He Kōrero Paihama Possum Research News

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Manaaki Whenua
Landcare Research
NEW ZEALAND LTD

Trapping Possums - not Weka or Kiwi

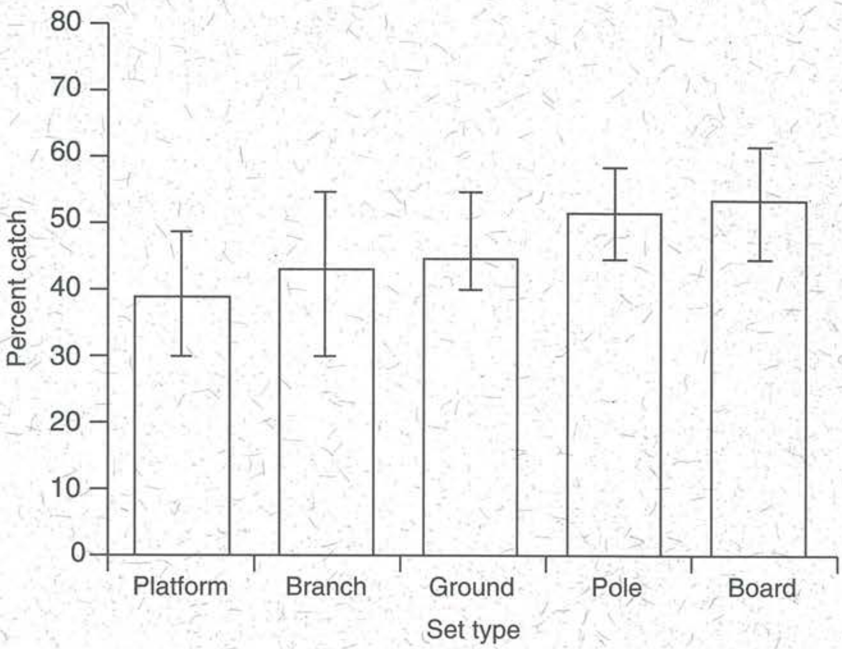
Leg-hold traps are used extensively for trapping possums in New Zealand, but occasionally when used in areas inhabited by weka or kiwi, they catch these species as well. At worst, such non-target trappings may put flightless bird populations at risk. Trappers have suggested a variety of trap sets to avoid capturing flightless birds but none of these have been tested. Nor has the effectiveness of these trap sets been tested for possum catch rates.

In areas with weka and kiwi, the Department of Conservation has a policy that requires all traps to be set at least 700 mm above the ground, either on platforms, attached directly to tree trunks, or attached to a sloping board set at least 38° to the ground. This requirement may significantly decrease the number of possums trappers catch, increase the time they need to set traps, or increase the amount of trapping equipment they need to carry.

Because of these problems, Caroline Thomson and Bruce Warburton evaluated a number of ways of excluding flightless birds from trap sets. Caroline and Bruce examined the effectiveness of the sets at preventing weka catches and their effect on possum capture rates.

To assess how determined weka were to jump or climb up to elevated traps, trials were carried out on weka in pens at Orana Park, Canterbury. These weka were offered a highly favoured food (freshly killed day-old domestic chicks) to lure them to the potential trap sites (no traps were used) including platforms attached to trees, and platforms at the top of sloping boards and poles. All weka were keenly interested in the chick baits and attempted to reach them by jumping or climbing. To prevent these weka getting the baits, Caroline and Bruce found that the platforms had to be at least 1 metre above the ground, and leaning boards and poles had to be angled at least 55°.

Three trap sets that excluded weka in the Orana Park trial were field tested by Les Moran at Tennyson Inlet, Marlborough Sounds, which is an area with high numbers of western weka and low possum numbers. The sets trialed were Victor No. 1 leg-hold traps placed 1 metre above the ground on platforms, above 55° sloping boards, and above 55° sloping poles (see photographs). All these sets successfully excluded weka on all (205) occasions except one in which a weka was caught on a board set.



Capture efficiency of trap-set types for possums (mean percent capture and 95% confidence limits).

These three trap sets and an extended platform ("branch") set were then compared with a standard ground set for their efficiency at capturing possums at Goose Bay, North Canterbury, an area with a high possum density and no flightless birds.

Over 1550 trap nights (310 for each set type), 714 possums were caught. The capture efficiency of the weka-excluding set types ranged from 38% to 53% (see graph), and did not differ significantly from the capture efficiency of the ground set (46%). There were also no significant differences between set types for the sex ratio, maturity, or injuries sustained by captured possums.

However, ground sets took significantly less time to establish than any of the other sets and did not require additional platform material. Consequently, a 20 kg pack-load of ground sets could be expected to catch the most possums per unit effort, followed by platform and "branch" sets.

These trials showed that leg-hold traps used on elevated sets can be

Two of the trap sets tested - the board set and the platform set.

used effectively without putting flightless birds at risk, but there are significant costs in time and effort. Further work is therefore required to develop trapping systems that are safe for flightless birds, but which do not require carrying additional materials. To this end, the Department of Conservation Northland has developed the "Scott board", an 18.5 x 16.5 cm platform of 8-mm plywood attached to a tree by 3 nails, with the trap stabilized by a rubber band made from a car tyre inner tube. These innovations will allow trappers to adapt their trapping practices to meet species protection requirements and perhaps assist in the recovery of New Zealand's flightless birds.

This research was funded by the Nelson Conservancy of the Department of Conservation.

***Bruce Warburton** and **Caroline Thomson** are in Landcare Research's Pest Impacts and Management team based at Lincoln. **Les Moran** is contracted to the Department of Conservation, Nelson.*

Guest Editorial

At first thought, there seems to be little if any connection between the tragic event at Cave Creek in 1995 and the ongoing challenge of managing possums to reduce the economic risks of bovine tuberculosis and the biological risks to forest sustainability and biodiversity. But there is. A major contribution to Cave Creek was deemed to be the persistence of the pioneering "4 x 2 and No.8 wire" approach to building structures for use by people visiting wildlands. The management of possums and other feral animal pests has long had elements of such an approach. Graham Nugent's observation (Issue 6 of *Possum Research News*) that Landcare Research was seeking to develop a model that would "replace the current 'seat of the pants' presumption that all possum control was beneficial", is striking confirmation that even after at least 100 years of the control of vertebrate pests, our policies and management practices are imperfect at best.

The Department of Conservation's response to the Cave Creek tragedy has been to restructure itself. In doing so, it has placed great emphasis on line accountability, and the development of "Quality Conservation Management" (QCM) systems for the building of structures, and for all other components of conservation management, including pest management. Readers will note that I draw a distinction between pest management and pest control; the former recognises the ongoing nature of the actions required to satisfy the goal of the programme, while the latter is but the delivery of a field operation without any necessary understanding of the overall aim of the programme. That the public, politicians, and policy makers understand this distinction is fundamental to the development of a pest management system for the future.

The Department is also placing significant emphasis on the assessment of risk by its pest managers. Risk can be both the conventional kind (was the poison bait laid in the right place?), and of a more fundamental nature (was the operation the *right* one?; did it deliver on the objectives specified?). Of course, such long-term risks may not become evident for many years after the completion of the operation. Those responsible for the hugely expensive and long-pursued policy of extermination for rabbits are no longer here to be held to account.

The developments of QCM and risk management for pest management systems requires an increased focus by the Department. In the longer term, this will have implications for all pest management agencies, since for several animal pests, and especially for possums, any effort to manage them other than within an integrated national framework is likely to fail. Pests are no respecters of boundaries, and nor are those people who perceive an advantage in maintaining feral populations; poisons are perceived to affect non-target species and the wider environment, and concerns for animal welfare and the environment affect political judgements despite (or because of) the public's increasing urbanisation and distance from many of the problems.

Efficiency of the delivery of pest control is not, and never has been, the appropriate measure of success for pest management. Such success must be specified in terms of improved soil conservation, water quality and regulation, biodiversity, or disease status. These goals, and the actions required to achieve them are interactive, complex, and long-lasting. Their achievement requires that politicians, managers, and the public have a much more comprehensive understanding of the goals of pest management than, generally speaking, they have previously shown.

The Department has taken the first tentative steps toward the development of an integrated pest management system which will link the various components of pest management. Many of these components are currently determined by value judgements, or 'gut feeling'; the unquantified and non-systematic decisions which have historically been common in land/ecosystem management. DoC must now develop and institute a system which will deliver sustainable management of possums. It will set objectives which reflect the relative values of the conservation assets being damaged, it will take into account the interactions between different pests in the same ecosystem, and it will reflect technical, economic, and social reality. The system must be constructed so that *all* decisions which must be made are transparent, and the assumptions required when knowledge is lacking made obvious. Only thus can the long term support of funders be reasonably expected, and only then will the opportunities for advancement in understanding be made clear.

Finally the Department must be able to monitor what it does, provide feedback so that progress can be monitored, techniques updated, assumptions replaced by knowledge; and reports provided to those who must be convinced of the benefits of programmes, if they are to be funded in the long term.

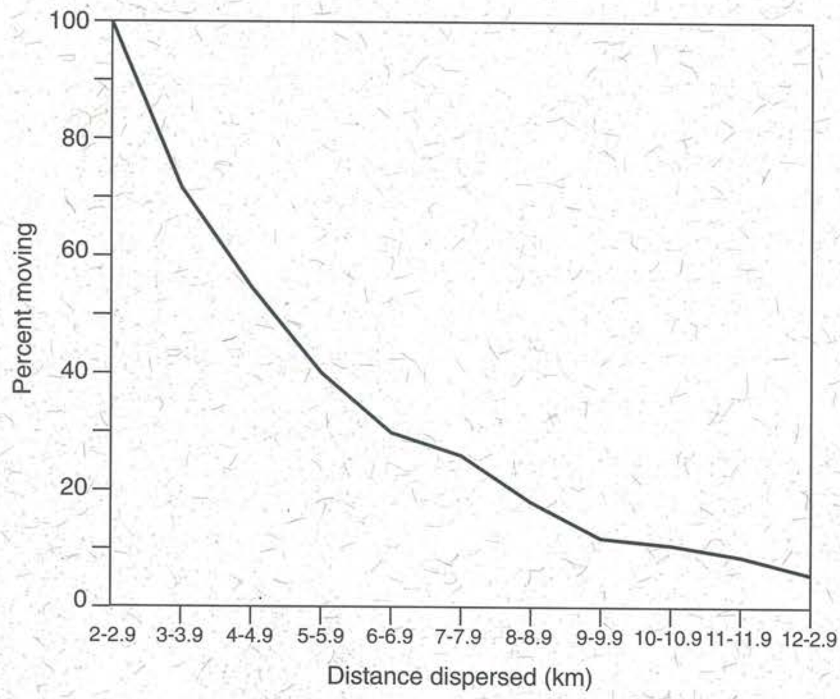
Until DoC does this in an integrated way according to national systems and national standards, it will not be able to advance from pest control to pest management. It will remain at risk of committing the same sin as its predecessors in the field of rabbit control but without an equivalent excuse – for it now has the knowledge base and the information tools to solve the problem.

***John Holloway** is the Director of the Science and Research Directorate, Department of Conservation, and is based in Wellington.*

Possum Dispersal - a Key Factor in the Recovery of Populations after Control

Although current possum control generally is effective in achieving initial reduction of possum numbers, rapid reinfestation and population recovery is often a problem, particularly when the control area is small. Repeated control may be needed, and control costs then become unacceptably high. The rates of recovery for possum populations following control, are affected by; (i) immigration, (ii) the breeding rate of the survivors, and (iii) changes in the survival rate of possums not killed by control. Phil Cowan and colleagues have been conducting a series of studies on possum dispersal to assess what contribution immigration makes to the recovery of populations.

One long accepted explanation for the rapid recovery of possum numbers following control is that possums from surrounding uncontrolled areas rapidly increase their home range and invade the controlled area because there is reduced competition for food and den sites. This is often referred to as the 'vacuum' effect, but there is little evidence to support it. Where recovery of populations after control has been studied in detail, the immigrants largely turn out to be young animals, mostly males, suggesting that they arrived as a result of normal dispersal rather than shifts in home range. Recent research by Murray Efford and Bruce Warburton found some such shifts in the home ranges of possums living adjacent to a controlled area during the two years after control, particularly in the first 3 months.



Relationship between the percentage of possums moving and the distance dispersed.

Long distance immigration (>2 km) is almost entirely made by juvenile possums, mostly males. About 25% of juvenile males disperse compared with about 10% of juvenile females. Average dispersal distance is about 6 km. Three extreme movements of 25, 31 and 41 km have been recorded, all by females. Dispersing females are more likely to make several movements before establishing a permanent home range than males are. The percentage of dispersing possums decreases sharply with distance (see graph).

Dispersal normally occurs shortly before animals become sexually mature, but whether the two events are linked is unknown. In possum populations where breeding is largely confined to autumn, the peak of dispersal occurs from February to June. Where significant breeding also occurs in the spring, there is a second peak of dispersal from October to December.

Habitat may also influence dispersal. In Hawkes Bay farmland, a higher proportion of possums dispersed from the low possum density area of pasture and crops than from higher possum density areas of swampy scrub and willows. This suggests that possums may be more likely to disperse from marginal habitats. However, juvenile possums appear to have an 'innate' tendency to disperse. Even in an area where possum density had been reduced by about 90%, presumably reducing competition for food and nest sites, both male and female juvenile possums dispersed at the same frequency as before control.

What are the implications of these findings for managers of possum populations seeking to reduce rates of recovery of possum numbers after control? Most immigrants come from some distance away rather than from immediately adjacent to the controlled area. This means that controlling nearby possum populations will reduce the number of immigrants. But because possums disperse relatively long distances, the size of the surrounding 'buffer' zone may need to be large because of the 'innate' tendency of possums to disperse. Buffer zones will not eliminate immigration. However, because dispersal is seasonal, it can be targeted by appropriately timed control, depending on the local breeding season. Conducting control early in the breeding season will also reduce dispersal because control will kill both mother and young before the young become independent.

Currently, little is known about the factors that determine where possum immigrants decide to settle, but they may include local density and sex ratio; competition for food, nest sites and mates; and other factors such as the number of previous attempts to settle or distance dispersed. Experiments to test how some of these factors affect settlement have begun.

This research is funded by the Foundation for Research, Science and Technology, the Department of Conservation, and the Cooperative Research Centre for Conservation and Management of Marsupials.

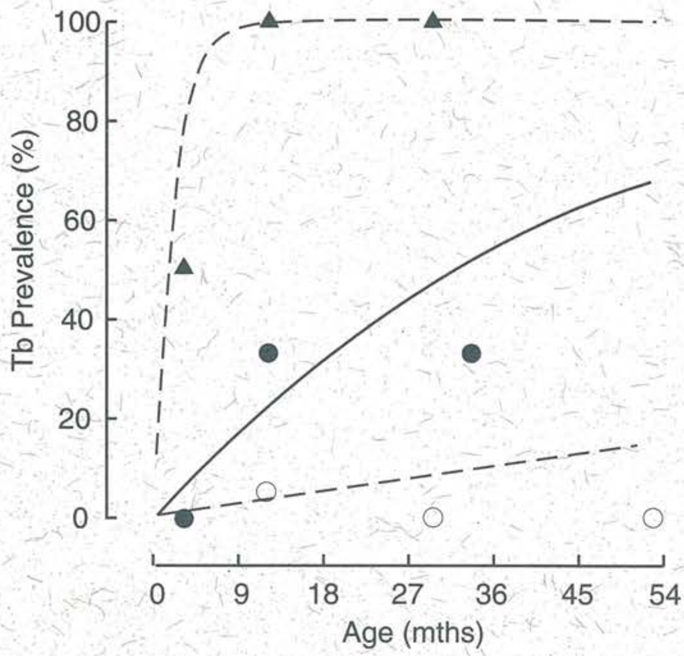
__Phil Cowan__ is Team Leader for the Wildlife Ecology, Tb and Biocontrol team of Landcare Research based at Palmerston North. __Murray Efford__ is an ecologist in the Ecosystems South team based in Dunedin, and __Bruce Warburton__ is an ecologist in the Pest Impacts and Management team based at Lincoln.

Are Possums the Source of Tb Infection in Wild Ferrets?

Possums may not be the only significant wildlife host of Tb in New Zealand. Wild ferrets, the descendants of the European polecat, are infected with Tb in many parts of New Zealand, often in connection with infected livestock. Speculation has centred on whether the high prevalence of Tb infection in ferrets results from them scavenging on tuberculous possums, or whether Tb is cycling independently in ferret populations. For the past two years, Peter Caley of Landcare Research and Ian Lugton of Massey University have been researching the epidemiology of Tb infection in ferrets.

Detailed surveys of ferret populations for Tb infection were undertaken at two sites in North Canterbury, one site in the central North Island, one site in coastal Wairarapa and one site in the Mackenzie Basin. Ferrets were examined for visible signs of Tb, with subsequent laboratory culture determining the disease status of each ferret. Lisa Street of Landcare Research determined the ages of the ferrets by sectioning their teeth and counting annual layers in the tooth. This was a major step forward as, previously, ferrets were considered difficult to age.

The results from this work indicated that juvenile ferrets less than three months of age were not infected with Tb (see graph). This means that transmission from mother to offspring during the nursing period was not an important factor in spreading the disease. However, ferrets were found to be acquiring Tb before they reached sexual maturity, demonstrating that disease transmission was occurring outside the breeding season.



Relationship between the prevalence of Tb and the age of ferrets surveyed from sites in Wairarapa (▲), North Canterbury (●) and Mackenzie Basin (○).

By examining how the prevalence of Tb increases as ferrets age, it was possible to estimate the rate at which ferrets encountered Tb infection. At the Mackenzie Basin site where possums were at very low abundance, ferrets were estimated to encounter infection 0.1 times per year. At the central North Island site where possum populations had been subject to control for many years, the figure was 0.3 times per year. In North Canterbury where possum populations are at naturally low to moderate numbers the figure was 0.4-0.5 times per year. In contrast, at the Wairarapa site where Tb possum populations are uncontrolled, ferrets were estimated to encounter infection 14 times per year.

An alert wild ferret.

Could this rate of encounters with Tb infections be produced by ferrets scavenging on Tb possums? Wild ferrets scavenge extensively, and although their diet is comprised mainly of rabbit, dead (and possibly live) possums are eaten. These findings tied in nicely with the results of the study of the pathology of Tb infection in ferrets by Ian Lugton, which showed that infection mostly occurred in lymph nodes associated with the alimentary tract – presumably as a result of eating Tb infected material. Infection in superficial lymph nodes originating from bites appeared to occur, but much less frequently.

Studies are now underway in collaboration with researchers from Lincoln University to determine whether the infection observed in ferrets can be adequately explained by ferrets scavenging on possum carcasses.

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

__Peter Caley__ and __Lisa Street__ work for Landcare Research in Palmerston North as members of the Wildlife Ecology, Tb and Biocontrol team. Peter currently works on the epidemiology of Tb in possums and ferrets, and the transmission of Tb from wildlife to livestock. Lisa is involved with research on possum ecology.

__Ian Lugton__ currently works as a veterinary epidemiologist with the New South Wales Department of Agriculture's Vertebrate Pest Research Unit based in Orange.

Air and Ground Control - Both Options for Possum Control

A recently completed study by Tom Montague for the Animal Health Board, compared aerial poisoning using 1080 pellets with ground hunters primarily using bait stations and cyanide. He showed that both strategies can reduce possum numbers by 75% or more in areas up to 5000 ha at costs ranging from $17-25/ha (excluding the cost of monitoring the kill achieved). For quite some time, there has been controversy over whether ground hunters can control possums as cost-effectively as aerial operations over areas greater than 1000 ha. DoC has used ground hunters during the last decade to control possums in areas smaller than 1000 ha, and Regional Councils have used ground hunters to control possums on farms about the periphery of aerial operations. Yet there was still doubt whether ground hunting could be as cost-effective as aerial poisoning operations. When the two techniques were used side by side in a paired trial in the Kaweka Ranges near Napier and the Matiri/Owen catchment near Murchison, Tom found that either method could be used satisfactorily. Hunters using ground poisoning techniques reduced possum numbers to less than 2% (2 possums per 100 trap nights) over a 6–9 month period, while aerial baiting reduced numbers to less than 4% over about 2 weeks.

The result may be a surprise to many people involved in possum management, but Tom found that hunters were using bait stations rather than traps as their main control tool. This appears to be a significant improvement from past practices. The introduction of Campaign® - loaded baits, a toxin marketed by AgrEvo (see Issue 6 of *Possum Research News*), also seems to have been a key factor in the hunters' success. Tom concluded that even though the study involved only two locations, the results provide good evidence that hunters can be just as effective, given time, as aerial operations in large areas of accessible bush.

This research was funded by the Animal Health Board.

__Tom Montague__ is an animal ecologist in Landcare Research's Pest Impacts and Management team based at Lincoln.

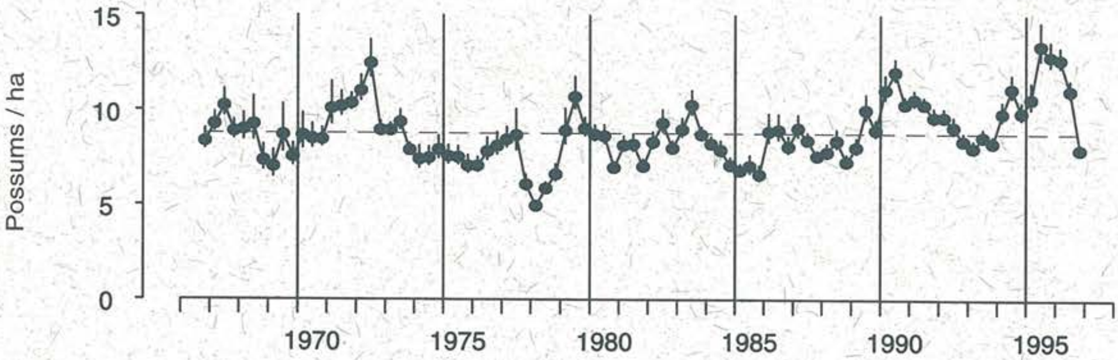
When Possums Stop Breeding...

Possums have established themselves this century in most of New Zealand's forests, and they are likely to remain throughout the next. What will be the long-term outcome of this colonisation? Will there be some accommodation between the possum and its adopted habitat? What natural checks and balances limit the growth of possum populations?

Female possum and backrider.

Live-trapping of possums in the Orongorongo Valley in the Rimutaka Forest Park seeks to answer questions such as these through a unique detailed record of changes over 30 years. Three times each year, Murray Efford and colleagues set cage traps throughout 15 ha of rata/rimu and hard beech forest. Each possum caught is ear-tagged and released. Statistical analysis of recaptures indicates how many possums are present and what their natural survival rate is. Breeding rates are obtained from the proportion of females with a joey in their pouch.

The research area has been off limits to possum trappers for many years. Possums have been left to regulate their own numbers. To many people's surprise, this is exactly what they have done. Except for a few short-lived ups and downs, the local density of possums has stayed near 8-10/ha (see graph 1). Each year there is a predictable summer increase (as autumn-born young become independent), followed by a decline in winter (from natural mortality). The major upswing in 1971/72 can be related to a particularly mild dry winter and good fruit crop; conversely,



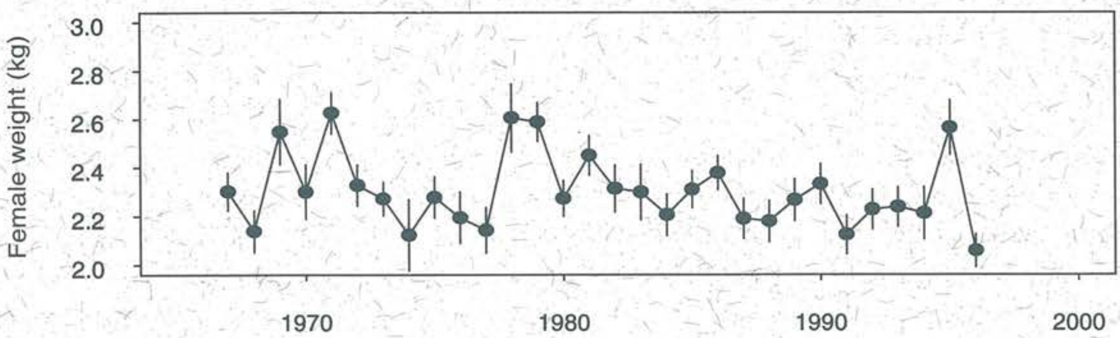
Graph 1: Possum population density in the Orongorongo study site
(the dashed line is the long-term average)

the crash in 1977/78 coincided with wet winter weather. However, these events have no cumulative effect because they are counteracted by 'density-dependent' feedback processes.

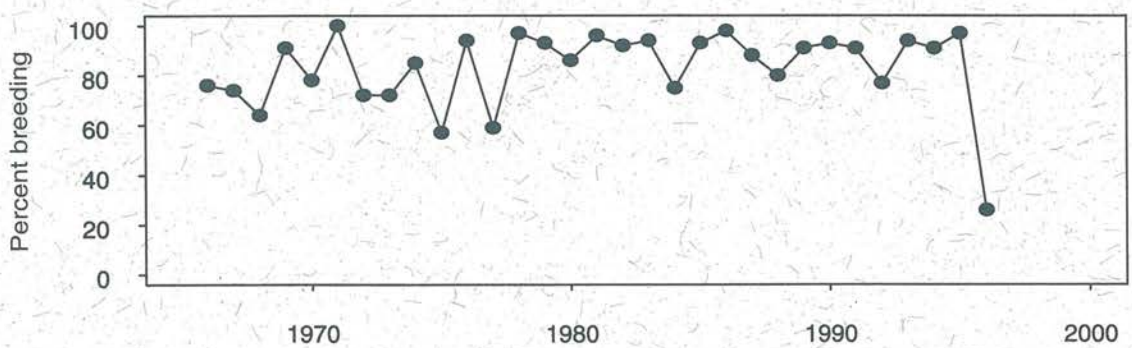
The nature of these feedbacks has great practical significance: when we attempt to hold possum numbers down there is a natural self-regulatory response that cannot be ignored. When numbers are low, some combination of decreased mortality, increased breeding, and increased dispersal into the area causes a predictable increase.

To pin down the mechanisms of population regulation we must measure changes in breeding or mortality at extremes of high and low density. This method works poorly when the population is more or less constant. Researchers could experimentally reduce the population, but continuity is critical to other aspects of the Orongorongo study and researchers are reluctant to sacrifice it. For example, detailed individual histories are currently being used in genetic studies to pin down the mating system of Orongorongo possums. The family tree of one female caught this year can be traced back through six generations to her great-great-great-great-grandmother first trapped on the study site in 1966!

So our best window on how the population works is to follow large natural fluctuations brought on by weather and random events. One such fluctuation is just passing through the Orongorongo system. For reasons not yet fully understood, possums did very well on the study area in 1995. Body weights were unusually high (see graph 2), and in mid-1995 the population reached an



Graph 2: Mean adult body weights of female possums in June of each year



Graph 3: Percentage of adult females breeding each year.

all-time peak density, perhaps 40% above normal. Feedback mechanisms then kicked in with a vengeance: the breeding rate recorded in 1996 was a mere 26% (see graph 3), the lowest ever. Over winter, 28% of the population disappeared (largely natural mortality), the greatest loss since 1977.

Winter disappearance had previously been recognised as a density-regulating factor in possums, so the low survival rate in 1996 was not really a surprise to researchers. On the other hand, the depression of the breeding rate was unexpected as usually almost all adult females attempt to breed. So why was 1996 so different? The key appears to be female body weights. These were the lowest in 30 years and averaged just 2.06 kg. Although this was only marginally less than the usual Orongorongo range of 2.1 - 2.4 kg, it appeared to be such that most females were unable to breed.

Murray believes that the 30 years of data indicate that the population will recover. Failure of breeding in one year has only a short-term impact on the population as most adults survive for several years. Density in 1997 will most likely be near the long-term mean of 8.8 possums per hectare. Faced with less severe competition, females will regain condition and return to their usual fecundity.

The 1996 event has refocused attention on natural year to year variation in undisturbed possum populations. With the extensive data now available, Murray and colleagues hope to analyse the factors that drive variation in possum population dynamics as well as the population's response.

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

__Murray Efford__ is an ecologist with Landcare Research's Ecosystems South team based at Dunedin, and is gathering data on possums for use in models of population recovery following control.

Where are we up to with Possums?

Landcare Research, in association with the Department of Conservation, is sponsoring a book on possums in New Zealand. The book aims to document what is known and where research is going in its struggle to understand the biology, impact, and management of New Zealand's most intensively managed vertebrate pest. The book's editor, Tom Montague, is currently seeking contributions from the nation's possum experts and aims to produce a hard back, 350-page volume for release in 18 to 24 months time. The book promises to provide the most up-to-date information on possums available for pest managers, policy writers, farmers and students.

For further information contact: Tom Montague, Landcare Research, Lincoln.

A Selection of Recent Possum-Related Publications

Burns, B.; Cowan, P.; Knightbridge, P. 1996: *Save a rata - kill a possum.* New Zealand science monthly 7: 6-7.

Cowan, P.E.; Tyndale-Biscoe, C.H. 1997: Australian and New Zealand mammal species considered to be pests or problems. *Reproduction, fertility, and development* 9: 27-36.

Parkes, J.P.; Nugent, G.; Warburton, B. 1996: Commercial exploitation as a pest control tool for introduced mammals in New Zealand. *Wildlife biology* 2: 171-177.

Parkes, J.P. 1996: Integrating the management of introduced mammal pests of conservation values in New Zealand. *Wildlife Biology* 2: 179-184.

Rogers, G.M.; Leathwick, J.R. 1997: Factors predisposing forests to canopy collapse in the southern Ruahine Range, New Zealand. *Biological conservation* 80: 325-338.

Warburton, B.; Orchard, I. 1996: Evaluation of five kill traps for effective capture and killing of Australian brushtail possums (Trichosurus vulpecula). *New Zealand journal of zoology* 23: 307-314.

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