Social acceptability of stoats and stoat control methods

A survey of the New Zealand public

SCIENCE FOR CONSERVATION 253

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Published by
Department of Conservation
PO Box 10–420
Wellington, New Zealand

Cover: Dean Caskey from DOC Stratford Area Office, showing Taranaki Kiwi Trust Chairman Barry Hartley (centre) and Wanganui TSO Nic Peet (right) one of the new stoat traps being placed around Mount Taranaki as part of a major stoat-trapping operation, Egmont National Park, October 2003. *Photo: Ross Henderson.*

Science for Conservation is a scientific monograph series presenting research funded by New Zealand Department of Conservation (DOC). Manuscripts are internally and externally peer-reviewed; resulting publications are considered part of the formal international scientific literature.
Individual copies are printed, and are also available from the departmental website in pdf form. Titles are listed in our catalogue on the website, refer www.doc.govt.nz under Publications, then Science and research.

ISSN 1173–2946
ISBN 0–478–14016–9

This report was prepared for publication by Science & Technical Publishing Section; editing by Helen O'Leary and layout by Lynette Clelland. Publication was approved by the Chief Scientist (Research, Development & Improvement Division), Department of Conservation, Wellington, New Zealand.

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A B S T R A C T

The Department of Conservation's stoat research programme has included studies to determine New Zealanders' perceptions of stoats (*Mustela erminea*) and attitudes to current and potential stoat control methods. Following on from earlier qualitative research in 2001, a telephone survey of a representative random sample of 1002 members of the public was conducted between March and June 2002 to assess attitudes to conservation, stoats, current stoat control methods, and possible biological control methods. The survey found that there is widespread support for controlling stoats. There is also widespread support for improving stoat control methods. In practice, this support extends only to researching and developing trapping, with an emphasis on fatal forms of trapping. The public is clearly uncomfortable with using poisons to control stoats. In terms of biological control methods, the public does not support the use of diseases that could affect other animals, and there is clear opposition to the use of a virulent strain of the canine distemper virus. New forms of control designed to reduce the stoat's fertility are only marginally acceptable. The public is less supportive of the practical use of genetic engineering of organisms to develop and / or deliver fertility control. The level of public support for existing and new forms of stoat control is likely to be determined by the specificity, humaneness, and effectiveness of the control, with cost a relatively minor consideration. The New Zealand public, at this time, is unlikely to support the development of biological control methods for stoats, including methods that make use of genetic engineering. This study indicates that the most socially acceptable option for researchers and decision-makers would be to focus stoat control development on trapping.

Keywords: stoats, *Mustela erminea*, stoat control, public attitudes, perceptions, biological control, genetic engineering, genetic modification, social research, survey, kiwi, New Zealand

Fitzgerald, G.; Fitzgerald, N.; Wilkinson, R. 2005: Social acceptability of stoats and stoat control methods: a survey of the New Zealand public. *Science for Conservation 253*. 40 p.

1. Introduction

1.1 BACKGROUND

Because of continuing concerns about the impact of feral stoats (*Mustela erminea*) on the nation's biodiversity, especially its avifauna, the New Zealand Government created, in 1999, a special five-year fund for research into the control of stoats. The overall programme focused on improving understanding of stoat biology and behaviour, and on developing control methods. Investigations were initiated into better traps and trapping methods, better poisons and lures, and new forms of control, such as biological control[1]. Under consideration as biological control methods were diseases such as canine distemper virus, potential mustelid-specific diseases, and possible techniques for controlling the fertility of stoats which could require the genetic modification or 'engineering' of organisms for use in biological control. The results of these technical investigations have been summarised in the annual reports of the Department of Conservation's (DOC's) stoat research programme (DOC 2000a, b, 2001, 2002; Murphy & Fechney 2003).

In addition to being technically feasible, public support for the development of new biologically-based stoat control methods was felt to be necessary for such controls to be realistic. This support was felt to be critical, given the heated public debate over the genetic modification of organisms and the various applications of such organisms. To ascertain the nature of public understanding of and views towards stoats and stoat controls, a two-step programme of social research was commissioned by DOC.

The results of the first round of this work (i.e. qualitative research to assess the range of views held by stakeholder groups and the public) have been published (Fitzgerald et al. 2002). This report presents the findings from the second phase of the research—a questionnaire survey of the New Zealand public.

1.2 APPROACH

Previous research by the authors on public attitudes to environmental pest control technologies, including potential biological control technologies for rabbits and possums, indicated that the range of views of stakeholders and the public needed to be understood, as well as how widely the views were held (Fitzgerald et al. 1996; Wilkinson & Fitzgerald 1998, 2002). In this earlier work, qualitative research methods proved valuable in identifying and describing the range of views about environmental pests, their control, and the potential use of new biological control techniques, including the use of genetic engineering. The extent to which the views were held was gauged using quantitative sample surveys, with their design being based on the findings of the qualitative research.

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[1] Biological control is the control of pests and weeds by other living organisms, such as predators, parasites, disease-carrying bacteria or viruses. In biological control, one organism ('a vector', such as a parasite) may be used to carry another (such as a disease virus) to the target pest.

Taking the authors' earlier approach as a tested model, focus groups were used to identify and explore the range of views about stoats and various current and potential approaches to stoat control. While valuable in their own right, the findings from these focus groups also provided a strong foundation for the development of the quantitative research intended to assess New Zealanders' understanding of the stoat problem, and how widely the various views on their control were held. As previously, this involved the design and implementation of a structured sample survey of the New Zealand public.

2. Methodology

The survey covered a final random sample of 1002 adult New Zealanders and was conducted by telephone. It was geographically stratified so that every household in New Zealand that was listed in a New Zealand Telecom telephone directory in 2002 had a theoretically equal chance of selection.

2.1 SURVEY DESIGN AND IMPLEMENTATION

In addition to being informed by the results of the focus groups conducted in May and June 2001 (see Fitzgerald et al. 2002), the design of the questionnaire was shaped by the need to assess the public's understanding of stoats and their role as an environmental threat, as well as a need to quantify the acceptability of a range of current and potential stoat control methods. These potential control methods included biological controls that could utilise modified / engineered organisms. Learning from our earlier surveys, the questions on the control methods included descriptions of each technology and its effect to ensure that the respondents understood something of the stoat control methods they were being asked about. Thus, where in the 1994 survey on possum control we had simply asked about the acceptability of 'trapping', in the current survey on stoats we described how the stoat was trapped and how it died. Previous experience indicated that assessment of the acceptability of any application of genetic engineering (GE) in pest controls and their development required several questions. In this case, as well as asking about the acceptability of various uses of GE in stoat control, we covered GE use in questions about kiwi protection, stoat control methods, and the required features of a stoat control method.

All but two of the questions in the final questionnaire were closed-ended and pre-coded. The draft questionnaire was subjected to two rounds of field pre-testing, including debriefing of the pilot respondents on the wording and interpretation of the questions and on the answers provided, to arrive at the final questionnaire. The questionnaire is reproduced in full in Appendix 1.

We recruited and trained a team of 17 interviewers, ten of whom had worked on previous similar surveys. The telephone interviews were carried out during evenings (1830 to 2130 hours) and in the daytime on weekends between the third week of March and the first week of June, 2002. Each interview took an average of 15 minutes to complete. Coding, data entry, and analysis were carried out by the members of the research team.

2.2 SAMPLE FRAME AND RESPONSE

The sample frame consisted of all New Zealanders aged 18 years and over living in households with a telephone number listed in the published Telecom telephone books that were current in February 2002. Census data for 2001 shows that 96.3% of all New Zealand households had access to a telephone (Statistics New Zealand 2002). The sample frame excluded listed businesses, cellular phone numbers, people living in households with unlisted telephone numbers, and people in households without telephones. A two-stage sampling method was applied to arrive at the sample:

- A random selection of qualifying households, with the sample stratified according to the number of qualifying households in each region (telephone book area).
- A random selection of individuals within the selected households made on the basis of birthday (i.e. the person who normally lived in the household aged 18 years and over who had the most recent birthday) once telephone contact had been made.

In drawing the numbers for the stratified household sample, allowance was made for changed numbers or disconnections, no answers, and refusals. In the case of no answers, up to two further attempts at contact were made by the interviewer. Where the target individual was unavailable, up to two further attempts were made to contact the particular person, and wherever possible, appointments were made for call-backs.

Just over 3600 numbers were dialled, resulting in 2140 contacts, of which 47% were successfully interviewed. This response rate (the number of successful interviews as a proportion of the contacts with the targeted individuals) compares well with similar previous surveys on possum and rabbit biocontrol in 1994, 1996, and 2001 which had response rates of 45%, 39% and 37% respectively (Fitzgerald et al. 1996; Wilkinson & Fitzgerald 1998, 2002).

2.3 ANALYSIS

Although many of the measurement scales used in the survey could be considered interval scales (in that the points on the scale are equidistant numbers, and only the end points are labelled), the distribution of responses often departed substantially from the normal distribution assumed by parametric statistics. Consequently, we have tended to report non-parametric statistics, in particular the Spearman rank order correlation coefficient (r_s), the Mann-Whitney U, and the the Kruskal-Wallis H tests, each of which is based on the analysis of ranks. Levels of statistical significance were generally set at the 1.0% level ($P < 0.01$) or below, which reduces the chance of spurious results when large numbers of statistical tests are undertaken. Chi-square tests (2-tailed) are also used to test the independence of pairs of categorical (non-numeric) variables. The 95% confidence interval for the estimates of the percentage of respondents quoted in this report is ± 3%. This interval is commonly called the 'margin of error'. It holds for a sample of 1002 respondents, and for estimates of between 20% and 80%. (For estimates of 6%–19% and 81%–94% it is ± 2%; and for estimates of 1%–5% and 95%–99% it is ±1%).

3. The survey sample and its characteristics

3.1 SEX AND AGE

Of the 1002 survey respondents, 52% were female and 48% male. The ratio of males to females was fairly consistent across the age groups. Compared with the population recorded in the New Zealand Census of Population and Dwellings in 2001, those in the 20- to 29-year age bracket were noticeably under-represented in the sample (Fig. 1). The lower respondent numbers in this group were made up by the 40 and over age groups, which were over-represented. The 18- to 19-year-olds were also under-represented, though they make up only a small proportion of the New Zealand population.

The patterns in the age and sex of the sample are similar to those found in comparable past studies conducted by the authors (e.g. Wilkinson & Fitzgerald 1998), and possibly reflect the residential arrangements of younger people which are manifested in the public listings in New Zealand telephone books from which the sample was drawn.

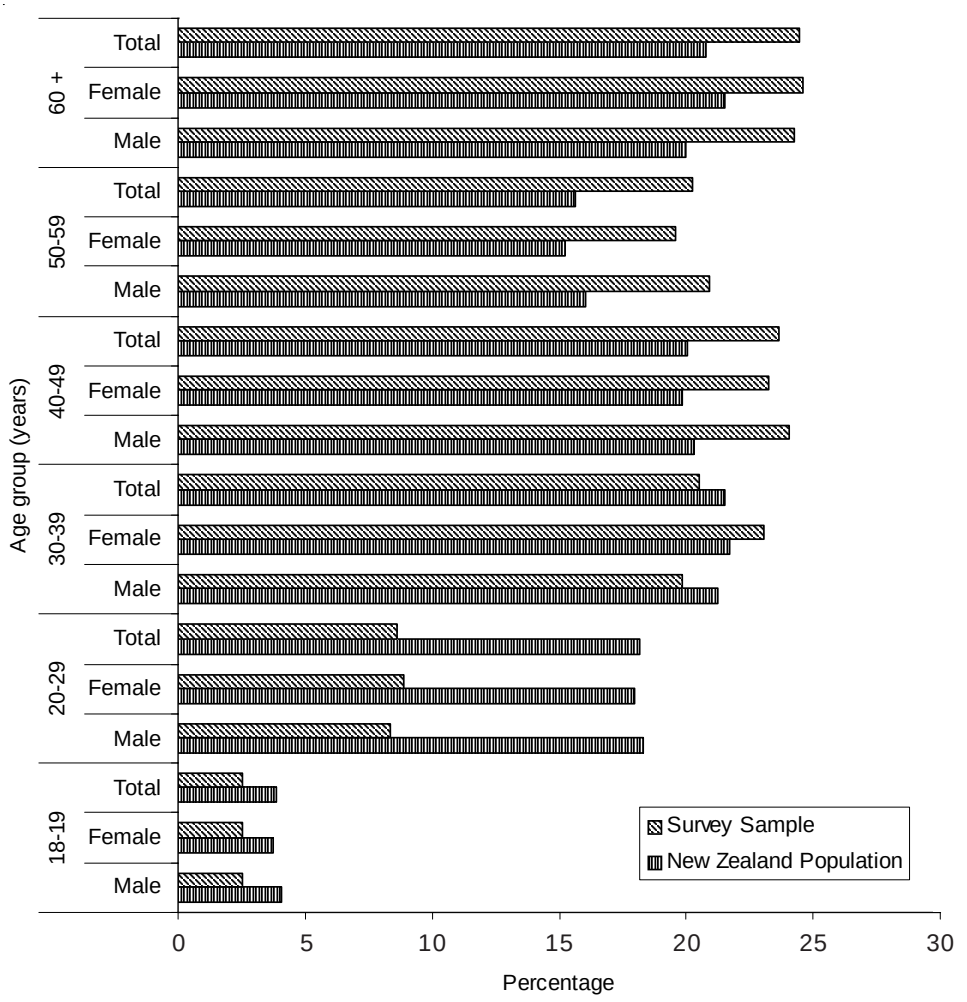

Figure 1. Age and sex characteristics of the sample compared with the New Zealand population 2001 (source: Statistics New Zealand 2002).

3.2 EDUCATIONAL QUALIFICATIONS

Figure 2 shows the highest educational qualifications of the sample group relative to the New Zealand population in 2001. Those with no school qualification were under-represented in the sample (12% cf. 24% for the New Zealand population), and those with either a vocational qualification, diploma or university degree were over-represented (52% cf. 30%). A much lower proportion of the sample fell into the 'not elsewhere included' category relative to the New Zealand population in the 2001 census (2% cf. 14%).

3.3 RESIDENCE

Classification of a survey respondent as a rural or urban resident was determined by the respondent. Sixty-six percent classified themselves as urban residents and 33% as rural, with 1% undecided or declining to answer. A similar study conducted by the researchers, which measured rural / urban belonging in the same way (Wilkinson & Fitzgerald 1998), found that 71% of the respondents classified themselves as urban and 29% as rural. Because residence was classified according to the perceptions of the participant, meaningful comparisons with national statistics are not possible.

3.4 OCCUPATIONS

Seventy-three percent of the survey respondents were in the labour force. Figure 3 depicts the occupational distribution of these working participants relative to that for the New Zealand population in 2001. The sample shows an over-representation of those in the professional, technical and associate professionals group, the trades workers group, and particularly agriculture and

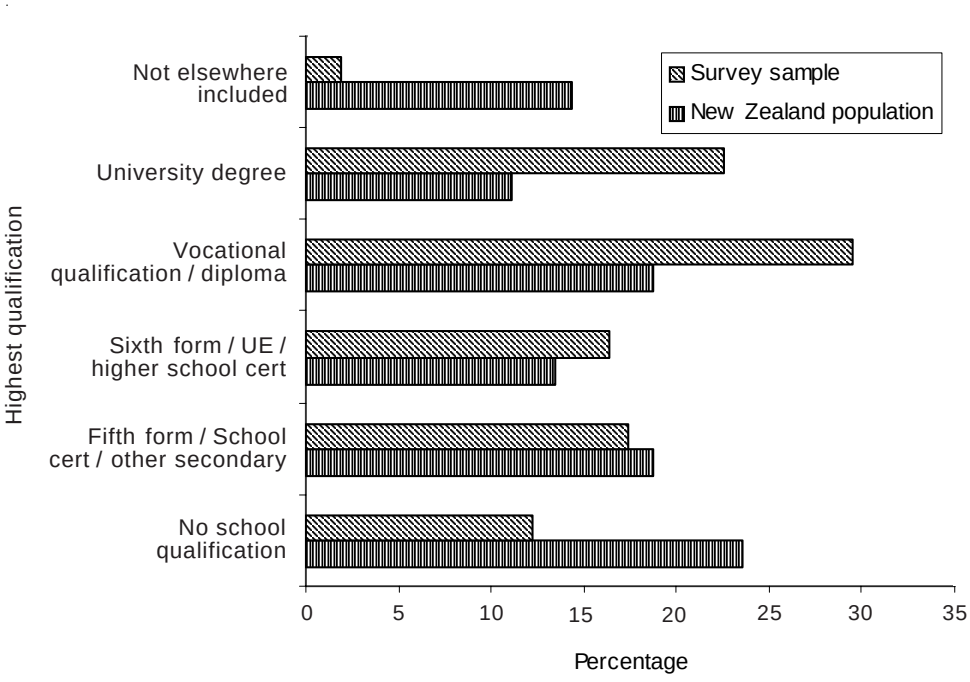

Figure 2. Highest educational qualifications of the sample compared with the New Zealand population, 2001 (source: Statistics New Zealand 2002).

fishery workers. Some pink-collar workers (clerical, service and sales), and blue-collar workers (plant & machine operators and assemblers) are under-represented. Twenty-seven percent of the respondents were not in the labour force, being students, retired, homemakers, or unemployed. This compares with the 39% of the New Zealand population aged 18 and over who were not in the workforce in 2001.

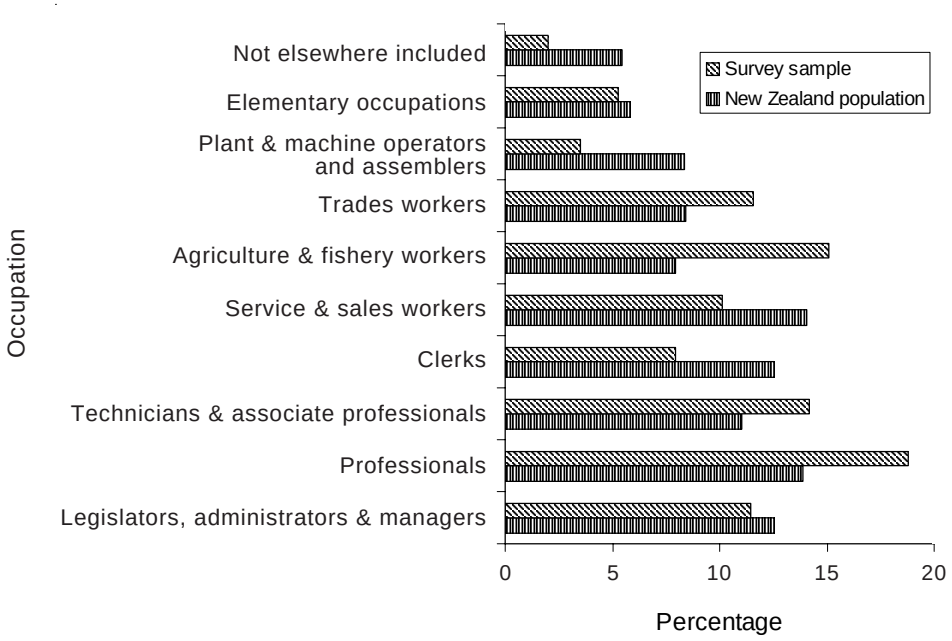

Figure 3. Occupational characteristics of the sample compared with the New Zealand population, 2001 (source: Statistics New Zealand 2002).

3.5 MEMBERSHIP OF ENVIRONMENTAL AND ANIMAL WELFARE ORGANISATIONS

Of the 996 respondents who completed this question, 17% were members of an environmental group, an animal welfare group or both. Three percent reported belonging to an animal welfare and an environmental group, 9% to only an environmental group, and 5% to an animal welfare group only.

As with previous studies (Wilkinson & Fitzgerald 1998), twice as many females as males reported belonging to an animal welfare group (11% of females cf. 6% of males). However, membership of an environmental group was more evenly balanced (13% of females cf. 12% of males). There was little difference in membership in either type of organisation between rural and urban respondents. In terms of age group, a relatively low percentage of those in their twenties belonged to either an animal welfare group or environmental group (5% and 7% respectively), while those aged 30 years and over tended to have higher rates of membership. Most noticeable was the relatively high rate of membership of animal welfare groups (12%) among those aged 60 and over.

In terms of education, environmental group membership was relatively high among university degree holders (24%) and relatively low among those with either no qualification or school certificate only (7% and 6% respectively). Animal welfare group membership, while low overall, was higher among those with diplomas or equivalent qualifications (11%) than those with school certificate only (7%).

In terms of occupation, students recorded the highest rate of membership in environmental groups (28%), while homemakers and blue-collar workers had the lowest rates of membership. Consistent with the age-related membership, retirees had the highest rate of membership of animal welfare groups, while those in service or sales, or plant and machinery operation and assembly reported the lowest membership.

The respondents in this survey were slightly less likely to be members of animal welfare or environmental organisations than those in similar previous surveys (Fitzgerald et al. 1996; Wilkinson & Fitzgerald 1998).

3.6 FERRET AND DOG OWNERSHIP

Respondents were asked if they currently owned or had ever owned a dog or a ferret. Only five respondents (0.5%) reported currently owning a ferret, but 42 respondents (4% overall) reported having owned a ferret in the past but did not have one at the time of the survey. Thirty-six percent of the respondents reported owning a dog at the time of the survey, and a further 40% had owned a dog in the past but did not have one at the time of the survey.

Rural respondents had a much higher likelihood of past or present dog ownership than urban respondents (86% of rural respondents cf. 67% of urban respondents). With regard to past or present ferret ownership, there was little difference between rural and urban residents (6% cf. 4% respectively). Such animal ownership was generally independent of age. Respondents over 60 years old were twice as likely as all others in the sample to have owned a ferret. Past or present owners of ferrets or dogs had no obvious difference in their level of membership of an animal welfare group when compared with non-owners.

4. Attitudes to native birds and conservation

4.1 ATTITUDES TO THE ENVIRONMENT AND CONSERVATION

Using a five-point scale ranging from 'strongly disagree' to 'strongly agree', survey respondents were asked the extent to which they agreed or disagreed with nine attitudinal statements about the environment, conservation and kiwi protection. Respondents were also given the option of a 'don't know' answer (see Appendix 1).

The scores for these attitudinal items (Table 1) show that respondents had strong feelings about the importance and the protection of New Zealand's native birds, especially kiwi, with over 90% of respondents agreeing (by scoring '4' or '5' on the scale) that the kiwi 'is an essential part of New Zealand's identity' and that 'kiwi are an endangered species in New Zealand', 85%

agreeing that 'New Zealand needs to protect its remaining native birds no matter what it costs', and 76% agreeing that 'New Zealand needs to be able to show tourists live kiwi'. The agreement that New Zealand needs to invest in kiwi protection flows logically out of the strong association of kiwi with the New Zealand identity, recognition that it is endangered and, to a lesser extent, its symbolic importance for tourism. The common pro-environment / conservation sentiment underlying the responses to these four items was confirmed through cluster analysis.

With regard to the statements about the future role of tourism, reduction in Government expenditure, and the importance given to kiwi relative to other native species, respondents were more inclined to neutrality in their responses (i.e. scoring '3' on the scale), though more tended to agree than disagree (indicated by scoring '1' or '2' on the scale). Respondents did not agree that 'New Zealand can only afford to protect kiwi in wildlife sanctuaries' or that 'to protect kiwi New Zealand should be prepared to use genetic engineering to get rid of kiwi predators' (42% and 47%, respectively, disagreeing), though more respondents answered 'do not know' to these items than to the previous items.

TABLE 1. RESPONDENTS' ATTITUDES TO CONSERVATION ISSUES.
See Appendix 1 for the order in which the questions were asked.

STATEMENT	PERCENTAGE OF RESPONDENTS					
	1 STRONGLY DISAGREE	2	3	4	5 STRONGLY AGREE	DON'T KNOW
The kiwi is an essential part of New Zealand's identity	1	1	7	14	77	0
The kiwi is an endangered species in New Zealand	1	1	6	17	73	3
New Zealand needs to protect its remaining native birds no matter what it costs	1	2	12	27	58	1
New Zealand needs to be able to show tourists live kiwi	2	5	16	23	53	0
New Zealand's future lies in tourism	2	9	35	28	24	2
It is essential that Government reduces its expenditure so that there can be lower taxes	9	15	30	15	26	5
Too much is made of the importance of the kiwi compared with other native birds and animals	10	20	31	27	10	3
New Zealand can only afford to protect kiwi in wildlife sanctuaries and offshore islands	18	24	19	17	11	11
To protect kiwi, New Zealand should be prepared to use genetic engineering to get rid of kiwi predators	30	17	17	14	15	8

Cluster analysis indicated the last four items tended to group together (collectively representing a more reserved or conditional attitude to environment / conservation), but this grouping was not as clear as for the first four items.

As might be expected, there were positive statistical correlations between the scores for the need to protect native birds, kiwi as an endangered species, kiwi as an essential part of the New Zealand identity, and the need to be able to show tourist live kiwi (for all correlations: $r_s > 0.22$, $P < 0.001$). The strongest correlations were between kiwi as part of the New Zealand identity, and both the need to show tourist live kiwi ($r_s = 0.46$, $P < 0.001$) and recognition of kiwi as an endangered species ($r_s = 0.35$, $P < 0.001$).

Similarly, there tended to be inverse, but weak, correlations between each of the first four items (covering the need to protect kiwi, their endangered status, the importance of protecting them, and being able to show them to tourists), and items covering the relative importance of kiwi (the need to reduce government expenditure, being only able to afford to protect kiwi in sanctuaries, and that New Zealand should be prepared to use GE to get rid of kiwi predators) (for all correlations: r_s between –0.1 and –0.16, $P < 0.001$).

Level of agreement with some of the attitudinal statements was related to the respondent's characteristics. Females showed higher levels of agreement than males with all but two of the statements—the need to reduce government expenditure, and New Zealand only being able to afford to protect kiwi in wildlife sanctuaries (Mann-Whitney *U* tests, $P < 0.005$). Non-members of environment groups were more likely than members to agree with these two statements (Mann-Whitney *U* tests, $P < 0.005$). The same pattern of responses is evident with educational level, with those with no or few formal qualifications more likely to agree with the same two statements (Kruskall-Wallis *H* test, $P < 0.001$). Age of respondent appeared to be only a factor in whether New Zealand should be prepared to use GE to combat kiwi predators—agreement with this proposition tending to increase with age ($r_s = 0.13$, $P < 0.001$). Membership of an animal welfare organisation and urban or rural residence did not appear to a factor in attitude scoring. However, it is worth noting that rural residents were a little less likely than urban residents to agree that New Zealand's future lies in tourism (Mann-Whitney *U* test, $P < 0.01$).

4.2 EXPERIENCE OF KIWI

The great majority of respondents reported they had 'seen a live kiwi in the bush, a zoo, or a sanctuary' (86%), and 9% of respondents had been 'personally involved in kiwi protection efforts'. Surprisingly, 7 of the 88 respondents who said they had been involved in kiwi protection had never seen a live kiwi (respondents were not asked to describe the nature of this involvement).

Experience of kiwi appeared to be independent of the age, education, and sex of the respondent. However, there was a weak association between involvement in kiwi protection ($r_s = 0.12$, $P < 0.001$) and membership of an environmental or animal welfare group ($r_s = 0.19$, $P < 0.001$). Experience of kiwi did not appear as a factor in respondents' attitudes to native birds and conservation.

4.3 PERCEIVED THREATS TO KIWI

Respondents were given four known threats to kiwi and asked to indicate which one they thought was the biggest threat. This list included wild predators such as stoats and ferrets, and was the first time stoats had been mentioned in the survey interview. Seventy-four percent of the respondents felt that wild predators were the biggest threat, followed by loss of forest habitat due to logging and agriculture (Table 2). Overall, the respondents rated domestic dogs and possum trapping as relatively minor threats to kiwi.

TABLE 2. PERCEIVED BIGGEST THREATS TO KIWI.

BIGGEST THREAT	PERCENTAGE OF RESPONDENTS (n = 997)
Wild predators, such as stoats and ferrets	74
Loss of the forest to logging and agriculture	13
Domestic dogs	4
Possum trapping	3
Don't know	6

The rating of wild predators as the biggest threat to kiwi, followed by loss of habitat, was independent of respondent characteristics. However, there was some variation on the remaining two threats. Females, for example, were more likely than males to see loss of habitat as the biggest threat to kiwi, and to rate possum trapping as more of a threat than dogs (χ^2 = 15.8, df = 4, P = 0.003). The same pattern holds for those who had not seen a live kiwi (χ^2 = 13.9, df = 4, P = 0.008). Also, those aged under 20 years were the most likely of all age groups to see either loss of habitat and domestic dogs as the biggest threat, and the least likely to see wild predators as the biggest threat. Of all the respondents, the members of animal welfare groups were the most likely to answer 'not sure' or don't know' when asked what they thought was the biggest threat (11%).

5. Knowledge and perceptions of stoats

5.1 KNOWLEDGE OF STOATS

Respondents' experience of stoats was tested by asking if they had heard of stoats before the survey, and if so, whether they had seen a picture of a stoat, seen a dead or live stoat, and if they could distinguish between a stoat and ferret. Of the 959 respondents who had heard of stoats before the interview, 91% said they had seen a picture of a stoat, 68% said they had seen a dead or stuffed stoat, and 66% said they had seen a live stoat. However, considerably fewer respondents (40%) thought they could distinguish between a stoat and a ferret (Table 3). Despite their exposure to stoats, many respondents seemed to feel their knowledge of them was limited. For example, only 42% of those who had seen a picture of a stoat, 50% of those who had seen a dead stoat, and 51% of those who had seen a live stoat thought they could distinguish a stoat from a ferret.

To provide an overall measure of a respondent's claimed experience or knowledge of stoats, his / her responses to the five relevant questions (heard of stoats, seen a picture of a stoat, seen a dead stoat, seen a live stoat, and could distinguish a stoat from a ferret) were then combined. For each of these questions a 'yes' was scored as 2 points, a 'maybe / not sure' as 1 point, and a 'no' or 'don't know' as 0 points. The respondents' scores ranged from 0 (the minimum) to 10 (the maximum), with a mean score of 7.3. With the exception of having seen 'a picture of a stoat', males and rural residents scored significantly higher than females and urban residents on overall claimed experience and on each of the component experiences (Mann-Whitney *U* tests, $P < 0.001$). Each type of experience, and total experience, was independent of other respondent characteristics.

TABLE 3. RESPONENTS' EXPERIENCE OF STOATS.

EXPERIENCE	PERCENTAGE OF RESPONDENTS (n = 959)			
	DON'T KNOW	NO	MAYBE / NOT SURE	YES
Seen a picture of a stoat	0	7	2	91
Seen a dead (or stuffed) stoat	0	28	4	68
Seen a live stoat	0	30	4	66
Could distinguish between a stoat and a ferret	1	44	15	40

5.2 PERCEPTIONS OF STOATS

Leading on from their experience of stoats, the respondents who had heard of stoats were asked, in separate open-ended questions, to describe a stoat's appearance and characteristics. These descriptive statements fell into nine types:

- Comparisons with other animals
- Size and shape statements, colouring
- Appearance of face, head, or tail
- The nature of the animal's movement, visibility or location
- The relationship with humans and the environment
- Eating or hunting habits and impact
- Character or intellect
- Behaviours or actions
- Other general negative or positive statements

Because of the frequent overlap of appearance and character descriptions, a single set of codes was developed and used to classify respondent's answers to both the appearance and character questions.

5.2.1 Appearance

A total of 2200 appearance statements were offered by the 959 qualifying respondents. The 20 most used descriptions of a stoat's appearance are presented in Table 4, and represent 84% of all the descriptions offered by respondents.

The most common comparisons with other animals were with other mustelids, especially ferrets and weasels (13% of responses) and with rats or other rodents (6%). However, these comparisons were not always accurate. Male and female respondents were similar in the frequency of mention of 'long', 'skinny' etc, and 'small' etc. However, females were more likely than males to mention the stoat's furriness and sharp teeth, and males were more likely to refer to the stoat's colouring. Urban respondents were more likely than rural residents to mention the stoat's fur, but less likely to refer to its colour. A higher proportion of females than males (6% cf. 2%) and a higher proportion of urban residents than rural residents (5% cf. 2%) felt they did know enough to be able to describe a stoat's appearance.

TABLE 4. RESPONDENTS' DESCRIPTIONS OF A STOAT'S APPEARANCE.

APPEARANCE DESCRIPTION	PERCENTAGE OF RESPONSES (n = 2200)	PERCENTAGE OF RESPONDENTS (n = 959)
Long	16.9	38.9
Skinny / thin / slender	10.5	24.1
Little / small / tiny	7.2	16.6
Furry	5.4	12.3
Brown	4.6	10.5
Low to the ground / short legs / short	4.4	10.0
Like a ferret	4.3	9.9
Rodent or rat like	4.1	9.4
White / white patches / grey / light-coloured	3.5	8.1
Like a weasel	2.8	6.5
Nasty / big / sharp / vicious teeth	2.7	6.3
Ferret feature or size comparison	2.3	5.3
Like other animal	2.3	5.3
Rat or rodent feature or size comparison	2.1	4.8
Smaller or shorter than a ferret	2.1	4.8
General negative statement (bad, ugly etc.)	2.0	4.6
Other fur / colour statement	1.9	4.3
Bigger or longer than a ferret	1.8	4.1
General positive statement (okay, cute etc.)	1.7	4.0
Don't know	1.7	4.0

5.2.2 Character

A total of 1716 statements were made by the respondents about a stoat's character. However, 9% felt they were unable to make any comment. The 20 most common descriptions of a stoat's character are presented in Table 5, collectively representing 78% of the descriptions offered. Respondents tended to give shorter but more varied descriptions of character than they did for appearance and, generally, were less able to describe the stoat's character than its appearance. The character comments also tended to focus on the stoat as a predator and hunter, and were negative in tone, as revealed in the use of the terms 'vicious', 'nasty', 'aggressive', 'killer', 'mean', 'sneaky' and 'cunning'. Just over 5% of the respondents noted that stoats eat birds, eggs, and other wildlife, or described the animal as a pest. The responses generally paint a picture of an animal that is regarded very negatively by the New Zealand public.

Male and female respondents had a similar pattern of responses, though females were more inclined than males to describe character by reference to appearance. Urban and rural residents also tended to have a similar pattern of responses, though a higher proportion of urban residents than rural residents were unable to describe a stoat's character (11% cf. 6%).

TABLE 5. RESPONENTS' DESCRIPTIONS OF A STOAT'S CHARACTER.

CHARACTER DESCRIPTION	PERCENTAGE OF RESPONSES (n = 1716)	PERCENTAGE OF RESPONDENTS (n = 959)
Vicious	11.1	20.0
Predator / predatory	10.8	19.4
Aggressive	5.4	9.7
Don't know	5.0	8.9
Killers, kills for fun, kills for no reason	4.8	8.6
Quick moving / fast	4.6	8.3
General negative statement (bad, etc.)	3.8	6.8
Mean / unmerciful / cruel / nasty	3.5	6.3
Sneaky	3.4	6.2
Cunning / sly	3.4	6.2
Pest / vermin	3.0	5.5
Eat birds / wildlife / eggs	2.9	5.1
Little / small / tiny	2.4	4.3
Other negative character/intellect comment	2.4	4.3
Feral / survival driven	2.3	4.1
Other eating or hunting habit	2.2	3.9
Other neutral or positive character / intellect	1.9	3.5
Other visibility / movement comment	1.8	3.3
Hunters	1.6	2.8
Feed on or eat anything / scavenger	1.6	2.8

5.3 BELIEFS ABOUT STOATS

In addition to their experience and perceptions of stoats, respondents' beliefs were assessed by asking respondents whether they agreed or disagreed with seven statements about stoats (Table 6). If a respondent indicated neither agreement nor disagreement, their response was recorded accordingly.

Stoats were typically seen as a threat to New Zealand's birdlife, an environmental problem, and a threat to domestic poultry. On the other hand, there was common disagreement with the statements that 'stoats are basically harmless' and that 'stoats are native to New Zealand'. Seventy-one percent of the respondents said they felt concerned about stoats.

Male and female respondents were not generally much different in their beliefs about stoats, though females were more likely than males to agree that stoats 'are a threat to domestic hens and chickens', and that they are 'a problem for New Zealand's environment' (Mann-Whitney U tests, $P < 0.001$ and $P = 0.01$, respectively). Members and non-members of environmental groups only differed in the extent to which stoats were of concern to them, with members

more likely to agree they were concerned (Mann-Whitney U test, $P < 0.01$). Members and non-members of animal welfare groups did not differ significantly in their beliefs about stoats. Rural residents had a greater likelihood than urban residents of being concerned about stoats (Mann-Whitney U test, $P < 0.001$). The respondent's education was only relevant in relation to the proposition that stoats are a threat to hens and chickens, with those with higher levels of education tending to disagree ($r_s = 0.13$, $P < 0.001$). Age of the respondent did not appear to be a significant factor in any of the beliefs about stoats.

TABLE 6. RESPONDENTS' BELIEFS ABOUT STOATS.

STOATS ARE:	PERCENTAGE OF RESPONDENTS				TOTAL RESPONDENTS (n)
	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	DON'T KNOW	
A threat to New Zealand's birdlife	97	1	1	1	963
A problem for New Zealand's environment	91	2	4	3	963
A threat to domestic hens and chickens	83	4	6	7	961
A concern to me	71	4	24	1	963
Cute animals	18	2	78	2	964
Native to New Zealand	2	1	86	12	960
Basically harmless	3	1	95	1	964

6. Attitudes to stoat control

6.1 ACCEPTABILITY OF STOAT CONTROL METHODS

Before moving to answer questions about stoat control methods, all respondents, regardless of their previous experience or knowledge of stoats, were read the following statement:

'Stoats are slim, furry, meat-eating animals about 30 to 40 centimetres long. They belong to the mustelid family that also includes ferrets, weasels, mink and polecats. Stoats are particularly good hunters, and for this reason they were introduced to New Zealand in the 1880s to control wild rabbits. However, they have since spread throughout New Zealand, especially into native forests. They are now a major predator of New Zealand's native birdlife, and are responsible for killing about 60% of all North Island brown kiwi chicks that are born. A government-funded research programme is underway to find more effective ways of controlling stoat numbers and protecting kiwi.'

Respondents were then asked to rate the acceptability of 11 stoat controls using a five-point scale where '1' was taken to be 'very unacceptable' and '5' was 'very acceptable'. The controls included current trapping and poisoning methods, potential biological controls, as well as a twelfth option of 'not controlling stoats at all'. The full description of each control method and its effect on the stoat as given to the respondent can be seen on the questionnaire (Appendix 1).

Survey respondents were not offered the option of a 'don't know' answer, though where they answered in this fashion, or gave a conditional answer, their answers were recorded as 'don't know' or 'depends'.

The most acceptable options for the respondents were the two forms of trapping (kill traps and hold traps), followed by GE-based fertility controls and disease-based biological controls (Table 7). The least acceptable single option was not controlling stoats at all, with only 2% considering it acceptable (i.e. rated it '4' or '5') and 96% considering it unacceptable (i.e. rated it '1' or '2') with 91% rating it as 'very unacceptable'. Clearly, the respondents were not prepared to allow stoats to remain uncontrolled in New Zealand.

TABLE 7. ACCEPTABILITY OF DIFFERENT STOAT CONTROL METHODS.

CONTROL METHOD	PERCENTAGE OF RESPONDENTS					DON'T KNOW OR DEPENDS	TOTAL RESPONSES (*n*)
	1 VERY UNACCEPT-ABLE	2	3	4	5 VERY ACCEPT-ABLE		
Kill trap	6	6	12	16	58	2	1001
Hold trap	10	8	16	20	46	< 1	1002
GE sterilization virus	23	9	12	17	36	3	1000
GE immunocontraceptive protein	20	10	14	19	33	4	998
Vaccine strain of canine distemper virus	17	12	19	21	28	3	998
GE immuno-contraceptive bacteria	21	11	15	19	31	3	996
Imported mustelid-specific fatal disease	21	11	14	18	28	8	996
1080 poison at bait station	25	15	18	15	25	2	1000
Talon® poison at bait station	42	19	14	9	15	1	1000
Virulent strain of canine distemper virus	59	18	11	6	4	2	998
Existing non-specific fatal disease	65	18	6	3	2	6	998
Not controlling stoats	91	5	1	1	1	1	1002

6.1.1 Trapping

Trapping methods were the most acceptable (and the least unacceptable) of the various stoat controls. Kill trapping was described as follows: 'the stoat is attracted into a box using a lure of fresh meat or hen eggs. It is then caught in a trap that breaks its back and kills it'. This was considered acceptable by 74% of the respondents (58% rating it 'very acceptable'), and was considered unacceptable by 12% (6% rating it very unacceptable). Hold trapping was less acceptable than kill trapping, but still the second most acceptable form of control (acceptable to 66%).

6.1.2 Poisoning

Poisoning, along with trapping, is currently used for the control of stoats. Two forms of poisoning were presented to the respondents—feeding stoats at bait stations with 1080-poisoned eggs, or with Talon®-poisoned eggs. The only variation was the type of poison used. 1080 poisoning, which was described as causing death 'from heart and lung failure within 12 hours', was acceptable to 40% of respondents and unacceptable to the same number. Talon®, which was described as 'a common rat poison' causing death 'from internal bleeding within a week', was acceptable to only 24% of respondents and unacceptable to

61%. Views about use of Talon® were clearer and more negative than about 1080, and possibly indicate a negative reaction to the description of the type of death induced by Talon®

6.1.3 Biological controls

Seven potential or proposed biological control options were rated for their acceptability by respondents. These fell into two groups: fatal naturally occurring diseases, including an unspecified disease and the canine distemper virus; and genetically engineered (GE) organisms that affected the stoat's fertility. Generally speaking, the GE fertility control organisms were considered much more acceptable than the fatal diseases. Both types of biological control had more respondents saying they did not know or gave a conditional ('depends') answer than for trapping or poisoning. However, the proportion of these responses was relatively low.

Diseases

The disease-based controls varied in their level of acceptability. The most acceptable disease-based control was a vaccine strain of canine distemper virus that is fatal to mustelids (acceptable to 49% of respondents and unacceptable to 29%), followed by an imported mustelid-specific fatal disease (acceptable to 46% of respondents). The least acceptable disease-based methods were the virulent strain of canine distemper virus, and a disease already in New Zealand that could affect other animals (acceptable, respectively, to 10% and 5% of respondents and unacceptable to 77% and 83%). Given that canine distemper is, itself, a non-mustelid-specific fatal disease that is already in New Zealand, the similarity of the ratings given to the these two controls, taking into account the 'depends' responses for the unnamed theoretical non-specific disease, indicates a high level of consistency in the respondents' opinions.

GE-based controls

The three control options involving the potential use of genetic engineering to reduce stoat fertility collectively rated second after trapping in acceptability. The GE-based methods showed very similar levels of acceptability, with 50% to 53% of respondents ranking them as either acceptable or very acceptable (i.e. rated them '4' or '5'). An infectious stoat-specific virus that induces sterility by 'attacking the part of the stoat's brain that controls reproduction' was marginally more acceptable than using bait containing a GE immuno-contraceptive protein—itself marginally more acceptable than an infectious stoat-specific immuno-contraceptive bacterium. Each of these methods was unacceptable to approximately 30% of respondents, while about 2% responded that they did not know.

While it appears that the respondents might not have put much emphasis on the differences between particular forms of GE fertility control, a comparison of the respondents' positions on the GE sterility virus and the GE immuno-contraceptive bacteria was made. This indicates that the vast majority (81%) took the same basic position about a GE bacterial control as a GE viral control, but 20% of the respondents changed their position: 11% moved from neutrality or acceptance of the viral control that induced sterility to neutrality or rejection of a bacterial immuno-contraceptive control, and 8% moved in the other direction.

6.1.4 Differences between respondent groups

Apart from for the option of not controlling stoats at all, statistically significant differences were found between males and females in their ratings of acceptability of the various forms of stoat control (Mann-Whitney *U* tests, all $P < 0.001$). Males consistently gave higher ratings of acceptability to the controls (all $P < 0.001$) than females, with the differences being most evident (by approximately one scale point) for both of the poisons and the vaccine-strain of distemper.

With the exception of Talon® poisoning, a non-specific disease already present in New Zealand, and the virulent strain of canine distemper virus, the various controls were acceptable to over 50% of male respondents. Only kill trapping and hold trapping were acceptable to more than half the female respondents, and more than half the females found 1080 poisoning, Talon® poisoning, a non-specific disease already in New Zealand, and the virulent strain of canine distemper virus unacceptable. Females appeared to be more neutral than males about most forms of stoat control, and were clearly opposed to the use of poisons. Males and females were both opposed to the use of a non-stoat-specific disease and the virulent form of canine distemper virus.

Apart from a relatively weak but statistically significant negative correlation between respondent's age and the acceptability of a strong distemper control ($r_s = 0.15$, $P < 0.001$), age did not appear to be critical to the acceptability of stoat controls. However, the under 20 year olds in the sample tended to be the most accepting of all forms of control (except trapping where they were the least accepting).

Members of environmental groups showed a tendency to give lower ratings of acceptability than non-members to all the control methods, other than kill trapping and a GE virus-based immuno-contraceptive (to which they gave higher ratings). However, the differences between members and non-members in scoring were only statistically significant in the case of the two forms of trapping (Mann-Whitney *U* tests, both $P < 0.02$).

Members of animal welfare groups also tended to give lower acceptability scores than non-members for all control methods, this difference being statistically significant for both poisoning methods (Mann-Whitney *U* tests, all $P < 0.005$); and, to a lesser extent, for hold trapping and the use of vaccine-strength distemper virus (Mann-Whitney *U* tests, both $P < 0.02$).

Rural respondents tended to give higher acceptability scores than urban residents for all control methods, the differences being statistically significant, particularly in the case of both forms of trapping and Talon® poisoning (Mann-Whitney *U* tests, all $P < 0.001$) and, to a lesser extent, for 1080 poisoning and an imported mustelid-specific disease (Mann-Whitney *U* tests, both $P < 0.30$).

There was no significant difference between past or present ferret owners and non-owners in the ratings of acceptability of the various controls. Dog owners differed from non-owners only with regard to the acceptability of the use of a virulent strain of canine distemper virus, with the owners finding it less acceptable (Mann-Whitney *U* test, $P < 0.04$)

While those with university degrees tended to give higher acceptability ratings than others to most of the forms of stoat control, there was no clear relationship between the educational level of the respondent and acceptability. However, in the case of the virulent strain of canine distemper virus, those with degrees were significantly more accepting than all others (Kruskall-Wallis *H* test, $P < 0.001$).

Current or former dog owners, and current or former ferret owners, tended to be less accepting than non-owners of disease-based controls and 1080 poisoning, though the differences were not statistically significant. Correlations were found between the respondent's knowledge of stoats and the level of acceptability of the trapping methods and of the poisoning methods ($r_s = 0.26$ for kill traps, $r_s = 0.14$ for hold traps, $r_s = 0.1$ for 1080 poisoning, $r_s = 0.16$ for Talon® poisoning; all $P \leq 0.001$).

6.2 PREFERENCES FOR STOAT CONTROL RESEARCH AND DEVELOPMENT

The respondents were asked two questions covering their preferences for which direction future stoat control research and development should take.

6.2.1 Research preference

Three research options were provided: improving existing control methods such as traps and poisons; developing new biological methods; or a combination of improving existing methods and developing new biological methods. The clear preference was for focusing on the combination (65% of respondents), followed by improving existing methods (24%). The least preferred option was focusing on new biological control methods (10%). One percent of the respondents felt unable to answer.

The preferences for research focus were consistent across the various types of respondents, though there was some minor variation—males and those aged under 20 tended to opt more for researching new biological controls rather than existing controls.

6.2.2 Development preference

To assess the preferred direction for stoat control development, three options were put to the respondents: controls that reduce stoat numbers by reducing their fertility; controls that result in the direct death of the affected stoat; or both types together. As with research preference, the majority of respondents (59%) wanted to see development of both approaches to control rather than just fertility control (17%) or fatal controls (22%). Just over 2% of respondents were unable or unwilling to choose.

The pattern of preference for the kind of stoat control development was generally consistent across all types of respondents with the exception that those with a university degree favoured controls that reduced stoat fertility over controls that resulted in the death of the stoat.

6.3 PREFERRED FUTURE DEVELOPMENT OF STOAT CONTROLS

The two questions in Section 6.2 combine to provide four theoretical stoat control research and development directions: improving the existing fatal techniques; developing new biological methods that reduce stoat fertility; developing new but fatal biological methods; and improving existing techniques so that they reduce stoat fertility. In practice, it is difficult to see how any of the existing trapping methods (kill traps, hold traps, 1080 poisoning, and Talon® poisoning) could be modified to enable them to reduce stoat fertility. The most favoured form of development was researching and improving existing fatal control techniques (74%). The least favoured was researching and developing new biologically-based fatal controls (60%). These preferences are consistent with the acceptabilities of the various current and proposed methods for stoat control.

7. Use of genetic engineering in stoat control

7.1 ATTITUDES TO POTENTIAL USES OF GE

Respondents were asked, using a five-point scale (with 1 being 'very unacceptable' and 5 being 'very acceptable'), to rate the acceptability of various applications of genetic engineering to controlling stoats. A 'don't know' option was included. These included: laboratory research on GE; using genetically engineered organisms in the laboratory to produce a stoat fertility control drug; controlled field testing of a live genetically engineered fertility control organism; and releasing a live genetically engineered infectious fertility control organism into wild stoat populations. Table 8 presents the responses.

TABLE 8. ACCEPTABILITY OF VARIOUS APPLICATIONS OF GENETIC ENGINEERING TO STOAT CONTROL.

APPLICATION OF GE	PERCENTAGE OF RESPONDENTS					DON'T KNOW	TOTAL RESPONSES (*n*)
	1 VERY UNACCEPT -ABLE	2	3	4	5 VERY ACCEPT -ABLE		
Using GE organisms in the laboratory to produce a stoat fertility control drug	20	9	17	23	29	3	993
Laboratory research on GE for stoat control	19	9	19	19	30	3	996
Controlled field testing of a live GE stoat fertility control organism	26	13	20	18	20	3	995
Release of a live GE fertility control organism into wild stoat populations	30	13	17	15	21	4	1002

Only one application of GE—to produce a stoat fertility control drug in the laboratory—was felt to be acceptable (i.e. rated '4' or '5') by more than half of the respondents (52%), with 29% rating it 'very acceptable'. This is consistent with the earlier acceptability of a genetically engineered immuno-contraceptive protein delivered to stoats in a bait (also acceptable to 52% of respondents). However, it was only marginally more acceptable than laboratory research on GE for stoat control (49% rating it acceptable, with 30% 'very acceptable') and controlled field testing of a live GE fertility control organism (48% rating it acceptable, also with 30% 'very acceptable'). Release of a live GE fertility control organism into wild stoat populations was clearly the least acceptable option (acceptable to only 36%). All options had similar high proportions of neutral ('3') scores, and similar, but low, numbers of 'don't know' answers.

Female respondents were less accepting than males of all four possible uses of GE in stoat control, with none of the uses being acceptable to more than 50% of females. More than 50% of males were accepting of researching or using GE in the laboratory only, but not field testing or release (Mann-Whitney *U* tests, all $P < 0.001$).

There were no clear statistical relationships between respondent's age and the acceptability of the various applications of GE, though the under-20-year-olds were the least accepting of all applications and older people (60 years or older) tended to be more accepting. The highest level of acceptance of any of the uses was by those in their twenties in relation to the use of GE in the laboratory to produce fertility control drugs (acceptable to 63% of this age group).

Only in the case of laboratory research on GE was educational level of the respondent correlated with acceptability, with acceptance tending to increase with educational level ($r_s = 0.12$, $P < 0.001$). More highly educated respondents also tended to show higher rejection of field testing or release of GE organisms. However, the highest levels of acceptance of any of the uses were by those with university degrees in relation to research and using GE in the laboratory (both uses acceptable to just over 61% of degree holders).

There was little, if any, difference between members and non-members of environmental groups or animal welfare groups in the levels of acceptability of the various uses of GE.

7.2 ATTITUDE CHANGES

The apparent equivocation with regard to GE-based stoat control was evident when the earlier ratings of acceptability of an infectious GE sterility virus and of an infectious GE immuno-contraceptive bacterium (see Section 6.1.3) were compared against the acceptability of field release of a GE fertility control organism. Compared with their position on the genetically engineered sterility virus:

- Twenty-seven percent of respondents maintained their position of rejecting the technology when asked about field release of an unspecified genetically engineered fertility control 'organism'

- Eight percent of respondents moved from an earlier position of rejection to one of neutrality or acceptance, or from neutrality to acceptance
- Twenty-seven percent of respondents moved in the other direction (11% moving from acceptance to rejection)
- Five percent continued to remain neutral
- Thirty-two percent maintained their position of acceptance

An almost identical pattern of change in respondents' positions is evident when comparing the acceptability of an infectious GE immuno-contraceptive bacteria and the field release of an unspecified infectious GE fertility control organism.

The apparent change in some respondents' positions on GE controls might be expected from earlier research findings (Fitzgerald et al. 2002). That is, as respondents moved through the survey interview they were increasingly exposed and sensitised to the issue of stoat control and the possible development and use of GE for affecting stoat fertility, which appeared to influence their views about such controls.

8. Important features of a stoat control method

8.1 ATTITUDES TO VARIOUS FEATURES

Respondents were asked to rate, on a five-point scale, the importance of six different features of a stoat control method. A 'don't know' option was provided. They were then asked to indicate which one of these features was the most important to them. These features were developed from both the focus groups and the findings of previous surveys by the authors (Table 9).

Two features of a stoat control method emerged as being important or essential to almost all the respondents. These were: specificity of the control (i.e. 'should not affect any animals other than stoats, ferrets and weasels') and effectiveness (i.e. 'should be very effective in reducing stoat numbers'). Ninety-six percent of respondents rated both features as '4' or '5'—the majority rating them '5' ('essential'). In addition, 71% felt that it was important or essential for a control

TABLE 9. RELATIVE IMPORTANCE OF VARIOUS FEATURES OF A STOAT CONTROL METHODS.

STOAT CONTROL SHOULD:	PERCENTAGE OF RESPONDENTS					DON'T KNOW (*n*)	TOTAL RESPONSES
	1 NOT AT ALL IMPORTANT	2	3	4	5 ESSENTIAL		
Not affect other animals	1	0	2	10	86	0	1002
Be very effective in reducing numbers	0	1	3	11	85	0	998
Be humane	9	7	13	19	52	0	998
Not involve release of a live GE organism	11	11	19	14	41	4	996
Not cause additional cost	14	18	33	11	22	1	998
Not involve any GE at all	24	16	23	10	24	3	994

method to be 'humane', and 55% felt it important that a control method not involve the release into the environment of a live genetically engineered organism. Not causing 'the taxpayer any additional cost' and not involving 'any genetic engineering at all', (the scorings of which were closely correlated), were considered relatively less important (33% and 34% of respondents respectively rating them '4' or '5').

Female respondents gave higher ratings of importance than males to all of the features apart from the control having to be 'very effective' (Mann-Whitney *U* tests, all $P < 0.001$). The difference between males and females was especially evident in the importance of humaneness.

The age of respondents only appeared to be relevant in the case of a stoat control having to be effective, with the importance of this tending to increase with age ($r_s = 0.14$, $P < 0.001$). Education was only relevant with regard to not causing additional cost—with this becoming less important with increasing level of education ($r_s = -0.21$, $P < 0.001$). Members of animal welfare groups considered humaneness more important than non-members, while environmental group members considered the issue of additional cost to be less important than the non-members (Mann-Whitney *U* tests, both $P < 0.001$).

8.2 THE MOST IMPORTANT SINGLE FEATURE

A further question then asked respondents to state which of the six features of stoat control (see Section 8.1) was the most important to them. Figure 4 presents these results. Specificity was judged the most important feature of a stoat control method—the choice of a 34% of respondents. Just under a quarter (24%) felt that the most important thing was for the control method to be humane, and about the same proportion (23%) felt that effectiveness of the method was most important. Non-use of GE or non-release of live GE organisms was felt to be crucial by 17% of respondents. Cost to taxpayers was a key issue for less than 2% of respondents. While several features of stoat control were rated as essential by the majority of respondents (see Section 8.1), no particular single feature emerged as crucial for the majority (Fig. 4).

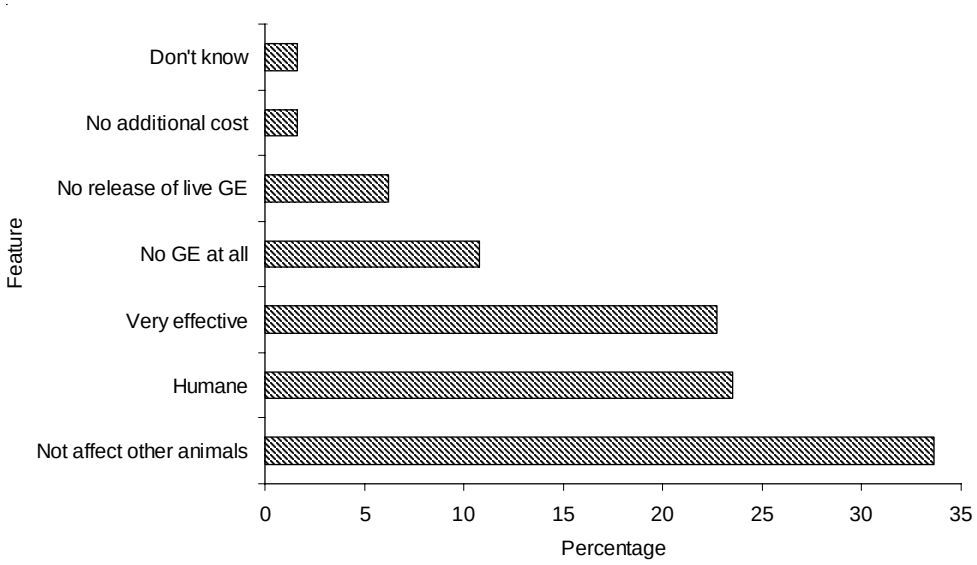

Figure 4. Survey respondents' choices of the most important feature of a stoat control method.

Respondent characteristics were relevant in terms of the relative priorities given to the three most important features. Females were twice a likely as males to nominate humaneness and tended to put it on an equal footing with specificity. Teenagers (under 20 years) and the elderly (60 years and over) rated humaneness the most important and specificity the second most important, and younger people in general (under 30 years) were more likely than other age groups to state that there should be no use of GE. Those with no or minimal qualifications felt humaneness to be about as important as specificity. Animal welfare group members rated humaneness the most important, while environment group members ranked it third behind specificity and effectiveness. Past or present dog owners and ferret owners were more likely than by non-owners to nominate humaneness as the most important criterion for deciding about a stoat control.

9. The use of live GE organisms in stoat control

To ascertain the respondent's basic position on the field release of a GE organism for stoat control, a scale was constructed using the responses relating to the acceptability of releasing a GE organism in live stoat populations, and to the importance (with the scale reversed) for a stoat control that did not involve the release of a live GE organism into the environment. The acceptability ratings for use of a live GE sterility virus and use of a live GE immuno-contraceptive virus for stoat control were not included in the scale since those responses appeared to be influenced by the type of organism and the use of the technology. The constructed scale was based on the *z*-scores[2] of the summed ratings for the two items (maximum rating = 10). A respondent's position on the constructed scale therefore indicated his or her position relative to the average and to all other respondents. Relative 'position' labels were assigned to ranges of scale values (*z*-scores) as follows:

- 'Very anti live GE': values ≤ –1.5
- 'Anti live GE': –1.5 < value ≤ –1.0
- 'Mild opponent to live GE': –1.0 < value ≤ –0.5
- 'Neutral': –0.5 < value ≤ +0.5
- 'Mild support for live GE': +0.5 < value ≤ +1.0
- 'Pro live GE': +1.0 < value ≤ +1.5
- 'Very pro live GE: values > +1.5

Based on these positions, opponents to the field release of GE organisms (i.e. classified as very anti or anti live GE) outnumbered the supporters (very pro and pro live GE) (Table 10). This opposition held even when those with a 'mild' position were included.

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[2] The *z*-score is the number of standard deviations by which a particular value varies from the sample mean.

Gender was the only social characteristic that emerged as relevant to the respondent's position on releasing a live GE organism to control stoats, with male respondents more likely to support the use of the technology, and females more likely to be neutral or opposed to it.

10. Discussion and conclusions

DOC's stoat research programme, of which this social survey is part, grew out of a wide recognition that stoats are 'the most significant predator of a number of New Zealand's most threatened and endangered bird species' and that 'new, more cost-effective, and sustainable approaches to controlling stoats are urgently needed' if these species are to survive (DOC 2002). Of particular and ongoing concern is the impact of stoats on kiwi—itself synonymous with, or symbolic of New Zealand and its people. However, for a stoat control method to be 'sustainable', among other things, it has to be socially justifiable and acceptable. This study set out, through representative sample survey of the New Zealand public, to assess the extent of the social mandate for controlling stoats, and for the various approaches that are, or could be, used to achieve such control.

10.1 SUPPORT FOR PROTECTING KIWI

The symbolic importance of the kiwi to New Zealanders that was noted in our earlier research (Fitzgerald et al. 2002) was confirmed by the survey respondents: they commonly agreed that 'the kiwi is an essential part of New Zealand's identity' and that the importance given to kiwi is not excessive compared to other native fauna. The public also know what a kiwi is—most of our respondents (86%) having seen live kiwi in the bush, a zoo, or a sanctuary. People also commonly believe, as our survey shows, that this iconic species is endangered.

The importance of kiwi is such that, along with other native birds, the vast majority of people feel they need protecting 'no matter what it costs'. This lack of focus on the cost was confirmed by the generally neutral or negative response to the proposition that Government should be cutting its expenditure and reducing taxes. The survey respondents also indicated they were not willing to see the adoption of the cost-saving fall-back position of only protecting kiwi in sanctuaries and off-shore islands. Also, while the respondents felt that it was important to be able to show live kiwi to tourists, the need to protect kiwi does not seem to be motivated by aspirations for tourism development.

TABLE 10. RESPONDENTS' POSITIONS ON RELEASING A LIVE GE STOAT CONTROL ORGANISM.

RESPONDENTS' POSITIONS	PERCENTAGE OF RESPONDENTS (n = 923)
Very anti live GE	0
Anti live GE	28
Mild opponent	8
Neutral	31
Mild supporter	10
Pro live GE	15
Very pro live GE	8
Total	100

There is clearly a high level of support for national efforts to protect kiwi and a willingness to pay for such protection; and this support does not depend on individuals having seen kiwi, being involved in protection efforts, or belonging to environmental or conservation groups. While the majority of people perceived the main threat to kiwi to be predation by wild stoats and ferrets, rather than loss of habitat or domestic dogs, they do not feel that New Zealanders 'should be prepared to use genetic engineering to get rid of kiwi predators'.

10.2 SUPPORT FOR CONTROLLING STOATS

Contrary to some of the focus group findings in the first phase of our research (Fitzgerald et al. 2002), we found that the majority of the current survey's respondents had some basic knowledge and experience of stoats, having seen pictures of them, seen dead stoats, or seen them in the wild. As in the focus groups, the survey respondents did not feel particularly confident about distinguishing stoats from ferrets. Despite this lack of confidence, most seemed able to provide a reasonably accurate, but basic, un-prompted description of a stoat (as 'long' and 'skinny', 'small', 'furry', 'brown', 'low to the ground', and even rat- or ferret-like).

The negative perception of stoats that was evident in the focus group discussions was confirmed in the survey when it came to respondents describing a stoat's character: stoats were commonly characterised as feral, predatory hunters and killers to the point of being 'aggressive', 'vicious', 'mean', and 'nasty', as well as 'quick', 'sneaky', and 'cunning'. A clear majority of respondents disagreed with the notion that stoats are 'cute' and 'native to New Zealand', and they especially disagreed that stoats are 'basically harmless'. On the other hand, there was general agreement that stoats are a threat to New Zealand's birdlife, a problem for New Zealand's environment, and a problem for domestic poultry. It was not surprising then, that the majority of people felt a degree of personal concern about stoats.

In summary, the survey respondents displayed a reasonable, but basic knowledge about stoats: they were able to provide (or guess at) a basic physical description, knew that they are not native to New Zealand, and that their predation is threatening New Zealand's birdlife to the point of being an environmental problem. These views were consistent across most sections of the public.

10.3 SUPPORT FOR VARIOUS KINDS OF STOAT CONTROL

Given the potentially high level of support for active stoat control, especially to protect kiwi and other native birds, and that not controlling stoats was almost universally unacceptable, the central question becomes 'what forms of control are acceptable?'. The current survey examined the public acceptability of existing controls (trapping and poisoning), proposed controls (canine distemper virus), and potential forms of control involving the use of GE.

Both kill trapping and hold trapping are the most acceptable forms of stoat control, and both were acceptable to the majority of people. Poisoning using 1080- or Talon®-poisoned baits was much less acceptable. Talon® poisoning was unacceptable to the majority of the respondents, though views were mixed about using 1080. Use of virulent diseases that are already in New Zealand but which could affect other animals, including using a virulent strain of the canine distemper virus, was unacceptable to the majority. However, a vaccine-strength strain of canine distemper virus (i.e. an attenuated strain which is less likely to affect other animals), and an imported mustelid-specific fatal disease, were more acceptable, though still not to the majority of people. The greater acceptability of the vaccine-strength canine distemper virus and the imported mustelid-specific disease appeared to be due to their specificity—that is, their lower likelihood of fatally affecting non-target animals.

Consistent with the findings of previous research on attitudes to pest controls (Fitzgerald et al. 1996, Wilkinson & Fitzgerald 1998, Wilkinson & Fitzgerald 2002) we found that the use of a GE-based stoat or mustelid-specific fertility control would be only marginally acceptable to the public. Three forms of potential GE-based stoat control were examined in this survey: releasing an infectious virus that attacks the stoat's brain thereby inducing sterility; releasing an infectious bacterium that induces an immuno-contraceptive response; and feeding stoats with bait containing a protein that induces an immuno-contraceptive response. Each of these was acceptable to only a half of the respondents, with the GE sterility virus and GE protein being marginally more acceptable than the bacterium.

Gender was an important factor determining acceptability of the control method, with female respondents significantly less accepting than males of all methods. Indeed, only kill and hold trapping were acceptable to the majority of females. All methods, except for the non-specific disease and Talon® poisoning, were acceptable to the majority of males. As found by previous researchers (Fitzgerald et al. 1996; Wilkinson & Fitzgerald 1998, 2002), the use of poisons was unacceptable to the majority of female respondents. Rural respondents were also significantly more accepting of all methods investigated than urban respondents.

The acceptability of each of the various stoat controls was generally consistent with the criteria people think should be applied when deciding about a control. Specificity and effectiveness were considered important by almost everyone, and the majority felt a control should be humane and not involve the release of a live GE organism. However, specificity emerged as the single most important criterion when people were asked to choose between them. Female respondents and members of animal welfare organisations especially valued humaneness of the method. The cost of the control was not a particularly important issue for most respondents.

Since the overall DOC stoat research programme was partly concerned with identifying and developing new control techniques, we also examined people's preferences for the direction that research should take. The majority expressed a preference for a programme that would investigate existing control methods (trapping and poisoning) as well as develop new biological techniques. People also expressed a preference for research and development on fatal forms of

control as well as controls that reduce fertility. Given the limited acceptability of poison-based controls, disease based controls, and GE-based controls, the only really acceptable feasible research and development direction would appear to be one focused on further development of kill trapping. If it were feasible, work on a non-GE-based fertility control for stoats would also be acceptable.

10.4 SUPPORT FOR THE USE OF GE IN STOAT CONTROL

The survey found that the respondents were unwilling to agree to the use of GE to get rid of kiwi predators, that GE-based controls were marginally acceptable, and that there was a clear preference for a stoat control method which did not involve the release of a live GE organism. It was not surprising that the survey respondents were also opposed to releasing live GE organisms into wild stoat populations, and that they had mixed feelings about controlled field testing of a GE fertility control organism. While not clearly opposed, people also appeared to be uneasy about laboratory-based research on GE for use in stoat control, and, to a lesser extent, using GE organisms in the laboratory to produce a stoat fertility control drug.

From the responses to the questions about the use of GE in kiwi-predator and stoat control and about specific applications of the technology, it appears that the majority of respondents would be unwilling, or at best reluctant, to see GE used for developing and carrying out stoat control, especially if it involved the use of live organisms. In general, approximately one-third of the respondents tended to be accepting of the potential use of GE for stoat fertility control, an equal number tended to be in opposition, and the remaining third appeared neutral. Earlier research on similar pest control technologies (Fitzgerald et al. 1996; Wilkinson & Fitzgerald 1998, 2002) indicates that this neutral group includes those who are cautious or have conditional views about the technology, and actually tend more towards non-acceptance. This suspected tendency of the neutral group was borne out by the observed movements in attitude—away from acceptance of the use of GE in stoat control—that occurred as the survey interview progressed.

10.5 THE VERACITY OF THE SURVEY FINDINGS

While the survey sample was biased in favour of older New Zealanders and those with higher levels of education; age and education played little detectable role in determining the acceptability of different forms of stoat control, the use of GE in stoat control, preferred research and development directions, and the key criteria for choosing forms of control. It is, therefore, reasonable to conclude that the views of the survey respondents in these key areas closely approximated those of the New Zealand public at the time of the survey.

10.6 CONCLUSIONS

The survey results, like the earlier focus group research, indicate that there is widespread support for controlling stoats in order to reduce the threats to kiwi (which is regarded as an iconic species) and other native birds. There is also widespread support for improving stoat control methods. In practice, this support extends only to the development of trapping, with an emphasis on fatal forms of trapping. The public is clearly uncomfortable with using poisons to control stoats (as it has been shown to be with the control of possums), even if delivered through bait stations. In terms of biological controls, the public does not support the use of diseases that could affect other animals, whether or not these diseases are already present in New Zealand. There is clear opposition to the use of a virulent strain of the canine distemper virus. New forms of biological control that aim to reduce the stoat's fertility are marginally acceptable in theory, especially because they are likely to be relatively humane and specific to stoats. However, when it comes to using genetic engineering or genetic modification of organisms to develop and / or deliver the fertility control, the public is less supportive.

The level of support for existing and potential forms of stoat control reflect people's concerns about the degree to which the control is able to be confined to stoats (its specificity), the extent of pain or discomfort caused to the stoat by the method (its humaneness), and the likelihood of its being effective. Cost is not important for most people.

Unless there has been a major shift in public opinion since the survey was conducted, these findings suggest that the New Zealand public is unlikely to support the development of biological controls for stoats, including controls that make use of genetic engineering. The option that would be most acceptable to the public would be to focus stoat control development on trapping, while seeking to understand how fertility control can be achieved through means other than genetic manipulation.

11. Acknowledgements

This research project was made possible by funding from the DOC (science investigation no. 3394) through the Stoat Control Research Programme. The authors acknowledge and thank Dr Elaine Murphy, and members of the Stoat Technical Advisory group for their support and encouragement. Thanks also to Helen O'Leary who made a valuable contribution to revision of the draft, and to the referees for their useful suggestions.

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Appendix 1

STOAT SURVEY TELEPHONE QUESTIONNAIRE

Stoat survey telephone questionnaire

Phone number: ( ) ..... Phoning area .....

Date ..... / ..... Time ..... am / pm Interviewer initials

Hello. My name is *[first name & surname]*. I am calling on behalf of the Department of Conservation. We are conducting a survey on New Zealanders' views about the protection of native birds, such as kiwi, and the control of pests. **This is not a market research survey, and we are not trying to sell you anything**.

The person who lives in your household I would like to interview on this topic is the one who most recently had their birthday and is aged 18 or over. Is that person at home now?

[If no:] When can I call back? *and* And who should I ask for? *[Record details on phone sheet]*

[If a new person:]
My name is *[first name & surname]*. I am calling on behalf of the Department of Conservation. We are conducting a survey on New Zealanders' views about the protection of native birds, such as kiwi, and the control of pests. **This is not a market research survey, and we are not trying to sell you anything.**

[To all] Your responses will be treated anonymously and absolutely confidentially. Would you be willing to go through the questionnaire? It typically takes 10 to 15 minutes.

[if not willing] Thanks for your time. *[Record 'no' on phone list sheet]*

[If willing but not now, ask:] When can I call you back? *and:* And who should I ask for?

[Record call-back details on phone list sheet]

———

***Q1**. I'd first like to get your views on some general matters. To what extent do you agree or disagree with each of the following statements? Use a scale where 1 means 'strongly **dis**agree', up to 5 meaning 'strongly **agree**'. If you don't know, please tell me*

[1–5, DK = 9]

New Zealand needs to protect its remaining native birds no matter what it costs	
New Zealand's future lies in tourism	
It is essential that Government reduce its expenditure so that there can be lower taxes	
The kiwi is an endangered species in New Zealand	
The kiwi is an essential part of New Zealand's identity [*prompt*: symbol]	
New Zealand needs to be able to show tourists live kiwi	
Too much is made of the importance of the kiwi compared with other native birds and animals	
New Zealand can only afford to protect kiwi in wildlife sanctuaries and offshore islands.	
To protect kiwi, New Zealand should be prepared to use genetic engineering to get rid of kiwi predators	

Q2. The next two questions are **yes** or **no** answers

[Y = 1, N = 2, DK = 9]

Have you ever seen a live kiwi in the bush, a zoo, or a sanctuary?	
Have you ever been personally involved in kiwi protection efforts?	

Q3. Which **one** of the following do you think is currently the biggest **single** threat to kiwi?

[1–4, DK = 9]

1. Loss of the forest to logging and agriculture
2. Domestic dogs
3. Wild predators, such as stoats and ferrets, or
4. Possum trapping

[Yes = 1, No = 2, DK = 9]

Q4. Have you heard of stoats before now?

[If NO, go to Q9—the briefing statement]

Q5. *[Yes = 1, No = 2, maybe/not sure = 8, DK = 9]*

Have you ever seen a picture of a stoat?	
Have you ever seen a dead (or stuffed) stoat?	
Have you ever seen a live stoat?	
Do you think you could distinguish between a stoat and a ferret?	

Q6. How would you describe a stoat's **appearance**? **(note down 2 key words/ideas)**

Q7. How would you **characterise** a stoat? [*Prompt*: 'their behaviour'] (*note 2 key words/ideas*)

Q8. Can you tell me whether you **agree** or **dis**agree with each of the following statements?

Stoats are ... *[1 = agree, 2 = disagree, 3 = neither agree nor disagree, 9 = DK]*

Cute animals	
Basically harmless [*if asked say:* 'harmless in general']	
Native to New Zealand	
A threat to New Zealand's birdlife	
A threat to domestic hens and chickens	
A problem for New Zealand's environment	
A concern to me *[i.e. to the respondent]*	

[Briefing statement]

Before we go on, I'd like to tell you something about stoats.

Stoats are slim, furry, meat-eating animals about 30 to 40 centimetres long. They belong to the mustelid family that also includes ferrets, weasels, mink and polecats. Stoats are particularly good hunters, and for this reason they were introduced to New Zealand in the 1880s to control wild rabbits. However, they have since spread throughout New Zealand, especially into native forests. They are now a major predator of New Zealand's native birdlife, and are responsible for killing about 60% of all North Island brown kiwi chicks that are born. A government-funded research programme is underway to find more effective ways of controlling stoat numbers and protecting kiwi.

I would now like to ask you about your views on a number of current and possible approaches and methods for controlling stoat numbers—these cover the use of trapping, poisoning, and biological methods.

Q9. How acceptable to you are each of the following? Use a scale where 1 means '**very unacceptable**', up tp 5 meaning '**very acceptable**'.

[1-5, Depends = 8, DK = 9]

Not controlling stoats at all	
The stoat is attracted into a box using a lure of fresh meat or hen eggs. It is then caught in a trap that breaks its back and kills it.	
The stoat is attracted by a lure of fresh meat or hen eggs and caught in a trap. It is held there and killed within 24 hours by the trapper [by a blow to the head].	
The stoat is attracted into a box containing hen eggs that have been injected with a fatal dose of 1080 poison. The stoat eats the poisoned egg, and it dies from heart or lung failure within 12 hours.	
The stoat is attracted into a box containing hen eggs that have been injected with a fatal dose of Talon, which is a common rat poison. The stoat eats the poisoned egg, and it dies from internal bleeding within a week.	
Stoats are infected with a fatal naturally occurring disease that has been imported into New Zealand and only affects stoats, ferrets and weasels.	
Stoats are infected with a fatal naturally occurring disease that is already in New Zealand, but which can also affect other animals.	
Stoats are infected with a vaccine strain, that is a weakened form, of canine distemper, a naturally occurring disease that is already in New Zealand. The vaccine strain of the disease cannot affect other animals. The stoat dies from flu-like symptoms.	
Stoats are infected with a virulent strain, that is a strong form, of canine distemper. This strain of the disease can kill dogs, so dogs would need to be vaccinated against it. The stoat dies from severe flu like symptoms.	
A virus that affects only stoats is released among stoats and allowed to spread from one to another. The virus has been genetically engineered to attack the part of the stoat's brain that controls reproduction. The stoat becomes sterile.	
The stoat eats a bait which contains a protein that cannot pass from stoat to stoat. This protein has been genetically engineered to cause the female stoat to become immune to its own eggs. It fails to become pregnant.	
The stoat is infected with a bacteria that is found only in the stomachs of stoats, ferrets and weasels, and which can spread from stoat to stoat. The bacteria has been genetically engineered to contain a protein that causes the female stoat to become immune to its own eggs. It fails to become pregnant.	

Q10. Which **one** of the following three options do you think stoat control researchers should concentrate on?

[Option 1-3, DK = 9]

[1]	Improving existing stoat control methods such as traps and poisons	
[2]	Developing new biological methods for stoat control	
[3]	A combination of improving existing methods and developing new biological methods	

Q11. Which **one** of the three approaches to stoat control would you prefer to see developed?

[1-3, Doesn't matter = 4, DK = 9]

[1]	Controls that reduce stoat numbers by reducing their fertility	
[2]	Controls that result in the direct death of the affected stoat, **or**	
[3]	Both kinds	

Q12. There are a number of possible ways that genetic engineering could be applied to controlling stoats. How acceptable to you are each of the following? Use a scale where 1 means '**very unacceptable**', up to 5 meaning '**very acceptable**'.

[1–3, Doesn't matter = 4, DK = 9]

Laboratory research on genetic engineering for stoat control.	
Using genetically engineered organisms in the laboratory to produce a drug that can be used to control a stoat's fertility. The genetically engineered organisms are confined to the laboratory.	
Controlled field testing of a live genetically engineered organism which is designed to affect a stoat's fertility.	
Release of a live genetically engineered organism into wild stoat populations, which then spreads from stoat to stoat, reducing their fertility. [*explain if necessary*: 'after appropriate testing']	

Q13. How important to you are each of the following features of a stoat control method? Use a scale where 1 means '**not at all important**', up to 5 meaning '**essential**'.

[1–5, DK = 9]

[1]	The stoat control method should be **humane**, in that the stoat does not suffer.	
[2]	The stoat control method should **not affect** any animals **other** than stoats, ferrets and weasels.	
[3]	The stoat control method should be **very effective** in reducing stoat numbers.	
[4]	The stoat control method should not cause the taxpayer any **additional** cost.	
[5]	The stoat control method should **not** involve the release **into the environment** of a **live** genetically engineered organism.	
[6]	The stoat control method should **not** involve any genetic engineering **at all.**	

Q14. Which **one** of the features we have just asked about is the **most** important to you? [*Repeat the features if required*: 'that it be **humane**, **not affect other animals**, be **very effective**, not involve **additional cost**, not involve releasing a **live genetically engineered organism**, not involve **any** genetic engineering **at all**']. *[Repeat the highest scores if asked]* *[Enter code number relating to the most important feature]*

To finish up, a few questions about yourself.

[Urban = 1, DK = 9]

Q15. At present, are you an urban [*city/town*] or rural resident?

Q16. Are you currently a member of ... *[Yes = 1, No = 2, DK = 9]*

An environmental or conservation group or organisation?	
An animal welfare group or organisation?	

[Yes = 1, No = 2, DK = 9]

Q17. Do you currently own **a dog**?

[IF NO]: Have you **ever** owned a dog?

[Yes = 1, No = 2, DK = 9]

Q18. Do you currently own a **ferret**?

[IF NO]: Have you **ever** owned a ferret?

Q19. Which one of the following age groups do you belong to? *[1–6, Refused = 8, DK = 9]*

[1 =]	Under 20
[2 =]	20 – 29,
[3 =]	30 – 39
[4 =]	40 – 49
[5 =]	50 – 59
[6 =]	60 or over

Q20. From the following list, can you tell me your highest formal educational qualification?
[1–6, Refused = 8, DK = 9]

[1 =]	No school qualification
[2 =]	School Certificate (5th form)
[3 =]	6th Form Certificate or University Entrance
[4 =]	Trade certificate or equivalent
[5 =]	Professional diploma or other technical qualification
[6 =]	University degree

Q21. What is your usual occupation: _____
[get details, e.g. if engineer—'what kind of engineer?']

Q22. *[Note down gender:]* male/female *[1 = male, 2 = female]*

[Wind up—express thanks for their coopertation etc.]

Time taken: . . . . . mins