

# Tracking Aucklanders' Conservation Perceptions and Behaviours: Natural Environment Portfolio Social Outcome Monitor 2020 (Baseline)

Kathryn Ovenden and Laura Roberts

June 2021

Technical report 2021/15







# Tracking Aucklanders' conservation perceptions and behaviours: Natural Environment Portfolio Social Outcome Monitor 2020 (Baseline)

June 2021

Technical Report 2021/15

Kathryn Ovenden  
Environmental Services

Laura Roberts  
Research and Evaluation Unit

Auckland Council  
Technical Report 2021/15

ISSN 2230-4525 (Print)  
ISSN 2230-4533 (Online)

ISBN 978-1-99-100232-7 (Print)  
ISBN 978-1-99-100233-4 (PDF)

This report has been peer reviewed by the Peer Review Panel.
Review completed on 31 <sup>st</sup> May 2021 Reviewed by two reviewers
Approved for Auckland Council publication by:  Name: Samantha Hill  Position: Head of Natural Environment Design, Environmental Services
Name: Craig Pratt
Position: Team Manager, Community Conservation and Engagement, Environmental Services
Date: 16 June 2021

#### Recommended citation

Ovenden, K and L Roberts (2021). Tracking Aucklanders' conservation perceptions and behaviours: natural environment portfolio social outcome monitor 2020 (baseline). Auckland Council technical report, TR2021/15

#### Acknowledgements

This report has greatly benefited from detailed reviews from Dr Jane Groom and Danielle Kennedy.

© 2021 Auckland Council

Auckland Council disclaims any liability whatsoever in connection with any action taken in reliance of this document for any error, deficiency, flaw or omission contained in it.

This document is licensed for re-use under the [Creative Commons Attribution 4.0 International licence](https://creativecommons.org/licenses/by/4.0/).

In summary, you are free to copy, distribute and adapt the material, as long as you attribute it to the Auckland Council and abide by the other licence terms.



## Table of contents

Executive summary .....	1
1 Background .....	3
1.1 Behaviour change model .....	4
1.2 Key terms used in this report .....	5
2 Outcome monitoring .....	5
3 Method.....	6
3.1 Survey data collection.....	6
3.2 Survey data analysis.....	7
3.3 Measure calculation.....	7
3.4 Behavioural analysis statistical procedure .....	7
4 Participant sample .....	10
5 Monitoring results .....	14
5.1 Aucklanders who are knowledgeable about biodiversity and biosecurity pressures... 14	
5.1.1 Scoring.....	17
5.2 Aucklanders who have capabilities and capacity to undertake conservation activities..18	
5.2.1 Capabilities to undertake conservation activities.....	18
5.2.2 Capacity to undertake conservation activities .....	20
5.2.3 Scoring.....	23
5.3 Aucklanders who value biodiversity .....	23
5.3.1 Scoring.....	27
5.4 Aucklanders who feel a sense of connectedness with nature.....	27
5.4.1 Scoring.....	28
5.5 Aucklanders who feel a sense of personal responsibility for reducing their biosecurity risk .....	29
5.5.1 Scoring.....	31
5.6 Aucklanders who participate in conservation activity .....	31
5.6.1 Scoring.....	34
5.7 Auckland public who frequently perform biosecurity-related behaviours .....	35
5.7.1 Scoring.....	38
5.8 Demographic trends .....	39

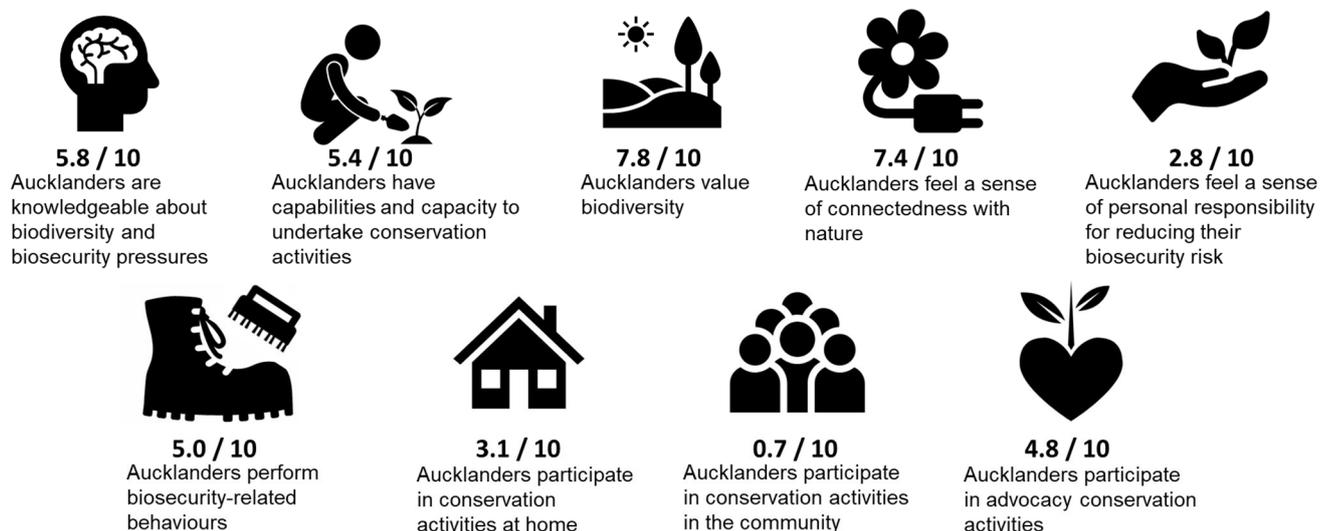
5.9	Summary .....	40
6	Behaviour change model .....	41
6.1	Conservation activities results .....	41
6.1.1	Activities at home .....	41
6.1.2	Activities in the community .....	43
6.1.3	Advocacy conservation activities.....	44
6.2	Biosecurity-related behaviour results.....	46
6.3	Summary .....	48
7	Conclusions and recommendations.....	49
8	References .....	51
9	Appendix.....	53
9.1	Questionnaire .....	53
9.2	Transformation of variables .....	64
9.3	Scoring for Aucklanders who are knowledgeable about biodiversity and biosecurity pressures .....	64
9.4	Coding likelihood responses for opportunity construct.....	65
9.5	Statistical procedures .....	66
9.6	Internal consistency (Cronbach's alpha ( $\alpha$ )) .....	67
9.7	Principal Components Analysis (PCA).....	67

## Executive summary

Auckland Council's Environmental Services Unit delivers a range of biodiversity management programmes. These programmes are funded through general rates, local board funding and from 2018, through the Natural Environment Targeted Rate (NETR). Social outcomes are one area of focus for the Natural Environment Portfolio and the programmes and projects within funded by NETR – alongside ecosystem, species, and Māori outcomes. Social outcomes such as increased conservation capabilities, awareness of conservation, and performance of good biosecurity-related behaviours are shared across programmes in the Natural Environment Portfolio.

This study forms the baseline report in what will become a series of reports monitoring the achievement of social outcomes over the 10-year duration of NETR (ending in 2028). This study involved a survey of Aucklanders administered through Auckland Council's People's Panel which was undertaken in November 2020 and collected 1813 responses. The findings and recommendations are also of relevance and interest to those who contribute towards conservation outcomes outside the Natural Environment Portfolio such as other Auckland Council units, the Department of Conservation, and conservation community groups.

The social outcomes analysed in this report provide a snapshot of Aucklanders' conservation values, knowledge, and behaviours which are illustrated in Figure 1 below. Scores have been calculated to provide a single figure for these measures which can be tracked over time.



**Figure 1: Baseline scores of the natural environment social outcome measures.**

The COM-B model of behaviour has been applied to suggest on which areas the Natural Environment Portfolio should focus to bring about behavioural change in Aucklanders to increase participation in conservation activities and biosecurity-related behaviours. Modelling was undertaken to explore which of the COM-B constructs (capability, opportunity,

and motivation) are the strongest predictors of behaviour for this context<sup>1</sup>. It was found that the opportunity to perform a behaviour or activity and the ability to perform a behaviour or activity were the strongest predictors of behaviour. Motivations (e.g., a sense of personal responsibility) and knowledge about biodiversity were non-significant predictors of behaviour. The Behaviour Change Wheel that accompanies the COM-B model of behaviour should be considered as a framework to apply these findings.

A series of recommendations are provided based on the findings. These include:

- Further research into the terminology used in council natural environment communications and a need to investigate the means of clearly communicating the relationship between biosecurity actions and biodiversity outcomes.
- Adopt a segmented approach to deliver targeted initiatives for different Aucklanders whereby different initiatives are developed for different segments of Aucklanders<sup>2</sup>.
- Investigate means to increase the conservation abilities (i.e., practical skills) of Aucklanders.
- Consider delivering support services, such as garden waste collection and tool libraries, that enable participation in conservation activities.
- Focus on delivering events and opportunities for participation in conservation activities that are accessible and appealing for a diverse range of Aucklanders.

---

<sup>1</sup> The COM-B model is well accepted in literature and this analysis does not attempt to validate the model.

<sup>2</sup> In marketing, a segmentation describes an approach whereby the market is split into segments and products / services are tailored to meet the needs of different segments.

# 1 Background

Auckland Council delivers a range of biodiversity management programmes in accordance with objectives in the Auckland Plan, the Auckland Council Biodiversity Strategy, and the Regional Pest Management Plan. These programmes are funded through general rates, local board funding, and more recently, through the Natural Environment Targeted Rate (NETR). The NETR provides an additional \$311 million over 10 years (2018-2028) towards achieving biodiversity outcomes across the Auckland region. Social outcomes such as increased conservation capabilities, awareness of conservation, and performance of good biosecurity-related behaviours are shared across programmes in the Natural Environment Portfolio. These outcomes are seen to be required by portfolio management to achieve overarching biodiversity outcomes which are the ultimate focus of the NETR. This focus on human behaviour is critical as the outcomes cannot be achieved by council-delivered action alone (e.g., contracted pest control). It therefore requires monitoring to determine if the NETR project and activity level interventions (such as awareness building communication campaigns and training workshops) are contributing as theorised to achieve the NETR programme and portfolio aims. Reporting on success at these higher levels requires standardised and centralised data collection at the activity and project levels.

A robust monitoring and evaluation process is fundamental to understanding progress made towards biodiversity and biosecurity objectives as well as evaluating the efficiency and effectiveness of projects contributing to achieving these objectives. To enable this a framework (The Framework) of outputs, outcomes and associated measures was developed. Programmes, projects, and activities within the Natural Environment Portfolio are required to align with the framework and are justified by evidencing their contribution towards outcomes.

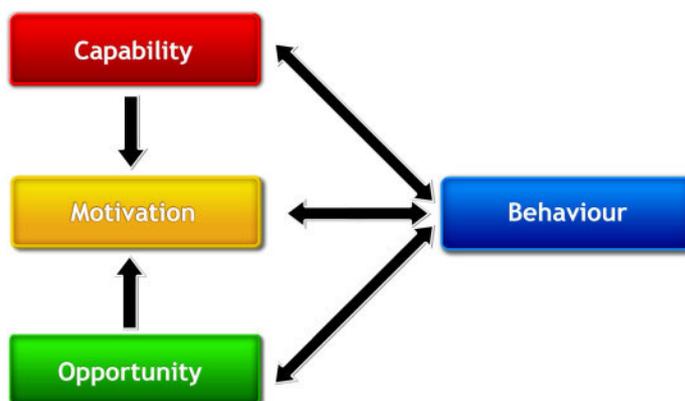
The Framework has been divided into four workstreams (social, species, ecosystem, and Māori outcomes) for which data is collected, analysed, and measures reported. The social data workstream collects data at the activity (direct customers) and portfolio (regional) levels. This design facilitates evidence-based decision-making for projects using direct feedback from customers and regional-scale monitoring of trends through which impact of the NETR can be inferred. The social outcome measures were influenced by the COM-B model of behaviour which is used to inform the design of behaviour change projects.

This report is the first in what will become a series of reports monitoring regional trends over the 10-year lifespan of the targeted rate. Regionally representative data will be collected every two years. This frequency of data collection is anticipated to be long enough for measurable change in, for example, awareness, attitudes, and behaviours to occur, and short enough to enable adaptive portfolio management.

Data collected in the survey conducted for this study will be directly compared to data collected from direct customers both in this report and in project / activity level reports. Direct customers include, for example, event and training attendees, and recipients of tools and resources. These customers will be surveyed on the outcomes of their service experience such as increased capabilities following a training workshop. The reported capabilities of attendees can be compared with capabilities of Aucklanders overall from the data in this survey.

## 1.1 Behaviour change model

There are many models to describe human behaviour and mechanisms for changing human behaviour. Susan Michie's COM-B model is applied here (see Figure 2) (Michie et al., 2011). The COM-B model has been widely applied (4862 citations on Google Scholar) and complemented in its ability to enable the development of effective theory-based interventions (Whittal et al., 2020). Social-cognitive models, such as COM-B and Theory of Planned Behaviour, have received general criticism for their individualistic focus, rationalising of human behaviour, and assumptions of universalism (Ajzen, 1991; Marks et al., 2020). COM-B is one of the strongest of the many social-cognitive models because it includes consideration of the physical and social structures that create opportunities for behavioural performance. This model has been adopted by the Natural Environment Portfolio to frame its approach to behaviour change. The COM-B model influenced the development of The Framework to monitor the Portfolio's achievements.



**Figure 2: COM-B model (Michie et al., 2011).**

The COM-B model describes how capability, motivation, and opportunity interact to produce a behaviour. Capability is defined as an individual's psychological and physical ability to engage in the behaviour such as the required knowledge and skills. Motivation describes the 'brain processes' that influence conscious and automatic decision-making including emotions, attitudes, values, and beliefs. Opportunity is defined as the social and physical context outside an individual that allows a behaviour to occur (Michie et al., 2011). Behaviour

itself forms a positive feedback loop to each of the elements. Interventions must target one of more of these areas to bring about behavioural change.

## 1.2 Key terms used in this report

NETR – Natural Environment Targeted Rate (from 2018-2028).

Natural Environment Portfolio – the suite of programmes and projects receiving funding from the Natural Environment Targeted Rate and contributing towards shared outcomes.

Conservation activities – pro-conservation actions undertaken by Aucklanders such as controlling for pests by setting traps or weeding, planting native species, and advocating for the natural environment.

Biosecurity-related behaviours – actions undertaken by people in Auckland to reduce the spread of pests. For example, using kauri dieback cleaning stations and cleaning gear used in freshwater.

COM-B model – A model of behaviour which explains that a behaviour (B) is performed when an individual has the capabilities (C), opportunity (O), and motivation (M).

## 2 Outcome monitoring

The primary purpose of this study is to monitor the social outcomes described in The Framework to enable effective Natural Environment Portfolio management. These outcomes are expressed in the following measures:

- Aucklanders are knowledgeable about biodiversity and biosecurity pressures.
- Aucklanders have capabilities and capacity to undertake conservation activities.
- Aucklanders value biodiversity.
- Aucklanders feel a sense of connectedness with nature.
- Aucklanders feel a sense of personal responsibility for reducing their biosecurity risk.
- Aucklanders participate in conservation activities.
- Auckland public frequently perform biosecurity-related behaviours.

These measures are used to indicate the achievements of the Natural Environment Portfolio. The measures were developed through consultation with programme managers, commitments made in the establishment of the NETR through a cost-benefit analysis (Rohani and Murray, 2018), and informed by the COM-B model of behaviour.

## 3 Method

### 3.1 Survey data collection

Members of Auckland Council's self-selected People's Panel were invited by email to participate in an online survey in November 2020 (see section 4, Participant sample for more details). The People's Panel was used over an independent market research panel for budget reasons and is intended to be used for subsequent data collection. A prize draw of one of four \$100 vouchers was offered to recognise participant contribution. 1813 completed responses were received. The survey had a 11% response rate (16,400 panel members were invited) and took on average 16 minutes to complete.

The questionnaire was developed by the first author in consultation with project and programme managers. It drew some questions from previous surveys administered by the Department of Conservation and consultancy TRA to allow comparisons. The same questionnaire is intended to be repeated with subsequent data collection waves. Some minor adjustments may be required overtime and should be made cautiously to ensure comparability. The questionnaire was programmed into Qualtrics.

Participants were randomly shown a selection of statements for some Likert scale<sup>3</sup> questions (e.g., 6 out of 8 possible statements shown) to reduce completion time and participant effort. Approximately half of the participants were asked to complete the New Ecological Paradigm scale and the other half to complete the Connectedness to Nature scale to reduce the response time (see sections 5.3 and 5.4 for more details on these scales). The survey was initially piloted and minor changes made following the pilot.

Surveys as a method are limited in that they can only collect data on *reported*, which may be different to *actual*, behaviour, attitudes, and knowledge. This may produce results which are inflated or otherwise biased. The design of questions has aimed to reduce self-reporting bias by, for example, asking participants to categories species rather than asking for a subjective rating of personal knowledge (see section 9.1 for the full questionnaire). These questions are to be repeated in future surveys with direct customers (e.g., training / event attendees) and those involved in the conservation community for comparison.

The global COVID-19 pandemic was a significant event in 2020 and collecting baseline data during such an event is not ideal. This survey went ahead in late 2020 following several months at alert level 2 or below when Aucklanders had returned to a degree of normality. The survey could not be delayed until the effects of COVID-19 had been resolved as the Natural Environment Portfolio will continue to deliver through and beyond the pandemic until 2028. It was critical to collect baseline data as soon as possible as it was not collected in 2018 at the establishment of the NETR.

---

<sup>3</sup> A Likert scale question asks participants to provide a rating for a statement or question, for example, rating satisfaction with a product on a scale from 'very dissatisfied' to 'very satisfied'.

### **3.2 Survey data analysis**

The dataset was exported from Qualtrics, cleaned and transformed in SPSS (statistical analysis software), and uploaded into Harmoni (statistical analysis software). Data cleaning involved back coding open responses (such as ethnicity). Transforming included recoding inverted scale responses. Descriptive analysis was completed in Harmoni with additional analysis (including modelling) completed in SPSS. Open responses were thematically analysed (see Braun and Clarke (2006) for details).

### **3.3 Measure calculation**

Scores have been created for each measure to allow simple comparisons overtime. These scores are an average reported as a score out of 10 with a high score being desirable. The calculation for each score is included in a brief section following a discussion of the survey results (for more details see the Appendix).

### **3.4 Behavioural analysis statistical procedure**

Multiple regression modelling was undertaken to apply the COM-B model of behaviour (see Figure 2). The aim of this analysis was to identify the strongest predictors of participation in conservation activities. The survey variables prior to modelling were transformed where needed and appropriate tests undertaken to check model assumptions (see Statistical procedures for more details).

The data collected in this survey is indicative of the three constructs in the COM-B model: capability, motivation, and opportunity. More comprehensive academic studies applying the COM-B model have also incorporated theoretical domains framework (TDF) to allocation data collection tools to each of these concepts (for example, Alexander et al., (2014)). A relatively simplistic approach inspired by such studies has been undertaken in this study to meet the needs of the operational Environmental Services unit. The table below describes which survey questions are used to indicate the COM-B constructs.

**Table 1: Survey questions and variables used to indicate COM-B constructs.**

<b>COM-B construct</b>	<b>COM-B sub-construct</b>	<b>Survey questions</b>	<b>Variable name (used in diagrams)</b>
Capability	Physical capability	Self-rated ability to perform conservation activities and biosecurity-related behaviours	Ability
	Psychological capability	To categorise named images of species as 'native' or 'invasive pest'	Pest native score
		To indicate from a list of possible indicators which can indicate high native biodiversity	Biodiversity indicators
Motivation	Reflective motivation	New Ecological Paradigm scale	NEP mean score
		Connectedness to Nature scale	CNS mean score
		Locus of Control scale	LOC mean score
		Ranking organisations and social groups from most to least responsible	Relative personal responsibility
Opportunity	Social and physical opportunity	Likelihood to perform conservation activities and biosecurity-related behaviours in next 12 months	Opportunity or Likelihood

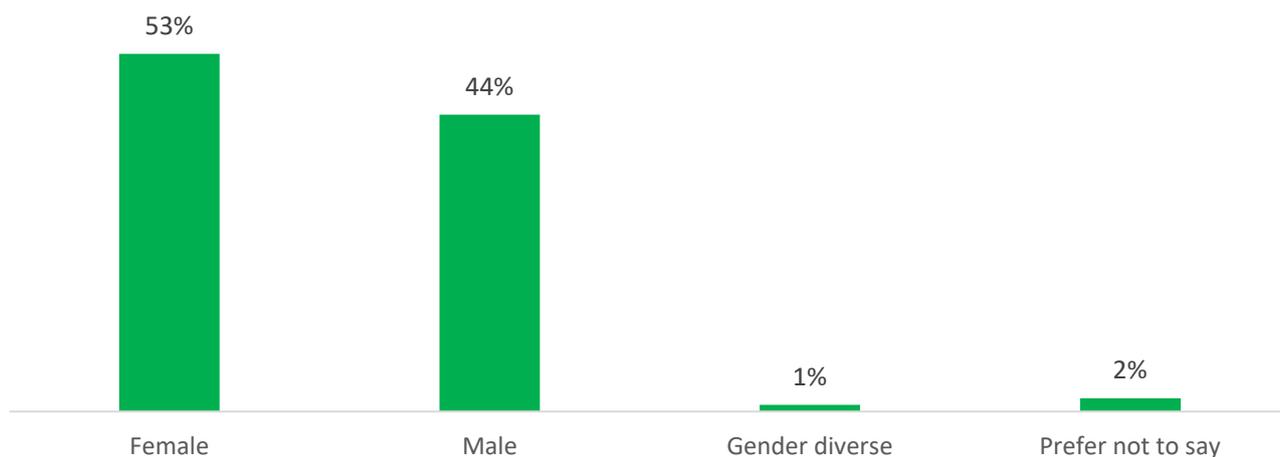
The New Ecological Paradigm scale and Connectedness to Nature scale both indicate environmental motivation. There are many co-benefits to participation in conservation activities beyond biodiversity such as health and wellbeing, socialising, and community connectedness. Future studies could collect data on alternative motivations for participation and test the strength of these motivators in predicting behaviour.

To measure 'opportunity' participants were asked how likely they would be to undertake a series of actions in the next 12 months. This phrasing was used to indicate perceived opportunity to perform actions of interest to the portfolio. Designing a question to appropriately measure opportunity in a survey is challenging and there are limitations of the approach used. Participants who rated themselves as being unlikely to perform these behaviours were asked why. A range of reasons were provided as discussed in section 5.2. Two-thirds of these reasons overall can be categorised as demonstrating an absence of opportunity such as lacking the physical space, time constraints, or someone else performing the task on their behalf (see Appendix 9.4 for coding breakdown across conservation activities). This suggests that likelihood is an imperfect, but acceptable, indicator of opportunity for the purposes of this study. Likelihood is used as an indicator for opportunity in the general models and a dummy variable for opportunity is used in models for individual behaviours.

## 4 Participant sample

The People's Panel<sup>4</sup> comprises of adult Auckland residents who have opted-in to receive email invitations to participate in research and public consultations undertaken by Auckland Council. Demographically the panel overrepresents people aged 35-74 years and NZ European / Pākehā, and underrepresents people aged 15-24 years, and Pacific and Asian ethnic groups (compared with the 2018 census). It is acknowledged that the representativeness of the People's Panel has limitations beyond demographic features. It could be assumed that panel members tend to be more engaged in local government issues, including the natural environment, and as such extrapolating results to represent Aucklanders overall needs to be done with caution. The use of an independent market research panel as an alternative sample was cost prohibitive and independent panels also face representation limitations.

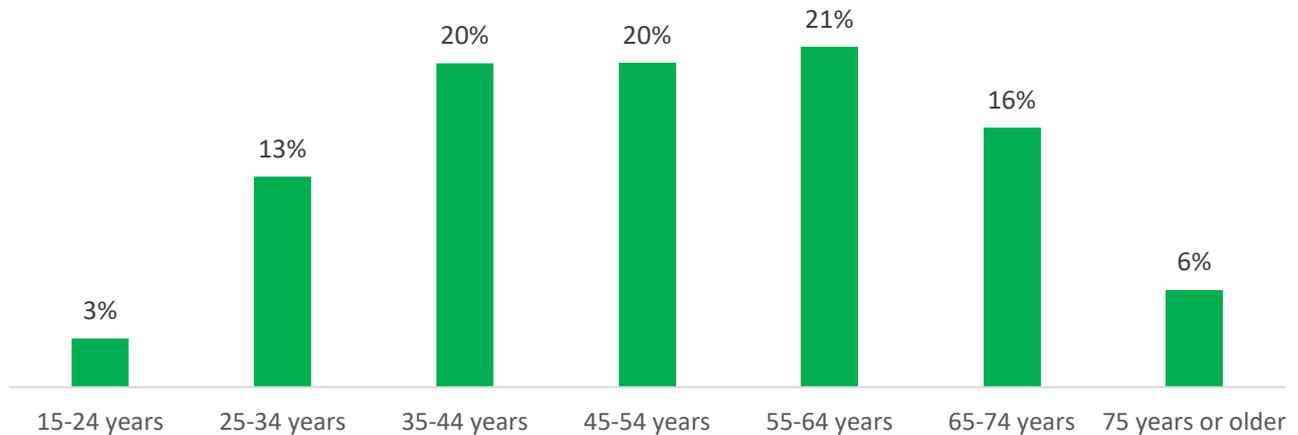
Slightly over half (53%) of all participants identified as female and 44% identified as male. One per cent identified as gender diverse (Figure 3).



**Figure 3: Participant gender (base: n=1,720).**

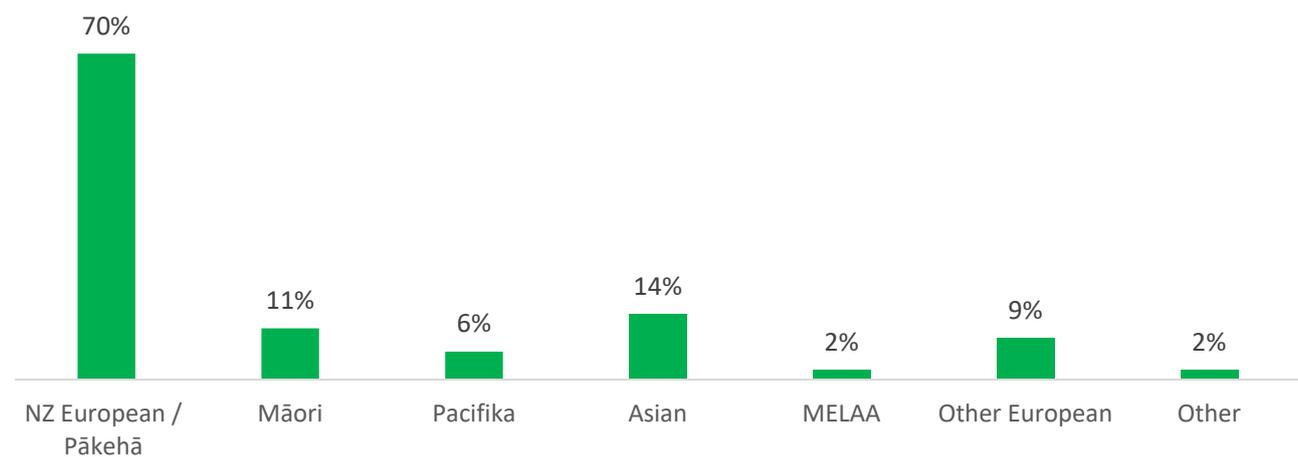
<sup>4</sup> The People's Panel is an online panel that is inaccessible by those without internet access. Inclusion of hard-to-reach audiences could be considered in the future with the addition of phone or in-person surveying.

Close to two thirds (61%) of participants were aged between 35 and 64 years (Figure 4). Younger Aucklanders (aged 15 to 34 years) are underrepresented comprising only 16% of the sample.



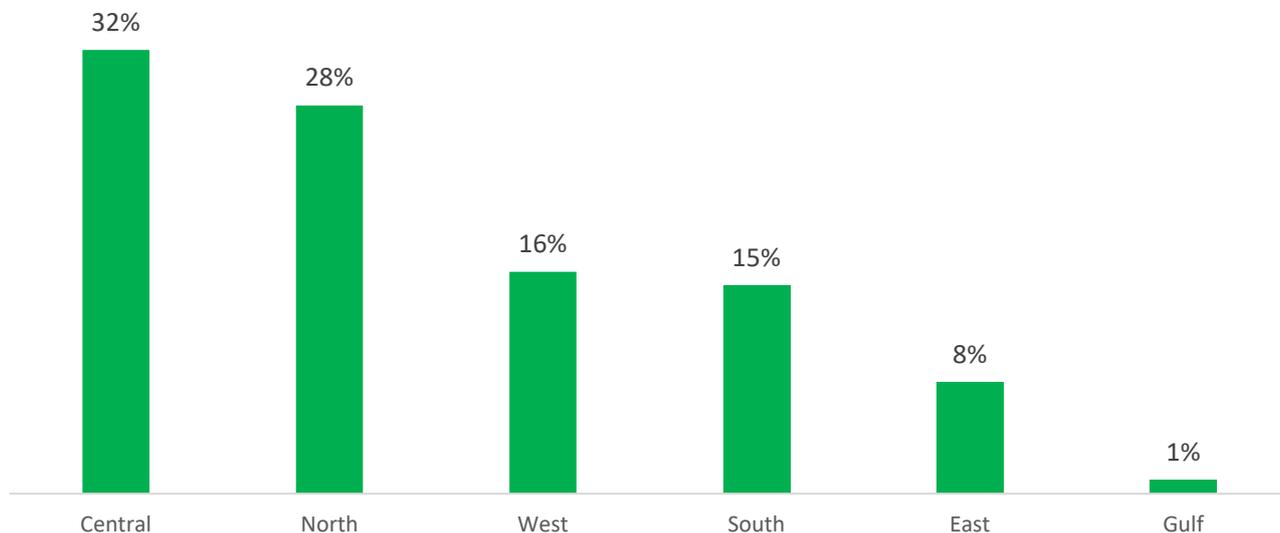
**Figure 4: Participant ages (base n=1,674).**

Participants of NZ European / Pākehā ethnicity are overrepresented at 70% compared with the 2018 census (see Figure 5, 54% identified as European in census) (Stats NZ, 2018). Eleven per cent identified as Māori (12% in census). Asian and Pacific ethnicities are both underrepresented (Asian 14% compared with 28% in census, Pacific 6% compared with 16% in census).



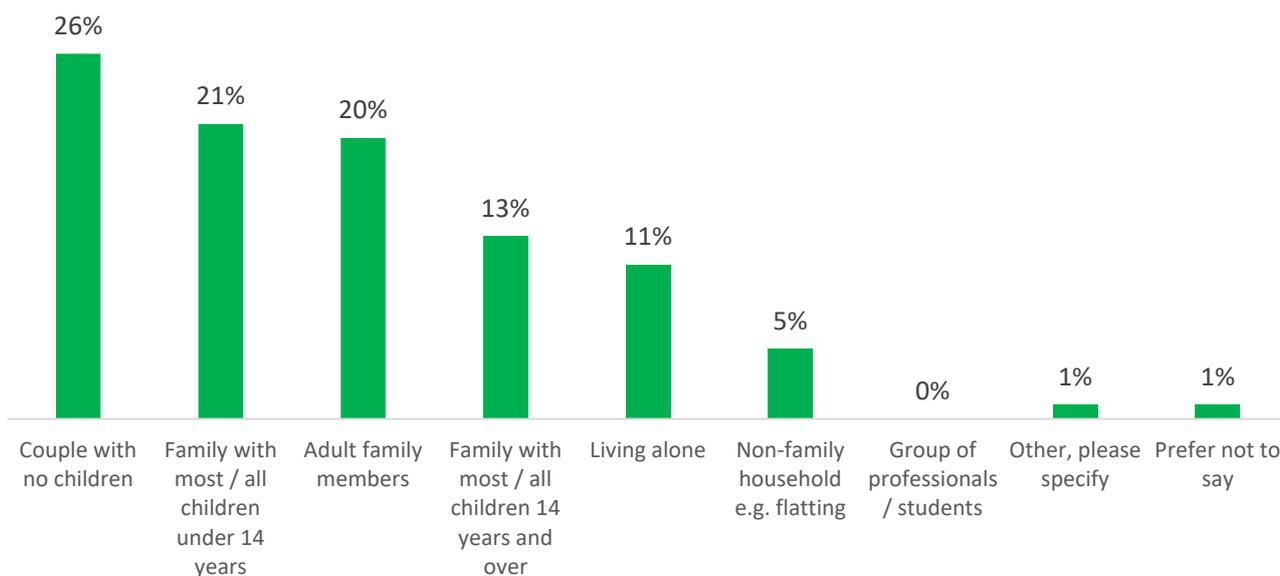
**Figure 5: Participant ethnicity (base n=1,649). Note: multiple responses, percentages do not add to 100%.**

Distribution of participants throughout the Auckland area is a little different to the population (Figure 6). Central and north are overrepresented (central: 32% compared with 26% as of June 2020, north: 28% compared with 24%) (Stats NZ, 2020). South is underrepresented comprising only 15% of participants (25% of Auckland population as of June 2020).



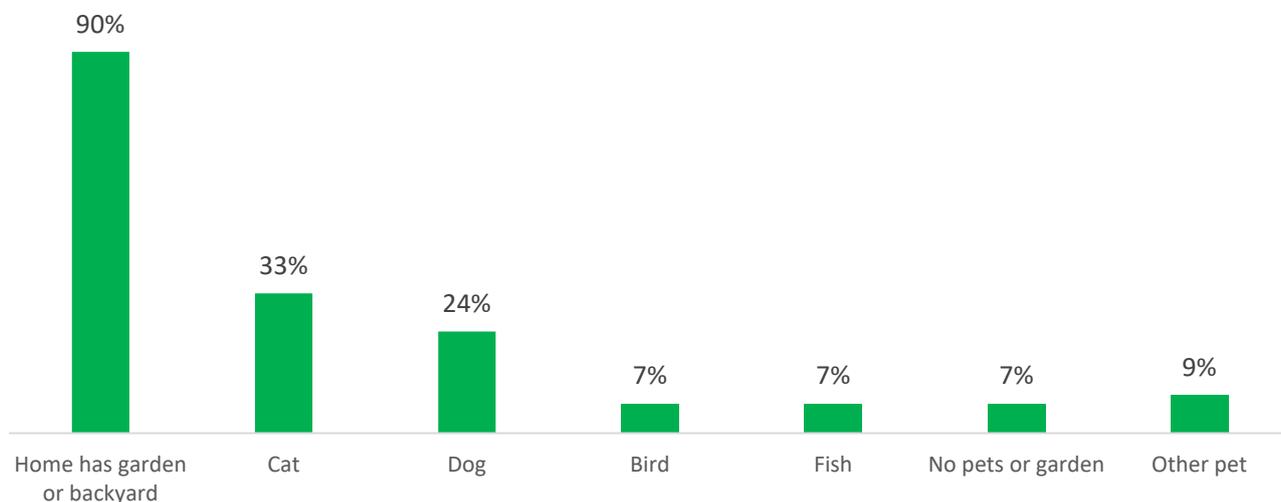
**Figure 6: Auckland area where participants usually live (base: n=1,688).**

A quarter (26%) of participants' households comprise of a couple with no children, 21% are families with most children under 14 years, and 20% are a family group with only adults (Figure 7).



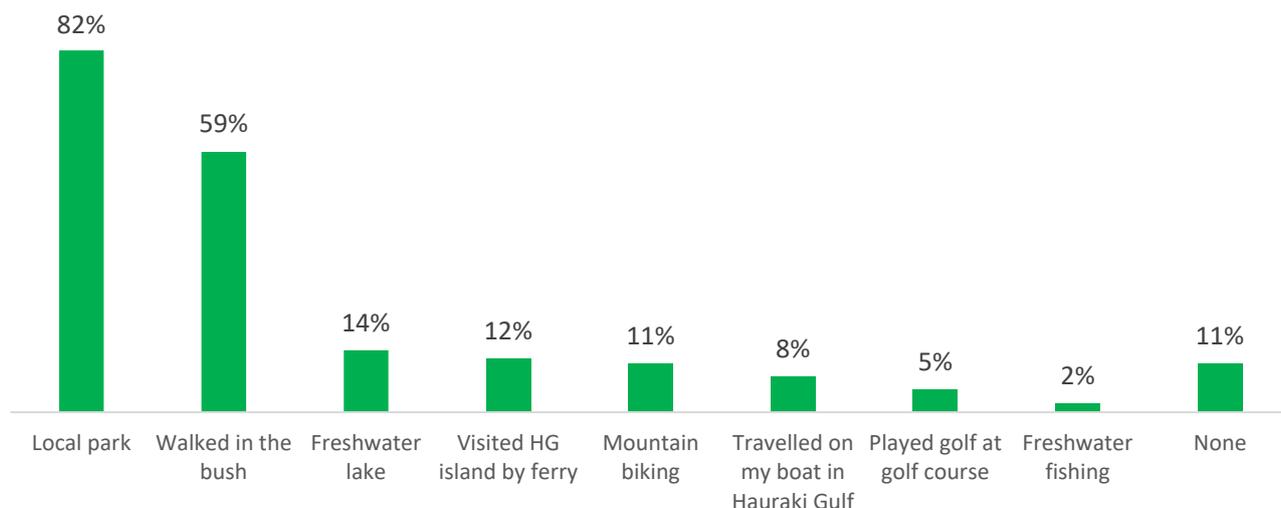
**Figure 7: Participant household type (base: n=1,804).**

The majority (90%) of participants live in homes with a garden or backyard (Figure 8). One in ten participants live in a home without an outdoor space. Cats were the most common pet with a third (33%) of participants having at least one cat. A quarter (24%) of participants have a pet dog.



**Figure 8: Participant pet ownership and green space at home (base: n=1,808). Note: multiple responses, percentages do not add to 100%.**

Eighty-nine per cent of participants have engaged in at least one nature recreation activity in the last three months (Figure 9). Visiting a local park is the most common with 82% of participants doing this in the last three months followed by walking in the bush with 59% of participants. Other activities such as visiting a freshwater lake (14%), visiting a Hauraki Gulf island by ferry (12%), or mountain biking (11%) are much less common.



**Figure 9: Recreational activities undertaken in last three months (base: n=1,809). Note: multiple responses, percentages do not add to 100%.**

## 5 Monitoring results

In this section each of the measures are explored in detail and recommendations are given. Any differences across demographic characteristics are described.

### 5.1 Aucklanders who are knowledgeable about biodiversity and biosecurity pressures

Participants overall have good knowledge of biodiversity and biosecurity pressures. Participants were asked four questions to assess their knowledge on biodiversity and biosecurity:

1. 'What, if anything, does the word 'biosecurity' mean to you?'
2. 'What, if anything, does the word 'biodiversity' mean to you?'
3. 'Which of the following might indicate high native biodiversity to you?' and shown a list of possible indicators.
4. To 'arrange the following into natives and invasive species to the best of your knowledge' and shown a selection of species images to drag and drop into categories.

Responses to the first two open answer questions were thematically analysed. All themes demonstrate correct understandings of the terms 'biodiversity' and 'biosecurity'.

'Biosecurity' themes include:

- Protecting to maintain factors such as the natural environment / native species / agriculture / biodiversity.
- Protecting *something* from 'bad' species described as pests / foreign species / alien species.
- Related to the theme of 'protecting from' was keeping 'bad' things outside of New Zealand in phrases such as "bugs etc out of NZ", dangerous things, or the general sentiment of keeping New Zealand free of pests. Related again was a theme of keeping 'good' things safe such as the environment, native species, and New Zealand overall.
- There were some mentions of border control.
- Descriptions of controlling / eradicating / removing pests form a final, less prevalent theme.

'Biodiversity' themes include:

- Increasing or maintaining the variety of species existing in New Zealand.
- Diversity of animals, plants, biomes, marine life, organisms, insects, flora, fauna, bacteria, soils, and species.

- Encourages ecosystems to thrive.
- Perceived as a positive element of a healthy natural environment.
- A balance and co-existence of species that allows for mutual benefit, and benefit of the wider environment.
- Preventing species becoming threatened or extinct.
- Eliminating foreign or exotic species that threaten New Zealand's natural or native biodiversity / eco-systems.
- Focus on diversity of native species.

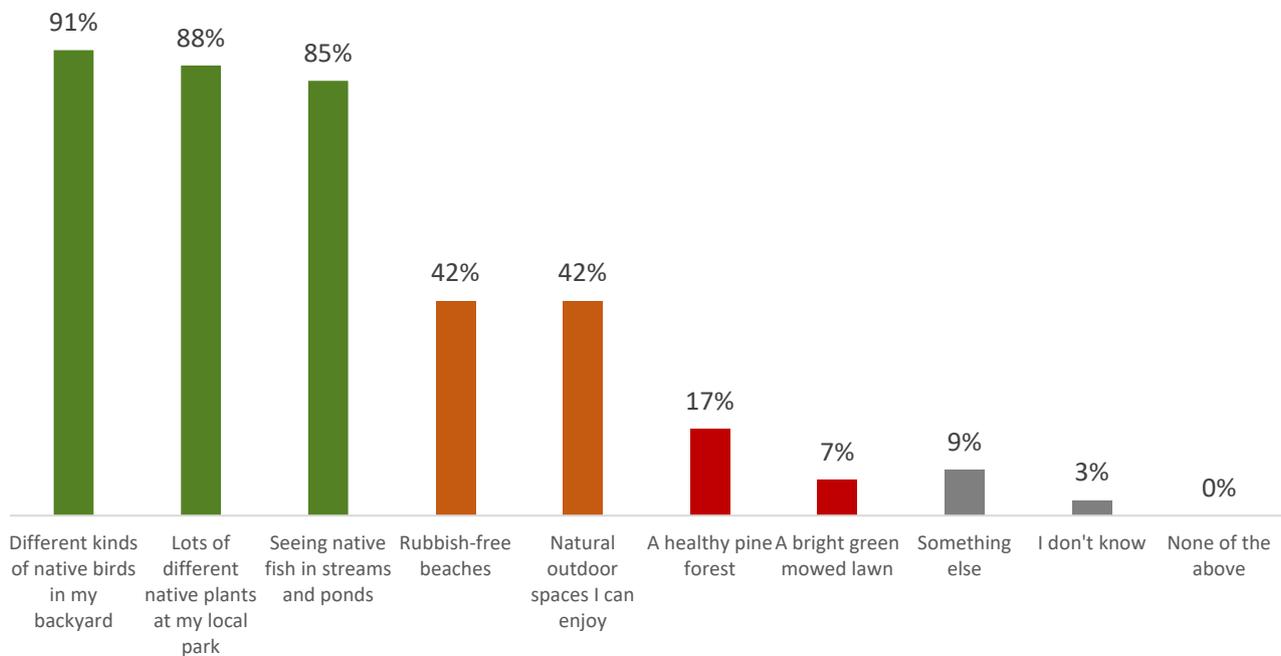
There is some understanding of the relationship between the two concepts, specifically that good biosecurity supports good biodiversity. This finding is similar to that from the *Towards a Pest Free Auckland* research which reported only 8% of participants making a spontaneous link between pests, biodiversity, and the environment (TRA, Unpublished). Strengthening understanding of this relationship may enable Aucklanders to grasp *why* their involvement in conservation actions and compliance with biosecurity-related behaviours matters<sup>5</sup>.

**Recommended action:**

Undertake further research into communicating about biosecurity, biodiversity, conservation, natural environment, pests, etc. and investigate means of communicating the relationship between biosecurity and biodiversity to ensure comprehension. This research should aim to identify terms that are widely understood by Aucklanders and then have these terms used consistently in all environment related communications. Communicating the complex relationship between biosecurity and biodiversity outcomes will likely require science communication expertise and novel audio-visual or interactive medium to convey this information.

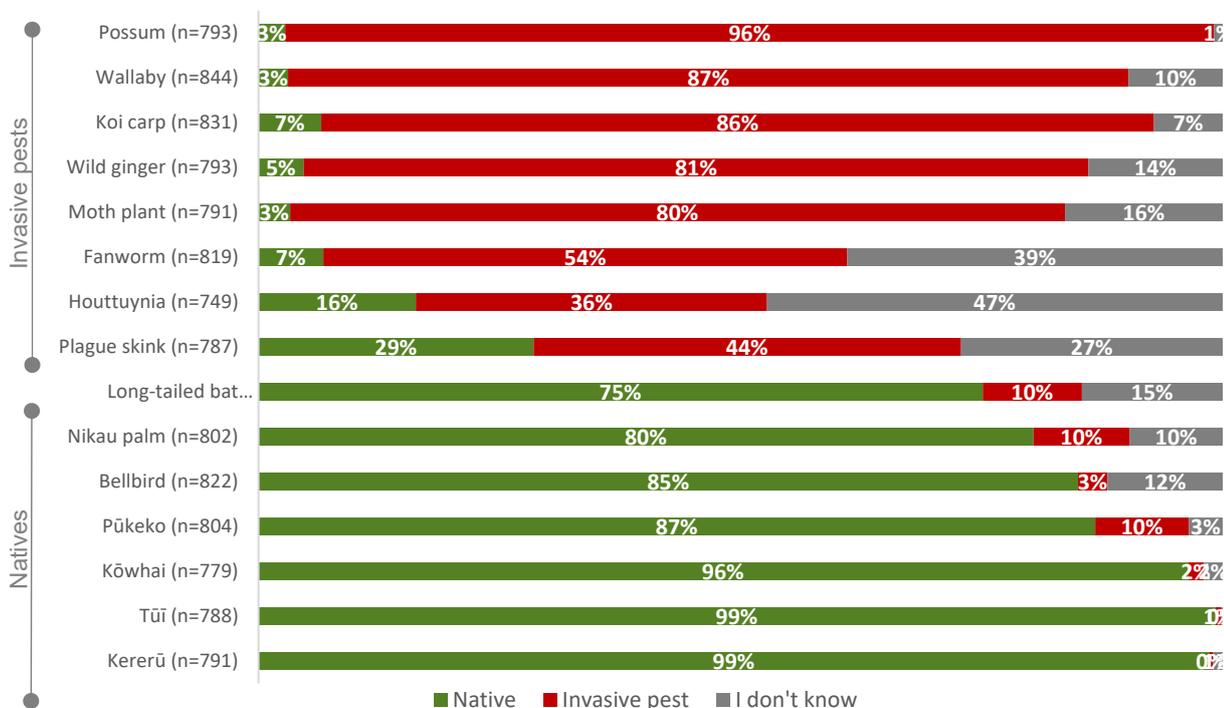
<sup>5</sup> Reminder of the knowledge-behaviour gap (Kollmuss and Agyeman, 2002). Increasing this understanding alone will not necessarily result in behavioural change.

Participants were asked to select from a list what might indicate high native biodiversity. The answer options included statements that are considered 'correct' by biodiversity professionals (green bars in Figure 10), not applicable to biodiversity that instead indicate other environmental concepts (orange bars), and 'incorrect' by biodiversity professionals (i.e., indicate 'low' native biodiversity, red bars). The responses initially look encouraging with large proportions selecting the 'correct' options. However, just 38% of participants *only* selected the 'correct' options (i.e., did not select any 'not applicable' or 'incorrect' options). Thirty-six per cent (36%) selected a combination of 'correct' and 'not applicable', and 18% selected a combination of 'correct' and 'incorrect'. Only twelve participants did not select one of the 'correct' options and selected either a 'not applicable' and/or 'incorrect' option. These results suggest that slightly over a third (38%) of participants have a correct understanding of the concept of native biodiversity, a third (36%) have a weaker understanding, and 18% have a confused understanding.



**Figure 10: Indicators of high native biodiversity (base: n=1,737). Green bars illustrate 'correct' indicators, orange bars illustrate indicators not applicable to biodiversity, red bars indicate 'incorrect' indicators.**

Participants were asked to categorise a selection of species images with names as 'native' or 'invasive pests'. The species included a mixture of those commonly known (e.g., possum and tūī) and more obscure (e.g., houttuynia and long-tailed bat). Most participants were able to correctly categorise the species.



**Figure 11: Species categorised as native, invasive pest, or 'I don't know'.**

It was hypothesised that people who participated in activities in the natural environment such as fishing, recreational boating, or bush walking may have greater knowledge of species. There are, however, no trends between species categorisation responses and participation in these activities.

It was also hypothesised that people who have a garden may be more knowledgeable through greater exposure to plants and birds. There are, however, no trends between species categorisation responses and home type (e.g., having pets or a garden).

### 5.1.1 Scoring

A score has been created to provide a single figure that can be monitored over time for this measure. This score is based on two survey questions: high native biodiversity indicators, and categorising pest and native species (see Appendix 9.3 for details on how this score is generated).

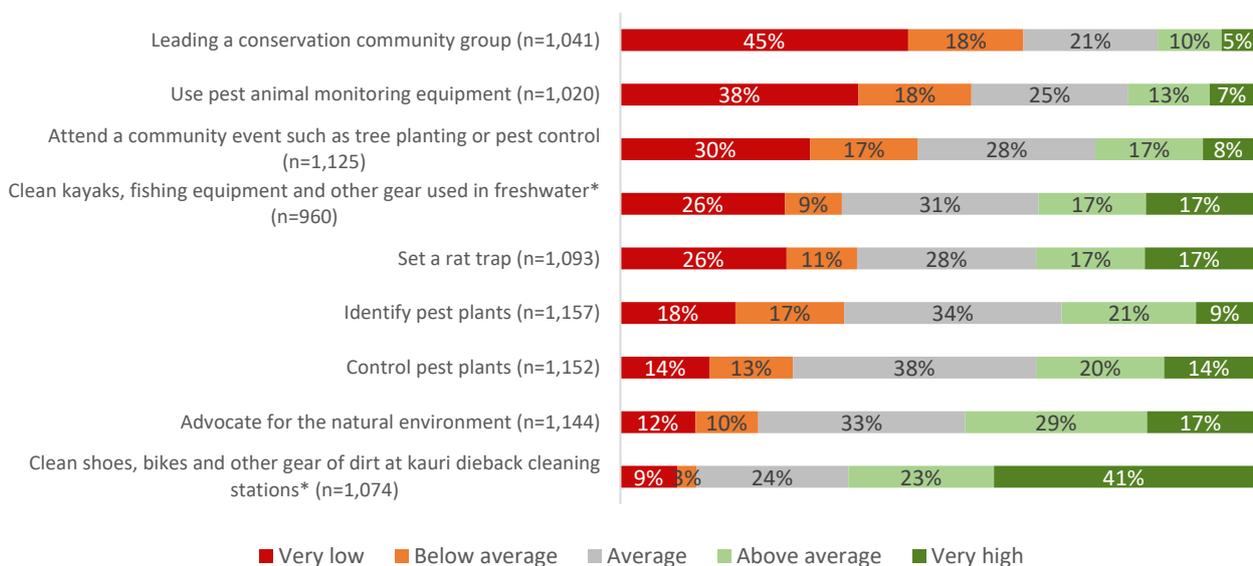


The baseline score for this measure is 5.8 out of 10.

## 5.2 Aucklanders who have capabilities and capacity to undertake conservation activities

### 5.2.1 Capabilities to undertake conservation activities

Participants were asked to rate their ability to participate in a series of activities to indicate the capability of Aucklanders to undertake conservation activities. The activities included were selected to represent a range of conservation activities (e.g., use pest animal monitoring equipment) and biosecurity-related behaviours (e.g., clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations). The conservation activities encompass a spectrum of skills levels from 'beginner' (e.g., advocate for the natural environment) through to 'advanced' (e.g., leading a conservation community group). This spectrum is used to infer the degree of Aucklanders' capabilities. The more 'advanced' activities have a greater proportion of participants rating their abilities as 'below average' or 'very low' as expected.



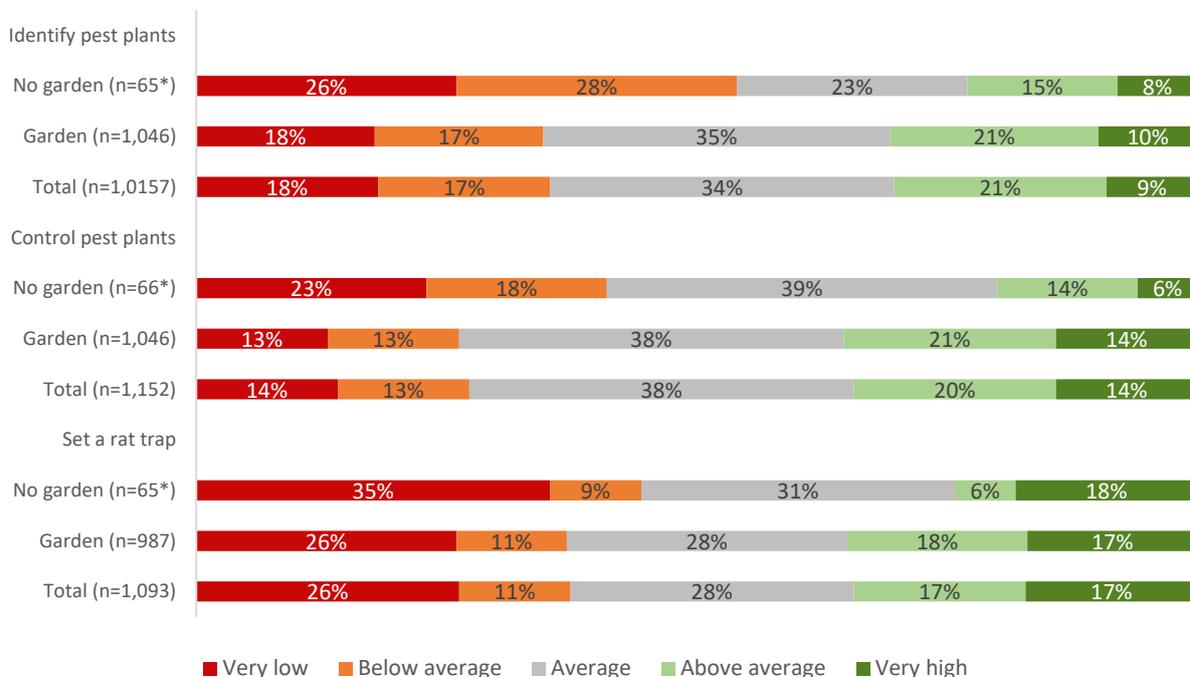
**Figure 12: Self-rated abilities to participate in conservation activities and biosecurity-related behaviours (indicated by \* in chart).**

There are few correlations with capabilities and demographic characteristics:

- Controlling pest plants is the only activity that shows a trend with age: younger participants are more likely to rate their abilities as 'below average' or 'very low' and older participants more likely to rate their abilities as 'above average' or 'very high'.
- Female participants are more likely to rate their ability to advocate for the natural environment as 'very high' (21%) compared with males (12%).
- Participants identifying with an Asian or Pacific ethnicity are generally more likely to rate their abilities across all activities as 'below average' or 'very low'.

It was hypothesised that Aucklanders with a garden at home would have higher abilities to undertake conservation activities which can be performed at home. The small number of

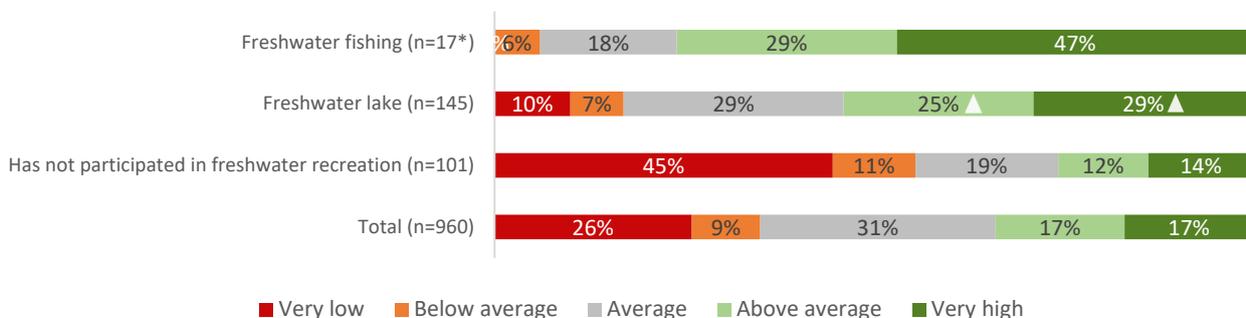
participants (n=65) who said they do not have a garden at home limits our ability to test this hypothesis. Participants without a garden are more likely to report less than average abilities to identify pest plants or control pest plants, however, the small sample size prevents reporting on this difference with confidence.



**Figure 13: Capability to identify pest plants, control pest plants, and set a rat trap for home with and without gardens. \*Caution: low base for no garden.**

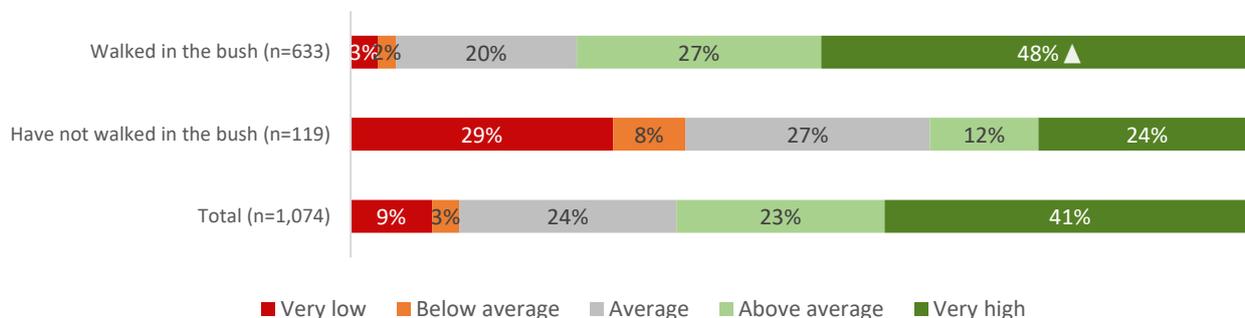
Aucklanders participating in recreational activities that require compliance with biosecurity-related behaviours (e.g., bush walking) report great abilities to perform biosecurity-related behaviours compared with those who do not engage in these activities.

Participants who report they participated in freshwater fishing or visiting a freshwater lake to swim, picnic, have a day out in the past three months were more likely to highly rate their abilities to clean gear used in freshwater higher than those who did not.



**Figure 14: Self-rated abilities to clean kayaks, fishing equipment and other gear used in freshwater for participants that have and have not engage in freshwater recreation in the last three months. Arrows indicate proportions significantly higher/lower than the total. \*Caution: low base for freshwater fishing.**

Similarly, participants who report they have walked in the bush were more likely to highly rate their abilities to clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations.



**Figure 15: Self-rated ability to clean shoes, bikes, and other gear at kauri dieback cleaning stations for participants that have and have not walked in the bush in the last three months. Arrows indicate proportions significantly higher/lower than the total.**

If participants rated their abilities as ‘below average’ or ‘very low’ they were asked what could enable them to carry out that activity or become better at the activity.

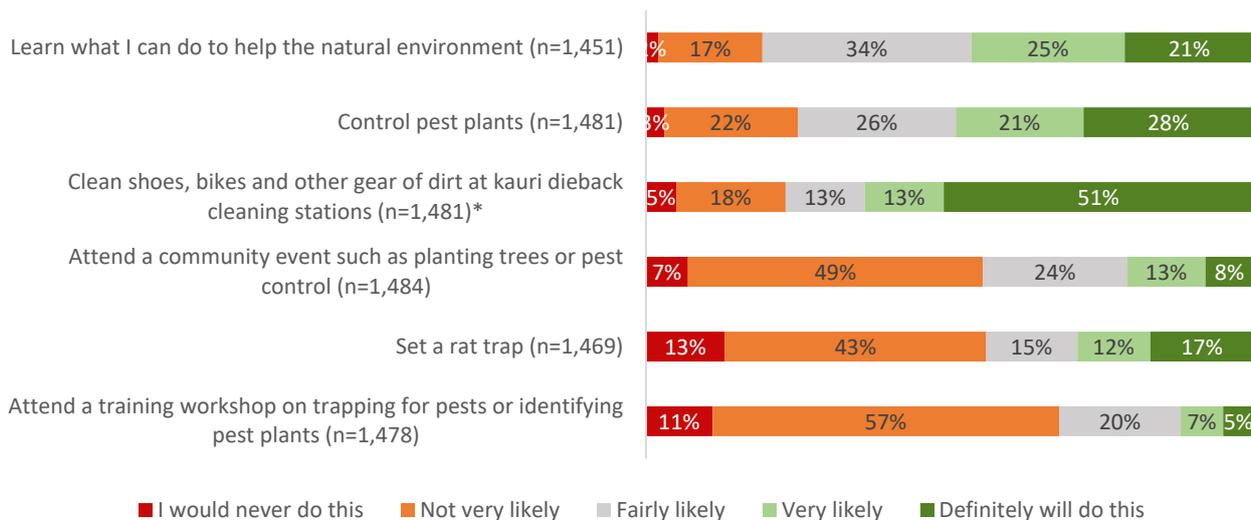
Responses have been thematically analysed across all capabilities; key themes include:

- Education, training, and information about how to properly conduct the conservation activity. This could be in the form of a physical workshop, online course, brochure, signs in relevant public places, or a webpage. It is perceived that these should target adults, as there are a lot of resources currently available that target children.
- Many participants report not having the tools and equipment required to conduct the conservation activity (e.g., rat traps), and that these could be provided free of charge to encourage their use. The cost associated with these is a barrier for some.
- Engaging communication and information about conservation events to encourage participation (e.g., tree planting or rat trapping).
- Some participants report not being fit, young, healthy, or able enough to participate in physical conservation activities.
- Some participants report that conservation activities are already being done by others, or that they are not their responsibility. Encouraging personal responsibility may help shift this attitude.
- Lack of time to participate in conservation activities.
- Lack of desire, interest, or motivation to participate in conservation activities.

### 5.2.2 Capacity to undertake conservation activities

Participants were asked how likely they would be to do a selection of conservation activities in the next 12 months. This question is used to indicate the *capacity* of Aucklanders to participate in conservation activities.

Overall, participants intention to undertake conservation activities within the next 12 months is mixed. Over two-thirds (68%) of participants are ‘not very likely’ or ‘would never’ attend a training workshop on trapping or identifying pest plants, 56% are ‘not very likely’ or ‘would never’ attend a community event such as planting trees or pest control, and 56% are ‘not very likely’ or ‘would never’ set a rat trap. Meanwhile, close to half of participants said they were ‘very likely’ or ‘definitely will’ control pest plants (49%) or learn what they can do to help the natural environment (46%).



**Figure 16: Likelihood of participating in conservation activities and biosecurity-related behaviours (indicated by \* in chart) in the next 12 months.**

As with capabilities, there are few demographic correlations with likelihood to undertake conservation actions:

- Females were more likely to ‘definitely’ learn what they can do to help the natural environment and to ‘never’ set a rat trap compared with males.
- Participants who identified with an Asian or Pacific ethnicity were less likely to ‘definitely’ control pest plants.

Likelihood to undertake conservation activities shows similar trends to capabilities to perform conservation activities. Participants who report their ability to attend a community event such as tree planting or pest control, for example, as ‘very low’ were more likely to report that they ‘would never do this’ activity. This relationship holds for all activities with data available.

Participants who have walked in the bush in the last three months were more likely to report that they ‘definitely will’ clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations than those who had not walked in the bush (63% vs 24% respectively). This may be reflective of the perceived opportunity to perform this biosecurity-related behaviour by bush walkers.

If participants answered that they were unlikely to perform these activities, they were asked why. Responses have been thematically analysed across all activities, and themes include:

- The activity not being something they personally should do or is not relevant to their situation (e.g., “do not see the need to do this”, “does not apply”, “no rats in my garden”, “live in an apartment”, “in a rental”, “I live in a very urban location so limited access to the bush”).
- Would prefer or expect someone else to do the activity on their behalf (e.g., “my husband does it”, “I would prefer to pay a professional”, “landlord does it”, “live in an apartment and would be reliant on the body corp to do this”, “I rent & a gardener looks after the section”).
- Not knowing how or lacking the tools / services to perform the activity (e.g., “can’t tell the difference with plants”, “nowhere to put plants after removal”, “scared of using chemicals”, “I do not have the tools for this”).
- Lack awareness of opportunities to attend community events or training workshops for people like me: perception they are not available in local area, only occur at inconvenient times, are not accessible by public transport, are not for older Aucklanders, families with young children, or Aucklanders with disabilities. (e.g., “In my experience, these activities are almost always at the weekends, and as the owner of a hospitality business, it is impossible for me to take time off to attend these. If they were made available online, or in the evenings, I would certainly partake.”, “unaware of activities”, “breastfeeding friendly with children?”).
- Lacking the physical ability (e.g., “because I am elderly and disabled”, “I need a walker these days”).
- Lack of interest (e.g., “no interest”, “Not my cup of tea”) or time (e.g., “too busy”, “no time”, “I tend to have other priorities with my time”) to perform the activity.
- Being against controlling animals for various reasons including religion, veganism, and animal welfare concerns.

**Recommended action:**

Consideration be given as to how Aucklanders could be better enabled to perform these activities through capability building (e.g., pest plant identification, safe chemical use) and support services that overcome capacity barriers (e.g., garden waste removal, gardening tool libraries).

Support services could be provided through various models such as a paid subscription to a tool library, a one-off cost for garden waste removal, or council could act as a concierge connecting Aucklanders with accredited professionals. These various models and the appropriate price point, for these services could be explored through a service design process.

The means to build capability requires consideration beyond the in-person workshop format as participants have identified this format’s limitations. There was some interest expressed by participants in e-learning through webinars or reading online content (e.g., “I prefer to learn online so that I can choose a convenient time and do not need to organise childcare”).

### **Recommended action:**

The accessibility of community events and training offerings should be investigated to ensure equitable access for *all* Aucklanders. Such an investigation would benefit from a human-centred design approach through which the desired attendees of events / training would collaborate with council in their creation.

### **5.2.3 Scoring**

A score has been created to provide a single figure that can be monitored over time for this measure. The score for this measure is based on a question about participants self-rated ability to undertake conservation activities. These activities formed a single component (see Principal Components Analysis in Appendix 9.7) and a mean score was calculated. The mean score has been doubled to be reported out of 10 rather than out of 5 to make comparisons across measures easier.



The baseline score for this measure is 5.4 out of 10.

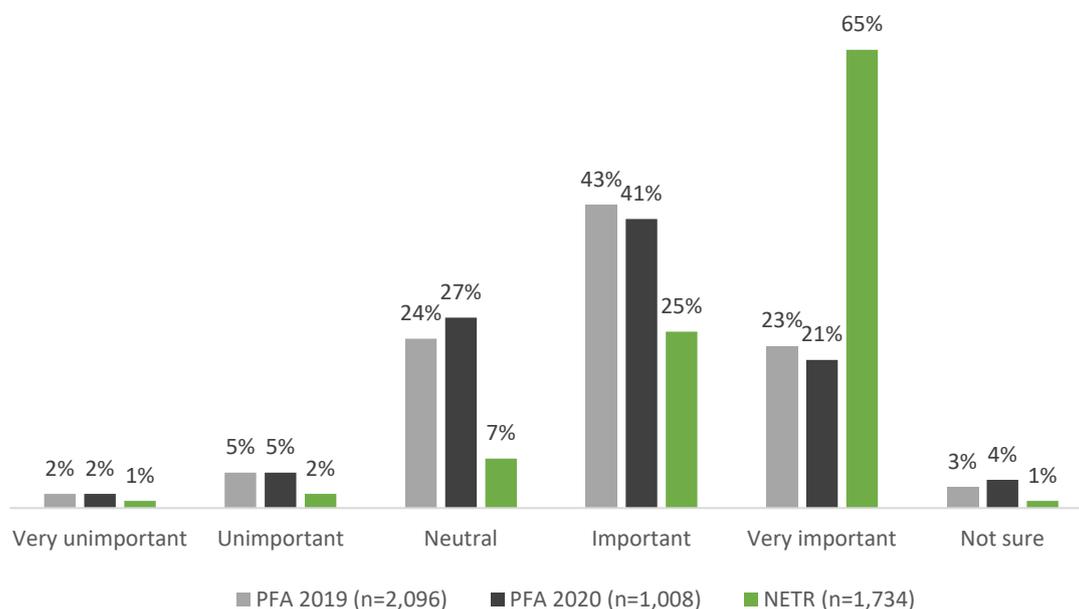
## **5.3 Aucklanders who value biodiversity**

Participants were asked two questions in relation to valuing biodiversity. Both questions were included as were asked in previous studies on Aucklanders with data available to allow comparison.

The *Towards a Pest Free Auckland* research has two waves of data (first wave in May 2019 and second in July 2020) (TRA, Unpublished). This survey asked: ‘How important is a strong amount of native plants, animals and insects in Auckland to you?’ with responses collected on a five-point Likert scale ranging from ‘very important’ to ‘very unimportant’. The wording of this question was changed slightly for the social outcome monitor questionnaire to read ‘How important is a large amount of native plants, animals, and insects in Auckland to you?’.

The responses collected in the two waves of *Towards a Pest Free Auckland* are consistent showing no significant differences with 43% (2019) and 41% (2020) answering ‘important’. The responses collected as part of the social outcome monitor, however, show a different trend with 65% of participants answering ‘very important’. This change is likely to be the

result of a different sample<sup>6</sup> rather than a significant change in opinion of Aucklanders or the result of the slight question wording change.



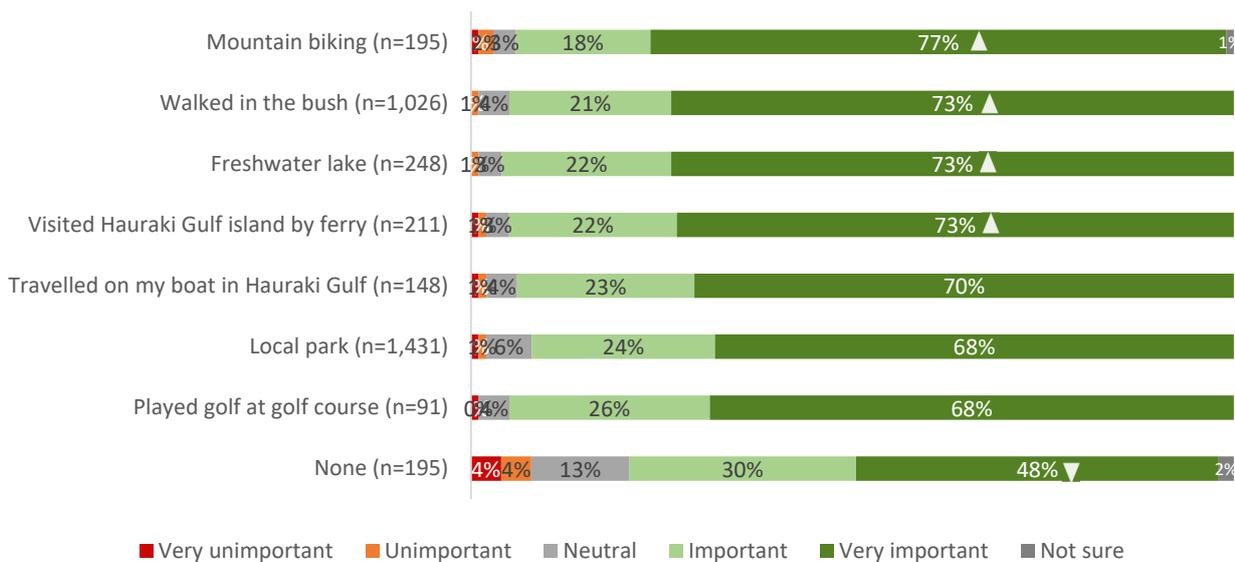
**Figure 17: Importance of native plants, animals, and insects (native biodiversity) in Auckland. Towards a Pest Free Auckland (PFA) data and the NETR (NETR) social outcome monitor data.**

The importance of native biodiversity for participants varied slightly across demographic variables:

- Females more likely to answer ‘very important’ (70%) compared with males (60%).
- Participants identifying as Māori were more likely to answer ‘very important’ (74%) and those identifying with an Asian ethnicity less likely to answer ‘very important’ (55%).

Participants who engaged in recreational activities in nature in the last three months were more likely to rate biodiversity as ‘very important’ compared with those who did none of the activities.

<sup>6</sup> Participants of Towards a Pest Free Auckland were sourced from an independent market research panel. The biases present in this panel and the People’s Panel are different and direct comparisons require caution.



**Figure 18: Ratings of biodiversity importance for participants who have engaged in recreational activities in nature. Arrows indicate proportions significantly higher/lower than the total.**

The New Ecological Paradigm (NEP) scale is a globally recognised scale to indicate a participant’s endorsement of a pro-ecological worldview (Dunlap et al., 2000). The scale is used to assess the relationship between environmental worldviews and other aspects of interest such as recreation participation, attitudes on public policy, and pro-environmental behaviours (Thapa, 2010). The revised NEP scale was used in this study and consists of 15 statements. Agreement with the seven even numbered statements indicates endorsement of the dominant social paradigm (DSP) and agreement with the eight odd statements indicates endorsement of the new ecological paradigm (NEP) (Dunlap et al., 2000). A mean score can be calculated for each participant by inverting the responses to the seven even numbered statements (i.e., those that indicate endorsement of DSP, see graph below). An average of this mean score provides an indication of the worldview for a population with a higher score suggesting a more pro-ecological worldview.

The following graph shows high levels of agreement with the statements ‘despite our special abilities, humans are still subject to the laws of nature’ (89% agree), ‘humans are seriously abusing the environment’ (86% agree), and ‘plants and animals have as much right as humans to exist’ (79% agree).

Participants are less likely to agree with the statements ‘the balance of nature is strong enough to cope with the impacts of modern industrial nations’ (10% agree), ‘the so-called “ecological crisis” facing humankind has been greatly exaggerated (11% agree), and ‘humans were meant to rule over the rest of nature (11% agree).



**Figure 19: New Ecological Paradigm scale statements (base: n=859).**

This scale was used in a segmentation study on Aucklanders for which the data was published (MacDonald et al., 2019). The data for this study was collected in late 2016 from an independent market research panel which is conveniently before the NETR was established in July 2018. Worldviews tend to be relatively stable and slow changing. The time between 2016 and 2020 may have been enough for a measurable change to occur.

This study (social outcome monitor) found a mean score of 3.9 (out of 5). This compares to a mean score of 3.6 (out of 5) found in the 2016 segmentation study on Aucklanders (MacDonald et al., 2019), representing an increase of 0.3. This increase is statistically significant and suggests there may be a possible positive shift in public attitudes towards a more pro-ecological world view.

### 5.3.1 Scoring

A score has been created to provide a single figure that can be monitored over time for this measure. This score is the mean score from the New Ecological Paradigm scale question. The mean score has been doubled to be reported out of 10 rather than out of 5 to make comparisons across measures easier.



The baseline score for this measure is 7.8 out of 10.

## 5.4 Aucklanders who feel a sense of connectedness with nature

Connectedness to nature is defined as ‘the way people identify with predominantly natural landscapes and the relationship they form with elements in those environments’ (Salazar, Kunkle & Monroe, 2020). The Connectedness to Nature Scale (CNS) developed by F. Stephan Mayer and Cynthia M. Frantz is a globally recognised scale that measures an individual’s emotional and experiential response to nature. Specifically, the tool measures the extent to which an individual feels a sense of community, equality, kinship, embeddedness, and belongingness to nature. The scale consists of fourteen statements, three of which are negatively phrased. The CNS can also be used to predict whether or not a person is likely to engage in behaviours that support the environment. It is hypothesised that those with a high connectedness to nature would be more likely to participate in conservation activities and perform biosecurity-related behaviours.

As with the New Ecological Paradigm scale (NEP) the CNS was also used in the same segmentation study of Aucklanders allowing comparison (MacDonald et al., 2019).

The graph below shows the level of agreement with each statement in the scale. Generally, participants tended to either agree or remain neutral on most statements. The three negative statements have the greatest proportions of disagreement as expected<sup>7</sup>.

This study (social outcome monitor) found an overall mean score of 3.7 out of 5. This compares to a mean score of 3.4 (out of 5) found in MacDonald et al. (2019), representing an increase of 0.3 points. This is a statistically significant increase indicating a possible

---

<sup>7</sup> Negative statements were reverse coded for mean score calculation.

positive shift towards higher levels of connectedness to nature among Aucklanders.

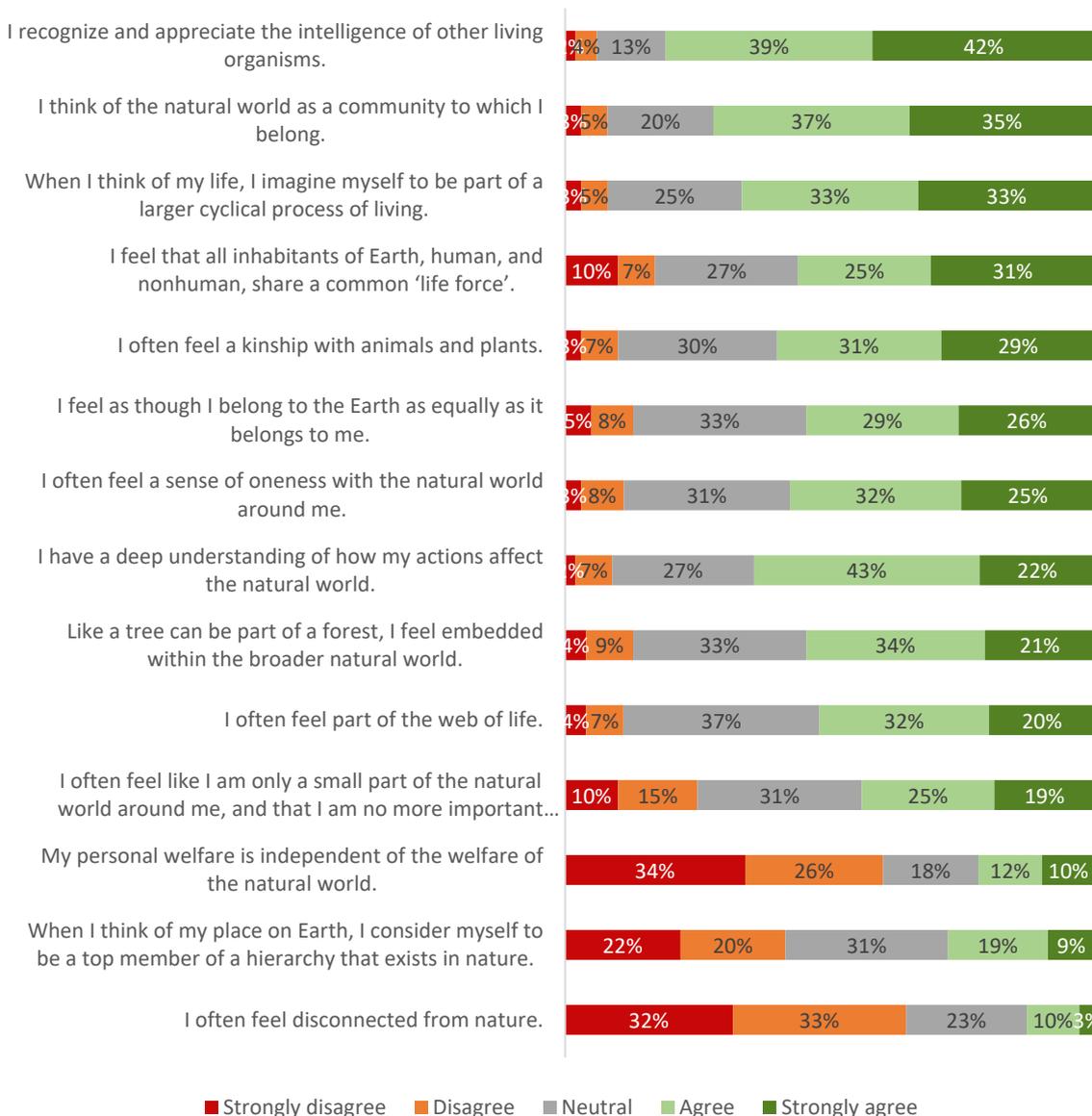


Figure 20: Connectedness to Nature scale (base: n=862).

### 5.4.1 Scoring

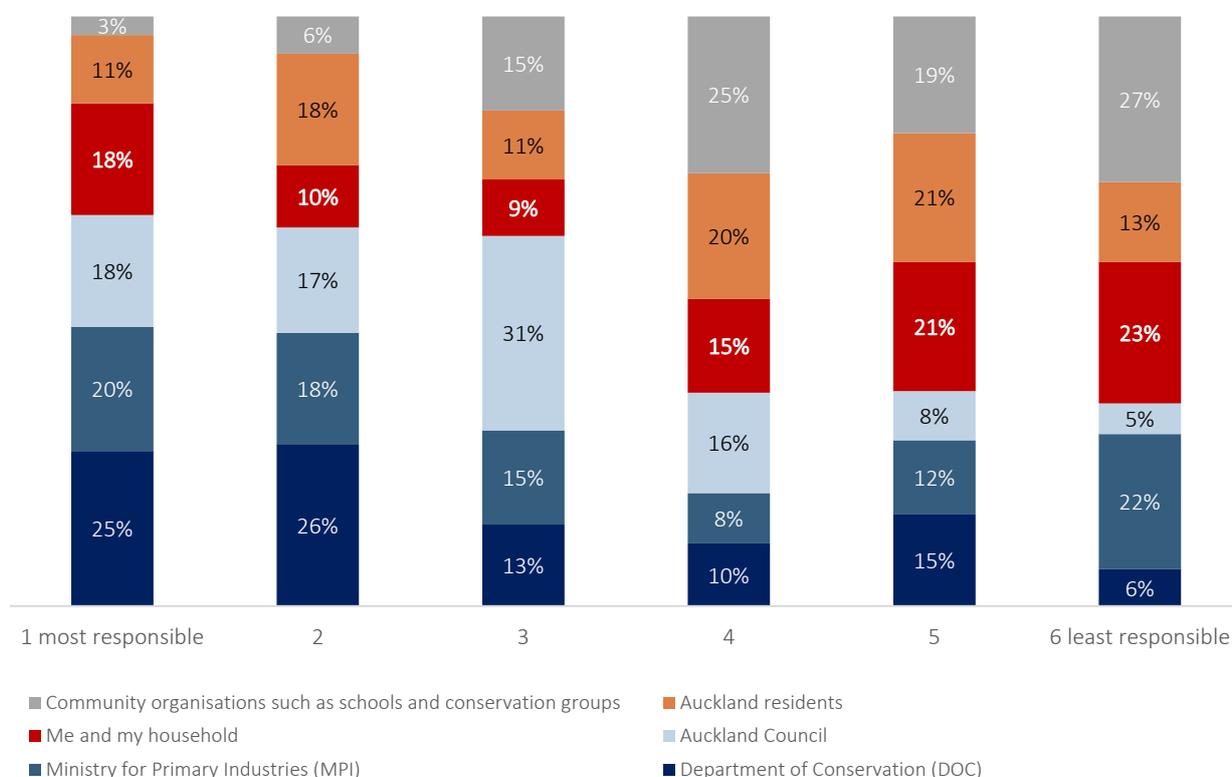
A score has been created to provide a single figure that can be monitored over time for this measure. This score is the mean score from the Connectedness to Nature scale question. The mean score has been doubled to be reported out of 10 rather than out of 5 to make comparisons across measures easier.



The baseline score for this measure is 7.4 out of 10.

## 5.5 Aucklanders who feel a sense of personal responsibility for reducing their biosecurity risk

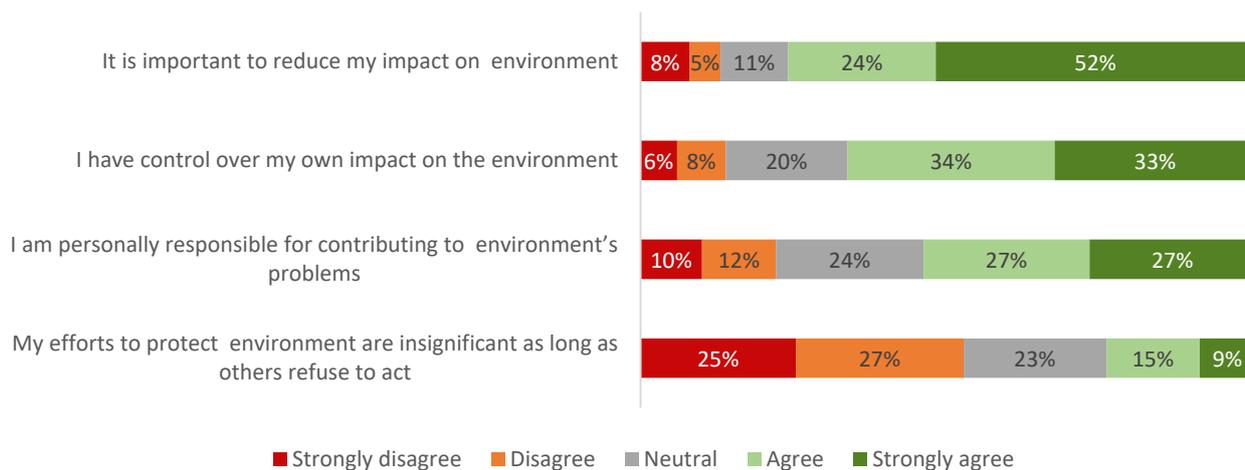
Participants were asked to rank a selection of organisations and groups from most to least responsible for reducing the spread of pests around the Auckland region. Government organisations (Department of Conservation, Ministry for Primary Industries, and Auckland Council) were seen to be more responsible compared with community organisations (e.g., schools and conservation groups) or social groupings (Auckland residents and ‘me and my household’). Twenty-eight per cent of participants saw themselves and their household as being very responsible for biosecurity (combining the top two ‘most responsible’ ranking positions).



**Figure 21: Who is responsible for biosecurity in the Auckland region (base n=1,813).**

‘Locus of control’ describes how strongly people believe they have control over their experiences and aspects of their life. People with an ‘internal locus of control’ generally believe they themselves can determine what happens in their life, whereas people with an ‘external locus of control’ believe factors beyond their control determine what happens in their life. The constructs of ‘personal responsibility’ and ‘internal locus of control’ are closely related and have been used as equivalent constructs (MacDonald et al., 2019; McMullin et al., 2007). An Environmental Locus of Control scale was used to assess participants’ locus of control with relation to the environment (i.e., the degree to which participants believe their actions can have an impact on the environment).

Participants were asked to rate how strongly they agreed or disagreed with four statements to assess their environmental locus of control. Three quarters agree ‘it is important for them to reduce my impact on the environment’ (76% agree) and two thirds agree they ‘have control over my own impact on the environment’ (67% agree). Fewer agree that they are ‘personally responsible for contributing to the environment’s problems’ (54%). Positively, only a quarter agree that their ‘efforts to protect the environment are insignificant as long as others refuse to act’ (24%).



**Figure 22: Environmental Locus of Control (base: n=1,725).**

Conservation and biosecurity are perceived to be the responsibility of government agencies (MPI, DOC, Auckland Council) over individuals and community. However, participants are likely to have an internal environmental locus of control (i.e., they perceive themselves to be in control of the impact they have on the environment). These two findings are not immediately complementary. This may suggest that Aucklanders misunderstand the impact of their small actions in achieving conservation outcomes. The challenge to overcome may be to strengthen the link in Aucklanders’ minds between their small actions (e.g., removing a pest plant) and the greater biodiversity outcomes we can all enjoy (e.g., recreation in native forest).

**Recommended action:**

More research is required to explore the role of personal responsibility in the performance of biosecurity risk-behaviours (i.e., behaviours which reduce the spread of pests).

### 5.5.1 Scoring

A score has been created to provide a single figure that can be monitored over time for this measure. This score is the proportion of participants who rated 'me and my household' as '1 most responsible' or '2' for reducing the spread of pests in the Auckland region. This proportion is reported as a score out of 10 to be easily comparable across measures.

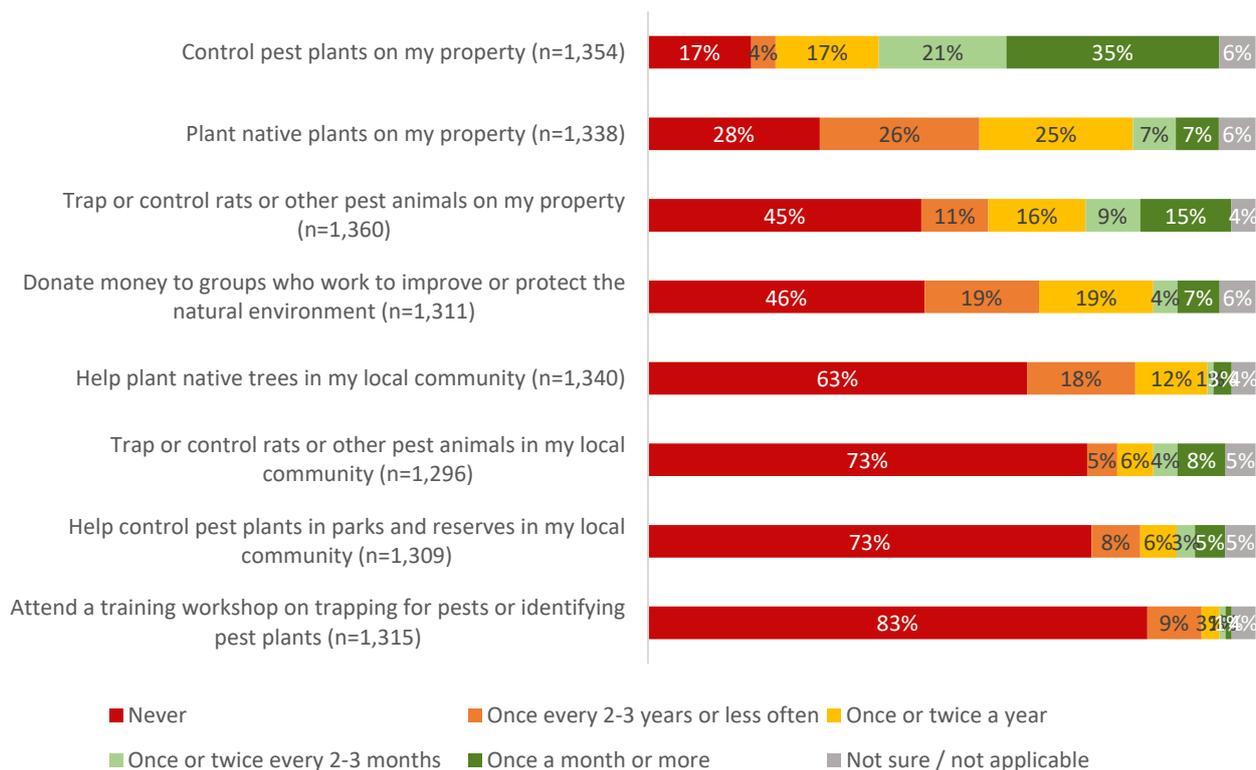


The baseline score  
for this measure is  
2.8 out of 10.

## 5.6 Aucklanders who participate in conservation activity

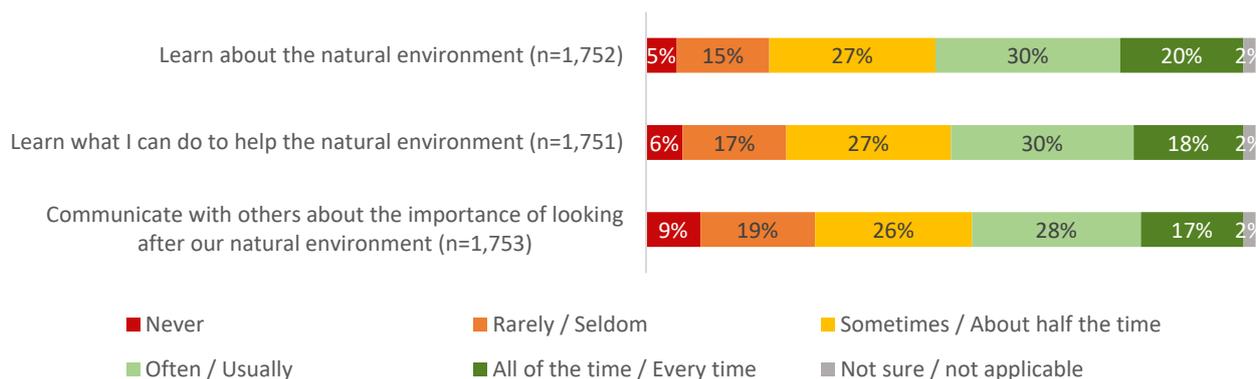
Participants were asked to state how often they participate in a range of conservation activities on a scale from 'never' to 'once a month or more'. Activities that participants undertook in most frequently included controlling pest plants on their property (56% once or twice every 2-3 months more), trapping or controlling rats or other pest animals on their property (24% once or twice every 2-3 months more), and planting native plants on their property (14% once or twice every 2-3 months more). Fewer participants regularly donate money to groups who work to improve or protect the natural environment (11% once or twice every 2-3 months more), help control pest plants in parks and reserves in their local community (12% once or twice every 2-3 months more), help plant native trees in their local community (4% once or twice every 2-3 months more), or attend training on trapping for pests or identifying pest plants (2% once or twice every 2-3 months more). This indicates that participants more regularly engage in conservation activities that occur on their own property, in comparison to activities in their community.

The Expanding Community Action programme (largely NETR-funded) in the Natural Environment Portfolio seeks to grow community-led conservation to support biodiversity outcomes at a landscape scale. It is hypothesised that this can be achieved through initially encouraging participation from people at home, and then encouraging participation in the local community as a next step. If this is happening, we would expect the proportions of both at-home and in-community activities to increase over time with the relative proportion of conservation activities at home to always be greater than conservation activities done in the community.



**Figure 23: Frequency of participation in conservation actions.**

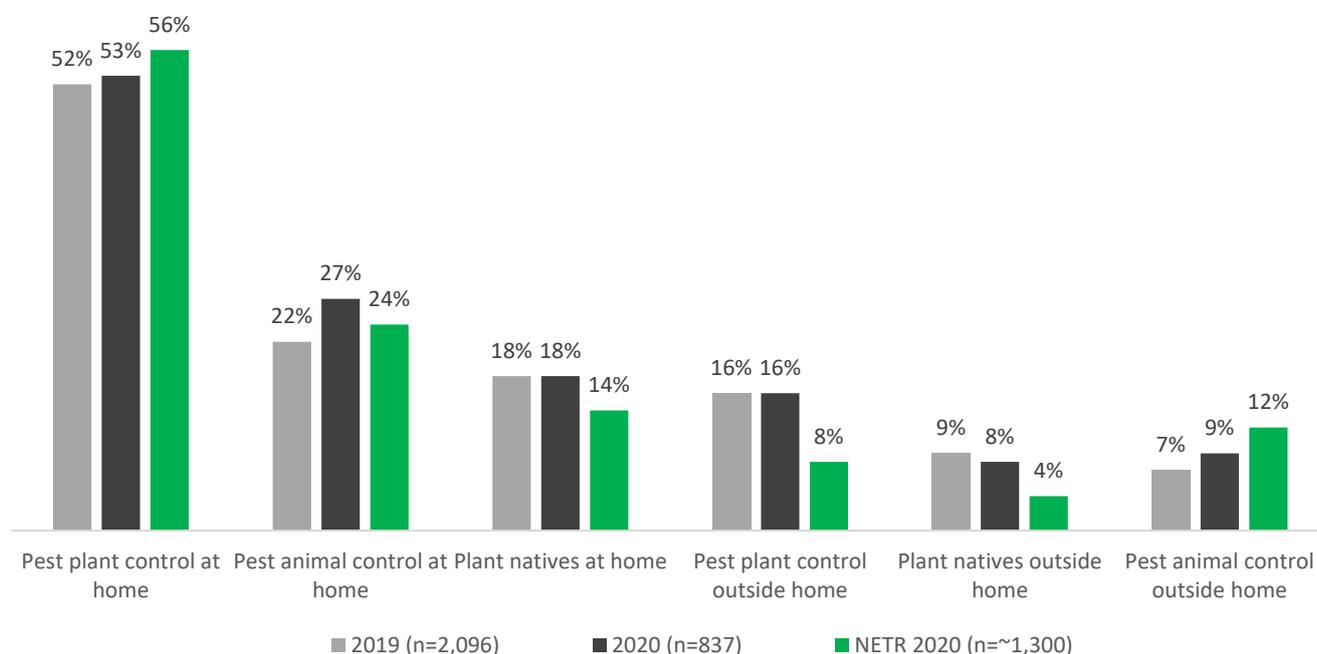
Participants were asked to state how frequently they participate in some other conservation actions on a different scale from ‘never’ to ‘all of the time / every time’. These advocacy activities show the greatest proportion of Aucklander participation with close to half of participants doing these actions ‘often’ or ‘all of the time’.



**Figure 24: Frequency of participation in conservation activities.**

The *Towards a Pest Free Auckland* research asked participants to select from a list of conservation actions which they have done in the last three months or the last 12 months (TRA, Unpublished). This study (social outcome monitor) asked participants how often they generally perform these activities to avoid seasonal differences in behaviour biasing results with data collection occurring at different times of the year, and therefore, restricting the

ability to make comparisons over time. The chart below demonstrates that the frequency of performing conservation activities are similar. Any trends visible in this chart should be interpreted with caution because of different data collection tools.



**Figure 25: Participation in conservation activities in ‘the last three months’ from TRA Pest Free Auckland surveys (grey bars: 2019 and 2020) and participation in conservation activities ‘once a month or more’ and ‘once or twice every 2 to 3 months’ from Social Outcome Monitor (green bars: NETR 2020).**

Generally younger participants (25-34 years) and those of Asian or Pacific ethnicities are less likely to engage in conservation activities, while older participants (55-64 years) are more likely. For example:

- 41% of participants who identify with an Asian ethnicity would ‘never’ ‘donate money to groups who work to improve the environment’ (34% of total would ‘never’).
- 43% of participants who identify with an Asian ethnicity and 51% of participants aged 25-34 years would ‘never’ ‘trap or control rats of other pest animals on my property’ (34% of total would ‘never’). While 19% of participants aged 55-64 years would ‘trap or control’ ‘once a month or more’ (11% of total would ‘once a month or more’).
- 62% of participants who identify with a Pacific ethnicity would ‘never’ ‘help native trees in my local community’ (46% of total would ‘never’).
- 35% of participants who identify with a Pacific ethnicity, 33% of participants who identify with an Asian ethnicity, and 33% of participants aged 25-34 years would ‘never’ ‘plant native plants on my property’ (21% of total would ‘never’). While 9% of participants aged 55-64 years and older would ‘plant natives’ ‘once a month or more’ (5% of total would ‘once a month or more’).
- 25% of participants aged 25-34 years would ‘never’ ‘control pest plants on my property’ (12% of total would ‘never’), while 35% of participants aged 55-64 years

control pest plants 'once a month or more' (26% of total would 'once a month or more').

This trend has been seen several times in recent studies:

- The *Towards a Pest Free Auckland* research found that the 'Youth', 'South Asian', and 'East Asian' segments are undertaking the fewest pest control actions (TRA, Unpublished).
- A People's Panel survey conducted in 2019 found young people are the keenest to become more involved in conservation activities (Auckland Council, Unpublished).
- A People's Panel survey conducted in 2018 found young people and those identifying with Asian ethnicities were least involved, but also most interested in becoming involved in conservation activities (Auckland Council, Unpublished).

**Recommended action:**

Employ a segmented approach to communications and service offerings. Younger Aucklanders and those of Asian and Pacific ethnicities could be enabled to start participating in conservation activities, while other demographics could be encouraged to continue or increase their engagement in these activities.

### 5.6.1 Scoring

Scores have been created to provide single figures that can be monitored over time for this measure. These scores are the proportion of participants who engage in conservation activities regularly. Frequency of participation in conservation activities were split over two questions. These questions both consisted of a series of activities and asked participants to rate the frequency at which they perform each activity. Participants who answered with 'once or twice every 2-3 months' or 'once a month or more' in the first question (see Figure 23) or 'often/usually' or 'all of the time / every time' in the second question (see Figure 24) were included. The statement related to donating money to groups was excluded because of the Principal Components Analysis results (PCA, see Appendix 9.7 for more details). PCA demonstrated that there are three components to 'conservation activities' and therefore reporting these separately instead of an average is more appropriate.



The baseline score for conservation activities undertaken at home is 3.1 out of 10.



The baseline score for conservation activities undertaken in the community is 0.7 out of 10.



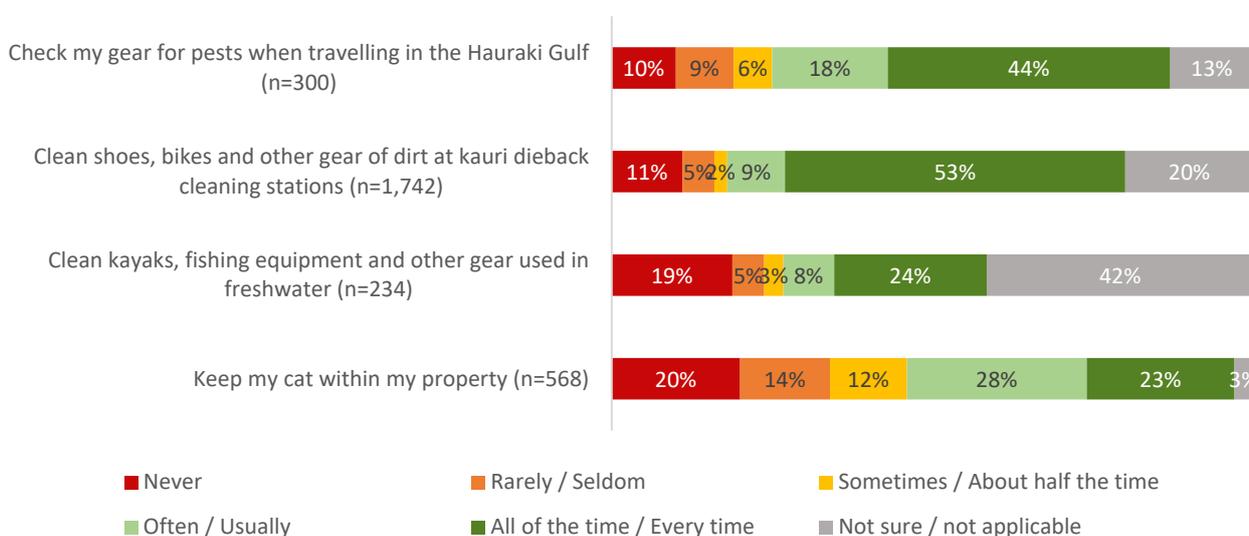
The baseline score for advocacy conservation activities is 4.8 out of 10.

## 5.7 Auckland public who frequently perform biosecurity-related behaviours

Participants were asked how often they perform biosecurity-related behaviours, from ‘never’ to ‘all the time / every time’. Participants were only asked about behaviours that were relevant to them based on their responses for previous questions, for example only those that said they had a pet cat were asked about biosecurity-related behaviours relating to their cat.

Participants indicated they most often ‘check their gear for pests when travelling in the Hauraki Gulf’ and ‘clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations’. Participants less often ‘keep their cat contained within their property’ or ‘clean fishing equipment and other gear used in freshwater’.

Performance of biosecurity-related behaviours varied somewhat by demographics. Generally, females were more likely to engage in such behaviours compared to males. Those of Pacific ethnicities were also less likely to engage in such behaviours relative to other ethnic groups. This indicates that males and those of Pacific ethnicities could be targeted to start engaging in biosecurity-related behaviours.

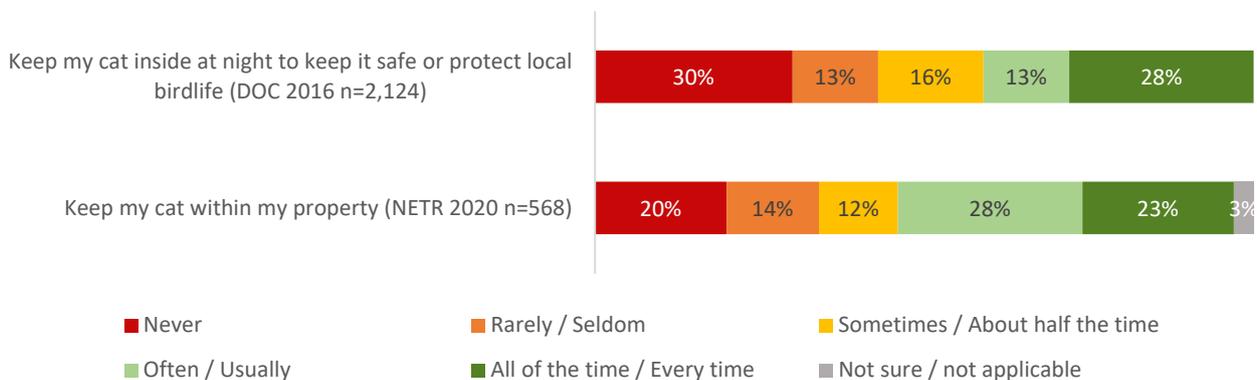


**Figure 26: Frequency of performing biosecurity-related behaviours.**

Data has been collected for these behaviours in previous surveys. Direct comparison is problematic, as with the conservation activities, and any trends should be interpreted with caution because of differences in data collection tools, methods, and participant sample.

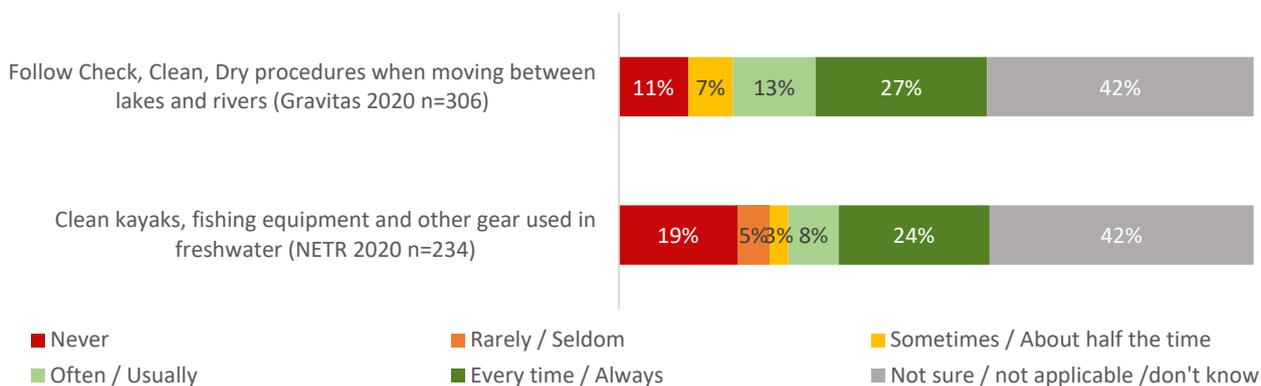
There have been several surveys over recent years investigating responsible cat ownership behaviours including cat containment. This study found 23% of cat owners reported keeping their cats contained on their property ‘all of the time’. 24/7 cat containment is Auckland was

reported at 12% in 2016 (New Zealand Companion Animal Council Inc., 2016). A survey by the Zoo and Aquarium Association in August 2020 reports 21% of Aucklanders contain their cats on their property (Zoo and Aquarium Association, Unpublished). Another survey (in 2016) asked how often cat owners ‘keep their cat inside at night to keep it safe or protect local birdlife’ with 28% of participants answering ‘all of the time’ (MacDonald et al., 2019).



**Figure 27: Cat containment behaviours. 'NETR 2020' refers to this study. 'DOC 2016' refers to MacDonald et al., 2019 (data collected in 2016).**

In the summer of 2020, an intercept survey was undertaken a Lake Rototoa and Lake Tomorātā with recreational lake users (Gravitas Research, Unpublished). This survey asked participants how frequently they followed Check, Clean, Dry procedures. The results of the intercept survey and this survey are similar. The large proportion of participants who answered ‘not sure / not applicable / don’t know’ in both surveys suggests minimal awareness of this behaviour.

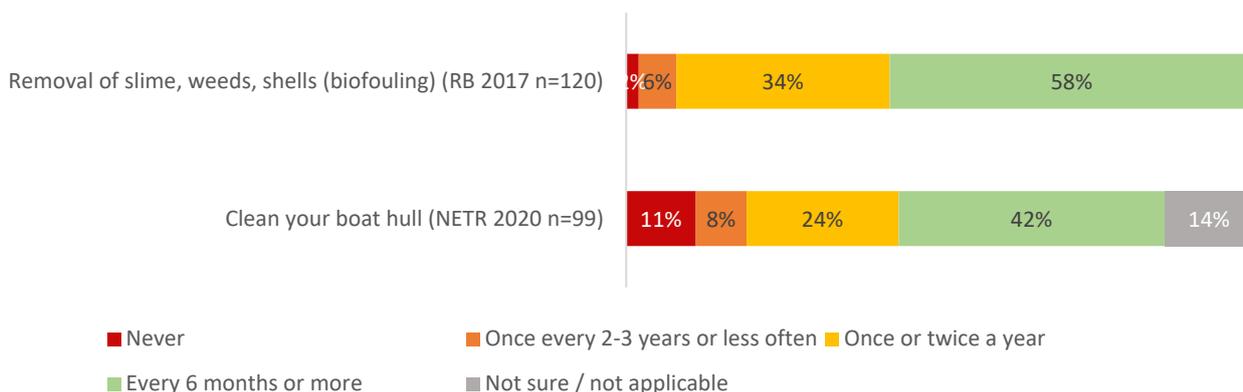


**Figure 28: Freshwater biosecurity 'Check, Clean, Dry' behaviours. 'NETR 2020' refers to this study. 'Gravitas 2020' refers to a freshwater lake intercept survey commissioned to Gravitas Research (unpublished, data collection in January-March 2020).**

Boat owners who store their vessels in-water (e.g., at a marina or mooring) are recommended to have their hull cleaned (i.e., biofouling is removed) at least annually. A survey of recreational boat owners was conducted by council in 2017. This found 92% of participants were compliant with this behaviour (Auckland Council, Unpublished). This figure

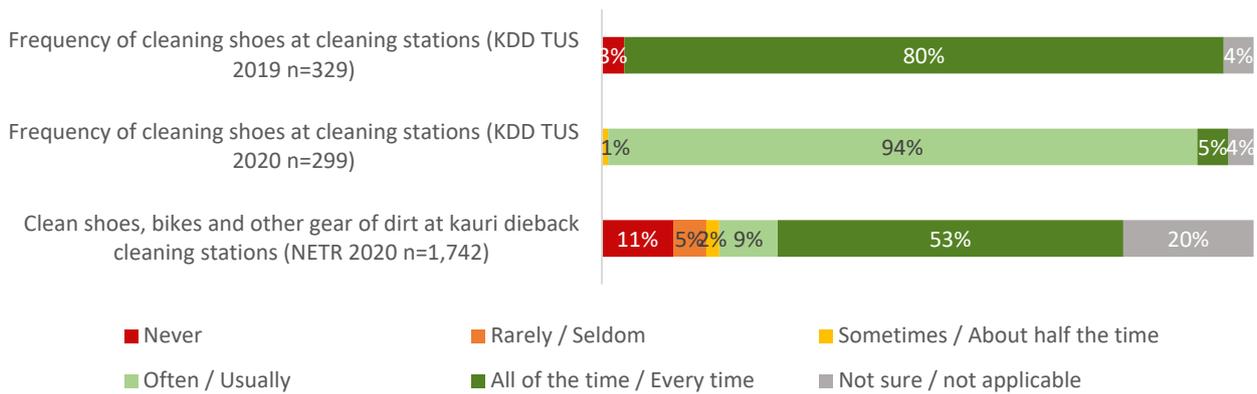
is much greater than that found in this survey (66% clean at least once a year). Some of this difference may be accounted for in the participant samples. The 2017 survey was specifically about marine biosecurity and invitations were sent to people subscribed to newsletters from Westhaven Marina, New Zealand Marina Operators Association (NZMOA), New Zealand Underwater Association (NZUA), and advertised on the Harbourmaster website. Subscribers to such newsletters or visitors to the Harbourmaster website who would opt-in to a survey on marine biosecurity may be more likely to be performing ideal marine biosecurity-related behaviours. This could have resulted in an inflated rate of compliance that is not representative of boat owners overall.

An annual intercept survey is undertaken at marinas around Auckland. Over the 2019 / 2020 summer period this survey reported 66% of participants cleaned their boats at least annually (or after every use) (Auckland Council, Unpublished). The clean 'after every use' category in this survey is assumed to capture trailer boat owners who store their vessels on land making the frequency of 'every time' is ambiguous. The 2020 / 2021 summer survey has adopted the same answer options as this questionnaire allowing direct comparison in the future.



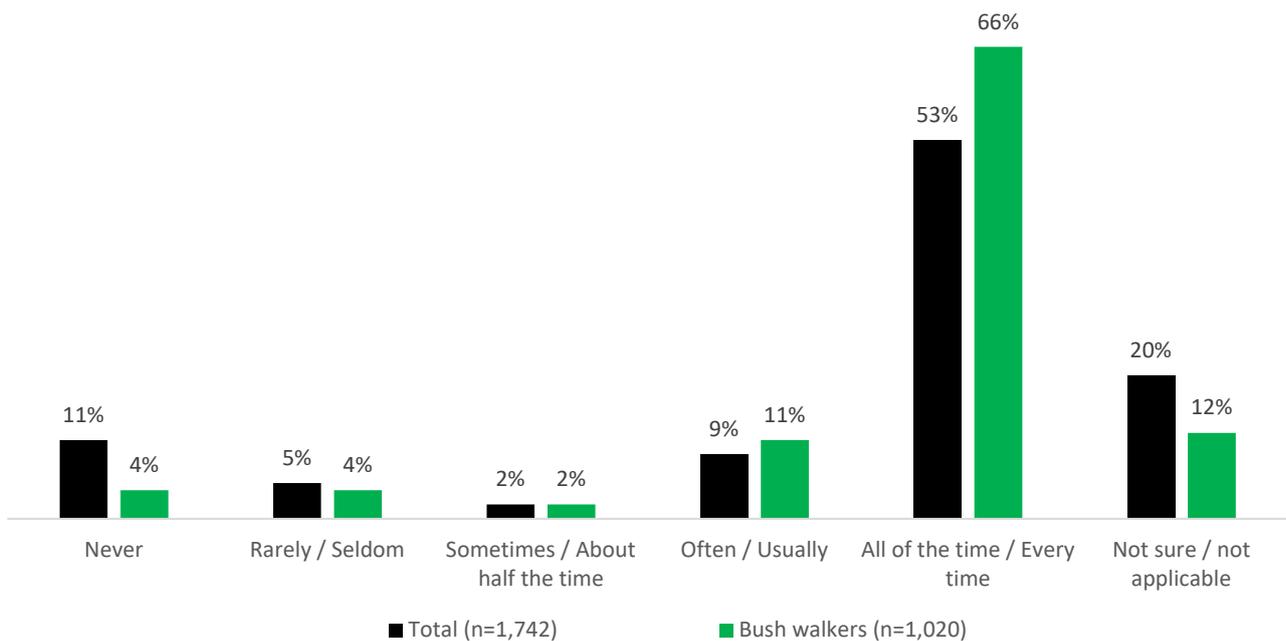
**Figure 29: Marine biosecurity-related behaviours. 'NETR 2020' refers to this study. 'RB 2017' refers to a recreational boater survey (data collected in January-March 2017).**

People visiting walking tracks and other locations with kauri are required to clean their shoes and other gear of dirt at cleaning stations to prevent the spread of kauri dieback disease. This study found 53% of participants report cleaning their shoes, bikes, and other gear 'every time' and 9% cleaning 'usually'. In contrast, the 2020 kauri dieback track user study found 5% of participants clean their shoes 'every time' and 94% 'usually' clean their shoes (Ovenden, 2020). In 2019 and years prior, the kauri dieback track user study asked the question about cleaning frequency on a different scale: 'never', '1', '2', '3', '4', 'every time'. Eighty per cent of participants in the 2019 survey reported cleaning their shoes 'every time' (Ovenden, 2020).



**Figure 30: Kauri dieback cleaning behaviours. 'NETR 2020' refers to this study. 'KDD TUS' refers to the annual intercept Kauri Dieback track user study (Ovenden, 2020), data collection from February-March in 2020 and 2019).**

In contrast to the previous biosecurity-related behaviours, this question regarding kauri dieback cleaning stations was asked of all participants. Participants who said they have 'walked in the bush' in the past three months have slightly higher compliance with 66% reporting they clean at cleaning stations 'every time', 11% 'usually', and only 4% 'never'.



**Figure 31: Kauri dieback cleaning behaviours for all participants (total) and participants who have walked in the bush in the last three months (bush walkers).**

### 5.7.1 Scoring

A score has been created to provide a single figure that can be monitored over time for this measure. This score is the proportion of participants who engage in biosecurity-related behaviours regularly. Frequency of participation in biosecurity-related behaviours were split over two questions. These questions both consisted of a series of behaviours and asked participants to rate the frequency at which they perform each behaviour. Participants who

answered with 'once or twice every 2-3 months' or 'once a month or more' in the first question (see Figure 29) or 'often/usually' or 'all of the time / every time' in the second question (see Figure 26) were included.



The baseline score for this measure is 5.0 out of 10.

## 5.8 Demographic trends

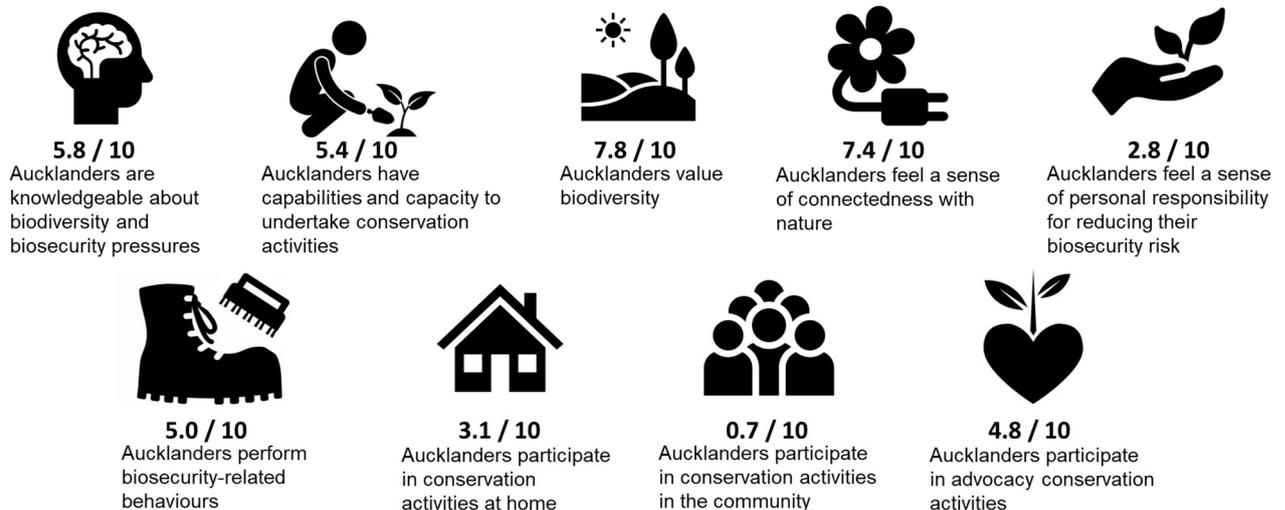
Across the outcome measures there are some general demographic trends. These trends can be taken into consideration when identifying and designing, for example, services, opportunities, and communications for demographic segments.

- Females are more likely, compared with males, to:
  - Have a pro-ecological worldview (NEP),
  - Have greater connectedness to nature (CNS),
  - Report that they participate in advocacy conservation activities, and
  - Be likely to participate in conservation activities in the next 12 months.
- Participants who identified with Māori, European, or NZ European ethnic groups are more likely, compared with Asian ethnic groups, to:
  - Be more knowledgeable about biodiversity,
  - Report that they participate in conservation activities at home, and
  - Feel they have greater capabilities to undertake conservation activities.
- Participants aged between 55 and 74 years are more likely, compared with those aged 25 to 44 years, to:
  - Feel a sense of personal responsibility for biosecurity in the Auckland region,
  - Report that they participate in conservation activities at home and in the community, and
  - Feel they have greater capabilities to undertake conservation activities.
- There are no notable geographic trends across local boards. When aggregated up to areas we can see participants living in Central Auckland are more likely, compared with participants living in South Auckland, to:
  - Be more knowledgeable about biodiversity,
  - Report that they participate in advocacy conservation activities, and
  - Feel they have greater capabilities to undertake conservation activities.

## 5.9 Summary

This section described the baseline scores of social outcome measures for the Natural Environment Portfolio. These are summarised in the figure below. Recommendations to improve these baseline scores have been provided and include:

- Undertake research to improve how we communicate about biosecurity, biodiversity, pests, etc. and make our message relevant to our audiences. This is a necessary step in enabling Aucklanders to comprehend the impact of their conservation and biosecurity-related behaviour (in)action.
- Investigate options for building the skills required to participate in conservation activities (e.g., pest plant identification training) and complementary support services (e.g., pest plant disposal services) to enhance Aucklanders' capabilities and capacity.
- Provide accessible and appealing opportunities for diverse Aucklanders to participate in conservation activities.
- Employ a segmented approach to communications and service offerings. Different offerings, messages, and media appeal to different Aucklanders and being targeted is likely to produce greater outcomes.
- Undertake further research into the role of personal responsibility in motivating biosecurity-related behaviours.



**Figure 32: Baseline scores of social outcome measures.**

## 6 Behaviour change model

The Natural Environment Portfolio aims to encourage Aucklanders' engagement in conservation activities and biosecurity-related behaviours through behavioural change. This section explores which variables can predict participation in conservation activities and the performance of biosecurity-related behaviours through statistical modelling (see Appendix section 9.5 for more details). The optimal allocation of investment to achieve behavioural outcomes can be informed by this analysis.

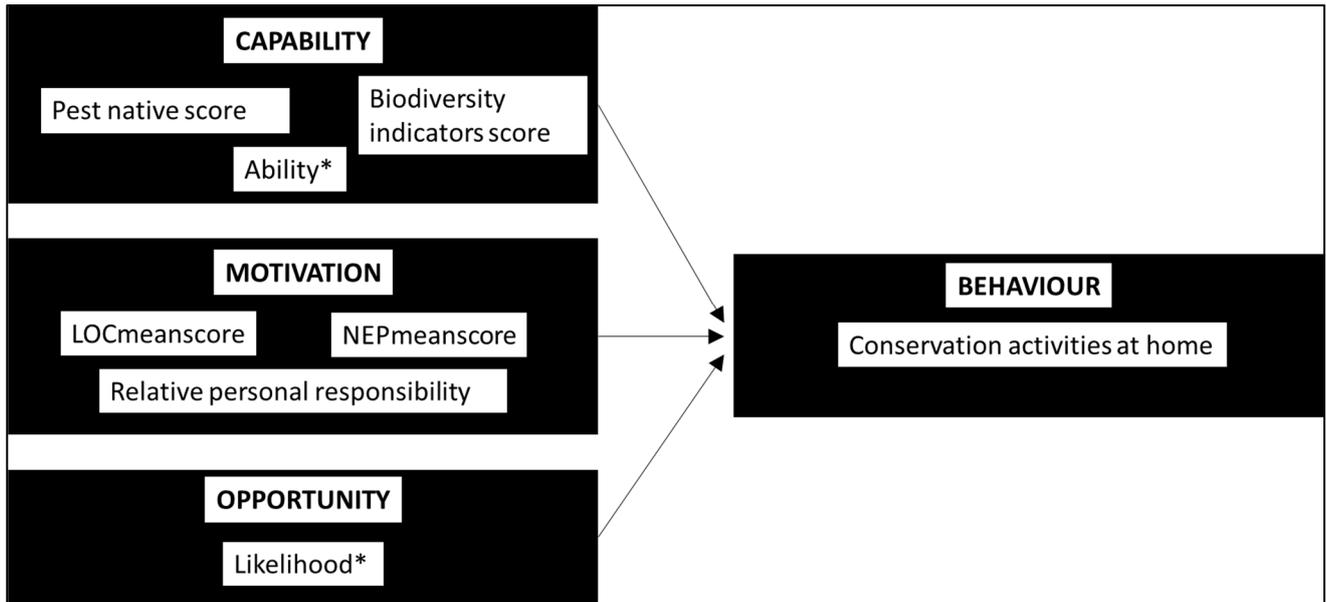
### 6.1 Conservation activities results

This section describes the results for the three types of conservation activities as defined by the Principal Components Analysis: activities undertaken at home, activities in the community, and finally advocacy conservation activities (see Appendix 9.7 for details). Conservation activities done at home includes 'control pest plants on my property', 'plant native plants on my property', and 'trap or control rats or other animals on my property'. Conservation activities done in the community includes 'help plant native trees in my local community', 'trap or control rats and other pest animals in my community', 'help control pest plants in parks and reserves in my local community', and 'attend a training workshop / webinar such as learning how to trap for pests or identify pest plants'. Advocacy conservation activities include 'communicate with others about the importance of looking after our natural environment', 'learn what I can do to help the natural environment', and 'learn about the natural environment'.

The generalised models are described first before considering models for individual behaviours.

#### 6.1.1 Conservation activities done at home

Conservation activities undertaken at home, in general, are moderately well explained by the COM-B model (34% of the variance in behaviour explained). Ability to perform these activities, and likelihood to undertake these activities in the next 12 months are significant predictors ( $\beta = 0.264$  and  $\beta = 0.379$  respectively). This model suggests that Aucklanders' abilities and opportunities to undertake conservation activities at home have the greatest impact on their participation. Our investment to encourage greater participation in these activities should, therefore, focus on creating opportunities and improving physical skills (see section 5.2 for further discussion and recommendations).



**Figure 33: COM-B model for conservation activities done at home.  $R^2 = 0.340$ ,  $F = 62.107$  (sig  $p < 0.05$ ). \*Beta coefficients significant at  $p > 0.05$ .**

Models that consider the three conservation actions performed at home separately account for a larger amount of variance in the activities compared with the generalised model above. The model to explain the activity ‘trap on control rats and other pest animals on my property’ accounts for 44% of the variance. ‘Opportunity to set a rat trap’ and ‘ability to set a rat trap’ were the two significant predictors for this activity. Focusing our investment in providing opportunities for rat trapping and improving skills in setting rat traps is most likely to increase Aucklanders’ participation in controlling for rats and other pest animals on their property. Less investment should be given to increasing Aucklanders’ motivations to participate in this activity.

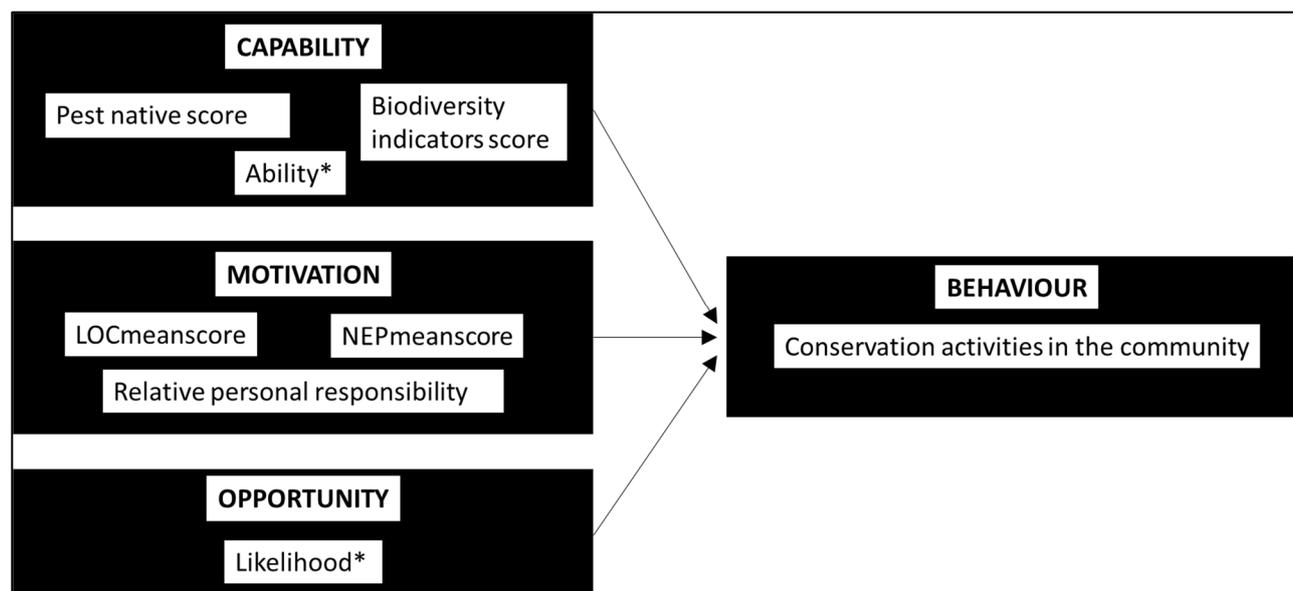
Models for plant related activities (controlling and planting) accounted for less variance (31% and 23% respectively). ‘Opportunity to control pest plants’, ‘ability to control pest plants’, and ‘ability to identify pest plants’ were significant predictors for both activities. Connectedness to nature was also a significant predictor for ‘control pest plants on my property’. As with controlling pest animals, these results suggest that investment should focus on creating opportunities to perform these activities and improving skills in pest plant control and pest plant identification.

**Table 2: COM-B models for conservation activities undertaken at home. Beta coefficients significant at  $p > 0.05$ . Adjusted  $R^2$  describes the amount of variance accounted for by predictor variables – when  $R^2 = 1$ , 100% of the variance is explained and the predictors entirely explain the behaviour.**

Activity	Adjusted $R^2$	Significant predictors
Control pest plants on my property	0.309	Ability to control pest plants ( $\beta = 0.323$ ) Ability to identify pest plants ( $\beta = 0.140$ ) Opportunity to control pest plants ( $\beta = 0.140$ ) Connectedness to nature score ( $\beta = 0.138$ )
Plant natives on my property	0.234	Ability to control pest plants ( $\beta = 0.273$ ) Ability to identify pest plants ( $\beta = 0.176$ ) Opportunity to control pest plants ( $\beta = 0.133$ )
Trap or control rats or other pest animals on my property	0.435	Opportunity to set a rat trap ( $\beta = 0.320$ ) Ability to set a rat trap ( $\beta = 0.440$ )

### 6.1.2 Conservation activities done in the community

Conservation activities undertaken within the community in general are also moderately well explained by the COM-B model with 32% of the variance explained. As with activities performed at home, ability, and likelihood to perform these activities in the next 12 months were the significant predictors ( $\beta = 0.231$  and  $\beta = 0.431$ ). Again, our investment to encourage greater participation in these activities should focus on creating opportunities and improving physical skills (see section 5.2 for further discussion and recommendations).



**Figure 34: COM-B model for conservation activities done in the community.  $R^2 = 0.315$ ,  $F = 55.99$  (sig  $p < 0.05$ ). \*Beta coefficients significant at  $p > 0.05$ .**

Models that consider the four conservation actions performed in the community separately account for a slightly less variance in the activities (between 11% and 24% of the variance

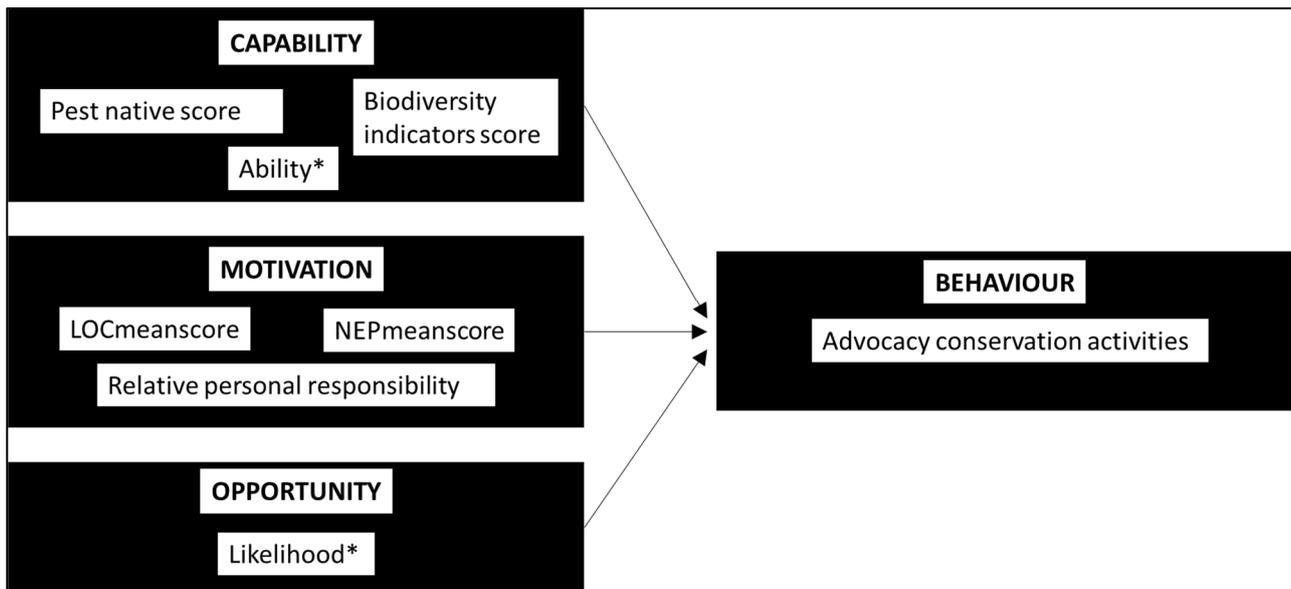
explained). Ability and opportunity to perform the activities were the significant predictors across all activities. Our investment should, therefore, be focused on increasing skills and creating opportunities to increase Aucklanders' participation in conservation activities happening in the community. Considering accessibility and appealing to 'people like me' are key to enabling attendance of community events and training workshops (see section 5.2.2 for further discussion and recommendations). These events need to accommodate Aucklanders' work schedules, family care commitments, physical mobility, and access to transport.

**Table 3: COM-B models for conservation activities undertaken in the community. Beta coefficients significant at  $p > 0.05$ . Adjusted  $R^2$  describes the amount of variance accounted for by predictor variables – when  $R^2 = 1$ , 100% of the variance is explained and the predictors entirely explain the behaviour.**

Activity	Adjusted $R^2$	Significant predictors
Help control pest plants in parks and reserves in my local community	0.193	Opportunity to attend a community event such as planting trees or pest control ( $\beta = 0.124$ ) Ability to identify pest plants ( $\beta = 0.225$ ) Ability to attend a community event such as planting trees or pest control ( $\beta = 0.143$ )
Help plant natives in my community	0.243	Opportunity to attend a community event such as planting trees or pest control ( $\beta = 0.160$ ) Ability to identify pest plants ( $\beta = 0.207$ ) Ability to attend a community event such as planting trees or pest control ( $\beta = 0.298$ )
Trap or control rats or other pest animals in my community	0.204	Opportunity to set a rat trap ( $\beta = 0.153$ ) Ability to set a rat trap ( $\beta = 0.302$ ) Ability to attend a community event such as tree planting or pest control ( $\beta = 0.169$ )
Attend a training workshop / webinar such as learning how to trap for pests or identify pest plants	0.108	Opportunity to attend a training workshop on trapping for pests or identifying pest plants ( $\beta = 0.123$ ) Ability to attend a community event such as tree planting or pest control ( $\beta = 0.247$ )

### 6.1.3 Advocacy conservation activities

Advocacy conservation activities again are moderately well explained by the COM-B model with 40% of the variance explained. The same trend seen with conservation activities at home and in the community are seen here with ability and likelihood as the two significant predictors ( $\beta = 0.192$  and  $\beta = 0.402$  respectively).



**Figure 35: COM-B model for advocacy conservation activities.  $R^2 = 0.396$ ,  $F = 54.362$  (sig  $p < 0.05$ ). \*Beta coefficients significant at  $p > 0.05$ .**

Models that consider the three advocacy conservation activities separately account for a similar amount of variance. ‘Ability to advocate for the natural environment’ is the strongest predictor for each activity. The New Ecological Paradigm score and pest native score were significant predictors unlike conservation activities at home or in the community. This suggests that, unlike the other conservation activities, participation in advocacy conservation activities may benefit from increasing the pro-ecological worldview of Aucklanders.

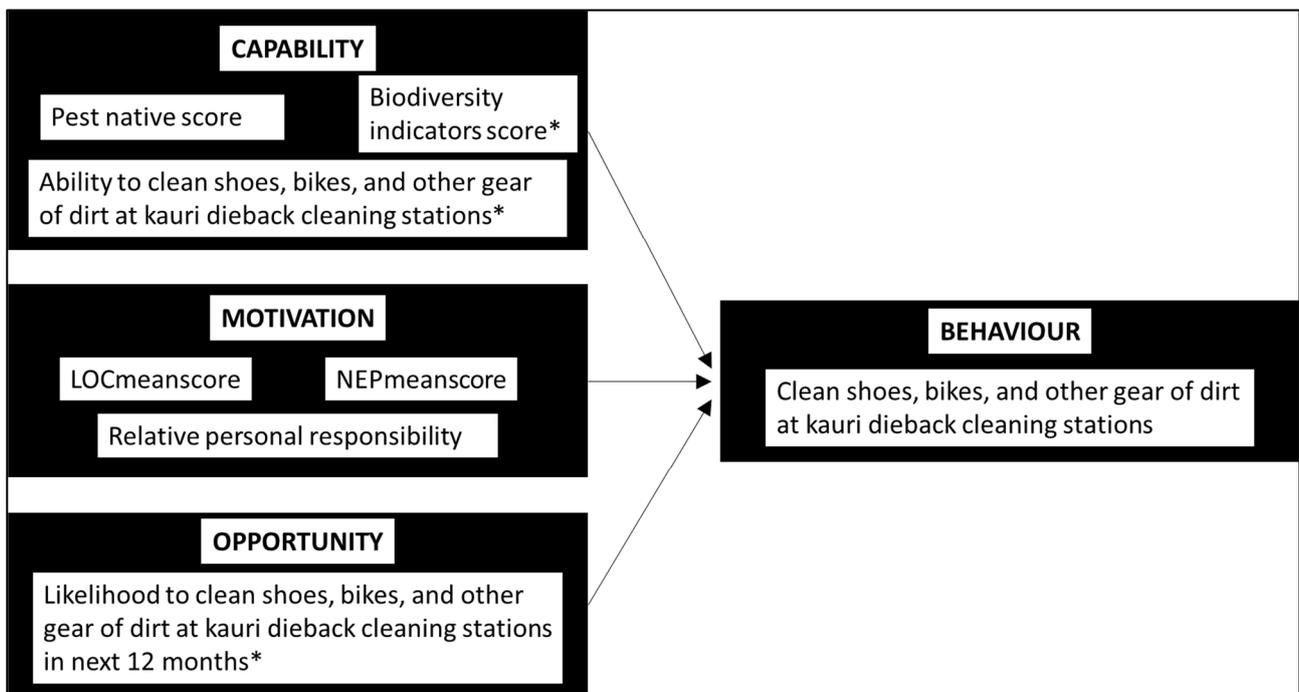
**Table 4: COM-B model for advocacy conservation behaviours. Beta coefficients significant at  $p > 0.05$ . Adjusted  $R^2$  describes the amount of variance accounted for by predictor variables – when  $R^2 = 1$ , 100% of the variance is explained and the predictors entirely explain the behaviour.**

Activity	Adjusted $R^2$	Significant predictors
Communicate with others about the importance of looking after our natural environment	0.380	Ability to advocate for the natural environment ( $\beta = 0.541$ ) New Ecological Paradigm score ( $\beta = 0.116$ )
Learn what I can do to help the natural environment	0.394	Ability to advocate for the natural environment ( $\beta = 0.516$ ) Opportunity to learn what I can do to help the natural environment ( $\beta = 0.093$ ) New Ecological Paradigm score ( $\beta = 0.116$ ) Pest native score ( $\beta = 0.081$ )
Learn about the natural environment	0.395	Ability to advocate for the natural environment ( $\beta = 0.522$ ) Opportunity to learn what I can do to help the natural environment ( $\beta = 0.110$ ) New Ecological Paradigm score ( $\beta = 0.082$ ) Pest native score ( $\beta = 0.107$ )

Another advocacy conservation activity (donating money to groups who work to improve or protect the natural environment) was included in the survey. This activity was found to not form part of the advocacy conservation component in the Principal Component Analysis. Thirteen per cent of the variance in this activity was explained by the COM-B model ( $R^2 = 0.126$ ). 'Ability to advocate for the natural environment' and New Ecological Paradigm score were the two significant predictors ( $\beta = 0.249$  and  $\beta = 0.128$  respectively).

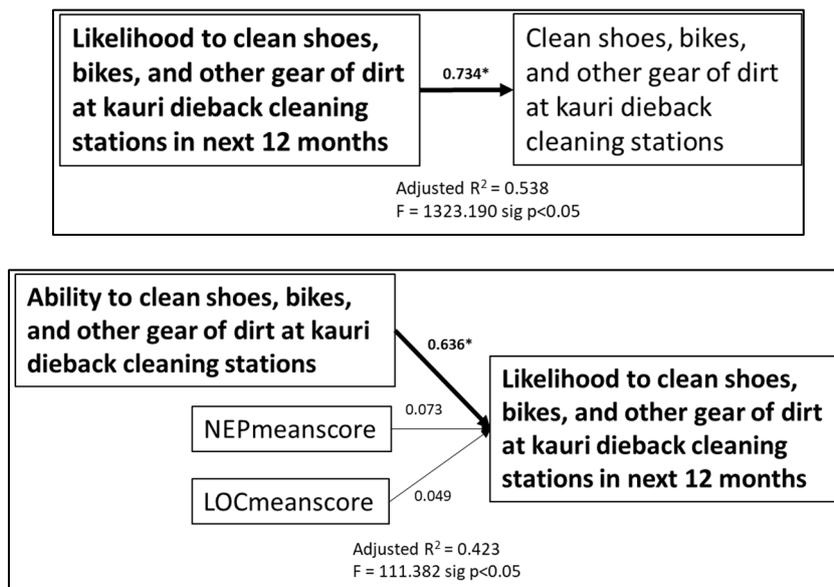
## 6.2 Biosecurity-related behaviour results

The kauri dieback biosecurity-related behaviour of cleaning shoes, bikes, and other gear of dirt at kauri dieback cleaning stations is well explained by the model (60% of variance in behaviour explained). Likelihood to perform this behaviour in the next 12 months, ability to perform this behaviour, and biodiversity indicators score account for the greatest proportion of the behaviour ( $\beta = 0.509$ ,  $\beta = 0.285$ , and  $\beta = 0.106$  respectively).



**Figure 36: COM-B model for kauri dieback biosecurity-related behaviours.  $R^2 = 0.601$ .  $F = 77.909$  (sig  $p < 0.05$ ). \*Beta coefficients significant at  $p > 0.05$ .**

Alternative models were explored as likelihood had a large beta coefficient ( $\beta$ ) and relationships between independent variables were anticipated (see Figure 37). A model with only likelihood as the independent variable accounts for 54% of the variance in the behaviour ( $R^2 = 0.538$ ). Forty-two per cent of the variance in likelihood can be accounted for by NEP, LOC, and capability ( $R^2 = 0.423$ ). Likelihood is confirmed as a mediating variable through a Sobel test ( $T = 14.1, p = 0$ ). This alternative model is not dissimilar to the theory of planned behaviour in which the behaviour is primarily driven by intention which is then driven by attitude, subjective norm, and perceived behavioural control.



**Figure 37: Alternative models for kauri dieback biosecurity-related behaviours. \*Beta coefficients sig at  $p < 0.05$ .**

To enable cleaning behaviours at kauri dieback cleaning stations an intention to perform this needs to be established. This can in part be established by building track users capabilities. Sixty-four per cent of participants answered having an 'above average' or 'very high' ability to clean their gear at cleaning stations. This model demonstrates the importance of maintaining this ability to ensure continued compliance.

This survey asked participants about two other biosecurity-related behaviours: one related to freshwater biosecurity and the other marine biosecurity. COM-B models were run for both behaviours. In neither model did the independent variables reliably predicted by the dependent variable (freshwater  $F = 2.412, p > 0.05, R^2 = 0.186$ , marine  $F = 0.443, p > 0.05, R^2 = -0.068$ ). Small sample sizes (marine  $n = 85$ , freshwater  $n = 136$ ), and no ability or likelihood questions specific to these behaviours are likely to explain why these models were unsuccessful.

### 6.3 Summary

The results of modelling demonstrate the significance of perceived opportunities and abilities to perform biosecurity-related behaviours and participate in conservation activities. Variables that added to the construct of motivation contributed little to explaining the variance in biosecurity-related behaviours and participation in conservation activities (except for advocacy conservation activities).

To increase the proportion of Aucklanders engaging in these behaviours and activities focus should, therefore, be given to increasing capabilities and providing opportunities (see section 5.2 for discussion). Minimal focus should be given to providing motivation in the form of growing environmental locus of control, relative personal responsibility, pro-ecological worldview (NEP), or connectedness to nature. Data on alternative motivators such as socialising, health and wellbeing, or community connectedness could be collected in subsequent waves and modelling repeated to test how these motivators could predict the performance of biosecurity-related behaviours and participation in conservation activities.

## 7 Conclusions and recommendations



**Figure 38: Baseline scores of social outcome measures.**

**Communications:** This study found participants had varied comprehension of biodiversity and biosecurity and a minimal understanding of the relationship between these. Further research on Aucklander comprehension of biosecurity, biodiversity, and ‘pests’ is recommended to inform public facing communications. This research and the communications direction it could provide would benefit the entire Portfolio as this is a challenge shared by freshwater biosecurity, plant pathogens, island biosecurity, pest plant management, community conservation initiatives and more.

**Take a segmented approach:** Participation in conservation activities, capabilities, and capacity, were found to vary across age and ethnicity. Utilise a segmentation to develop initiatives tailored to different Aucklanders. Younger Aucklanders and those of Asian and Pacific ethnicities could be encouraged to start engaging in conservation activities, while other demographics could be encouraged to continue or increase their engagement, for example. A segmentation, such as that developed by MacDonald et al. (2019), based on psychographic characteristics as opposed to demographic characteristics is worth considering to direct the development of offerings such as skills development and participation opportunities.

**Focus on capabilities:** Modelling demonstrated the importance of personal capabilities to undertake conservation activities. Consideration should be given as to how Aucklanders could be better enabled to perform these activities through capability building (e.g., pest plant identification, safe chemical use).

**Consider support services:** Consider supplementing capability building with support services that enable Aucklanders to engage in conservation activities (e.g., garden waste removal, gardening tool libraries).

**Focus on opportunities for participation:** Modelling demonstrated the importance of perceived opportunity to undertake conservation activities. Lack of awareness or knowledge about how to get involved in community conservation activities and the perception that such events are not for ‘people like me’ are key barriers. Address these barriers to participation by delivering accessible community events and other participation opportunities to ensure equitable access for *all* Aucklanders. A segmented approach and further research into communications may address the awareness and knowledge barriers.

**Personal responsibility:** Few participants felt they were personally responsible for biosecurity in the Auckland region. This may be due to a misunderstanding the impact individual’s actions can have on the natural environment and what this means for them (e.g., availability of forest for recreation, presence of wildlife in local community). Further research is required to explore the role of personal responsibility in bringing about behavioural change.

The Behaviour Change Wheel that accompanies the COM-B model of behaviour should be considered as a framework to action these recommendations.

## 8 References

Ajzen, I (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50, 179-211.

<https://www.sciencedirect.com/science/article/abs/pii/074959789190020T>

Alexander, K.E., Brijnath, B., Mazza, D (2014). Barriers and enablers to delivery of the Healthy Kids Check: an analysis informed by the Theoretical Domains Framework and COM-B model. *Implementation Science* 9, 60. <https://doi.org/10.1186/1748-5908-9-60>

Auckland Council (Unpublished). Auckland's Environment and Conservation Survey: North West Wildlink.

Auckland Council (Unpublished). Biodiversity People's Panel Research.

Auckland Council (Unpublished). Marine Biosecurity: Understanding antifouling and movement behaviour, and marine pest awareness of Auckland's recreational vessel owners – 2017.

Auckland Council (Unpublished). Tāmaki Makaurau Marine Biosecurity Marina/Boat Ramp Outreach Engagement Report 2019/2020.

Braun, V., Clarke, V (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology* 3, 77-101. <https://doi.org/10.1191/1478088706qp063oa>

Dunlap, R.E., Liere, K.D.V., Mertig, A.G., Jones, R.E (2000). New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues* 56, 425-442. <https://doi.org/10.1111/0022-4537.00176>

Gravitas Research (Unpublished). Lake User Survey: October 2020.

Kollmuss, A., Agyeman, J (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research* 8, 239-260.

MacDonald, E., Harbrow, M., Jack, S., Kidd, J., Wright, A., Tuinder, P., Balanovic, J., Medvecky, F., Poutasi, M (2019). Segmenting urban populations for greater conservation gains: A new approach targeting cobenefits is required. *Conservation Science and Practice* 1, e101. <https://doi.org/10.1111/csp2.101>

Marks, D.F., Murray, M., Estacio, E.V (2020). *Health Psychology: Theory, Research and Practice*, Sixth edition. ed. SAGE Publications Ltd, Thousand Oaks.

McMullin, S.L., Hockett, K.S., McClafferty, J.A (2007). Does angling or boating improve the stewardship ethic of participants?, in: *American Fisheries Society Symposium* 55. American Fisheries Society, San Francisco, CA, pp. 145-155.

- Michie, S., van Stralen, M.M., West, R (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science* 6, 42. <https://doi.org/10.1186/1748-5908-6-42>
- New Zealand Companion Animal Council Inc. (2016). Companion Animals in New Zealand 2016.
- Ovenden, K., (2020). Kauri dieback track user study 2020. Auckland Council technical report, TR2020/020
- Rohani, M., Murray, C (2018). Cost benefit analysis of the natural environment investment options for the Auckland Council Long-term plan 2018-2028. Auckland Council technical report, TR2018/005
- Stats NZ (2020). Representation table 2020 estimates from 2018 census base.
- Stats NZ (2018). Place Summaries, Auckland Region.
- Thapa, B (2010). The Mediation Effect of Outdoor Recreation Participation on Environmental Attitude-Behavior Correspondence. *The Journal of Environmental Education* 41, 133-150. <https://doi.org/10.1080/00958960903439989>
- TRA (Unpublished). Towards a Pest Free Auckland – 2019.
- Whittal, A., Atkins, L., Herber, O.R (2020). What the guide does not tell you: reflections on and lessons learned from applying the COM-B behavior model for designing real life interventions. *Translational Behavioral Medicine*. <https://doi.org/10.1093/tbm/ibaa116>
- Zoo and Aquarium Association (Unpublished). Safe Cat, Safe Wildlife survey 2020.

## 9 Appendix

### 9.1 Questionnaire

Invitation email:



#### Kia ora Wendy

This survey is about the [natural environment](#).

[Start survey now](#)

Be in to win! Complete this survey to be in the draw to win 1 of 4 [\\$100 vouchers](#).

It should take about 12 minutes and closes midnight Tuesday 17 November.

Thanks,

*Allanah and Geena*  
The People's Panel Team

[Start survey](#) 🐸

Know someone who might find the People's Panel interesting? Forward this email and ask them to [sign up here](#).

**Want to update your email address or other details?** [Update your details](#)

This information helps us make sure we are including a wide range of perspectives from the people who live in Auckland.

[Household]

SR randomised, anchor 'other'

QX. Which of the following best describes your household?

Non-family household e.g. flatting	1	
Family with most children under 14 years	2	
Family with most children 14 years and over	3	
Living alone	4	
Couple with no children	5	
Other, please specify	96	OPEN
Prefer not to say		

**[\$Home\_type]**

**MR randomized, anchor ‘Another type of pet’ and ‘No’**

QX. Which of any of the following for you have at home?

Cat(s)	[Pet_cat]	
Dog(s)	[Pet_dog]	
Lizard(s) or other reptiles	[Pet_reptile]	
Turtle(s), frog(s), or other amphibians	[Pet_turtle]	
Fish	[Pet_fish]	
Bird(s)	[Pet_bird]	
Another type of pet, please specify	[Pet_other] [Pet_other_OPEN]	
A garden or other outdoor space with plants	[Home_garden]	
None of the above	[Pet_garden_none]	

**[\$Activities]**

**MR randomized, anchor ‘don’t know’ and ‘none of the above’**

QX. Which of the following activities have you done in the past 3 months?

Walked in the bush	[Act_walk]	
Mountain biking	[Act_bike]	
Visited my local park	[Act_park]	
Freshwater fishing	[Act_fish]	
Visited a freshwater lake to swim, kayak, fish, or have a day out	[Act_lake]	
Travelled on my boat on the Hauraki Gulf	[Act_boat]	
Visited a Hauraki Gulf island on a ferry	[Act_ferry]	
Played golf at an Auckland golf course	[Act_golf]	
None of the above	[Act_none]	SR exclusive
I don’t know	[Act_dontknow]	SR exclusive

*Proportion of Aucklanders who participate in conservation activity*

**[#Conservation\_Actions]**

**Randomised statements, break statements into two questions**

QX. How often, if at all, do you personally do the following?

Donate money to groups who work to improve or protect the natural environment	[CAction_money]	AA
Help plant native trees in my local community	[CAction_plantcomm]	AA
Trap or control rats or other pest animals on my property	[CAction_traphome]	AA

Help control pest plants in parks and reserves in my local community	[CAction_weedcomm]	AA
Trap or control rats or other pest animals in my local community	[CAction_trapcomm]	
Plant native plants on my property	[CAction_planhome]	
Control pest plants on my property	[CAction_weedhome]	
Clean your boat hull	[BAction_boat]	Ask IF QX:6
Attend a training workshop on trapping for pests or identifying pest plants	[CAction_workshop]	

Once a month or more	5
Once or twice every 2-3 months	4
Once or twice a year	3
Once or twice every 2-3 years	2
Never	1
Not sure	98

*Proportion of Aucklanders who frequently perform biosecurity risk-reducing behaviours*

**#[Biosecurity\_Actions]**

**Randomised statements**

QX. How often, if at all, do you personally do the following?

Keep my cat within my property	[CAction_cat]	Ask IF QX:1
Clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations	[BAction_KDDclean]	
Clean kayaks, fishing equipment and other gear used in freshwater	[BAction_FWclean]	Ask IF QX:4 or 5
Check my gear for pests when travelling in the Hauraki Gulf	[BAction_vector]	Ask if QX: ferry or boat
Communicate with others about the importance of looking after our natural environment	[CAction_advocate]	
Learn what I can do to help the natural environment	[CAction_learnhelp]	
Learn about the natural environment	[CAction_learn]	

Every time / all of the time	5
Usually / often	4
Sometimes / About half the time	3
Rarely / Seldom	2
Never	1
Not sure / not applicable	9
	8

*Proportion of Aucklanders who have increased capabilities and capacity to undertake conservation activities*

**#[Capabilities]**

**Randomised statements**

QX. How would you rate your ability to do the following activities?

Set a rat trap	[Cap_trap]	
Control pest plants	[Cap_Cplant]	
Identify pest plants	[Cap_IDplant]	
Attend a community event such as tree planting or pest control	[Cap_plant]	
Advocate for the natural environment	[Cap_advocate]	
Clean kayaks, fishing equipment and other gear used in freshwater	[Cap_FWclean]	
Clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations	[Cap_KDDclean]	
Use pest animal monitoring equipment	[Cap_monitor]	
Leading a conservation community group	[Cap_lead]	

Very High	5
Above Average	4
Average	3
Below Average	2
Very Low	1
don't know	98

*Proportion of Aucklanders who have increased capabilities and capacity to undertake conservation activities*

**[Incapable\_OPEN]**

QX. The following activities you rated as having 'below average' or 'very low' ability. What, if anything, could enable you to carry out or become better at these?

<i>Pipe from Qabove max 3</i>	OPEN
	OPEN
	OPEN

*Proportion of Aucklanders who have increased capabilities and capacity to undertake conservation activities*

**[#Likelihood]**

**Randomised statements**

QX. How likely would you be to do the following in the next 12 months?

Set a rat trap	<b>[Like_trap]</b>	
Control pest plants	<b>[Like_weed]</b>	
Attend a community event such as tree planting or pest control	<b>[Like_plantcomm]</b>	
Clean shoes, bikes, and other gear of dirt at kauri dieback cleaning stations	<b>[Like_KDDclean]</b>	
Attend a training workshop on trapping for pests or identifying pest plants	<b>[Like_workshop]</b>	
Learn what I can do to help the natural environment	<b>[Like_learnhelp]</b>	

Definitely will do this	5
Very likely	4
Fairly likely	3
Not very likely	2
I would never do this	1

*Proportion of Aucklanders who have increased capabilities and capacity to undertake conservation activities*

**[Unlikely\_OPEN]**

QX. Why are you unlikely to do these activities in the future?

<i>Pipe from Qabove max 3</i>	OPEN
	OPEN
	OPEN

*Proportion of Aucklanders who are knowledgeable about biodiversity and biosecurity pressures (biosecurity understanding)*

**[Biosecurity\_understanding\_OPEN]**

QX. What, if anything, does the word 'biosecurity' mean to you?

OPEN		
I don't know	98	

*Proportion of Aucklanders who are knowledgeable about biodiversity and biosecurity pressures (biodiversity understanding)*

**[Biodiversity\_understanding\_OPEN]**

QX. What, if anything, does the word 'biodiversity' mean to you?

OPEN		
I don't know	98	

*Proportion of Aucklanders who are knowledgeable about biodiversity and biosecurity pressures (biodiversity comprehension)*

**[\$High\_biodiversity]**

**MR randomised**

QX. Which of the following might indicate high native biodiversity to you?

Seeing native fish in streams and ponds	[HB_fish]	Correct
Lots of different native plants at my local park	[HB_plants]	Correct
Rubbish-free beaches and waterways	[HB_rubbish]	NA
Natural outdoor spaces that I can enjoy	[HB_enjoy]	NA
Different kinds of native birds in my backyard	[HB_birds]	Correct
A bright green mowed lawn	[HB_lawn]	Incorrect
A healthy pine forest	[HB_pine]	Incorrect
Something else, please explain	[HB_other] [HB_other_OPEN]	
None of the above	[HB_none]	SR exclusive
I don't know	[HB_dontknow]	SR exclusive

*Proportion of Aucklanders who value biodiversity*

**[BIO\_ABS\_value]**

**Randomised. SR.**

QX. How important is a large amount of native plants, animals, and insects in Auckland to you?

Very important	1
Important	2
Neutral	3
Unimportant	4
Very unimportant	5
Not sure	98

*Proportion of Aucklanders who are knowledgeable about biodiversity and biosecurity pressures (pest comprehension)*

**[Native\_Pest\_Knowledge]**

**Drag and drop. Randomised. Show pax half list.**

QX. Please arrange the following into natives and invasive pests to the best of your knowledge.

Kowhai	1	Native
Ginger	2	Pest
Moth plant	3	Pest
Nikau palm	4	Native
Tūī	5	Native
Possum	6	Pest
Long-tailed bat	7	Native
Wallaby	8	Pest
Bellbird	9	Native
Fanworm	10	Pest
Plague skink	11	Pest
Houttuynia	12	Pest
Kererū	13	Native
Koi carp	14	Pest
Pukeko	15	Native

Native	1
Invasive pest	2
I don't know	9
	8

*Proportion of Aucklanders who feel a sense of personal responsibility for reducing their biosecurity risk*

**#[Locus\_of\_control]**

**Randomised statements**

QX. How much do you agree or disagree with the following?

I have control over my own impact on the environment	<b>[LOC_control]</b>	AA - LOC
It is important to reduce my impact on the environment	<b>[LOC_reduce]</b>	AA - LOC
I am personally responsible for contributing to the environment's problems	<b>[LOC_response]</b>	AA - LOC
My efforts to protect the environment are insignificant as long as others refuse to act	<b>[LOC_effort]</b>	AA - LOC

1 Strongly disagree	1
2	2
3	3
4	4
5 Strongly agree	5
I don't know	9
	8

*Proportion of Aucklanders who feel a sense of personal responsibility for reducing their biosecurity risk*

**[Responsibility]**

**Rank**

QX. Arrange the below from MOST responsible to LEAST responsible for reducing the spread of pests (such as ginger plant, koi carp, kauri dieback disease, and fanworm) around the Auckland region?

Auckland Council	1	
Department of Conservation (DOC)	2	
Auckland residents	3	
Community organisations such as schools and conservation groups	4	
Me and my household	5	
Ministry for Primary Industries (MPI)	6	

We are now going to ask about your views on nature. There are no right or wrong answers. Please be as honest and candid as you can.

*Proportion of Aucklanders who value biodiversity*

**#[New\_Ecological\_Paradigm]**

**Randomized statements. Show half pax.**

QX. How much do you agree or disagree with the following?

We are approaching the limit of the number of people the Earth can support.	1	AA – NEP-high
Humans have the right to modify the natural environment to suit their needs.	2	AA_NEP-low
When humans interfere with nature it often produces disastrous consequences.	3	AA – NEP-high
Human ingenuity will ensure that we do not make the Earth unliveable.	4	AA – NEP-low
Humans are seriously abusing the environment.	5	AA – NEP- high
The Earth has plenty of natural resources if we just learn how to develop them.	6	AA – NEP-low
Plants and animals have as much right as humans to exist.	7	AA – NEP-high
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	8	AA – NEP-low

Despite our special abilities, humans are still subject to the laws of nature.	9	AA – NEP-high
The so-called “ecological crisis” facing humankind has been greatly exaggerated.	10	AA – NEP-low
The Earth is like a spaceship with very limited room and resources.	11	AA – NEP-high
Humans were meant to rule over the rest of nature.	12	AA – NEP-low
The balance of nature is very delicate and easily upset.	13	AA – NEP-high
Humans will eventually learn enough about how nature works to be able to control it.	14	AA – NEP-low
If things continue on their present course, we will soon experience a major ecological catastrophe.	15	AA – NEP-high

1 Strongly disagree	1
2	2
3 Neutral	3
4	4
5 Strongly agree	5

*Proportion of Aucklanders who feel a sense of connectedness with nature*

**#[Connectedness\_with\_nature]**

**Randomised statements. Show half pax.**

QX. How much do you agree or disagree with the following?

I often feel a sense of oneness with the natural world around me.	1	AA - CNS
I think of the natural world as a community to which I belong.	2	AA - CNS
I recognize and appreciate the intelligence of other living organisms.	3	AA - CNS
I often feel disconnected from nature.	4	AA - CNS
When I think of my life, I imagine myself to be part of a larger cyclical process of living.	5	AA - CNS
I often feel a kinship with animals and plants.	6	AA - CNS
I feel as though I belong to the Earth as equally as it belongs to me.	7	AA - CNS
I have a deep understanding of how my actions affect the natural world.	8	AA - CNS

I often feel part of the web of life.	9	AA - CNS
I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'.	10	AA - CNS
Like a tree can be part of a forest, I feel embedded within the broader natural world.	11	AA - CNS
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	12	AA - CNS
I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.	13	AA - CNS
My personal welfare is independent of the welfare of the natural world.	14	AA - CNS

1 Strongly disagree	1
2	2
3 Neutral	3
4	4
5 Strongly agree	5

Lastly, we have a few questions about you...

### [Gender]

#### SR

QX. Which gender do you most identify with?

Female	1	
Male	2	
Gender diverse	3	
Prefer not to say	99	

### [Age]

#### SR

QX. What is your age?

14 years old or younger	1	
15-24 years	2	
25-34 years	3	
35-44 years	4	
45-54 years	5	
55-64 years	6	
65-74 years	7	
70 years or older	8	
Prefer not to say	99	

**[Suburb]**

QX. In which suburb do you live?

<i>Start to type and auto-populate</i>
--

**[Local\_board] Hidden variable**

**[\$Ethnicity]**

**MR**

QX. Which ethnic group(s) do you identify with?

New Zealand European / Pākehā		
Other European		
Māori		
Samoan		
Tongan		
Fijian		
Cook Island Māori		
Tokelauan		
Niuean		
Other Pacific peoples		
Southeast Asian		
Korean		
Chinese		
Indian		
African		
Middle Eastern		
Latin American		
Other, please specify		
Prefer not the say		

## 9.2 Transformation of variables

- Tested scales (NEP, CNS, and LOC) were incorporated as mean scores (variable names: NEPmeanscore, CNSmeanscore, LOCmeanscore). Participants were asked either NEP or CNS which prevents inclusion of both scales in a model. Models were run separately with each scale and only the strongest model has been included in this report.
- Likert scale questions for abilities and frequency of performing behaviours (dependent variable) were not transformed for models on individual behaviours.
- Personal responsibility was asked as a ranking exercise. The relative rank of answer option 'me and my household' was included as a single score (variable name: Relative personal responsibility).
- An index was created to transform the question on defining high native biodiversity (variable name: HBD score).
- One 'point' was awarded for each correctly categorised native/pest species (variable name: native pest knowledge).

## 9.3 Scoring for Aucklanders who are knowledgeable about biodiversity and biosecurity pressures

The question on high native biodiversity indicators was transformed into a single score for each response between 0 and 5. The table below summaries the index.

**Table 5: High native biodiversity indicator index.**

Score	Interpretation	Count of responses
5	All three 'correct' responses selected, no NA or 'incorrect' selected	500
4	Two out of three 'correct' responses selected, no NA or 'incorrect' selected	107
3	Two out of three 'correct' responses selected, one NA response selected	586
2	One out of three 'correct' responses selected and/or at least one NA response selected	119
1	One out of three 'correct' responses selected and/or at least one 'incorrect' response selected, or None of the 'correct' responses selected and at least one NA response selected	347
0	All other possible combinations, including 'none of the above', 'other', and 'I don't know'	154

The question asking participants to arrange species as 'invasive pests' or 'natives' was transformed into a single score for each response between 0 and 7. For each correct

categorisation one 'point' was awarded. The score for each response is a sum of these points.

The overall score for this measure was calculated by averaging the mean scores for each question.

Score = (mean for high biodiversity indicator: 2.91 + mean for pest/native categorisation: 5.20) / (range for high biodiversity indicators: 6 + range for pest/native categorisation: 8) = 0.579 = 5.8 / 10

## 9.4 Coding likelihood responses for opportunity construct

If participants said they were unlikely to perform one of the conservation activities in the next 12 months they were asked why. The open responses for 'set a rat trap', 'control pest plants', 'attend a community event such as tree planting or pest control', 'attend a workshop on trapping for pests or identifying pest plants', and 'learn what I can do to help the natural environment' were categorised as indicating a lack of 'opportunity', 'capability', or 'motivation'. Overall, 64% of responses (n=1,074) were coded as 'lack of opportunity', 20% coded as 'lack of motivation', and 16% coded as 'lack of capability'. The relative proportion of 'lack of opportunity' to 'lack of motivation or capability' varied across these five conservation activities.

**Table 6: Coding open responses into 'lack of opportunity' and 'lack of motivation or capability'.**

Conservation Activity		Count	Percentage
Set a rat trap	Lack of opportunity	282	71%
	Lack of motivation or capability	113	29%
Control pest plants	Lack of opportunity	98	63%
	Lack of motivation or capability	57	37%
Attend community event	Lack of opportunity	214	68%
	Lack of motivation or capability	99	32%
Attend workshop	Lack of opportunity	65	55%
	Lack of motivation or capability	53	45%
Learn what I can do to help the natural environment	Lack of opportunity	33	36%
	Lack of motivation or capability	60	64%

A dummy variable was created to incorporate 'opportunity' into models for individual behaviours. Where participants said they were 'likely' to participate in the activity they were given a value of '1', if they were unlikely due to a lack of opportunity (based on the coding described above) they were given a value of '0'. Participants who were unlikely to perform the activity due to a lack of motivation or capability were given a 'missing' value and therefore excluded.

## 9.5 Statistical procedures

Cronbach's alpha was first calculated to assess internal consistency with the three scale questions (NEP, CNS, and LOC, see Appendix 9.6 for results). An alpha value of, or greater than, 0.70 provides good evidence of internal consistency.

Spearman's rho ( $\rho$ ) was then calculated to assess relationships between the dependent variable (behaviour) and the independent variables, and between independent variables combined to represent one of the model constructs (i.e., 'capability' or 'motivation'). Values between  $\pm 0.3$  and  $\pm 0.5$  show a moderate relationship and those greater than  $\pm 0.5$  show a good relationship.

The linear multiple regression model was initially run for each individual behaviour using all variables. Models were unable to be run for boat hull cleaning (marine biosecurity), cleaning kayaks, fishing equipment and other gear used in freshwater (freshwater biosecurity), and checking gear for pests when travelling in the Hauraki Gulf (island biosecurity) due to small sample sizes of participants who engage in these behaviours and/or a limitation of the questionnaire design resulting in data for likelihood and ability of these behaviours not being collected<sup>8</sup>. The adjusted  $R^2$  describes the amount of variance in the dependent variable accounted for by the independent variable. When  $R^2 = 1$ , 100% of the variance is explained and the predictors entirely explain the behaviour. The F-value describes the fit of the model (i.e., how reliably the independent variables predict the dependent variable). The significance of the F-value is set at  $p < 0.05$ . The beta ( $\beta$ ) standardised coefficients describe how much each independent variable contributes to the model. The significance of  $\beta$  is determined by a t-test with  $p < 0.05$ . Alternative models were explored to investigate relationships between predictor variables in the initial models. Further investigation using structural equation modelling (SEM), or equivalent would be required to thoroughly explore alternative models to explain these relationships.

A Principal Components Analysis of the Likert scale questions was then undertaken (behaviours, abilities, and likelihood) to simplify and generalise the models run for individual behaviours (see Appendix 9.7). Conservation activities were found to form three components that together account for 68% of the variance. These components are:

- activities (control plants, control animals, plant plants) done at home,
- activities (control plants, control animals, plant plants, attend training workshops) done in the community, and
- advocacy activities (learn about the natural environment, learn how to help the natural environment, and communicate with others about the natural environment).

Ability to perform conservation actions formed one component that accounts for 56% of the variance. Likelihood of performing conservation activities in the next 12 months also formed

---

<sup>8</sup> This data was not collected due to survey duration restrictions of the People's Panel. It was decided that these biosecurity behaviours were of lower priority relative to conservation activities for the purposes of social outcome monitoring.

one component that accounts for 56% of the variance. These components were computed as mean scores for use in multiple regression modelling.

## 9.6 Internal consistency (Cronbach's alpha ( $\alpha$ ))

The Cronbach's alpha values for the tested scales are all above 0.7 except for locus of control. These values are all very close to those cited in Macdonald et al., (2019).

**Table 7: Cronbach's alpha for tested scales**

Construct	Cronbach's alpha (this study)	Cronbach's alpha (MacDonald et al., 2019)
New ecological paradigm	0.85	0.83
Connectedness to nature	0.86	0.86
Locus of control	0.55	0.51

## 9.7 Principal Components Analysis (PCA)

Principal Components Analysis was undertaken for three Likert scale questions: on conservation activities, capabilities, and likelihood to perform conservation activities. Variables were excluded pairwise.

Capabilities and likelihood were found to comprise of one component. Capabilities had an eigenvalue of 3.933 which accounts for 56% of the variance. Likelihood had an eigenvalue of 2.800 which accounts for 56% of the variance.

Conservation activities were found to comprise of three components and so a rotated method was used (varimax). The three components combined account for 68% of the variance with eigenvalues of 4.246, 1.564, and 1.050. The conservation activity 'donating money to groups who work to improve or protect the natural environment' was found to have a low communality of 0.366. Removing this variable from the PCA resulting in a greater amount of variance being explained (64% vs 68%).

Factor variables for use in modelling were created for each of the components by taking the mean score. All variables were normally distributed except for community conservation activities with a strong right skew (skewness: 2.2, kurtosis: 4.7).



**Find out more:** phone 09 301 0101, or visit  
[aucklandcouncil.govt.nz](http://aucklandcouncil.govt.nz) and [knowledgeauckland.org.nz](http://knowledgeauckland.org.nz)