He Kōrero Paihama
Possum Research News

Issue 14 November 2000

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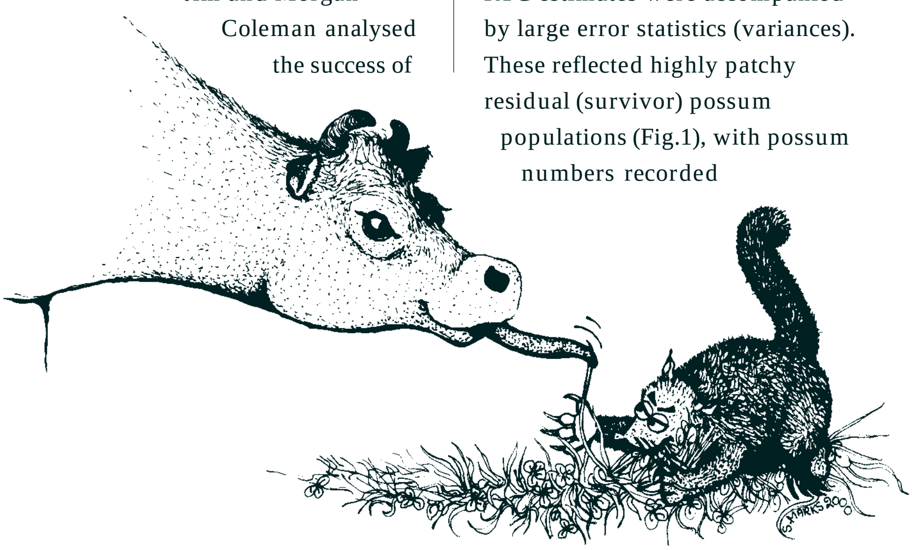
Manaaki Whenua
Landcare Research

Is Current Possum Control Adequate to Eliminate Tb from Possum Populations?

The management of possum populations infected with bovine tuberculosis (Tb) generally comprises an initial "knockdown" with toxic bait sown from aeroplanes or helicopters or laid directly on the ground. This is followed by regular annual or biennial maintenance control using ground baiting or trapping to sustain the benefits achieved by initial control. Each control operation is managed by regional Vector Control Managers who, in consultation with regional Disease Control Managers and the Animal Health Board (AHB), set population target indices for the reduction and maintenance of the infected population. The index used is based on the numbers of possums trapped following control (the residual trap catch; RTC), and a target of 5% or less is normally imposed.

Jim and Morgan Coleman analysed the success of initial and associated maintenance control operations at seven sites around New Zealand in achieving operational target maxima of 5%. They used RTC surveys of possum populations on forest–pasture margins after initial control and before and after maintenance control to determine the effectiveness of the control. They also determined the annual rate of population change between successive RTC surveys. Data from five of the seven sites surveyed (71%) indicated possum densities following initial control were under the 5% targeted, and some population densities were close to zero (Fig.1). Data from two sites (2 & 4, Fig.1) exceeded the population target, and as a consequence Tb may persist in the immediate future in these populations.

Of equal concern, most of the mean RTC estimates were accompanied by large error statistics (variances). These reflected highly patchy residual (survivor) possum populations (Fig.1), with possum numbers recorded



on survey lines in such patches well in excess of control targets. Such patches appear to result from the local non-availability of poison bait to possums following initial control. This is presumably due to unacceptably wide gaps in the flight paths of aircraft sowing bait or from problems of bait flow from bait hoppers. Subsequent RTC surveys following maintenance control revealed similar patchiness amongst survivor possum populations to that seen after initial control. These patches represent areas missed by local ground control operators, and reflect variable standards of control activity.

The annual rate of possum population change following initial control showed similar variability to that of the RTC estimates, ranging from 0.20 to 0.94 (* = 0.59), and in many instances exceeded the documented natural rate of increase of the species (0.22–0.59). Jim and Morgan believe that much of this increase can be put down to possums from neighbouring uncontrolled habitat and / or survivors from within the control area dispersing out to and settling on the highly favoured pasture margins where the survey lines were located. The rapid overall recovery of possum populations on pasture margins, where they forage freely amongst livestock and may expose them to infection from Tb, together with the pockets of possums surviving control operations, are cause for concern. Clearly, if possum populations rapidly exceed control target levels, then either more-effective or more-frequent control is needed, and operational costs will increase. Even more worrying is the possibility that pockets of survivors may coincide with patches of infected possums,

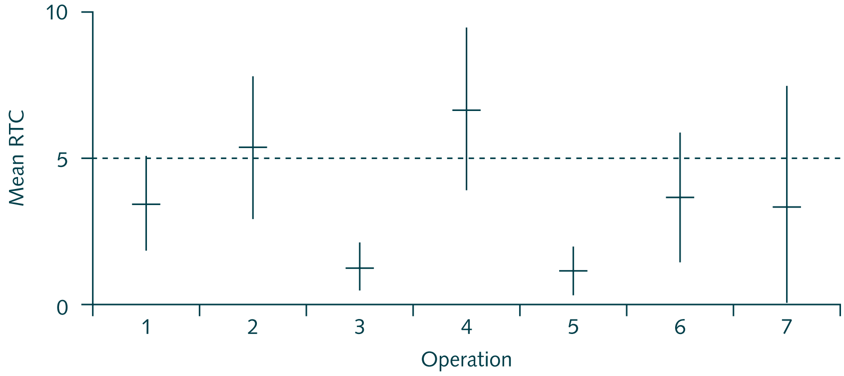


Fig. 1. *Distribution of residual trap-catch indices (mean ± confidence intervals) of possums from seven control operations. The dashed line indicates the standard operation target.*

which could result in Tb surviving and spreading, rather than disappearing. The local eradication of Tb from infected possum populations seems unlikely from patchily distributed populations that quickly recover from earlier control.

This research was funded by the Animal Health Board.

***Jim** and **Morgan Coleman** work on possum ecology, possum management, and the epidemiology of Tb in possums.*

As a consequence of these findings, the AHB held a workshop on the relationship between the RTC index and the eradication of Tb from possum populations. At the workshop, a model developed by Nigel Barlow, AgResearch, showed that there is a 95% probability of eradicating Tb from a possum population provided it is held below an RTC of 2% for 5 years. Therefore, in preparation for the 2001 / 02 Tb vector control programme, Vector and Disease Control Managers have stratified their operational areas and modified their RTC targets according to the risk of Tb-infected possums being present. The risk in each area is assessed from the history of infection in livestock and from the location of infected wild animals. High-risk strata contain persistently infected herds or infected wild animals. Medium-risk strata contain herds that have been sporadically infected over many years or which have not been persistently infected for at least 5 years. Low-risk strata contain herds with a Tb-free history.

There are now two components to the trap-catch index: the mean RTC and the maximum trap-catch permissible per line of 10 traps. The latter is designed to ensure that clusters of possums do not survive control operations. In high-risk strata, mean RTCs may be set as low as 2% and no more than two possums captured per trap line (7% RTC). In contrast, in low-risk strata, the mean RTC may be set as high as 7% and up to four possums trapped per line (14% RTC).

Guest Editorial

Over the last year my team and I, in association with Landcare Research and AgResearch, have been investigating public perceptions and concerns about the possible use of biocontrols for possums. Several factors contributed to the development of this project, including New Zealand's experiences with rabbit haemorrhagic disease (RHD), and the fact that most of the methods currently being researched for possum biocontrol involve genetic engineering, the most controversial technology of our times.

Our project was guided by a Reference Group including regional government, the rural sector, Māori, non-government-organisations (NGOs) and the biotechnology industry. Our methodology comprised a series of structured focus group discussions (analysed by Landcare Research), consultation with interested groups and sectors, hui with tangata whenua, and an evaluation of the ethical and moral issues by AgResearch's agricultural science ethicist. The investigation has identified the range of views, values and concerns of the New Zealand public about biocontrol technologies. Some clear trends and priorities have emerged, but this study has yielded qualitative rather than quantitative information. Further survey work is needed to establish how widely the views identified are held by particular groups across society.

We talked with a wide range of people – farmers, scientists, Māori, officials from councils and government, anti-genetic engineering (GE) activists, conservationists, biotechnology advocates, and ordinary New Zealanders – exploring their feelings and thoughts about biocontrol techniques for possums. Invariably the wider context – pest management, biodiversity protection, cultural and spiritual values of tangata whenua, the genetically modified (GM) food controversies, globalisation, public good versus private interests, and the role of science in society – was highly influential. It is obvious that addressing public responses to genetically engineered biocontrols will require researchers and decision makers to recognise and take into account a much broader range of factors than simply the science itself.

Regarding the particular methods being researched for possum biocontrol, some definite patterns came through. Methods that would target pouch young, by interfering with lactation or disrupting the transfer of immunity from the mother possum, were almost unanimously rejected as unacceptably inhumane. Contraception was seen more favourably, as a method humans have been familiar with for decades. Sterilisation methods were viewed with caution – the permanence of their effects increased the perceived risks. Possible delivery methods were also discussed – there was strong opposition, from both Māori and non-Māori, to the idea of genetically modifying native plants to convey a biocontrol. Possum-specific parasites were perceived as less risky vectors than viruses; biocontrol baits were seen as safer than a self-spreading vector, but lacking much advantage over current poisoning methods.

Generally there was intense concern about safety, understood in terms of specificity of the biocontrol to possums, controllability, the extent of how much is yet unknown with these new technologies, and the risks of unforeseen downstream effects on non-target species and the wider environment. Humaneness was a major factor, both ethically and for the acceptability of New Zealand's products in overseas markets. For Māori, while there was support for getting rid of possums, any disruption of the integrity of living things, and impacts of GMOs on the spiritual and metaphysical dimensions of the natural world, were fundamental concerns.

The application of GE to biocontrols will, on the basis of this study, be as dependent on moral and ethical acceptability and communities' values, as on the quantification of benefits and risks by science. Building trust between science and society is pivotal; trust is the basis for public confidence in safety, effectiveness, or the need for biocontrols. There is enormous demand for more information to help people understand the implications of genetic science and its possible applications in pest control. The general public and tangata whenua insist on being involved and having their concerns heeded in the evaluation and decision-making processes. This will require significantly increased investment in social research and in communications.

My report, "Caught in the Headlights: New Zealanders' reflections on possum control options and genetic engineering", will be released in the next month. *To request a copy, please contact Megan Chisholm on 04 471 1669 or megan@pce.govt.nz*

Dr J. Morgan Williams *is the Parliamentary Commissioner for the Environment.*

Do Possums Really Cluster at Bush–Pasture Margins?

Cattle grazing improved pasture at a bush–pasture margin.

Determining patterns of possum density across the landscape is crucial to understanding the status of possums as pests. For example, identifying areas where possums occur in high densities, and the possible ecological reasons for high and low densities, may help quantify the transmission of Tb amongst possums and to livestock. Currently, it is assumed that highest densities of possums occur along bush–pasture margins. Surprisingly, however, the evidence for this assumption is weak and is not consistent between areas or through time. Previous studies showing high densities of possums at bush edges are also confounded by altitudinal gradients. Hence, it is difficult to predict whether possum densities will be highest on bush edges, and if so, when and where.

A key related question is whether quantity and quality of resources, such as food, determine possum density. This question can be answered by comparing the extent and nature of possum density gradients across bush–pasture margins in a range of areas; some with poor-quality pasture and forest food, some with good-quality pasture and forest food, and some with a mixture of both. Andrea Byrom tested the hypothesis that possum densities are highest on bush–pasture margins with good-quality food by plotting the profile of possum abundance across well-defined bush edges, and for 500 m into the forest. She chose six sites throughout the South Island to test this hypothesis. Three of the sites were located adjacent to “improved” pasture (fertilised, well-maintained grazing pasture), and three located adjacent to “unimproved” pasture (native grassland). She also compared density gradients by forest type: two sites were on the edge of podocarp forest, and four sites were on the edge of beech forest. At each site, possums were trapped for 3 nights for 500 m along the bush–pasture margin, and along trap lines parallel to the bush edge and spaced at 100-m intervals for 500 m into the bush.

Andrea found that possum densities were generally highest within 200 m of the bush–pasture margin (Fig.1). Interestingly, possum densities varied little according to pasture or forest type, and were generally consistent among sites. The exception was the Taipo site (podocarp forest and unimproved pasture), where trap catch estimates were very low and confounded by recent hunting by fur trappers. In general, however, the hypothesis that pasture quality determines possum density gradients at bush–pasture margins was not supported.

Based on these results, Andrea argues that possum densities will be highest at, or close to, bush edges regardless of forest or pasture type. Although counterintuitive, it may be possible to eliminate food availability as a

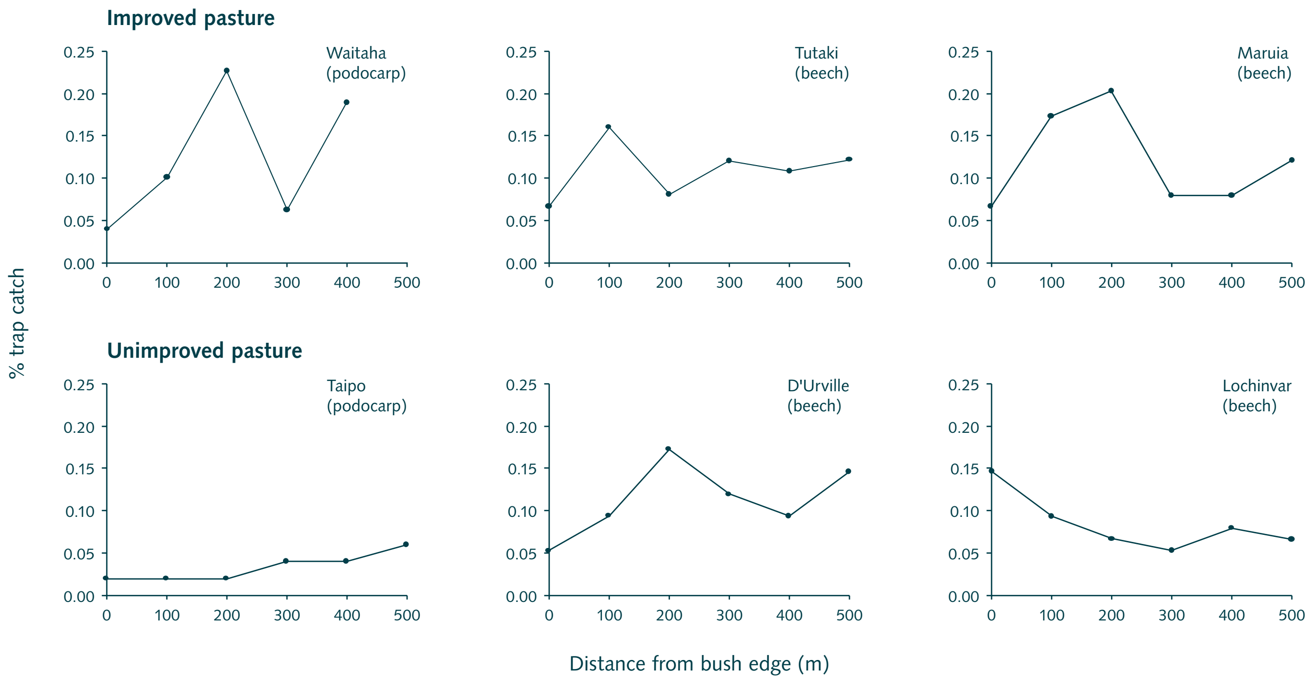


Fig. 1. *Percent trap-catch estimates from six bush–pasture margins in the South Island, three adjacent to improved pasture and three adjacent to unimproved pasture.*

factor influencing possum density gradients at bush–pasture margins. Other factors, such as den site availability and quality, need to be examined, to help predict where possums may be located in the landscape and to determine where den-sharing (and hence possum-to-possum transmission of Tb) is most likely to occur.

This work is funded by the Foundation for Research, Science and Technology.

Andrea Byrom *works on population ecology of small mammals, and the management of mammalian vertebrate pests.*

Long-Life Baits for Sustained Control of Possums

Possum control is being conducted over a steadily increasing proportion of New Zealand. As populations in many areas are brought under control, the emphasis is shifting towards maintenance control of low-density populations rather than initial control of higher-density populations. Aerial and ground-based baiting strategies developed for use against high-density possum populations may therefore be less appropriate in areas where population density has been reduced to low levels. These strategies are based on the principles of using baits with a short field-life delivered either at high application rates, or following periods of prefeeding, so that most possums find and eat them soon after delivery. Baits delivered aerially remain palatable for a few days while those placed in bait stations may remain palatable for a few weeks depending on climatic conditions.

Such "pulsed" baiting can not control possums that disperse into the targeted area after baits have become unpalatable. This is regarded as a strategic weakness, particularly in present Tb control programmes, where infected possums surviving in, or dispersing into, an area under control may infect cattle with the disease. Similarly, protection of fauna or flora of high conservation value and limited abundance (e.g. kōkako, mistletoe) may be difficult to achieve with present pulsed baiting strategies. Clearly there is a need for a "sustained" baiting strategy.

Such a strategy may be not far away. Dave Morgan is investigating new formulations of baits and new ways of presenting them that will ensure they remain effective for up to 12 months. These baits will be used more sparingly than current baits, and rely on resident and immigrant possums eventually discovering them. The new baits, in various types of bait station, have recently been exposed to West Coast weather in two enclosures (one shaded and one sunny site) that excluded possums and livestock (Fig. 1). The bait types tested were:

- Feratox® cyanide capsules embedded in Ferafeed® paste and presented in biodegradable bags suspended in plastic shrouds
- FeraCol® paste containing cholecalciferol presented as for Feratox®
- PESTOFF® 1080 pellets with double wax-coating presented in Philproof bait stations
- PESTOFF® brodifacoum pellets with double wax-coating presented in Philproof bait stations
- No Possums® 1080 gel bait presented in purpose-designed bait stations
- No Possums® cholecalciferol gel bait presented in purpose-designed bait stations.

Fig. 1. Gel baits and pellet baits in bait stations mounted on "possum-proof" poles in a bait-weathering enclosure.

Non-toxic baits of all types were also placed in the enclosures. Every 2 months, Dave and his team collected samples of all baits, and non-toxic baits were presented to captive possums to assess palatability, while toxin concentration was measured in samples of toxic baits. A decline in toxicant concentration was clear for some bait types (Fig. 2). Increases in toxicant concentration over time also occurred due to variations in the concentrations in the samples collected, and this became more pronounced towards the end of the 12-month period.

No Possums® gel bait showed the most promise for effective 12- month field use, as palatability remained high (a value of 50% indicates equality with freshly-made industry-standard RS5 cereal pellets) for 12 months (Fig. 3) and toxin concentrations of both the 1080 and cholecalciferol formulations remained acceptable for 8–10 months (Fig. 2).

By comparison, Feratox® and FeraCol® paste baits had a field life of 4 months after which the palatability of the peanut paste declined and the cyanide in Feratox® began to degrade (Figs 2 & 3). However, there was no overall decline in cholecalciferol content over the 12-month period

PESTOFF® pellets were only moderately palatable at the outset, perhaps due to the thick wax coating, and palatability declined quickly (Fig. 3), strongly suggesting that these products have a useful

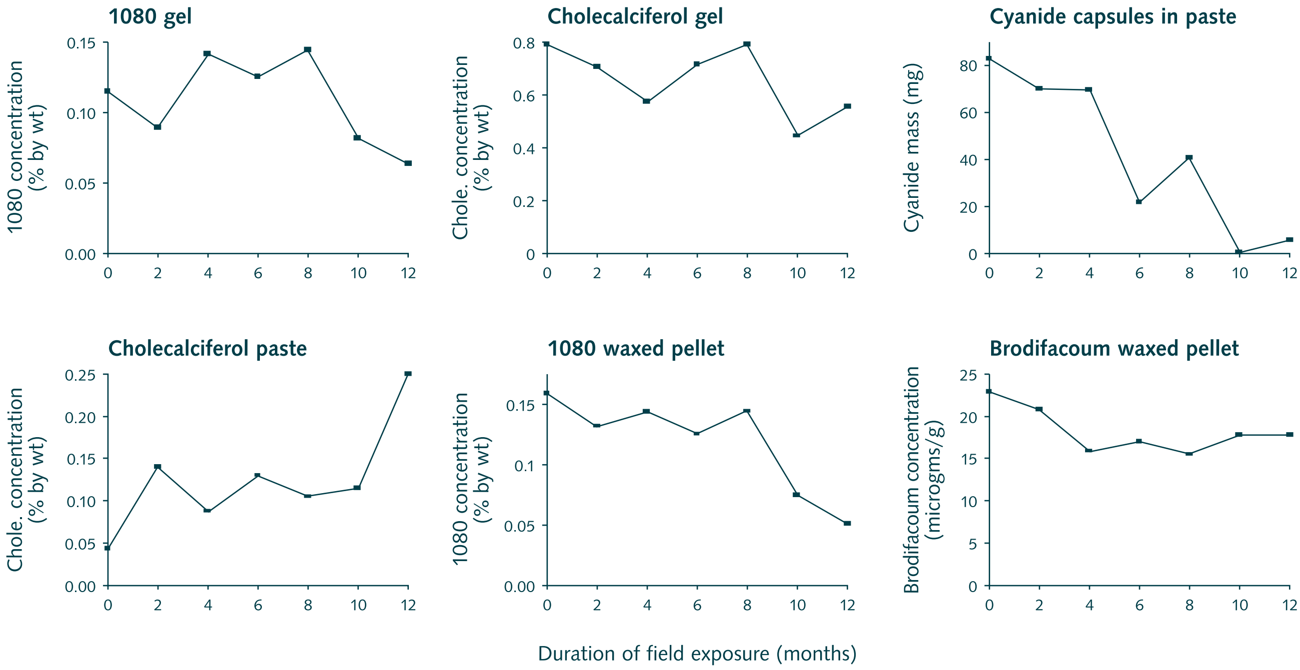


__Fig. 2.__ Concentration of toxicants in samples of gel, paste, and pellet baits collected every two months from two West Coast field sites. Data from the sunny and shaded sites were combined.

field life of 2–3 months when used in bait stations. However, 1080 and brodifacoum concentrations remained stable for 8 and 12 months respectively (Fig. 2).

In the next phase of this work, Dave is now assessing the use of the most promising product, No Possums® gel bait (containing cholecalciferol), along the bush-edge at three Westland sites for long-term, low-labour control of low-density possum populations. Baits will be positioned following scheduled maintenance control, and population recovery along the bush-edge monitored and compared with equivalent sites where long-life baits are not presented.

This work is funded by the Animal Health Board.

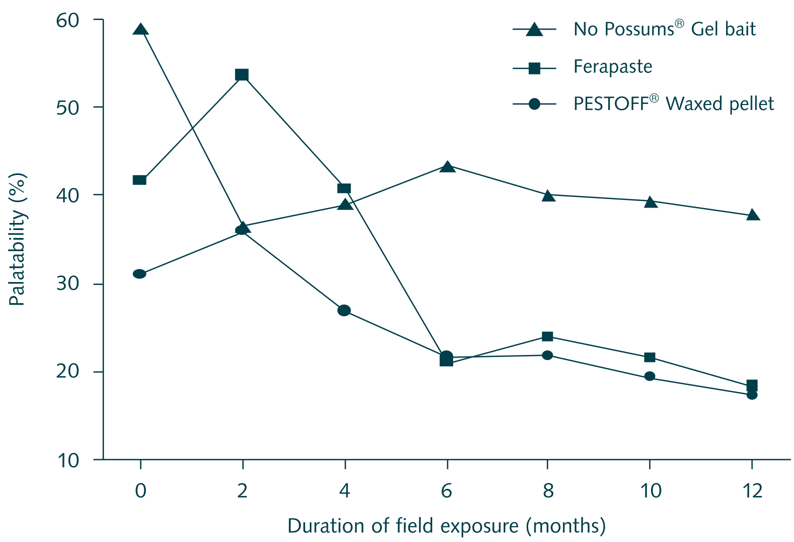


__Fig. 3.__ Palatability of three types of non-toxic bait after continuous exposure to field conditions for 12 months. Data from the sunny and shaded sites were combined.

***Dave Morgan** works on the improved management of possum populations.*

Possums as Pests – the Public Perception

What do people think about introduced wildlife? Public perceptions play an important role in determining official policy towards such animals. Also, people's views affect the success of some wildlife conservation and management programmes. In 1994, Wayne Fraser used a postal survey to assess public attitudes to introduced mammalian wildlife. A sample of 2828 adult resident New Zealanders were randomly selected. Each person was sent a questionnaire about their general knowledge, experience, and attitudes towards introduced mammals and their management. A choice of responses was presented for each question.

Completed questionnaires were received from 859 individuals. Demographic data from these respondents showed that the sample was reasonably representative of the adult population. The results as they relate to possums are presented here.

Overall, Wayne's survey revealed that the general public is reasonably well aware of introduced wild animals and their impacts on the New Zealand environment. Most respondents (82%) considered that not enough is being done to manage them. When asked to classify each animal as either a "pest", a "resource" or "both", most respondents (84%) scored possums as pests. However, 13% considered them both a pest and resource and 3% as a resource. Rodents, feral cats, and rabbits received similar ratings to possums, but the larger introduced mammals, such as feral goats, feral pigs, and deer, were viewed mostly as either both a pest and a resource (44–51%) or a resource only (26–44%).

Most respondents (68%) were equally concerned about the threats possums pose to agriculture (through transmission of bovine Tb to livestock) and to conservation (through their effect on native plants and animals). Of those with a single concern, rural respondents were slightly more concerned about the threat to agriculture (17%, cf. 12% for urban) than to conservation values (14%, cf. 20% for urban).

Respondents were asked to allocate a "nominal $100 tax" for wild animal control between the introduced species present in New Zealand, and possums received the greatest share (Fig. 1). Confirmation of the possum's perceived status as New Zealand's no. 1 vertebrate pest was provided by responses to a question on appropriate management for introduced wild animals (Fig. 2). Most respondents (71%) chose "extermination" for possums, with a further 21% choosing "control at low numbers". Despite a history of commercial harvesting of possums, there was little support (6%) for managing possums as a resource. In contrast, larger species such as deer are viewed more as "resources" and less as "pests" requiring eradication or control (Fig. 2).

The acceptability of methods of control was also investigated. While shooting was the most acceptable control method for the larger introduced species, the most preferred method for the smaller

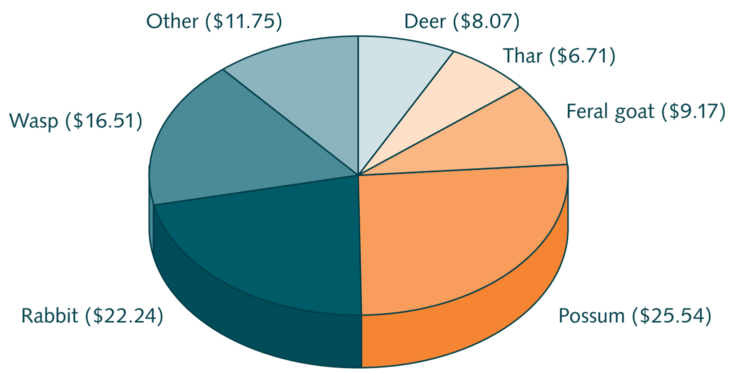


Fig. 1. *How people would prefer to see a nominal $100 tax spent on wild animal control (n = 777).*

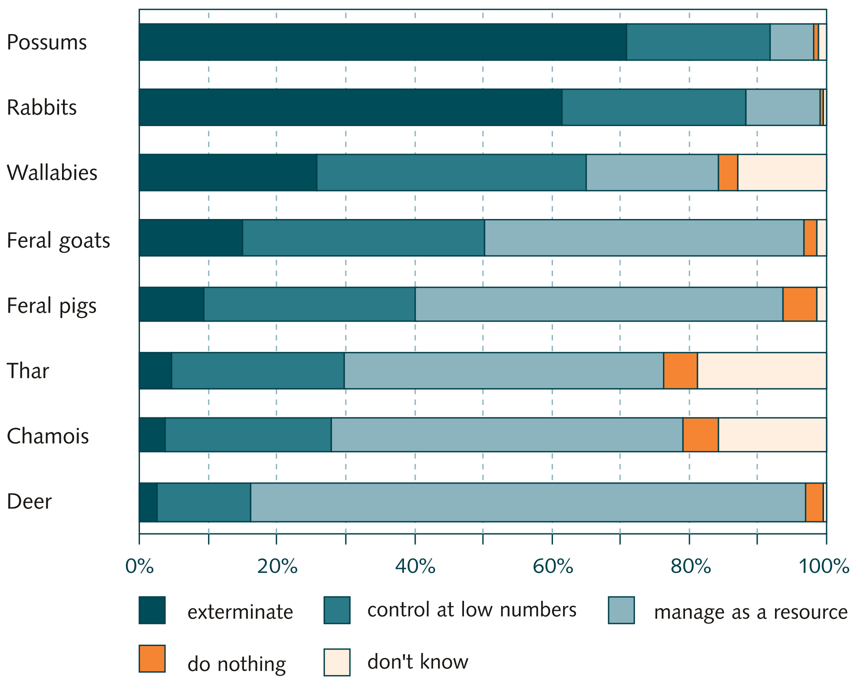


Fig. 2. *The sort of management people felt most appropriate for various introduced wild animals (n varied between species: range 827 – 840).*

species was poisoning. For possums, 52% of respondents favoured poisoning, with shooting (20%) and trapping (18%) next most preferred. Fewer than 10% favoured biological control. However, males and females preferred different control methods: poisoning and biological control received more support from males whereas shooting and trapping were more preferred by females. This preference was similar for rabbits and feral cats and, along with other survey responses, indicated that females were more concerned about issues of humaneness than males.

Female respondents' reservations about poisoning and biological control were further highlighted in responses to the question of whether staff from government departments and local government, and other landowners, should be allowed to use poisons such as Compound 1080 to control possums and other pest animals. Only 48% of female respondents answered "yes", compared with 75% of male respondents. A similar response was obtained for questions about the introduction of pest-specific diseases or parasites as biological controls, with only 45% of females in favour compared with 60% of males. Wayne believes this suggests that, in addition to being more concerned about humaneness, females are less inclined to support control methods that involve the introduction of chemical or other exotic organisms into the New Zealand environment.

There are clear parallels between Wayne's findings and those presented in our guest editorial.

This work was funded by the Foundation for Research, Science and Technology.

Wayne Fraser *works chiefly on the ecology and management of ungulates.*

Monitoring Possum Populations

A protocol covering the monitoring of possum populations has been established by the National Possum Control Agencies (NPCA). The protocol sets rules for the correct application of the residual trap-catch (RTC) technique, now used by all Tb vector and disease control managers to set measurable targets for the control of infected possum populations, and to audit the performance of contractors undertaking the control. Training courses run by the NPCA ensure people using the technique do so to national standards, and over the past 3 years more than 400 staff from regional councils, AgriQuality, and the Department of Conservation, along with private contractors have attended the courses.

The trap-catch protocol has been modified several times, however, following user requests, the availability of new statistical packages, and advances in technology. Bruce Warburton, a technical advisor to NPCA, has assessed many of the proposed modifications to the protocol, including the most significant modification to date, i.e. the inclusion of alternative sampling choices that enable planners to trade off the number of traps placed on each line with the number of lines monitored. The initial protocol fixed the number of traps per line at 20, and recommended the minimum number of lines necessary to monitor control operations of different sizes (Table 1). The variability of catch between lines and between traps was used to optimise the sampling and maximise the statistical precision of the population estimate for minimum cost. For example, instead of using 5 lines of 20 traps, RTC estimates with similar precision can be achieved by using 9 lines of 10 traps, resulting in 10% fewer traps being used. The choice depends on the habitat being monitored, and the ease with which the trapper can move between lines. Several Tb vector managers have already adopted the 10-trap-per-line option, and more will follow, because the additional lines provide greater coverage of the control area, and are therefore more likely to identify high-density pockets of surviving possums.

A possum caught in forest in a Victor No. 1 leg-hold trap.

Table 1. *The number of lines required when using 10 traps per line and trapping for 2 or 3 nights compared to the current recommendation of 20 traps per line trapped for 3 nights.*

Number of lines when using 10 traps per line		Number of lines when using 20 traps per line set for 3 nights
Nights		
2	3	
11	9	5
21	17	10
31	25	15
41	33	20
51	41	25
61	50	30

Other modifications or clarifications to the original trapping protocol include:

- Bridger No.1 traps being used as alternatives to Victor No.1 traps
- backing boards or stakes 50cm

- high and 10cm wide being used for applying lure when monitoring possum populations in tussock country (see photograph)
- all traps being cleared within 12 hours of sunrise on the day following their setting
- farmland being stratified into patches greater or less than 16 ha
- clarification of possum habitat on farmland to include everything except clean pasture

Bruce, Dave Forsyth and Morgan Coleman are also involved in research projects that aim to enhance the application and interpretation of trap-catch monitoring. One such example involves assessing the effect of habitat, season, and time following control on the variation in RTC estimates. Understanding such variation is critical for setting rigorous trap-catch targets if Tb and unwanted impacts on conservation values are to be eliminated.

Finally, Bruce and Morgan are also assessing the usefulness of trapping webs as estimators of absolute possum numbers. Trapping webs comprise a number of traps set on radii about a central point, and analysis of the resultant trap-catch data provides an estimate of possum density at the centre of the web. Initial trials using 50 traps (10 traps spaced at 20 m on 5 radii) provided realistic estimates of possum numbers. Further work in 2000 will optimise and field test modifications to the technique.

Should the above research indicate that further modifications to the national trapping protocol are required, then Bruce and his colleagues will make recommendations to the NPCA to ensure ongoing “best practice” and more cost-effective possum control.

A Victor No. 1 trap set with backing board for use in tussock country.

***Bruce Warburton**, **Dave Forsyth** and **Morgan Coleman** work on the development of improved auditing of possum populations.*

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A Selection of Recent Possum-Related Publications

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