He Kōrero Paihama
Possum Research News

Issue 9 *June 1998*

CONTENTS

Animal Ethics in Possum Research 1

Guest Editorial - An "Iwi" Perspective on Possum Control 3

So Why Breed More Possums? 4

Māori Relationship with the Natural World: What does it mean for Possum Control Priorities? 5

Possum Tb infection in the Hohonu Range - Left alone it won't go away 7

Possums and Hīnau - Impacts and Interactions 9

Conference 11

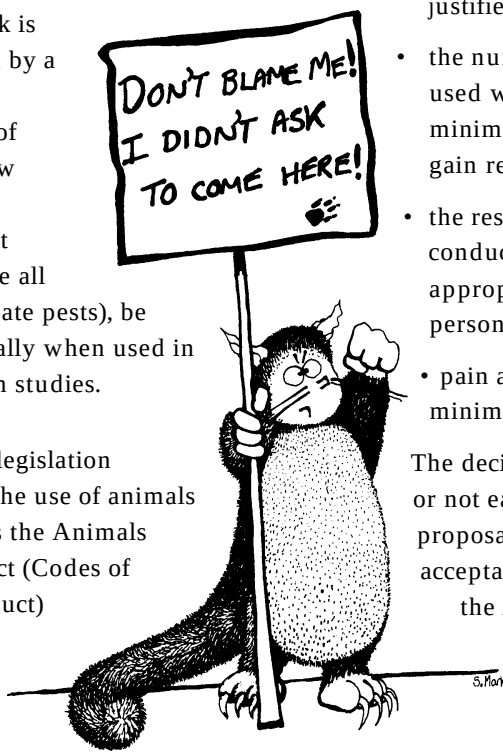
Contacts and Addresses 11

A Selection of Recent Possum-Related Publications 12

Manaaki Whenua
Landcare Research

Animal Ethics in Possum Research

As in all modern civilised societies, the humane treatment of animals in New Zealand is encouraged by law. The possum deserves this respect as much as any other animal, even though it is New Zealand's foremost vertebrate pest. Possums extensively damage natural ecosystems through their browsing and predation, and threaten New Zealand's trade in livestock products through the spread of bovine Tb. These effects are the results of a man-made mistake (i.e., their introduction into New Zealand) rather than possums' being intrinsically bad. Even so, possums are currently controlled over about 10% of New Zealand, and this work is underpinned by a $14.5 million programme of research. New Zealand law demands that possums (like all other vertebrate pests), be treated ethically when used in such research studies.



The present legislation applying to the use of animals in research is the Animals Protection Act (Codes of Ethical Conduct) Regulations 1987.

This legislation requires that researchers wishing to use all vertebrate and some invertebrate animals must comply with a 'Code of Ethical Conduct', including seeking prior approval from an Animal Ethics Committee (AEC). Landcare Research has its own AEC, which decides whether each proposal meets the conditions included in the Code. Our AEC comprises two staff scientists, a member of the public, a member of the Māori community, a veterinarian, and a member of the RNZSPCA.

The Landcare Research Code of Ethical Conduct ensures that:

- the use of animals is justified,
- the number of animals used will be the minimum required to gain reliable results,
- the research is conducted by appropriately trained persons, and
- pain and suffering is minimised.

The decision on whether or not each research proposal is ethically acceptable is made by the AEC. This is an important feature of the New Zealand

Animal Ethics approval is required for all laboratory studies of live animals such as blood sampling of possums.

Studies of possums' responses to toxic baits used in control require Animal Ethics approval.

system and recognises that issues of ethics should be established by community representatives working within a legal framework. It is an improvement on the system used in countries such as the United Kingdom, where licences for carrying out research procedures on animals are issued by a centralised government agency. Such systems lack community input and do not consider proposals individually.

Another very positive feature of the New Zealand approach to animal ethics is the establishment of the National Animal Ethics Advisory Committee (NAEAC) which provides information on animal ethics issues to institutional AECs. Landcare Research is also a member of ANZCCART (the Australian and New Zealand Council for the Care of Animals in Research and Teaching) which provides a forum on the ethics and practicalities of using animals in research. The information that our AEC receives from these organisations helps to ensure that our committee reflects an up-to-date overview of community attitudes towards the use of animals in research.

The Landcare Research AEC will mark its 10 year anniversary in July 1998. Since its establishment, the committee has reviewed proposals that involved the use of many thousands of possums. The projects have ranged from the development of more effective and humane poisons and traps, to fundamental studies on the breeding and behaviour of possums. The committee has provided a community-based 'filter' for all of our possum research, and has encouraged researchers to maintain a respectful attitude towards this and other introduced vertebrate pests.

This work is funded from individual science project budgets.

David Morgan *is an animal ecologist in Landcare Research's Pest Control and Wildlife Ecotoxicology Team based at Lincoln, and has chaired the organisation's AEC since its establishment in 1988.*

Guest Editorial

An "Iwi" Persective on Possum Control

I have often been asked what the Iwi perspective on possums is, or what would Māori do to deal with the possum crisis. That question is as inane as asking what is the Pakeha or Solomon Islander or Australian perspective on possums. My initial response has always been that "there isn't one".

The response to "what is the Pakeha perspective on possums?" would be just as mixed. The Royal Forest and Bird Society would have very different views to the Royal Society for the Prevention of Cruelty to Animals or any of the animal rights organisations.

Thus, I would expect a Māori possum trapper employed by a regional council would see the possum as a source of income to support his family; a Māori farmer would see the possum as competing with livestock for grass on his property; and a Māori conservationist would see the possum as a predator of eggs and chicks and as a competitor with native birds for their food.

The cultural beliefs of people influence their stance on key issues. If I was asked to give a five word summary of a generic Māori conservation ethic, I would say "Respect nature and waste not". In fact, I would go so far as to say that is not just a Māori conservation ethic but a commonsense approach to conservation. In the Māori order of creation, mankind came after trees and sea life, therefore Māori (mankind) have an obligation to care for their tuakana (elder brothers), i.e., the land and life on the land including forests, the water and water life, sea and sea life.

The basic Maori philosophy regarding conservation originated from a spiritual respect for Papatūānuku (mother earth) and Tāne (the God of forests and birds). In practice, this amounted to *no wastage, no hunting for pleasure, no littering, no desecration of tapu, no desecration of waterways, and no over-exploitation of resources.*

Given such a philosophy, it is not difficult to envisage what an intelligent, forward thinking pre-European Council of Māori elders would have implemented had they encountered the current day possum problem. In fact, they would not have seen it as a problem but as a godsend. They would not therefore have carried out intensive eradication programmes against possums, developed a pest management strategy, appointed a national possum control body, or had meeting after meeting to discuss ways of getting rid of possums.

Instead they would have accepted the possum as a bountiful food source, eaten its meat, brains and innards, used its fur for cloaks, used the bones for needles and adornments, and probably grown to accept possum heart, liver or brains as the most sought after delicacy (similar to that of the kūkupa (native wood pigeon). Such a council would definitely have observed the habits of possums in relation to the moon, weather, and seasons, had possum included in their hunting and harvesting calender, caught and used possum as pets and decoys for calling others into supplejack cages, and declared a rāhui when possum numbers fell below a sustainable level to allow the numbers to build up again.

Possum control has become quite a substantial industry in New Zealand. Hundreds of jobs have been created, and millions of dollars spent directly and indirectly every year without many tangible signs of success.

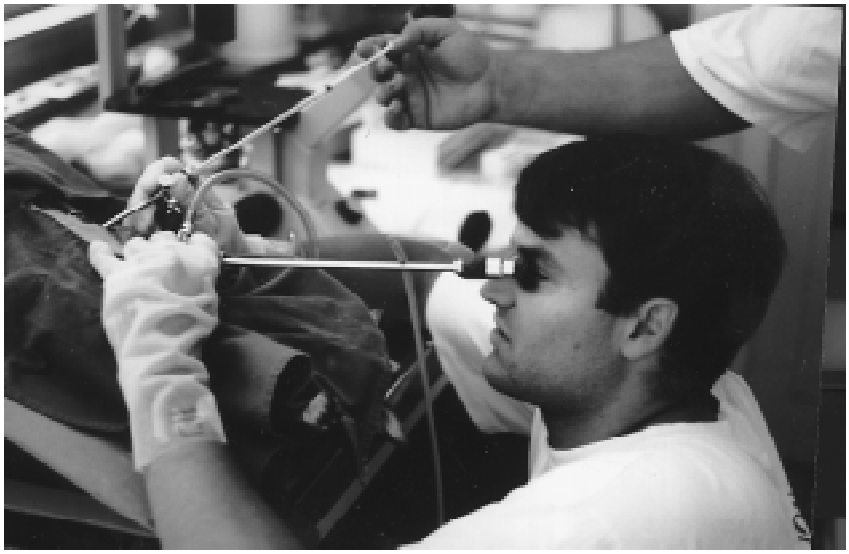
I have a lot of faith in the wisdom of old time Māori. While 25% of the world's population is starving, we blithely trap, kill, and poison to waste an abundant animal resource. As New Zealanders we could do much better by tapping this substantial food reservoir that is available throughout the country for our own use and for export.

New Zealanders are renowned for being innovative. Let us start by promoting a national possum menu competition, albeit educating potential chefs against poisoned possums and on recognising tuberculosis. Next, we could publish our possum recipe booklet using all the information available to us such as catching, bleeding, skinning, dressing, garnishing, cooking, presenting, and eating the animal. A second booklet could cover preparation of possum offal : brains, heart, liver, intestines, and gonads, and present a chart on the nutritional value of such delicacies. The preparation, treatment and curing of the pelts and the use of powdered possum claws as a replacement for rhinoceros horn, are possible subjects for further publications. The mind boggles at the possibilities.

Kevin Prime *is the Environmental Co-ordinator for Te Rūnanga o Ngātihine.*

So Why Breed More Possums?

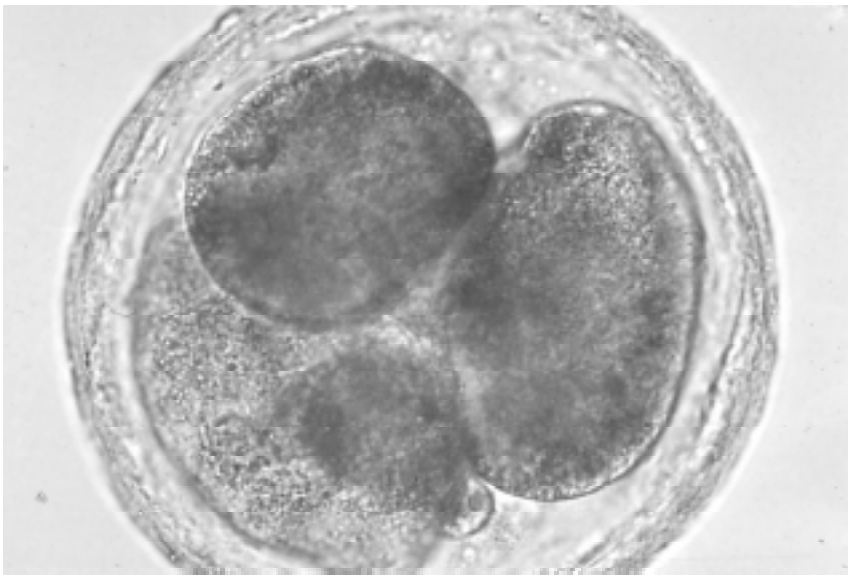
Anyone who has visited Landcare Research's Gamete Laboratory lately may have pondered this question, especially after seeing Frank Molinia peering down a laparoscope to artificially inseminate possums (AI) with sperm, or Andy Glazier culturing sperm with eggs in an effort to achieve *in vitro* fertilization (IVF). So why are we trying to breed possums artificially?



Using a laparoscope to look at the female reproductive tract of a possum before inseminating it with sperm.

The answer is that by understanding key processes in possum fertilization, we can identify effective targets for blocking reproduction. Possums are seasonal breeders and normally produce one egg per cycle, which makes it difficult to access sufficient raw material to study fertilization. Recent improved methods for superovulation (which increases the egg yield in a single hormone-induced cycle) and artificial insemination (which permits timed insemination of sperm, instead of waiting for natural matings) has resolved most of the difficulties in this research.

The development of this "assisted breeding technology" has allowed researchers to observe interactions between sperm and eggs *in vivo*, that is, in the living animal. For example, possum sperm, like their non-marsupial counterparts, undergo a process called capacitation in the female oviduct (or fallopian tube). This process permits sperm to bind to and fertilize recently ovulated eggs. Attempts to mimic conditions in the oviduct and obtain fertilization *in vitro* (in a test-tube) has become the focus of the IVF Task Force, a trans-Tasman collaboration between staff at Landcare Research and colleagues John Rodger, Karen Mate and Kuldip Sidhu working in the Cooperative Research Centre (CRC) for the Conservation and Management of Marsupials, at Macquarie University, Australia. The first IVF experiments were completed recently. Combining sperm recovered from the oviducts of artificially-inseminated possums with eggs retrieved from large ovarian follicles, appears to result in sperm binding and egg penetration after *in vitro* culture. This will need to be confirmed by electron microscopy of the eggs.



A 4-cell embryo retrieved from the female reproductive tract of an artificially-inseminated possum.

Apart from helping unravel the mysteries surrounding possum fertilization, IVF and AI represent two powerful tools in the armoury for testing vaccines to block fertilization. Fewer animals and resources would be used compared with a natural breeding trial. Conversely, this technology benefits the captive breeding of endangered marsupials in Australia – a core component of research undertaken by the Marsupial CRC.

This research was supported by the Foundation for Research, Science and Technology, MAF Policy, and the Cooperative Research Centre for the Conservation and Management of Marsupials.

Frank Molinia *and* ***Andy Glazier*** *are reproductive physiologists in the Wildlife Ecology, Tb and Biocontrol team of Landcare Research based at Lincoln.*

Māori Relationship with the Natural World: What does it mean for Possum Control Priorities?

Does possum control protect natural values that are important to Māori? The principles of partnership implicit in the Treaty of Waitangi require managers of natural ecosystems to incorporate Māori conservation priorities into overall strategies for ecosystem protection and rehabilitation. Because the history and natural resources of each iwi and hapū vary enormously, the conservation priorities, and the policies needed to address them, will differ between individual iwi and hapū. However, there are likely to be strong similarities in the guiding principles on which local priorities and goals are based.

Derek Wano holding a kererū (=kūkupa or native wood pigeon).

A first step in recognising where Māori conservation priorities lie (and hence whether present possum management is meeting them), is for pest managers to understand the Māori conservation values and processes for setting priorities. Manaaki Whenua has a programme of Crown-funded research aimed at achieving that.

The initial step was to convene a hui in August 1997 with Māori from various hapū and iwi to develop preliminary ideas about Māori conservation concerns, and a framework for substantive research involving Māori.

The August hui confirmed that many Māori have a strong sense of cultural connection to the natural world and feel part of it. This traditional relationship has both human and spiritual elements that generates a sense of duty to nurture the mauri (essential life force) of all things in the natural world and the human communities who depend on it. As a consequence, Māori developed an ethic of conserving resources to ensure their availability for present and future generations. Examples of how this was practised include rāhui (temporary harvest ban) and

tapu (restrictions), both of which were applied frequently and widely. This traditional ethic strongly suggests that iwi and hapū will support appropriate conservation measures taken to protect cherished natural resources. Certainly, the Māori present at the hui expressed strong concern at the devastation caused particularly by possums, rats and stoats, and to a lesser degree, other introduced pests.

The key question is what natural resources are most cherished by Māori? At the highest level, whole ecosystems are valued. However, given that total protection of all native ecosystems from possums and other pests is presently unattainable, Māori are likely to favour protecting components with which they have the greatest cultural connection. This would include tōtara (revered and used for carving waka and ancestral meeting houses) and kererū or native wood pigeon (of special significance as a customary food). Māori are also likely to favour protecting places of traditional importance, including sacred mountains and sites, as well as mahinga kai (traditional harvest areas).

Such priorities may not match closely the priorities of the Department of Conservation (DoC). DoC's priorities are developed according to criteria such as species rarity, and community diversity or how pristine it is. Cultural values *per se* have no particular weighting in DoC's ranking system. In the Urewera/Waikaremoana area, for example, the primary aim of possum control is to protect kōkako. Species such as kererū and tōtara, valued by Māori, and sites of cultural significance are of lower priority.

That said, the intensive pest management effort of recent years in the 50,000 hectares of kōkako habitat in the Urewera/Waikaremoana area, not only protects kōkako, but also benefits kererū, kiwi and kākā, as well as most of the tree species threatened by possums in that area. However, this is only a small part of the Ureweras that is of concern to the tangata whenua. Possum control in this natural ecosystem is clearly protecting some things treasured by Māori, even though the priority species and areas may differ. However, it will not always be sufficient to rely on such fortuitous overlaps.

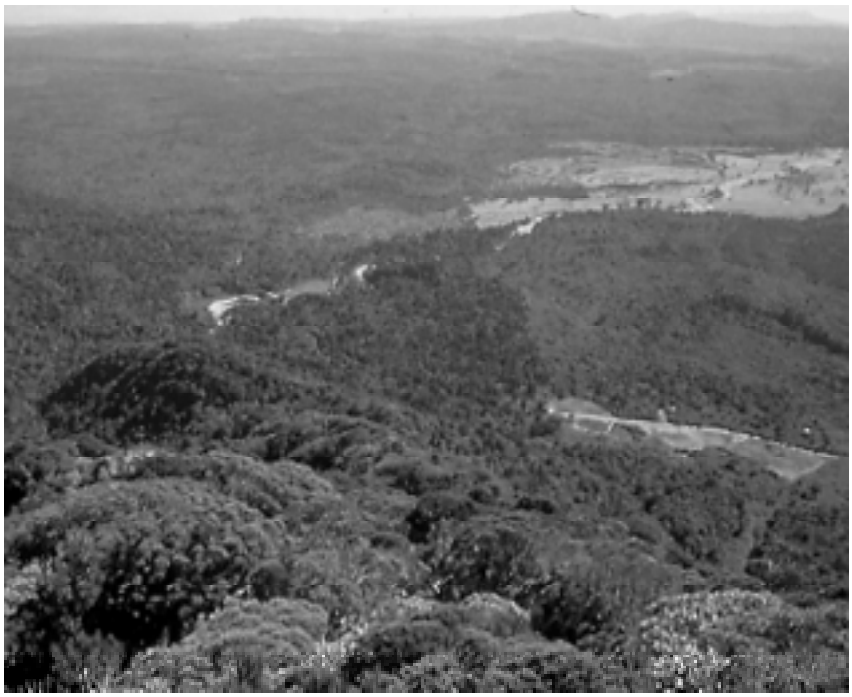
This research is funded by the Foundation for Research, Science, and Technology.

Tōtara carving by Riki Manuel symbolising 'new life' - in the foyer of the Fleming building, Manaaki Whenua, Lincoln.

John Kape *(Ngāti Kahungunu) is an Issues Analyst in the Land Management team of Landcare Research based at Lincoln.*

Possum Tb Infection in the Hohonu Range - Left alone it won't go away

The Hohonu Range is a familiar name to researchers studying bovine tuberculosis in brushtail possum populations. In 1973, the first large-scale survey of possums for Tb infection took place in the Range – Jim Coleman co-led a joint team from the Ministry of Agriculture and Fisheries and the Forest Research Institute (FRI). The survey covered a wide area, ranging from lowland podocarp forest through to subalpine scrub, and from the bush / pasture margin to deep forest. The location of all trap sites were permanently marked.



The Hohonu Range study site showing developed and undeveloped rough grazing surrounded by forest and containing many Tb possums.

Possums may be infected with Tb in lymph nodes in their groins or armpits. These nodes drain bacteria to the exterior. Such possums are highly infectious to other animals.

Of possums sampled in the 1973 survey, 8% were visibly infected by Tb. Infection was most prevalent (*c.* 20%) in the lowland podocarp / mixed hardwood forest adjacent to pasture grazed by cattle. However, the survey team found less Tb in possums the further the trap lines were from pasture, cows and lowland forest. Deep in the heart of the Hohonu Ranges, little Tb was found. This trend of decreasing prevalence with increasing distance from the pasture edge could have been caused by (i) transmission of Tb between possums being higher on the pasture edge; (ii) possums interacting with tuberculous cattle increasing the transmission rate of Tb to possums; or (iii) Tb had recently established in the possum population and was spreading progressively deeper into the forest.

In 1989, a FRI team resurveyed many of the original 1973 lines. Although the disease was not as prevalent as in the original survey, researchers were surprised to find that tuberculous possums occurred only where they had been found previously, and there had been

Tb infection in an axillary lymph node.

no spread of disease deeper into the forest. Closer inspection of the trapping data showed that the prevalence of disease mirrored the abundance of possums. Disease was most prevalent in the abundant possum population near the pasture margin, and rare in deep forest where possum numbers were low. Most cattle had been removed from the study site in 1974, so the hypothesis that cattle were continually reinfecting possums with Tb was discounted.

In 1997, Peter Caley and Jim Coleman from Landcare Research resurveyed a selection of the original lines. This time, there were still very few cows present, pasture was largely overgrown, and the 'forest / pasture margin' was largely nonexistent. But the Tb in the possums had not gone away. To the contrary, it was there with a vengeance. Twenty three of 261 possums (9%) examined had visible signs of the disease. Again, the disease was most prevalent in the lowland forest. It was found in similar areas as before, though not matching the 1973 survey results as closely as the 1989 survey results did.

So of the original three hypotheses put forward to explain the decreasing prevalence of Tb from the 'pasture edge' to deep forest, none survive. The cows have largely gone, the forest / pasture margin has largely disappeared with the advances of blackberry and bracken, and 25 years is ample time for the disease to spread deep into the forest. But for the tuberculous possums, nothing has changed. They clearly don't need grass, cows, or a bush edge playground to spread the disease amongst themselves.

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

Peter Caley *is a member of the Wildlife Ecology, Tb and Biocontrol team of Landcare Research based at Palmerston North. Peter currently works on the epidemiology of Tb in possums and ferrets, and the transmission of Tb from wildlife to livestock.*

Jim Coleman *is a vertebrate ecologist in the Pest Impacts and Management team of Landcare Research based at Lincoln. He works on the epidemiology of Tb in possums and on their improved management.*

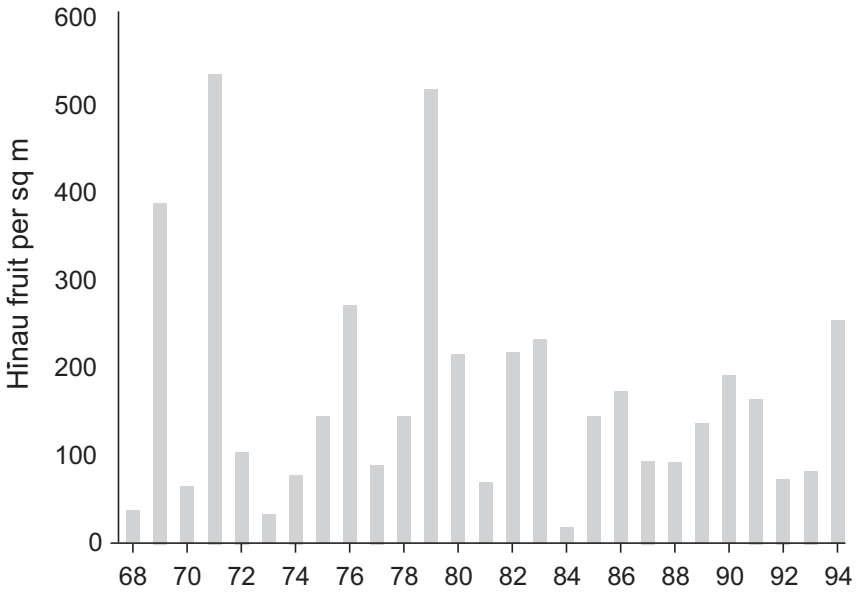
Possums and Hinau - Impacts and Interactions

The impacts of possums on native plants is well known, but a detailed study of one forest tree species, hīnau (*Elaeocarpus dentatus*), has shown that natural variations in forest productivity influence and are influenced by possums. Hīnau is a broad-leaved, evergreen tree, up to 15 m tall, locally common in most lowland forests in the North Island, but sparsely distributed in the South Island. From spring through to autumn, possums eat the buds, flowers and fruits of hīnau, but rarely browse the leaves.

Like most plants, hīnau fruiting responds to variations in the weather. Hence, the amount of fruit produced varies annually. Since 1968, Phil Cowan, Murray Efford and their predecessors have measured hīnau fruit production at a site in the lowland podocarp / hardwood forest in the Orongorongo Valley, east of Wellington. Annual fruitfall varied from 11 to 533 fruits / m^2 (see graph 1). Climate and characteristics of individual trees were responsible for most of this variation. More fruit was produced when sunshine hours and average maximum temperatures were higher than average in the preceding 1-2 years, and less when rainfall and the number of rain days were higher than average, and the average minimum temperature, lower.

A fruitfall trap used to measure fruit production of hīnau trees.

Possums feeding on the buds and flowers of hīnau also had a major impact on the amount of fruit produced. The presence of higher than average possum densities at the time when flower buds were developing was associated with a reduction in fruit production the next year. This effect was confirmed when possums were eradicated from a second site in the Orongorongo Valley. The amount of hīnau flowers in the litterfall increased significantly

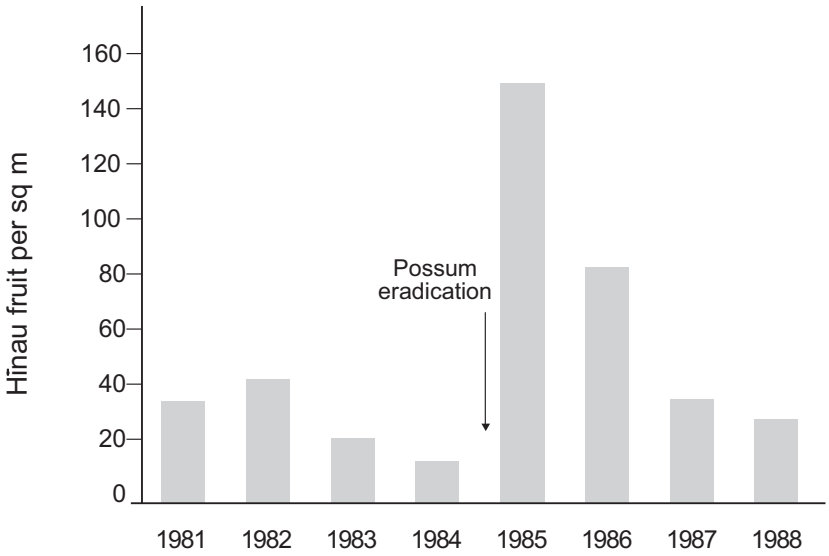


Graph 1: Annual fruitfall of hīnau (1968-1994) at one site in the Orongorongo Valley.

and four times as many fruit were produced the following year. Then, as possums recolonised the area, fruit production declined to former levels (see graph 2).

Thus, both climate and possums affect hīnau fruit production. Also, the extent of fruit production affects possum survival and breeding. Years when hīnau produced lots of fruit (as in 1969, 1971 and 1979), were years of higher than average possum body weight, survival and breeding – including breeding by one-year-old females, an unusual event (see Issue 7 of *Possum Research News*).

The implications of these complex interactions for the future persistence of hīnau in native forests are unknown. There may be beneficial aspects of the interaction. Although possums normally eat only the flesh of the hīnau fruit, some fruit are swallowed whole, voided and are able to germinate. Hīnau seedlings do not survive well under hīnau trees, so possums may be assisting recruitment by moving seeds away from the parent plants. The New Zealand pigeon is the only major avian disperser of hīnau seeds. But there is increasing evidence that possums are major predators of New Zealand pigeon chicks and eggs. In ecology, nothing is ever simple!



Graph 2: Annual fruitfall of hī nau before (1981-84) and after (1985-88) local possum eradication at a second site in the Orongorongo Valley.

This work was funded by the Foundation for Research, Science, and Technology, building on previous research by B. Bell, M.J. Daniel and D.C. Waddington.

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 of Landcare Research based at Dunedin.*

Conference

Ecological Consequences of Poisons used for Mammalian Pest Control

A two day scientific meeting has been organised by the New Zealand Ecological Society on the ecological consequences of using poisons to control mammalian pests. It is to be held at the Law School auditorium, University of Canterbury, Christchurch, from 9-10 July 1998.

Recent efforts to control predators as well as herbivores, increasing use of brodifacoum and cholecalciferol, as well as efforts to measure non-target impacts and secondary poisoning, have generated new information on the ecological consequences of poison use for controlling mammalian pests. This conference has been organised to communicate and discuss these studies.

A variety of papers will be given on topics such as: the effect of 1080 on non-target species such as short-tailed bats, North Island robins and different invertebrates; brodifacoum residues in target and non-target animals; secondary poisoning of predators after rat and possum control; the fate of morepork and brown kiwi populations after poison operations; and the fate of 1080 in the environment.

Further oral and poster papers are welcomed.

The registration fee is $265. For conference enquiries contact the organiser:

Ian Rivers
Conference Coordinators
PO Box 29060
Christchurch
ph 03 351 9188
fax 03 343 3316

Contacts and Addresses

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

Jim Coleman
Andy Glazier
John Kape
Frank Molinia
David Morgan
Landcare Research
PO Box 69, Lincoln
ph: +64 3 325 6700
fax: +64 3 325 2418

Murray Efford
Landcare Research
Private Bag 1930
Dunedin
ph: +64 3 447 4050
fax: +64 3 447 5232

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

Kevin Prime
Environmental Co-ordinator
Te Rūnanga o Ngātihine
Motatau RD1
Kawakawa
ph: +64 9 404 0651
fax: +64 9 404 1727

A Selection of Recent Possum-Related Publications

Carey, P.W.; O'Conner, C.E.; McDonald, R.M.; Mathews, L.M. 1997: Comparison of the attractiveness of acoustic and visual stimuli for brushtail possums. *New Zealand journal of zoology* 24: 273-276.

Duckworth, J.A.; Buddle, B.M.; Scobie, S. 1998: Fertility of brushtail possums (*Trichosurus vulpecula*) immunised against sperm. *Journal of reproductive immunology* 37: 125-138.

Eason, C.T.; Wickstrom, M.; Milne, L.; Warburton, B.; Gregory, N. 1998: Implications for animal welfare considerations for pest control research: The possum a case study. *In*: D. Mellor (*ed.*). Ethical approaches to animal-based science. *Proceedings of the joint ANZCART/NFAC Conference*, Royal Society of New Zealand, Wellington: 125-130.

Lugton, I.W.; Wobeser, G.; Morris, R.S.; Caley, P. 1997: Epidemiology of *Mycobacterium bovis* infection in feral ferrets (*Mustela furo*) in New Zealand: I. Pathology and diagnosis. *New Zealand veterinary journal* 45: 140-150.

Lugton, I.W.; Wobeser, G.; Morris, R.S.; Caley, P. 1997: Epidemiology of *Mycobacterium bovis* infection in feral ferrets (*Mustela furo*) in New Zealand: II. Routes of infection and excretion. *New Zealand veterinary journal* 45: 151-157.

Morgan, D.R.; Woolhouse, A.D. 1998: Sulphurous predator odours as repellents to prevent browsing by brushtail possums (*Trichosurus vulpecula*) and rabbits (*Oryctolagus cuniculus*). *Proceedings of repellents in wildlife management symposium*, Denver Wildlife Research Centre, Denver: 241-252.

O'Keefe, J.S.; Wickstrom, M. 1998: Routine blood values for New Zealand brushtail possums (*Trichosurus vulpecula*) at capture. *New Zealand veterinary journal* 46: 41-42.

Ramsey, D.S.L. 1998: Population responses of wild possums to fertility control. *In*: Biological control of possums. *Royal Society of New Zealand miscellaneous series No 45*: 111-114.

Spurr, E.B.; Powlesland, R.G. 1997: Impacts of aerial application of 1080 on non-target native fauna. *Science for conservation No 62.* Department of Conservation, Wellington. 31p.

Stankiewicz, M.; Cowan, P.E.; Heath, D.D. 1997: Endoparasites of brushtail possums (*Trichosurus vulpecula*) from the South Island, New Zealand. *New Zealand veterinary journal* 45: 257-260.

Stankiewicz, M.; Heath, D.D.; Cowan, P.E. 1997: Internal parasites of possums (*Trichosurus vulpecula*) from Kawau Island, Chatham Island and Stewart Island. *New Zealand veterinary journal* 45: 247-250.

Warburton, B. 1998. The humane trap saga, a tale of competing ethical ideologies. *In*: D. Mellor (*ed.*). Ethical approaches to animal based science. *Proceedings of the joint ANZCART/NFAC Conference*, Royal Society of New Zealand, Wellington: 131-137

Editors: Jim Coleman, Caroline Thomson
Editorial Assistance: Judy Grindell
Layout: Jayne Crawford
Cartoons: Susan Marks

Published by: Manaaki Whenua, Landcare Research, PO Box 69, Lincoln, New Zealand
ph +64 3 325-6700
fax +64 3 325-2418

ISSN 1173 - 2784