conservation

MDPI

Article

Attitudes, Involvement and Public Support for Pest Control Methods

Geoff Kaine [1,*] and Vic Wright [2]

[1] Manaaaki Whenua Landcare Research, Private Bag 3127, Hamilton 3240, New Zealand
[2] UNE Business School, University of New England, Armidale, NSW 2351, Australia
* Correspondence: kaineg@landcareresearch.co.nz; Tel.: +64-027834-9319

Abstract: Public support is crucial to the widespread application of pest control methods both in the form of political support and, where people have direct agency in control methods, compliance with the demands of the methods. It is commonplace for personal behaviours reflecting political support for public policies to be presumed to depend on relevant attitudes, beliefs and values of the person. The finite amount of attention and cognitive effort each person possesses implies that attention and effort are rationed, indicating that *changing* behaviour requires that the targeted individual is attentive and willing to invest the required cognitive effort; that is, they are motivated to consider new information and, subsequently, to reviewing their attitudes and behaviour. We examine whether attitudes and involvement (a measure of motivation) together provide better predictions of public support for pest control methods than attitudes alone, using the distribution of baits containing sodium fluoroacetate (1080) in New Zealand to control invasive, non-native rats and possums as a case study. We found the novel combination of involvement and attitudes did provide significantly better predictions of an individual's support for using 1080 for the purpose of environmental conservation, and their pest control behaviour, than did attitudes alone.

Keywords: behaviour; pest control; involvement; attitudes; 1080; pest management; conservation

Citation: Kaine, G.; Wright, V. Attitudes, Involvement and Public Support for Pest Control Methods. *Conservation* **2022**, *2*, 566–586. https://doi.org/10.3390/conservation2040038

Academic Editor: Iain J. Gordon

Received: 25 August 2022
Accepted: 30 September 2022
Published: 9 October 2022

1. Introduction

The very notion of conservation implies a need for intervention to moderate human behaviour in relation to cultural or environmental assets. Therefore, as Kareiva and Marvier (pp. 966–967, [1]) assert, 'because the success or failure of conservation depends heavily on whether human behaviors can be changed, conservationists should pay greater attention to human psychology and the impact of their messages on people.' This is of clear importance where individuals are (a) the direct agents of change and (b) potentially conflicted by characteristics of the change required. Since the suppression or elimination of invasive species is often a key conservation strategy [2–5] then public support for the use of pest control methods, particularly on a large scale, is often critical to successful conservation [6–8]. The following relates to a real example involving the elimination of invasive non-native pests.

The control of pests and weeds to prevent or reduce harm to people, agriculture, fisheries, urban and rural infrastructure and the environment is a global activity [8–11]. Invasive species, alone, cause an estimated $1.4 trillion in damage globally each year [12]. Many different methods are employed to control or eradicate pests and weeds including trapping, shooting, poisoning, and genetic modification, and new methods of control based, for example, on advances in genetic research are constantly being developed [8].

Public support is a prerequisite for the widespread use of a pest control method [2,13–18]. Consequently, there is extensive literature on quantifying public attitudes towards, and consequent support for, pest control methods [11,19–21]. This literature is largely based on models linking beliefs, attitudes and social norms (a social source of values) to behaviour [22–26].

An attitude is defined as 'an organized predisposition to think, feel, perceive, and behave toward a referent or cognitive object . . . an enduring structure of beliefs that predisposes the individual to behave selectively toward attitude referents . . . [:] physical objects, events, behaviours, even constructs' (pp. 495–496, [27]). They relate to things beyond the person. Attitudes have cognitive, behavioural and affective (emotional) dimensions. They are the most object-specific sources of behavioural intention amongst attitudes, beliefs and values and, in that sense, the most clearly related to specific referents evoking levels of 'support' or 'compliance'. Having an objective reference, attitudes are the outcomes of contemplation of the object, the referent in question.

Models linking attitudes and behaviour share a common, often implicit, assumption: that the matter under investigation is, or has been, sufficiently interesting and important to an individual to merit them making the cognitive effort needed to formulate an attitude [28], although [12] provide an interesting exception in regard to pest management. That is, the individual is, or has been, sufficiently involved with a behavioural choice to engage in subjectively rational decision-making activity rather than simply ignore the choice as irrelevant to them, or make it randomly.

The behavioural context of the choice determines whether a current measure of involvement can be expected to moderate the role of attitudes in determining choice outcomes. Where a choice is related to ways of satisfying personal goals related to routine needs, such as for food and other consumables, involvement may be persistently low (where options are perceived to be effectively identical) or may be low following earlier, highly involved choices where the choice outcome has been sufficiently satisfactory for the needs in question to prompt routine solutions: the notion marketers refer to as 'brand loyalty'. Involvement is then low unless and until some event perturbs the adequacy of the routine response; a change in needs or a change in optional solutions are common triggers of this kind.

Where the context is one where public policy, rather than personal needs, is intended to trigger a change in conservation behaviour (e.g., engendering public support for a pest control method), the involvement of people will be as critical, as it would be were the trigger a truly new product. Involvement is the first hurdle to be overcome for decision-making efforts to be activated and for salient information to be attended to, attitudes formed, and behavioural responses chosen. The relevant information environment is very likely to be dynamic for public policy initiatives, as programs are rolled out, attract public commentary and are adopted by a community to a greater or lesser extent. Thus, findings from cross-sectional analyses of involvement will likely be ephemeral but also pertinent information for the evolution of program management.

In the case of public policy initiatives, models of attitude-behaviour linkages will suffer from the breach of the assumption of rational choice if involvement is low. Interpreting behaviour in response to public policy initiatives therefore requires evaluation, at least, of the state of involvement among target people. The risk of assuming that behavioural responses, or lack of them, are deliberate when they are not may lead to serious errors in adjustments to a policy designed to enhance acceptance of the policy.

To our knowledge, in public policy domains the inclusion of involvement in the analysis of links between attitudes (and underlying beliefs and values) and behaviours, ranging from political or public support to compliance with specific behavioural requests, has rarely been undertaken by other researchers. Our work has its origins in Kaine et al. [29] who suggested people's responses to policy measures, such as the use of a particular pest control method, can be inferred from their:

- Involvement with the relevant policy outcome (e.g., reducing pest populations).
- Involvement with, and attitude towards, the policy measure itself (i.e., pest control methods).

The framework in Kaine et al. [29] has been employed to predict compliance behaviour in agricultural contexts [30–33], predator control [34,35], and public support for predator control [36]. It has also been used to predict community compliance with measures to prevent the spread of COVID-19 [37]. More generally, the concept of involvement has been employed to understand people's responses to biosecurity issues [38], farmers' approaches to nutrient budgeting [39] campers' firewood collection behaviour [40] and policy design [41].

Drawing on well-established behavioural models [25,26,42] in which attitudes are a function of beliefs (and relevant social norms), several fundamental propositions concerning the relationship between attitudes, involvement and behaviour arise from Kaine et al. [29]. These are that:

- People's attitudes towards the policy outcome will be a function of their beliefs about the outcome.
- People's attitudes towards the policy measures will be a function of their beliefs about the policy measure.
- Involvement with policy measures depends on involvement with the policy outcome.
- The strength of attitudes regarding policy measures will be a function of involvement with the outcome, involvement with the measures, and active beliefs with respect to other subjects that are perceived to be highly relevant (such as social norms, and regulations and penalties that nominally apply).
- Responses to the policy outcome will be a function of involvement with the outcome, attitudes towards the outcome, and its personal relevance (in the sense that the individual perceives personal agency).
- Responses to the policy measures will be a function of involvement with, and attitudes to, the outcome, and involvement with, and attitudes to, the measures, and their personal relevance.

We will examine these propositions using, as a case study, public support for the control of rats and possums, which have long been characterised as introduced, non-native pests in New Zealand [8], using ground and aerial baiting containing sodium fluoroacetate (1080).

2. Materials and Methods

New Zealand, as a developed, relatively small island nation, is fertile, has a temperate climate and no significant deserts. It is arguably one of the few developed countries that can meaningfully contemplate eradication as a pest or disease strategy. The productivity of the islands has allowed introduced, non-native animals to thrive, some assuming very damaging population sizes. For some decades, central and regional governments in New Zealand have funded the ground and aerial distribution of baits containing sodium fluoroacetate (1080) to suppress introduced possum (*Trichosurus vulpecula*) populations on public and private land with the purpose of eliminating bovine tuberculosis. In 2015, the central government established Predator Free 2050, a collaborative project that aims to conserve native flora and fauna by eradicating introduced possums, rats (*Rattus norvegicus, Rattus rattus*), stoats (*Mustela erminea*), ferrets (*Mustela furo*), and weasels (*Mustela nivalis*) from New Zealand by the year 2050 [8,43–45]. In the absence of practical and affordable alternatives, community support for continued aerial and ground baiting with 1080 is critical to achieving the goals of making New Zealand predator free and of eliminating bovine tuberculosis. However, the use of 1080 to kill rats, possums and mustelids in New Zealand has been, and continues to be, controversial [21,46]. There has been, and continues to be, substantial public opposition to the use of 1080 based on perceptions that it is a danger to human health, harmful to native birds and animals, and cruel [21].

OSPRI (Operational Solutions for Primary Industries, formerly the Animal Health Board) is the government agency responsible for the elimination of bovine tuberculosis in New Zealand, while the New Zealand Department of Conservation ('the Department') is responsible for the conservation of the natural environment on Crown land. OSPRI and the Department commissioned Manaaki Whenua Landcare Research to investigate public support (or otherwise), in both urban and rural areas, for ground and aerial baiting with 1080 [30]. OSPRI and the Department were particularly interested in the strength of people's support for, or opposition to, the use of aerial baiting with 1080 as this might influence the design and implementation of their predator control programs.

In the context of people's support, or not, for using ground and aerial baiting with 1080 to reduce rat and possum populations, and their willingness themselves to trap rats and possums, the propositions advanced in the Introduction translated into the following hypotheses:

1. People's attitude towards reducing populations of possums and rats will depend on their beliefs about the consequences of the presence of significant populations of these pests.
2. People's attitudes towards ground baiting with 1080 will depend on their beliefs about 1080 and their beliefs about ground baiting. Correspondingly, people's attitudes towards aerial baiting with 1080 will depend on their beliefs about 1080 and their beliefs about aerial baiting.
3. Involvement with ground baiting will depend on involvement with reducing possum and rat populations and beliefs about 1080 (in the absence of data on involvement with the personal use of 1080 per se).
4. Involvement with aerial baiting will depend on involvement with reducing possum and rat populations and beliefs about 1080.
5. The strength of people's attitudes towards ground baiting with 1080 will depend on involvement with reducing possum and rat populations, involvement with ground baiting, and beliefs about 1080.
6. The strength of people's attitudes towards aerial baiting will depend on involvement with reducing possum and rat populations, involvement with aerial baiting, and beliefs about 1080.
7. People's sense of responsibility for achieving the outcome of reducing populations of rats and possums will depend on their involvement with, and attitude towards, reducing pest populations, and the personal relevance of the outcome (specifically, eliminating rats and possums on their properties or in their area).
8. People's willingness to take action to achieve the outcome of reducing populations of rats and possums will depend on their involvement with, and attitude towards, reducing pest populations, and the personal relevance of the outcome.
9. People's willingness to make sacrifices to achieve the outcome of reducing populations of rats and possums will depend on their involvement with, and attitude towards, reducing pest populations, and the personal relevance of the outcome.
10. People's willingness to work together to achieve the outcome of reducing populations of rats and possums will depend on their involvement with, and attitude towards, reducing pest populations, and the personal relevance of the outcome.

A questionnaire based on the I_3 Framework [36] was designed to test these hypotheses (see Supplementary Materials). In the questionnaire, information was sought from the public on their beliefs regarding, attitudes towards, and involvement with reducing rat and possum populations and the idea of using 1080. The purpose of the survey was to test associations between people's involvement with, and attitudes towards, ground and aerial baiting with 1080, and their attitudes towards using 1080 to reduce rat and possum numbers, so as to identify likely support and compliance. As well, relevant beliefs were explored to identify their role in explaining attitudes. We also wished to test associations between involvement and intentions in terms of people's feelings of personal responsibility for reducing possum and rat numbers, and their willingness to act, make sacrifices and work with others to reduce rat and possum numbers. Lastly, we wanted to test associations between involvement and people's behaviour with respect to trapping and shooting possums and rats.

The survey was conducted in six New Zealand regions of particular interest to OSPRI and the Department: Auckland, Taranaki, Wellington, Nelson-Tasman-Marlborough, Dunedin, and the West Coast. The sample for the survey was not intended to be statistically representative of New Zealand as a whole.

The survey was voluntary, and respondents could stop answering the survey at any time. All survey questions were optional and could be skipped. The questionnaire was reviewed and approved through an internal Manaaki-Whenua Landcare Research social ethics process (Application no. 1920/04).

The questionnaire was administered online and by telephone by a commercial market research company in the six regions. The survey was open for four weeks in September 2019. Online respondents were randomly selected with replacement sampling from a consumer panel database of metropolitan and provincial urban addresses. Telephone respondents were randomly chosen with replacement sampling from a database of rural addresses with landline telephones. Sampling proportions were Auckland and Wellington, 100% urban; Nelson-Tasman-Marlborough, 75% urban and 25% rural; Taranaki and Dunedin, 50% urban and 50% rural; West Coast, 25% urban and 75% rural.

Involvement was measured using a condensed version [47] of the Laurent and Kapferer [48] involvement scale. Following [47], respondents evaluated two statements for each of the five components of involvement (functional, experiential, identity-based, risk-based, and consequence-based). Attitudes towards aerial and ground baiting with 1080 were measured using an evaluative five-point scale and an ipsative scale based on Olsen [49].

A series of questions was formulated to elicit respondents' beliefs about the effects of reducing possum and rat numbers, their beliefs about 1080, and their beliefs about using 1080 in bait stations on the ground and about aerial baiting with 1080. The statements, which include some beliefs that reflect values individuals own that relate explicitly to animal rights, were formulated based on the literature [13–15,19,46,50,51] and discussions with biosecurity researchers and experts from Manaaki-Whenua Landcare Research, OSPRI and the Department.

Respondents were questioned about their preferences regarding different modes of aerial baiting (e.g., they could tolerate aerial baiting until a replacement is found; they oppose repeated aerial baiting). Furthermore, elicited were respondents' intentions in terms of feelings of personal responsibility for reducing possum and rat numbers, and their willingness to act, make sacrifices and work with others to reduce rat and possum numbers. The statements in the involvement, belief, attitude, preference and intention scales were presented in random order to respondents to avoid introducing bias in responses.

Respondents' agreement with statements in all the involvement, preference, belief, attitude, and intention scales was indicated using a five-point rating, ranging from strongly disagree (1) to strongly agree (5). They were also asked whether they trapped (or shot) rats or possums on their properties (yes/no).

To limit the length of the questionnaire and to maintain focus on a specific pest, two versions were developed, one for possums and one for rats. The questionnaires were almost identical except for the statements in the belief scales with respect to rats and possums. Respondents answered only one version. Versions were randomly allocated among respondents while maintaining the representation of each region across each questionnaire.

Following [47], involvement scores were calculated for each respondent as the average of their agreement ratings for the ten statements in each involvement scale. Attitude scores were calculated as the average of their agreement ratings for the statements in the attitude scales. The strength of respondents' attitudes was calculated as the square of the attitude score, less the mid-point value (which indicated an unsure or neutral rating).

To begin with, beliefs were analysed to identify their informational role in forming attitudes, with a view to identifying the most appropriate focus of campaigns and other measures designed to modify attitudes. Cluster analysis was employed to classify respondents into belief segments based on their agreement ratings with the extensive set of relevant belief statements. Ward's method was employed as the clustering algorithm, with squared Euclidean distance used as the dissimilarity measure [52]. Respondents were classified into belief segments regarding the effects of reducing rat and possum populations, their beliefs about 1080, and their beliefs about ground and aerial baiting with 1080. Cluster solutions were chosen based on the proportional change in fusion coefficients, ease of interpreting the segments, and a desire to keep the number of segments as small as practical [52].

The validity of the central proposition, that involvement and attitudes need to be analysed independently to assess properly the role of the latter in influencing support for a policy and associated policy measure, was investigated using regression analysis to test the hypotheses listed above. All analyses were undertaken using SPSS version 27 [53].

3. Results

3.1. The Sample

We received 918 complete responses, of which 454 responses (49%) were about reducing possum numbers and 464 responses (51%) were about reducing rat numbers. The age distribution of the sample was skewed compared to the national population, being marginally older, and had a higher level of education (see [36] for details). The reliability of the involvement and attitude scales was satisfactory, with Cronbach's alpha [54] being 0.69 or higher for all scales [36].

3.2. Belief Segments

3.2.1. Belief Segments for Reducing Rat Populations

Respondents were grouped into four belief segments with regard to reducing rat populations (Table 1). Respondents in segments one and four believed that reducing rat numbers would have favourable effects on native plants, trees, birds, and wildlife and would reduce damage to orchards and gardens. The main difference between respondents in these segments was that the beliefs of respondents in segment one were not as strong as the beliefs of respondents in segment four.

Respondents in segment two had similar beliefs to those in segment four except the respondents in segment four were more certain that rats do not suppress mice numbers and that rats do not have just as much a right to life as other animals. Respondents in segment three did not believe that reducing rat numbers would have favourable effects on native plants, trees, birds, and wildlife nor reduce damage to orchards and gardens.

3.2.2. Belief Segments for Reducing Possum Populations

With respect to reducing possum populations, respondents were grouped into four belief segments (Table 2). Respondents in segments three and four believed that reducing possum numbers would have favourable effects on native plants, trees, birds, and wildlife, would reduce damage to nurseries, orchards and gardens and would help eradicate bovine tuberculosis.

The main difference between respondents in these segments was that respondents in segment four were surer than those in segment three that possums do not compete with other pests, do not have just as much of a right to life as other animals, and that possums are not needed to keep people employed in the fur industry.

Respondents in segment two had similar beliefs to those in segment three except that the respondents in segment two were much less certain that reducing possum numbers would protect native birds and plants, reduce damage to nurseries, orchards and gardens, and would help eradicate bovine tuberculosis. Respondents in segment one, like those in segments three and four, believed that reducing possum numbers would have favourable effects on native plants, trees, birds, and wildlife, would reduce damage to nurseries, orchards and gardens and would help eradicate bovine tuberculosis. However, respondents in segment one also believed that possums compete with other pests, do have just as much of a right to life as other animals, and that possums are needed to keep people employed in the fur industry.

3.2.3. Belief Segments for 1080

With respect to the advantages and disadvantages of 1080, respondents were classified into four belief segments (Table 3). Respondents in segment three believed that 1080 controls possums and rats and this has beneficial effects on native bird populations and helps eradicate bovine tuberculosis. They believed 1080 is not a risk to people's health, biodegrades, and rapidly becomes harmless if it enters rivers and lakes. They do not believe 1080 is an inhumane or cruel way to kill animals such as stoats or rats.

Respondents in segment one also believed that 1080 controls possums and rats and this has beneficial effects on native bird populations and helps to eradicate bovine tuberculosis. However, while these respondents believed that 1080 biodegrades and rapidly becomes harmless if it enters rivers and lakes, they did believe that 1080 was a risk to people's health and to farm animals and pets. They also believed 1080 is an inhumane or cruel way to kill animals such as stoats or rats.

Respondents in segment two believed that 1080 controls possums and rats but were unsure whether it had beneficial effects on native bird populations and helped eradicate bovine tuberculosis. They were unsure that 1080 biodegrades and becomes harmless if it enters rivers and lakes, and thought it posed a risk to people's health and to farm animals and pets. They were unsure whether 1080 is an inhumane or cruel way to kill animals such as stoats or rats.

Respondents in segment four did not believe that 1080 controls possums and rats nor that it has beneficial effects on native bird populations and helps eradicate bovine tuberculosis. They believed 1080 is a risk to people's health, farm animals and pets and that it neither biodegrades nor becomes harmless if it enters rivers and lakes. They believe 1080 is an inhumane or cruel way to kill animals such as stoats or rats.

3.2.4. Belief Segments for Ground Baiting with 1080

Respondents were grouped into three belief segments regarding ground baiting with 1080 (Table 4). Respondents in segment three believed that, while using 1080 in bait stations was not always practical, it was safer where there were farms and waterways, was not a risk to people's health, wild foods or recreational hunting, and would reduce bovine tuberculosis.

Respondents in segment one shared these beliefs with the exception that they, unlike segment three, were unsure whether ground baiting with 1080 was a risk to people's health and wild foods. Respondents in segment two believed that using 1080 in bait stations was a risk to people's health, a danger to wild foods, and was not safe where there were farms and waterways. They were unsure whether it would reduce bovine tuberculosis.

3.2.5. Belief Segments for Aerial Baiting with 1080

Respondents were grouped into four belief segments regarding aerial baiting with 1080 (Table 5). Respondents in segment three believed that aerial baiting with 1080 was cost effective and the only practical method in difficult terrain. They believed aerial baiting helped prevent bovine tuberculosis, was not a risk to people's health, wild foods, farm animals and pets, or recreational hunting, that it did not contaminate waterways, and would reduce bovine tuberculosis.

Table 1. Belief segments for reducing rat numbers.

Statement (n = 464)	Segment 1 (39%)	Segment 2 (21%)	Segment 3 (3%)	Segment 4 (37%)
We need to reduce the number of rats to protect our native birds and wildlife	3.91	4.99 [a]	1.18 [a,b]	4.98 [a,c]
We need to reduce the number of rats to conserve our native plants and trees	3.81	4.91 [a]	1.09 [a,b]	4.85 [a,c]
We need rats because they suppress mice numbers	2.83	3.48 [a]	2.64 [b]	1.67 [a,b,c]
We need to reduce the number of rats because they compete with native wildlife for food sources	3.74	4.96 [a]	1.09 [a,b]	4.83 [a,c]
We need to reduce the number of rats because in high seed production ('mast') years rat numbers can reach plague levels in our native forests	3.76	4.86 [a]	2.09 [a,b]	4.83 [a,c]
We need to reduce the number of rats to prevent damage to orchards and gardens	3.53	4.79 [a]	2.00 [a,b]	4.45 [a,b,c]
Rats have just as much of a right to life as other animals	2.95	2.87 [a]	2.55 [a,b]	1.47 [a,b,c]

Notes: Values are mean agreement ratings. Ratings ranged from a minimum of 1 (strongly disagree) to a maximum of 5 (strongly agree). Differences in mean agreement ratings between segments tested using Tukey's HSD [55]. [a] Mean rating is statistically significantly different to the mean for segment 1 ($p < 0.01$). [b] Mean rating is statistically significantly different to the mean for segment 2 ($p < 0.01$).[c] Mean rating is statistically significantly different to the mean for segment 3 ($p < 0.01$).

Table 2. Belief segments for reducing possum numbers.

Statement (n = 454)	Segment 1 (27%)	Segment 2 (26%)	Segment 3 (29%)	Segment 4 (18%)
We need to reduce the number of possums to protect our native birds and wildlife	4.26	3.26 [a]	4.74 [a,b]	4.86 [a,b]
We need to reduce the number of possums to conserve our native plants and forests	4.28	3.22 [a]	4.69 [a,b]	4.85 [a,b]
We need to reduce the number of possums to eradicate bovine Tb	4.11	2.95 [a]	4.44 [a,b]	4.14 [b]
We need to reduce the number of possums to prevent damage to plant nurseries	4.29	2.77 [a]	4.41 [b]	3.89 [a,b,c]
We need to reduce the number of possums because they compete with livestock by eating pasture damage to pasture	3.88	2.41 [a]	3.95 [b]	3.22 [a,b,c]
We need to reduce the number of possums to prevent damage to orchards and gardens	4.06	2.91 [a]	4.63 [a,b]	3.59 [a,c]
Possums have just as much of a right to life as other animals	3.60	3.62	2.38 [a,b]	1.76 [a,b,c]
We need possums because they compete with other pests	3.48	2.77 [a]	2.21 [a,b]	1.40 [a,b,c]
We need to have some possums to keep people employed in the fur industry	3.99	2.84 [a]	1.99 [a,b]	1.79 [a,b]

Notes: Values are mean agreement ratings. Ratings ranged from a minimum of 1 (strongly disagree) to a maximum of 5 (strongly agree). Differences in mean agreement ratings between segments tested using Tukey's HSD [55]. [a] Mean rating is statistically significantly different to the mean for segment 1 ($p < 0.01$). [b] Mean rating is statistically significantly different to the mean for segment 2 ($p < 0.01$). [c] Mean rating is statistically significantly different to the mean for segment 3 ($p < 0.01$).

Table 3. Belief segments about 1080.

Statement (n = 918)	Segment 1 (17%)	Segment 2 (52%)	Segment 3 (23%)	Segment 4 (9%)
1080 helps to control possums, rats and stoats	4.22	3.67 [a]	4.73 [a,b]	2.30 [a,b,c]
1080 is a cruel and inhumane way to kill animals such as stoats and rats	3.73	3.12 [a]	1.95 [a,b]	4.75 [a,b,c]
Independent scientific studies have proven that native bird populations increase in areas where 1080 poison is used	4.03	3.13 [a]	4.44 [a,b]	1.87 [a,b,c]
1080 poison is more effective in saving birdlife than trapping the predators	3.98	2.86 [a]	4.34 [a,b]	1.61 [a,b,c]
1080 poison is biodegradable and at most takes several months to break down	3.88	3.05 [a]	3.86 [b]	2.18 [a,b,c]
The benefits to bird populations from increased nesting success following 1080 predator eradication far outweigh any side effects	4.21	2.97 [a]	4.46 [a,b]	1.63 [a,b,c]
1080 kills as many birds, if not more, than it might save	3.59	3.28 [a]	1.83 [a,b]	4.66 [a,b,c]
The suffering of predators due to 1080 poisoning far outweighs the benefits of increasing nesting success and native bird numbers	4.18	2.98 [a]	2.43 [a,b]	3.25 [a,b,c]
1080 is a risk to farm animals and pets	4.16	3.75 [a]	2.95 [a,b]	4.84 [a,b,c]
1080 is a risk to people's health	4.01	3.53 [a]	2.17 [a,b]	4.64 [a,b,c]
A benefit of using 1080 to reduce possum numbers is that stoats also can be killed if they feed on poisoned possums, rats, and mice	4.22	3.40 [a]	4.29 [b]	2.52 [a,b,c]
1080 rapidly becomes harmless if it gets into rivers and lakes	3.80	2.75 [a]	3.85 [b]	1.39 [a,b,c]
Tb can be eradicated from cattle in New Zealand by using 1080 to reduce possum numbers	4.03	3.06 [a]	3.91 [b]	1.75 [a,b,c]
1080 poison gets into our waterways	4.07	3.62 [a]	2.82 [a,b]	4.78 [a,b,c]

Notes: Values are mean agreement ratings. Ratings ranged from a minimum of 1 (strongly disagree) to a maximum of 5 (strongly agree). Differences in mean agreement ratings between segments tested using Tukey's HSD [55]. [a] Mean rating is statistically significantly different to the mean for segment 1 ($p < 0.01$). [b] Mean rating is statistically significantly different to the mean for segment 2 ($p < 0.01$). [c] Mean rating is statistically significantly different to the mean for segment 3 ($p < 0.01$).

Table 4. Belief segments about ground baiting with 1080.

Statement (n = 918)	Segment 1 (50%)	Segment 2 (18%)	Segment 3 (32%)
Using bait stations with 1080 to reduce possum numbers is not cost effective	3.09	3.30 [a]	2.60 [a,b]
Using bait stations with 1080 to reduce possum numbers is not practical in some areas	3.69	4.28 [a]	3.39 [a,b]
Using bait stations with 1080 to reduce possum numbers is much safer where there are farms and water ways	3.52	1.95 [a]	3.86 [a,b]
Using bait stations with 1080 to reduce possum numbers is a risk to people's health	3.25	4.42 [a]	1.94 [a,b]
Using bait stations with 1080 to reduce possum numbers is a danger to wild foods	3.37	4.60 [a]	2.08 [a,b]
Using 1080 in bait stations helps save cattle and farmed deer from Tb	3.50	2.62 [a]	3.69 [a,b]
Using 1080 in bait stations is bad for recreational hunting	3.59	3.28 [a]	1.83 [a,b]

Notes: Values are mean agreement ratings. Ratings ranged from a minimum of 1 (strongly disagree) to a maximum of 5 (strongly agree). Differences in mean agreement ratings between segments tested using Tukey's HSD [55]. [a] Mean rating is statistically significantly different to the mean for segment 1 ($p < 0.01$). [b] Mean rating is statistically significantly different to the mean for segment 2 ($p < 0.01$).

Table 5. Belief segments about aerial baiting with 1080.

Statement (n = 918)	Segment 1 (29%)	Segment 2 (36%)	Segment 3 (20%)	Segment 4 (15%)
Aerial baiting with 1080 kills as many birds, if not more, than it might save	3.81	2.95 [a]	1.68 [a,b]	4.49 [a,b,c]
Aerial baiting with 1080 is a risk to farm animals and pets	4.24	3.21 [a]	2.63 [a,b]	4.96 [a,b,c]
Aerial baiting with 1080 helps save cattle and farmed deer from Tb	3.12	3.22	4.17 [a,b]	1.98 [a,b,c]
Aerial baiting with 1080 is a risk to people's health	4.16	2.97 [a]	1.93 [a,b]	4.89 [a,b,c]
Aerial baiting with 1080 is cost effective	3.27	3.17	4.40 [a,b]	2.43 [a,b,c]
Aerial baiting with 1080 is the only practical method of pest control in areas that are rugged and difficult to reach	3.28	3.43 [a]	4.69 [a,b]	1.61 [a,b,c]
Aerial baiting with 1080 contaminates waterways	4.27	3.16 [a]	2.32 [a,b]	4.91 [a,b,c]
Aerial baiting with 1080 is bad for recreational hunting	3.96	3.05 [a]	2.48 [a,b]	4.78 [a,b,c]
Aerial baiting with 1080 is a danger to wild foods	4.20	3.05 [a]	2.49 [a,b]	4.88 [a,b,c]

Notes: Values are mean agreement ratings. Ratings ranged from a minimum of 1 (strongly disagree) to a maximum of 5 (strongly agree). Differences in mean agreement ratings between segments tested using Tukey's HSD [55]. [a] Mean rating is statistically significantly different to the mean for segment 1 ($p < 0.01$). [b] Mean rating is statistically significantly different to the mean for segment 2 ($p < 0.01$). [c] Mean rating is statistically significantly different to the mean for segment 3 ($p < 0.01$).

The beliefs of respondents in segment four were basically the opposite of those in segment three. Respondents in segment four did not believe aerial baiting with 1080 was cost effective and the only practical method in difficult terrain nor that aerial baiting helped prevent bovine tuberculosis. They believed aerial baiting with 1080 was a risk to people's health, wild foods, farm animals and pets, and recreational hunting, and that it contaminated waterways. The beliefs of respondents in segment one were similar to those in segment four, the difference being that the beliefs of respondents in segment one were not as strong as those in segment four. Respondents in segment two were unsure what to believe about aerial baiting with 1080.

3.3. Predicting Support for Using 1080

The aim in this stage of the analysis was to quantify the effect of respondents' beliefs, attitudes, and involvement on their support for the use of 1080 to control rats and possums. In other words, we wanted to estimate, separately, the influence of involvement (as a measure of motivation) and the influence of beliefs and attitudes on respondents' support for using 1080 in the context of eliminating rats and possums from New Zealand.

Attitudes and Beliefs

We began by analysing the relationship between attitudes and beliefs. Binary dummy variables were used to represent respondents' membership of belief segments with respect to reducing rat (Table 1) and possum (Table 2) populations, the effects of 1080 (Table 3), ground baiting with 1080 (Table 4) and aerial baiting with 1080 (Table 5). Attitudes towards ground baiting and aerial baiting were measured using the evaluative scale described earlier.

The explanatory power of the regressions, and the resulting parameter estimates, are reported in Table 6. The attitudinal regressions were statistically significant and, for cross-sectional data, a substantial proportion of the variance in respondents' attitudes was explained by their beliefs (hypotheses 1 and 2).

Table 6. Parameter estimates for attitude towards attitude towards reducing pest numbers, aerial baiting, and ground baiting.

Belief Segments	Attitude towards Reducing Pest Numbers	Attitude towards Ground Baiting	Attitude towards Aerial Baiting
Possum segment one	–0.59 **	–0.06	–0.13
Possum segment two	–1.51 **	–0.40 **	–0.28 **
Possum segment three	–0.21 **	–0.13	0.03
Rat segment one	–0.89 **	–0.29 **	–0.04
Rat segment two	–0.08	–0.08	–0.05
Rat segment three	–2.07 **	–0.20	0.37
1080 segment one		1.20 **	1.04 **
1080 segment two		0.86 **	0.38 **
1080 segment three		1.44 **	1.15 **
Ground baiting segment one		–0.52 **	
Ground baiting segment two		–1.64 **	
Aerial baiting segment one			0.89 **
Aerial baiting segment two			1.60 **
Aerial baiting segment three			2.43 **
Intercept	4.70 **	3.11 *	1.07 **
R	0.61	0.76	0.81
Adjusted R^2	0.37	0.57	0.65
F-Test significance	<0.01	<0.01	<0.01

Notes: n = 918 for all equations. * Indicates statistically significant *t*-test, $p < 0.05$. ** Indicates statistically significant *t*-test, $p < 0.01$.

The regression results testing the link between respondents' involvement with ground (or aerial) baiting, their beliefs about 1080 and their involvement with reducing rat and possum populations are reported in Table 7. The involvement regressions were statistically significant. Respondents' beliefs about 1080 and their involvement with the outcome of reducing rat and possum populations explained a substantial proportion of the variance in respondents' involvement with ground and aerial baiting (hypotheses 3 and 4).

The regression results testing the link between the strength of respondents' attitudes towards ground (or aerial) baiting, their involvement with reducing rat and possum populations, their involvement with ground (or aerial) baiting and their beliefs about 1080 are reported in Table 8. Both attitude strength regressions were statistically significant, with a reasonable proportion of the variance in the strength of respondents' involvement with ground and aerial baiting explained by the independent variables (hypotheses 5 and 6).

Table 7. Parameter estimates for involvement with ground and aerial baiting.

	Involvement with Ground Baiting	Involvement with Aerial Baiting
Pest (outcome) involvement	0.35 **	0.36 **
1080 segment one	0.67 **	0.53 **
1080 segment two	0.27 **	0.25 **
1080 segment three	0.37 **	0.54 **
Intercept	1.76 **	1.72 **
R	0.58	0.59
Adjusted R^2	0.33	0.34
F-Test significance	<0.01	<0.01

Notes: n = 918 for both equations. ** Indicates statistically significant *t*-test, $p < 0.01$.

Table 8. Parameter estimates for strength of attitude towards ground and aerial baiting.

	Strength of Attitude towards Ground Baiting	Strength of Attitude towards Aerial Baiting
Pest involvement	0.29 **	0.15 **
Ground involvement	0.09	
Aerial involvement		−0.07
1080 segment one	−1.69 **	−0.77 **
1080 segment two	−1.94 **	−0.95 **
1080 segment three	−0.82 **	−0.43 **
Intercept	1.57 **	1.45 **
R	0.46	0.44
Adjusted R^2	0.21	0.19
F-Test significance	<0.01	<0.01

Notes: n = 918 for both equations. ** Indicates statistically significant *t*-test, $p < 0.01$.

Respondents' behavioural intentions were identified by asking, in the questionnaire, whether they felt a sense of responsibility for reducing rat and possum numbers, and whether they were willing to take action, make sacrifices and work with others to reduce rat and possum numbers. Respondents answered these questions using a five-point scale ranging from 'strongly agree' to 'strongly disagree'.

These attitudes were regressed (Table 9) against the explanatory variables: involvement with, attitude towards, and the personal relevance of, reducing rat and possum populations. Personal relevance was measured by binary variables indicating whether rats or possums were present on respondents' properties or in their area.

All regressions were statistically significant with the independent variables explaining a substantial proportion of the variance in the respondents' sense of responsibility and willingness to act, sacrifice, and work with others (hypotheses 7, 8, 9 and 10). The regressions predicting respondents' willingness to accept different ways of implementing aerial baiting with 1080 are reported in Table 10. We expected that willingness to accept alternative methods of aerial baiting would depend on their involvement with, and their attitude towards, reducing possum and rat populations, and their involvement with, and attitude towards, aerial and ground baiting. The results support this.

Lastly, we proposed that respondents' trapping behaviour would depend on their involvement with, and attitude towards, reducing rat and possum populations, and the personal relevance of the outcome as measured by the presence of rats and possums on respondents' properties or in their area. Regarding trapping behaviour, respondents were asked if they knew rats or possums were on their property or in their area, and if they trapped rats or possums. Respondents answered these questions with 'yes' or 'no'.

Both regressions were statistically significant and explained a substantial percentage of the variation in the respondents' trapping behaviour (Table 11). The trapping of rats depended on involvement with reducing rat numbers and the presence of rats on properties or in the area. The shooting or trapping of possums depended on the attitude towards reducing possum numbers, and their presence on the property or in the area.

Table 9. Coefficient estimates for personal responsibility, willingness to act, willingness to sacrifice and willingness to work together.

	Responsibility	**Willing to Act**	**Willing to Sacrifice**	**Willing to Work Together**
Pest involvement	0.65 **	0.55 **	0.64 **	0.37 **
Pest attitude	0.29 **	0.44 **	0.34 **	0.53 **
Pest on property	0.53 **	0.22 **	0.28 **	0.02
Pest in area	0.10 **	0.28 **	–0.03	0.07
Intercept	0.23	–0.21	–0.12	0.44
R	0.64	0.70	0.63	0.74
Adjusted R^2	0.41	0.49	0.40	0.54
F-Test significance	<0.01	<0.01	<0.01	<0.01

Notes: n = 918 for all equations. ** Indicates statistically significant *t*-test, $p < 0.01$.

Table 10. Parameter estimates for different modes of aerial baiting.

	Tolerate Every Few Years	**Tolerate Once-Off Aerial Baiting**	**Tolerate until a Replacement Is Found**	**Oppose Repeated Aerial Baiting**	**Oppose Completely**
Pest involvement	0.02	0.13 *	0.07	–0.02	–0.08
Pest attitude	0.08 *	0.07	0.11 **	–0.09 *	–0.17 **
Ground involvement	–0.03	0.10	–0.06	0.25 **	0.37 **
Ground attitude	0.13 **	0.15 **	0.13 **	–0.14 **	–0.21 **
Aerial involvement	0.19 **	0.12	0.27 **	0.20 **	0.08
Aerial attitude	0.71 **	0.49 **	0.66 **	–0.79 **	–0.76 **
Intercept	–0.36	–0.24	–0.51	4.83 **	5.29 **
R	0.84	0.66	0.81	0.78	0.80
Adjusted R^2	0.70	0.43	0.66	0.60	0.64
F-Test significance	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: n = 918 for all equations. * Indicates statistically significant *t*-test, $p < 0.05$. ** Indicates statistically significant *t*-test, $p < 0.01$.

Table 11. Parameter estimates for trapping and shooting.

	Possums (n = 454)	Rats (n = 464)
Pest involvement	0.01	0.09 **
Pest attitude	0.06 **	–0.04
Pest on property	0.46 **	0.35 **
Pest in area	0.11 **	0.22 **
Intercept	–0.26 **	–0.02 **
R	0.59	0.52
Adjusted R^2	0.34	0.27
F-Test significance	<0.01	<0.01

Notes: ** Indicates statistically significant *t*-test, $p < 0.01$.

4. Discussion

Kaine et al. [29] suggested that the willingness of individuals to support a policy measure depends on the strength of their involvement with the associated policy outcome and with the measure, as well as their attitude towards the measure. We have drawn on the reasoning underpinning that proposition to examine the relationships among people's relevant beliefs, attitudes, involvement, and support for a policy measure.

The results clearly show that support for policy outcomes and policy measures depends on involvement, as well as attitudes. For example, a sense of personal responsibility for reducing rat and possum populations depended on respondents' involvement with reducing rat and possum populations as well as their attitude towards these pests. This was also the case for their willingness to act, make sacrifices, and work with others, to reduce rat and possum populations. Respondents' support (or otherwise) for aerial baiting with 1080 depended to varying degrees on their involvement with, and attitude towards, reducing rat and possum populations and their involvement with, and attitude towards, ground and aerial baiting with 1080. While attitudes towards ground and aerial baiting depended on beliefs, the strength of respondents' attitudes depended, at least partly, on their involvement with reducing rat and possum populations.

These results signal the influential role that involvement plays in people's support for, and responses to, policy outcomes and the measures used to achieve those outcomes. This means that knowing the state of people's involvement with policy outcomes and measures, and its source when it is present, is fundamentally important in understanding the nature and extent of their support (or opposition) to outcomes and measures, and the degree to which these can be influenced, if at all. In other words, influencing the nature and extent of support for outcomes and measures depends on knowing how and to what degree the outcomes and measures are judged by people to contribute to, or detract from, their personal goals.

In the context considered here, respondents' involvement with reducing rat and possum populations was primarily driven by function, consequence and risk involvement [36]. That is, involvement was motivated by concerns for the damage these pests inflict on native plants, native birds and wildlife, gardens, and orchards, and (in the case of pos-sums) a concern to prevent bovine tuberculosis, and the potentially serious consequences of not controlling these pests. Their involvement with ground and aerial baiting with 1080, on the other hand, was mainly driven by consequences and risk, reflecting their concerns about the effectiveness and safety of 1080 with respect to people, pets, livestock, and native birds. This suggests that one strategy for improving support for the use of 1080 is to build functional involvement with, and more favourable attitudes towards, 1080 by promoting its effectiveness in reducing the harms done by rats and possums, and the potentially catastrophic consequences of uncontrolled growth in rat and possum populations.

This highlights the importance of involvement with the policy measures depending on involvement with the relevant policy outcomes: since involvement indicates the likely level of attention to promotional activity [24,56], boosting support for policy measures is problematic in the absence of involvement with policy outcomes.

Involvement, attitude and personal relevance contribute to explaining differences among respondents' intentions regarding feelings of personal responsibility and willingness to act, to make sacrifices and work with others. This underscores the importance of understanding that attitude alone is insufficient to motivate sustained support (or action) for a policy outcome. In the absence of moderate-to-high involvement, favourable attitudes are unlikely to translate into more than cursory support. Similarly, in the absence of moderate-to-high involvement, unfavourable attitudes are unlikely to translate into more than perfunctory opposition.

Distinguishing between high and low involvement provides, then, a foundation for making judgements about the scale and strength of support for, or opposition to, policy outcomes and measures, and formulating response strategies accordingly. Of course, if everyone has similar levels of involvement then involvement becomes inconsequential. In these circumstances, support is determined by differences in attitudes and behavioural constraints.

Our findings have several important general implications in relation to influencing support for, or responding to opposition to, pest control methods. The first is that people with low involvement in a policy outcome (suppressing or eliminating pest populations) and a policy measure (pest control method) may fail to notice important promotional messages about pests and pest control measures because they simply do not pay attention. When involvement with an outcome is low, sensitivity to promotional messages about the outcome is also very likely to be low. This is not to say promotional messages are deliberately ignored; they just fail to catch the attention of those with low involvement (i.e., they are not perceived). Popular suggestions in the literature around awareness-raising, education, and community participation to increase support for pest control [7,12,16,19,57–59] are likely of limited relevance for these people.

In the context of ground and aerial baiting with 1080, people with low-to-mild involvement with reducing rat and possum populations and with the use of 1080 may simply not notice, or fail to fully process, promotional messages about 1080. They may be entirely unaware of actions that are undertaken to reduce risks such as consulting with communities before baiting operations, the use of bait-free buffer corridors along waterways, and the development of deer repellent baits [46,60]. This increases the risk that people with low involvement may engage in perfunctory opposition, such as signing petitions, despite having little knowledge of, or strong views on, the use of 1080.

The second, related implication concerns the intrinsic pliability of the beliefs and attitudes that occurs when people have low involvement and so devote little time and effort to gathering information and forming beliefs and attitudes. 'The terms involvement and commitment are used almost interchangeably in the literature on attitude change' (p. 464, [61]) and highly involved people 'have a much narrower range of noncommitment and acceptance . . . [and] . . . are less susceptible to persuasion' (p. 458, [61]). This means the beliefs and attitudes of those with low involvement may be unstable and easily changed, though any change is unlikely to trigger changes in behaviour (see below).

This creates the potential for the distribution of misinformation to provoke undesirable changes in the beliefs and attitudes of people with low involvement with 1080 because they undermine support for its use, especially if this misinformation is linked to emotionally charged (and so potentially highly involving) topics for some people such as risks to children's health or cruelty to animals. However, people with low involvement are unlikely to strongly endorse misinformation, and so are unlikely to engage in behaviour that requires a significant investment of time and effort (such as attending rallies specific to 1080 poisoning), unless the misinformation is placed in a context they find highly involving. When it comes to investing resources in combating misinformation about pest control methods, authorities must be careful to discriminate between audiences on social media in terms of their involvement. Those with low involvement in ground or aerial baiting with 1080 may, for example, exhibit a lower engagement with misinformation on social media (such as less frequent and less extensive visits to relevant internet sites) than those with high involvement.

Another implication concerns the potential to influence the beliefs and attitudes of people who have high involvement with a subject. People who have high involvement with a subject are more likely to devote time and effort to gathering information about the subject, evaluating that information, and forming beliefs about, and attitudes towards, the subject. Consequently, their beliefs and attitudes, once formed, are stable and unlikely to change rapidly. These people may well resist educational efforts designed to persuade them to an alternate viewpoint [62–64]. Furthermore, while these people are the most likely to be participants in community group processes, their views and opinions are unlikely to be helpful in designing communications targeting the less involved [12,65].

With respect to 1080, a relatively high proportion of respondents with moderate-to-high involvement were unsure about the use of 1080 [36]. There is the potential that a sustained promotional program (through social and mass media) linking the use of 1080 to protecting and conserving native plants, birds, and wildlife may engender changes in the beliefs and attitudes of these people as they are less likely than people with strong attitudes to engage in motivated reasoning [62].

Another implication concerns the link between attitudes and intended actions for people who have low-to-mild (or even moderate) involvement with a subject. Such people are unlikely to act regarding the subject when that act requires a substantial commitment of time and effort. This means their willingness to express support for (or opposition to) a particular method of pest control is unlikely to extend beyond actions (such as signing petitions) that are quick, easy and convenient. Consequently, those responsible for pest management policies should be careful not to conclude that favourable (or unfavourable) attitudes necessarily translate into anything beyond passive support (or opposition): public commitment to positions on issues is not expected from people with low involvement with the issue. On the other hand, should a belief that the threat of child poisoning from 1080 is real trigger a public commitment to opposition, this may raise the individual's involvement [61] with the measure.

A related implication concerns involvement and the ethics of pest control in relation to both native and non-native pests [66–69]. Most respondents supported the suppression of rat and possum populations to avert economic and environmental damage. However, given the involvement of most participants with the suppression of rat and possum populations as a policy issue was moderate at best, most participants are likely to have invested limited time and effort in understanding the issue. This suggests that most respondents are unlikely to be aware of the debate over the validity of the distinction between native and non-native pests, and even less likely to be informed about the ethical implications of the validity or otherwise of the distinction. On the other hand, most respondents were ambivalent, at best, about the use of 1080 to suppress or eradicate rat and possum populations because they had concerns about its safety, effectiveness, and humaneness. This suggests that, irrespective of the validity of the distinction between native and non-native pests, most respondents are concerned about the ethics of using 1080 to control pests.

Our findings are subject to several qualifications including the following. First, the data used in this study were not collected for the express purpose of testing the propositions we derived from Kaine et al. [29]. Consequently, a variety of factors that may influence attitudes and behaviour (such as social norms, self-efficacy and others) which could be correlated with involvement were not included in the analysis where our principal focus was on the intervening role, between beliefs and attitudes, of involvement.

Second, there may be some selection bias as the sample was drawn from an internet panel and from telephone interviews. While the extent of this bias is unknown, it does seem reasonable to suppose, ceteris paribus, that people with low-to-mild involvement may be under-represented in the sample. Furthermore, while the results are based on an analysis of a relatively large sample of households, generalisations to the wider population must be treated with caution.

Third, the measures of personal rat and possum trapping behaviour were self-reported. There is the possibility that these measures may have been affected by social desirability bias.

Future research could include investigating associations between involvement and propensity to take actions of various kinds regarding support for pest management, as well as support for, and use of, different pest management techniques. The association between involvement and selective perception and motivated reasoning, and the implications of any associations for engaging with the public on pest management issues, could also be explored.

5. Conclusions

A prerequisite for the widespread use of pest control methods to conserve native flora and fauna is public support and, consequently, there is extensive literature on quantifying public attitudes towards, and consequent support for, pest control methods. Kaine et al. [29] proposed that the propensity of individuals to support policy measures, such as the application of particular methods of controlling non-native invasive pests, depends on the intensity of their involvement with, as well as their attitude towards, the measure. From this, a number of fundamental propositions concerning the relationship between beliefs, attitudes, involvement, and behaviour with respect to policy measures follow. We examined these using data on people's support, or otherwise, for using ground and aerial baiting with 1080 to reduce non-native rat and possum populations, and their propensity to trap rats and possums. Generally, the propositions were well-supported by the results and the dangers highlighted for public policy interventions founded on implicit assumptions of uniformly high involvement of targeted people.

These findings have several important implications for the regulation of pest control methods, and for the effectiveness of awareness-raising campaigns and educational programs intended to build support for pest control and pest control methods. These implications can be expected to apply to public policy initiatives across the conservation spectrum that require positive public responses for their effectiveness.

With respect to promoting the use of 1080 in New Zealand, the results highlight the importance of distinguishing between people's attitudes towards 1080, their involvement with reducing rat and possum populations, and with the idea of using 1080, and tailoring promotional strategies appropriately. The results also highlight the importance of distinguishing between those with low and high involvement in considering the possible effects on the support of the dissemination of misinformation through social media.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/conservation2040038/s1, File S1: Questionnaire; File S2: Data.

Author Contributions: Conceptualization, G.K. and V.W.; methodology, G.K. and V.W.; validation, G.K. and V.W.; formal analysis, G.K. and V.W.; resources, G.K. and V.W.; data curation, G.K.; writing—original draft preparation, G.K. and V.W.; writing—review and editing, G.K. and V.W.; project administration, G.K. and V.W.; funding acquisition, G.K. All authors have read and agreed to the published version of the manuscript.

Funding: The research on which this article is based was funded by Operational Solutions for Primary Industries (OSPRI) and Te Papa Atawhai—Department of Conservation, New Zealand.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved through the social ethics process of Manaaki Whenua Landcare Research (Application: 1920/04 and 13/08/2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available in Supplementary File S2.

Acknowledgments: We would sincerely like to thank those householders who completed the questionnaire. We would also thank our colleagues Robyn Kannemeyer and Dean Stronge for their contributions to the research on which this paper is based.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

1. Kareiva, P.; Marvier, M. What Is Conservation Science? *BioScience* **2012**, *62*, 962–969. [CrossRef]
2. Crowley, S.L.; Hinchliffe, S.; McDonald, R.A. Conflict in invasive species management. *Front. Ecol. Environ.* **2017**, *15*, 133–141. [CrossRef]
3. Subroy, V.; Rogers, A.A.; Kragt, M.E. To bait or not to bait: A discrete choice experiment on public preferences for native wildlife and conservation management in Western Australia. *Ecol. Econ.* **2018**, *147*, 114–122. [CrossRef]
4. Ferreira-Rodríguez, N.; Pavel, A.B.; Cogălniceanu, D. Integrating expert opinion and traditional ecological knowledge in invasive alien species management: Corbicula in Eastern Europe as a model. *Biol. Invasions* **2021**, *23*, 1087–1099. [CrossRef]
5. Loss, S.R.; Boughton, B.; Cady, S.M.; Londe, D.W.; McKinney, C.; O'Connell, T.J.; Riggs, G.J.; Robertson, E.P. Review and synthesis of the global literature on domestic cat impacts on wildlife. *J. Anim. Ecol.* **2022**, *91*, 1361–1372. [CrossRef]
6. Marshall, G.R.; Coleman, M.J.; Sindel, B.M.; Reeve, I.J.; Berney, P.J. Collective action in invasive species control, and prospects for community-based governance: The case of serrated tussock (*Nassella trichotoma*) in New South Wales, Australia. *Land Use Policy* **2016**, *56*, 100–111. [CrossRef]
7. Slagle, K.; Bruskotter, J.T.; Singh, A.S.; Schmidt, R.H. Attitudes toward predator control in the United States: 1995 and 2014. *J. Mammal.* **2017**, *98*, 7–16. [CrossRef]
8. Chand, R.R.; Cridge, B.J. Upscaling Pest Management From Parks to Countries: A New Zealand Case Study. *J. Integr. Pest Manag.* **2020**, *11*, 8. [CrossRef]
9. Klapwijk, M.J.; Hopkins, A.J.M.; Eriksson, L.; Pettersson, M.; Schroeder, M.; Lindelöw, Å.; Rönnberg, J.; Keskitalo, E.C.H.; Kenis, M. Reducing the risk of invasive forest pests and pathogens: Combining legislation, targeted management and public awareness. *Ambio* **2016**, *45*, 223–234. [CrossRef]

10. Parsons, M.H.; Banks, P.B.; Deutsch, M.A.; Corrigan, R.F.; Munshi-South, J. Trends in urban rat ecology: A framework to define the prevailing knowledge gaps and incentives for academia, pest management professionals (PMPs) and public health agencies to participate. *J. Urban Ecol.* **2017**, *3*. [CrossRef]
11. Aley, J.P.; Milfont, T.L.; Russell, J.C. The pest-management attitude (PMA) scale: A unidimensional and versatile assessment tool. *Wildl. Res.* **2020**, *47*, 166–176. [CrossRef]
12. McLeod, L.J.; Hine, D.W. Using Audience Segmentation to Understand Nonparticipation in Invasive Mammal Management in Australia. *Environ. Manag.* **2019**, *64*, 213–229. [CrossRef] [PubMed]
13. *Fitzgerald G Public Attitudes to Current and Proposed Forms of Pest Animal Control*; Invasive Animals Cooperative Research Centre: Canberra, Australia, 2009.
14. Russell, J. A comparison of attitudes towards introduced wildlife in New Zealand in 1994 and 2012. *J. R. Soc. New Zealand* **2014**, *44*, 136–151. [CrossRef]
15. Niemiec, R.M.; Pech, R.P.; Norbury, G.L.; Byrom, A.E. Landowners' Perspectives on Coordinated, Landscape-Level Invasive Species Control: The Role of Social and Ecological Context. *Environ. Manag.* **2017**, *59*, 477–489. [CrossRef]
16. Goldson, S.; Bourdôt, G.; Brockerhoff, E.G.; Byrom, A.; Clout, M.; McGlone, M.; Nelson, W.; Popay, A.; Suckling, D.; Templeton, M. New Zealand pest management: Current and future challenges. *J. R. Soc. New Zealand* **2015**, *45*, 31–58. [CrossRef]
17. McLeod, L.J.; Hine, D.W.; Please, P.M.; Driver, A.B. Applying behavioral theories to invasive animal management: Towards an integrated framework. *J. Environ. Manag.* **2015**, *161*, 63–71. [CrossRef] [PubMed]
18. van Eeden, L.M.; Newsome, T.; Crowther, M.; Dickman, C.; Bruskotter, J. Social identity shapes support for management of wildlife and pests. *Biol. Conserv.* **2019**, *231*, 167–173. [CrossRef]
19. Fraser, A. *Public Attitudes to Pest Control: A Literature Review*; DOC Research & Development Series 227; Science & Technical Publishing; Department of Conservation: Wellington, New Zealand, 2006.
20. Fitzgerald, G.P.; Fitzgerald, N.P.; Davidson, C. *Public Attitudes Towards Invasive Animals and Their Impacts*; Invasive Animals Cooperative Research Centre: Canberra, Australia, 2007.
21. Kannemeyer, R. *A Systematic Literature Review of Attitudes to Pest Control Methods in New Zealand, LCR2789*; Manaaki Whenua Landcare Research: Lincoln, New Zealand, 2017.
22. Schwarzer, R. (Ed.) Self-Efficacy in the Adoption and Maintenance of Health Behaviors: Theoretical Approaches and a New Model. In *Self-efficacy: Thought Control of Action*; Hemisphere: Washington, DC, USA, 1992; pp. 217–243.
23. Witte, K. Putting fear back into fear appeals: The extended parallel process model. *Commun. Monogr.* **1992**, *59*, 329–349. [CrossRef]
24. Petty, R.E.; Cacioppo, J.T. The Effects of Involvement on Responses to Argument Quantity and Quality: Central and Peripheral Routes to Persuasion. *J. Pers. Soc. Psychol.* **1984**, *46*, 69–81. [CrossRef]
25. Ajzen, I.; Fishbein, M. Attitude-behaviour relations: A theoretical analysis and review of empirical research. *Psychol. Bull.* **1977**, *84*, 888–918. [CrossRef]
26. Bandura, A. Self-efficacy: Toward a unifying theory of behavioural change. *Psychol. Rev.* **1977**, *84*, 191–215. [CrossRef] [PubMed]
27. Kerlinger, F.N. *Foundations of Behavioral Research*, 2nd ed.; Holt, Rinehart and Winston: New York, NY, USA, 1973.
28. Priluck, R.; Till, B.D. The Role of Contingency Awareness, Involvement and Need for Cognition in Attitude Formation. *J. Acad. Mark. Sci.* **2004**, *32*, 329–344. [CrossRef]
29. Kaine, G.; Murdoch, H.; Lourey, R.; Bewsell, D. A framework for understanding individual response to regulation. *Food Policy* **2010**, *35*, 531–537. [CrossRef]
30. Davies, A.; Kaine, G.; Lourey, R. Understanding factors leading to non-compliance with effluent regulations by dairy farmers. In *Environment Waikato Technical Report 2007/37*; Environment Waikato: Hamilton, New Zealand, 2007.
31. Kaine, G.; Tostovrsnik, N. Landholders and the management of weeds: Blackberry and serrated tussock. In *Service Design Research Working Paper 03-11*; Department of Primary Industries: Tatura, Victoria, 2011.
32. Lourey, R.; Kaine, G.; Davies, A.; Young, J. Landholder responses to incentives for wild dog control. In *Service Design Research Working Paper 07-11*; Department of Primary Industries: Tatura, Victoria, 2011.
33. Kaine, G. An application of the I3 framework to rat control in Hawke's Bay. In *Manaaki Whenua Landcare Research Report LC3646*; Lincoln, New Zealand, 2019; Available online: https://www.researchgate.net/publication/344730926_An_application_of_the_I_3_framework_to_rat_control_in_Hawke's_Bay (accessed on 24 August 2022).
34. Kaine, G.; Kirk, N.; Kannemeyer, R.; Stronge, D.; Wiercinski, B. Predicting People's Motivation to Engage in Urban Possum Control. *Conservation* **2021**, *1*, 16. [CrossRef]
35. Kaine, G.; Stronge, D. An application of the I3 framework to rat control in New Plymouth. In *Manaaki Whenua Landcare Research Report LC3734*; Lincoln, New Zealand, 2020; Available online: https://www.researchgate.net/publication/344730675_An_application_of_the_I_3_framework_to_rat_control_in_New_Plymouth (accessed on 24 August 2022).

36. Kaine, G.; Kannemeyer, R.; Stronge, D. Using 1080 to control possums and rats: An application of the I3 framework. In *Manaaki Whenua Landcare Research Report LC3747*; Manaaki Whenua Press: Lincoln, New Zealand, 2020.
37. Kaine, G.; Greenhalgh, S.; Wright, V. Compliance with COVID-19 measures: Evidence from New Zealand. *PLoS ONE* **2022**, *17*, e0263376. [CrossRef]
38. Bewsell, D.; Bigsby, H.; Cullen, R. Using involvement to understand individual responses to an issue: The case of New Zealand biosecurity. *New Zealand J. Agric. Res.* **2011**, *55*, 73–88. [CrossRef]
39. Bewsell, D.; Brown, M. Involvement: A novel approach for understanding responses to nutrient budgeting. *New Zealand J. Agric. Res.* **2011**, *54*, 45–52. [CrossRef]
40. Daigle, J.J.; Straub, C.L.; E Leahy, J.; De Urioste-Stone, S.M.; Ranco, D.J.; Siegert, N.W. How Campers' Beliefs about Forest Pests Affect Firewood Transport Behavior: An Application of Involvement Theory. *For. Sci.* **2018**, *65*, 363–372. [CrossRef]
41. Howlett, M. The criteria for effective policy design: Character and context in policy instrument choice. *J. Asian Public Policy* **2017**, *11*, 245–266. [CrossRef]
42. Rogers, R.W. A protection motivation theory of fear appeals and attitude change. *J. Psychol.* **1975**, *91*, 93–114. [CrossRef]
43. Department of Conservation (DOC). *Towards a Predator free New Zealand: Predator Free 2050 Strategy*; Department of Conservation: Wellington, New Zealand, 2020.
44. Russell, J.; Innes, J.G.; Brown, P.H.; Byrom, A.E. Predator-Free New Zealand: Conservation Country. *BioScience* **2015**, *65*, 520–525. [CrossRef] [PubMed]
45. Peltzer, D.A.; Bellingham, P.J.; Dickie, I.A.; Houliston, G.; Hulme, P.E.; Lyver, P.O.; McGlone, M.; Richardson, S.J.; Wood, J. Scale and complexity implications of making New Zealand predator-free by 2050. *J. R. Soc. New Zealand* **2019**, *49*, 412–439. [CrossRef]
46. Green, W.; Rohan, M. Opposition to aerial 1080 poisoning for control of invasive mammals in New Zealand: Risk perceptions and agency responses. *J. R. Soc. New Zealand* **2012**, *42*, 185–213. [CrossRef]
47. Kaine, G. A pilot application of the I3 framework to compliance behaviour in farming. In *Landcare Research Contract Report LC3513*; Manaaki Whenua Press: Hamilton, New Zealand, 2019.
48. Laurent, G.; Kapferer, J.N. Measuring consumer involvement profiles. *J. Mark. Res.* **1985**, *22*, 41–53. [CrossRef]
49. Olsen, S.O. Strength and conflicting valence in measurement of food attitudes and preferences. *Food Qual. Prefer.* **1999**, *10*, 483–494. [CrossRef]
50. Fraser, W. *Introduced Wildlife in New Zealand: A Survey of General Public Views*; Landcare Research Science Series No. 23; Manaaki Whenua Press: Lincoln, New Zealand, 2001.
51. Hughey, K.F.D.; Kerr, G.N.; Cullen, R. *Public Perceptions of New Zealand's Environment*; EOS Ecology: Christchurch, New Zealand, 2019.
52. Aldenderfer, M.S.; Blashfield, R.K. *Cluster Analysis*; Sage: Newbury Park, CA, USA, 1984.
53. IBM Corp. *IBM SPSS Statistics for Windows, version 27.0*; IBM Corp: Armonk, NY, USA, 2020.
54. Carmines, E.G.; Zeller, R.A. *Reliability and Validity Assessment*; Sage: Newbury Park, CA, USA, 1979.
55. Tukey, J. Comparing Individual Means in the Analysis of Variance. *Biometrics* **1949**, *5*, 99–114. [CrossRef]
56. Chaffee, S.H.; Roser, C. Involvement and the consistency of knowledge, attitudes, and behaviours. *Commun. Res.* **1986**, *13*, 373–399. [CrossRef]
57. Bremner, A.; Park, K. Public attitudes to the management of invasive non-native species in Scotland. *Biol. Conserv.* **2007**, *139*, 306–314. [CrossRef]
58. Niemiec, R.M.; Ardoin, N.M.; Wharton, C.B.; Asner, G.P. Motivating residents to combat invasive species on private lands: Social norms and community reciprocity. *Ecol. Soc.* **2016**, *21*, 30. [CrossRef]
59. Dunn, M.; Marzano, M.; Forster, J.; Gill, R.M. Public attitudes towards "pest" management: Perceptions on squirrel management strategies in the UK. *Biol. Conserv.* **2018**, *222*, 52–63. [CrossRef]
60. Warburton, B.; Livingstone, P. Managing and eradicating wildlife tuberculosis in New Zealand. *New Zealand Veter- J.* **2015**, *63* (Suppl. S1), 77–88. [CrossRef] [PubMed]
61. Britt, S.H. *Psychological Principles of Marketing and Consumer Behavior*; Lexington Books: Lexington, MA, USA, 1978.
62. Kunda, Z. The case for motivated reasoning. *Psychol. Bull.* **1990**, *108*, 480–498. [CrossRef] [PubMed]
63. Hornsey, M.J.; Harris, E.A.; Fielding, K.S. The psychological roots of anti-vaccination attitudes: A 24-nation investigation. *Health Psychol.* **2018**, *37*, 307–315. [CrossRef]
64. Zimmermann, F. The Dynamics of Motivated Beliefs. *Am. Econ. Rev.* **2020**, *110*, 337–363. [CrossRef]
65. Fitzgerald, G.; Wilkinson, R.; Saunders, L. Public Perceptions and Issues in Possum Control. In *The Brushtail Possum: Biology, impact and management of an introduced marsupial*; Monatgue, T.L., Ed.; Manaaki Whenua Press: Lincoln, New Zealand, 2000.
66. Sagoff, M. Do non-native species threaten the natural environment? *J. Agric. Environ. Ethics* **2005**, *18*, 215–236. [CrossRef]

67. Simberloff, D. Nature, natives, nativism, and management: Worldviews underlying controversies in invasion biology. *Environ. Ethics* **2012**, *34*, 5–25. [CrossRef]
68. Morris, M.C. Predator Free New Zealand and the 'War'on Pests: Is it a just War? *J. Agric. Environ. Ethics* **2020**, *33*, 93–110. [CrossRef]
69. Morris, M.C. Primary school education resources on conservation in New Zealand over-emphasise killing of non-native mammals. *Aust. J. Environ. Educ.* **2022**, *38*, 168–177. [CrossRef]