



Kararehe Kino

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Manaaki Whenua
Landcare Research

A Prickly 'Whodunit': Predation by Hedgehogs on Native Fauna

Hedgehogs have traditionally been regarded with a benign indifference by most New Zealanders. The appealing, snuffling little creatures that munch on garden and pasture pests and who feature in children's stories ranging from Enid Blyton to Bob the Builder hardly compare with the voracious mustelids and possums that the term 'pest' brings immediately to mind — or do they?

European hedgehogs were deliberately introduced into New Zealand in the late 19th century and are now widespread throughout all but the most inhospitable habitats. While their diet mainly consists of invertebrates, there is plenty of evidence from their native Europe that they are predators of other fauna including the eggs and chicks of ground-nesting birds.

More-recent work in this country has led to a reconsideration of the benign conservation status of the hedgehog in New Zealand. For example, between 1994 and 1999 hedgehogs were responsible for an average of 19% of all predation events recorded on video at banded dotterel and black-fronted tern nests in a braided riverbed system in the Mackenzie Basin. In the 2000/01 season this rose to 78%. Significant numbers of native skink remains have been found in hedgehog guts from Macraes Flat in Otago, and other studies have identified hedgehogs as a potentially





Hedgehog with radio transmitter and spool prior to release

serious threat to endangered native invertebrates—they are insectivores after all. The potential threats posed by hedgehogs to native ecosystems fall into three main types: direct predation, competition with native insectivores, and the removal of significant volumes of invertebrate biomass.

Chris Jones is currently investigating a number of aspects of hedgehog foraging behaviour. In particular he is interested in whether all hedgehogs in a local population prey on threatened native fauna to the same extent or whether some 'rogues' are responsible for a disproportionate amount of the damage done. In a braided riverbed system of the Mackenzie Basin Chris attached spools of thread to a sample of radio-tagged hedgehogs and followed the foraging paths

revealed by the thread. These paths were recorded using a GPS and will be overlain onto high-resolution aerial photographs to produce detailed maps of where each animal foraged. Not only will this show us how hedgehogs use different habitat types, but it will also indicate what proportion of the studied individuals foraged out on the river braids where the endangered terns and dotterels nest. Initial results show that of 10 hedgehogs studied in detail, only one female habitually used the river braids, whereas the others almost never did. This suggests that control measures to protect the birds would be most effective if focused in the immediate surrounds of the breeding areas. The thread traces also revealed the ease with which hedgehogs can traverse apparent barriers such as ponds.

Chris has also successfully trialled the use of a marker chemical, rhodamine B, in hedgehogs. When ingested in marked bait, rhodamine B leaves a characteristic mark (a band that fluoresces under ultra violet light) in hairs and whiskers growing at the time the bait is eaten. Multiple doses of the chemical spaced a few days apart give rise to a series of bands, each corresponding to a single dose. During the next spring breeding season, Chris plans to place eggs marked with rhodamine in artificial nests at regular intervals out on the river braids. Subsequent testing of the local hedgehog population for the presence of the marker should reveal which individuals have a taste for eggs: a series of bands will indicate a repeat offender.

The relative importance of native lizards in the diet of hedgehogs is another study currently underway in Central Otago. Here, Chris is documenting the presence of skink remains



Young hedgehogs, no more than a few days old, in the nest





Removing a radio transmitter from a hedgehog at the end of the study

in hedgehog droppings found at his study site. By collecting repeated samples of faeces from a group of radio-tagged animals, individual variations in skink consumption can also be investigated.

While the potential threats posed by hedgehogs to our native wildlife are becoming more widely recognised, there are still large gaps in our knowledge of the basic ecology of this species in New Zealand. Chris has plans

for further work to investigate their survival and reproductive rates and dispersal of juvenile hedgehogs. Estimates of the densities of hedgehogs in a range of vulnerable habitats are also urgently required. Only when these basic questions have been answered can we get a real impression of the level of threat posed by this prickly import.

This work is funded by a Landcare Research Investment Postdoctoral Fellowship and by the Miss E.L. Hellaby Indigenous Grasslands Research Trust.



Chris Jones

All You Ever Wanted to Know about 1080

New booklet: Technical review of sodium monofluoroacetate (1080) toxicology (C.T. Eason, 2002)

This review is the most significant New Zealand statement on the vertebrate pesticide 1080 since the proceedings of a workshop on the topic were published in 1993. The new work pulls together early and recent information on the toxicological features of 1080, including its toxic effects, rate of

breakdown, use by pest managers, effect on and relative susceptibility of target and non-target species, and effectiveness compared with other toxins for use in possum management. The publication thus provides an up-to-date summary and key working document for all operators directly or indirectly

involved or interested in the application of 1080 baits for the management of vertebrate pests.

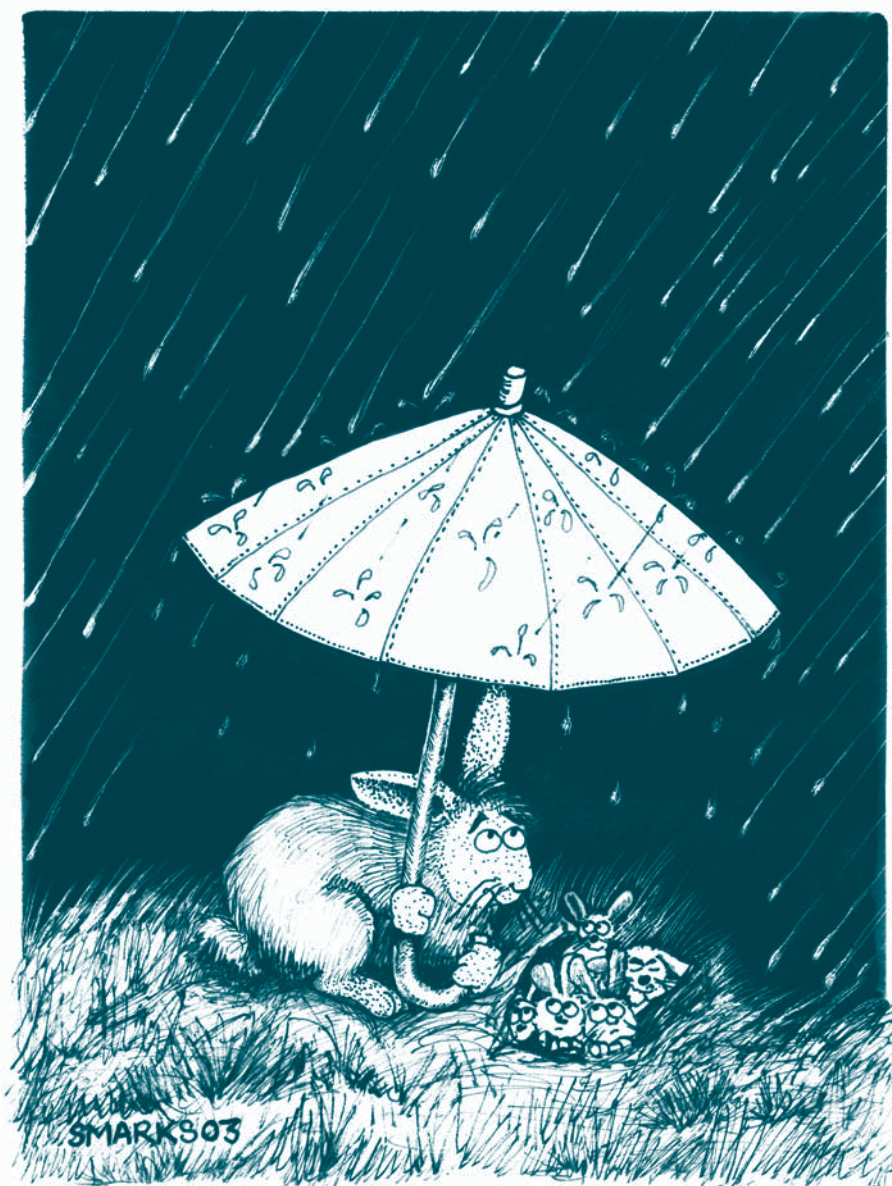
The booklet is available free of charge, from Nick Hancox, Communications Manager, Animal Health Board, PO Box 3412, Wellington.

Natural Processes Governing Rabbit Populations

Rabbits are high-profile pests in rural New Zealand. They affect agricultural production by competing with livestock for forage, and they threaten conservation values by eating native plants and by helping to maintain populations of exotic predators such as ferrets and feral cats. Nevertheless, rabbits are really only pests in some localities—the problem is most intense in semi-arid grasslands, especially in the South Island.

The patchy distribution of areas prone to rabbit damage is thought to be driven by regional differences in climate and soils. Researchers have proposed a ‘paradigm’ whereby rabbit populations in moderate-rainfall areas of lowland improved pasture are driven by ‘top-down’ processes that maintain low, stable rabbit densities. In these habitats, densities are controlled by the high mortality of young rabbits, caused by drowning of young in the nest, and by predation. The rabbits’ long breeding season also ensures a steady supply of young rabbits for predators, and hence significant predator populations.

In contrast, rabbit populations in low-rainfall, semi-arid regions are thought to be driven by ‘bottom-up’ processes, such as pasture growth. Predation is not considered a key factor in controlling rabbit numbers in these areas because young rabbits are available there for a shorter period of the year. Consequently, when predator populations begin to peak in late summer they struggle as they have few young rabbits to



prey on. Rainfall and pasture growth are less predictable in semi-arid regions and as a result, rabbit numbers can fluctuate more wildly from year to year.

One of the unknown outcomes of the illegal introduction of rabbit haemorrhagic disease (RHD) into New Zealand was the extent to which it might change or disrupt these ‘top-down’ and ‘bottom-up’ processes. Would post-RHD rabbit populations

be more affected by top-down processes, or would bottom-up processes be destabilised by RHD and rabbit problems worsen?

Ben Reddiex undertook the first controlled test of the effect of predation and RHD on rabbit populations in two areas of lowland improved pasture in North Canterbury and in two semi-arid areas in Central Otago. In each area, predators were trapped at two predator-removal



sites, and were not trapped at two non-treatment sites. Rabbit numbers were assessed by spotlight counts, while survival of juvenile rabbits was assessed by monitoring nestlings in breeding burrows and following juveniles radio-collared when they emerged from such burrows.

In November 1999, an epidemic of RHD spread through the North Canterbury areas, and rabbit abundance declined on both the predator-removal and nearby non-treatment sites. However, the declines were less marked on the sites where predator numbers had been reduced (Fig.) despite the epidemic being equally severe in these treatments, because the percentage of rabbits with RHD antibodies was similar in both treatments.

In contrast, in the semi-arid study sites in Central Otago, Ben believes there was no apparent effect of his predator reductions on rabbit

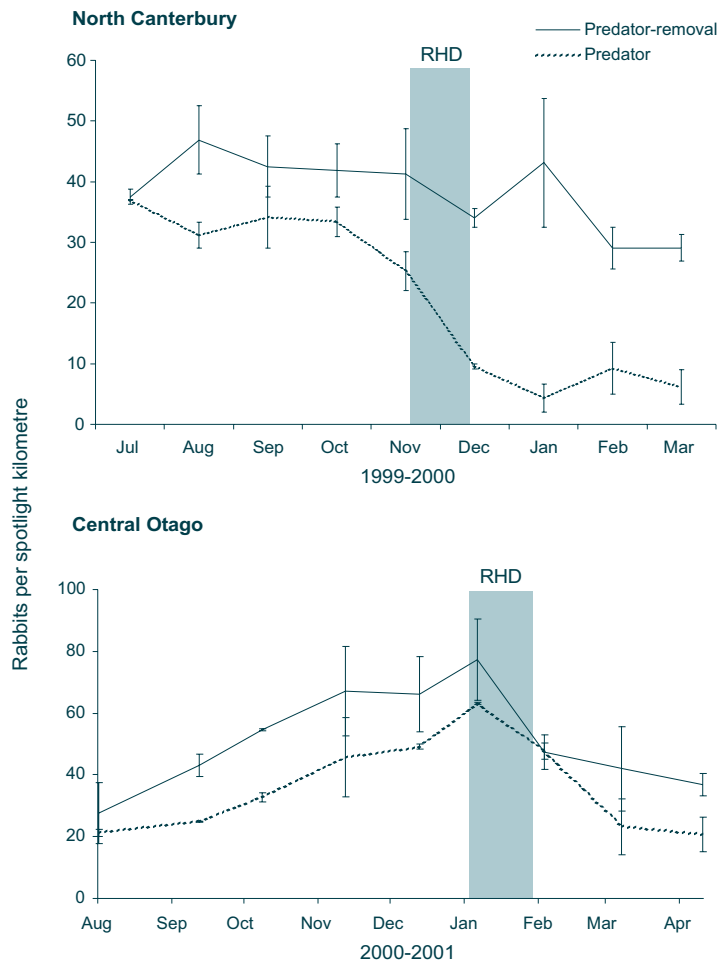


Fig. Changes in a rabbit abundance index along spotlight routes (mean and range of sites receiving the same treatment) in North Canterbury and Central Otago.



Releasing a juvenile rabbit that has been fitted with a mortality sensing radio-collar.

abundance during an RHD epidemic in early 2001 (Fig.). Here, rabbit densities declined at similar rates during the epidemic regardless of whether predator populations were lowered by trapping or not.

Differences between regions seem to be related to local survival of young rabbits. More nestling rabbits survived on predator-removal sites compared with non-treatment sites in North Canterbury (51% versus 32% survival, respectively). In contrast, there was no apparent effect of predator reductions on nestling survival in Central Otago (68% versus 72%

survival). Few radio-collared juveniles (<22%) survived at any of the sites in either region, apparently because of an interactive effect between predation and RHD.

This study implies that predation, in combination with RHD, has less impact on rabbits in semi-arid habitats than in lowland areas of New Zealand, and supports the paradigm of top-down processes in lowland regions and bottom-up processes in semi-arid regions. However, the relative contributions of the different causes of mortality, such as predation and disease, to

rabbit population dynamics is still not fully understood.

Ben suggests that ferret control currently undertaken in many areas, to protect livestock from bovine Tb and to protect indigenous fauna from predation, may reduce the efficacy of RHD in lowland areas. In contrast, predator control in drier areas may have no (or little) effect on the efficacy of RHD and, hence, on rabbit abundance. Where ferret control is imperative in lowland areas, integrated control programmes that simultaneously control ferrets

and rabbits are recommended.

This work was carried out as a PhD at Lincoln University. It was funded principally by FRST, AGMARDT, and the Miss E.L.Hellaby Indigenous Grasslands Research Trust.



Ben Reddix

Biological Monitoring of 1080 Exposure in the Pest Control Industry

The vertebrate pesticide, 1080, is an important toxin for the control of possums in New Zealand, and the debate on the risks and benefits of using it waxes and wanes but does not go away. Because 1080 is highly toxic, worker safety and occupational health are important considerations wherever it is used. The level of risk to those who work with 1080 is determined by the degree of exposure experienced while involved in their duties. The standard approach to managing such risk is to minimise worker exposure. Cheryl O'Connor and Penny Fisher have been monitoring workers handling 1080-loaded baits to assess exposure to the toxin during such tasks.

Biological monitoring of toxic substances (or their metabolites) in



Filling a sowing bucket with 1080-loaded cereal bait prior to aerial delivery.

body fluids is one of the techniques used to estimate exposure to workplace contaminants. In January

2002, Occupation Safety and Health (OSH) adopted a Biological Exposure Index (BEI) of 15 parts 1080 per



billion in human urine. This index does not provide an exact direct measure or a predictor of adverse health effects, however, as a precaution, 1080 levels in urine above the accepted index are classified as unacceptable risks. Further information on the BEI can be found on the OSH website: <http://www.osh.dol.govt.nz/order/catalogue/pdf/wes2002.pdf>

Staff in the Landcare Research toxicology laboratory, Lincoln, analysed urine samples from workers in New Zealand's vertebrate pest control industry for 1080. Samples were collected between 1998 and 2000 from individuals during the operational distribution of cereal, carrot or paste baits containing 1080. None of 27 urine samples collected from 11 workers involved in two aerial operations using 1080 cereal pellets was above the BEI (Fig.). Similarly, none of 15 urine samples from three workers in one operation involving the ground laying of 1080 paste bait was above the BEI. These results are encouraging as they indicate that the standard operating procedures followed by workers during the handling of aerially sown cereal baits and ground-laid paste baits can protect them from significant exposure to 1080.

However, a total of 11 out of 37 urine samples from workers in the three aerial 1080 carrot operations had 1080 levels above the BEI. In these three operations, 9 of the 14 workers had at least one sample above the BEI. This is of concern, as although the exact source(s) or

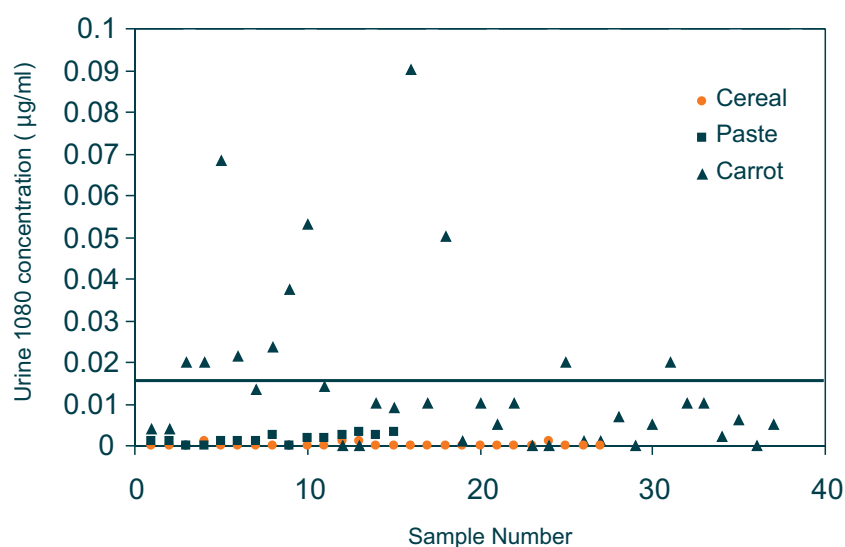


Fig. Results of analysis of 1080 concentration in urine samples taken from workers involved in the operational distribution of cereal, carrot or paste baits containing 1080. The BEI is represented by the horizontal line intercepting 0.015 on the y-axis. Samples with concentrations less than the method limit of detection (MDL = 0.001 µg/ml) are shown as 0.

route(s) of exposure to 1080 during 1080 carrot baiting cannot be identified from the monitoring undertaken, the results highlight the need for changes to equipment and practices.

Cheryl and Penny are continuing to monitor workers in the pest control industry. They aim to show that through the use of protective equipment and safe handling practices, worker exposure to 1080 can be minimised. In one recent cereal bait operation where compliance was carefully audited and strictly enforced, all workers monitored had no detectable levels of 1080. Based on these studies, Cheryl and Penny will be able to recommend changes in the use of appropriate handling practices and protective equipment that should further reduce the risk of 1080 exposure, for all workers.

The authors wish to thank all those workers who volunteered and continue to volunteer for this monitoring.

This work was funded by the Animal Health Board and the Department of Conservation.



Cheryl O'Connor



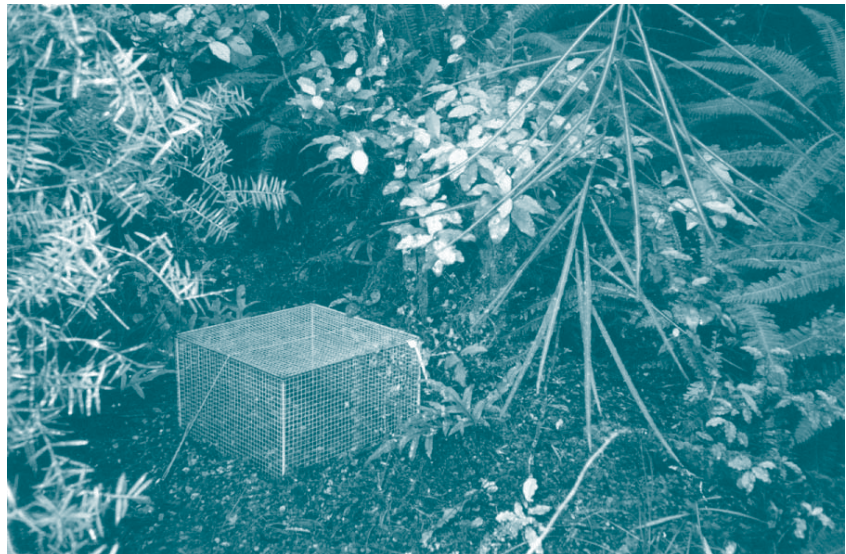
Penny Fisher



Possums, Rats and Forest Seedlings

Introduced possums and rats eat the seeds, fruits and foliage of New Zealand’s native trees, but little is known about their impacts on tree regeneration. This is particularly so on the mainland, where deer and goats often obscure the herbivorous effects of smaller mammals. In other parts of the world, small mammals eating seeds and seedlings are known to influence the species composition of forests.

Deb Wilson, Lisa McElrea and Gary McElrea have been investigating the role of possums and rats in forest regeneration by using exclosures in two quite different mainland forests. In each forest, five exclosures with large wire mesh excluded possums but not rats, and five exclosures with small mesh excluded both possums and rats. The team removed all woody seedlings from plots in all exclosures and from nearby unprotected control plots, and they counted new seedlings establishing in all plots over the next 2 years. Possum numbers in each forest



A small exclosure, 50 cm square and 30 cm high, in the forest at Waipori Falls.

were indexed from bite marks on wax blocks, and rat numbers from their use of tracking tunnels.

At the first of their study sites, a second-growth native forest remnant at Pigeon Flat north of Dunedin, possums were common, but rats were rare (Fig. a). At the end of the study, only five seedlings were recorded on the control plots but more than 50 inside each type of exclosure

(Table). Possums were primarily responsible for the difference, because excluding both rats and possums did not significantly increase seedling establishment compared to excluding only possums. Large mammals were absent from this fenced site.

At their second site, a beech–podocarp–broadleaved forest at Waipori Falls Scenic Reserve south of Dunedin, possums had become

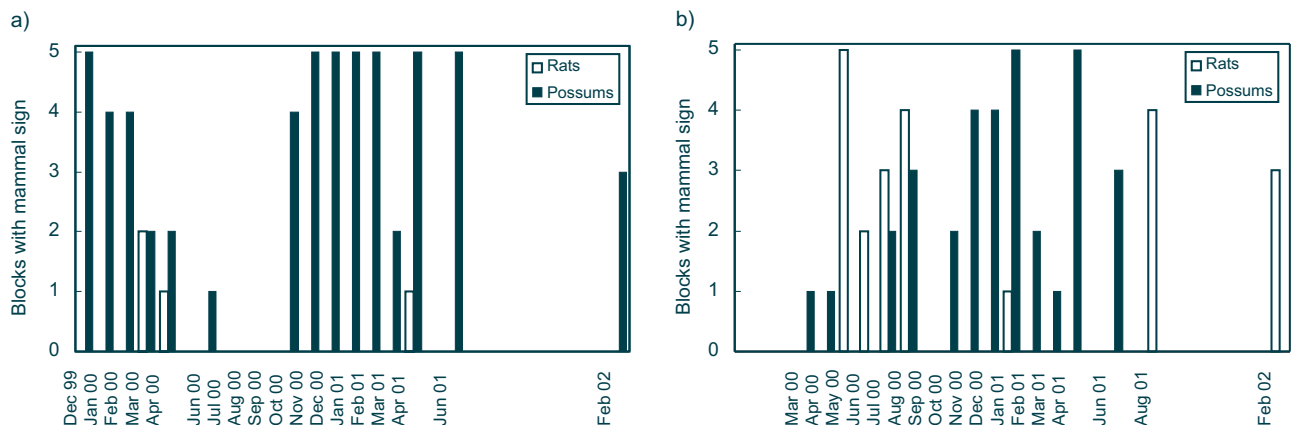


Fig. Number of experimental blocks (maximum five at each site) with mammal sign at (a) Pigeon Flat and (b) Waipori Falls, over two years. Reproduced with permission of the New Zealand Ecological Society.



scarce by the end of the study, as a result of control by the Otago Regional Council, whereas rats were often recorded (Fig. b). At this site, three times as many seedlings established when both rats and possums were excluded compared with the number that established on the control plots (Table). The difference in seedling numbers between possum-only exclosures and control plots was not significant. Rats, therefore, seem to have been the main

predator on seeds and seedlings at Waipori Falls. Deer were present at this site and able to access all exclosures accessible to possums. However, any effects of deer on seedling establishment must have been small, since the non-significant result for possum-only exclosures also applies to deer.

These trials built on earlier work. Flowers and fruit are now known to be important foods for possums. Rats also eat many types of fruit,

and probably take flowers and fruits from trees and shrubs. Norway rats and kiore eat seedlings, and possums and ship rats eat buds, leaves and stems and very likely kill seedlings too. Even the seedlings of the unpalatable pepper tree became more plentiful when possums or rats were excluded (Table), presumably because both species ate its berries.

While the work answered some

Table. Numbers of seedlings present within each type of exclosure at the end of the study in February 2002. Reproduced with permission of the New Zealand Ecological Society.

Site	Seedling species	Mammals present (✓) or excluded (✗)		
		Rats ✓ Possums ✓ (Control plots)	Rats ✓ Possums ✗	Rats ✗ Possums ✗
Pigeon Flat	Broadleaf	3	6	5
	Horopito, pepper tree	0	27	16
	Kaikōmako	2	0	6
	Lancewood	0	0	2
	Putaputāwētā, marbleleaf	0	1	6
	Stinkwood	0	3	2
	Other <i>Coprosma</i> species	0	4	7
	Unidentified	0	12	26
	Total	5	53	70
Waipori Falls	Broadleaf	5	2	3
	<i>Coprosma</i> species	13	25	51
	Hall's tōtara	1	1	0
	Haumakōroa	1	0	3
	Horopito, pepper tree	1	1	8
	Kōhūhū	0	0	0
	Lancewood	2	10	7
	Matipou, red māpou	0	0	2
	Silver beech	3	1	6
	Weeping māpou	0	0	1
	Unidentified	6	32	14
Total	32	72	95	



questions about possum and rat biology it raised many more. Deb and her team are particularly interested in how reduced seedling establishment may alter the future species composition of both of these forest types. Even without seed predators, not all tree seeds germinate, and not all seedlings grow into saplings and mature trees. Predation affects tree populations only if it reduces seed or seedling numbers below the levels that occur naturally. Such losses are most likely when seeds are scarce to begin with, and may therefore vary between years. The absence of certain sizes of saplings on islands colonised

only by rats shows that rats can affect tree population dynamics.

The environmental costs of possums and rats appear clear-cut, but does their presence also have benefits? Both species excrete some undamaged seeds that later germinate, and rats drop seeds while taking them to safe refuges

for caching or eating. Also, rats and possums kill invertebrate seed predators. However, because rats and possums kill native fruit-eating birds like kererū, their effects on seed dispersal are probably detrimental over all.

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



Deb Wilson



Lisa McElrea



Gary McElrea

An Automatic Tracking System for Monitoring Animal Movement

Radio-tracking has long been established as a valuable tool for measuring animal movement, and for providing useful information on their dispersal, habitat preferences, and home range use. Animals have a radio-collar attached that emits a specific radio frequency to allow manually operated receivers to identify each individual and plot its movements. A team from Landcare Research under Bruce Warburton's guidance has been working in partnership with electrical and software engineers Geoff Graham and Ian Trethowen. They have spent several years developing an automatic tracking system to provide the basis for high-quality data collection in radio-tracking studies, at a more cost-efficient rate than traditional systems.



Fig. 1. One of three automatic radio-tracking towers at Mt Somers

The new tracking system (or Radio Directional Finder) comprises three radio-receiving towers (Fig. 1), each of which is powered by a lead-acid battery charged by solar panels.

The towers communicate by UHF radio to coordinate searches for up to 50 radio frequencies in a programmed list. To search for a particular radio frequency, each



tower rotates its antenna through 360 degrees over 3 minutes. A bearing from each tower to the radio-collared animal being tracked is either downloaded to a laptop computer or transferred by cell phone modem to an office computer. Point estimates of possum locations can then be calculated by triangulating the bearings from the three towers (Fig. 2).

In its first major field trial, Steve Ball and Blair Brown recently used the new system to study possum home ranges near Mt Somers in the Canterbury foothills. From July to December 2002, data were collected from 18 radio-collared possums, providing a total of 50–200 night-time location estimates per possum (Fig. 3).

As well as obtaining data on a large number of individuals, the tracking system was programmed to record the location of a handful of individuals every 10 or 20 minutes (Fig. 4). In this intensive-use context, the system may be invaluable for detailed studies of habitat use.

The automatic tracking system is suitable for use with a variety of wildlife species. The key determinant of its suitability is a landscape in which radio-collared individuals stay within general line-of-sight of the towers. Possums are well suited in this regard, due to their relatively small home ranges (usually less than 10 hectares). The system has recently been moved to the Ohau forests,

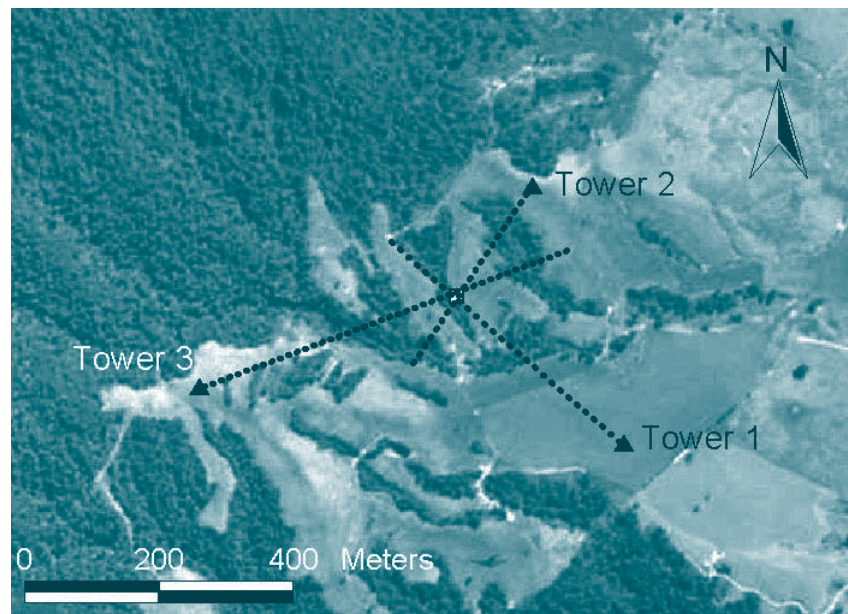


Fig. 2. Triangulation of bearings from the radio towers is used to estimate the point location of a radio-collared possum (aerial photo of field site at Mt Somers).

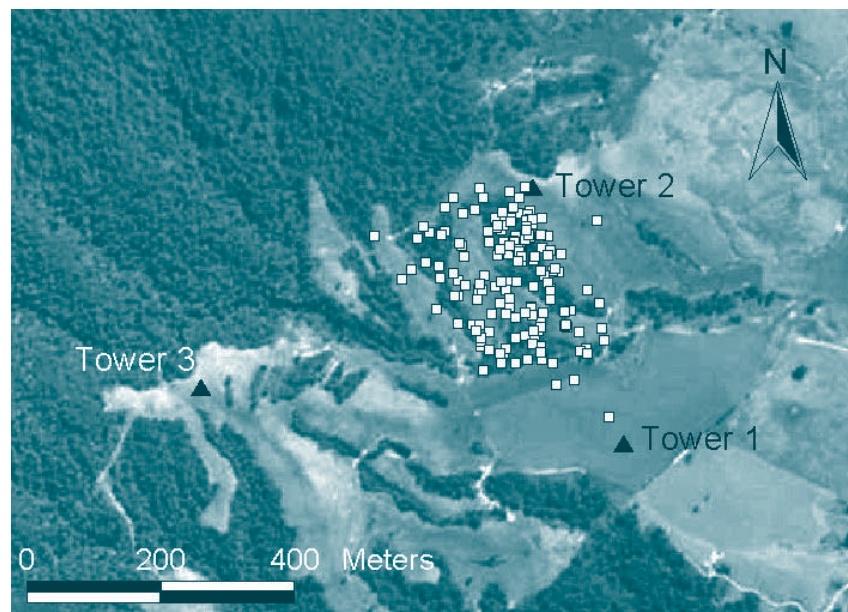


Fig. 3. Example of the data collected for a male possum at Mt Somers: a total of 164 night-time location estimates were collected for this individual between July and December 2002.

South Canterbury, where Steve will use it to determine whether the survivors of a possum control operation change the size of their home ranges in response to control.

As with any custom-designed electronics, the tracking system has not been without its 'bugs', and further use of the system is essential to firmly establish its reliability. After further



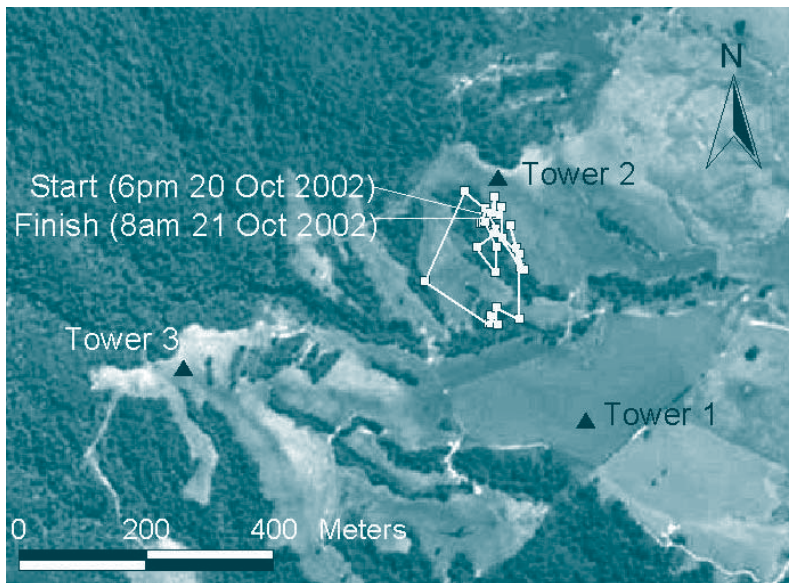


Fig. 4. Movement pattern of the male possum (shown in Fig. 3) at Mt Somers on the evening of Oct 20/21 2002).

development, the tracking system will become commercially available.

The development of the tracking system was funded by Landcare Research, and the Foundation for Research, Science and Technology. Landcare Research would like to kindly thank Murray and Linda Harmer for the use of their property near Mt Somers.



Steve Ball



Bruce Warburton



Blair Brown



Ian Trethowen



Geoff Graham

Stoats Breeding in Captivity at Last!

In November 2002 stoat research in New Zealand was given a huge boost with the arrival of two litters of stoats conceived and born in captivity at Landcare Research’s animal facility.

Stoats were brought to New Zealand in the late 1800s to control rabbits, despite the protests of ornithologists. Now we know, much to our regret, that stoats wreak havoc on many bird populations, killing far more than they need to survive. As an example, stoats kill up to 60% of all North Island kiwi chicks. Increased awareness of the scale and

consequences of stoat predation of indigenous wildlife, has led to significant new Crown funding (\$6.6 million over 5 years) being allocated to the Department of Conservation. This has enabled a new research programme into better management of stoats to be pursued simultaneously with increased control of stoats using traditional techniques.

Stoats are elusive and are difficult to catch and study. As a consequence, scientists at Landcare Research have been attempting to breed them in captivity to ensure they have access

to good numbers of healthy animals. Such investigations seek to find out more about the life cycles of stoats, in order to identify possible life-history ‘weaknesses’ that researchers and managers can target. In late 2001, Cheryl O’Connor and her team bred a litter of baby stoats (‘kits’) in captivity for the first time in the Southern Hemisphere. Now the team has built on that success, with two litters of three kits born to two new sets of parents. This latest success will allow pest control researchers to begin investigating stoat biology in the knowledge that their work is





One of the kits bred in the stoat facility



Two kits in the nest box

underpinned by a colony of breeding animals.

This work is funded by the Department of Conservation, as part of its 5-year stoat research programme.



Cheryl O'Connor



Janine Duckworth



Julie Turner

Monitoring Vertebrate Pests by Using their DNA

Assessing the effectiveness of pest control operations or predicting changes in pest abundance depends on the use of quality estimators of animal abundance. Typically, abundance is estimated from trap capture rates but such estimates can be inaccurate, as individuals vary in their trappability at low densities. An alternative approach for estimating animal abundance, in circumstances where other approaches may be inaccurate, uses DNA-based methods that give an individual 'fingerprint' or profile of an animal from small amounts of DNA derived from their hair or faeces. This same technology also offers the potential to identify

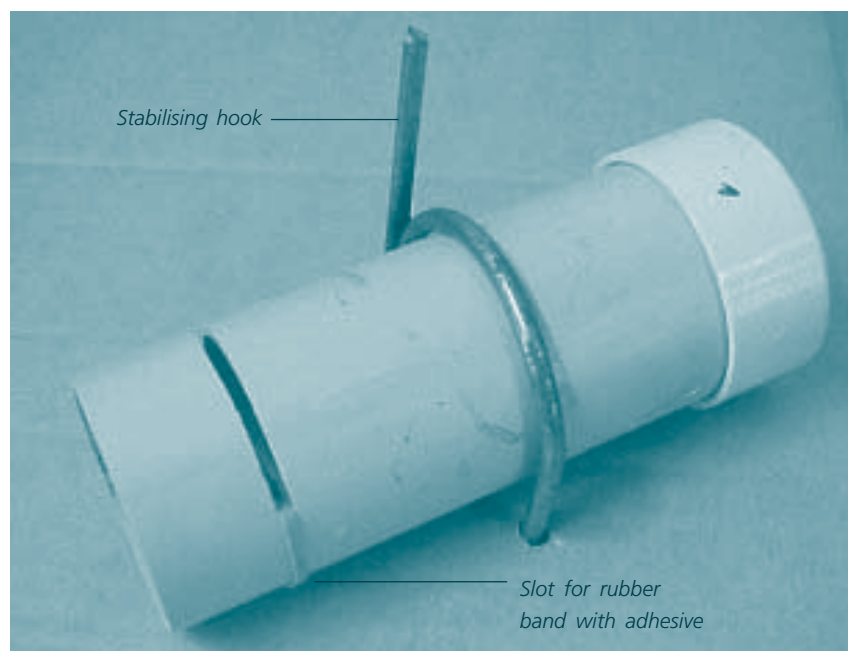


Fig. 1. A PVC tube set up to collect hair follicles from stoats.



Fig. 2. A stoat entering a hair-collecting tube.

individuals within a population without having to physically capture and/or mark them.

Dianne Gleeson and her colleagues recently investigated the feasibility of using DNA-based methods to monitor the abundance and distribution of stoats and possums, as part of a study to develop mark-recapture methods for population census using non-invasive genetic sampling.

Their initial studies sought to refine approaches to field collecting samples, extracting DNA, and analysing the data. In a month-long pilot trial in beech forest at Matakaitaki Station, near Murchison, PVC tubes, large enough for stoats to pass through and equipped with an adhesive-covered rubber band, were baited with rabbit meat. The tubes were placed 250 m apart on a 3-km by 3-km grid. Cage trials, carried out by Sam Brown through

Lincoln University, had previously demonstrated that these tubes successfully pulled entire hairs from stoats, with the hair follicle providing the major source of DNA. Against all expectations, the field trial had a very high 'hit rate', with approximately 60 hair samples 'collected' during each week of sampling, and around 98% of them originating from stoats. DNA profiles were obtained from about 80% of these samples. Dianne and her team used these data to estimate a population of 30 stoats in the area sampled, in the first realistic estimate of stoat density obtained in New Zealand.

This same DNA-based technology was then trialled using possum faeces, to determine whether individual possums could be distinguished from their droppings, and, if so, whether the technique could be used to determine the proportion of

individual populations trapped when indexing post-control possum densities using the nationally approved Residual Trap Catch (RTC) method. Possum hair was not used as underfur is often pulled out without the follicle attached.

Initial lab-based trials showed that usable DNA could be recovered from possum faeces for up to 27 rain-free days. A replicated field trial was therefore conducted in the Hokonui Hills and Catlins Forests, where low densities of possums had been recorded in recent RTC population indexing. Leg-hold traps were set for 9 nights on standard trap lines in each forest. All possums caught were killed and their tail tips were removed for standard DNA analysis, and fresh faeces were collected along the trap lines immediately before and after trapping. From the samples that provided DNA, Dianne and her team found that only one-third of the faecal samples matched the genetic profiles of the trapped possums, indicating that there were twice as many possums present as those trapped. This under-estimate of possum abundance derived from RTC indices could be due to trap shyness, to possums using only a small part of their range in any one night, or to possums spending little time on the ground at the time of the trapping. However, further testing of the DNA method is required to verify the accuracy of these results.

DNA-based methods offer a new option for accurately estimating



the population abundance of wildlife species, and a practical way of assessing whether more possums survive most controls than RTC indices suggest. The method thus offers new opportunities for estimating the population size for species that are especially difficult to find due to the habitat they occupy or their behaviour. Larger confirmatory field studies on estimating stoat population size in

Okarito, and on refining the methods used for estimating possum populations, are underway in order to fully assess their utility in relation to other methods and to enable

this technology to be affordable for more routine applications.

This work was funded by the Animal Health Board and Landcare Research.



Dianne Gleeson



Andrea Byrom



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Contacts and Addresses

Researchers whose articles appear in this issue of *Kararehe Kino – Vertebrate Pest Research* can be contacted at the following addresses:

Also, for further information on research in Landcare Research see our website:

<http://www.LandcareResearch.co.nz>

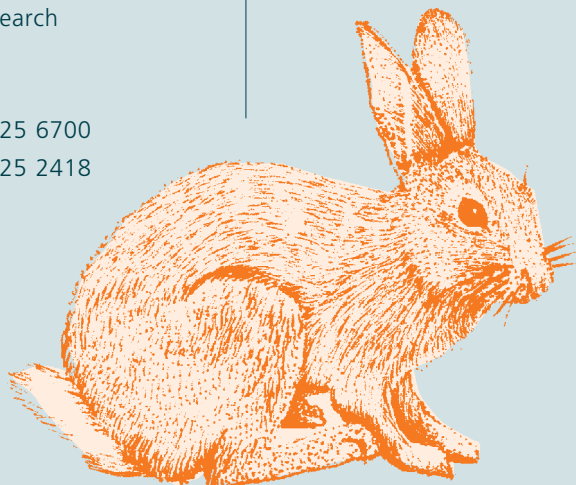
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A Selection of Recent Vertebrate Pest-related Publications

Cowan, P.E.; Heath, D.D.; Stankiewicz, M. 2002: Local variation in endoparasite infection of brushtail possums, *Trichosurus vulpecula*, along a forest margin transect, lower North Island, New Zealand. *New Zealand Journal of Zoology* 29: 171-176.

Eason, C.T.; Murphy, E.C.; Wright, G.R.G.; Spurr, E.B. 2002: Assessment of risks of brodifacoum to non-target birds and mammals in New Zealand. *Ecotoxicology* 11: 35-48.

Eason, C.T. 2002: Rodenticide (and vertebrate pesticide) effects on wildlife health. *Encyclopedia of Pest Management* by Marcel Dekker, Inc.: 731-734.

Morgan, D.R.; Milne, L. 2002: Cholecalciferol-induced bait shyness in possums (*Trichosurus vulpecula*). *International Journal of Pest Management* 48: 113-119.

Norbury, G. 2001: Conserving dryland lizards by reducing predator-mediated apparent competition and direct competition with introduced rabbits. *Journal of Applied Ecology* 38: 1350-1361.

Norbury, G.; Heyward, R.; Parkes, J. 2002: Short-term ecological effects of rabbit haemorrhagic disease in the short-tussock grasslands of the South Island, New Zealand. *Wildlife Research* 29: 599-604.

Nugent, G.; Whitford, J.; Innes, J.; Prime, K. 2002: Rapid recovery of kohekohe (*Dysoxylum spectabile*) following possum control. *New Zealand Journal of Ecology* 26: 73-79.

O'Connor, C.E.; Booth, L.H. 2001: Palatability of rodent baits to wild house mice. *Science for Conservation* 184. Wellington, Department of Conservation. 20 p.

Reddiex, B.; Hickling, G.J.; Norbury, G.L.; Frampton, C.M. 2002: Effects of predation and rabbit haemorrhagic disease on population dynamics of rabbits (*Oryctolagus cuniculus*) in North Canterbury, New Zealand. *Wildlife Research* 29: 627-633.

Spurr, E.B. 2002: Iophenoxic acid as a systemic blood marker for assessment of bait acceptance by stoats (*Mustela erminea*) and weasels (*Mustela nivalis*). *New Zealand Journal of Zoology* 29: 135-142.

Sweetapple, P.J.; Burns B.R. 2002: Assessing the response of forest understoreys to feral goat control with and without possum control. *Science for Conservation* 201. 33 p.

Sweetapple, P.J.; Nugent, G.; Whitford, J.; Knightbridge, P.I. 2002: Mistletoe (*Tupeia antarctica*) recovery and decline following possum control in a New Zealand forest. *New Zealand Journal of Ecology* 26: 61-71.

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