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Householders' interest in urban possum control in Dunedin

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Summary

The potential for people in urban areas to contribute to predator control is of interest to Predator Free Dunedin. This potential can be realised by using policy instruments such as education, incentives, and regulations to stimulate interest, encourage participation and change behaviour. We used a quantitative approach (The I₃ Framework; Kaine et al. 2010) to predict the likely responses of householders to a policy of using traps to reduce the population of introduced brushtail possums in Dunedin.

The results of the survey indicate widespread support for a programme of possum trapping. This support appears to be primarily motivated by residents' concerns for the environment and the health of themselves and their families, and the potential for possums to damage property, gardens, and equipment. Consequently, attempts to encourage participation in a programme of urban trapping should concentrate on promoting its potential to reduce these harms.

While there was general support for a possum trapping programme, most householders were only mildly or moderately interested in such a programme. This means many householders would be more likely to participate if the programme were easy to join, and traps were inexpensive and simple to maintain. In addition, those householders with relatively weak interest in trapping still support reducing possum numbers; consequently, they are likely to permit the installation of traps on their properties, provided they do not have to service and maintain them.

The widespread but moderate interest and support among householders in reducing possum populations indicates that personal contact is likely to be the most effective, perhaps the only, means of promoting and implementing a programme.

The interest respondents in Dunedin had towards the idea of reducing possum numbers, and in trapping possums, was largely unrelated to their socio-demographic characteristics.

1 Introduction

The potential for people in urban areas to contribute to predator control by trapping introduced brushtail possums is of interest to Predator Free Dunedin. This potential can, in principle, be realised by using a range of policy instruments, including marketing, education, incentives, charges and regulations to stimulate interest, encourage participation, and modify behaviour and practice. For example, participation in an urban programme of possum trapping could be encouraged by offering incentives to households to install and monitor traps.

Choosing which policy instrument to employ depends on several factors, the likelihood of householders responding favourably being, perhaps, the most critical. For example, incentives could be popular among householders but prohibitively expensive given the trapping densities that may be required. Regulations compelling the installation of traps could have the potential to change the behaviour of all households but may be unpopular among householders and problematic to enforce. Hence, knowing the likely response of householders to any proposed policy instrument is crucial when choosing between policy instruments (and knowing when there may be merit in combining them).

In this study, we investigate the responses of urban households to a policy that would promote the use of traps to reduce the population of possums in Dunedin.

2 Theory

The responses of households to a policy of using traps to reduce possum numbers was predicted using the I₃ Response Framework (Murdoch et al. 2006; Kaine et al. 2010). The Framework is based on social psychology and consumer behaviour theory (Derbaix & Vanden Abeele 1985; Laurent & Kapferer 1985; Zaichkowsky 1985; Dholakia 2001; Verbeke & Vackier 2004). The premise of the Framework is that people's responses to policy instruments, such as the provision of traps for catching possums, can be inferred from their:

- involvement, which is a measure of motivation, with the relevant policy outcome (such as reducing possum numbers)
- involvement with the policy instrument itself (trapping possums), and
- attitude towards the instrument (trapping possums).

Once responses have been predicted, strategies to promote achievement of the policy outcome may then be identified (Kaine et al. 2010).

2.1 The I₃ Framework

As mentioned above, involvement is a measure of motivation (Assael 1998; Verbeke & Vackier 2004). The degree of involvement an individual has in a subject is a key determinant of the effort that individual will expend in making decisions in relation to that subject and then acting on them (Celsi & Olson 1988; Poiesz & Cees 1995). Involvement

arises from functional needs in relation to comfort and security, experiential needs in relation to feelings of pleasure and reward, and identity needs in relation to self-expression and belonging (Laurent & Kapferer 1985). Involvement also tends to be higher the more the subject of interest is novel, complex, and entails substantial social and financial risks (Dholakia 2001). Consequently, involvement can be characterised in terms of functional, experiential, identity-based, risk-based, and consequence-based components (Laurent & Kapferer 1985).

A person's involvement with a subject will be greater the more they associate each of these component needs with the subject. Farmers, for example, should exhibit very high involvement with farming because it provides them with an income (functional involvement), with the opportunity to be physically active and work outdoors (experiential involvement), and to work independently of others (identity involvement). Farming is characterised by long production cycles that are sensitive to seasonal conditions, and product prices are highly variable. Consequently, production and revenue performance are inherently unpredictable (risk-based involvement) with serious consequences for business success and family income (consequence-based involvement).

High involvement with a subject is associated with greater time and effort devoted to obtaining information about the subject, the formulation of strongly held beliefs and attitudes about the subject, and greater likelihood of acting regarding the subject. In contrast, low involvement in a subject is associated with little time and effort devoted to obtaining information about the subject, the formulation of weakly held beliefs and attitudes, if any, about the subject, and a lower likelihood of acting regarding the subject.

The two dimensions of involvement with the policy outcome and involvement with the policy instrument mean that the reactions of people to a policy instrument can be classified into four quadrants (Kaine et al. 2010) as shown in Figure 1.

People in quadrant 1 exhibit low involvement in both the policy outcome and the policy instrument. These people are likely to have little knowledge or even awareness of the policy outcome. They are likely to have limited knowledge of the policy instrument and have weak attitudes towards it, if any at all. Non-compliance with the instrument is largely unintentional (Murdoch et al. 2006).

If people in quadrant 1 present little risk in terms of achieving the policy outcome, they can be ignored. Otherwise, their compliance may be encouraged by:

- linking the policy outcome to a subject they find more involving
- reducing the effort required to be compliant, and
- promoting awareness of the policy outcome and the policy instrument.

The last strategy is likely to be the least effective.

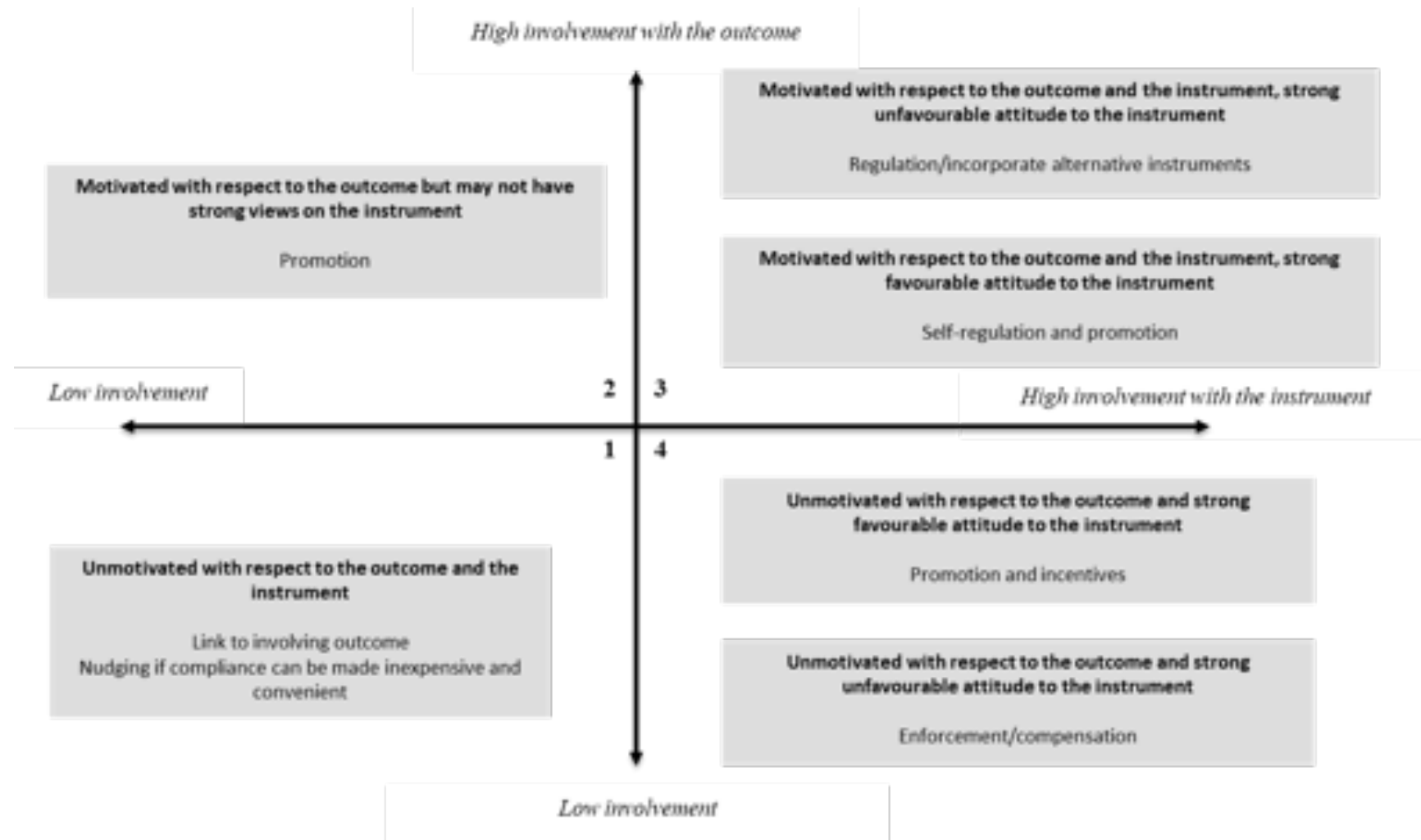


Figure 1. I₃ Response Framework.

Bold text describes the strength of motivation with respect to the policy outcome (e.g. reducing possums) and the policy instrument (e.g. subsidised traps). Plain text describes potential policy measures to promote compliance with the policy instrument. (Source: adapted from Kaine et al. 2010)

People in quadrant 2 exhibit high involvement with the policy outcome but low involvement with the policy instrument. These people are likely to have some knowledge about the policy outcome. They are likely to have limited knowledge of the policy instrument and may have weak or ambiguous attitudes towards it. Non-compliance with the instrument is largely unintentional (Kaine et al. 2010).

If people in quadrant 2 represent little risk in terms of achieving the policy outcome, they can be ignored. If their compliance is important to achieving the policy outcome, then reducing the effort required for compliance (Thaler & Sunstein 2008) and promoting awareness of the policy instrument may be worthwhile.

People in quadrant 3 exhibit high involvement with the policy outcome and the policy instrument. These people are likely to have extensive and detailed knowledge of the policy outcome. They are also likely to have extensive knowledge of the policy instrument and strong attitudes towards it. If their attitude towards the policy instrument is favourable, then they will comply with the instrument and may even advocate for it (Murdoch et al. 2006).

If people in quadrant 3 have an unfavourable attitude towards the policy instrument, then they may comply, but reluctantly (Kaine et al. 2010). Non-compliance with the instrument will be intentional. Most likely they will prefer, and even advocate for, alternative instrument designs. Where practical, incorporating alternatives into the design of the policy instrument may encourage the compliance of these people. Alternatively, offering incentives to reduce compliance costs may neutralise unfavourable reactions.

People in quadrant 4 exhibit low involvement with the policy outcome but high involvement with the policy instrument. People in this quadrant are likely to have limited knowledge of the policy outcome. They are likely to have detailed knowledge of the policy instrument and have strong attitudes towards it. If their attitude towards the policy instrument is favourable, then they will comply with the instrument (Kaine et al. 2010).

If people in quadrant 4 have an unfavourable attitude towards the policy instrument, then they will only comply reluctantly, or may intentionally refuse to comply at all. These people will regard the instrument as imposing unwarranted costs upon them. Most likely they will agitate against the policy instrument (Kaine et al. 2010). Offering incentives to offset compliance costs may neutralise unfavourable reactions.

Where non-compliance may put implementation of the policy instrument at risk then modifications to the policy instrument may be required to neutralise this risk. The specific measures required will depend on the circumstances.

3 Methods

A questionnaire was developed to elicit people's views on three key sets of scales. The first set of scales measured their involvement with the idea of reducing possum numbers and their involvement with the idea of trapping possums. Involvement was measured using a condensed version of the Laurent and Kapferer (1985) involvement scale developed by Kaine (2019) with respondents rating statements for each of the five components of involvement as follows:

- statements about functional involvement concerned the importance of, and caring about, reducing possum numbers
- Statements about experiential involvement concerned the reward from, and passion about, reducing possum numbers.
- statement about self-identity concerned opinions about reducing possum numbers reflecting on your identity, and others identity, as a person
- statements about consequences concerned the seriousness or importance of consequences arising from making a mistake in relation to reducing possum numbers.
- statements about the risk of making mistakes concerned the complexity or difficulty of making decisions about reducing possum numbers.

Similar statements were formulated for involvement with trapping possums.¹

The second set of scales measured attitudes, and attitude strength, towards trapping possums. Attitudes were measured using a simple, evaluative Likert scale.² The strength of respondents' attitudes to possum trapping was expected to vary depending on the strength of their involvement with trapping. Consequently, respondents were also questioned about their uncertainty, or otherwise, towards trapping using an ipsative scale or 'forced choice' based on Olsen (1999).³ In addition, the Pest-Management Attitude scale (Aley et al. 2020) was included in the questionnaire to obtain a measure of respondents' attitudes towards pests generally.

The third set of scales were a series of questions formulated to discover respondents' beliefs about the advantages and disadvantages of reducing possum numbers, and of trapping to achieve this. Information was sought on whether respondents trapped possums and their experiences if they did. Respondents who did not trap were asked about their reasons for not doing so.

¹ Complete statements are available on request from the authors.

² A Likert scale consists of a series of statements about a subject and respondents use a scoring system to rate their level of agreement or disagreement with each statement. Their scale score is the average of their ratings on all the statements.

³ With an ipsative scale (sometimes called a "forced choice" scale) respondents compare two or more desirable statements and pick the one they most prefer.

In addition, Predator Free Dunedin were also interested in the degree to which people's willingness to participate in urban possum trapping, and predator control generally, was associated with their demographic characteristics. Consequently, a series of questions were included concerning respondent's age, gender, education, income, property, and location. Finally, information was collected on whether respondents were aware of, or volunteered for, Predator Free Dunedin.

The ordering of the statements in the involvement, attitude, and belief scales was randomised among the individual questionnaires to avoid bias in responses. Participation in the survey was voluntary, respondents could leave the survey at any time, and all survey questions were optional and could be skipped.

The questionnaire was approved for distribution by Manaaki Whenua – Landcare Research's social ethics process (application 1920/29). The questionnaire was administered online and through telephone by Versus Research, a market research company in Hamilton, New Zealand. Telephone respondents were randomly selected from a database of urban addresses in Dunedin. Internet respondents were randomly selected from a database of panellists in Dunedin. Internet respondents received compensation for competing surveys and had greater flexibility with respect to when they participated. The survey was open for approximately 4 weeks beginning in the first week of April 2020. And we received 404 responses.⁴

4 Results

4.1 The sample

Approximately 54 per cent of the 404 respondents were men. The age distribution of the sample is marginally older than current census estimates for Dunedin (see Table 1) and has a higher level of education than current census estimates for Dunedin (see Table 2). The overwhelming majority of respondents lived in a house (82 per cent) with most of the remaining respondents living in apartments, townhouses or units (14 per cent). A small proportion of respondents lived on farmlets or lifestyle blocks (4 per cent) bordering the city.

4.2 Involvement with trapping and reducing possum numbers

Respondents were mapped into the I₃ Response Framework (see Fig. 2) based on their involvement with, or interest in, the idea of reducing possum numbers and their involvement with, or interest in, trapping. A score of one indicates the minimum possible level of involvement, and a score of five indicates the highest possible level of involvement.⁵

⁴ Given the large sample, statistical significance was set to $p \leq 0.01$.

⁵ Involvement scores were interpreted as low (1–2), mild (2–3), moderate (3–4) and high (4–5) involvement.

Table 1. Age profile of sample

Age category	Proportion of sample %	Proportion of Dunedin population ¹ %
20–39	27.9	37.5
39–60	34.1	33.3
More than 60	37.9	29.2

Notes: (1) Derived from NZ Stats (2020a).

Table 2. Education profile of sample

Education category	Proportion of sample %	Proportion of Dunedin population ¹ %
No qualification	-	16.5
Some or all secondary school	23.5	-
Certificate (1–6)	14.4	45.4
Diploma (5–7)	11.1	8.1
Bachelor’s degree	24.5	14.1
Post-graduate diploma/certificate	8.7	6.0
Post-graduate degree	17.8	6.3

Notes: (1) Derived from NZ Stats (2020b).

(2) indicates no data were collected or available for this category.

Table 3. I₃ classification

Quadrant	Proportion of sample %
One – indifferent	11.1
Two – involved with reducing possum numbers	11.4
Three – involved with reducing possum numbers and with using traps	74.0
Four – involved with using traps	3.5

Statistical tests indicated that the scales were reliable, that is, internally consistent in the sense that scores on related statements were highly correlated with each other (see Table A1 in the Appendix).⁶ This is important as it means the scales are consistent measures of respondents' involvement with reducing possum numbers and trapping.

Respondents were classified into quadrants based on their involvement scores relative to the scale mid-point. For example, respondents with involvement scores less than three for reducing possum numbers and using traps were classified into quadrant 1.

Inspection of Figure 2 reveals that most respondents exhibited moderate to high involvement with the idea of reducing possum numbers, and mild to moderate involvement with using traps to catch possums. Consequently, most respondents were classified into quadrant 3 (see Table 3).

The moderate to high involvement of respondents with reducing possum numbers indicates that residents of Dunedin would support a policy to eradicate possums in urban areas (see Table 4). The mild to moderate levels of residents' involvement with trapping suggests that, while they would support the use of traps, they would be likely to invest only a limited amount of their time and energy in trapping.

Almost 50 per cent of respondents had a strongly favourable attitude to trapping. Only 5 per cent of respondents had an unfavourable attitude towards trapping (see Table 5). Consistent with reporting only mild to moderate involvement with trapping possums, just under half of respondents were unsure about or indifferent towards trapping. As we expected, these respondents had lower levels of involvement than respondents who had a definite favourable attitude towards trapping (see Table 6).⁷

Also as expected, a relatively high proportion of respondents who were uninterested in reducing possum numbers and uninterested in trapping (quadrant 1) had not thought about, or were indifferent to, the use of traps, while a relatively high proportion of respondents who were interested in reducing possum numbers and in trapping (quadrant 3) had a definite and favourable attitude toward trapping (see Table 7). The relatively high proportion of respondents that were interested in reducing possum numbers but had not thought about or were indifferent to the use of traps (quadrant 2) is consistent with the respondents in this quadrant exhibiting low to mild involvement with trapping possums.

The moderate to high involvement of respondents with the idea of reducing possum numbers, and their mild to moderate levels of involvement with using traps to catch possums, indicates that residents of Dunedin are only likely to invest a limited amount of their time and energy in trapping.

⁶ Reliability was tested using Cronbach's alpha (Carmines & Zeller 1979).

⁷ Tukey's honestly significant difference test (Cooksey 1997), $p < 0.01$.

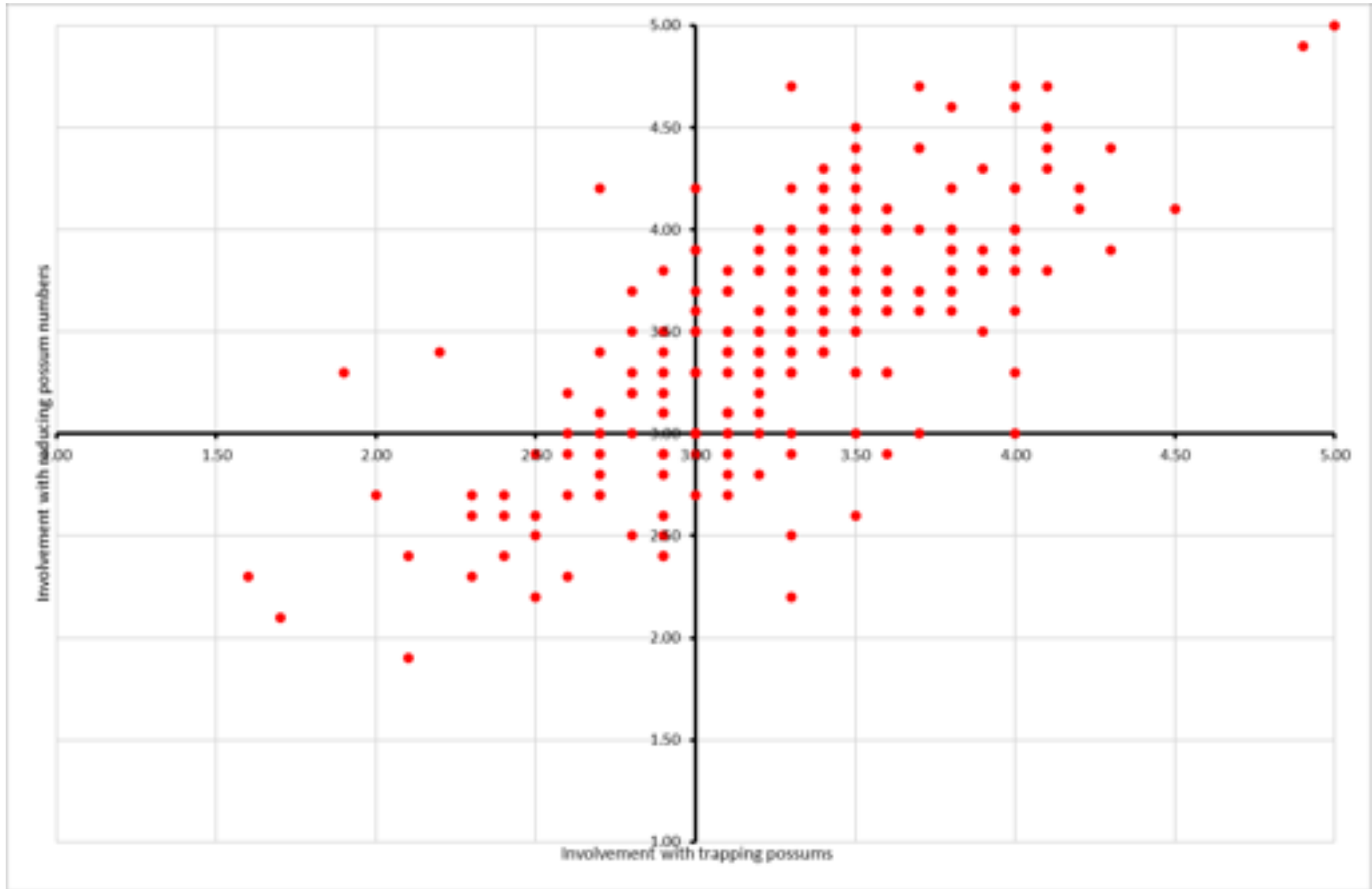


Figure 2. I₃ mapping of involvement with the idea of reducing possum numbers and the idea of using traps.

Table 4. Mean involvement by I₃ quadrant

	Involvement with reducing possum numbers¹	Involvement with using traps to reduce possum numbers²
Quadrant 1	2.54	2.49
Quadrant 2	3.43	2.65
Quadrant 3	3.78	3.54
Quadrant 4	2.72	3.22

Notes: ¹ Test for difference in means across quadrants (F=131.5, $p<0.01$)

² Test for difference in means across quadrants (F=152.6, $p<0.01$)

Table 5. Attitude towards trapping possums

Attitude	Proportion of sample %
Right thing to do	48.8
Doesn't matter to me	13.1
Not sure	15.6
Haven't given it much thought	17.1
Bad thing to do	5.4

Table 6. Involvement and attitude towards trapping possums

Attitude	Involvement with reducing possum numbers¹	Involvement with using traps to reduce possum numbers²
Right thing to do	3.82	3.53
Doesn't matter to me	3.33	3.08
Not sure	3.40	3.19
Haven't given it much thought	3.26	3.06
Bad thing to do	3.27	3.02

Notes: ¹ Test for difference in means across attitude categories (F=21.4, $p<0.01$)

² Test for difference in means across attitude categories (F=18.8, $p<0.01$)

Table 7. I₃ classification and attitude towards trapping possums

Attitude	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
Right thing to do	13.3	21.7	59.5	21.4
Doesn't matter to me	31.3	21.7	8.4	28.6
Not sure	17.8	17.4	15.1	14.3
Haven't given it much thought	24.4	28.3	14.0	21.4
Bad thing to do	13.3	10.9	3.0	14.3

Note: Values are proportion of respondents in each quadrant. Test for differences in proportions across quadrants ($\chi^2=68.9$, $p<0.01$)

4.3 Involvement profiles

The involvement profiles of respondents in each quadrant with respect to reducing possum numbers are reported in Figure 3. The profiles represent the average score, for each of the involvement statements, of the respondents in each quadrant. On average, respondents exhibited higher involvement with the idea of reducing numbers of possums than with the idea of using traps to catch possums (see Table A2 in the Appendix).

On average, respondents in quadrants 2 and 3 exhibit moderate functional, experiential, and identity involvement with the idea of reducing possum numbers. This implies that, to the degree these respondents were involved with the idea of reducing possum numbers, their involvement stems from concerns about the potentially unfavourable impact possums can have on their material well-being and enjoyment. These concerns could stem from the perceived impact of possums on biodiversity and the environment, as well as the risks they pose to human health and the damage they can inflict on buildings, gardens, and so forth. Respondents in quadrants 1 and 4 exhibited mild involvement on these dimensions. Respondents in all quadrants exhibited moderate consequence and risk involvement suggesting they believe there is some risk that mistakes could be made with reducing possum numbers, and any such mistakes could have serious consequences.

The involvement profiles of respondents in each quadrant with respect to using traps to reduce possum numbers are reported in Figure 4. Again, the profiles represent the average score, for each of the involvement statements, of the respondents in each quadrant. On average, with respect to the idea of using traps to reduce possum numbers, respondents in quadrant 3 exhibited moderate involvement across all the components of involvement. Respondents in quadrant 4 exhibited mild involvement with most aspects of trapping possums but moderate consequence and risk involvement, suggesting they may be concerned about the consequences of making mistakes when trapping possums. Respondents in quadrants 1 and 2 primarily exhibit mild involvement with the idea of using traps to reduce possum numbers.

Involvement with the idea of reducing possum numbers and involvement with the idea of using traps to reduce possum numbers was not related to the gender, education, income, or property type of respondents.⁸ There was a statistically significant, but inconsequential, association between age and involvement with the idea of reducing possum numbers, with older respondents exhibiting marginally higher involvement than younger respondents. There was no association between age and involvement with the idea of using traps to reduce possum numbers.⁹

⁸ Results of one-way analysis of variance tests.

⁹ These results are available on request from the authors.

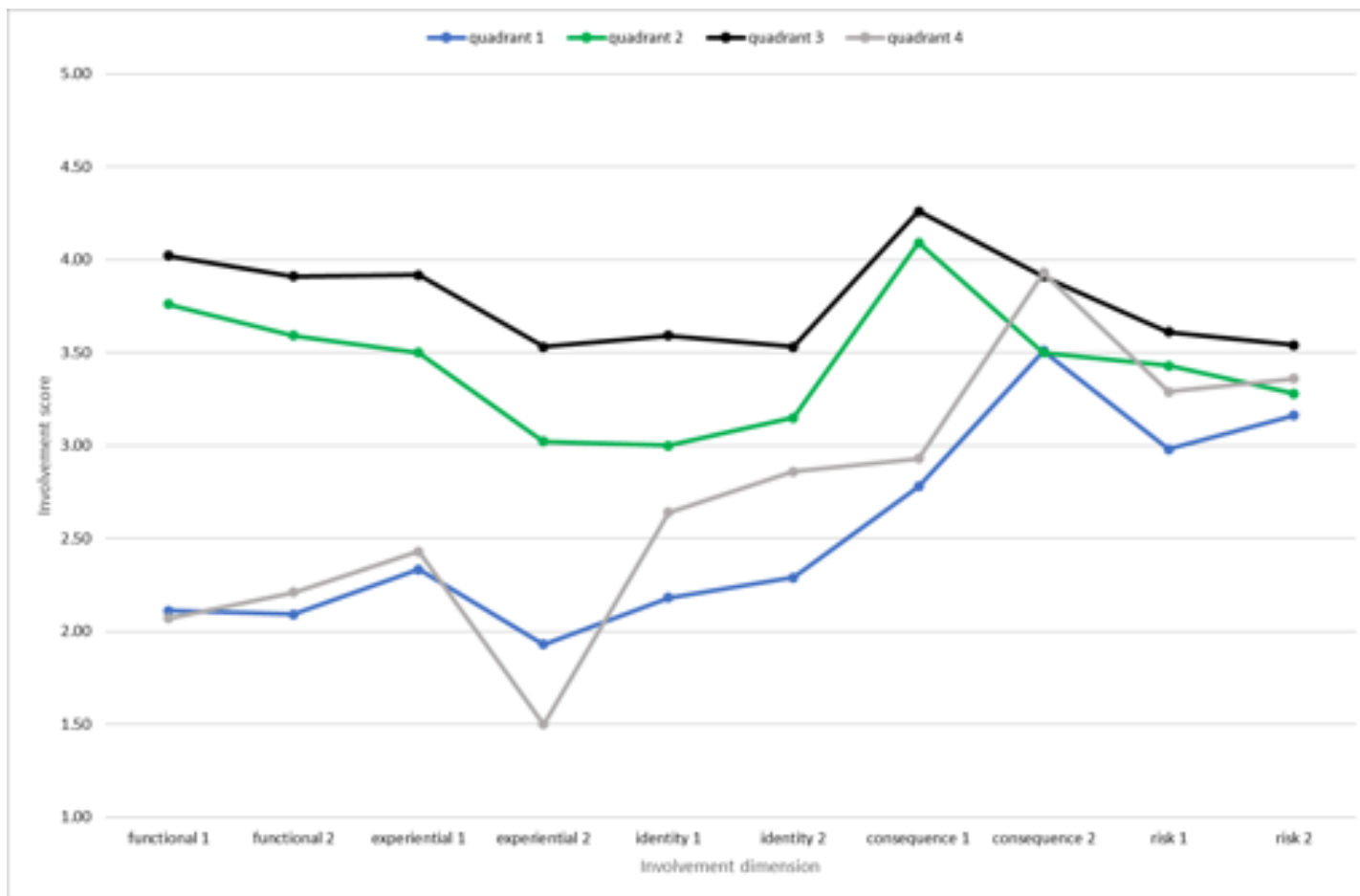


Figure 3. Involvement profiles for the idea of reducing possum numbers.

Note: The statements concerned the importance of (functional 1) and caring about (functional 2) reducing possum numbers; the reward from (experiential 1) and passion about (experiential 2) reducing possum numbers; opinion about reducing possum numbers reflecting on you (identity 1) and others (identity 2) as a person; the seriousness (consequence 1) or importance (consequence 2) of consequences arising from making a mistake in relation to reducing possum numbers; and the complexity (risk 1) or difficulty (risk 2) of making decisions about reducing possum numbers. Complete statements are available on request from the authors.

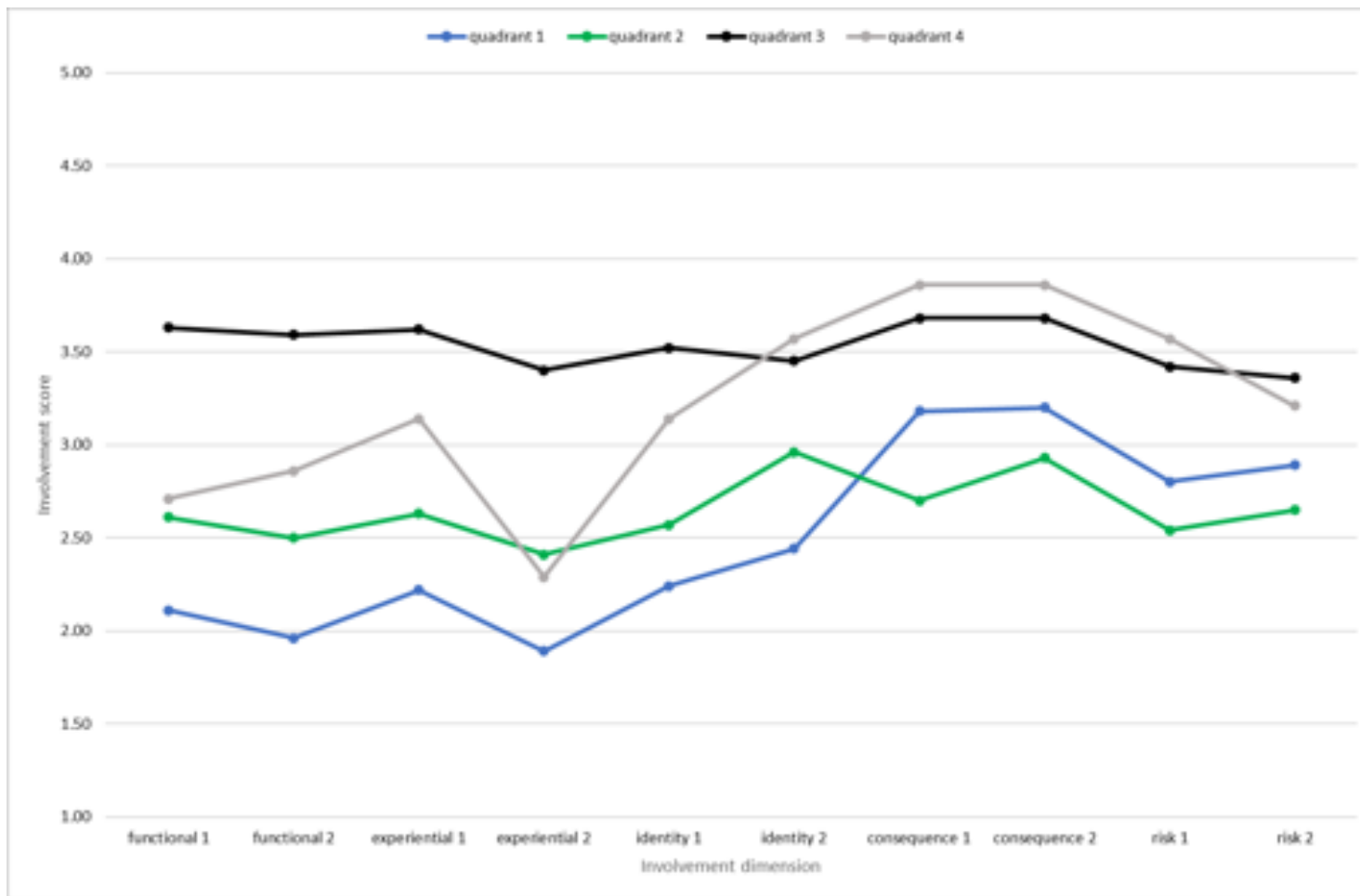


Figure 4. Involvement profiles for the idea of using traps to reduce possum numbers.

Note: The statements concerned the importance of (functional 1) and caring about (functional 2) using traps; the reward from (experiential 1) and passion about (experiential 2) using traps; opinion about using traps reflecting on you (identity 1) and others (identity 2) as a person; the seriousness (consequence 1) or importance (consequence 2) of consequences arising from making a mistake in relation to using traps; and the complexity (risk 1) or difficulty (risk 2) of making decisions about using traps. Complete statements are available on request from the author.

Respondents who completed the questionnaire via telephone were hypothesised to exhibit higher involvement with reducing possums and, possibly, trapping than respondents who were registered members of a market survey panel and completed an online questionnaire, as the former would be more likely to be motivated by an intrinsic interest to participate while the latter are recompensed for completing questionnaires. This hypothesis was supported with respect to involvement with reducing possum numbers and trapping.¹⁰

Most respondents were moderately involved with the idea of using traps and perceived traps to be an effective and relatively safe method for catching possums. They may well experience some sense of achievement when they successfully trap possums.

4.4 Involvement and beliefs about possums

Respondents in quadrants 2 and 3, representing 85 per cent of the sample, believe possum populations should be reduced to protect and conserve native birds and wildlife, as well as native plants and forests. They also believe possums damage orchards and gardens as well as buildings and equipment, and that they are a risk to health (see Fig. 5). They disagree, on average, with the view that possums are as entitled to life as other animals.

We expected differences across the quadrants in respondents' opinions about possums. Specifically, we hypothesised, because of their relatively low involvement with the idea of reducing possum numbers, that respondents in quadrant 1 would be less likely than respondents in other quadrants to express definite opinions about the unfavourable effects of possums on native plants, birds and animals, and on orchards, gardens, buildings and equipment. This hypothesis was supported with respondents in quadrant 1 being less sure, on average, about the unfavourable effects of possums than respondents in quadrants 2 and 3 (see Fig. 5). On average, the opinions of respondents in quadrant 4, who also have relatively low involvement with the idea of reducing possum numbers, were like those of respondents in quadrant 1.

4.5 Involvement and attitudes about using traps

As previously mentioned, measuring attitudes is an important aspect of the Framework as the interaction between involvement and attitudes determines the types of strategies that may be employed to change behaviour in each quadrant (Kaine et al. 2010). Consequently, both the direction and strength of respondents' attitudes towards trapping possums were

¹⁰ For involvement with reducing possums $F=18.9$, $p=0.01$ and for involvement with using traps $F=5.7$, $p=0.02$.

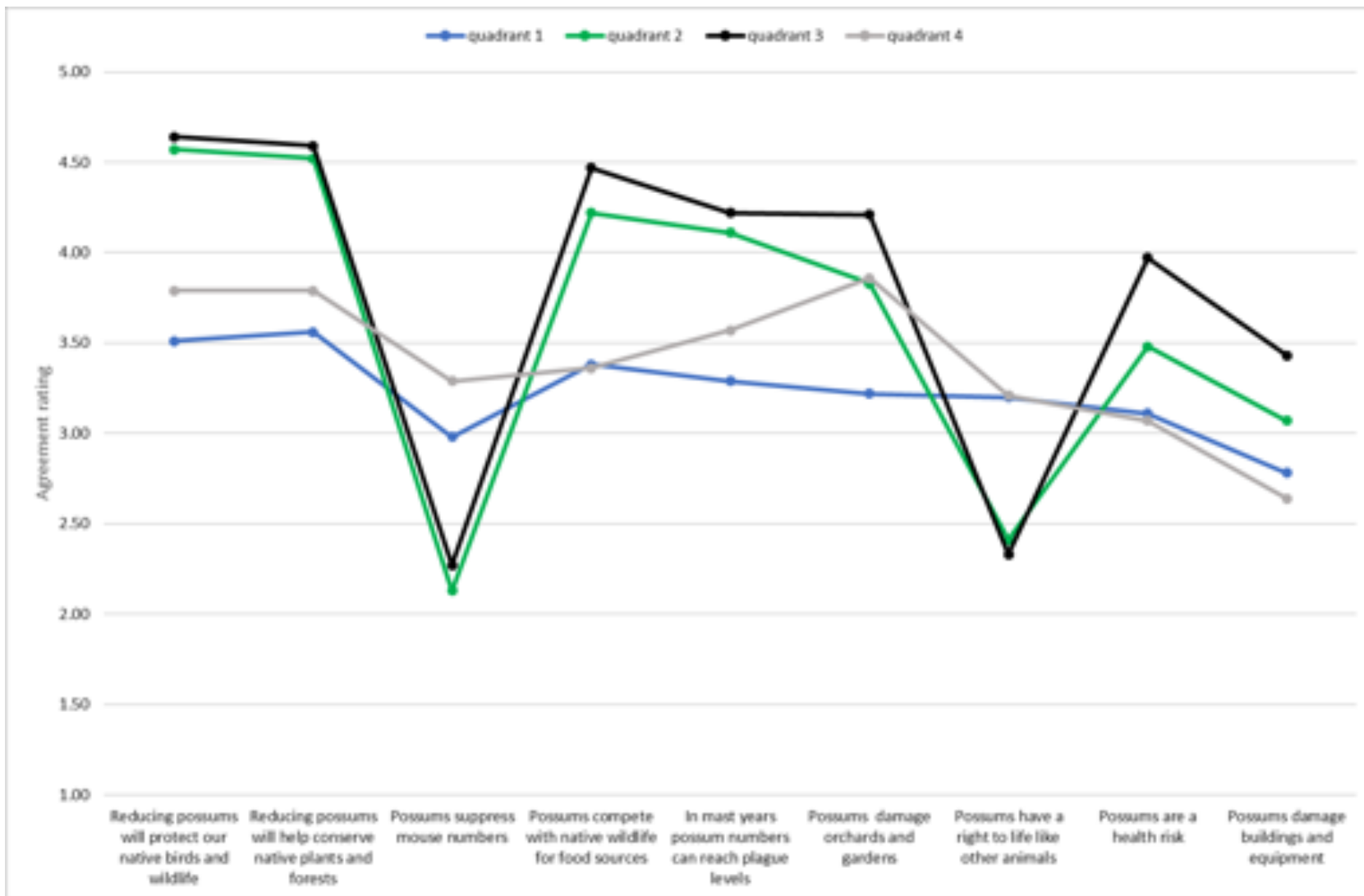


Figure 5. Respondents' beliefs about the advantages and disadvantages of reducing possum numbers.

measured with a four-statement normative scale about trapping and a five-statement ipsative scale about trapping, respectively.¹¹ Statistical testing indicated that responses to the normative scale were internally consistent meaning the scales are consistent measures of respondents' attitudes towards trapping.¹²

Responses were also consistent across the two methods, with respondents who indicated trapping was the 'right thing to do' on the ipsative scale displaying the most favourable scores, on average, on the normative scale. Correspondingly, respondents who indicated trapping was a 'bad thing to do' displayed the least favourable scores, on average, on the normative scale (see Table 8).¹³ Responses were also satisfactorily consistent with respect to attitudes towards pests generally and attitudes towards trapping possums (see Table 8) with the two measures being reasonably correlated.¹⁴

On average, respondents in quadrant 1 were unsure about, or had a neutral attitude, towards trapping. Respondents in the other quadrants expressed a favourable attitude towards trapping, with respondents in quadrant three having the most favourable attitude (see Table 9).¹⁵

Respondents' beliefs about the advantages and disadvantages of using traps to reduce possum numbers were broadly similar, on average, across the quadrants. However, respondents in quadrants 2 and 3 were less likely than respondents in quadrants 1 and 4 to believe that trapping was a danger to children, pets or native birds, a risk to health or inhumane, and more likely to agree that traps were more effective than baiting (see Fig. 6).

On average, respondents in all the quadrants believed trapping was effective but not practical in all areas.

Overall, these results imply that there is widespread support for using traps to reduce possum numbers in Dunedin. This is consistent with experience of community attitudes to predator control in Wellington (PFW 2019a).

¹¹ With a normative scale the respondent uses a scoring scale to rate their agreement with a series of statements. With an ipsative scale (sometimes called a 'forced choice' scale) respondents compare two or more desirable statements and pick the one they most prefer.

¹² Cronbach's alpha was 0.93 (Carmines & Zeller 1979).

¹³ Tukey's honestly significant difference test (Cooksey 1997), $p < 0.01$.

¹⁴ The Pearson correlation between the two scales was 0.46.

¹⁵ Tukey's honestly significant difference test (Cooksey 1997), $p < 0.01$.

Table 8. Consistency in attitudes towards trapping possums

Attitude statements (ipsative scale)	Attitude towards trapping possums (normative scale)¹	Attitude towards pests (normative scale)^{2,3}
Right thing to do	4.42	3.76
Doesn't matter to me	3.75	3.55
Not sure	3.24	3.51
Haven't given it much thought	3.52	3.50
Bad thing to do	1.82	3.10

Note: Values are mean scores of respondents on the normative scale for each ipsative attitude category

¹ Test for differences in means across attitude categories ($F=121.1, p<0.01$)

² Test for differences in means across attitude categories ($F=10.7, p<0.01$)

³ Pest-Management Attitude scale (Aley et al. 2020)

Table 9. I₃ classification and attitudes towards trapping possums

	Attitude towards trapping¹	Attitude towards pests^{2,3}
Quadrant 1	3.07	3.21
Quadrant 2	3.54	3.72
Quadrant 3	4.05	3.69
Quadrant 4	3.32	3.06

Note: ¹ Test for differences in means across quadrants ($F=21.6, p<0.01$)

² Test for differences in means across quadrants ($F=16.4, p<0.01$)

³ Pest-Management Attitude scale (Aley et al. 2020)

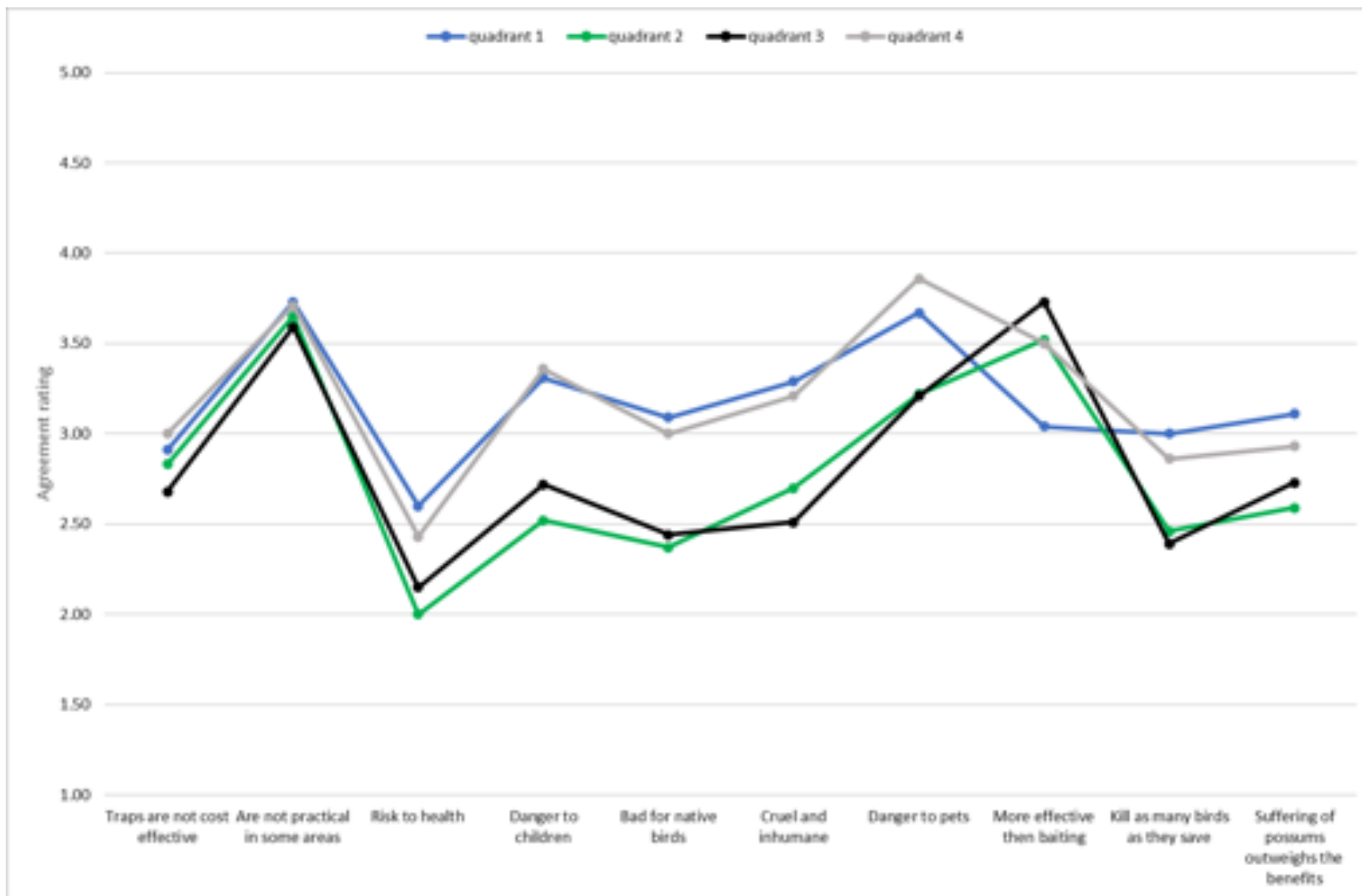


Figure 6. Respondents' beliefs about the advantages and disadvantages of using traps to reduce possum numbers.

4.6 Involvement and possum trapping activity

We expected differences across the quadrants in the degree to which respondents agreed they were personally responsible for reducing possum numbers. Consistent with differences in their involvement with the idea of reducing possum numbers, respondents in quadrants 2 and 3 expressed stronger agreement than respondents in quadrants 1 and 4, that reducing possum numbers was the right thing to do, that reducing possum numbers was their responsibility and that they were willing to take action and make sacrifices to reduce possum numbers (See Fig. 7). These differences were also apparent in respondents' opinions about the willingness of others to take responsibility for reducing possum numbers.

We also hypothesised respondents who had higher involvement with the ideas of reducing possum numbers and with trapping (quadrant 3) would be more likely to actually trap possums than respondents who are less involved with these ideas (quadrants 1, 2 and 4). This hypothesis was supported (see Table 10).

Respondents who currently trap possums exhibited higher involvement, on average, with the idea of reducing possum numbers and trapping than those that did not (see Table 11). Furthermore, respondents who were indifferent to, or unsure about, trapping were much less likely to be trapping than respondents who favoured trapping (see Table 12). These results indicate that differences in motivation, as measured by involvement, are an important factor influencing trapping.

With one exception, there were no significant differences between respondents who were and were not trapping in their perceptions of the advantages and disadvantages of reducing possum numbers. The exception was with respect to the need to keep possums to suppress mice with those that were trapping possums being less likely to agree that possums were needed to suppress mice.¹⁶

Respondents who were trapping possums differed in their beliefs about the advantages and disadvantages of trapping from those who did not (see Fig. 8). Basically, those who were currently trapping had more favourable opinions of the cost effectiveness, safety, and humaneness of trapping than those who were not. The latter were, on average, less certain about these qualities.

The proportion of respondents in each quadrant who were in favour of, unsure about, or against trapping possums is summarised in Figure 9. The two largest groups of respondents in our sample were in quadrant 3 who either favoured or were unsure about trapping. Comparing these two groups confirms the importance that interest in the idea of reducing possum numbers and in using traps, together with attitudes towards using traps,

¹⁶ Mean agreement rating for respondents that trap was 1.98 compared with a mean agreement rating of 2.42 for those that were not trapping ($F=7.4$, $p=0.01$).

Table 10. I₃ classification and proportion of respondents that currently trap possums¹

	Proportion of quadrant %
Quadrant 1	2.2
Quadrant 2	2.2
Quadrant 3	13.4
Quadrant 4	0.0

Note: ¹Test for differences in proportions across quadrants ($\chi^2=11.0$, $p=0.01$)

Table 11. Involvement and trapping

	Currently trap possums	Don't trap
Involvement with reducing possums ¹	3.96	3.52
Involvement with trapping ²	4.36	3.79

Note: ¹ Test for differences in in means $F=21.6$, $p<0.01$

² Test for differences in in means $F=21.1$, $p<0.01$

Table 12. Attitude and proportion of respondents that currently trap possums¹

Attitude	Proportion %
Right thing to do	16.8
Doesn't matter to me	11.3
Not sure	1.6
Haven't given it much thought	1.4
Bad thing to do	4.5

Note: ¹ Test for differences in proportions across categories ($\chi^2=20.6$, $p<0.01$)

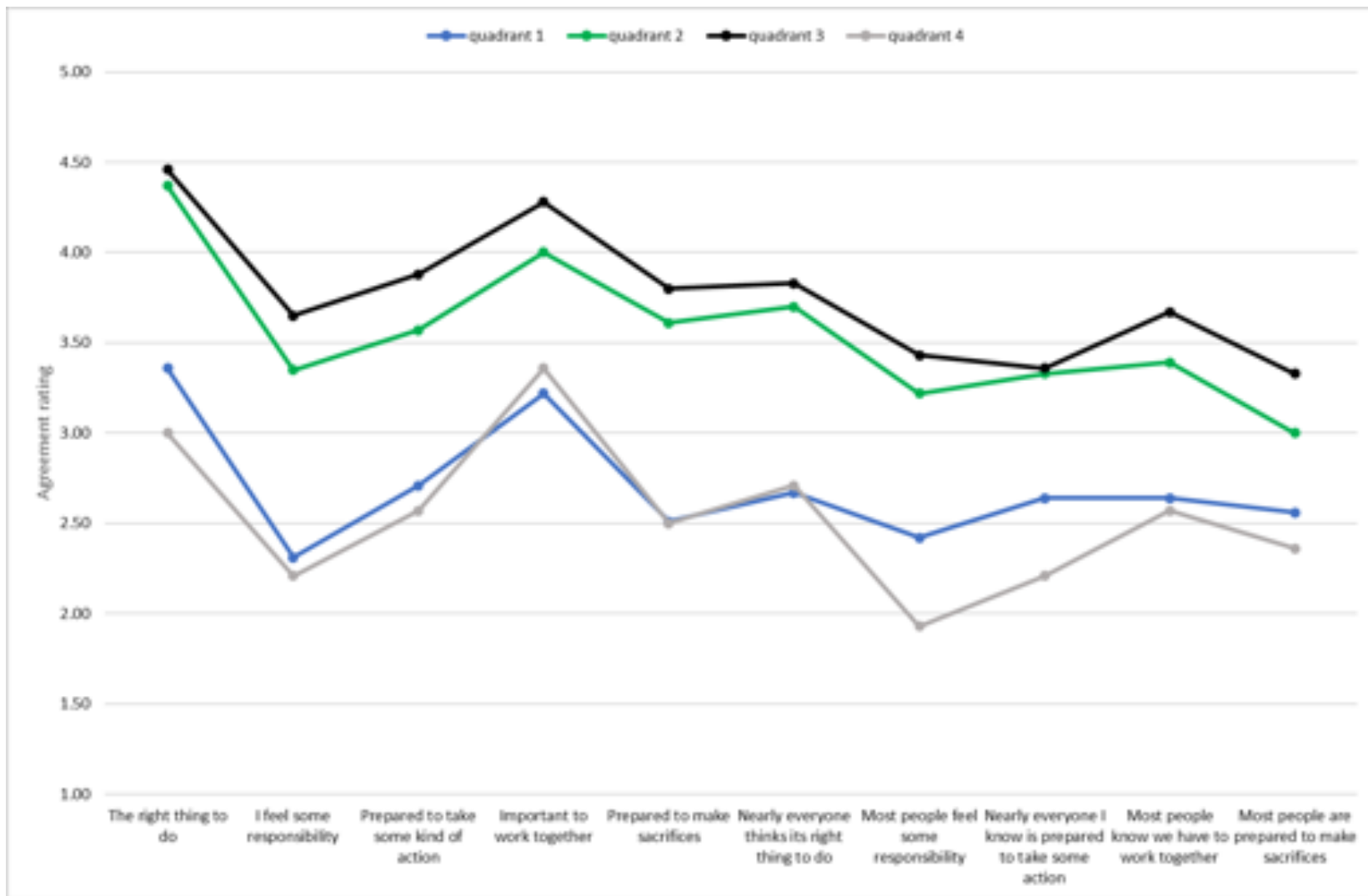


Figure 7. Respondents' beliefs about responsibility for reducing possum numbers.



Figure 8. Trapping behaviour and respondents' beliefs about the advantages and disadvantages of using traps.

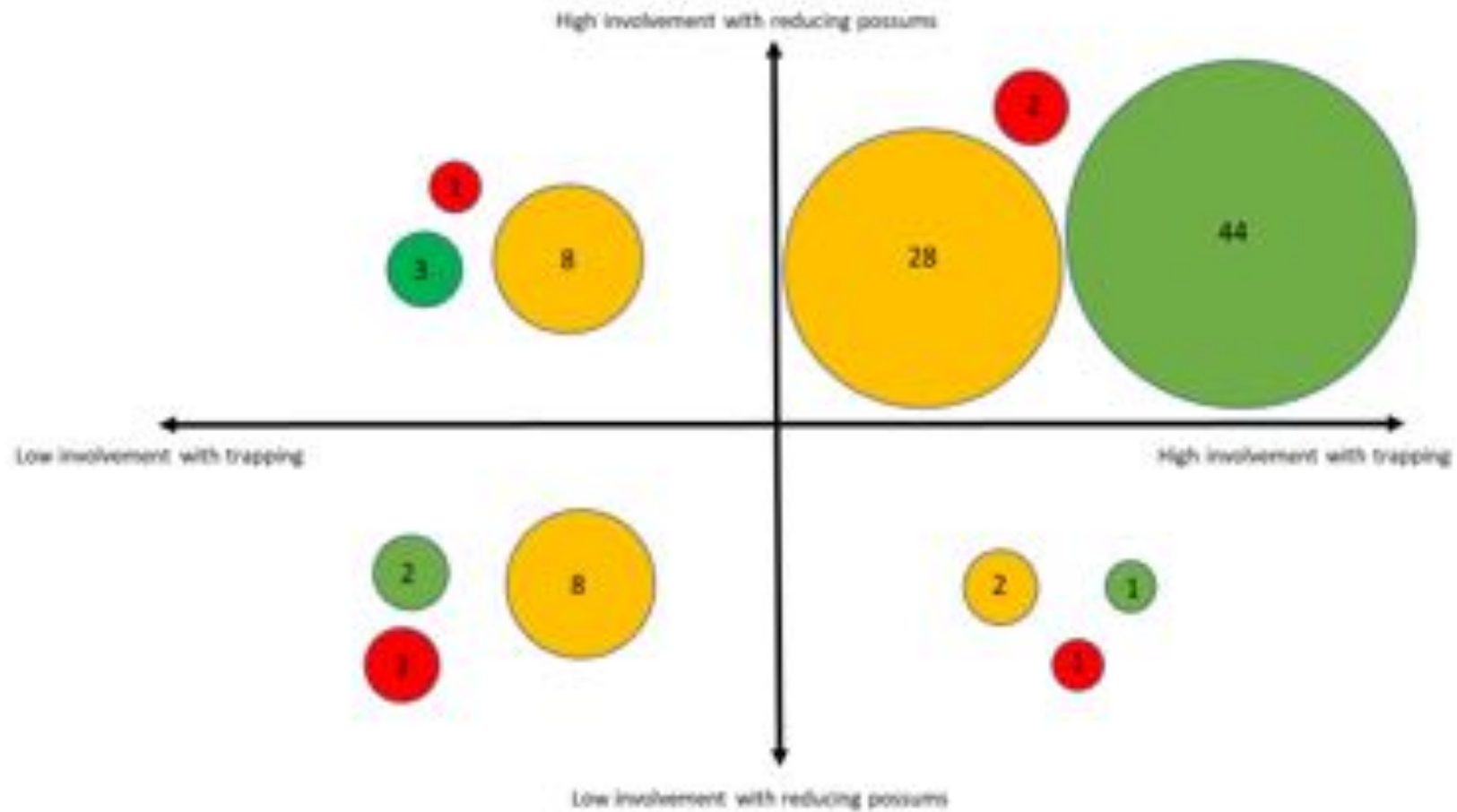


Figure 9. Graphical summary of respondents' involvement with the idea of reducing possum numbers and their involvement with, and attitudes towards, the idea of using traps.
 Note: Green indicates favourable, yellow indicates unsure, and red indicates unfavourable attitude to trapping possums. Values are percentage of sample and the size of circles is proportional to the relevant percentage of the sample.

has on the propensity to trap. Almost 19 per cent of those in quadrant 3 who favoured trapping, trapped possums, compared with only five per cent of those in quadrant 3 who were unsure.¹⁷

Compared to respondents in quadrant 3 who favoured trapping, the respondents in this quadrant who were unsure about trapping were:

- not as certain of the importance of reducing possum numbers and thought there was a greater chance of mistakes being made in trying to reduce possum numbers (see Fig. 10)
- not as sure of the importance of using traps to reduce possum numbers and thought there was a greater chance of mistakes being made in using traps to reduce possum numbers (see Fig. 11), and
- less sure of the advantages of trapping, and less confident about the safety and welfare aspects of trapping (see Fig. 12).¹⁸

These results indicate that the propensity to trap is moderately influenced by involvement with reducing possum numbers and with trapping. Beliefs about the advantages and disadvantages of reducing numbers of possums have little influence on the propensity to trap; however, beliefs about the advantages of trapping do have an important influence on whether respondents trapped possums.

4.7 Experiences with trapping possums

We questioned respondents who currently trapped possums about their experiences with trapping. We questioned those who were not trapping about why they did not trap possums and what they imagined the experience of trapping would be like. Respondents were questioned about the emotional (affective) aspects of their experiences, real or imagined, and the reasoned (cognitive) aspects of their experiences, real or imagined.¹⁹ The results are summarised in Table 13 and Figures 13 and 14.

¹⁷ Test for differences in proportions ($\chi^2=10.3$, $p<0.01$).

¹⁸ Classical eta and eta-squared statistics on effect size (Kirk 2007; Richardson 2011) are available on request from the authors.

¹⁹ Cronbach's alpha was 0.65 for affective aspects and 0.82 for cognitive aspects respectively, indicating consistent responses (Carmines & Zeller 1979).

Table 13. Real and imagined experience with trapping

Statement	Currently trap possums	Don't trap
Affective:		
Trapping is rewarding	3.95	–
Trapping is inspiring*	4.26	3.51
Catching possums is exciting*	3.36	2.80
Catching possums is encouraging*	4.38	3.35
Trapping makes a difference*	4.41	2.79
Wish checking traps was easier*	2.93	2.54
Boring when you don't catch possums	2.76	2.41
Dislike disposing of dead possums	3.00	3.42
Cognitive:		
Trapping is useful*	4.64	3.76
Trapping is practical*	4.57	3.71
Trapping is helpful*	4.48	3.77
Set a good example for family and friends*	4.1	3.12
Set a good example for people around me*	4.12	3.15
Naïve or simplistic to think trapping makes a difference*	2.07	2.92
Safety:		
Scared of hurting myself	–	2.89
Traps might injure children	–	2.78
Traps might accidentally catch pets	–	3.52
Preference:		
Oppose using traps	–	2.30
I prefer baits	–	2.45
Just not interested	–	3.08

Notes: * indicates F-test for difference in means across quadrants was significant ($p < 0.01$).

– indicates statement was not included in the questionnaire for respondents in this category.

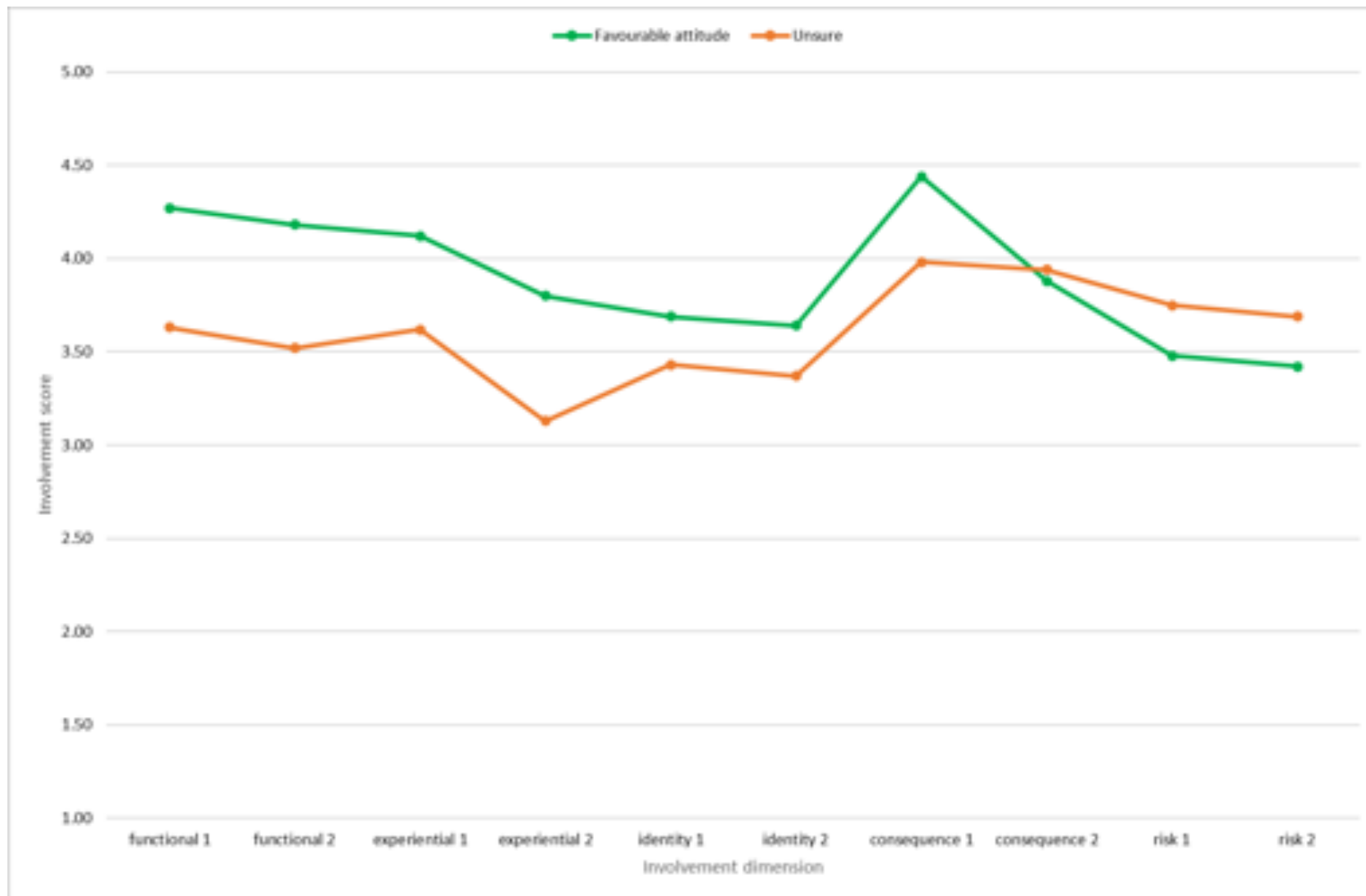


Figure 10. Respondents' attitude and involvement with reducing possums (quadrant 3).

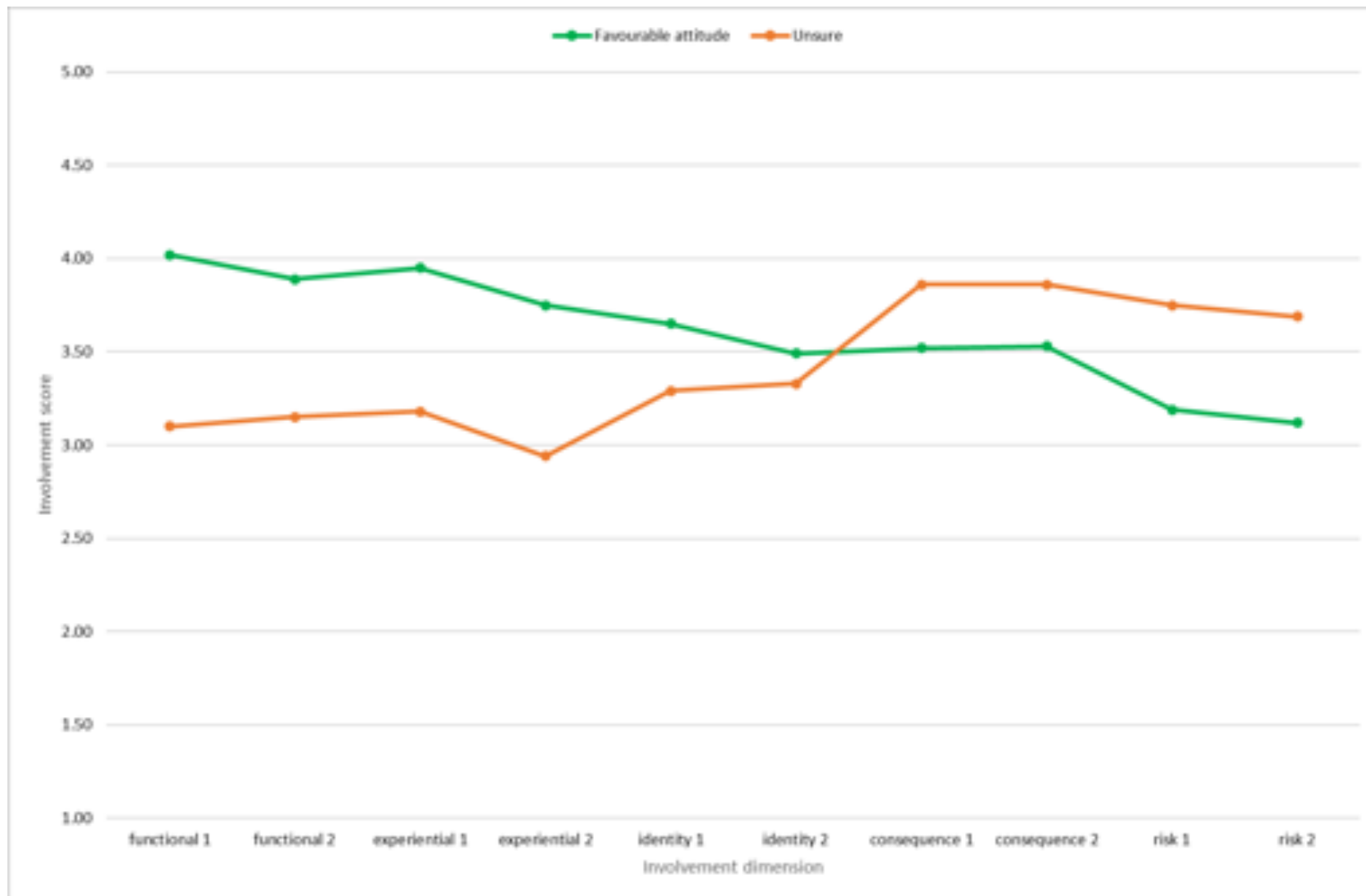


Figure 11. Respondents' attitude and involvement with using traps (quadrant 3).



Figure 12. Respondents' attitudes and beliefs about the advantages and disadvantages of using traps (quadrant 3).



Figure 13. Respondents' real and imagined experience with trapping possums – affective aspects.

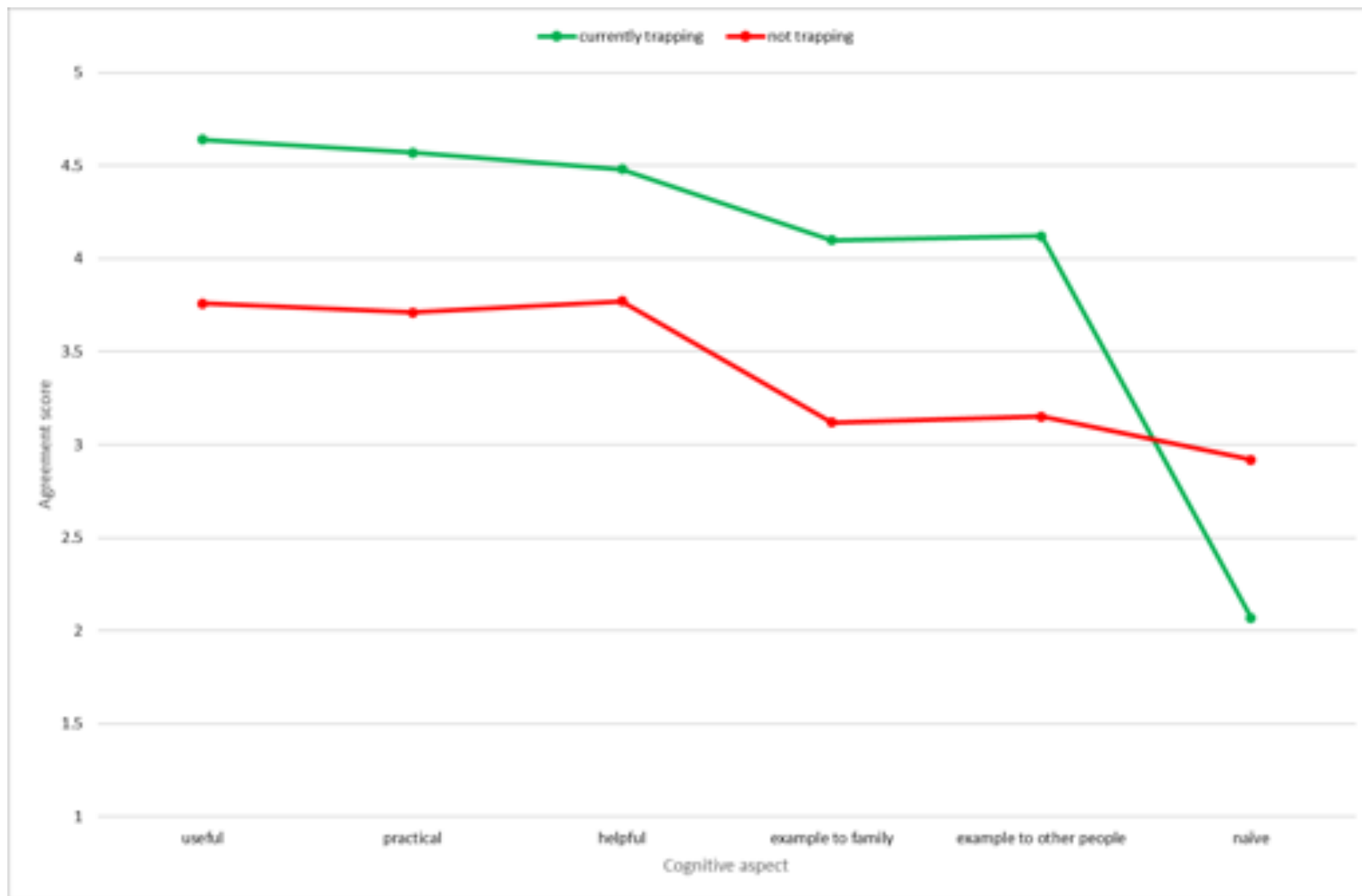


Figure 14. Respondents' real and imagined experience with trapping possums – cognitive aspects.

Respondents who were trapping strongly agreed that catching possums was inspiring, that they were encouraged and excited when they caught a possum and that they felt that they were making a difference. They were not particularly concerned about the time taken to check traps and dispose of dead possums, or about getting bored if they did not catch a possum (see Fig. 14).

On the other hand, respondents who were not trapping expressed only moderate agreement with the proposition that catching possums would be inspiring and that they would be encouraged and excited when they caught a possum and were less likely to agree they would be making a difference. While they appeared unconcerned about the time taken to check traps and getting bored if they did not catch a possum, they were more likely to be concerned about disposing of dead possums (see Fig. 13 and Table 13).

Respondents who were trapping strongly agreed that catching possums was useful, practical, helpful, set a good example for family, friends, and others, and made a difference (see Fig. 14). In contrast, respondents who were not trapping expressed only moderate agreement with the proposition that catching possums was useful, practical, helpful, set a good example for family, friends, and others, and made a difference (see Fig. 14 and Table 13). These respondents did appear to be slightly concerned about the safety of traps but did not prefer baiting to trapping and were not opposed to trapping (see Table 13).

This suggests, first, that most respondents who did not trap would support (and not oppose) an urban trapping programme; and second, that many of these respondents would participate in such a programme, provided participation was inexpensive and required little effort; bearing in mind that a proportion of these respondents may already control possums by other means such as baiting.

Overall, these results confirm there is likely to be widespread support among residents for reducing possum numbers in Dunedin. This support was motivated by concern about the environmental damage possums cause, as well as concerns for personal health and material well-being. There is also likely to be widespread support and participation in an urban program of possum trapping.

4.8 Involvement and engagement with Predator Free Dunedin

From theory, we expected respondents with higher involvement in the idea of reducing possum numbers and the idea of using traps (quadrant 3) to be more likely than respondents in the other quadrants to be aware of Predator Free Dunedin and interested in joining their programme. This hypothesis was supported with a significantly higher proportion of respondents in quadrant 3 indicating awareness of, and interest in, the programme than in other quadrants (see Table 14). These results confirm that the higher the motivation of householders in Dunedin to reduce possum numbers and to use traps, the more likely they are to join an urban trapping programme.

Unfortunately, an insufficient number of respondents were volunteers with an environmental group or with Predator Free Dunedin to test for differences across the quadrants in these variables.

4.9 Involvement, attitudes, and socio-economic demographics

Predator Free Dunedin were interested in the degree to which differences in the socio-economic characteristics of respondents were associated with differences in involvement with the idea of reducing possum numbers, involvement with using traps, and attitudes towards trapping.²⁰ With one exception, we did not find any significant associations between the socio-economic characteristics of respondents and their involvement with the idea of reducing possum numbers (see Table 15). The exception was an association with age; older respondents exhibiting slightly higher involvement with the idea of reducing possum numbers than younger respondents (indicated by the small η^2 value in Table 15).

We did not find any significant associations between the socio-economic characteristics of respondents and their interest in the idea of trapping possums. We did find a significant association between attitude towards trapping possums and gender, and between attitude towards trapping possums and whether respondents owned or rented their housing. Women had a slightly less favourable attitude towards trapping than men, and renters had a marginally more favourable attitude towards trapping than homeowners (see Table 15).²¹

We found a significant association between attitude towards pest management in general and education, with more highly qualified respondents exhibiting a more favourable attitude towards pest management in general than less qualified respondents (see Table 15).

With respect to predicting respondent's actions and interest we found significant associations between involvement with the idea of reducing possum numbers and using a pest control company, trapping of possums, being an urban trapper with Predator Free Dunedin, being a volunteer, being a volunteer with Predator Free Dunedin and being interested in joining Predator Free Dunedin. We found significant associations between respondent's involvement with the idea of using traps to reduce possum numbers and whether they trapped possums, used a pest control company, and were interested in joining Predator Free Dunedin.

We found significant associations between respondents' attitude towards of using traps to reduce possum numbers and whether they trapped possums and were interested in joining Predator Free Dunedin (see Table 15). We also found a significant association

²⁰ One-way analysis of variance tests were undertaken to identify statistically significant differences, followed by classical eta and eta-squared statistics to ascertain effect size (Kirk 2007; Richardson 2011). Complete test results are available on request from the authors.

²¹ Multiple regression analyses were also undertaken using the socio-demographic characteristics as predictors of involvement with reducing possums, involvement with trapping possums, and attitudes towards trapping possums. The results confirmed the absence of any strong associations between socio-demographics and involvement or attitudes. The results are available on request from the authors.

between respondents' attitude towards pest management generally, and whether they were interested in joining Predator Free Dunedin (see Table 15).

As a final point, we expected involvement with the idea of reducing possum numbers, and with the idea of trapping possums, might be higher among telephone respondents than panel respondents because the latter receive compensation for their participation and have greater flexibility with respect to when they participate. While there was a significant difference between the two groups of respondents regarding involvement with the idea of reducing possum numbers, there weren't any significant differences between the two groups regarding their interest in, or attitudes towards, trapping possums (see Table 15).

These results indicate that respondents' involvement with the idea of reducing possum numbers is not related to their socio-economic characteristics. Respondents' involvement with the idea of trapping possums, and their attitudes towards trapping possums were also unrelated to their socio-economic characteristics. Involvement with the idea of reducing possum numbers, together with interest in trapping and attitude towards trapping, predicted actual trapping behaviour and interest in joining Predator Free Dunedin.

Table 14. I₃ classification and awareness and interest in Predator Free Dunedin

	Heard of Predator Free Dunedin ¹	Interested in joining Predator Free Dunedin ²
Quadrant 1	40.0	4.4
Quadrant 2	58.7	15.2
Quadrant 3	59.9	28.8
Quadrant 4	28.6	0.0

Note: Values are percentage of respondents in each quadrant

¹ Test for differences in proportions across quadrants ($\chi^2=10.9$, $p=0.01$)

² Test for differences in proportions across quadrants ($\chi^2=19.7$, $p<0.01$)

Table 15. Socio-economic demographics, involvement, and attitudes¹

	Involvement with the idea of reducing possums	Involvement with trapping	Attitude towards pest management ²	Attitude towards trapping possums
Age	0.065	–	–	–
Gender	–	–	–	0.058
Education	–	–	0.057	–
Income	–	–	–	–
Property	–	–	–	–
Ownership	–	–	–	0.025
Currently trap	0.051	0.050	–	0.036
Volunteer	0.017	–	–	–
Volunteer with environment group	–	–	–	–
Urban trapper with PFD	0.023	–	–	–
Volunteer with PFD	0.040	–	–	–
Interested in joining PFD	0.078	0.046	0.063	0.103
Use pest control company	0.016	0.017	–	–
Internet or telephone respondent	0.045	–	–	–

Note: ¹ Values are eta-squared (η^2), the proportion of the variance in involvement or attitude explained by the variance in the socio-demographic variable. For example, the variation in the age of respondents explains 6.5% of the variation in involvement with the idea of reducing possums ($\eta^2 = 0.065$).

Values of η^2 are only reported for statistically significant differences in means for involvement or attitude ($p < 0.01$).

The – symbol indicates statistically insignificant difference in means for involvement or attitude (i.e. $p > 0.01$).

² Aley et al. (2020) pest management scale.

5 Discussion

As expected, we found that moderate to high involvement with reducing possum numbers and trapping was associated with a greater likelihood to express a definite, usually favourable, attitude towards the use of traps to catch possums. We also found that higher levels of involvement with the idea of reducing possum numbers, and with using traps to catch possums, were associated with a greater likelihood of believing possums had damaging effects. Higher levels of involvement with reducing possum numbers and trapping were also associated with a greater sense of responsibility for reducing possum numbers and a greater likelihood of using traps to catch possums.

The results reported here have several implications for designing strategies to encourage acceptance of, and participation in, a programme to control possums in Dunedin. Most importantly, the results indicate there is widespread support among residents of Dunedin for reducing possum numbers in the city and for using traps. Most respondents exhibited moderate involvement with reducing possum numbers and mild to moderate involvement with using traps.²² Most respondents also exhibited favourable attitudes towards reducing possums and using traps.

This means many households in Dunedin would participate in an urban programme for trapping possums, either by installing and managing traps themselves or by permitting the installation of traps on their properties which could be serviced by programme volunteers. Given most respondents exhibited only mild to moderate involvement with trapping, participation in the programme should be made as simple and easy as possible.

The results confirmed there is a strong association between respondents' propensity to trap possums and their involvement with the idea of reducing possum numbers and using traps, and their attitude towards trapping. This means respondents' willingness to trap possums is not just matter of their attitude towards trapping but also depends on how strongly motivated they are to reduce possum numbers.

Knowing the primary reasons for respondents' desire to reduce possum numbers provides a foundation for influencing their willingness to participate in a possum trapping programme. We found these to be functional, experiential, and consequential. Functional involvement arises from concerns about comfort and safety (e.g. health). Experiential involvement comes from the feelings and emotions that are the result of an experience or activity (e.g. satisfaction or excitement). Consequential involvement arises from the seriousness of the consequences of mistakes (e.g. loss of native species).

Our findings suggest residents' desire to reduce possums in Dunedin is primarily motivated by concerns for biodiversity and the environment, the health of themselves and their families, and the potential for possums to damage property, gardens, and equipment. Consequently, to promote trapping and participation in a trapping

²² Recall, involvement scores were interpreted as low (1-2), mild (2-3), moderate (3-4) and high (4-5) involvement.

programme we suggest attempts to encourage participation should concentrate on promoting the potential of urban trapping to reduce these harms.

Self-identity, i.e. the need for self-expression and belonging, was not a key source of involvement with reducing the number of possums or with trapping. This suggests attempts to encourage participation in a programme of urban trapping by concentrating only on promoting the participation of neighbours are unlikely to be particularly successful.

A substantial proportion of respondents, nearly 30%, were moderately interested in the idea of reducing possums and with trapping but were unsure of their attitude towards trapping. These respondents were less convinced of the benefits of trapping and were uncertain about the safety and welfare aspects of traps. Consequently, to promote trapping and participation in a trapping programme among this group we suggest promotional efforts should emphasise the safety of traps, and the speed and efficacy with which they function.

These results indicated that respondents who did not trap were simply less interested in the problem of possums and in trapping, compared to those that did. Although those that did not trap were aware of the advantages of reducing possum numbers, they were just less enthusiastic about the benefits they might experience from trapping than those that did trap. This provides additional support for the conclusion that most householders who do not trap would support (or at least not oppose) an urban trapping programme; and that many of these householders would participate in such a programme, provided participation was inexpensive and required little effort on their part (for example, traps were supplied and delivered to households for free). This is consistent with experience in predator control in Wellington (PFW 2019b).

We suggest increasing engagement in possum trapping in Dunedin by concentrating on promoting trapping among households with the involvement characteristics of quadrant 3. Most of the respondents were classified into this quadrant (72% of respondents) most of whom had a favourable attitude toward using traps. We expect that a high proportion of residents who are like those in quadrant 3 would, if not trapping independently, participate in the programme provided it was easy to join, and traps were inexpensive and easy to maintain.

We found the interest respondents in Dunedin had in the idea of reducing possum numbers and in trapping possums was largely unrelated to their socio-demographic characteristics. On the other hand, respondents' interest in the idea of reducing possum numbers and in trapping possums, together with their attitude towards trapping, predicted respondents' actual trapping behaviour, their propensity to be a Predator Free Dunedin volunteer and their interest in joining Predator Free Dunedin.

6 Conclusion

The results of the survey indicate widespread support for a programme of trapping to reduce possum populations in Dunedin. Support for reducing possum populations was

primarily motivated by residents' concerns for the environment, the health of themselves and their families, and for the potential for possums to damage property, gardens, and equipment. Consequently, attempts to encourage participation in a programme of urban trapping should concentrate on promoting the potential of urban trapping to reduce these harms.

Respondents' interest in the idea of reducing possum numbers and in trapping possums, together with their attitude towards trapping predicted respondents' actual trapping behaviour, their propensity to be a Predator Free Dunedin volunteer and their interest in joining Predator Free Dunedin. While there was general support for a possum control programme in Dunedin, most householders were only mildly or moderately interested in such a programme. This widespread but moderate interest and support among householders indicates that householders would be more likely to participate if the programme was easy to join and traps were inexpensive and simple to maintain, and that personal contact is likely to be the most effective means of promoting and implementing a programme.

The interest respondents in Dunedin had in the idea of reducing possum numbers, and in trapping possums, was largely unrelated to their socio-demographic characteristics.

7 Acknowledgements

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Appendix

Table A1. Reliability of involvement scales

	Mean involvement score	Reliability coefficient
Involvement with reducing numbers of possums	3.57	0.81
Involvement with using traps	3.31	0.73

Notes: Involvement scores are sample means. The mean for involvement with reducing possums was significantly different ($p \leq 0.01$) from the mean for trapping possums using paired-sample t-test (Cooksey 1997).

Reliability coefficient is Cronbach's alpha (Carmines & Zeller 1979).

Table A2. Involvement profiles for reducing numbers of possums and using traps

Involvement component:	Reducing numbers of possums	Using traps
Functional 1	3.71	3.31 ^a
Functional 2	3.61	3.26 ^a
Experiential 1	3.64	3.33 ^a
Experiential 2	3.22	3.08 ^a
Identity 1	3.33	3.26
Identity 2	3.33	3.29
Consequence 1	4.03	3.51 ^a
Consequence 2	3.82	3.55 ^a
Risk 1	3.51	3.26 ^a
Risk 2	3.46	3.33 ^a

Notes: Values are sample means.

^a Denotes statistically significant difference in means ($p \leq 0.01$) between reducing possum numbers and using traps for each component using paired-sample t-test (Cooksey 1997).