He Kōrero Paihama
Possum Research News

Issue 4 April 1996

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Manaaki Whenua
Landcare Research
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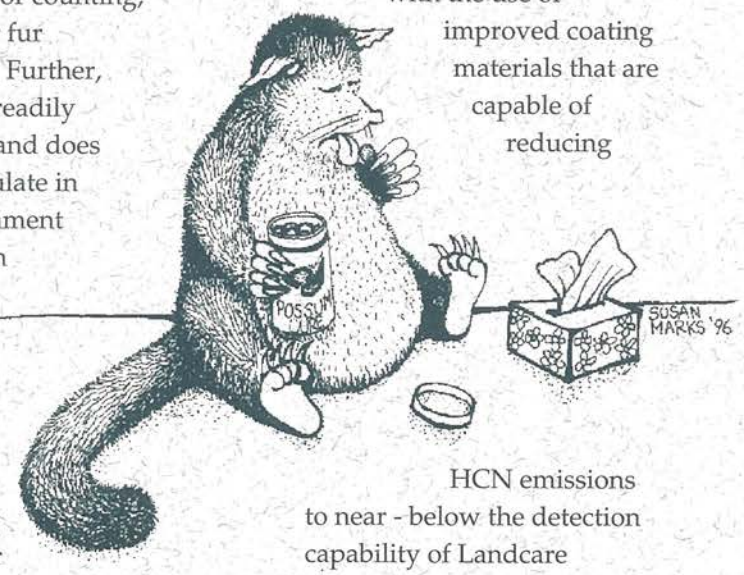
A Lethal Prescription For Possums

Cyanide paste is widely used by possum hunters for harvesting fur (possum skins). However, it can be detected by possums as it produces hydrogen cyanide gas (HCN) which some people say smells strongly of burnt almonds. The result of this is that in some forest areas where cyanide has been used to poison possums over several years, up to 60% of the possums have become cyanide-shy and are consequently now very difficult to poison.

Cyanide has several advantages over other poisons for killing possums. It is generally considered humane, its action is extremely rapid and poisoned animals can be recovered for counting, autopsy, or fur harvesting. Further, cyanide is readily detoxified and does not accumulate in the environment or persist in poisoned carcases. It poses little if any secondary hazard to scavenging dogs or other non-target species. It is also available to most people prepared to sit an examination to obtain a licence for its use.

Because of the advantages of cyanide for possum control and to attempt to alleviate some of the problems, Bruce Warburton, Charlie Eason and Geoff Wright of Landcare Research, Lincoln have been working with Feral Control Ltd of Auckland, to develop a new cyanide product where the cyanide is contained within a coated tablet. Initial trials proved frustrating as the hydrogen cyanide (HCN) molecule is small and extremely difficult to contain. However, progress has been made over the last 12 months with the use of improved coating materials that are capable of reducing



HCN emissions to near - below the detection capability of Landcare

Research's toxicology gas chromatographs.

Having solved the problem of how to seal in HCN, the team is now addressing the problem of getting the possums to eat the tablet. A range of bait materials to accompany the tablet are being examined. A coarse but palatable texture sufficient to disguise the tablet should ensure possums eat the mixture. Trials to date seem promising showing that the product has the potential to significantly improve the effectiveness and efficiency of ground-based possum control.

This research is funded by the Animal Health Board.

***Bruce Warburton** works on a wide range of techniques and strategies for the improved control of possums and wallabies. He is in Landcare Research's Integrated Pest Management Team based at Lincoln.*

***Charlie Eason** and **Geoff Wright** both work in the field of toxicology and are in Landcare Research's Pest Control Technology Team based at Lincoln.*

Editorial

The amount of money being spent on possum management and research is increasing, but how can we be sure that it is being spent most effectively? Where does one go to get an overview of possum research in New Zealand? The best place to start is with the 1995 Annual Report of the National Science Strategy Committee (NSSC) for the Control of Possums and Tb*. This committee, established in 1992 and reporting directly to the Hon. Simon Upton, Minister for Research, Science and Technology, plays an important role in coordinating possum/bovine Tb research in New Zealand. It has members from major funding agencies and end-users of research (Animal Health Board, Department of Conservation, AGMARDT, Ministry of Agriculture, Foundation for Research, Science & Technology, Local Government Authorities, Federated Farmers) and from the research community (nominated by the Ministry for Research, Science & Technology and the Royal Society of New Zealand).

The committee's main functions are to (i) develop a national science strategy for research on the control of possums and bovine Tb; (ii) identify and provide advice to funding agencies on priority areas for research and where there are gaps; (iii) coordinate research and research funding; (iv) provide advice to the Minister for Research, Science & Technology; and (v) provide specific proposals to inject urgency into the research programme for possum/Tb control.

Developing the national science strategy and identifying gaps and priorities in research are largely done through NSSC workshops that review the 'state-of-the-art' in various research areas and identify

new priority research topics. By bringing together people involved directly in possum management, those affected by the possum problem, and those involved in possum research, the workshops are ensured of a strong focus on practical research questions. Recently there have been workshops on 'Possums as Conservation Pests', 'Biological Control of Possums', 'Improving Conventional Control', and 'Ferrets as Vectors of Tb'.

In the Annual Report of the NSSC possums/Tb, you can find information on the amount of funding for possum research in each of seven key research areas, who provides the funding, and where the research dollars are spent. About $13 million was spent on possum research in 1994-95, with about half of this coming from the Government's Public Good Science Fund.
The database currently lists 103 research projects, each with a short description of its aims and the details for contacting the project leader.

With all this research going on, the NSSC is concerned that the information gets out to people and agencies involved in possum management. So in the report there is a comprehensive bibliography of 176 scientific papers, conference presentations, and contract reports produced in the previous year. The NSSC also maintains close contact with the National Possum Control Agencies who are responsible for coordinating possum control programmes.
The research described in this fourth edition of ***He Kōrero Paihama - Possum Research News*** covers a wide range of topics relating to priorities identified by the NSSC Possums/Tb whose ultimate goal is the elimination of possums and feral/wild animal populations as reservoirs of Tb.

***Phil Cowan**, Team Leader, Bovine TB, Landcare Research, Palmerston North*

**Available from Possum and Bovine Tuberculosis Control National Science Strategy Committee, c/- Royal Society of New Zealand, PO Box 598, Wellington.*

In-vitro Fertilisation for Possums!

In-vitro fertilisation (IVF) or "test-tube" fertilization allows infertile people to have babies, enables couples who are in danger of passing on an inherited genetic disease to have healthy offspring, and may eliminate a genetic mutation in one generation. IVF is also used widely in farming to improve the blood lines and productivity of domestic animals. So if IVF is normally used to enhance reproduction, why is Andy Glazier and his colleagues applying IVF technology to possums, a species whose natural reproduction has helped to make it a pest? The answer lies in the programme that is working on developing biological control of fertility for possums (e.g., a contraceptive vaccine): a successful IVF system can be used to assess various methods for blocking possum reproduction.
Possums, like humans, only produce a single egg in a natural cycle, so currently research is focusing on methods for stimulating female possums to produce large numbers of eggs "on demand". Females are treated with hormones to mimic natural ovulation and methods of growing eggs in culture (to produce mature eggs at the right stage for fertilisation) are being developed. Already Andy and his colleagues can collect sperm from possums and

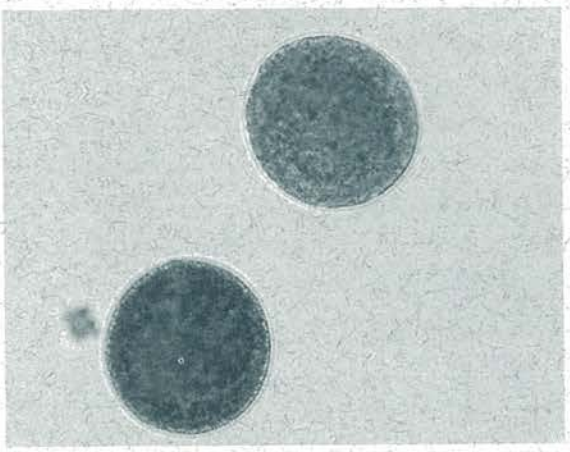
store it by freezing, in much the same way as human and cattle semen are stored. However, they are still researching ways of culturing possum sperm to maturity (which they are not at ejaculation). At present they can only do this by artificially inseminating females and later retrieving mature sperm from their uteri. Once mature sperm and eggs have been successfully cultured, the team can proceed to define the best combination of culture medium, supplements, temperature and other conditions for successful "test-tube" fertilisation.

IVF is considerably more complex than just mixing sperm and eggs in a test tube. The end product of successful IVF is (nearly) always a baby, but the steps along the way are intricate and fraught with problems. It is now 17 years since the first human IVF baby was born, but there is still a limited understanding of the basic mechanisms involved in fertilisation and the optimum conditions for success. Even less is known about possum reproductive biology, so it will be 5-10 years before "test-tube Joeys" are produced. Then methods of preventing fertilisation can be tested and the biological control of possums through contraception will become a practical reality.

IVF research could also assist captive breeding of endangered marsupials in Australia. IVF research on possums is undertaken jointly between Landcare Research and the University of Newcastle - two members of the Cooperative Research Centre for the Conservation & Management of Marsupials.

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

Possum sperm



Possum eggs

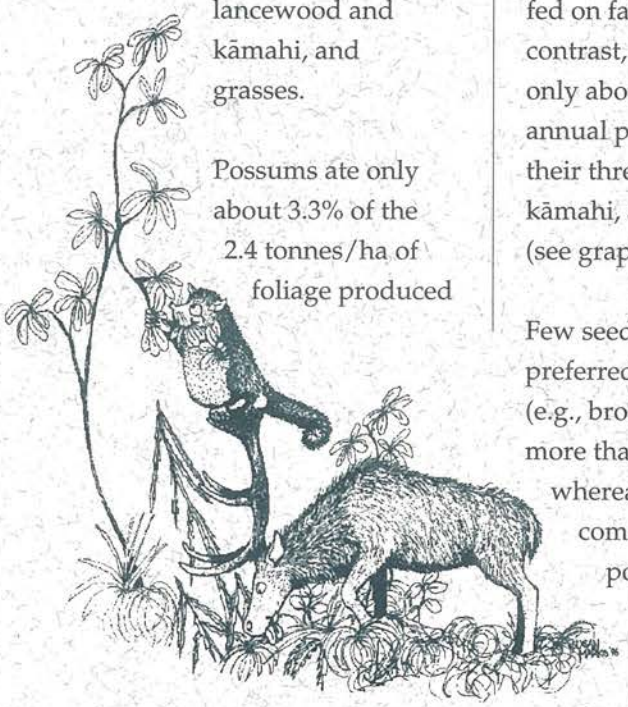
***Andy Glazier** is a reproductive physiologist who until recently worked on IVF in humans. He is currently working on gamete (egg and sperm) biology and developing IVF systems for possums as part of Landcare Research's Bovine Tb Team at Lincoln.*

Possums vs Deer: Which is Worse at Waihaha ?

Recently, the impacts of possum and deer on native forest in the Waihaha catchment, west of Lake Taupo, were compared by Wayne Fraser, Graham Nugent, and Peter Sweetapple. Within a 25-km² area of rimu/tōtara/broadleaf forest, the team compared possum and deer densities, what they ate, where they got it from, and how much of each food species was available. The goal of this research is to determine how much animal densities would need to be reduced by to achieve specific conservation goals.

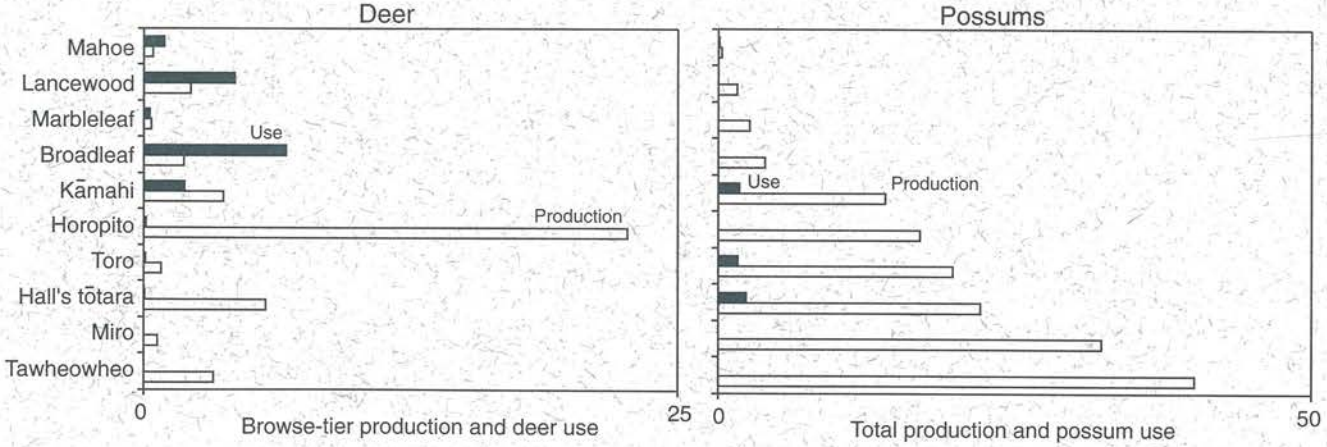
MAIN FINDINGS

Densities of deer (c. 6/km²) and possums (c. 300/km²) in the Waihaha catchment were moderate. Both animals ate about 100 plant species but did not really compete for food. Main foods for possums were the leaves of Hall's tōtara, kāmahi, and toro - mostly obtained from the canopy. The main foods for deer were fallen leaves of broadleaf, lancewood and kāmahi, and grasses.

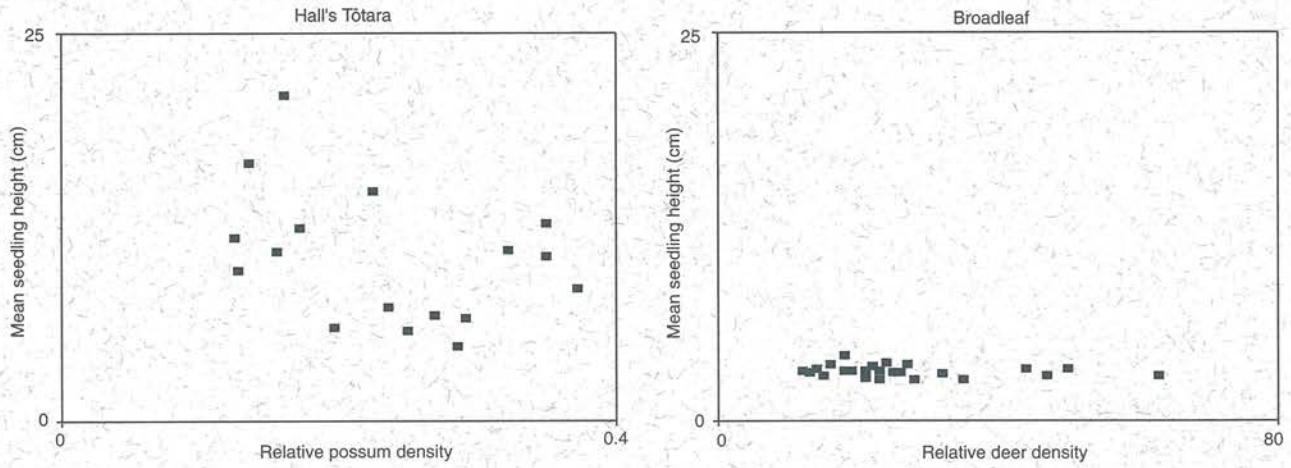


Possums ate only about 3.3% of the 2.4 tonnes/ha of foliage produced annually, while deer ate just 1.1%. However, deer ate about 10% of all foliage (0.2 tonnes/ha) that grew within their reach. Deer consumption often exceeded 100% of browse-tier production for some preferred tree species such as broadleaf, because they also fed on fallen leaves. In contrast, possums consumed only about 10% of total annual production for each of their three main foods tōtara, kāmahi, and toro (see graph).

Few seedlings of deer-preferred species (e.g., broadleaf) ever reached more than 5 cm in height, whereas taller seedlings are common for some of the possum-preferred species not eaten by deer (eg., Hall's tōtara). As the graphs indicate, it appears broadleaf can regenerate only when deer numbers are very low, whereas Hall's tōtara seedlings can survive without possum control.



Annual leaf production (kg/ha) and use of some of the most common species at Waihaha. For deer, the data is for the browse tier alone.



Mean seedling heights and animal densities for different locations within the study area for (a) Hall's tōtara and possum density, showing that although mature Hall's tōtara foliage is a preferred possum food, seedlings can survive at relatively high possum densities, and (b) broadleaf and deer density, with broadleaf being a preferred food species for deer and seedlings are unable to survive even at relatively low animal densities.

IMPLICATIONS

Neither possums nor deer threaten total deforestation in Waihaha. Overall, deer had greater impact on the plants they could browse than possums had on the forest as a whole. Hence deer had most impact on regeneration. Possums threatened some species not eaten by deer (e.g. tōtara), so controlling only possums may provide long-term protection to only those species not also eaten by deer. Controlling only deer will protect more species, but only if deer numbers are reduced to very low levels and kept there. Total forest protection will require both deer and possum control.

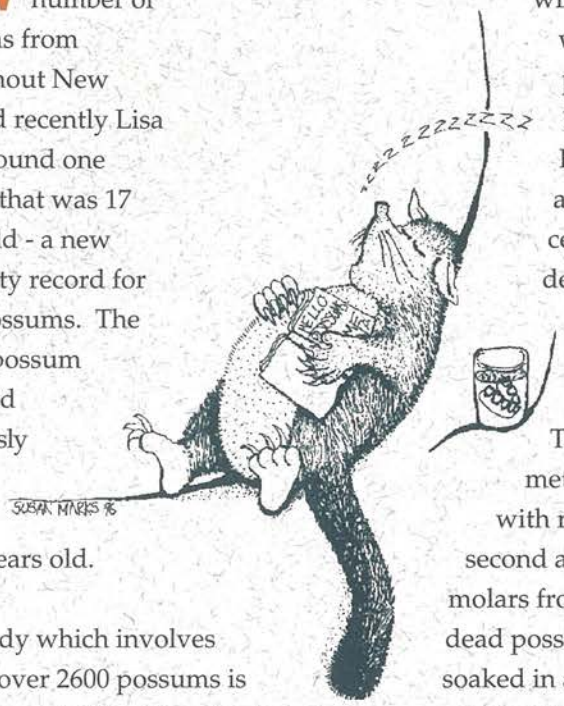
In winter 1994, the entire Waihaha catchment was aerially poisoned. Possum numbers within the study area were reduced by 93% and deer numbers by about 60%. We predict that in future Hall's tōtara canopies will improve but regeneration patterns for broadleaf will not change. Continued research will prove whether our hypothoses are right or wrong.

The study was jointly funded by the Department of Conservation and the Foundation for Research, Science and Technology.

***Wayne Fraser, Graham Nugent** and **Peter Sweetapple** work mainly on the impacts, management and control of possums and deer and are all in the Ecological Impacts Team based at Lincoln.*

The World's Oldest Possum

While aging a large number of possums from throughout New Zealand recently Lisa Street found one animal that was 17 years old - a new longevity record for wild possums. The oldest possum recorded previously was about 12-13 years old.



The study which involves ageing over 2600 possums is part of a project looking at what parasites and diseases possums have. About 200 possums have been sampled from each of 14 different sites throughout New Zealand. All these possums are being aged so that the prevalence of infection with age can be determined. Ultimately this information will help us assess what effect existing parasites and diseases are having on possum populations, and the potential effects of introducing new pathogens for possum control.

Possums can be aged by looking at their teeth. They have rings which develop annually in their teeth, similar to growth rings in tree trunks. A substance called cementum builds up in the teeth each year, and gives the appearance of rings. The first growth ring develops during the winter months when the possum is 1 to $1^1/_2$ years old. Each year another layer of cementum develops adding another ring to the tooth.

The aging method begins with removing the second and third molars from the jaw of a dead possum. A molar is soaked in a decalcifying agent which softens the tooth so it can easily be cut. About 10 to 15 sections are cut from each tooth, using a freezing microtome. Each section is about 20 µm thick, which is about the thickness of a human hair. The tooth sections are then dyed so the rings can be seen, examined under a microscope, and counted to establish the age of the possum.

***Lisa Street** is involved with research on possum ecology. She is a researcher in the Bovine Tb team based at Landcare Research's Massey site, Palmerston North.*

A tooth section from a seven year-old possum caught near Palmerston North. It has six incremental rings indicating it has been through six winters since leaving its mother's pouch and was in the process of laying down a seventh ring.

Long-term Trends in Possum Population Life Histories

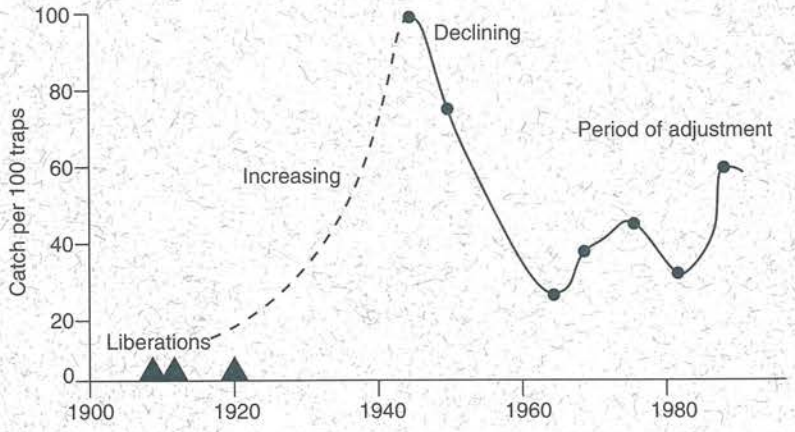
Animals introduced into new environments often undergo a rapid increase in numbers until their food consumption exceeds supply. Widespread starvation typically follows and numbers tumble until the population reaches some equilibrium with the food available, although the population may vary from year to year depending on seasonal food abundance.

Landcare Research staff Jim Coleman and Malcolm Thomas in conjunction with former New Zealand Forest Service colleague Les Pracy, have collected 50 years of data on such a cycle of establishment, increase and decline of possums in Haurangi Forest Park, Wellington. Understanding the causes, frequency and magnitude of fluctuations in unmanaged populations of possums will improve our understanding of both the long-term consequences of possum browsing on native plants and animals, and of the factors limiting population recovery following possum control.

Possums arrived in Haurangi Forest Park in the 1920's, and their numbers and biology have been documented from trap line samples collected first in 1945. In 1965, four additional trap lines were established in the same area and since then these lines have been set for 3 fine nights each year. Each trapped sample comprises about 100 possums all of which are autopsied. The possum's sex, reproductive status, breeding success and physical condition are scored and some teeth are taken for aging later.

Jim and Malcolm found that possum numbers rose from zero at colonisation to a peak of between 24 and 30/ha in about 25 years. The population then declined just as rapidly to 4-6/ha by the mid 1960's. This was followed by minor irregular post-peak fluctuations around a more or less stable population equilibrium (see graph). A population crash in 1977 following a particularly wet autumn period and a failure of forest fruiting, resulted in a 65% decline in numbers from the previous year. Numbers have risen since.

Possum life history data gathered over the 1965-1994 period show a similar pattern with body weight, condition and breeding success staying generally stable between 1965 and 1976 and declining sharply in 1977. Body weight, condition and breeding success returned to near pre-1977 levels after the population crash, presumably in response to greater per capita availability of food.
This study indicates that even in long-established post-peak populations of possums, numbers can fluctuate significantly from year to year because of abnormally severe weather or a lack of food. Such fluctuations show that possum



Possum trap catch for three nights from the original trap lines set periodically since 1945 in the Haurangi Forest Park. Possum numbers in the earlier years would have been greater than trap catch indicated as trap lines were then saturated with possums.

populations respond quickly to increases in food availability. Control operations mimic natural fluctuations and populations always rebound after control. However, even at the low densities which follow normal control, possums will continue to put some local native food species at risk. Where possible, pest managers should conduct possum operations immediately following natural declines in possum populations, as these are likely to reduce numbers to exceptionally low levels and provide for a longer period of relief before browsing again becomes unacceptable.

***Jim Coleman** works on management strategies for possum control and on aspects of possum ecology relevant to the epidemiology of bovine tuberculosis. He is the leader of Landcare Research's Integrated Pest Management Team based at Lincoln.*

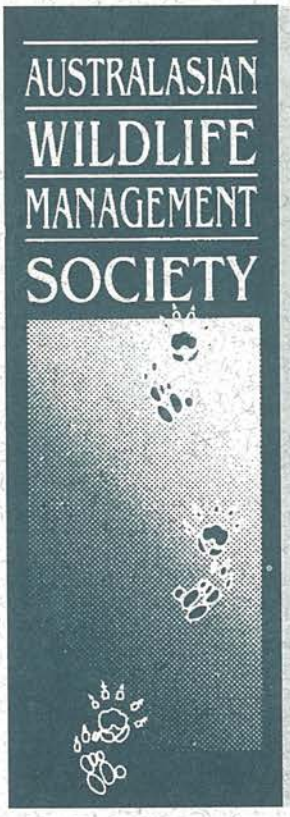
This project is supported by the Foundation for Research, Science and Technology.

***Malcolm Thomas** works on new technologies for possum control, including testing new toxins, baits and delivery systems. He is in Landcare Research's Pest Control Technology Team based at Lincoln.*

Conference Report:

The 8th Australasian Wildlife Management Society (AWMS) Conference December, 4-7 1995

Last years' annual AWMS conference was convened in December in Christchurch at the University of Canterbury Law School. It was attended by 172 delegates from New Zealand and Australia and was the second AWMS conference to be held in Christchurch since the organisations inception in 1988.
This year the symposia sessions covered the very topical 'Rabbit Calicivirus Disease (RCD) and biocontrol', 'Indigenous people and wildlife management' and 'Wildlife Management for Species Diversity'. There were also some open sessions where speakers addressed a range of topics from 'Possums vs deer: Which is worse?', 'Persistence of 1080 in water', through to 'Artificial brood reduction as a conservation management tool for Yellow-Eyed penguins'. The RCD symposia was coordinated by Morgan Williams (MAF Policy) and he gave an up-to-date look at the escape of RCD in Australia and its spread. The Keynote addresses were by Drs John Craig on 'Pest control: winning battles and losing the war' and by Tony Sinclair on 'Is conservation meeting its objectives?' In all, 53 presentations were given over the 4 days and a fine conference dinner at the University club was enjoyed by all.
Abstracts were distributed to delegates and copies are available for $20 from:
Dr T Montague,
Landcare Research,
PO Box 69, Lincoln.



The ninth annual scientific meeting of Austrasian Wildlife Management Society (AWMS) will be held at the University of Canberra on December 3, 4, 5, 1996. All scientists, managers and others with an interest in wildlife management are invited to attend and contribute to a great conference. We hope it will be as interesting and enjoyable as last December's conference in Christchurch. Planning has already started, and a detailed announcement will be included in the next AWMS newsletter.

So put the dates in your diary and start thinking about what you may contribute and how you will get to Canberra. Make a special point of telling your colleagues about it and talking them into coming as well.

The conference organiser is Jim Horne, so contact Jim about the conference if you wish to talk over a few ideas.

Jim's telephone number, till June 28, is (06) 241 3343 and email (Hone@aerg.canberra.edu.au or jim.hone@dwe.csiro.au).

Contacts and Addresses

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

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Welcome To:

Mark Wickstrom who joined Landcare Research as our second post-doctoral toxicologist in February 1996. Mark comes from the USA and has completed a degree in Biological Science, a MSc in Wildlife Biology, a degree in Veterinary Medicine at Washington State University and recently a PhD in Toxicology at the University of Illinois. He has worked in veterinary practice and held research positions in veterinary toxicology, natural toxins, immunology, infectious diseases and wildlife nutrition and been employed as an Ecological Toxicologist with the US Environmental Protection Agency in Denver, Colorado.
Mark's background in veterinary medicine and wildlife biology and the flexibility he has shown in applied toxicology makes him well placed to consolidate and extend Landcare Research's skills in pest control technology and environmental/wildlife toxicology. He will be developing improved mammalian pest control techniques, assessing animal behaviour, humaneness and the sub-lethal effects of pesticides on animals and be involved in the development of biomarkers in wildlife to signal environmental contamination.

Richard Barker is a biometrician who joins the Integrated Pest Management Team at Lincoln. Although attached to the IPM team he will be servicing the biometrical needs of other groups within Landcare Research. Richard has recently completed a PhD at Massey University on mark-recapture models. Prior to his PhD he spent three years as a wildlife biometrician at the Patuxent Wildlife Research Center in the USA, and four years as a Fish and Game Officer based in Wanganui.

Aaron McGlinchy joins the Integrated Pest Management Team at Lincoln, after spending three years with the Rabbit and Land Management Programme at Alexandra. Aaron is a decision support specialist who also offers skills in biometrics and data analysis. He will be assisting in the development of decision support tools for pest management, and helping with data analyses throughout Landcare as required. He holds a B.For.Sc. degree from Canterbury and a Diploma in Wildlife Management from Otago.

Martin Cox has joined the Bovine Tb Team at Dunedin, working for six months with Murray Efford on a new version of the Geoposs spatial simulation model to optimize possum control policies. Martin's skills and experience in Pascal programming are being used to add new functions to the Geoposs program, particularly the flexible simulation of possum control. Martin has degrees in surveying and computer science. He has held a range of technical positions in surveying and computing for business and research.

Amelia Pascoe recently completed an MSc on ferret and rabbit ecology at Otago University and is now using those skills in the Bovine Tb team providing technical support for a wide range of possum and ferret projects relating to Tb management and possum biocontrol. She has a keen interest in conservation biology and research.

Warwick Baldwin completed a BSc Honours at Victoria University in 1993 and since then has worked on a number of contracts with Landcare Research quantifying forest vegetation, surveying possum browse, looking at *Heiracium* invasion, and surveying deer and possum densities by pellet counting. In September he joined the Bovine Tb team at Massey providing technical assistance for Dave Ramsey and the large scale field trial of sterilisation in possums.

Grant Smith worked with seals, ferrets, and mutton birds while completing a Diploma in Wildlife Management at Otago University. He is now part of the Bovine Tb team at Massey for the next year.

A Selection of Recent Possum-Related Publications

Eason, C.T.; Spurr, E.B. 1995: The toxicity and sub-lethal effects of brodifacoum in birds and bats. A literature review. *Science for conservation* 6: Department of Conservation, Wellington: 16 p.

Eason, C.T.; Rumpf, S. 1995: Pollutants leave a mark. *New Zealand science monthly 4*: 10-11.

Fraser, K.W.; Spurr, E.B.; Eason, C.T. 1995: Non target kills of deer and other animals from aerial 1080 operations. Rod & Rifle 16, (5): 20-22.

Innes, J. 1995: The impacts of possums on native fauna. *In:* C.F.J. O'Donnell (compiler), Possums as conservation pests: *Proceedings of a workshop on possums as conservation pests.* Department of Conservation, Wellington. Pp. 11-15.

Innes, J.; Warburton, B.; Williams, D.; Speed, H.; Bradfield, P. 1995: Large-scale poisoning of ship rats (*Rattus rattus*) in indigenous forests of the North Island, New Zealand. *New Zealand journal of ecology 19(1)*: 5-17.

Jolly, S.E.; Scobie, S.; Coleman, M.C. 1995: Breeding capacity of female brushtail possums *Trichosurus vulpecula* in captivity. *New Zealand journal of zoology 22*: 325-330.

Morgan, D.R. 1995: Where should we be with possum control in 2005? - a researcher's perspective. *In:* C.F.J. O'Donnell, Possums as conservation pests: *Proceedings of a workshop on possums as conservation pests.* Department of Conservation, Wellington. Pp. 63-66.

Morgan, D.R. 1995: Dodging the bait. *New Zealand science monthly, August 1995*: 3-4.

Morgan, D.R.; Innes, J.; Frampton, C.M.; Woolhouse, A.D. 1995: Responses of captive and wild possums to lures used in poison baiting. *New Zealand journal of zoology 22:* 123-129.

Ogilvie, S. 1995: Sodium monofluoroacetate (1080) in water - an update on research. *Water & wastes in New Zealand 84*: 29.

Thomas, M.; Hickling, G.J. 1995: An evaluation of bait stations containing sodium monofluoroacetate (1080) for sustained control of possums on farmland. *Proceedings of the 10th Australian vertebrate pest control conference, Hobart, Tasmania.* Pp. 48-53.

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