Karārehe Kino
Vertebrate Pest Research

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Manaaki Whenua
Landcare Research

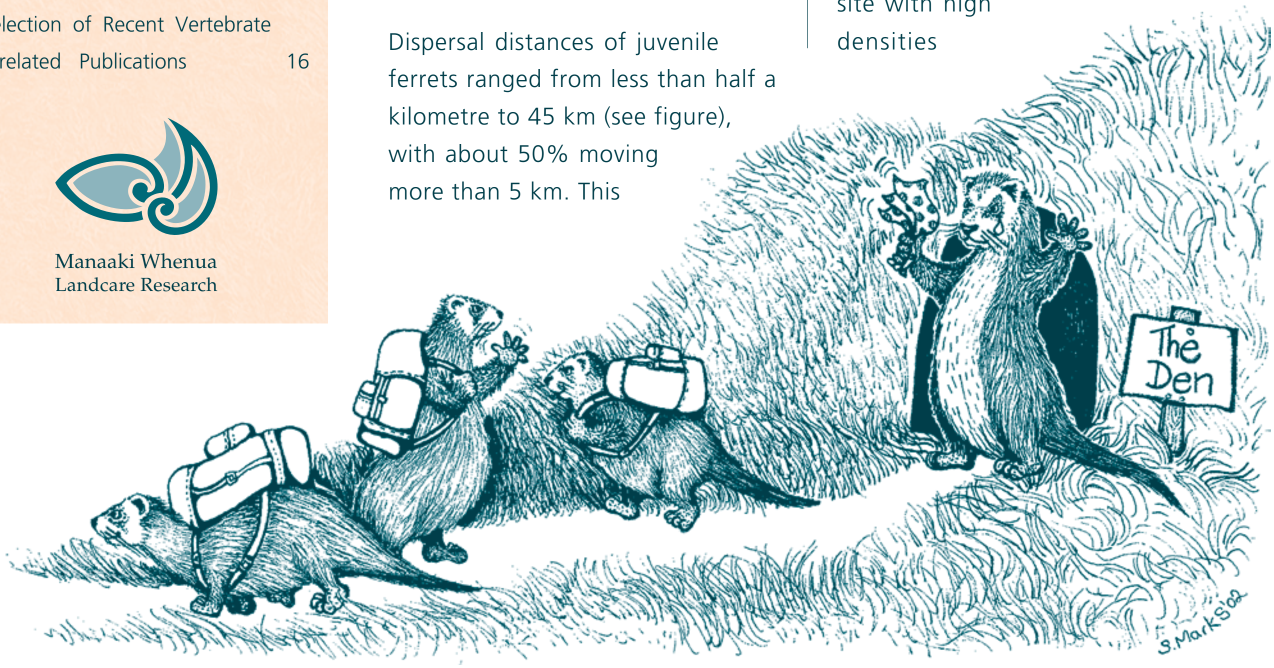
The Young and the Restless: Dispersal and Survival of Juvenile Ferrets

Ferrets are significant predators of indigenous wildlife (birds, eggs, lizards, and invertebrates) in New Zealand. They also carry bovine tuberculosis (Tb), a disease that threatens New Zealand's beef, dairy, and venison markets.

In 1997–98, Andrea Byrom (working in braided riverbeds in the Mackenzie Basin) studied the dispersal of young ferrets from their place of birth and their survival in their first 4 months of life. Andrea radio-collared 52 juvenile ferrets when they emerged from their mothers' dens, and then every few days from January to April she radio-tracked each ferret.

Dispersal distances of juvenile ferrets ranged from less than half a kilometre to 45 km (see figure), with about 50% moving more than 5 km. This indicates that effective ferret control may be compromised by the rapid immigration of juvenile ferrets, and thus buffers designed to prevent at least 50% of young ferrets reinvading a control area need to be at least 5 km in width.

Survival of the radio-collared juvenile ferrets depended largely on the population density of adult ferrets. In an area where ferret density had been reduced to protect nesting areas of endangered birds, juvenile ferrets had remarkably high survival: 86% in the first year of the study, and 100% in the second year. However, in a site with high densities



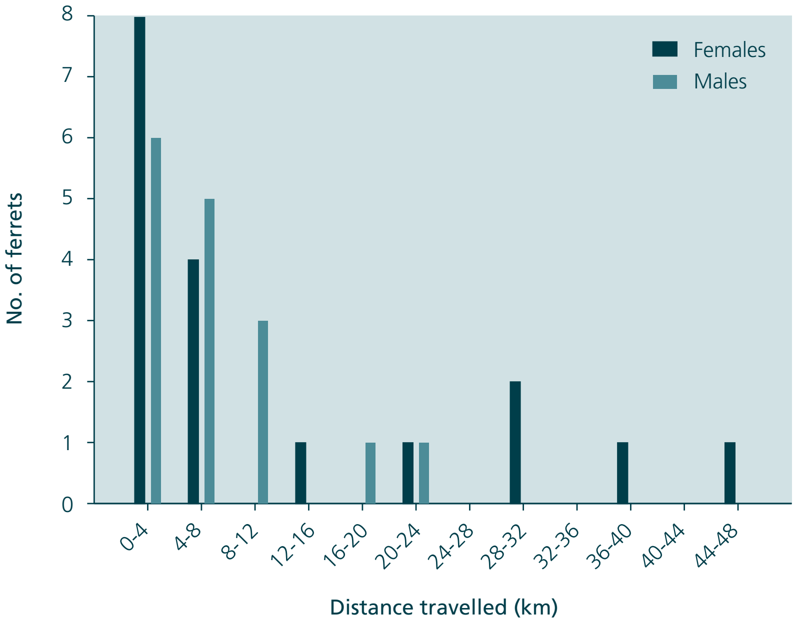


Fig. *Distances moved by radio-collared juvenile ferrets in their first 4 months of life.*

Captured ferrets were sexed, weighed, ear-tagged, and radio-collared before release.

of resident adult ferrets and no history of recent control, juvenile survival was lower: 19% in the first year and 70% in the second year. People carrying out ferret control should therefore be aware that survival of juvenile ferrets might actually be enhanced by previous ferret control operations, and that the observed density-dependent survival of juvenile ferrets should be a key element in determining the frequency and seasonal timing of ferret control. The data also indicated that ferret control to conserve native wildlife and minimise Tb spread should be carried out in late autumn *after* juvenile dispersal, to provide a longer time lag before juveniles reinvade an area. If successful, this would reduce the need for annual control of ferrets.

Another interesting finding was that female ferrets were just as likely as males to move several kilometres from their birthplace, contrary to popular belief that only males disperse long distances. In fact, the longest distance covered was 45 km by a radio-collared female. Likewise, male and female ferrets had similar survival rates. This is of concern to managers because of the risk female ferrets pose in establishing a new population.

Some questions still remain however. Andrea suggests comparing the rate of recovery of ferret populations trapped in

Juvenile ferret with radio-collar.

Ferrets can move long distances during dispersal.

spring and autumn, to be sure that autumn trapping is more cost-effective. She also believes it would be extremely useful to find out whether juvenile ferrets are infected with Tb before dispersal. If so, ferrets are capable of creating new foci of infection far from the original source of Tb. A third area needing investigation is the potential for Tb-infected ferret carcasses to transmit Tb to other species like possums and pigs, thereby starting new cycles of infection of Tb in wildlife. Some of this research is currently being undertaken by Landcare Research.

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

Andrea Byrom *works on the population ecology and management of mustelids.*

For advice on ferret control visit www.landcareresearch.co.nz/research/biosecurity/ferrets

Editorial

This is our first issue of a revamped Landcare Research newsletter that expands the focus of He Kōrero Paihama – Possum Research News to cover all our research on vertebrate pests. The change is in recognition of Landcare Research's ongoing work with a wide range of vertebrate pests in addition to possums, and of the wide suite of vertebrate pests managed by many of our readers. The Foundation for Research, Science, and Technology (FRST) is providing funding support for us to broaden the focus of this and future issues of our newsletter.

We will seek to address key questions that land managers and the public want answers to about protecting New Zealand's indigenous biodiversity from assault by vertebrate pests and improving vertebrate pest management. Articles will cover recent and ongoing research funded largely by FRST, the Department of Conservation, and the Animal Health Board, on the ecology and management of major vertebrate pests in New Zealand.

We will continue to send to those of you who received He Kōrero Paihama, free copies of this newsletter every 6-months or so. We hope **Kararehe Kino–Vertebrate Pest Research** is as favourably received as its predecessor, and we encourage you to take up any issues of concern to you raised in our pages with the authors involved.

Jim Coleman

Ferrets or Stoats: Which are Worse for Kiwi?

In the next few months, the Biosecurity Amendment Bill will go before Parliament for its second reading. If it is eventually passed, it will prohibit the keeping of ferrets in captivity. This legislation was called for, in part, by conservation groups concerned at the impact ferrets were having on kiwi and other birds. They argued that the liberation of unwanted ferrets and escapees were boosting populations in the wild, and allowing ferrets to establish in areas not yet colonised. So what effect is the legislation likely to have? Will it really benefit kiwi, or will it merely deny ferret lovers the chance to keep the animals as pets?

Pete & Judy Morrin

Fig. 1*. The remains of an adult male kiwi, killed by a ferret and eaten over 1–2 days. An adult male kiwi weighs about 2 kg, possibly twice as much as the ferret that killed it.*

John McLennan is in no doubt that ferrets kill kiwi, weka, and waterfowl. Ferret kills are generally unmistakable. The animals often leave distinctive strong–smelling faeces near the remains of their prey and their canine puncture marks are generally easily recognised. Ferrets also often eat the bill, skull, neck-vertebrate and skin of birds, something that cats and stoats seldom do (Fig. 1). At Lake Waikaremoana, ferrets killed four radio-tagged kiwi (three adults and one sub-adult) over a 10-year period. In Northland forest remnants, an adult male ferret is believed to have killed six adult kiwi over a 5-month period, while in northern Hawke's Bay, ferrets killed five of 18 sub-adults released into a reserve.

So are these predation losses any worse than those caused by other pets (e.g. dogs, cats) and could ferrets significantly accelerate kiwi decline? John's answer to the first question is a qualified yes. In the three localities mentioned above, two other adult or sub-adult kiwi were lost, one to a cat and the other to a dog. In a more extensive 8-year study in Northland, eight radio-tagged adult kiwi were lost to dogs and nine to ferrets.

John also believes the decline of kiwi is being accelerated by ferrets. However, kiwi are likely to continue to decline even if ferrets are eliminated, because stoats are the main threat driving kiwi populations towards extinction in mainland forests. In most localities, stoats kill about 60% of chicks in their first 20 weeks of life. Natural mortality also plays a part, and up to 95% of chicks fail to reach adulthood. The few that do make it are insufficient to replace the adults, which inevitably die of old age. It is this shortfall in recruitment resulting from predation that is causing kiwi populations throughout the North Island to decline at about 6% per year.

Given the extraordinary impact of stoats on kiwi chicks, it is easy to dismiss the loss of a few adults to ferrets as inconsequential. However, predation on adults is much more significant than predation on chicks. In the absence of predators, natural mortality rates of adult North Island brown kiwi are 2–5% per year, and they live for 20–50 years. During this time, pairs fledge about one chick each year, and two of these chicks must reach adulthood to replace their parents. Any additional survivors contribute to population growth. Clearly, populations can withstand chick mortality rates of 90–96%, and still persist, provided adults have normal life spans.

Small changes in adult survival profoundly influence adult longevity, and thus the chick survival rates required for population stability. At Lake Waikaremoana, the annual mortality of 74 radio-tagged adults monitored by John over a 10-year-period was 3.7%, and the estimated average longevity was 26.8 years. If the three ferret kills had not occurred, mortality would have been 2.1% per annum, and the average longevity 46.8 years. Incredibly, the loss of just three adults nearly halved average adult longevity and lifetime productivity.

In Northland, ferrets increase adult death rates by as much as 5% per year. When this happens, stoat predation on chicks becomes critically important. If females produce just 12 chicks over a (much shortened) 12-year adult lifespan, then nearly 20% have to survive to adulthood to maintain populations. This target is seldom reached in the presence of uncontrolled stoat populations.

Clearly, several different predators are collectively responsible for the decline of kiwi in mainland forests. Nevertheless, John believes that stoats are the primary driver of kiwi decline. If their impact was eliminated for 2 consecutive years, kiwi populations would double. Two years of reprieve from ferrets (with stoats still present) would hardly make any difference.

Kiwi are in trouble, so any effort that increases their survival rates must be viewed favourably. The legislation before Parliament will benefit wildlife if it prevents ferrets from establishing in uncolonised areas. However, nothing much is going to change throughout the greater part of New Zealand where self-sustaining populations of ferrets already exist. In these places, ferret lovers may justifiably feel aggrieved if the feral ferret populations are not controlled.

Pete & Judy Morrin

John McLennan with a sub-adult male kiwi.

This work was funded by the Foundation for Research, Science and Technology, Department of Conservation, and Bank of New Zealand.

John McLennan *studies kiwi in the wild.*

What Limits House Mouse Population Irruptions in Beech Forests?

Beech forests in New Zealand seed heavily at irregular intervals, providing periodic increases in food for native birds, insects and introduced rodents. Within 3 months of a heavy beech seedfall, house mouse and ship rat populations increase, followed by an increase in stoat populations. This cascade of pest irruptions is a major conservation concern in New Zealand because mice in beech forest prey on beech seed and native invertebrates, while ship rats and stoats prey on both invertebrates and also ground-dwelling and hole-nesting native birds.

The Hollyford Valley research site.

Wendy Ruscoe, Ivor Yockney and Richard Heyward have been studying the factors limiting rodent and stoat populations in beech forest in the Eglinton and Hollyford valleys in Fiordland National Park. In each valley, rodent populations were monitored quarterly from May 1999 to February 2002 using standard live-trapping techniques on two grids. Beech seedfall was also scored. In the Eglinton Valley, 792 stoats were destroyed by the

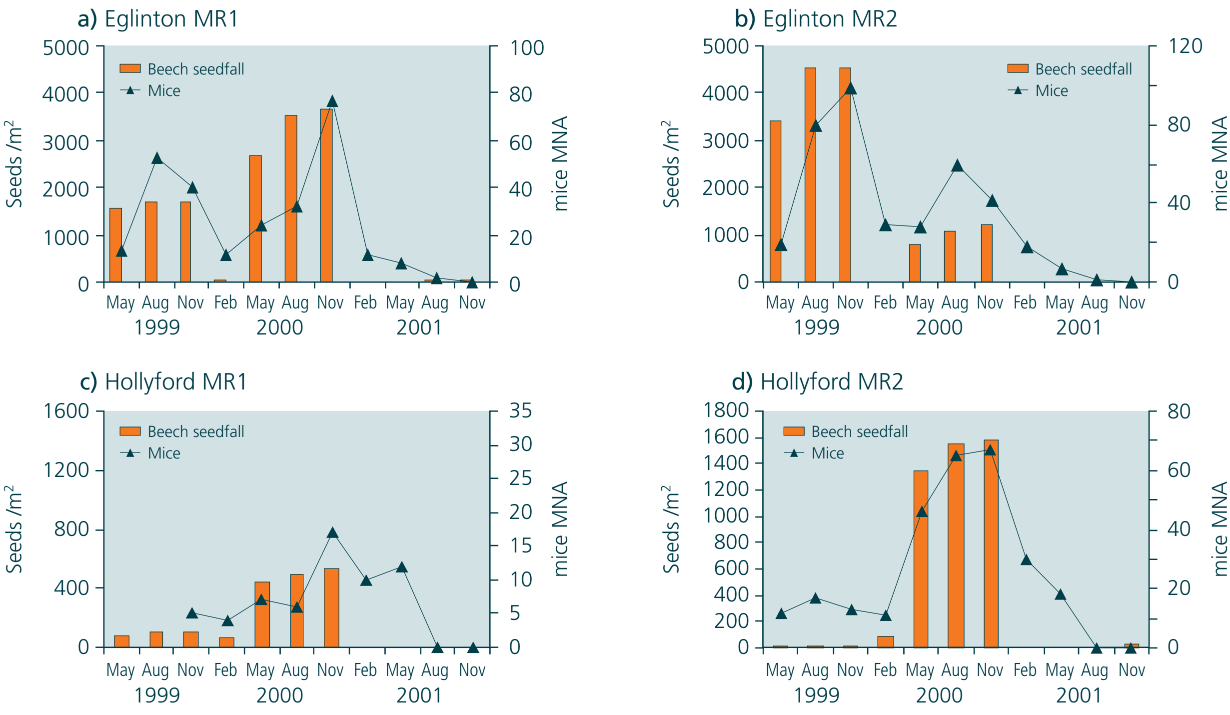


Fig. *Cumulative within-year beech seedfall and mouse population size on each of the grids in the Eglinton and Hollyford valleys from May 1999 to November 2001 (no rodent data was collected in May and August 1999 in MR1).*

Department of Conservation as part of an ongoing native bird protection programme, and stoat numbers there were very low. In the nearby Hollyford Valley, no stoats were killed.

Overall, beech seedfall varied sharply between years: in the Eglinton Valley, seedfall from the red beech was high in both 1999 and 2000, although the amount and its timing varied between the grids (see figure). In the Hollyford Valley, the seedfall from the silver beech was high only in the second year and was markedly more abundant on one (MR2) of the two grids.

Mouse population changes largely followed the pattern of seedfall (see figure). In the Eglinton Valley, mouse numbers were highest in the months and years of highest seedfall at each site. In the Hollyford Valley, however, mouse numbers were less predictable. They were highest on the grid with greatest seedfall (MR2), despite both grids being only 2 km apart, and were present in moderate numbers on both grids in 1999 when there was virtually no seedfall, presumably due to the presence of other seed-bearing plants not found in the Eglinton Valley. Mouse populations crashed in 2001, with none being caught in either valley, when no beech seedfall occurred at either site.

An ear tagged mouse about to be released.

Ship rats were present on all four grids in most quarterly trapping sessions, with up to six caught over 5 nights of trapping in Eglinton Valley, and up to 17 ship rats (and/or kiore) in the Hollyford Valley. Although the study was not designed to index their abundance, stoats were also trapped in both valleys.

Overall, Wendy and her team believe the differences in mouse numbers between the Eglinton and Hollyford valleys are most likely related to beech seedfall and not to differences in rat or stoat numbers. Following a high seedfall event and high mouse numbers in winter and spring, mouse populations decline to reach low levels in late summer–autumn. At this time, stoat numbers are at their highest, with the increase due to their young being weaned in January-February, and entering the population during the mouse population decline. High house mouse numbers in the previous year gave rise to pregnant stoats in good condition, and high birth and juvenile recruitment rates. Stoats may, however, exacerbate a decline in mouse populations indirectly, by influencing their foraging efficiency, although this remains unproven. In contrast to stoats, rat diet studies have yet to show rats actively prey on mice.

Wendy Ruscoe processing live-captured rodents in the Hollyford Valley.

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

Wendy Ruscoe *works on the ecology of small mammals in beech forests;* ***Ivor Yockney*** *and* ***Richard Heyward*** *work on the ecology and management of a wide range of vertebrate pests.*

Sustained Feral Goat Control – Mt Egmont National Park

Feral goats are a widespread, abundant conservation pest in New Zealand. The idea of eradicating them is intuitively appealing, although it is likely to be more difficult and more expensive than their sustained control, at least in the short term. A team led by Dave Forsyth has been analysing annual hunting effort and kills of goats in Egmont National Park to establish whether sustained control to low densities could be changed to eradication.

Goats have been present in the park since about 1910 and controlled annually since 1925 in one of the longest sustained vertebrate pest control programmes in the world. Dave and his colleagues analysed park records between 1961 and 1999. During the winters of 1961–1964, the New Zealand Forest Service (NZFS) employed four hunters with dogs and rifles to control goats. Subsequently, NZFS hunters undertook control over summer from 1964 to 1987. This effort has been continued by hunters working for the Department of Conservation (DOC). Helicopter-based control has been used only occasionally since 1971 and has taken about 150 animals. Honorary rangers and recreational hunters have had unrestricted hunting access to goats in the park since 1955. They contributed a large proportion of the kill until 1965, but almost none since 1970. Including the 9000 goats known to be shot during 1925–1943, at least 96,900 goats have been killed in Mt Egmont National Park (Fig. 1).

A feral goat photographed foraging in an introduced grassland.

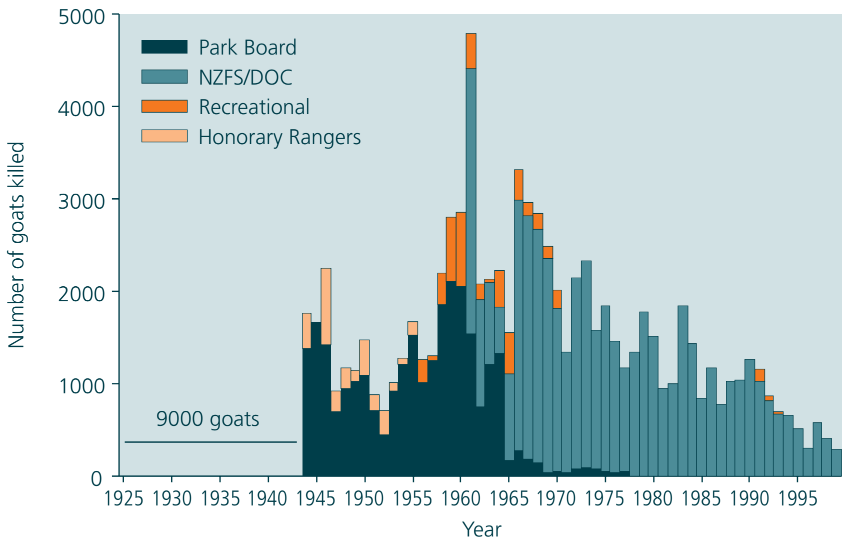


Fig. 1. *Annual kills of feral goats at Egmont National Park, 1944–1999.*

Annual hunting effort in the park was initially low, but steadily increased to a maximum of over 1400 hunter days in both 1983 and 1984 (Fig. 2a). Hunting effort then declined to a low in 1994 and stabilised thereafter. Goat kills also declined with time (Fig. 1), with the number shot per hunter per day (a crude index of the total number present) highest when NZFS hunters started in 1961 (seven kills per hunter per day; Fig. 2b). Kills declined to less than one kill per hunter per day in 1986, and have remained at low levels since then. These figures indicate a large decline in the abundance of goats in the park from 1961 to 1999.

Dave and his team argue that three conditions are essential before goats can be eradicated from the park. Firstly, all immigration must be prevented. Goats are currently farmed on several properties around Mt Egmont, and some escape into the park. One expensive management option is erecting goat-proof fences around the park. A considerably cheaper and probably more effective option would be to restrict the farming of goats within a 'buffer' zone around the park.

Secondly, all goats must be targeted so that all animals face a strong likelihood of being killed. The team believes that goats living in the tall forest are at risk from ground-based hunting with dogs. Goats living in the alpine grasslands could be targeted by helicopter-based hunters, but it is not clear whether this could effectively reach all goats living in the subalpine shrubland. Further research is needed.

Thirdly, the harvest of goats must exceed their rate of increase from breeding and immigation. A simple mathematical model suggested that the current population of goats in the park is about 1050, and that removing 50% of them annually would achieve eradication in >50 years while removing 90% annually would achieve eradication in 12 years.

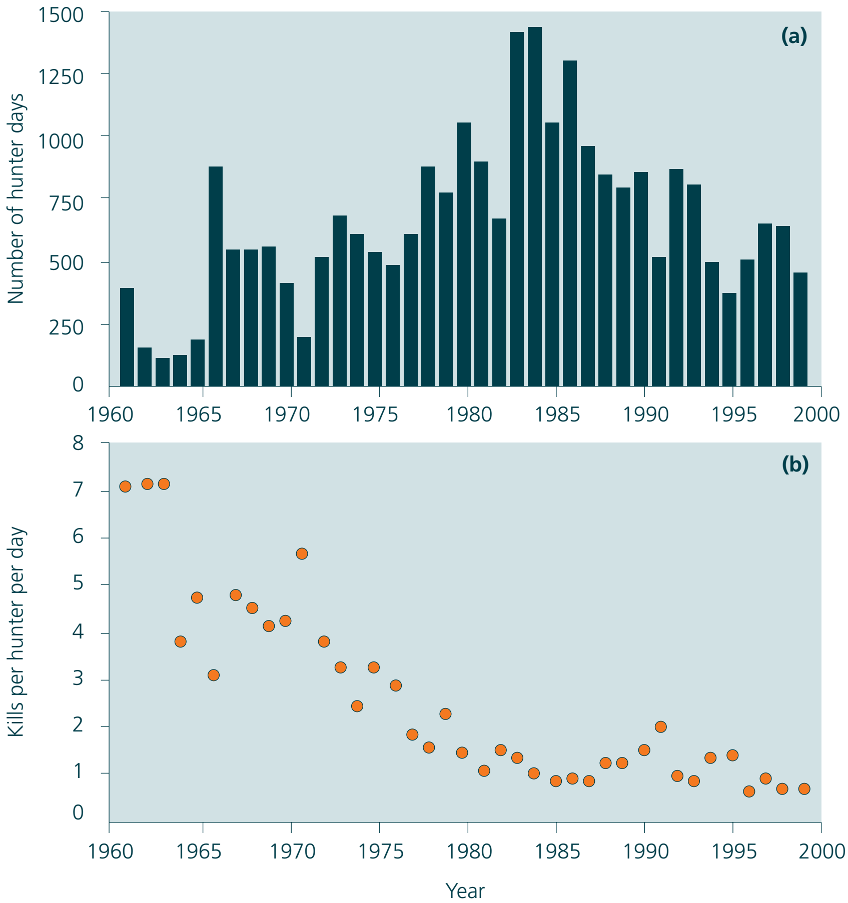


Fig. 2. *Trends in (**a**) hunting effort, and (**b**) the number of feral goats killed per hunter per day, during 1961–1999.*

Dave and his team consider 12 years the maximum time frame for an eradication attempt. Provided the above conditions can be met, culling more than 90% of the goat population annually is quite a sobering challenge for even the most stout hearted. That said, DOC is now in a position to consider the eradication of goats from Mt Egmont National Park and an end to over 75 years of sustained goat control.

This work was funded by the Department of Conservation.





Dave Forsyth *and* ***John Parkes*** *work on the ecology and management of mammalian pests;* ***Jim Hone*** *is Associate Professor at the University of Canberra and researches the management of vertebrate pests;* ***Garry Reid*** *and* ***Dean Stronge*** *work for the Department of Conservation.*

Are Wētā Populations Affected By 1080?

Wētā are potentially at risk from 1080 poisoning for possum control as several species have been observed eating toxic baits. Also some wētā collected alive after 1080-poisoning operations have contained residues of 1080. To date, wētā populations that have been monitored in poison baited areas have not been affected by the toxin. These results are open to challenge, however, because the methods used to monitor impacts have not included individually marked wētā. For example, one study recorded wētā calls heard at night and another the number of wētā caught in pitfall traps.

To confirm the risk to wētā (or not), Eric Spurr and Peter Berben monitored individually marked wētā occupying artificial refuges before and after simulated aerial 1080-poisoning (i.e. baits spread by hand). To do this, they set up 10 randomly located artificial refuges (Fig. 1) in each of 20 plots spaced at least 50 m apart on a north-facing ridge in Tararua Forest Park in August 1999. From October onwards, the refuges were checked monthly for occupancy by wētā and other invertebrates, and any tree wētā present were individually marked with coloured paint. In August 2000, 10 of the plots, chosen at random, were sown by hand with 1080 bait at 5 kg/ha. The bait was green-dyed, cinnamon-lured, Wanganui No.7 cereal-based bait containing 1500 ppm (0.15%) 1080. The remaining 10 plots were not baited. The artificial refuges were checked for occupancy by wētā and other invertebrates a week after bait application, and then again at monthly intervals for the next 4 months.

Eric and Peter found the Wellington tree wētā and a species of cave wētā in the refuges, as well as a wide range of other invertebrates, and the numbers of most of these invertebrates using the refuges increased steadily over 15 months of monitoring in both the poisoned and non-poisoned plots (Fig. 2). The bait application had no impact on the numbers of either species of wētā or on the numbers of slugs, spiders, and cockroaches (the main other invertebrates occupying the refuges).

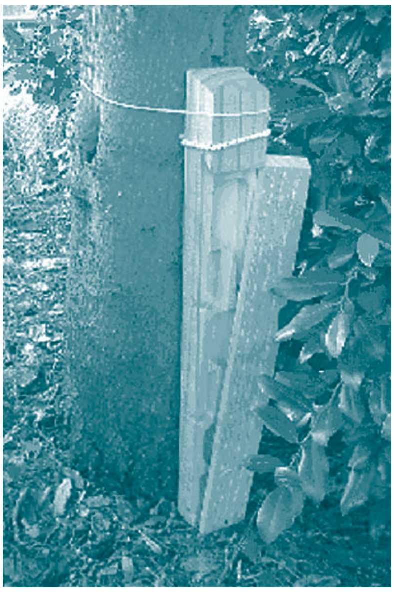


Fig. 1. *Artificial refuge used for monitoring wētā populations (lid ajar to expose galleries).*

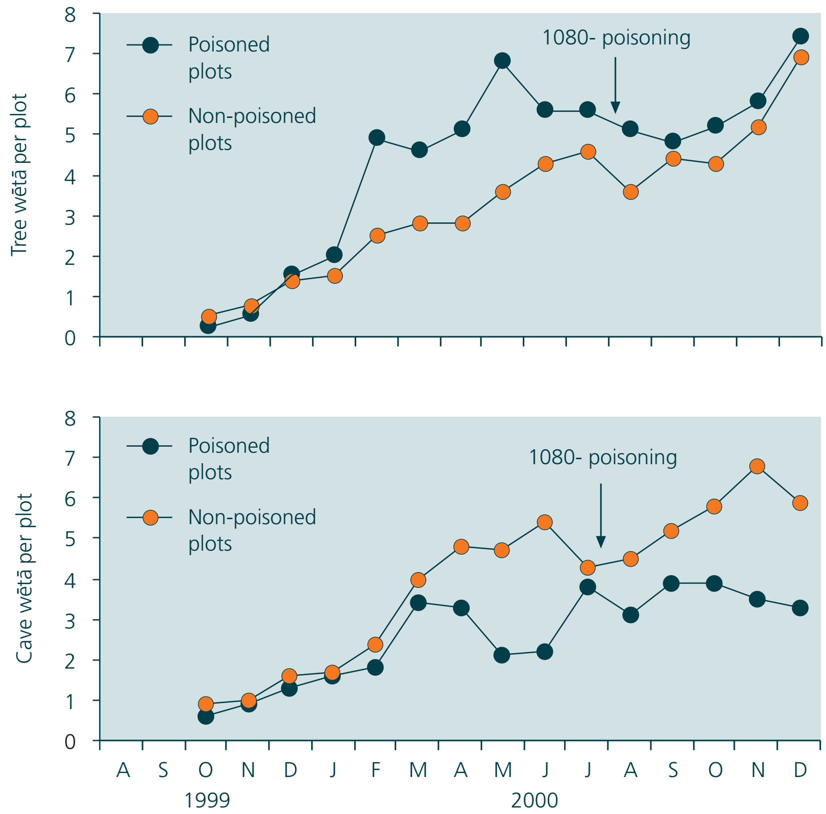


Fig. 2. *Number of wētā occupying artificial refuges in poisoned and non-poisoned plots, before and after the experimental 1080-poisoning operation; (a) tree wētā, (b) cave wētā.*

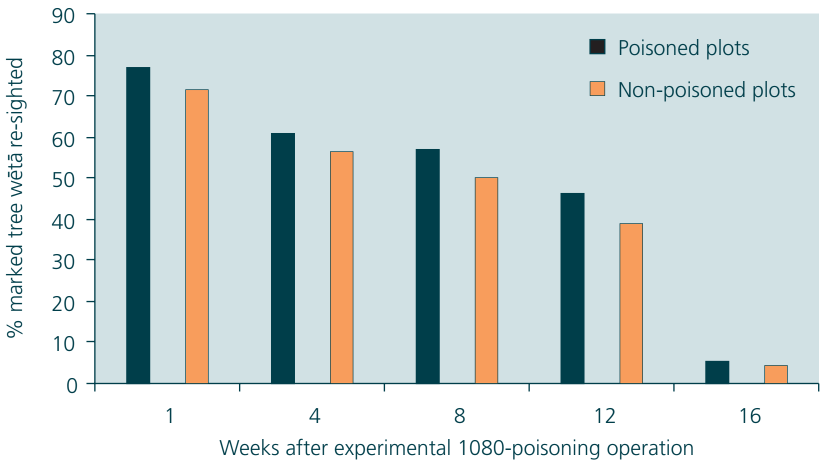


Fig. 3. *Percentage of individually marked tree wētā resighted in poisoned and non-poisoned plots.*

Tree wētā in gallery of refuge.

One week after spreading bait, 80% of the 56 marked tree wētā were resighted alive in the poisoned plots and 72% of the 46 marked tree wētā in the non-poisoned plots. The number of marked tree wētā resighted alive declined over the next 4 months, but the rate of decline was similar in both the poisoned and non-poisoned plots (Fig. 3). Eric and Peter presume the decline was a result of natural mortality, predation, loss of paint markings, and movement out of the artificial refuges into natural refuges. There was no evidence that it resulted from 1080-poisoning.

The study indicates that aerial 1080-poisoning for possum control is unlikely to affect the population numbers of Wellington tree wētā or of one species of cave wētā. Aerial 1080-poisoning also appears unlikely to affect the population numbers of the slug, spider, and cockroach species recorded in the artificial refuges. While the study was restricted to one area in Tararua Forest Park, there is no reason to believe that the results would be different for these or related species of invertebrates exposed to 1080 baits elsewhere in New Zealand.

Cave wētā in gallery of refuge.

This work was funded by the Foundation for Research, Science and Technology, and is modified from an article submitted for publication in ConScience.


Eric Spurr *and* ***Peter Berben*** *work on the effects of 1080 baits laid for possum control on vertebrate and invertebrate non-target species.*

Some Ecological Limitations of Predator Control

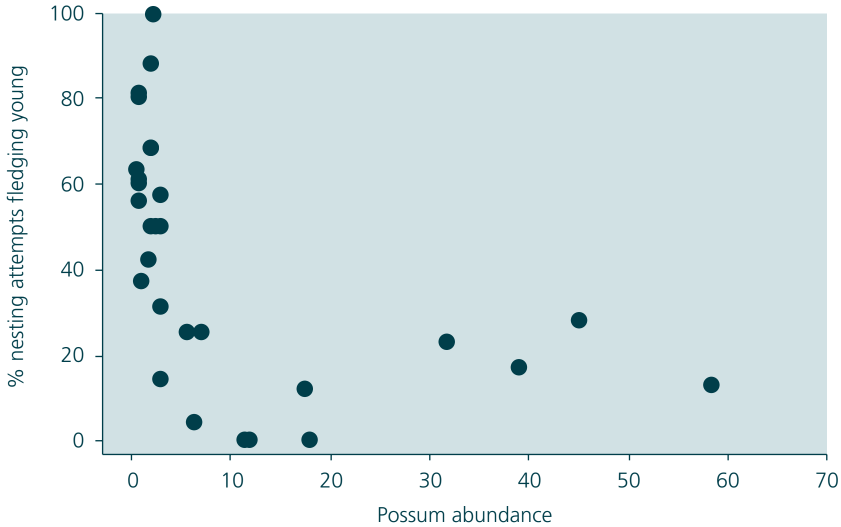


Fig. *The nesting success of kōkako and kūkupa in relation to possum abundance (% trap catch).*

This McCann's skink relies on the background vegetation to seek refuge from predators.

The failure to protect threatened populations of some native prey species from predators is often blamed on the technical limitations of control methods to kill enough predators over the required area at the critical time. However, ecological factors can also limit the effectiveness of predator control and Grant Norbury and John Innes have been examining some of these.

Firstly, the relationship between a predator's abundance and its impact on prey populations (the 'damage function') is seldom linear and can be strongly curved, e.g. nesting success of kōkako and kūkupa in the face of predation by possums (see figure). For these birds, possum control provides little protection for eggs and nestlings unless the possum population is reduced to levels indicated by trap catches of <5%. Above that level, few birds of either species successfully fledge, so any control undertaken is largely wasted. It appears that even when predator numbers are greatly reduced, those remaining are still able to find such vulnerable and attractive prey. Further, unless control is very intense, the partial removal of predators may leave the most efficient hunters (or 'rogues'; those most likely to have survived past control) in place to continue preying on at-risk species.

What is intriguing for kōkako and kūkupa was why fledging success did not quickly decrease to zero with increasing predator density. Perhaps by chance a few birds always live or nest in refuge areas safe from predators, or possibly predators become less efficient hunters at high densities because their hunting behaviour interferes with others'.

Habitat structure is potentially a second ecological limitation to effective predator control. In New Zealand's native grassland, two structural changes are taking place: succession to more woody vegetation as livestock grazing is removed through land tenure review, and degradation and simplification of habitat through over-grazing. Such changes may result in predators losing or gaining hunting efficiency. One possibility is that lizards and birds will find greater refuge from cats, as grasslands become less open.

Feral cats are a problem predator in a wide range of habitats.

Such changes may allow prey to coexist with predators, and the need for predator control be reduced compared with that in degraded and simplified habitats. Thus, habitat manipulation might provide a longer-term, more sustainable solution to reducing predation, but considerably more species and habitat-specific research would be needed to verify that.

Thirdly, various biological parameters change with animal density, e.g. increasing density results in increasing competition for food and shelter thereby limiting population size. Typically these limiting factors are strongest when populations are close to the carrying capacity of their environment. There is inevitably a tendency to assume that because a species is rare, its populations are nowhere near carrying capacity. While that is often true, it cannot be automatically assumed. Degraded habitats may limit prey populations because little food or shelter is available, and predator control may achieve little. Hence, it is important to find out whether prey populations will respond to the complete absence of predators, particularly in degraded habitats. This could be done using predator exclosure techniques.

Throughout most of New Zealand, several introduced predator species generally co-exist, yet little is known about how the different species interact. Stoats, for example, prey on rodents, and both stoats and rats prey on native birds (also see article on house mouse population irruptions in beech forest in this issue). Controlling 'superpredators' like stoats could result in many more 'mesopredators' like rats, resulting in increased rather than decreased predation on birds.

The effects of predator control can be short-lived if predator populations have ample alternative prey. In New Zealand, the primary prey of cats, ferrets and stoats are the generally plentiful introduced rabbits, rats and mice. Secondary prey such as endangered native skinks or mohua (yellowhead) suffer excessive predation from predator populations boosted by primary prey. These impacts are further exaggerated following a decline in the abundance of primary prey (e.g. after rabbit control operations) because predators switch to secondary prey. At these times predator numbers may need to be reduced to extremely low levels to protect native species.

There are other ecological limitations of predator control, but this article highlights some of those affecting the effectiveness of predator control strategies in New Zealand. More work is clearly needed to improve protection of prey species.

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

Grant Norbury *and* ***John Innes*** *work on the control of vertebrate predators and the protection of their iconic prey species.*

New Technology – A Proximity Detector System

A system designed to log interactions between individuals in a population of animals is currently being developed by Trevor Jordan at Sirtrack, a subsidiary of Landcare Research based in Havelock North. The equipment is at the prototype stage. The units are being built for testing in the field and are likely to be available by June 2003. Trevor and Dave Ward, his manager, anticipate the system will be used to monitor interactions between and within species and, as an example, will have value in helping to determine the routes and frequencies of bovine Tb transmission among wildlife.

Each Proximity Detector System consists of a group of units equipped with a Very High Frequency (VHF) transmitter circuit transmitting pulses at a nominated rate just like normal radio beacons. When not transmitting the VHF pulse, the devices broadcast a unique identity (ID) code, while simultaneously listening for other transmitters. If another ID code is detected, indicating another unit is nearby, the receiving unit queries an onboard clock and logs both the time and the ID code of the nearby transmitting unit. The other unit, also listening, does the same, logging time and ID data of the interaction. On retrieval of the units from the field (currently by capturing the radio-collared animal), each unit is connected to a computer and the interaction data downloaded for analysis.

The new system includes most of the features found on standard VHF transmitters including switch-on switch-off daily cycles and animal mortality cut-offs. To help save further power (and thus extend the life of the unit) and data space, digital filters are utilised so that, for example, when two (or more) units are apart for less than some predetermined period, only the ID code, the 'time of contact' and the 'time of separation' are recorded. Other similar filters and ways of storing data can be added as needed, in a custom-designed manner depending on the exact application proposed and customer feedback.

One problem anticipated by Trevor and Dave is the possibility of simultaneous multiple contacts between three or more units. Such contacts could occur when social animals den or feed together. The units have now been programmed to cope with such eventualities, and tests have shown that the software employed to do this works well.

Trevor Jordan *(not pictured) and* ***Dave Ward*** *develop and market radiotelemetry equipment for monitoring the behaviour of wildlife.*

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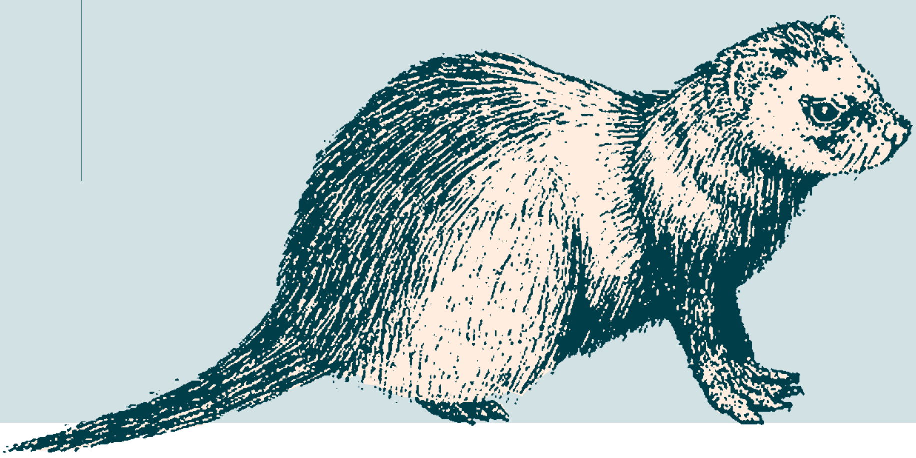

A Selection of Recent Vertebrate Pest-related Publications

Alley, J. C.; Berben, P. H.; Dugdale, J. S.; Fitzgerald, B. M.; Knightbridge, P. I.; Meads, M. J.; Webster, R. A. 2001: Responses of litter-dwelling arthropods and house mice to beech seeding in the Orongorongo Valley, New Zealand. *Journal of the Royal Society of New Zealand 31:* 425–452.

Barlow, N.; Choquenot, D. 2002: Predicting the impact and control of stoats: a review of modelling approaches. *Science for Conservation 191.* Wellington, Department of Conservation. 46 p.

Byrom, A. E. 2001: Ferrets as vectors of bovine Tb in New Zealand: a review. *Proceedings of the New Zealand Society of Animal production 61*: 60–63.

Byrom, A. E. 2002: Dispersal and survival of juvenile feral ferrets *Mustela furo* in New Zealand. *Journal of Applied Ecology 39:* 67–78.

Caley, P.; Hone, J.; Cowan, P. E. 2001: The relationship between prevalence of *Mycobacterium bovis* infection in feral ferrets and possum abundance. *New Zealand Veterinary Journal 49:* 195–200.

Caley, P.; Ramsey, D. 2001: Estimating disease transmission in wildlife, with emphasis on leptospirosis and bovine tuberculosis in possums, and effects of fertility control. *Journal of Applied Ecology 38:* 1362–1370.

Caley, P.; Hone, J. 2002: Estimating the force of infection: *Mycobacterium bovis* infection in feral ferrets *Mustela furo* in New Zealand. *Journal of Animal Ecology 71:* 44–54.

Caley, P. A.; Morley, C. G. 2002: Assessing growth rates of European rabbit populations using spotlight transect counts. *Journal of Wildlife Management 66:* 131–137.

Eason, C.; Murphy, E.; Wright, G.; O'Connor, C.; Buckle, A. 2001: Risk assessment of broad-scale toxicant application for rodent eradication on islands versus mainland use. *In*: Pelz, H.-J.; Cowan, D. P.; Feare, C. J. *eds.* Advances in vertebrate pest management II. Fürth, Filander. Pp. 45–58.

Nugent, G. 2001: Deer and pigs as hosts of bovine tuberculosis, and their potential use as sentinels of disease presence. *Proceedings of the New Zealand Society of Animal Production 61:* 64–67.

O'Connor, C. E.; Booth, L. H. 2001: Palatibility of rodent baits to wild house mice. *Science for Conservation 184.* Wellington, Department of Conservation. 11 p.

Parkes, J. 2001: Methods to monitor the density and impact of hares (*Lepus europaeus*) in grasslands in New Zealand. *DOC Science Internal Series 8.* Wellington, Department of Conservation. 13 p.

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