.4 Actionable plans and challenges**

Bringing people to act together in the form of actionable plans has been a challenge in lizard conservation. The Wildlife Act of 1953 established the varying degrees of protection for different animal species in New Zealand. The act protects all defined native species of gecko. The population decline of many New Zealand gecko species has spurred agencies in the nation, such as DOC, to take preventative actions to combat this trend. These efforts have had mixed results thus far, however, many problems stand in the way of a wholly successful conservation effort (Russell, Innes, Brown & Byrom, 2015).

Current efforts to conserve gecko species in New Zealand range in scope and type. The ongoing efforts to aid the Wellington Green Gecko population align with general efforts in the greater Wellington region to conserve lizard species. Different types of conservation work have been given varying degrees of priority by DOC. Altogether, conservation efforts by the agency can be classified into three categories: survey, management, and research (Adams, 2009). Surveys have determined the distribution and diversity of a species within a specified geographic area. Management efforts elevate the conservation status of a species at risk, or maintain the status of species not currently at risk. These efforts may include introducing new populations, or enhancing habitats. Research includes examining threats to species and determining effective and low-cost management solutions (Adams, 2009).

General conservation goals have been laid out in the Department of Conservation’s *Lizard Action Plan for Poneke Area, Wellington Conservancy 2009-2014* and the Wellington Regional Lizard Network’s (WRLN) *Lizard strategy for the Wellington region 2012-20*. The Poneke Area encompasses the southeast portion of New Zealand’s North Island, including the



Wellington region. The Wellington Regional Lizard Network is a group comprised of many agencies and organizations that have been working on gecko conservation for several years. Overall, the two groups' goals have a lot of overlap and share a similar goals for the region. The primary goals for Wellington City include educating communities on lizard habitat enhancement in gardens, and recording all lizard sightings on DOC's Herpetofauna Database (Adams, 2009). The first goal clearly aims to include collaboration with the general public. The latter goal also looks to the public for aid as DOC asks anyone able to accurately identify lizards to report them and fill out an Amphibian and Reptile Distribution Scheme (ARDS) card, shown in Figure 2.3. This system allows DOC to gain a stronger understanding of both the diversity and distribution of lizard species throughout New Zealand. To promote peoples' involvement in reporting lizard sightings, WRLN aims to develop a lizard guide for the Wellington Region (Romjin, Adams, & Hitchmough, 2012).

Card:	NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME Department of Conservation, PO Box 10420, Wellington				Code:
Observer	Ima R.	SAMPLE	Date: 17/7/85	Locality Name:	
	Initials	Surname	Alt. (M) 1700(ft)	The Crater, Taieri Ridge Central Otago	
Address:	77 Constance Terrace Ilam Christchurch				
Affiliation:	NZHS	Series	Number	Grid	Reference
		0 0 1	1 4 5	3 9 2 9	3 2 3 1
Species Name	No.	Time	Habitat	Weather	Major Habitat Types
1 L. grande	2	1405	15/08 g,d	Light	1 Beech forest
2 L. otagense				1 Fine/sunny	2 Podocarp forest
3 "otagense"	1	1415	15/08 f	2 Part cloudy	3 Broadleaf forest
4				3 Overcast	4 Exotic forest
5				4 Showers	5 Scrub
				5 Rain	6 Sub-alpine
				Temperature	7 Alpine
				1 Hot	8 Undeveloped tussockland
Voucher specimen/photograph	Yes/No			2 Warm	9 Developed farmland
Extra notes on reverse side	Yes/No			3 Moderate	10 River terrace
				4 Cool	11 Fresh water
				5 Cold	12 Wet land
Identified by:	I. Expert			Wind	13 Coastal
Authority used:	A.N. Other (1986)			1 Calm	14 Suree
				2 Light breeze	15 Bare rocks
				3 Mod breeze	16 Beach
				4 Gusty	17 Urban
				5 Strong winds	18
					19
					Micro habitats
					A Foliage
					B Trunk
					C Branches
					D Under stones
					E Under wood
					F Open ground
					G Crevices
					H

Figure 2.3: DOC Amphibian and Reptile Distribution Scheme card (Pickard & Towns, 1988)

DOC and WRLN have also established several goals in their respective *Lizard Action Plan* and *Lizard strategy* for lizard conservation on Wellington Harbour Islands, specifically for Maiti/Somes Island. One high priority goal would be to continue translocation, or the transfer of species, of green geckos, among other species, onto the island and affirm that a stable population has been established. DOC established disease screening of all translocated geckos as high

priority, with the intention of facilitating a healthy population on the island (Adams, 2009). Additionally, DOC has tried to gather more survey data via outreach to the public. This has primarily included asking the public to report any Wellington Green Gecko sightings on websites such as naturewatch.org.nz. All of the general goals to conserve lizard species outlined above apply directly to the green gecko.

ZEALANDIA has also contributed to the green gecko conservation effort through public education and habitat protection. The main entrance to the sanctuary contains a display box with juvenile Wellington Green Geckos. ZEALANDIA uses this box to show visitors what green geckos look like, so that visitors might better be able to identify them in the wild. Beyond this, ZEALANDIA has implemented a 50 year plan to raise the Wellington Green Gecko population within the walls of the sanctuary (Lynch, 2016). In the past, ZEALANDIA has successfully translocated multiple reptile species into the sanctuary, including Tuatara and Ngahere geckos. Especially with the recent eradication of “mammalian pests (except for mice),” ZEALANDIA has seen an increase in growth rate of translocated reptile populations that they hope to extend to the Wellington Green Gecko (Ledington, 2016).

Limited public awareness about the green gecko and its need for protection has led Wellington Zoo to get involved. Wellington Zoo is a not-for-profit organization with a dream to “ignite a zoo revolution” (Wellington Zoo, n.d.). It maximizes visitors’ connections with animals while simultaneously involving them in creative and exciting message-driven experiences. The zoo is an innovator in sustainable practices, including becoming the world’s first carboNZero certified zoo. The organization is a leader in both animal care at the zoo and with research projects aimed towards saving animals in the wild. Some previous conservation efforts include the Grand and Otago Skink Recovery Plan, the Kākā Breed for Restoration Program and the Kea Conservation Trust. On a global scale, Wellington Zoo takes part in Cheetah Outreach, Free the Bears Asia, and Jane Goodall Institute USA-Africa Programs (Wellington Zoo, n.d.). Through all of its actions and messages, Wellington Zoo hopes to inspire community involvement in conservation efforts, such as the efforts involving the Wellington Green Gecko.

The zoo conducted previous research to assess visitor awareness of ongoing projects and visitor experience at the zoo. For example, Wellington Zoo hired Ben Parsons & Associates to gather data on visitor awareness of ongoing developments and campaigns at the zoo (Parsons, 2012). They repeated the survey the following year to determine the effect of changing

campaigns and advertisements around the zoo over time (Parsons, 2013). Ben Parsons & Associates were previously hired by the zoo in 2011 to conduct research on visitor use and opinions of the recently opened animal hospital and center for native wildlife. The Nest Te Kōhanga aims to engage visitors as well as educate them at the same time (Parsons, 2011).

Wellington Zoo is taking the initiative in their long-term gecko conservation project to increase their involvement in the WRLN. Wellington Zoo aims to take on an active role in engaging the Wellington public in gecko conservation. Public participation in this conservation project could benefit not only the population of Wellington Green Geckos, but also the larger ecosystem. As a native species, the green geckos play an important role in maintaining the delicate biome in the Wellington region.

The work initiated and proposed to conserve the green gecko ranges from these efforts to research new viable conservation methods, to management efforts such as translocation. The public plays a large role in these ongoing efforts, both for management and surveying of current populations. As noted by the Department of Conservation, “Protection measures for lizard populations, therefore, depend on human activity and attitude, as well as the usual ecological issues such as introduced predators and habitat modification” (Adams, 2009, p. 1).

The steps being taken to aid green gecko conservation vary, and rely on work from both herpetological professionals and the general public. While actions are being taken to aid the conservation of the green gecko, many challenges block the path ahead to a successful conservation movement. These vary from introduced threats, difficulty in assessing population dynamics, and uncertainty in public support levels. These include predation and competition from non-native species (Adams, 2009). Fortunately, momentum has been growing behind the Predator-Free New Zealand campaign. The Predator-Free New Zealand campaign aims to eradicate predators from the two largest offshore islands in the country, create mammal-free mainland peninsulas, establish large eco-sanctuaries, and carry out many small scale eradications that together will have a lasting effect (Russell et al, 2015). Many preserves have already been established in which a large proportion of non-native species have been removed. However, these efforts are very difficult to coordinate across jurisdictions and are often haphazardly located. There is also difficulty in understanding the dispersal and reinvasion behaviors of the target species (Russell et al, 2015). The large degree of public support for conservation

movements, especially for those involving non-native species' removal, represents a positive sign for facing this challenge to gecko conservation.

A major difficulty facing gecko conservation work is that of tracking individual specimens to determine population size and distribution because of the geckos' excellent camouflage. For example, despite ZEALANDIA's belief that Wellington Green Geckos should exist within the walls of the sanctuary, no sightings have been recorded in 20 years (Lynch, 2016). Despite a variety of monitoring techniques, there are few, "effective or efficient methods for monitoring arboreal forest lizards in areas with low lizard densities" (Bell, 2009, p. 415). Research continues to develop a suitable technique to monitor these lizards that is both cheap and effective. Bell's method of using a closed-cell foam sheets shows promise, but no technique yet stands out. The difficulty in spotting the New Zealand geckos led Rod Hitchmough, a leading expert on the species, to state in his 1997 thesis at Victoria University of Wellington, that "despite having attracted considerable attention in the last 2 decades, lizards remain the least-known and most systematically uncertain group in New Zealand's terrestrial vertebrate fauna"(Hitchmough, 1997, p. 5). Fortunately, the public can be an invaluable resource in facing this challenge.

As we noted, current conservation measures include asking the public to report gecko sightings. Twenty years ago, Hitchmough inferred that, "[i]dentification of species and of important patterns of variation within species is of vital importance in conserving this increasingly threatened group in a period of limited resources" (Hitchmough, 1997, p. 5). More must be learned about the New Zealand gecko species in order to better protect them. To accomplish this, the New Zealand public may prove to be a useful and low cost resource.

Although the public can be a useful resource, the degree of the public's support and attitudes toward the gecko can have large influence on conservation measures' success. Overall, challenges facing the New Zealand geckos do not exist without possible answers. As it appears public support stands out as an important aspect of any path ahead. It could prove vital that the New Zealand public become fully connected to the plight of the Wellington Green Gecko and New Zealand's other native lizard species.

## **2.5 Relevant case studies in animal conservation:**

In order to gain a deeper understanding of the intricacies involved in conservation related outreach, we chose to look at three previous examples of conservation efforts in communities.

These case studies were selected as they focused on animal conservation similar to that of our project. They all involve either raising awareness of conservation issues or gauging public awareness/opinions of conservation issues.

### **Case 1: Raising awareness of sea turtle habitat in coastal Florida**

The most effective conservation efforts involve the community to raise awareness of the issue. This is illustrated in the case study *Raising Awareness of Sea Turtle Habitat* by Daniel Evans where a local conservation group reached out to coastal Florida communities to distribute information regarding endangered sea turtle habitats. The Sea Turtle Survival League (STSL), as a part of the Caribbean Conservation Corporation, built upon their previous work to create the 2002 Sea Turtle Nesting Habitat Awareness Campaign (Evans, 2005). During the campaign, the group came up with three objectives they wanted to achieve to raise awareness for the turtle habitat.

The first objective the group created was to provide local sea turtle groups and businesses along the Florida coast with printed educational material for distribution to coastal businesses. Another objective that the STSL established was acknowledging sea turtle friendly businesses through an awards program. The final objective that the league created was to improve educational resources available to the public online (Evans, 2005). This campaign by the STSL led to the signing of The Marine Turtle Conservation Act of 2004 which helped bring funding to the conservation of sea turtles in foreign countries. As the organization involved the public, they were able to create incentives for participating in their campaign as shown by the turtle awards program. Additionally, they provided outlets for which people were able to gather more information on turtles. A takeaway from this case study is that local businesses are a major source of support for raising awareness in conservation efforts. In addition, the distribution of materials also had a positive impact in providing information to the public.

### **Case 2: Conserving manatees: knowledge, attitudes, and intentions of boaters in Tampa Bay, Florida**

The example set by researchers from the University of Florida and the Florida Marine Research Institute in their work done to aid manatee conservation efforts in Tampa Bay, Florida may prove a useful resource in our similar endeavor to engage the public in the Wellington Green Gecko conservation effort. The work done by the manatee group aimed to draw

information from the area's boaters in order to assess the connections between their knowledge, attitudes, and intentions toward manatees, as well as the marine mammal's conservation.

The group established a survey questionnaire designed to determine boater knowledge of manatees, and opinions on both conservation and manatees. They also conducted in-person interviews to garner more specific information, such as boater attitudes and subjective norms (Aipanjiguly et al., 2003). The information led to recommendations that involved spreading manatee knowledge to boaters via their primary source of information, newspapers and magazines (Aipanjiguly et al., 2003). The work done by Sampreethi Aipanjiguly et al. depicts a successful effort to establish data on public awareness, attitudes, and support for a species. They also managed to produce several recommendations that may have ultimately contributed to successful manatee conservation efforts. We will look to the work done by Aipanjiguly et al. as a useful resource for our work to aid Wellington Zoo in their efforts to engage the public in the Wellington Green Gecko conservation movement.

### **Case 3: Understanding beach users' awareness of shorebird conservation in central Queensland**

One piece of work that we found that closely parallels what we hope to accomplish while working with Wellington Zoo is the study done by Tamara van Polanen Petel and Ashley Bunce on beach users' attitudes towards shorebird conservation in Central Queensland Australia. The official title of their study is *Understanding Beach Users' Behavior, Awareness, and Attitudes to Shorebird Conservation in Central Queensland: Tools for Effective Shorebird Conservation*. During this study Petel and Bunce gathered information from 163 beach-goers using a 36 question survey in order to draw their conclusions. Petel and Bunce lay out the goal of their project in three steps. The first was to investigate the behavior and activity of beach users, establish a baseline for the awareness and attitudes of beach users towards shorebirds and their conservation, and determine some of the most effective educational resources and management actions to raise public awareness of the issue (van Polanen Petel & Bunce, 2012). This study was similar to our project in that, they wished to determine public awareness of shorebirds and shorebird conservation issues in order to improve upon conservation strategies used in regards to at risk or threatened shorebirds.

The authors also stated that education of the community on such issues is very important but continue on to note, "Although education and awareness raising actions are often mentioned



as important and included in conservation models, few studies investigate public awareness of and attitudes towards shorebird conservation...” (van Polanen Petel & Bunce, 2012). This mirrors what we have found about the lack of data collected regarding public awareness of the Wellington Green Gecko. From this study, Petel and Bunce gathered some information on the most effective educational methods for conveying information on conservation to the public. Another important takeaway from this study was that a majority of people surveyed believed they could take action in order to help protect shorebirds and coexist with the birds.

## **2.6 Summary**

Our preliminary research improved our awareness of the multifaceted issues surrounding the Wellington Green Gecko. The gecko’s elusive behavior, along with external threats, have posed challenges to both data collection and conservation efforts. To help resolve these issues, the public was an invaluable resource. The case studies we have examined have given us useful insight on effective methods of both surveying the public and raising public awareness. We formulated our methodology such that we took into consideration the difficulties associated with working with the Wellington Green Gecko, and utilized previous case studies to guide our work. More detailed summaries of each case can be found in Appendix D.

## 3 Methodology

The following section details the methodology used to accomplish the three objectives laid out for this project. In order to complete our goal of assisting Wellington Zoo's green gecko conservation efforts, we completed the following objectives:

1. Gauged public awareness of the Wellington Green Gecko;
2. Assessed public willingness to aid in the zoo's conservation efforts; and,
3. Identified possible directions for community outreach and engagement projects the zoo might pursue in the future.

Upon arrival in Wellington the team conducted a site assessment to become better oriented with the region and working with the Wellington Zoo. This focused the team's early efforts on the development of the tools utilized in our methodological strategies. These tools included a survey for the general public, a survey for gardening groups and interview questions for experts, all of which are discussed below.

### 3.1 Gauging public awareness, and willingness to engage in conservation of the Wellington Green Gecko

To accomplish our first and second objectives, the team used surveys as our primary data collection means, due to the ease of collection and the wide availability of participants. We distributed our survey across a broad swath of Wellingtonians.

#### 3.1.1 General public survey

Initially we planned to use two surveys: one focused on gauging public awareness and one focused on assessing public interest. Through review of the proposal in collaboration with Wellington Zoo, we decided to focus on a more concise survey that would generate a higher number of responses. The two surveys were combined into one 22 question survey that took participants approximately five minutes to complete. We verbally administered the survey in English only, using a tablet and the online program Qualtrics to record the responses. To ensure that the survey remained concise while still touching on all the topics under our two objectives, we utilized display logics so that not all participants would be required to answer all 22 questions. Although some questions that could have garnered interesting data had to be forgone to shorten the survey, it was still able to capture pertinent details with opportunity still to gather additional anecdotal data.

We recruited potential participants with a brief, prepared preamble (as seen in Appendix A). This consisted of an initial greeting, followed by a statement describing who we were and what we were asking. We recorded the number of individuals that declined to participate, as well as the approach time, date and location. For those that agreed to take our survey, we began with a screening question asking if participants were from New Zealand. We decided to only survey those from New Zealand, as these are the people that the zoo looks to engage in its gecko conservation efforts and few non-New Zealanders would likely know about lizards native to New Zealand. The survey concluded if participants were not from New Zealand. The team also recorded the number of non-New Zealanders that we approached. Immediately after confirmation of an individual's eligibility and willingness to participate, they were then asked whether or not they currently live or have ever lived in the Wellington region in order to track the differences between respondents with or without local knowledge.

Ten questions of the 22 question survey encompassed the first objective's section of the survey. These questions included participant knowledge about the existence of the Wellington Green Gecko and other local gecko species, and participants' knowledge of threats native geckos face. The survey also assessed the public's awareness of conservation efforts, and laws and regulations in place to protect native gecko species. Answers to these questions ranged from yes/no to open-ended format. To facilitate data entry and coding of open-ended response questions, we identified a set of likely responses based on our review of the literature and feedback from interviews and the survey pretest. Respondents were not privy to these response categories, but we could use them as check-off lists to rapidly collect and pre-code responses without prompting respondents. We included an 'other' category with a text box to record responses that did not match any of the other categories on the list.

Six questions in the survey applied to our second objective. These questions focused on assessing the participants' interests and opinions of geckos as well as their willingness to participate in conservation. Answers to these questions produced a mix of qualitative and quantitative data through formats similar to the previous survey section. Some questions targeting our second objective obtained answers in the form of a range of interest levels to prompts that provided insight to the participants' views on gecko conservation. Other questions aimed toward our second objective asked participants how they would describe geckos and how important they considered native species' conservation.

In the survey, there were six general demographic questions. These include questions regarding participants' age, gender and ethnicity. Another question differentiated Wellington region residents' responses from those of New Zealanders living outside of the region. We included a question to determine whether or not the respondent gardens. We gathered this demographic information to provide further insight for our data analysis. Data regarding participants' demographics allowed us to analyze any gaps in general awareness and willingness among particular groups.

We pretested our survey at the zoo in order to refine it and make any necessary adjustments. It took two days of pre-testing two different renditions of the survey in order to develop the version we used to collect our data. During the pretest we asked for feedback on the survey itself from the participants. The team used this feedback to make necessary alterations to the survey.

Through our site assessment and discussion with our sponsor, we identified high traffic locations across the region at which to conduct the surveys. The locations we chose included Wellington Zoo, Wellington City Library, Wellington Botanic Gardens, Miramar Library, Karori Park Cafe and Karori Library. We chose these locations to try to ensure a broad, representative sample of the population in terms of age, occupation, knowledge and interests. We also determined various peak times throughout the day at which to survey people to maximize response yield. For example, at the zoo we coordinated our surveying with the *Talk Times* schedule. *Talk Times* occur at set times throughout the day at different exhibits and are informational talks given by zookeepers about specific animals. Visitors at the zoo tend to plan their trip around these times and crowds gather at the exhibits during the talks. The specific times and locations of these talks can be seen below in Figure 3.1 which includes a map of the whole zoo. We also conducted surveys at different times throughout the day at various other locations across the Wellington region, in order to capture a broad cross section of participants and to minimize potential bias in our sample.

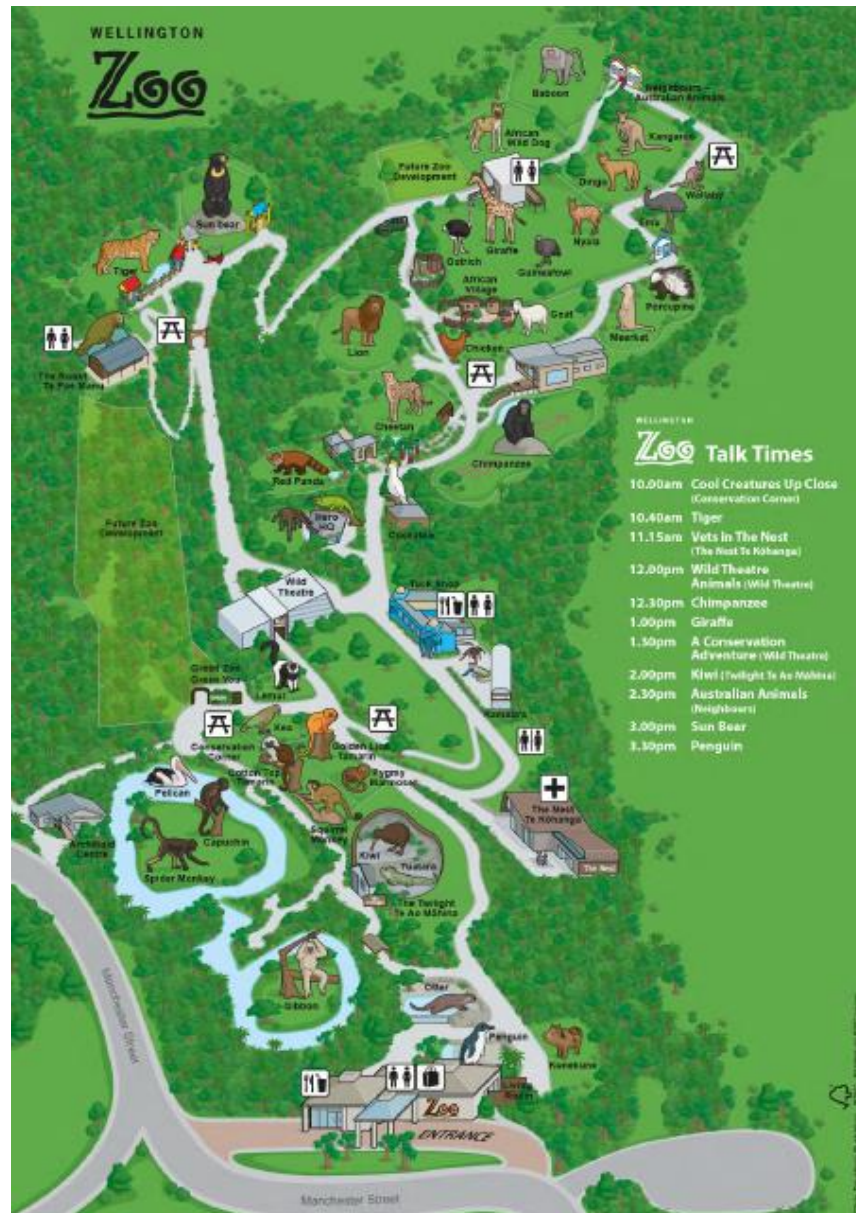


Figure 3.1: Wellington Zoo map and talk times (Wellington Zoo, n.d.)

We surveyed the general public in the previously specified areas utilizing simple random sampling. In the case of Talk Times, the team waited at the exit of the exhibit area to approach individuals. To create an unbiased sample, we used the strategy of approaching every 3rd person age 18 or above. We used this same technique in the other public locations, with the exception of using a landmark or corner as a reference instead of the exit of an exhibit. For groups of people or families, we targeted an adult within the group to complete the survey. We chose this strategy to randomize our sampling and to try to eliminate any potential bias that may arise from selecting individuals by eye.

### 3.1.2 Gardener survey

In order to supplement the data collected from our general public survey, we chose to target gardeners with a more focused survey. After our review of literature the team developed a hypothesis that gardeners spend more time outside and pay closer attention to the flora and fauna that may attract lizards. Gardeners also could play an important role in future conservation efforts that could include gecko monitoring, planting gecko friendly species, public outreach, etc. For these reasons, the team decided it was critical to capture information from this demographic in order to be able to draw comparisons between the knowledge and awareness of gardeners and the non-gardening general public. The team reached out to certain gardening groups and organizations in order to ask permission to send our survey, via email, to their respective mailing lists. We were aware that, generally, this method of data collection does not receive a favorable response rate. Given our restricted time frame and the difficulties of identifying a sufficient sample of gardeners through convenience sampling on the street, we chose to use email surveys of the target group.

The gardener survey focused on retrieving data from individuals involved with some of the region's community and private gardens. Our questions asked gardeners to describe their habits, their willingness to change these to create a more gecko-friendly environment, and their general gecko knowledge. The survey consisted of 27 questions that took participants approximately five minutes to complete. To ensure that the survey remained concise while still touching on all the topics, we utilized display logics and skip patterns so that not all participants would be required to answer all 27 questions.

Twelve questions of the 27 question survey focused on participants' gardening habits. These questions ranged from asking gardeners' current habits to surveying the changes they were willing to make to their gardens. Answers included both qualitative and quantitative data, displayed in yes/no, multiple choice, and open ended formats. The answers included facts about the individual's' garden composition and maintenance schedule. Questions about garden changes included predetermined answers for users to select.

Eleven questions of the 27 question survey identified participants' knowledge of the Wellington Green Gecko and the conservation efforts surrounding it. Questions varied from basic identification of lizards typically found in gardens to the identification of threats to lizards in New Zealand. Questions and answers for this section were taken directly from the general



survey found in Appendix A. However, unlike the general survey, gecko specific questions were asked in the second half of the survey, not the first. Garden specific questions were included first for two reasons. The reason for this, was that if participants were to only partially complete the survey, we would be provided with the information unique to this survey.

In the survey, there were four general demographic questions. These include questions regarding participants' age, gender and ethnicity. Another question differentiated which suburb Wellington region residents' lived in. We gathered this demographic information to provide further insight for our data analysis. Data regarding participants' demographics allowed us to analyze any gaps in general awareness and willingness among particular groups.

### **3.1.3 Survey responses**

We aimed to get between 200 and 300 responses to our general survey in order to achieve a sample with minimal bias and statistical significance. During our time in Wellington we managed to obtain 165 responses to our survey with a refusal rate of 25%. There were 45 willing respondents that were turned away for not being a New Zealander. The refusal rate may include people ineligible to take the survey as we do not know if everyone approached was from New Zealand. Our respondents include 97 women and 68 men. With our gardener specific survey, we aimed to get 200 responses and received 69 responses, not all of which were complete, from the four mailing lists to which we sent our survey. Of these respondents 13 were male, 41 were female, and one preferred not to say. The remainder did not state their gender. A majority of the respondents were age 60 or above.

## **3.2 Identify feasible directions for future community involvement**

To accomplish our third objective we used the survey results and in-depth, semi-structured interviews with experts in conservation and herpetology to evaluate the gecko conservation work currently conducted and targeted by DOC and WRLN as well as to develop our own viable gecko conservation strategies and approaches. The team reached out to experts in disciplines related to conservation and lizard species, in order to gain insight on gecko conservation work and public outreach projects. We worked with Wellington Zoo to identify an initial set of experts to contact. From this list, we utilized snowball sampling in order to expand on the original set of experts. At the end of each interview, we asked the individual or individuals for other experts they believed would be useful for us to contact. A full list of

everyone we interviewed as well as their affiliation, title, and date of interview can be seen below in Table 3.1.

*Table 3.1: List of interviewed experts*

<b>Name</b>	<b>Affiliation</b>	<b>Title</b>	<b>Interview Date</b>
Myfanwy Emeny	Wellington City Council	Team Leader, Urban Ecology	Wednesday, January 25 <sup>th</sup>
Sarah Herbert	Victoria University of Wellington	PhD Student	Tuesday, January 24 <sup>th</sup>
Rod Hitchmough	Department of Conservation	Science Advisor	Monday, February 20 <sup>th</sup>
Angus Hulme-Moir	Predator Free New Zealand	Community Conservation Lead	Tuesday, February 7 <sup>th</sup>
Dennis Keall	Independent Work	Lizard Breeder	Tuesday, February 14 <sup>th</sup>
Jo Ledington	ZEALANDIA	Conservation Lead Ranger	Thursday, January 19 <sup>th</sup>
Zoë Lennon	Victoria University of Wellington	PhD Student	Tuesday, January 24 <sup>th</sup>
Terese McLeod	Victoria University of Wellington	Senior Administrator	Monday, February 27 <sup>th</sup>
Nicola Nelson	Victoria University of Wellington	Associate Professor	Tuesday, January 24 <sup>th</sup>
David Stuart	Wellington City Council	Team Leader, Research and Evaluation	Monday, January 30 <sup>th</sup>

We conducted interviews face-to-face in teams of two, with one person interviewing and the other taking notes. Prior to the start of the interview, we asked interviewees for oral consent to record the interview and to potentially quote them within the paper. Upon permission, the team recorded each interview to provide full transcripts. All interviewees were given a final copy of the report to review prior to any publication.

We tailored each interview to the interviewee's area of expertise, in addition to general questions on innovative conservation and public outreach projects conducted by institutions other than Wellington Zoo. Through these interviews, we discussed different approaches to conservation projects and the factors that can lead to success. In addition, we also considered challenges facing lizard conservation, and potential solutions the public could take to help reduce threats. The interview script and introductory preamble soliciting consent can be found in Appendix C. We used recordings to supplement the notes taken during the interviews and to

verify quotations. The interviews we conducted were used as resources to help guide our construction of deliverables to Wellington Zoo.

The interviews we conducted gave us a stronger understanding of the complexity of gecko conservation and the steps necessary to engage the public. With our improved understanding we again looked at the various efforts conducted, and strategies planned by DOC and WRLN for gecko conservation in the Wellington region. By doing so we identified the strategies that fit what Wellington Zoo aims to do with their community-engaged conservation efforts. We refined this list to show which strategies would best fit the needs made apparent by the survey results. From the results of the interviews and surveys we brainstormed other possible strategies.

## 4 Results and discussion

During our surveying period, we obtained 165 general public survey responses from seven different locations throughout the Wellington region and 69 gardener-specific survey responses, not all of which were fully completed. Additionally, we interviewed 9 experts involved in either conservation or gecko research. The results point at the direction from which Wellington Zoo should approach future green gecko conservation efforts.

### 4.1 Results

In this section we present charts and graphs to display the results of our surveys. These graphs may be separated by survey, demographic, or question in order to best convey the levels of gecko awareness among New Zealanders, specifically those from Wellington. Each graph will be accompanied by a brief analysis. In the next section there will be a discussion on the takeaways of the results and analysis.

#### Public survey

The results from our survey generally showed that a majority of the public lacks awareness of not only the Wellington Green Gecko specifically, but also lizards in general. In the survey the team asked eleven questions pertaining to the assessment of respondents' general knowledge of lizards and the Wellington Green Gecko.

As we expected, 82% of the respondents to our survey had never heard of the Wellington Green Gecko. Among respondents from Wellington, 20% had heard of the Wellington Green Gecko. Interestingly, 50% of respondents aged 60 or above had heard of the Wellington Green Gecko while 17% of respondents age 45 to 59 and 17% of respondents age 30 to 44 had heard of it. Only 7% of respondents aged 18 to 29 had ever heard of the species. That being said, very few of the respondents that had heard of them before could produce any facts on the Wellington Green Gecko. Only two participants indicated that they knew the species was at risk. As a positive, 90% of respondents have seen lizards in New Zealand while only 10% have not. Of the 148 respondents that have seen lizards in New Zealand 64 said they had seen them in ZEALANDIA or a zoo while 97 responded 'in the bush;' some respondents indicated multiple locations. Four respondents had only seen lizards brought in by their cat. Of those from the Wellington region, 89% have seen a lizard in New Zealand. Forty-four percent of these

respondents saw lizards at zoos or wildlife sanctuaries, 54% had seen them in the wild or their garden and 2% of the respondents saw lizards when their cat brought them in.

While many respondents have seen lizards, 72% of respondents said they knew the names of native lizards and 28% did not know the names of any native lizards. Of the participants that claimed to know the names of native lizards, 63% of the respondents named the tuatara which is not a lizard. One person named the Wellington Green Gecko. Figure 4.1, below, shows the range of identification. It is good to note that the tuatara might easily be mistaken for a lizard but is instead classified as a separate species of reptiles, under the Rhynchocephalia order.

While many respondents have seen lizards, 72% of respondents said they knew the names of native lizards and 28% did not know the names of any native lizards. Of the participants that claimed to know the names of native lizards, 63% of the respondents named the tuatara which is not a lizard. One person named the Wellington Green Gecko. Figure 4.1 below shows the range of identification.

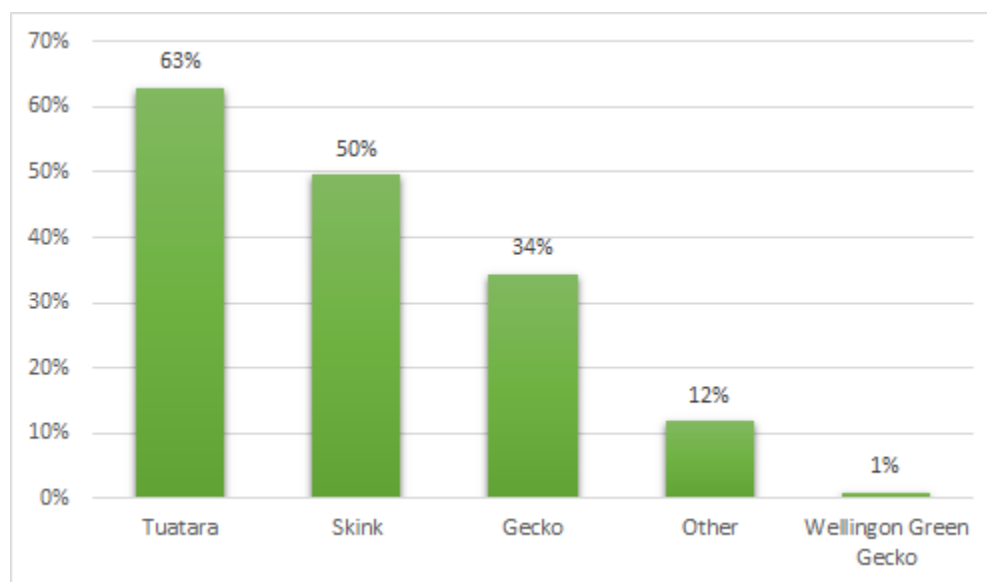


Figure 4.1: What native New Zealand lizards do you know? (n = 119)

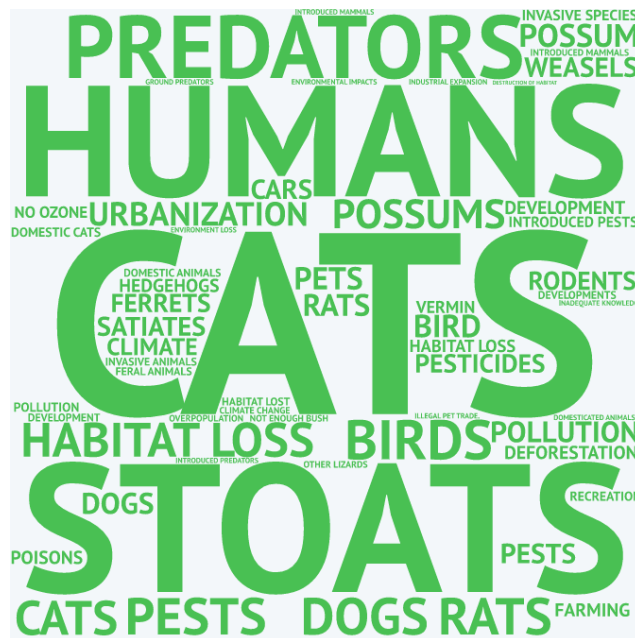
Of the portion of respondents that claimed to know the names of native lizards, 82% did not know if there were lizards unique to the Wellington region while 7% knew there are but could not name them, 4% said skinks, 3% replied tuatara, 2% said geckos, 2% replied that there are none, 2% said Wellington Green Gecko, and 1% replied other. Of all the respondents to our survey, 63% knew or inferred from our line of questioning that lizards are not thriving in New Zealand. Thirty-one percent were unsure and 6% believed that lizards are thriving.

We asked what words came to mind when the respondents thought of geckos, and the answers ranged from cute to creepy. The word cloud shown in Figure 4.2 illustrates the distribution of responses. The responses are scaled by the frequency with which they appear in responses. The larger the word, the more respondents said it.



Figure 4.2: What words come to mind when you think of geckos?

We used the same technique of a word cloud in Figure 4.3 to show the participant's perceptions of the risks that lizards face in New Zealand. The most common response was cats and the second most common was humans.



*Figure 4.3: What do you think are some of the threats native lizards face?*

Fifty-eight percent of respondents strongly agreed with the statement ‘conserving native lizards is worth investing time, money and resources.’ Thirty-five percent agreed with the statement and 7% were neutral. The most common rationale for this rating had to do with the importance of native biodiversity, with 37% of respondents stating this as the reason behind their rating. At the same time, 79% of respondents strongly agreed with the statement ‘conserving native birds is worth investing time, money and resources.’ Sixteen percent agreed with the statement, 2% were neutral on the topic and 2% strongly disagreed with the statement. Figure 4.4 below portrays the comparison between the responses to the two questions.

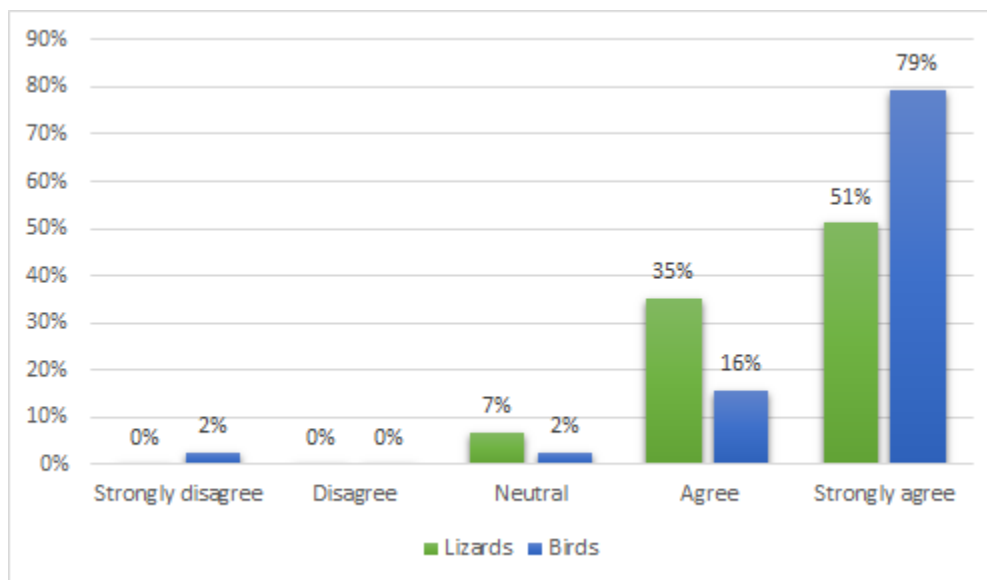


Figure 4.4: Rank this statement: conserving native \_\_\_ is worth investing funds, time and resources. (n = 165)

Ninety percent of respondents said that they would like to see more lizards in New Zealand, while 8% did not care and only 1% would not like to see more lizards. Narrowing the scope to only those living in Wellington region, 89% would like to see more lizards. Two percent of Wellingtonians would not like to see more, and the remaining 10% were indifferent. This could mean seeing lizard populations grow or physically seeing more lizards. At the same time, 27% of respondents said they would be very interested in helping save New Zealand's geckos. Thirty-three percent said they were interested, 30% were neutral, 9% were uninterested and 1% said they were not interested at all. We then asked respondents who answered neutral, interested or very interested what they would be willing to do out of the list we provided. Eighty-four percent of respondents said they were willing to report lizard sightings, 84% were willing to donate money or sign a petition, 71% were willing to maintain a lizard friendly section of their garden or yard, 58% were willing to set up or support predator pest control and 2% were not willing to do anything. Figure 4.5 details this distribution.



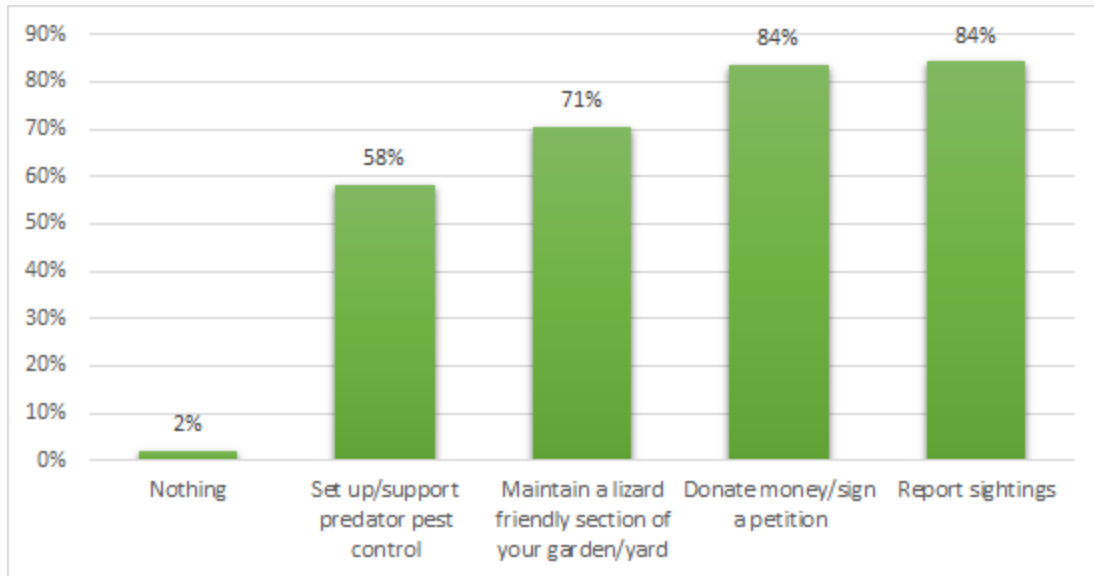


Figure 4.5: What would you be willing to try in order to help the Wellington Green Gecko? (n = 146)

Using some of the demographic questions, we teased out several interesting patterns in the data. We ranked respondents involvement in conservation based on what they had done in the past two years. We gave each option a value based on the level of involvement that they each required. ‘Nothing’ was given a value of 0, ‘receiving newsletters’ was given a 1, ‘donating money’ and ‘being a member’ were given a 2, and ‘participating in a conservation event’ or ‘volunteering’ were given a 3. We then added the values of each respondent’s selections and ranked them based on the cumulative value. If the respondent’s sum was a 5 or above we ranked them as highly involved in conservation, 2 to 5 was ranked as moderate involvement and 0 to 2 was ranked as little to no involvement. This system resulted in 44 respondents being ranked as highly involved, 66 ranked as moderately involved and 55 being ranked with little to no involvement in conservation. Figure 4.6 shows the comparison between each level of involvement versus what the respondents were willing to do to save New Zealand’s geckos. As you can see in the figure, respondents that had more of a background in conservation were more willing to engage in efforts to protect geckos.

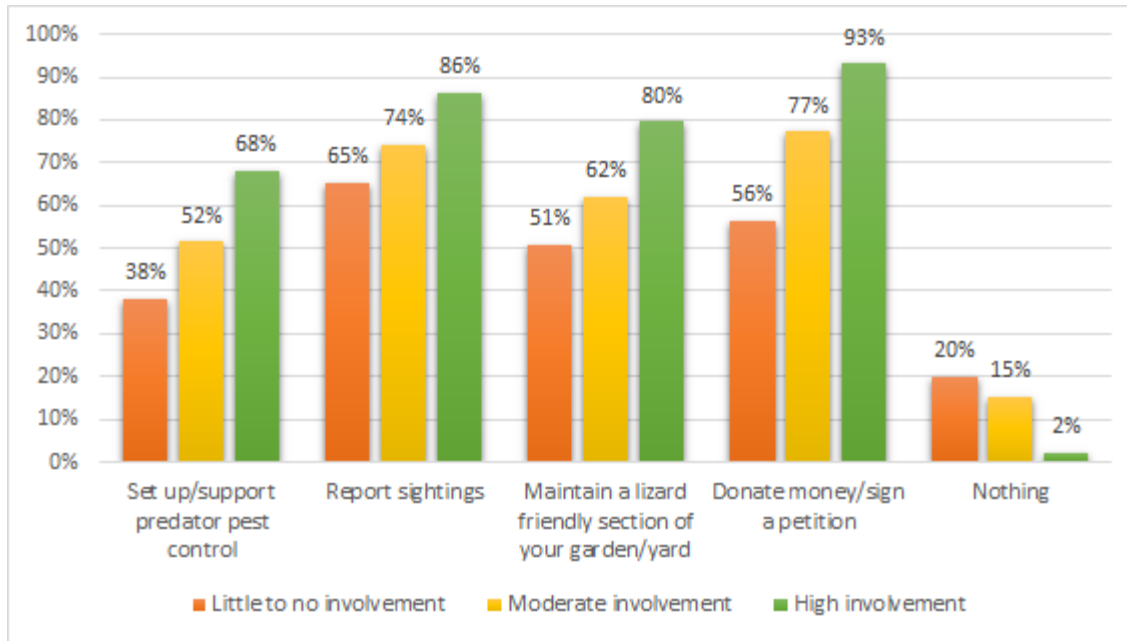


Figure 4.6: Involvement in conservation vs. willingness to help (n = 165)

While inspecting our general demographic information we found that 45 to 59 year old respondents were consistently more willing to explore different conservation options. This can be seen in Figure 4.7 below which filters out respondents who said they were uninterested in helping save New Zealand's geckos.

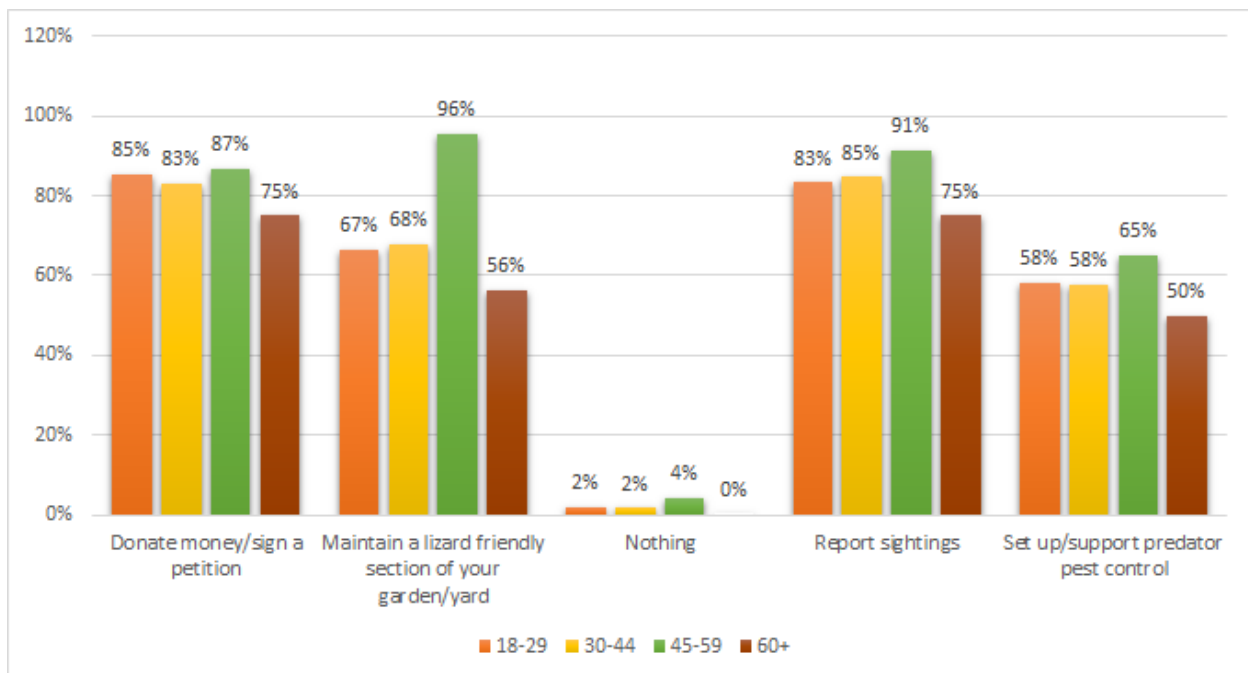


Figure 4.7: Age vs. willingness to help. (n = 146)

Almost 87% of 45 to 59 year old respondents were willing to donate money or sign a petition compared to the next highest which was 85% of 18 to 29 year olds. Ninety-six percent of 45 to 59 year olds were willing to maintain a lizard friendly section of their garden or yard compared to the next highest which was 68% of 30 to 44 year olds. Ninety-one percent of 45 to 59 year old respondents were willing to report lizard sightings while the next highest percentage was 85% of 30 to 44 year olds. Sixty-five percent of 45 to 59 year old respondents were willing to set up or support predator pest control compared to the next highest which was 58% of 18 to 29 year olds.

We concluded from our general public survey that there is no strong correlation between gardening and seeing lizards in New Zealand, as 93% of respondents that identified themselves as gardeners have seen lizards in New Zealand, but 85% of respondents that did not identify themselves as gardeners have seen lizards in New Zealand. Due to our sample's demographic distribution, we could not examine the relationship between Māori respondents and their views on geckos and lizards compared to those of European New Zealanders. It could be interesting to see if there is any cultural or heritage-based identification that drastically affects perceptions of lizards in future work. We could not examine any relationship between encountering lizards and perceptions of them as only 10% of respondents have never seen a lizard in New Zealand and we did not measure what type of interactions the 90% of respondents that have seen lizards had with lizards. There were also no major differences between male and female respondents.

### **Gardener survey**

We designed the gardener survey to capture a sample of residents that would likely have a higher interest in conservation, or at least interact more closely with gecko habitat. While the results from our gardener survey shows that a higher percentage of people in the gardening community have seen lizards, we found that they have a limited overall knowledge about lizards. Of the entire group of respondents that filled out our survey, 75% garden in their own personal garden, 4% garden in a community garden and 21% garden in both a personal and community garden.

Within the gardener groups, 96% have seen lizards in New Zealand while 4% have never seen them anywhere. Of the 54 respondents who have seen lizards, 10 individuals cited that they saw lizards in ZEALANDIA, 7 had sightings in wild bush and many were able to name numerous locations where they encountered lizards. Only 52% of the respondents had seen

lizards in their garden before and the other 48% had not seen any lizards in their garden. Of the gardeners that had seen lizards in their garden, 45% of the respondents said that they sighted lizards occasionally and 34% of respondents said they rarely sighted lizards.

We prompted gardeners who had seen lizards in their garden to identify the species they had seen. Forty-one percent of the respondents said they were able to identify the species while 59% of the individuals said no. Of the individuals that said yes, one person responded Wellington Green Gecko. Forty-two percent of respondents listed skink while 58% of respondents were able to identify the lizard as a common skink. Thirty-three percent of the respondents identified the lizard as a gecko and 8% specified a Forest Gecko. A majority of gardeners that have seen lizards in their garden described them as a small, brown skink. One respondent commented that they had only seen a lizard that was killed by their neighbor's cat. Of the total number of respondents to our gardener survey, 11% have seen a gecko in their garden.

When asked to describe geckos, the majority of gardeners associated geckos with green and cute. The word cloud displayed in Figure 4.8 illustrates the entire list of responses. The larger the word in the word cloud, the more times it got cited by those surveyed.



Figure 4.8: What words come to mind when you think of geckos?

Sixty-three percent of respondents strongly agreed with the statement 'conserving native lizards is worth investing time, money and resources. While 34% agreed with the statement, 2%

were neutral and 2% strongly disagreed. At the same time, 63% of respondents strongly agreed with the statement ‘conserving native birds is worth investing time, money and resources.’ Thirty-four percent agreed with the statement, 2% were neutral on the topic and 2% strongly disagreed with the statement. In the gardener survey, the respondents ranked the conservation of birds and lizards as equally worthwhile. The two charts, Figures 4.9 and 4.10, below show a comparison between the responses on the gardener survey versus those on the general public survey.

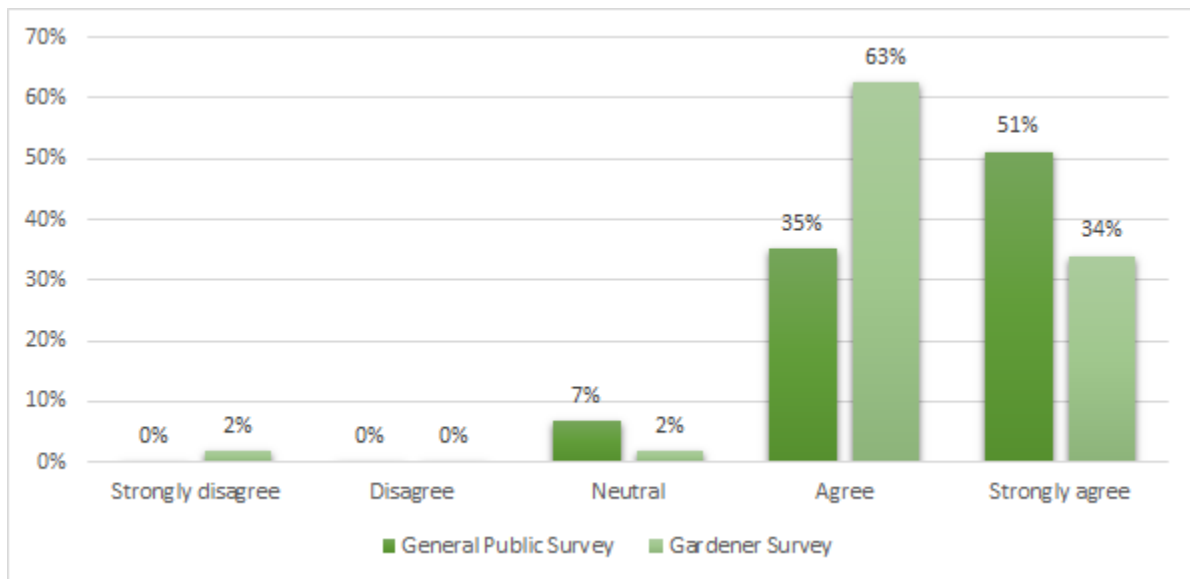


Figure 4.9: Rank this statement: conserving native lizards is worth investing funds, time and resources. (n = 56)

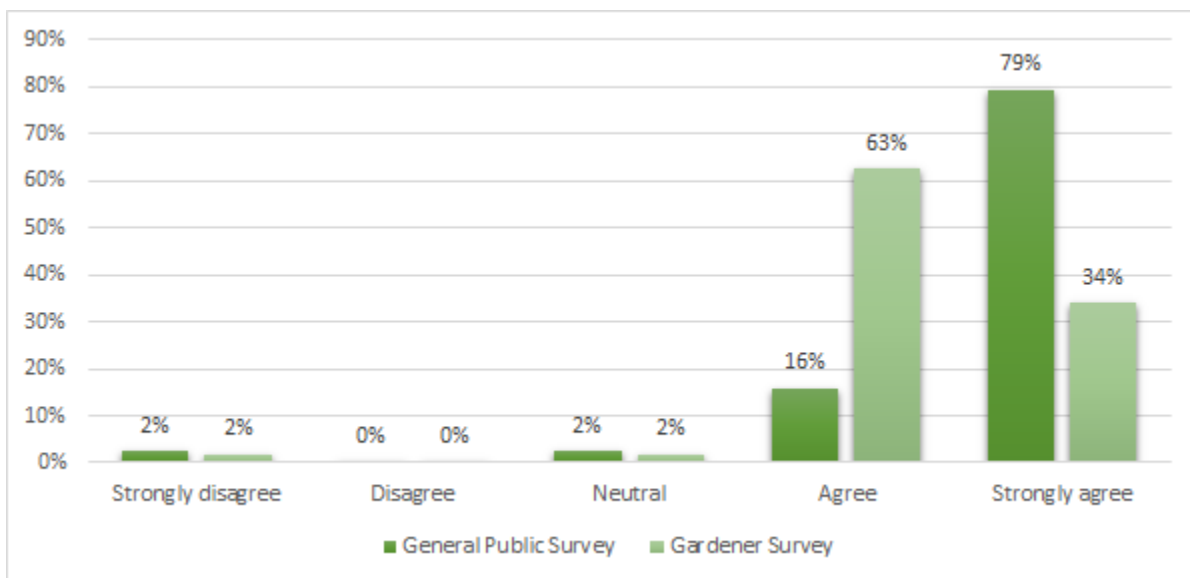


Figure 4.10: Rank this statement: conserving native birds is worth investing funds, time, and resources. (n = 56)

The survey also asked respondents if they would enjoy seeing geckos in their garden. Ninety-eight percent of the respondents replied yes, while 2% replied no. As a follow up to that question, we asked if gardeners would be keen to make their gardens more gecko friendly and 94% of people responded yes and 6% responded no. In order to determine the ways in which gardeners may be willing to help, we provided them with a list of options for which they were able to select choices to try. The most common answer to this list was to minimize the use of pesticides, with 69% of all respondents selecting this as a possibility. Furthermore, 62% of gardeners would also report sightings and 61% would be willing to plant more native plants. Table 4.1 below displays the range of all answers.

*Table 4.1: What would you be keen to do to make your garden gecko friendly? (n = 50)*

<b>What would you be keen to do to make your garden gecko friendly?</b>	<b>Percent of respondents</b>
<b>Minimize use of pesticides</b>	<b>69%</b>
<b>Report any lizard sightings</b>	<b>63%</b>
<b>Grow more native plants</b>	<b>61%</b>
<b>Keep a 'wild garden' section of your garden</b>	<b>59%</b>
<b>Plant berry and nectar producing plants</b>	<b>59%</b>
<b>Set up traps to reduce pests</b>	<b>53%</b>
<b>Leave water</b>	<b>51%</b>
<b>Build stacks of material or a loose stone wall</b>	<b>47%</b>
<b>Plant vines and creepers along fences and walls</b>	<b>35%</b>
<b>Supervise pets when in garden</b>	<b>29%</b>
<b>Nothing</b>	<b>6%</b>
<b>Other</b>	<b>4%</b>

Within our gardener specific survey we asked about what native vegetation the respondents had in their gardens. Ninety-eight percent of respondents did have native plants in their garden and only 2% responded that they did not have any native plants in their garden. Of those that did have native plants, the most common were manuka and tussock, both appearing in 43% of respondents' gardens. Helichrysum, parahebe or pimelia were listed by 26% of

respondents while thick leaved coprosma was listed by 25% of respondents. Nineteen percent of respondents could not identify what native plants they had. We used this to draw comparisons between having native plants and lizard sightings. Of the 52% of respondents that have seen lizards in their gardens, the most common plants are again the tussock, astelia or flax followed closely by the manuka plant. Figure 4.11 portrays the spread of all the percentages.

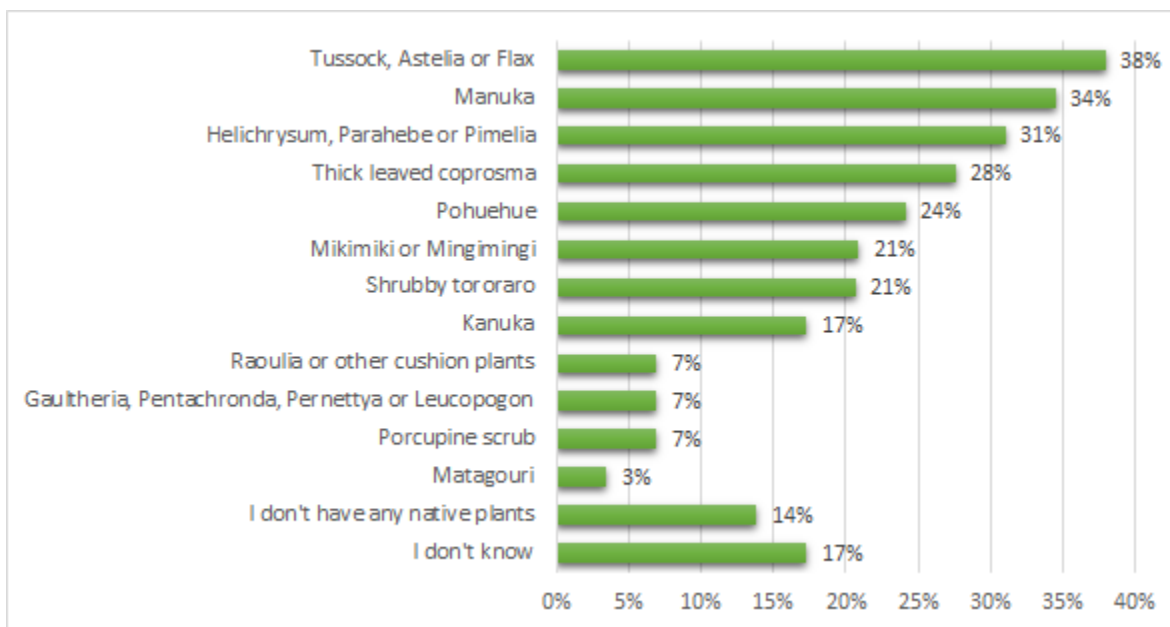


Figure 4.11: Native plants vs lizard sightings ( $n = 29$ )

In the survey we provided a list of features that could be in a garden and asked gardeners to select all that applied to their garden. We then related these features to how often a lizard was seen in their garden and developed the chart below. From our data, pest traps in and around the garden increased the frequency of lizard sightings the most with 20% of respondents that set up pest traps reporting to see lizards often. Forty-four percent of respondents that reported regular visitations by a cat rarely saw lizards in their garden. These were the two most prominent differences between features.

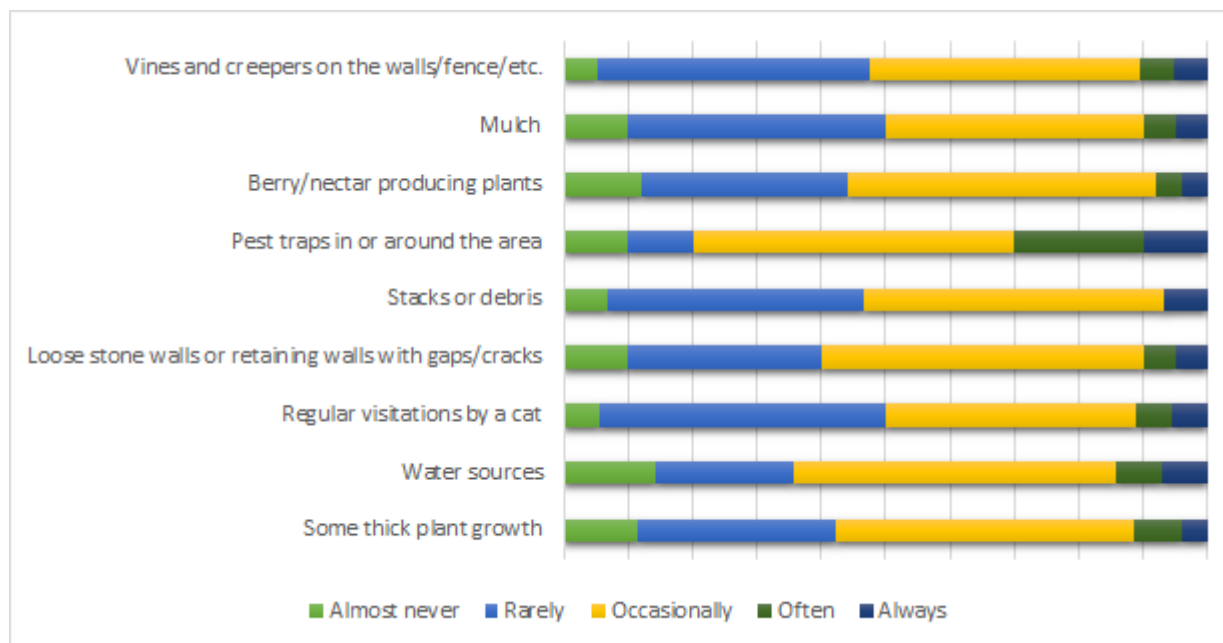


Figure 4.12: Garden features vs. frequency of lizard sightings. ( $n = 29$ )

We also drew comparisons between the frequency at which respondents maintained their garden and the frequency at which they see lizards. We found that 47% of respondents that maintained their garden once or more a week have seen a lizard in their garden while 53% have not. Fifty percent of gardeners that maintained their garden once in a fortnight have seen a lizard in their garden and 50% have not. Seventy-five percent of respondents that maintain their garden once a month have seen a lizard in their garden, 100% of respondents that maintain their garden only during the summer have seen a lizard in their garden and 100% of respondents that maintain their garden a few times a year have seen a lizard in their garden. It is important to note that the sample size for respondents that maintain their garden only during the summer and a few times a year is small. The charts in Figure 4.13 below show this data.



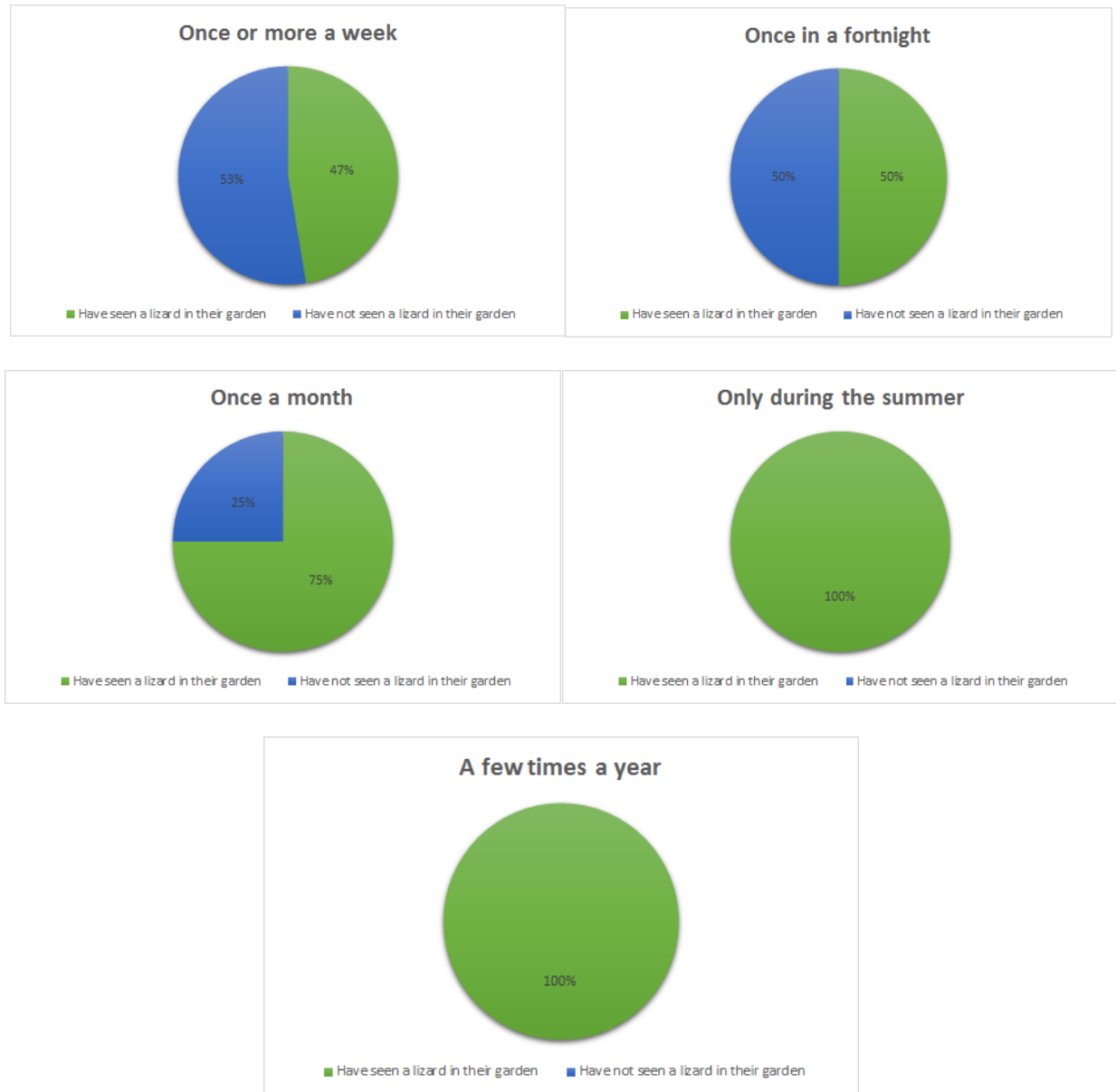


Figure 4.13: How frequently have you seen them? ( $n = 29$ )

Our team made a few observations from the comparison between the frequency at which respondents maintained their garden and what they would be willing to do to modify their garden. These numbers were taken from the 94% of respondents that said that they would be willing to make their garden more gecko friendly. We did not include respondents who maintained their garden only during the summer and a few times a year as the sample size for those groups was too small to observe any trends. This means we only looked at respondents who maintained their garden once or more a week, once in a fortnight and once a month. Eighteen percent of gardeners who maintained their garden once or more a week were willing to

supervise their pets in or around the garden, while 45% of gardeners who maintained their garden once in a fortnight and 50% of gardeners who maintained their garden once a month were willing to supervise their pets. Seventy-three percent of respondents who gardened once in a fortnight were willing to plant berry and nectar producing plants compared to 55% who gardened once or more a week and 50% who gardened once a month. Seventy-five percent of participants that garden once a month responded that they were willing to report lizard sightings along with 64% of participants that garden once or more a week. At the same time, 55% of gardeners that maintain their garden once in a fortnight were willing to report lizard sightings. Overall, no one group was more consistently willing than the others to modify their garden to make it more lizard friendly.

Interestingly, while 50% of the respondents to our general survey listed cats as a threat to native lizards, only 25% of respondents to our gardener survey said they were willing to supervise their pets while the pets are in their garden.

## **Interviews**

The interviews that we conducted provided us with vital information on conservation in general as well as insight to the many nuances involved in conservation of cryptic species like the Wellington Green Gecko. The experts themselves included representatives from DOC, Wellington City Council, and captive breeders. Each gave a distinct insight on the complex issue of gecko conservation. Piecing these perspectives together made it possible to understand the path gecko conservation must take to succeed. Although distinct, many answers overlapped in scope and content.

When asked why they were so passionate about New Zealand's lizards, most experts' answers, with some discrepancy, focused on the incredible diversity of New Zealand's lizards. Although birds have generally gained more recognition among New Zealanders for this reason, those knowledgeable of native lizards know that total number of species amounts to around 104. An interesting aspect of native lizards, unlike native birds lays in the high percentage - roughly 50 percent - that remain formerly undescribed. This means that plenty of discovery and study is ahead for New Zealand herpetology. Other responses contained personal reasons, such as local lizard breeder, Dennis Keall, and his passion for raising native lizard species. Figure 4.14 shows Keall's array of lizard enclosures.



*Figure 4.14: Dennis Keall's native lizard enclosures (Doty, 2017)*

When asked about what makes a successful, community involved conservation effort, many experts emphasized the importance of starting the conversation and the ability to interact with the species itself. This included interactions in the wild as well as through physically handling the animals during animal outreach programs. A ZEALANDIA ranger previously involved in a successful Kākāpō conservation effort exclaimed, “You need to get people linked to [the species]. They have to be able to relate to it” (J. Ledington, personal communication, January 19, 2017). Another expert expanded on this idea by mentioning that when people interact with her outreach animals, she often does not need to talk. Instead she remains silent and lets people forge a connection with the species. This expert later went on to discuss the Wellington Green Gecko specifically as an advocacy animal, declaring:

I think particularly the green gecko is just such a brilliant advocacy animal because, unlike birds, you actually can hold them, you can get a license to keep them, you can take them out, you can let them crawl on people and people can have that kind of transformative experience which often they can't have with a lot of our bird species.

(M. Emeny, personal communication, January 25, 2017)

In our discussions with experts we found that successful conservation efforts first begin the conversation with the public and then facilitate a connection between the public and the species.

Figure 4.15 portrays an example of establishing a connection with lizards through physical exposure.



*Figure 4.15: One of our team members establishing a connection with one of Wellington Zoo's Auckland Green Geckos (Doty, 2017)*

We followed up our question about past conservation successes with an inquiry about what barriers can get in the way of conservation. Responses ranged from the difficulty associated with attempting to change the public's habits for a species they have never seen, to the discouragement that could occur if geckos began to return to their yards or native bush only to disappear again. More general barriers mentioned in the interviews included the difficulty of simplifying a very complex conservation issue into a single, easily conveyed message.

We asked what the experts would like the public to know about lizards, and received responses ranging from simple messages to longer, overarching ideas on conservation as a whole. Multiple experts stated simply that they would like the public to know that there are lizards out there, and that there exists a huge variety of them. A PhD student from Victoria University of Wellington felt it important to also stress that, "...about 83 percent [of native

lizards in New Zealand] are threatened or vulnerable to extinction” (S. Herbert, personal communication, January 24, 2017). In a more broad sense, one expert replied:

I don't think New Zealanders are very good at living with nature. I think we are really proud of our landscapes and we have a big connection with that but there hasn't been a lot of native species in our living environments for a really, really long time--some of them hundreds of years--and now that they're starting to come back I think we have to relearn how to live with species and find that equilibrium of their right to be here and our need to exist and have our lifestyles as well. (J. Ledington, personal communication, January 19, 2017)

This response addresses conservation in New Zealand on a broader level than just lizard conservation.

We then asked respondents to consider one thing that they believe the community should do to save lizards and why they believe it would be effective. In response, multiple experts mentioned pest control or setting up traps to control non-native predator populations. Again, one expert mentioned the complexity of putting the conservation of a species into a single message.

During our interviews, interviewees made a few interesting recommendations. One expert mentioned a DOC-involved breed-for-release program in which members of the public could ‘adopt’ an animal and release it into the wild themselves. Another reiterated the idea that lizards could be easily connected to the public because children have the ability to go into their backyard and find them.

We asked experts to discuss their opinions on current efforts and organizations involved in lizard conservation. Using these expert opinions, we analyzed some of the planned or ongoing community engagement strategies. The following tables display the strategies identified in DOC's *Lizard Action Plan for Poneke Area, Wellington Conservancy 2009-2014* and WRLN's *Lizard strategy for the Wellington region 2012-20* that pertain or have the potential to pertain to community engagement. We identified these strategies in order to evaluate existing public engagement gecko conservation strategies to determine what Wellington Zoo should focus its future work on. We also felt it important to evaluate whether these planned strategies would alleviate any gaps in public awareness or willingness made evident by the data found earlier in this section. We found that many general strategies have been proposed but few specific community engagement strategies exist for Wellington regional gecko conservation. Tables 4.2 and 4.3 detail the respective DOC and WRLN strategies we determined to have a potential community involvement aspect.

Table 4.2: DOC strategies for lizard conservation

<b>Awareness and education</b>	<ul style="list-style-type: none"> <li>• Educate community to improve lizard habitat in gardens</li> <li>• Stress that lizards are protected by Wildlife Act and should only be observed, not handled or captured</li> </ul>
<b>Outreach</b>	<ul style="list-style-type: none"> <li>• Obtain lizard records and observations from the public</li> <li>• Advocate for protection of kanuka and manuka</li> <li>• Report sightings of lizards to the DOC Herpetofauna database</li> <li>• Support organizations and groups to survey and manage lizard populations</li> </ul>
<b>Risk management</b>	<ul style="list-style-type: none"> <li>• Manage biosecurity risks including invasive competitors and predators, and pathways for incursion</li> <li>• Cat and Dog or other appropriate mitigation for certain areas</li> </ul>

Table 4.3: WRLN strategies for lizard conservation

<b>Awareness and education</b>	<ul style="list-style-type: none"> <li>• Educate public and promote involvement in the restoration and conservation of lizard communities. This should include a tangata whenua perspective</li> <li>• Establish a lizard guide for the Wellington Region in order to provide a simple identification system to aid people in correctly reporting lizard sightings</li> <li>• Support educational programs for schools and the community</li> </ul>
<b>Outreach</b>	<ul style="list-style-type: none"> <li>• Support the use of captive lizards from breeders in conservation work</li> <li>• Train personnel to be able to record lizard sightings</li> <li>• Work in partnership with landowners in the region to promote and support lizard habitat restoration and protection</li> <li>• Support the involvement of the general public and community groups in conservation and restoration work</li> </ul>
<b>Risk management</b>	<ul style="list-style-type: none"> <li>• Consider poaching risks when supplying detailed information to the public</li> </ul>

We divided each agency's strategy list into the three broad categories of awareness and education, outreach, and risk management. We used what we learned through our interviews to analyze this list for what would be most effective for Wellington Zoo to pursue and support with its native gecko conservation campaign. The findings from our research shed light on some of

the gaps in current gecko conservation work, and helped us to better understand the complexity of the current state of New Zealand's geckos and their conservation.

## **4.2 Discussion**

We entered this project understanding that public awareness and perceptions of native lizards in New Zealand had been poorly documented. Through discussion with our sponsor and from some of our expert interviews, we conjectured that the general public had a low level of general awareness of native lizards, particularly geckos, and a relatively unknown level of willingness to aid these native animals in their plight. Through our survey we can now infer that the general public of the Wellington Region does have a low level of native lizard knowledge. Many participants had seen a lizard in New Zealand, however very few knew the country contains a large diversity of native lizard species. A majority of participants incorrectly named tuatara as one of the country's native lizard species, and fewer could correctly name either of the two major groups of native lizards. This has led us to believe that a key component of any future gecko conservation movement must lay in educating the general public about the incredible diversity of lizards in New Zealand. The Wellington Green Gecko makes for an excellent icon of regional gecko conservation due to its bright colors and distinct appearance; however, to best use it to characterize gecko conservation, the public must first know what it is. Few respondents recognized the green gecko, and even fewer knew anything about it besides its existence. To conserve these fascinating creatures, early conservation work must focus on fostering a better recognition of local geckos among regional residents.

New Zealanders had little knowledge of native lizard species, however most surveyed Kiwis could identify that lizards in general are not currently thriving in New Zealand. Few participants claimed that lizards are doing well, and a significant number stated their uncertainty over the question. Although this shows that part of conservation should focus on conveying the ecological status, it also reveals that efforts could be better spent on other areas of the issue. Bias may have seeped into these answers, as many respondents stated their answer as an assumption based on the general state of wildlife in New Zealand or on the conduction of the native lizard-related survey in itself. Fortunately, a general understanding of the ecological status of native flora and fauna as a whole would benefit gecko conservation. Along these same lines, many participants could correctly identify many of the threats to native lizards. Frequent answers include cats, stoats, habitat loss, and other predators. Few responses included mention of



introduced competitors, such as wasps or ants. Responses indicate that participants have a general awareness about the Predator Free New Zealand campaign, the controversial issue regarding cats' effect on the native wildlife, and human induced effects. With such an understanding of many of the ecological issues already instilled in the general public's knowledge, albeit not directly associated with native lizards, not as much work needs to be put towards educating and engaging the public in this area. Gecko conservation will benefit from the current plans towards Predator Free New Zealand, and the regional project, Predator Free Wellington.

From our survey and interviews we found that the general public in New Zealand understands and supports general conservation. Our survey illustrated that the general population responded strongly to the idea of conserving native species, such as birds and even lizards. Respondents' reasoning for this focused heavily on their high valuation of native biodiversity and its importance in New Zealand. Native New Zealanders also showed they have a strong understanding of the country's rare, varied ecosystems. The general public's support for the conservation of any native species bodes well for future community-involved gecko conservation. It is here that we find Wellington Zoo should base its conservation plan. We feel that emphasis on geckos as *native* species will create a connection between them and New Zealanders. Stressing geckos' importance in native ecosystems, and detailing the negative effects of geckos' absence from the environment will help the zoo to convey the importance of gecko conservation. The Wellington Green Gecko will aid with regional gecko conservation as its name connects itself with the region. This association can help to garner a connection between regional residents and the regional gecko conservation movement's icon.

The Wellington Green Gecko serves as an excellent conservation icon as not only is it unique to the region, but it also fits the majority of the regional resident's description of geckos. Despite most local gardeners finding common geckos - a small brown colored gecko - in their gardens, most described geckos as green. Therefore, although green geckos number much fewer than their grey and brown relatives, they dominate the public's image of a gecko. Use of the Wellington Green as an icon of Wellington regional gecko conservation would therefore be ideal to capture the public's attention. We found that many participants had a recognition of the setae, or bristly hairs on the gecko's feet that enable them to climb on almost any surface. This shows that, although a significant number of respondents failed to recognize gecko's as New Zealand



lizards, they still had knowledge about the distinct characteristics of geckos. Other common descriptions included quick and small, further displaying the public's knowledge of gecko characteristics. Fortunately for its conservation, more respondents described geckos charismatically than not, more frequently calling them cute than creepy.

From our interviews with gecko conservation experts, we learned that exposure to lizards can promote greater feelings of appreciation and connectedness for the animals among the public. Nicola Nelson, for example, has spoken to many groups over the past decade about tuatara and lizard conservation. She has brought a tuatara with her to these talks in order to give people an up close experience with the rare species of reptile. This has allowed her to truly engage with her audiences, and has enabled her to impart accurate information about native reptile research and conservation. Using advocacy animals like the tuatara, or even green geckos, can be invaluable in the conservation of cryptic species like geckos. It is likely the general public would rarely notice geckos whether their populations thrive or dissipate; so it is essential to show the public what animal the conservation work aims to save. Our survey results point out that use of advocacy animals may be a good pathway for successful gecko conservation as many respondents stated that they would like to see more geckos in New Zealand. Myfanwy Emeny elaborated on this idea in her interview, describing encounters with advocacy species, like green geckos, as “transformative experiences” that help to push the conservation message to a broader range of people, beyond those that would already welcome the sight of more geckos.

To involve the public in gecko conservation, Wellington Zoo's work must overcome a few challenges. The first lays in “beginning the conversation”, as Jo Ledington stated in her interview. Our survey showed that just over half of participants had an interest to save the green geckos, with a third somewhat interested and the rest not very interested. This shows that the general public does not have a strong interest in personally helping the species, despite previously stating their general support for conservation. We found that, of those at least somewhat interested in helping, most participants stated their willingness to aid gecko conservation by reporting sightings, donating money, or signing a petition. Only 2 percent of these interested participants were not willing to do any of the suggestions we listed. From this we inferred that the big issue may lay with informing the public of what exactly community or personal involvement in gecko conservation would entail. Spreading this information, in addition

to simple ways to help, would have a big impact on gaining public interest. Fortunately, Wellington Zoo has access to several outlets to spread this information including social media.

We found a useful correlation between participants' involvement in conservation and their interest in helping to save native geckos. The positive correlation between the two suggests that increased community engagement in general will lead to a greater interest in aiding gecko conservation. Therefore Wellington Zoo's current aim to connect people with animals will have a positive effect on public willingness to participate in native gecko conservation.

We determined that spreading awareness of native geckos and their conservation should take priority over raising public willingness to aid in their conservation. Participants seemed to already have a positive valuation of geckos as part of native biodiversity, and many appeared to have some willingness to aid in their conservation. Few respondents described geckos negatively, and the overwhelming majority described them charismatically. The primary issue with gecko conservation appears to be that few members of the general public have detailed knowledge of their biodiversity, their current ecological status, or the conservation efforts aimed at them. Unfortunately the primary threat to native lizards lays in introduced predators and competitors, and so the general public could only have a limited hand in helping to overcome this obstacle. Fortunately, however, the Predator Free New Zealand and upcoming Predator Free Wellington campaigns aim to resolve this issue for the benefit of all native flora and fauna. Wellington Zoo can therefore aim to target its campaign at spreading awareness of geckos and their conservation, as well as supporting simple, effective means for the public to become involved in gecko conservation.

## 5 Recommendations and conclusion

After reviewing our data, and the discussion that followed, we have developed some steps that the zoo and Wellington as a whole can take to build and foster lizard conservation in Wellington.

### 5.1 Recommendations

Through the results of our project we created the following list of recommendations for Wellington Zoo in order to engage the public in gecko conservation. As DOC and WRLN already have a long list of ongoing and planned strategies involving the general public, we focused our recommendations on filling any gaps left by these plans as well as adapting some of these strategies to what the zoo in particular could do.

To first address some of the shortcomings of our project, we recommend that the zoo continue to survey around the Wellington region to get stronger, more accurate data. Although 165 survey responses to our general survey gives us some statistical accuracy, it falls short of the accuracy associated with our initial target of 300 surveys. Should the zoo decide to extend the survey, we suggest that they aim to capture more of the suburban areas of the region, as we found it difficult to gain a high number of responses from some of the suburbs we targeted. Finding better distribution methods may be essential for this. We also recommend that the zoo explore the Māori perspective on lizards, and geckos specifically. Unfortunately, due to our brief time in Wellington we gained only limited insight into this. We found that a general view of native lizards encompasses them within Te Ao nui a Tanemahuta, the great forest domain, and as such are considered equally valuable to all else within the domain (T. McLeod, personal communication, February 27, 2017). To fully understand the cultural importance of native geckos, efforts would need to be made to include perspectives from each iwi.

The following recommendations detail some specific approaches Wellington Zoo could take to increase their involvement in native gecko conservation. The recommendations are separated by what Wellington Zoo could implement within the zoo itself and what the zoo could do to support the initiatives set forth by DOC and WRLN for the Wellington region.

## **Recommendations for within the Zoo**

### **1. Website**

An important step for Wellington Zoo to increase their involvement would be to devote a section of their website to the conservation work being done for native geckos. Part of the issue with New Zealand gecko conservation is that there is little information available about native species and their conservation. Therefore, putting this on their website could make information more available to the general public. From discussion with our sponsor, this work is already planned.

### **2. Pamphlet**

One reason for the limited public knowledge is the lack of gecko information accessible to the public. In response to this problem, Wellington Zoo could create an informative pamphlet that would be available to visitors at the zoo and online through the zoo's website. This pamphlet would include images and descriptions of each of the Wellington region's seven species of gecko. The cover would contain the Wellington Green Gecko, as its distinct coloring makes it ideal for serving as the icon of Wellington region geckos. The pamphlet would also include basic information on New Zealand's geckos as a whole, including conservation statuses, fun facts, and threats. A section of the pamphlet would be devoted to describing what can be done to help native gecko species, while a final section would list resources that could provide more information. A similar pamphlet could also be created for the region's skinks. Figure 5.1 shows the pamphlet's cover, general native gecko information, and how to help sections. The full mock up pamphlet can be seen in Appendix E.

The idea behind this pamphlet stems from WRLN's initiative to develop a lizard guide for the region. A basic informative pamphlet would enable the general population to learn more about the region's geckos, leading to greater awareness. As it would include sections devoted to describing conservation statuses of native geckos and how to help restore native species, it would provide a pathway for greater public involvement in gecko conservation. A key element of willingness we derived from conducting our survey is that even though individuals may not have felt strongly about participating in gecko conservation, they still felt that it was important and were willing to try some of the basic methods to help that we listed. Therefore it would be important to provide a resource to relay this information to the public effectively. We

recommend that Wellington Zoo create their own pamphlet, as the zoo would provide an effective means of distribution.

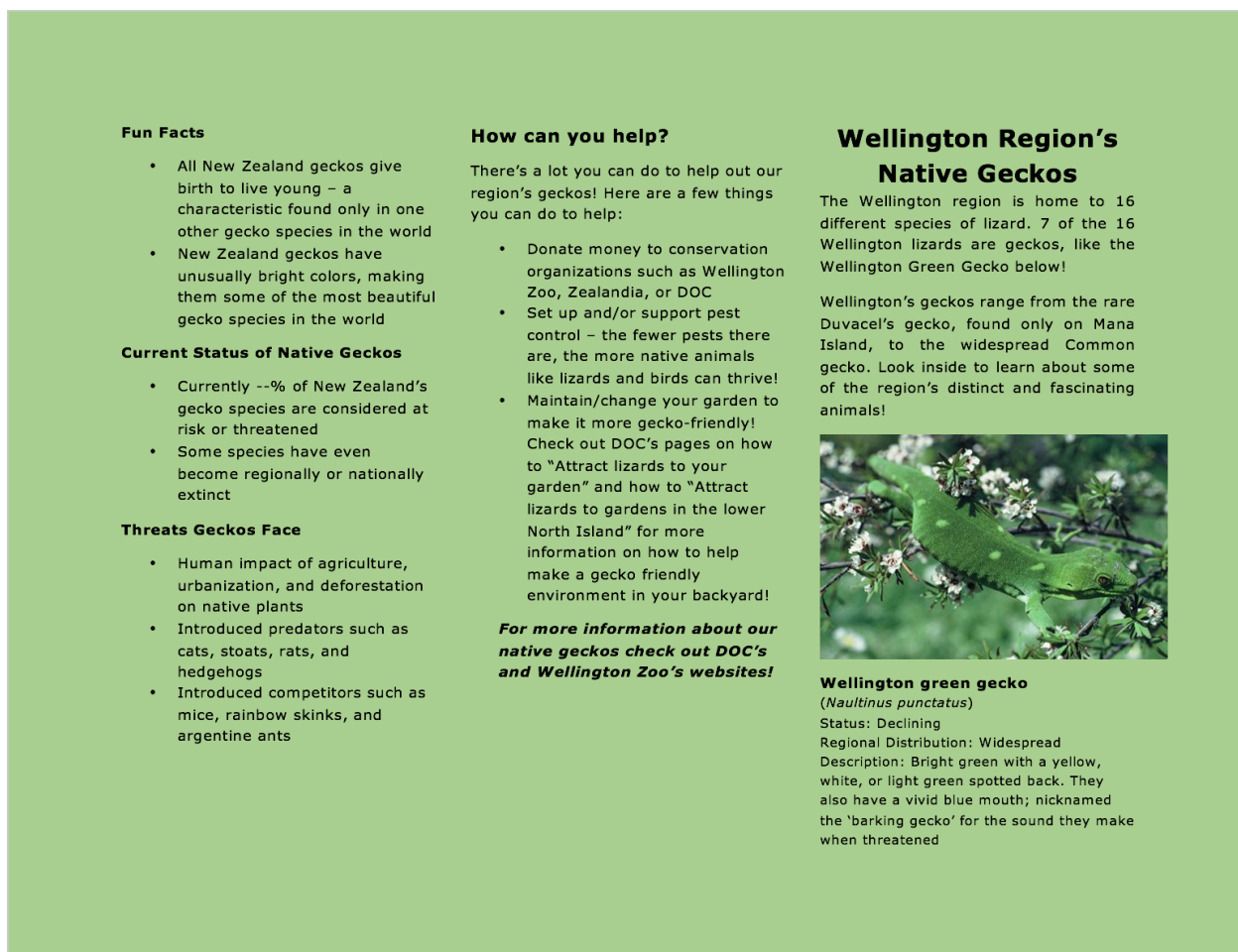


Figure 5.1: Regional gecko pamphlet – displaying the cover, general native gecko information, and how to help sections

### 3. Talk time

We also recommend that the zoo establish a talk time for native lizards. We feel that establishing a talk time would allow a better flow of information to visitors about native lizards and their conservation. If feasible, use of captive lizards out of their enclosure would provide a more effective means of spreading awareness. Part of the difficulty of gecko, and on the broader scale lizard conservation, rests with their cryptic nature; therefore, exposure to a native gecko would immensely improve the public's awareness of the species. Although it would be ideal for there to be physical contact, something as simple as a visual exposure would help capture the interest of zoo visitors.

Establishment of a native lizard talk time stems from the immeasurable benefits that stems from positive exposure with a charismatic species. Knowledge on the importance of geckos promotes pro environmental behaviour and stresses the emphasis Wellington Zoo places on verbally communicating information on their animals. Moreover, a talk time would provide a pathway for information about the incredible diversity of New Zealand lizard species and the percentage of these species currently at risk or threatened.

#### **4. Close encounter**

To develop further on the idea of a lizard talk time, the zoo could also consider organizing close encounters with native geckos. Although the zoo currently offers animal contacts with some of their lizards, these contacts do not follow a schedule nor does the zoo provide any advertisement about them. We suggest that the zoo could develop these informal animal contacts into a more routine, advertised lizard encounter. A close encounter would provide the physical exposure that a talk time could not provide, and could possibly provide monetary aid to gecko conservation. After exposure, the individual will remember geckos not only for their coloring, their size or speed, but for the way they feel in one's hands. Several of the gecko experts we interviewed, including Myfanwy Emery and Nicola Nelson, exclaimed the advantages that something as basic as holding a gecko can provide. This interaction forms a lasting connection with the species that cannot be replicated with many other animal species. Contact with native lizards may be one of the best ways for gecko conservation to gain a similar level of support as bird conservation achieves in New Zealand.

#### **5. Lizard exhibit**

As the zoo primarily works to communicate information about flora and fauna to zoo goers, it is important that the zoo establishes a native lizard exhibit. Although Wellington Zoo currently houses some native skinks, it does not yet convey the immense diversity of native lizard species to zoo goers. Establishing an open area with lizard cages would allow visitors to get a better understanding of the colorful and diverse native fauna. Informative signs at each cage would provide basic information to visitors about the native species. Having a lizard exhibit could open up more opportunities for Wellington Zoo to promote gecko conservation. The lizard exhibit would allow the zoo to also convey more information to visitors via informative pamphlets, talk times, and close encounters each of which was discussed above.

To go with this recommendation, we also suggest the formation of a garden within the zoo containing lizard-friendly native flora. This would likely fit well in the lizard exhibit proposed above, as the native foliage could accompany the lizard cages. Signs posted among the flora would allow visitors to learn which native plants offer excellent lizard habitat and how to find out more about how to maintain a more lizard friendly garden. We believe this would provide visitors a chance to see what a gecko-friendly garden would look like and encourage them to build similar sections within their gardens at home.

## **6. Naming poll**

Should the zoo decide to build a native lizard habitat, we suggest that they consider hosting a naming poll for the lizards. Having such a poll could lead to increased public involvement in gecko conservation, and could lead to the community feeling a connection to the lizards. One possible way of conducting the poll could be to use a shortlist of names. Having a series of polls for all the lizards would increase the number of participants.

## **7. School programs**

A native lizard exhibit would allow Wellington Zoo to host school programs with the specific aim of connecting and educating children from around the region with native lizard species. Establishing this direct contact with children could very positively affect future public awareness as not only will the children gain a better understanding and appreciation for native lizards, but they may also pass this along to their family members. A zoo program aimed at displaying native lizards at local schools could produce a similar effect. The program would ideally include an opportunity for children to hold one of the lizards; however, bringing children close to lizards while talking to them about the species would still be effective.

## **8. Merchandise**

From our first visit to Wellington Zoo, we noticed that there was little, if any, gecko or even lizard-themed merchandise in the zoo's gift shop. The tuatara was well represented, however the bulk of native reptiles were not. We recommend that the zoo consider selling more gecko-related merchandise. The sale of informative booklets, posters, or children's books would allow the zoo to have more involvement in the spread of awareness. By offering lizard-themed products, the zoo is able to further draw attention to existing native lizards which may ignite more interest towards the species with the community.

## **Recommendations for around the Wellington region**

Our research and data collection pointed to multiple recommendations that could be implemented throughout the entire Wellington region. These efforts could be initiated by Wellington Zoo but would require the cooperation of the entire WRLN and other agencies.

### **1. Promote lizard-friendly gardens**

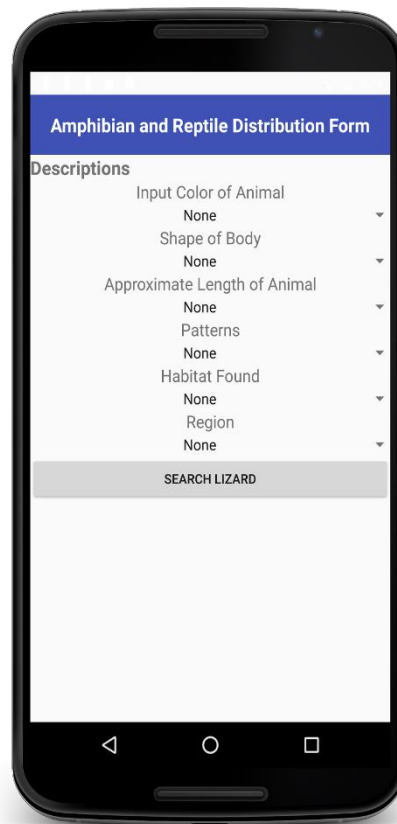
In order to foster community involvement and combat habitat loss, we believe the zoo should encourage the public to create lizard friendly sections of their gardens and yards. DOC currently has a page published on their website that provides tips on how to attract lizards to gardens. However the average member of the public would not likely stumble across this page unless directed there. Wellington Zoo could help spread this information by advertising the page through social media and other platforms of advertisement. To add to the first recommendation, the zoo could include a link to DOC's page or develop their own page on lizard friendly gardening to put on a native lizard section of the zoo's website. An additional pamphlet geared more towards individuals interested in home improvement could be developed and put into mainstream media. In one of our interviews with experts, they credited the success of one conservation effort they were involved in on documentaries and marketing on social media. A public service announcement video could be put on social media and television in order to reach more of the public. The PSA would promote useful, lizard-friendly gardening tips. These include stacking rocks and planting native vegetation that they could utilize to attract lizards to their gardens. The PSA would also direct individuals towards the DOC website for additional information on setting up gardens for lizards. The team filmed and provided an example PSA to the zoo for potentially use.

### **2. ARDS application or notebook**

Another area for improvement that we discovered was in the lizard identification system that is currently used by DOC and WRLN. An application could be developed that makes it easy for the public to identify and report sightings of New Zealand's amphibians and reptiles. This would include subdivisions for different types of native amphibians and reptiles as well as pictures and detailed descriptions so the public could more accurately report sightings. In order to increase the accuracy of lizard specific reports, lizard identification workshops could be held if sufficient interest is shown. The development of this application would take time as well as the combined resources of multiple organizations throughout the Wellington region and New



Zealand. Reaching out to local universities, or to our university, to aid in the application's development could help provide an inexpensive means of production as well as a sustainable stream of application support. Figure 5.2 illustrates one of the mock-up screens for the ARDS application.



*Figure 5.2: ARDS application mock-up*

The application would function using existing databases to draw data from which users would be able to access to learn more about the many unique species in New Zealand. Users would also be able to use the application in substitution for current ARDS cards by taking pictures of lizards and inputting their physical attributes alongside habitat information on a separate screen. Then the inputted data would be compared against known species and the application would produce the possible fauna for the user to select and learn more about. The user would then confirm the specific result they observed and the entry would be submitted to the database. This application would allow users to report sightings of lizards native to New Zealand and to educate people on specific lizards that they might not have knowledge about otherwise. By incorporating technology into lizard conservation, it facilitates New Zealander's

ability to aid native lizards' well-being. A full mock-up of the application can be found in Appendix F.

It is also possible to take this same application and put it in the form of a small, pocket sized notebook that could be carried by hikers where they would not have access to cellular service. This notebook could include multiple tear out, updated ARDS cards that can be sent to DOC in the mail. As a possible motivator to do this it could be set up in a way that once all ARDS cards in the notebook have been properly completed and submitted, the notebook can be returned for entry in a prize raffle or some other incentive.

### **3. New Zealand reptile book and education television program**

In order to reach a younger crowd a book, similar to those developed by Eyewitness Books, that tells the story of New Zealand's reptiles could be developed. This book would have a section detailing the history of lizards in New Zealand, highlighting the difference between the Tuatara and lizards, as well as portraying the cultural significance of lizards from the Māori perspective. Other, more basic sections could highlight the variety of species of lizards and their current ecological statuses. It should target children with the use of many pictures and accurate drawings, yet still contain a strong foundation of facts.

Similarly, the development of an educational television program would help to reach a younger audience. Television programming would be able to present the information put into the previously described book in a fun, yet educational manner. This would help to engage more members of the public, such as those not keen on reading. Like the book, a television program would need to capture the audience through interesting facts and videography, while instilling a story to connect audiences with native reptiles' history and significance. Beyond spreading awareness, this could help grow a sense of native lizards' values in members of the public.

### **4. New Zealand lizard documentary**

One of the major obstacles preventing gecko and lizard conservation from being a success is the lack of exposure they receive in comparison to other endangered species. In order to elevate the status of lizards in New Zealand, Wellington Zoo could support the production of a nature documentary focusing on these native New Zealand reptiles. This idea comes from our interview with Jo Ledington as she credits the success of Kākāpō conservation to a BBC nature documentary. The film thrust Kākāpō onto an international conservation stage by bringing the plight of the bird to conservationists all around the world. This in turn sparked interest amongst

people outside of New Zealand to participate in the conservation effort. We believe that a documentary on New Zealand reptiles could have similarly positive effects and draw attention to geckos from audiences around the world.

## 5.2 Conclusion

This study set out to provide Wellington Zoo with advice on how to approach their Wellington Green Gecko conservation effort. The team aimed to determine the general awareness New Zealand natives have of the Wellington Green Gecko, along with their willingness to help conserve the species. We believe that this research will fill a critical gap in current gecko conservation efforts by providing Wellington Zoo with more data on public interest. Through the use of our results, the zoo can better organize their current gecko conservation work such that it tailors to our findings of low public awareness of native lizards and high willingness to aid in gecko conservation. This will in turn lead to higher public participation in Wellington Green Gecko conservation, and help raise the species out of its at risk status. Beyond gecko conservation, we hope that this study will function as an example for future lizard conservation alongside public outreach and engagement projects. While our study was focused primarily on geckos, the findings that we analyzed can be applied to other similar projects and can serve as a guide for developing appropriate community driven conservation. This project will set a baseline for lizard conservation allowing future projects to function more efficiently and as a result create a lasting positive impact on New Zealand lizards.

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## Appendix A: Survey for general public

2/8/2017

Qualtrics Survey Software

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### Survey Info

---

#### Location:

- Wellington Zoo
- Wellington City Public Library
- Wellington Botanic Gardens
- Miramar Library
- Karori Park Cafe
- Karori Library
- Simla Crescent Station
- Other

---

#### If place is other:

---

#### Date

Month Day 

---

#### Time

Hour Minute AM/PM 

---

#### Who is giving the survey?

 Calvin Chen Michael Eaton

2/8/2017

Qualtrics Survey Software

- James Doty
- Derrick Naugler

---

**IF NEEDED: Good morning, how is your day at \_\_\_\_\_ going? We are university students working in collaboration with the Wellington Zoo to research public awareness of lizards. Do you have five minutes to take our survey? Before we start, do you happen to be from New Zealand? We are trying to gather results only from people who have lived on the island. We would also like to mention that all of your answers and information given are strictly confidential and anonymous.**

---

Is the participant from New Zealand?

- Wellington
- Not Wellington
- Reject Survey
- No
- 

### General Public Awareness

---

**Please answer the following questions on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree)**

---

Conserving native lizards is worth investing funds, time and resources.

Strongly Disagree	Neutral	Strongly Agree
1	3	5

Why?

---

Conserving native birds is worth investing funds, time and resources.

Not Valuable	Neutral	Extremely Valuable
1	3	5

---

2/8/2017

Qualtrics Survey Software

Have you ever seen a lizard in New Zealand?

- Yes  
 No
- 

If so, where?

---

Do you know the names of any New Zealand lizards?

- Yes  
 No
- 

Names:

- Gecko  
 Skink  
 Tuatara  
 Wellington Green Gecko  
 Forest Gecko  
 Common Skink  
 Other
- 

Do you know if any of these are unique to the Wellington Region?

- No/Not Sure  
 None  
 Yes, but can't name them  
 Gecko  
 Skink  
 Tuatara  
 Wellington Green Gecko  
 Forest Gecko  
 Common Skink

2/8/2017

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Other

What words come to mind when you think of geckos?

Have you ever heard of the Wellington Green Gecko?

- Yes  
 No

What do you know about it?

**Quick facts about the gecko: unique to the Wellington Region, green scaly skin, blue mouth, yellow or white spots on its back, barks when threatened**

Do you think lizards are thriving?

- Yes  
 Unsure  
 No

What do you think are some of the threats native lizards face?

Would you like to see more lizards in New Zealand?

- Yes  
 No  
 Don't Care

Have you done any of the following in the last two years?

2/8/2017

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- Volunteered for a conservation group
  - Donated funds to a conservation group
  - Been a member of a conservation organization
  - Participated in a conservation event such as a beach clean up or pest fest
  - Received newsletters or followed social media from a conservation group
  - None
- 

How interested would you be in helping to save New Zealand's green geckos?

1                      2                      3                      4                      5

---

What would you be willing to try to help the Wellington Green Gecko? Select all that apply.

- Nothing
  - Set up/support predator pest control
  - Maintain a lizard friendly section of your garden
  - Donate money/Sign a petition
  - Report sightings
- 

### Demographics

---

Do you garden?

- Yes
  - No
- 

What is your age?

- 18-29
  - 30-44
  - 45-59
  - 60+
- 

What is your gender?

2/8/2017

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- Male  
 Female  
 Prefer not to say
- 

### How would you describe your ethnicity?

- |   |   |
|---|---|
| <input type="checkbox"/> New Zealand European | <input type="checkbox"/> Pacific Islander       |
| <input type="checkbox"/> Maori                | <input type="checkbox"/> North American         |
| <input type="checkbox"/> European             | <input type="checkbox"/> Central/South American |
| <input type="checkbox"/> Asian                | <input type="checkbox"/> African                |
| <input type="checkbox"/> Australian           | <input type="checkbox"/> Other                  |
| <input type="checkbox"/> Indian               |   |
- 

### Comments/Key Points

Powered by Qualtrics

## **Appendix B: Survey for gardeners**

### **Email introduction:**

#### **Gaining insight of our gardening community**

By completing this anonymous survey, you will help us understand the practices and habits of local gardeners. This survey was made by third year university students from Worcester Polytechnic Institute. Please complete this survey by Wednesday February 15th so that we can complete our project on time.

If you are interested the results of this study will be published by WPI as well as given to Wellington Zoo for future reference.

Thank you for taking five minutes to complete our survey.

---

### Default Question Block

---

**This survey was constructed by students from Worcester Polytechnic Institute, working in collaboration with Wellington Zoo. It aims to gain insight on the practices and habits of local gardeners or garden owners. This survey should take approximately 5 minutes. All of your answers and information given are strictly confidential and anonymous.**

---

Where do you live?

- Thorndon
  - Te Aro
  - Karori
  - Brooklyn
  - Newtown
  - Island Bay
  - Miramar
  - Petone
  - Eastbourne
  - Other:
- 

Why do you garden?

---

Where do you garden?

- Personal Garden
- Community Garden
- Both



2/8/2017

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Other

---

How would you describe your garden?

- Fruit or Vegetable Garden
- Flower Garden
- Butterfly Garden
- Natural Garden
- Other
- 

How often do you maintain your garden? Select which answer is closest to your own habits.

- Once or more a week
- Once in a fortnight
- Once a month
- Only during the summer
- A few times a year
- 

I would garden more if \_\_\_\_\_

---

Do you have native plants in your garden?

- Yes
- No
- 

Tick any that are present in your garden:

- Porcupine scrub (*Melicytus alpinus*)
- Mikimiki or Mingimingi (*Coprosma propinqua*)
- Thick leaved coprosma (*Coprosma crassifolia*)
- Shrubby tororaro (*Muehlenbeckia astonii*)

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- Pohuehue (scrambling Muehlenbeckia species)
- Matagouri (Discaria toumatou)
- Manuka (Leptospermum scoparium)
- Kanuka (Kunzea ericoides)
- Gaultheria, Pentachondra, Pernettya, or Leucopogon
- Raoulia or other cushion plants
- Helichrysum, Parahebe, or Pimelia
- Tussock, Astelia orflax.
- Pohuehue.
- I don't know
- I don't have any of these native plants in my garden

---

Please tick ALL of the following that apply to your garden:

- My garden has at least some thick plant growth
- My garden has vines and creepers on the walls/fence etc.
- My garden contains berry/nectar producing plants
- I use mulch in my garden
- I have stacks in my garden, or a portion of my garden is filled with debris such as spilled wood
- My garden has stone walls, retaining walls or embankments that have plenty of small gaps, cracks and crevices
- I have water sources, such as bowls or baths ponds etc in the garden.
- My garden is regularly visited by my/a cat
- I do trapping of pests predators in or around my garden

---

Where do you get your plants?

---

Conserving native lizards is worth investing funds, time and resources

- Strongly Disagree      Disagree      Neither agree nor disagree      Agree      Strongly agree
-

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Why?

Conserving native birds is worth investing funds, time and resources.

- Strongly Disagree      Disagree      Neither agree nor disagree      Agree      Strongly agree
- 

Have you ever seen a lizard in New Zealand?

- Yes  
 No

If so, where?

What words come to mind when you think of geckos?

Have you ever seen lizards in your garden?

- Yes  
 No

How frequently have you seen them?

- Almost never  
 Rarely  
 Occasionally  
 Often  
 Always

Do you know what species they were?

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- Yes
- No

---

Could you describe them? If so, please do so below.

---

Which species were they?

- Gecko
- Skink
- Tuatara
- Wellington Green Gecko
- Forest Gecko
- Common Skink
- Other

---

Would you enjoy seeing geckos in your garden?

- Yes
- No

---

Would you be keen to make your garden more gecko friendly?

- Yes
- No

---

What would you be keen to do? Select all that apply.

- Nothing
- Grow more native plants
- Keep a 'wild garden' section
- Set up traps to reduce pests
- Plant berry and nectar producing plants
- Build stacks or a stone wall to provide shelter for lizards

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- Plant vines and creepers along fences and walls
  - Leave water
  - Supervise pets when in garden
  - Report any lizard sightings
  - Minimize use of pesticides
  - Other
- 

### What is your age?

- 15-29
  - 30-44
  - 45-59
  - 60+
- 

### What is your gender?

- Male
  - Female
  - Prefer not to say
- 

### How would you describe your ethnicity?

- |  |  |
|--|--|
| <input type="radio"/> New Zealand European | <input type="radio"/> Pacific Islander       |
| <input type="radio"/> Māori                | <input type="radio"/> North American         |
| <input type="radio"/> European             | <input type="radio"/> Central/South American |
| <input type="radio"/> Asian                | <input type="radio"/> African                |
| <input type="radio"/> Australian           | <input type="radio"/> Other                  |
| <input type="radio"/> Indian               |  |

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## Appendix C: Interview for experts

### Interview for Experts

Date: \_\_\_\_\_ Interviewer: \_\_\_\_\_ Location of Interview: \_\_\_\_\_

Interviewee: \_\_\_\_\_ Organization: \_\_\_\_\_ Position: \_\_\_\_\_

"We are a group of students from Worcester Polytechnic Institute in the USA working in collaboration with the Wellington Zoo on Wellington Green Gecko advocacy. Our project aims to gauge the public's awareness of the gecko and willingness to help in the efforts aimed at saving native lizards. We would like to conclude our project with some suggestions on directions the zoo should move towards in order to garner community involvement in the conservation efforts. Before we start, do we have your permission to record this interview? (YES/NO) Do we have your consent to use direct quotes taken from this interview? (YES/NO) You will have the right of review before any publication of our project."

#### Interview Questions:

1. How would you describe your involvement in XX? (Customized for each interviewee)
2. Why are you passionate about XX? (Customized for each interviewee)
3. What are some examples of a community outreach project that you have seen succeed and why do you think it was successful?
4. What are some barriers you have seen get in the way of conservation/community outreach projects?
5. If you would like the community to know one thing about the lizard status in New Zealand what would it be? Why?
6. **If not already touched upon in 5:** If everyone in the community of the Wellington region did one thing to save the lizards/geckos what do you think it should be? Why?
7. Do you have any recommendations on other experts that we should contact for their comments on the issue?

## **Appendix D: Summary of cases used in section 2.6**

### **Case 1: Raising awareness of sea turtle habitat in coastal Florida**

The most effective conservation efforts involve the community to raise awareness of the issue. This is illustrated in the case study *Raising Awareness of Sea Turtle Habitat* by Daniel Evans where a local conservation group reached out to coastal Florida communities to distribute information regarding endangered sea turtle habitats. The Sea Turtle Survival League (STSL), as a part of the Caribbean Conservation Corporation, built upon their previous work to create the 2002 Sea Turtle Nesting Habitat Awareness Campaign (Evans, 2005). During the campaign, the group came up with three objectives they wanted to achieve to raise awareness for the turtle habitat.

The first objective the group created was to provide local sea turtle groups with printed educational material for distribution to coastal businesses (Evans, 2005). Additionally, the campaign reached out to many different communities along the Florida coast, offering 800 businesses industry relevant educational material about the sea turtles. Each item circulated had an image of a sea turtle and location specific information on how locals could help reduce negative impact on the turtle habitats. This material was accepted by nearly 89% of these businesses (Evans, 2005).

Another objective that the STSL established was acknowledging sea turtle friendly businesses through an awards program (Evans, 2005). The awards program aimed to highlight local businesses that greatly contributed to the mission of the Sea Turtle Nesting Habitat Awareness Campaign. The STSL hoped that by supporting these businesses they would be able to encourage the public to go to those establishments more. In turn, more people and more businesses would have an incentive to join in on the effort. Between 2002 and 2005, the campaign reached out to 12 counties in Florida and granted turtle awards to approximately 60 businesses in 11 counties (Evans, 2005).

The final objective that the league created was to improve educational resources available to the public online (Evans, 2005). The STSL updated a section of the Caribbean Conservation Corporation website, [www.cccturtle.org](http://www.cccturtle.org), to provide additional information for individuals' looking to help conserve sea turtle habitats. The site contained material on Florida coastal management policies alongside other current turtle issues. According to Evans, between 2003 and 2005 the website had generated 220,000 new and distinct visitors, averaging about 600 users each day (Evans, 2005).

This campaign by the STSL led to the signing of The Marine Turtle Conservation Act of 2004. The bill helped bring funding to the conservation of sea turtles in foreign countries. As the organization involved the public, they were able to create incentives for participating in their campaign as shown by the turtle awards program. Additionally, they provided outlets for which people were able to gather more information on turtles. A takeaway from this case study is that local businesses are a major source of support for raising awareness in conservation efforts. In addition, the distribution of materials also had a positive impact in providing information to the public.

### **Case 2: Conserving manatees: knowledge, attitudes, and intentions of boaters in Tampa Bay, Florida**

The example set by researchers from the University of Florida and the Florida Marine Research Institute in their work done to aid manatee conservation efforts in Tampa Bay, Florida

may prove a useful resource in our similar endeavor to engage the public in the Wellington Green Gecko conservation effort. The work done by the manatee group aimed to draw information from the area's boaters in order to assess the connections between their knowledge, attitudes, and intentions toward manatees, as well as the marine mammal's conservation. The group gained important information from surveys and interviews that led to a series of recommendations.

The manatee group gauged awareness of the manatees, opinions of manatee conservation, and use the "theory of reasoned action" to look at the relationships between boater "beliefs, attitudes, norms, and behavioural intentions" in order to discover any knowledge gaps (Aipanjiguly, Jacobson, & Flamm, 2003). To accomplish these tasks, they defined several key terms that played a large role in their project, including attitude and the theory of reasoned action - the assumption that "people are reasoning beings who systematically utilize or process the information available to them and that people consider the implications of their actions before they decide to engage or not engage in a particular behaviour" (Aipanjiguly et al, 2003). They also established a survey questionnaire designed to determine boater knowledge of manatees, and opinions on both conservation and manatees. The group also conducted in-person interviews to garner more specific information, such as boater attitudes and subjective norms. Through data analysis, the group found a positive correlation between manatee knowledge and support for their conservation. This information led to recommendations that involved spreading manatee knowledge to boaters via their primary source of information, newspapers and magazines (Aipanjiguly et al., 2003).

The work done by Sampreethi Aipanjiguly et al. depicts a successful effort to establish data on public awareness, attitudes, and support for a species. They also managed to produce several recommendations that may have ultimately contributed to successful manatee conservation efforts. This success can be seen as apparent due to the Florida Fish and Wildlife Conservation Commission recent vote to remove the manatee off of the endangered species list. We will look to the work done by Aipanjiguly et al. as a useful resource for our work to aid Wellington Zoo in their efforts to engage the public in the Wellington Green Gecko conservation movement.

### **Case 3: Understanding beach users' awareness of shorebird conservation in central Queensland**

The study done by Tamara van Polanen Petel and Ashley Bunce titled *Understanding Beach Users' Behavior, Awareness, and Attitudes to Shorebird Conservation in Central Queensland: Tools for Effective Shorebird Conservation* provided insight on the processes behind gathering information from the public. In this study Petel and Bunce gathered information from 163 beach-goers in order to draw their conclusions. Petel and Bunce lay out the goal of their project in three steps. They investigated the behavior and activity of beach users, established a baseline for the awareness and attitudes of beach users towards shorebirds and their conservation, and determined some of the most effective educational resources and management actions to raise public awareness of the issue (van Polanen Petel & Bunce, 2012). This study was similar to our project in that, they wished to determine public awareness of shorebirds and shorebird conservation issues in order to improve upon conservation strategies used in regards to at risk or threatened shorebirds.

Human disturbance as well as habitat loss and predation were the three causes that Petel and Bunce list for the decrease in shorebird population. The authors also stated that education of



the community on such issues is very important but continue on to note, “Although education and awareness raising actions are often mentioned as important and included in conservation models, few studies investigate public awareness of and attitudes towards shorebird conservation...” (van Polanen Petel & Bunce, 2012). The three causes for the decrease in shorebird population mirror exactly what we have found to be the causes behind the decreasing Wellington Green Gecko population. In our research we have also found that there has been very little previous work done on the public’s awareness of the issue. Gathering and evaluating such data is what Petel and Bunce did as well as one of the objectives of our project.

Petel and Bunce conducted a majority of their survey on the central Queensland coast which is home to 40,000 migratory and 3,500 resident shorebirds that are vital to international and local populations. Some of these shorebirds are listed as rare and at risk under Queensland’s *Nature Conservation Act of 1992*. The region that was surveyed in this study has also undergone rapid human population growth in the years leading up to the study which lead to a lack of management actions for the increasingly used beaches. During the summer of 2007/2008, Petel and Bunce surveyed beach users on ten beaches all known to in close proximity with shorebird roosting/breeding sites as well as major urban areas. They developed a 36 question survey that they would ask to randomly selected beach-goers between the hours of 7:00 am and 5:00 pm, disregarding individuals under the age of 18. Their survey was made up of three sections: general information on the individual, details of their beach use, and knowledge of shorebirds and the threats they face. The third section included questions on education resources, level of concern for certain species of shorebird, and a section on identifying specific species (van Polanen Petel & Bunce, 2012). Petel and Bunce acknowledged that the small sample size of 163 people was not enough to be considered conclusive and stated that the study would serve as a preliminary analysis on the topic.

From this study, Petel and Bunce were able to gather some information on the most effective educational methods for conveying information on conservation to the public. They were able to conclude that 16% of the respondents had learned about shorebirds from newsprint, 15% from signage at the beach, and 15% from TV/radio. These were the most common sources of public information, but when asked which modes were the most effective they found the library was ranked the highest by 25% of participants followed by TV/radio with 12%, signage at the beach with 11%, and newsprint with 10%. The participants in the survey were also asked which medium was most likely to be read, viewed or listened to if given the opportunity. Signage at the beach ranked the highest with 20% of the respondents while signs in the car park at the beach was ranked the highest by 15% of the individuals (van Polanen Petel & Bunce, 2012). Another important takeaway from this study was that a majority of people surveyed believed they could take action in order to help protect shorebirds and coexist with the birds.

## Appendix E: Gecko pamphlet

### Fun Facts

- All New Zealand geckos give birth to live young – a characteristic found only in one other gecko species in the world
- New Zealand geckos have unusually bright colors, making them some of the most beautiful gecko species in the world

### Current Status of Native Geckos

- Currently --% of New Zealand's gecko species are considered at risk or threatened
- Some species have even become regionally or nationally extinct

### Threats Geckos Face

- Human impact of agriculture, urbanization, and deforestation on native plants
- Introduced predators such as cats, stoats, rats, and hedgehogs
- Introduced competitors such as mice, rainbow skinks, and argentine ants

### How can you help?

There's a lot you can do to help out our region's geckos! Here are a few things you can do to help:

- Donate money to conservation organizations such as Wellington Zoo, Zealandia, or DOC
- Set up and/or support pest control – the fewer pests there are, the more native animals like lizards and birds can thrive!
- Maintain/change your garden to make it more gecko-friendly! Check out DOC's pages on how to "Attract lizards to your garden" and how to "Attract lizards to gardens in the lower North Island" for more information on how to help make a gecko friendly environment in your backyard!

***For more information about our native geckos check out DOC's and Wellington Zoo's websites!***

### Wellington Region's Native Geckos

The Wellington region is home to 16 different species of lizard. 7 of the 16 Wellington lizards are geckos, like the Wellington Green Gecko below!

Wellington's geckos range from the rare Duvacel's gecko, found only on Mana Island, to the widespread Common gecko. Look inside to learn about some of the region's distinct and fascinating animals!



#### Wellington green gecko

*(Naultinus punctatus)*

Status: Declining

Regional Distribution: Widespread

Description: Bright green with a yellow, white, or light green spotted back. They also have a vivid blue mouth; nicknamed the 'barking gecko' for the sound they make when threatened



**Pacific gecko**

(*Dactylocnemis pacificus*)

Status: Relict (Conservation Dependent)

Regional Distribution: Upper Hutt

Description: Slender, with a brown, olive, and grey back; they are nocturnal; live both on the ground and in trees; known for being shy and nervous



**Duvaucel's gecko**

(*Hoplodactylus duvaucelii*)

Status: Relict (Conservation Dependent)

Regional Distribution: Mana Island

Description: Grey with some olive-green patches; largest living gecko species in New Zealand; live both on the ground and in trees



**Southern North Island forest gecko**

(*Mokopikikakau* "Southern North Island")

Status: Not Threatened

Regional Distribution: Widespread

Description: Grey, brown, or green-brown; have markings that help them to camouflage in the forests they live in; have an orange mouth



**Goldstripe gecko**

(*Woodworthia chrysosiretica*)

Status: Relict (Conservation Dependent, Range Restricted)

Regional Distribution: Mana Island

Description: Yellow-brown to olive color, with long alternating light to dark stripes; nocturnal; found in wide range of habitats from forests to scrub, and have even adapted to some urban environments



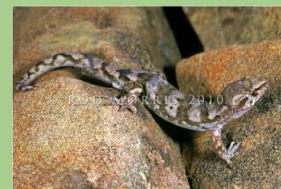
**Common gecko**

(*Woodworthia maculata*)

Status: Not Threatened (Partial Decline)

Regional Distribution: Widespread

Description: Similar coloring to forest geckos, however they have a distinctly pink mouth; primarily live on the ground



**Common gecko "Marlborough mini"**

(*Woodworthia* "Marlborough mini")

Status: Not Threatened

Regional Distribution: Wellington south and west coast

Description: Similar in appearance to common geckos, however they are notably smaller

## Appendix F: ARDS application

