He Kōrero Paihama
Possum Research News

Possum Research Newsletter • *Issue 16* • *December 2001*

ISSN 1173 - 2784

Contents

The Bulldog – an Effective New Kill-Trap

Possum control in New Zealand relies heavily on the use of poisons, but traps provide an important tool both for controlling possums and for monitoring their abundance. Traps are often used as an alternative to poisons where there is a risk of unacceptable environmental contamination, or where possums have developed aversions to poison baits. The ideal trap for possum control is one that kills quickly, has a high capture efficiency, is cheap, light, robust, and can be safely set in areas inhabited by ground birds such as kiwi and weka.

Of the kill-traps currently available in New Zealand, the Timms trap is the most popular, but its size largely restricts its use to areas accessible by vehicle. Other available kill-traps are not easy to use and do not always strike the animal in a position that rapidly kills them. Bruce Warburton and collaborators, Lincoln University engineering lecturer Ian Domigan and retired engineer John Hewitt, have developed an entirely new kill-trap that satisfies the welfare and practical requirements of such devices. They based their work on the results of earlier research undertaken by Bruce that determined the forces required to render a possum irreversibly unconscious within 3 minutes (a requirement of the National Animal Welfare Advisory Committee (NAWAC) draft guidelines). This research indicated that the two parameters most critical to the killing effectiveness of traps are impact momentum and clamping forces. Impact momentum is a combination of a trap's striking bar mass and velocity, while clamping force is the static force that the trap exerts after being sprung on the

A Bulldog trap in the 'set' position.

target animal. Bruce's earlier study found that clamping the neck requires less force than clamping the head to achieve unconsciousness, making the neck the more effective target. Unfortunately, existing traps that are compact enough for practical use often do not deliver sufficient clamping force to kill possums quickly. The work identified that an effective trap would have to exert a clamping force in excess of 10 kg and consistently strike in the correct location.

The Bulldog trap is the result of 2 years of work by the team, and meets all of the requirements of a good kill-trap. It consists of a folded leaf spring rather like an oversize bulldog clip, and automatically sets when opened. When a possum puts its head into this trap and pulls the lured trigger, the spring snaps closed, exerting about 20 kg of clamping force on the animal's neck.

The Bulldog trap has been the subject of pen trials run by Nick Poutu to determine the time to unconsciousness and death of 10 captured possums, by monitoring each animal's palpebral (blinking) reflex following capture. In these trials, the trap easily achieved the NAWAC guidelines, rendering all possums tested unconscious within 3 minutes, and most unconscious in less than 60 seconds.

The Bulldog trap is compact (see photo) and of moderate weight (approximately 750g), enabling 20–30 to be carried in a pack when setting them out. It can be baited with the usual variety of pastes. Because the spring covers the bait and restricts access to the front of the trap, no additional cover is needed to ensure it strikes correctly and consistently, regardless of whether it is set on the ground or on elevated sites.

Commercial production of the Bulldog trap is about to begin. Field trials will shortly be carried out to compare its capture efficiency with that of the most commonly used trap in New Zealand – the Victor No. 1 leg-hold trap. The design of the Bulldog trap is protected by a New Zealand patent and has a worldwide patent pending. It is to be marketed by Feral Control NZ Ltd.

The Bulldog trap appears likely to provide an additional, new and effective tool for possum control.

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

Bruce Warburton *and* ***Nick Poutu*** *work on the development of new and more humane possum traps.*

Ian Domigan *lectures in engineering at Lincoln University.*

Guest Editorial

This year is likely to be something of a watershed for both possum research and possum management. In the last issue of Possum Research News, Doug Wright reviewed the contribution of the National Science Strategy Committee for Possums and Bovine Tuberculosis control since its inception 10 years ago. Doug has now stepped down as the NSSC Convenor, and Peter O'Hara, formerly of MAF, has taken over the reins. At the same time, the NSSC has become a committee of the Foundation for Research, Science and Technology (FRST), and is about to embark on a review of its terms of reference and membership. In turn, the changes to the NSSC are just a small part of the implementation of the Government's new vision for Research, Science, and Technology, coming out of the Foresight Project. This vision emphasises the need for clearer articulation of the contribution of research to the Government's high-level goals and stronger partnerships between research and end-users. As a result we are likely to see new and/or revised priorities directed at solving the possum and Tb problems, and closer collaboration between research providers, like Manaaki Whenua, and end-users, such as the Department of Conservation, Animal Health Board and regional councils.

Over the last 5 years, there has been a significant thrust of research into new ways of controlling possums and Tb through the application of new genetic technologies – principally in development of possum fertility control and Tb vaccines. The Report of the Royal Commission on Genetic Modification, released a few months ago, provided cautious support for such research in the context of "preserving opportunities", and the Government's recent response to the Commission's report supports the Commission's overall strategy. The strategy will be a critical determinant of the directions and time frame for future research on biotechnological approaches to possum and Tb management. The new conditions on contained field tests of genetically modified plants and animals are unlikely to significantly push back the timetable for development and testing of possum control products involving genetic modification. But the social and political issues surrounding genetic technologies will not be resolved quickly, and so future impacts on this area of possum research remain uncertain.

This year, too, has seen the proposal from the Animal Health Board for the next phase of the Bovine Tuberculosis Pest Management Strategy, which aims to have New Zealand meeting international standards for Tb-free status by 2013. Achieving this goal will require a huge joint effort between pest managers and researchers. While the current approaches have been very successful at reducing numbers of reactor livestock, they have not prevented the spread of Tb to new areas. Given the huge areas to be controlled under the proposed new scheme, improving cost-effectiveness of control tools and better targeting of control will be major issues. These are currently priority areas for research, but preventing Tb spread and the goal of driving Tb prevalence down to very low levels throws up a new set of problems – how can we detect Tb at very low levels and how do we know when Tb has been eradicated? The most efficient way to answer these questions, and many others that Tb eradication is likely to throw at us, is for research to take place within the management framework. There is a formal framework for doing this, referred to as Adaptive Experimental Management. The AEM approach is already being used by the Department of Conservation to help it improve how it manages possum populations for conservation benefits. One of the challenges for researchers and managers will be to explore whether such an approach is feasible for addressing the Tb problem.

In a wider biosecurity context, MAF has just released its issues paper on developing a biosecurity strategy for New Zealand. We tend to think of biosecurity largely in terms of invasions, but the issues paper raises questions about the management of pests like possums. Interestingly, the paper also flags the current (and increasing) conflict in attitudes within New Zealand society towards species,

like possums and deer, which are seen as both pests and resources.

For the last ten years, possums alone have been centre stage as New Zealand's number one mammal pest. But that is changing too. Possums are still important – they are the major wildlife vector of bovine Tb and the main cause of canopy browsing damage. But, as well as the growing realisation of the impacts of predators, particularly stoats, there is increasing evidence that controlling suites of introduced mammal pests is often more important than focusing on single species, and that we need to understand the ecological interactions between the pests to better manage their combined impacts on conservation and agricultural production. Getting such understanding requires large, ecological experiments, often with fairly long time frames. The tension for research is in balancing short-term needs of managers for better tools with the need for better understanding of how systems operate, so that management can be planned and be effective over longer time frames. One outcome is therefore likely to be an increasing refocusing of possum research into multi-species frameworks.

Phil Cowan's *research career has focused largely on possums. He has recently taken over from Oliver Sutherland as Manaaki Whenua Science Manager for Biosecurity and Pest Management*

De-mystifying Science for Mâori

Over recent years Mâori interest in environmental management issues has heightened, but in ways that the Western science community sometimes finds difficult to understand. At a hui that Rau Kirikiri recently attended, kaumatua expressed concern about aerial spreading of 1080 baits for possum control. In their view the toxin acted indiscriminately and was therefore unacceptable; it was an unwarranted intrusion into the domain of Tâne (The God of Forest and Birds), and a blight on the landscape that Papatuanuku (Mother Earth) had created. These kaumatua argued that waterways would be polluted, plants would be destroyed, and even humans affected in some way. Little substantive proof was offered that these things were actually happening, or that the animal being targeted was a pest. The perception that harm was being done to the grandchildren of Tâne was all that mattered. This is hardly surprising, given that the possum has never featured prominently in Mâori thinking. It has never been a source of food for Mâori, nor used for clothing or other adornments, and until recently, most Mâori would not have regarded it as a pest.

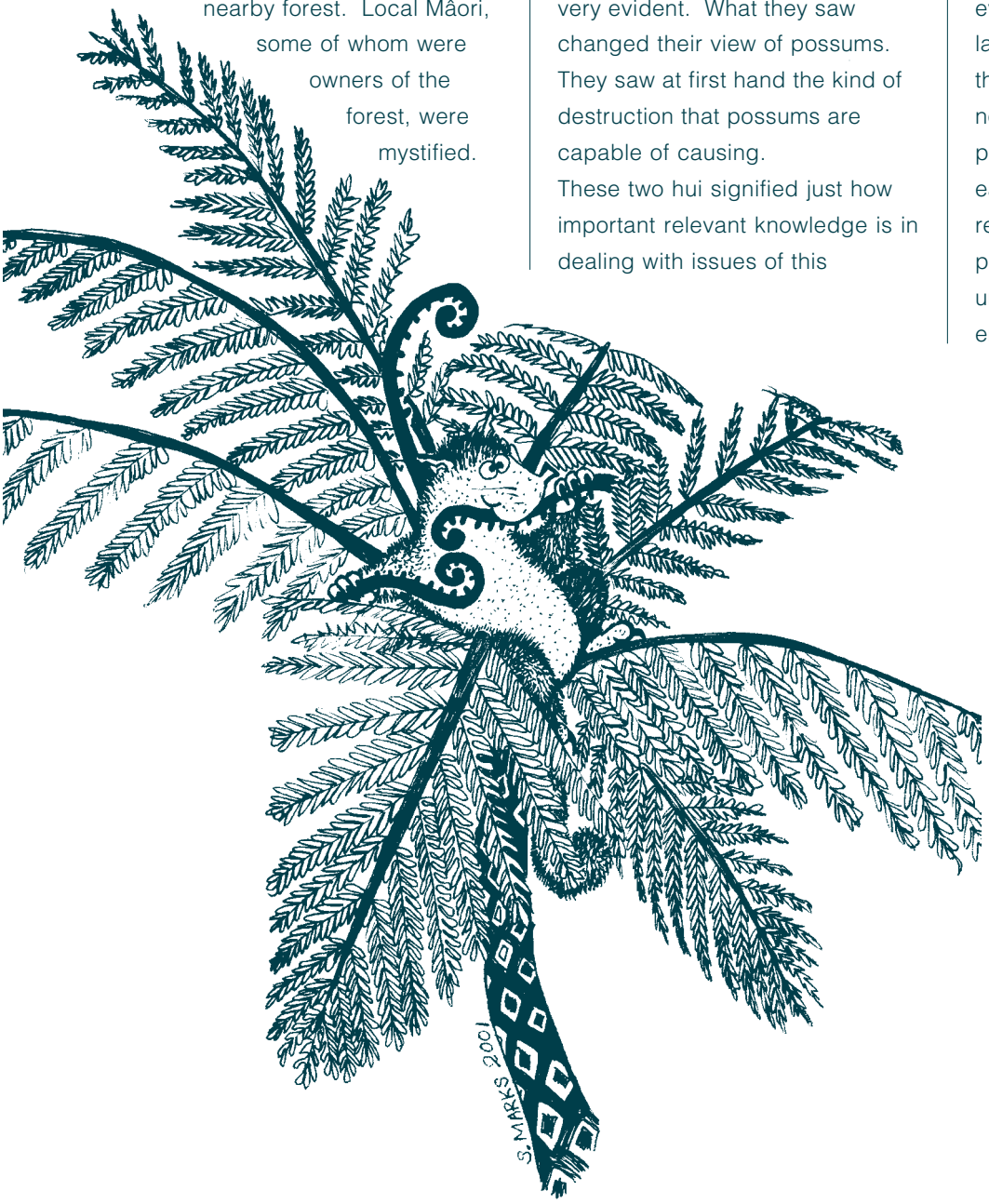
Younger, more Western-educated Mâori at the hui turned their attention to more scientific issues arising from poison baiting, like the actual dangers of contaminating the environment with 1080, the effectiveness of 1080 in killing possums, and alternatives to 1080. In the end the message nevertheless was the same – find a better way of using poisons to control possums, particularly in forests, and minimise, if not eliminate, the negative impacts 1080 may have on the environment.

One issue turned the tide of concern ever so slightly – bovine tuberculosis (Tb). It came as something of a revelation to many at the hui that possum control was important in the fight against Tb. No one had ever highlighted this issue for them previously. For once, there was a practical

concern that they could relate to and one that could detrimentally affect humans. However, the need to control Tb did not remove the dissatisfaction with aerial sowing of 1080 bait. It simply identified a reason for justifying the killing of possums.

At another similar hui attended by Rau, the local DOC Conservator outlined the damage that possums were doing to the nearby forest. Local Mâori, some of whom were owners of the forest, were mystified. They knew the forest well, they claimed. They hunted there often and had seen little, if any, possum damage. The truth was they were not at all sure what damage possums actually did to the forest. So, when the Conservator took them up in a helicopter to view the forest from above, they observed for the first time the devastation done by possums to the forest canopy. From the ground it was not visible, but from the air it was very evident. What they saw changed their view of possums. They saw at first hand the kind of destruction that possums are capable of causing.

These two hui signified just how important relevant knowledge is in dealing with issues of this magnitude. The notion of conservation for conservation's sake is not one that all cultures embrace immediately – particularly those that have relied on the sustainable use of species for their survival. Further, some important messages are still not getting through to the general public, e.g., that preventing the spread of Tb is a legitimate reason for killing possums. The assumption often made is that everyone is talking the same language when, as in the case of the possum damage that could not be seen from the ground, two parties can in fact be talking past each other. Science has a responsibility to ensure that people from different cultures fully understand such complex environmental issues.



Rau Kirikiri *is Landcare Research's Treaty Responsibilities Manager.*

Using Strain Typing to Identify Bovine Tb Transmission Patterns

Mycobacterium bovis bovine (Tb) is now widespread in possum populations. The bacillus reproduces asexually, so any genetic mutation results in a distinct lineage or strain that can be identified using DNA fingerprinting methods such as restriction endonuclease analysis (REA). In some localities there are few REA strains present, and they appear to show little variation over time. In others, such as Castlepoint in the Wairarapa and the West Coast, there is a multiplicity of different REA strains whose prevalence may alter dramatically over time. This variability can provide new insight into patterns of Tb spread within and between animal species.

For example, five different REA strains have recently been identified by AgResearch for Graham Nugent and Jackie Whitford from just 19 Tb cultures isolated from eight possums, eight pigs, and two deer killed in 1999 and 2000 on or near Flagstaff Flat, in central Westland, and from one researcher involved in the necropsy of the possums who became infected.

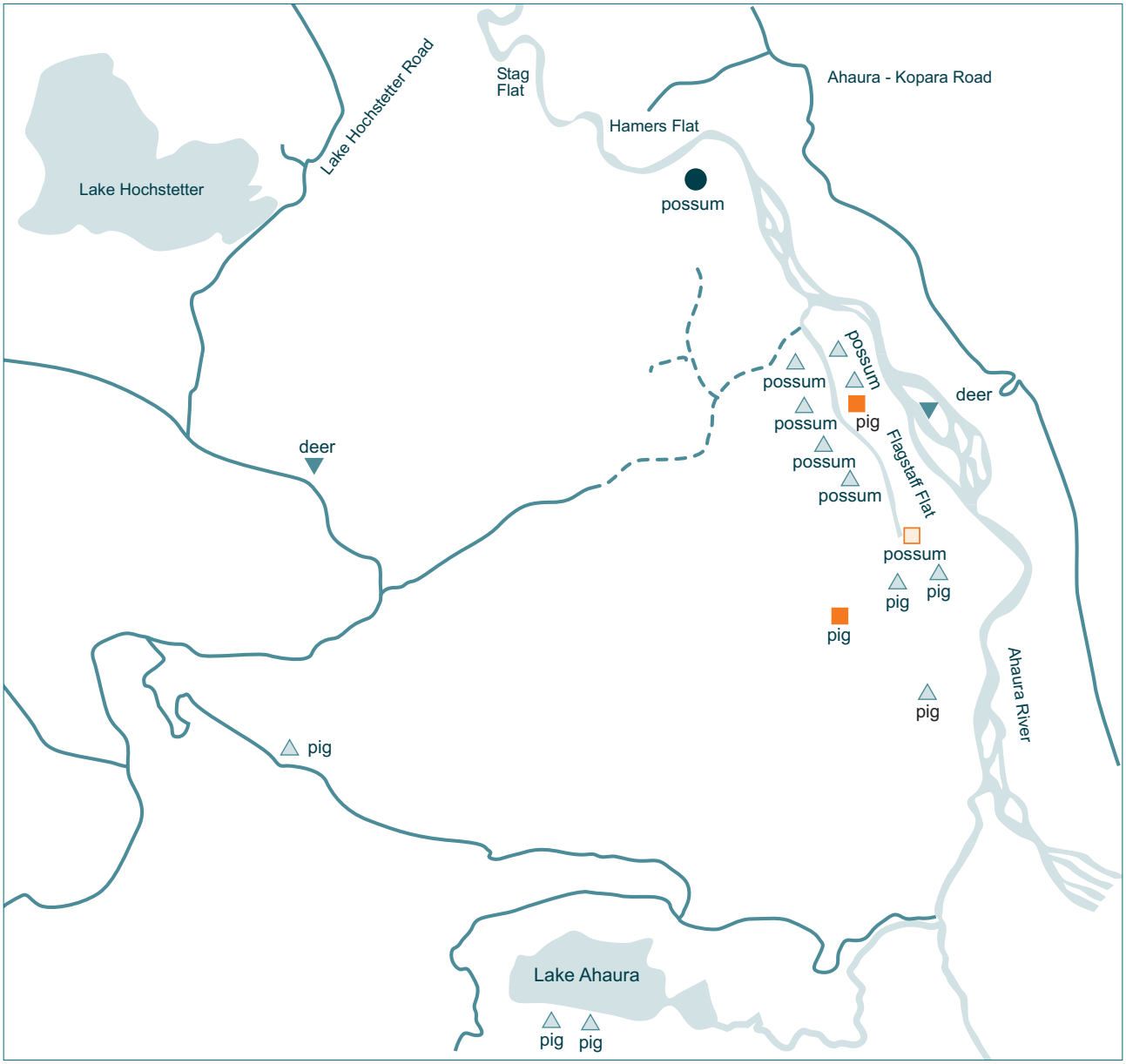


Fig. *Kill locations of possums, deer, and pigs infected with the different Tb strain types on or near Flagstaff Flat, central Westland.*

Three different strains were identified from the possums. The most common of these occurred in six of the possums, six of the pigs, and in the researcher. This strain was first recorded in 1999 in a nurse cow grazed 24 km from Flagstaff Flat, but which may have been reared on Flagstaff Flat in the mid-1990s as the herds on the two properties were linked. The strain was also isolated from pigs taken within up to 10 km from Flagstaff Flat, and from possums trapped in the central part of the flat. The possum population in the area was monitored from 1992 to 1999 by Jim Coleman, who identified a major outbreak of Tb in possums (> 60% infected) in 1992 that appeared to cause a decline in possum density to 2–3% (determined by Residual Trap Catch (RTC) rate). Tuberculosis then disappeared from Jim's samples in 1994 to reappear in 1999. The finding suggests that Tb, possibly in the form of a new strain, has spread through the possum population in this part of Flagstaff Flat during a period when, for most of the time, possum densities were well below the 10% RTC recorded there in 1999.

A different strain of Tb was found in one possum in 1999 on a pasture edge approximately 2 km from the northern end of Flagstaff Flat. The possum population at this particular site had been infected more or less continuously throughout the 1990s. Further REA typing from frozen isolates from the infected possums taken there in the early to mid-1990s is needed to assess the likelihood that this strain persisted at this site for at least a decade, in contrast to the possible change in strain type recorded on the main flat.

Both of the two isolates from deer typed from Flagstaff Flat were infected with a fourth strain of *M. bovis* that differed from those found in either the possums or the pigs. This appears to contradict recent research showing that deer are spillover hosts that become infected through contact with possums. An explanation for this latest finding may be that the deer, aged 4 and 10 years, became infected at a time when the REA type recorded from them was far more widespread in possums than it is now.

Although most of the pigs were infected with the most common strain found in the possums, the remaining two infected pigs had a new fifth strain not previously recorded on the West Coast but similar to one found in deer at Mesopotamia and elsewhere in Canterbury. One of the pigs was an illegally released 8-month-old barrow (a castrate) and the other a "sentinel" deliberately released by Graham and Jackie and known, at the time of release, to be Tb free. The occurrence of this new 'Canterbury-like' strain therefore suggests the possibility that the strain may have been imported with the barrow, and if so, that pig-to-pig transmission probably occurred in the wild. However, the strain also had some similarities with a rare strain from West Coast possums, in which case it may just be a recent mutation.

Each of the observations and inferences above has epidemiological and management implications, despite the few isolates typed. The observations highlight the value of strain typing as an epidemiological tool, especially where types are variable and where there is other epidemiological and ecological data on animal density, distribution, and age. The availability of frozen Tb isolates from possums killed in the early 1990s at Flagstaff Flat provides a unique opportunity to test some of the ideas and hypotheses raised here.

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

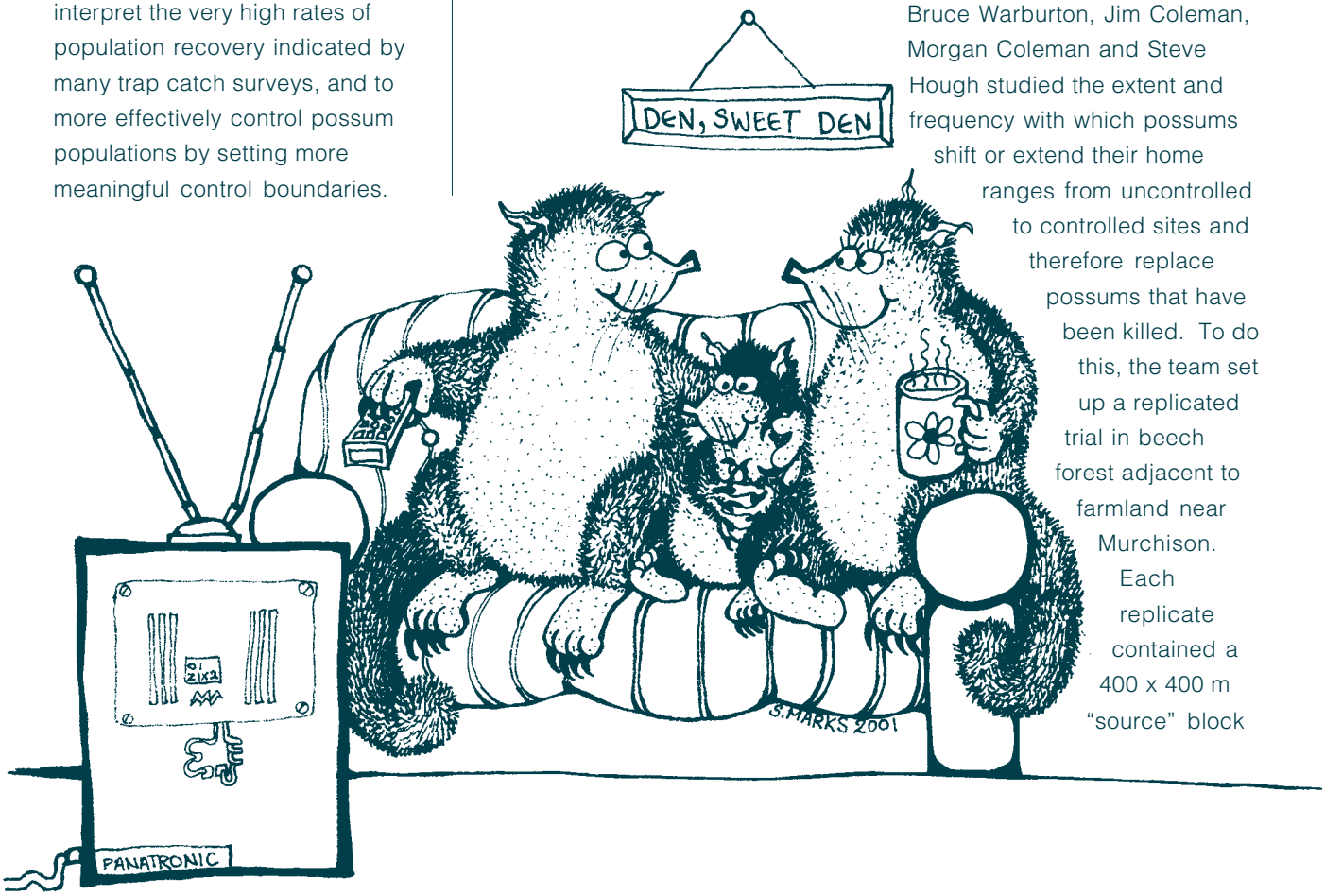
Graham Nugent, ***Jackie Whitford***, *and* ***Jim Coleman*** *work on the epidemiology of Tb in wild animal populations.*

Do Possums Respond to the Removal of their Neighbours?

Possum control to protect livestock health or conservation values currently costs about $45 million annually, and much of this is spent on maintaining the gains achieved from past control by repeating operations to hold possum populations at low levels. This is because one-off possum control operations have limited long-term effectiveness – such controlled populations quickly recover, often at rates that exceed their reproductive potential, and are apparently driven primarily but not solely by immigration from neighbouring uncontrolled populations. Understanding such population shifts is important, as it will enable control managers to interpret the very high rates of population recovery indicated by many trap catch surveys, and to more effectively control possum populations by setting more meaningful control boundaries.

Setting up the aerial for tracking radio-collared possums.

In the second recent study of its kind by Landcare Research, Bruce Warburton, Jim Coleman, Morgan Coleman and Steve Hough studied the extent and frequency with which possums shift or extend their home ranges from uncontrolled to controlled sites and therefore replace possums that have been killed. To do this, the team set up a replicated trial in beech forest adjacent to farmland near Murchison. Each replicate contained a 400 x 400 m "source" block



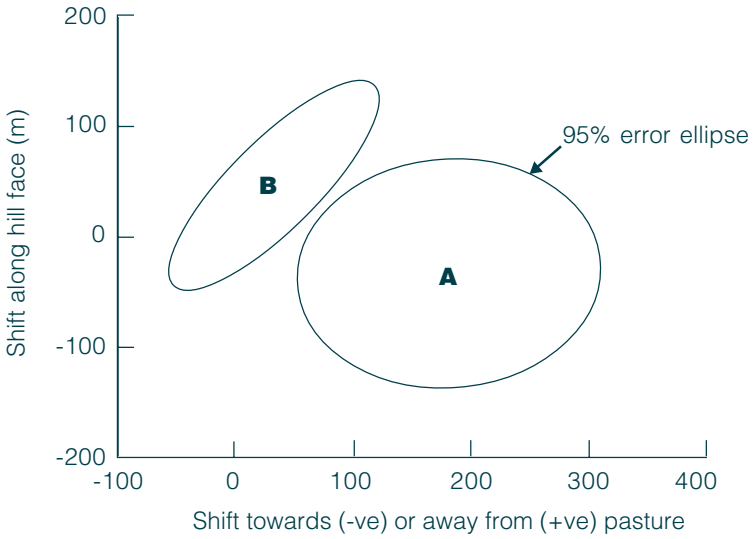


Fig. *Mean shifts in home range in the two replicates (A+B) as illustrated by 95% error ellipses (encompasses the confidence intervals of all animal range shifts). Zero represents the location of home ranges before population reduction.*

of possums 500 m from the pasture edge and similar sized "sink" blocks immediately adjacent: one across the hill face at the same level as the source block, and the other between the source block and the pasture. Possums in the source block were radio-collared and their foraging movements and den sites monitored for 12 months, the populations in the sinks were then lowered by c. 70%, and the radio-collared animals then monitored for a further 3 months.

The results differed between the replicates. Home ranges of possums in one replicate shifted on average over 180 m directly *uphill* (away from pasture), and this shift was significant. In contrast, possums in the second replicate did not appear to shift their range in either direction (Fig.). Some of the possums from one of the source blocks that spent time foraging out on the pasture, prior to population reduction, spent more time foraging within the forest afterwards, presumably because of the reduced competition there. Why this shift did not occur in our second replicate is baffling. In contrast, radio-telemetry data detailing den site use in both replicates showed no significant movement either laterally across the hill or vertically to or away from pasture. Thus, some possums responded to population reduction (i.e., control) in one of the replicates by adjusting their foraging areas, but irrespective of such changes the fidelity of all possums in both replicates towards den sites appeared as strong as ever.

Clearly, Bruce and his team have demonstrated in one of the two replicates that the attraction of a good den far outweighs access to less competitive foraging when populations are reduced. This finding has important but confusing implications for possum managers. Possum control along forest edges results in reductions in possum numbers feeding on pasture, apparently both because of the animals killed and because of the range shifts in survivors. The subsequent rapid recovery of possum numbers on the bush pasture margin, reported by most pest managers, indicates that such range shifts may be short lived. The ambiguity of the findings will need to be further evaluated across a range of different habitats.

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




***Bruce Warburton**, **Jim Coleman**, **Morgan Coleman**, and **Steve Hough** work on understanding possum population ecology.*

Water Monitoring for Contamination after Aerial 1080 Pest Control Operations – An Update

Possums living on agricultural or forested land in New Zealand are most often controlled by poisoning in operations using sodium monofluoroacetate (1080) in cereal or carrot baits sown from the air, or in cereal bait presented in bait feeders. Aerial baiting, and in particular the environmental hazards arising from it, has given rise to considerable public debate, especially over the fate of 1080 following its loss from baits and the risk of 1080 contaminating water catchments used for human supply. Because of this concern, Charles Eason, Geoff Wright, and the team in Landcare Research's Toxicology Laboratory have maintained a close interest in the results of their water monitoring for 1080 carried out over the past 10 years.

Significant contamination of waterways after baiting with 1080 is most unlikely.

During this period, Geoff has collated results from the analysis of over 1300 water samples collected from streams on the day following 1080 baiting and after subsequent heavy rain from 143 possum control operations scattered throughout New Zealand. Most (95.9%) of these samples contained no residues of 1080, even though these can be measured down to 0.1 parts per billion (ppb). Residues were, however, found in 4.1% (54) of all samples, but in most of these (49), the 1080 recorded was less than 1 ppb (Fig.). Where positive results were found in water samples, these have been mostly in very small streams and associated with the presence of bait. Sixty-five of the 1300 samples were taken from reticulated town water supplies, but all of them were free of measurable 1080.

The Ministry of Health has issued guidelines recommending that water taken from catchments sown with 1080-loaded baits should not be used for human supply until tests show that the concentration of 1080 is below 2 ppb. This value was taken from the Ministry's approach to prioritising the determinants of safe drinking water. The figure of 2 ppb is about to 50% of the maximum acceptable value (MAV) of 5 ppb set in the Ministry of Health's Drinking Water Standards 1995. In the few instances (5 samples, with 1 sample at 9 ppb), where the 1080 concentration recorded in samples exceeded the 2 ppb limit, contamination was limited to one only of the samples collected at that particular site. These individual samples did not represent any hazard to human water supply. It is important to point out that sampling has been undertaken predominantly within

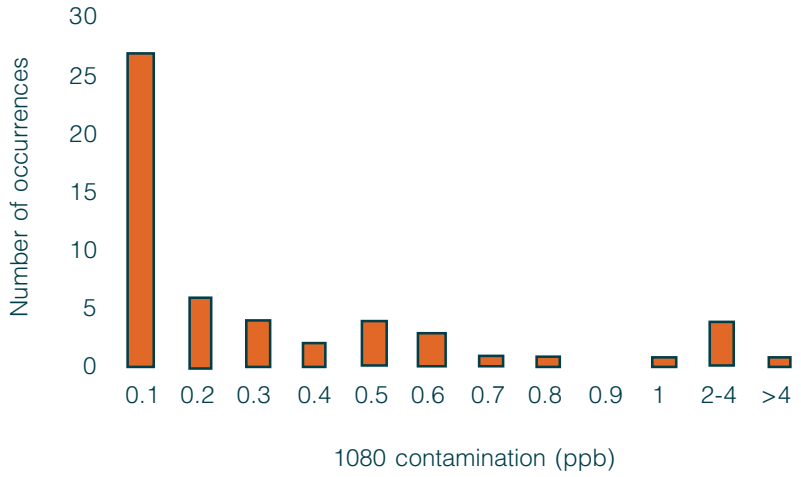


Fig. *Residue levels recorded in the 4.1% of all water samples positive for 1080. One ppb is 1,500,000 times lower than the concentration in 0.15% 1080 cereal bait.*

or adjacent to control areas where there would be the greatest chance of detecting contamination were it to occur.

Charles and Geoff believe their results suggest that significant or prolonged contamination of waterways after baiting with 1080 is most unlikely if care is taken by pest control operators to avoid watercourses in accordance with the regulations of poison baiting. These procedures stipulate that poison bait must not be laid in any catchment that provides water for human consumption, except where approved by the appropriate local authorities such as the Medical Officer of Health (Pesticides (Vertebrate Pest Control) Regulations 1983).

Water samples continue to be taken from all significant areas sown with 1080-loaded baits, in line with the Ministry of Health requirements and recommendations by Landcare Research as prudent actions to ensure public safety.

This work was funded by regional and district councils and the Department of Conservation.

Charles Eason *and* ***Geoff Wright*** *work on the toxicology of vertebrate pesticides in the environment.*

Contacts and Addresses

Researchers whose articles appear in this issue of *He Kōrero Paihama - Possum Research News* can be contacted at the following addresses:

Jim Coleman
Morgan Coleman
Charles Eason
Steve Hough
Rau Kirikiri
Graham Nugent
Nick Poutu
Bruce Warburton
Jackie Whitford
Geoff Wright

Landcare Research, PO Box 69, Lincoln
ph: +64 3 325 6700 fax: +64 3 325 2418

Phil Cowan
Landcare Research
Private Bag 11052
Palmerston North
ph: +64 6 356 7154
fax: +64 6 355 9230

Ian Domigan
Dept of Natural Resources Engineering
& Environment Management
Lincoln University
PO Box 84
Lincoln
ph: +64 3 325 3813
fax: +64 3 325 3845

A Selection of Recent Possum-related Publications

Caley, P.; Coleman, J.D.; Hickling, G.J. 2001: Habitat prevalence of macroscopic *Mycobacterium bovis* infection in brushtail possums (*Trichosurus vulpecula*), Hohonu Range, Westland, New Zealand. *New Zealand Veterinary Journal 49(3):* 82-87.

Coleman, J.D. 2001: Possums as vectors of Tb in livestock. Proceedings of the New Zealand Society of Animal Production 61: 57-59.

Coleman, J.D.; Cooke, M.M. 2001: *Mycobacterium bovis* infection in wildlife in New Zealand. *Tuberculosis 81(3):* 191-202.

Coleman, J.D.; Fraser, K.W.; Nugent, G. 2001: Buffer widths for controlling bovine Tb in brushtail possums, wild deer and cattle in New Zealand. *In* Pelz, H-J; Cowan, D.P.; Feare, C.J (eds), Advances in Vertebrate Pest Management II. Filander Verlag. Pp 363-371.

Cowan, P.E. 2001: Responses of common brushtail possums (*Trichosurus vulpecula*) to translocation on farmland, southern North Island, New Zealand. *Wildlife Research 28:* 277-282.

Eason, C.T. and Wickstrom, M. (2001). Vertebrate pesticide toxicology manual (poisons). *Department of Conservation Technical Series* 23. 121 p.

Khalil, A.M.; McFarlane, R.G.; Duckworth, J.A. 2001: Humoral immunity to cholera toxin and ovalbumin in the brushtail possum (*Trichosurus vulpecula*). *New Zealand Veterinary Journal 49(2):* 54-59.

MacCallum, H., Barlow, N., and Hone, J. 2001. How should pathogen transmission be modelled? *Trends in Ecology and Evolution 16:* 267-9.

Morgan, D.R.; Eason, C.T.; Wickstrom, M.L. 2001: Zinc phosphide as a poison for control of possums (*Trichosurus vulpecula*): the need for encapsulation. *In:* Pelz, H-J; Cowan, D.P.; Feare, C.J. (eds), Advances in Vertebrate Pest Management 11. Filander Verlag. Pp. 337–344.

Editors:	Jim Coleman Caroline Thomson	Published by:	Manaaki Whenua Landcare Research PO Box 69 Lincoln, New Zealand ph +64 3 325 6700 fax +64 3 325 2418
Layout:	Denice Webb		
Cartoons:	Susan Marks		
Thanks to:	Christine Bezar		

Also available electronically: http://www.landcare.cri.nz/information_services/publications/#news