



He Kōrero Paihama Possum Research News

Issue 1 December 1994

CONTENTS

<i>Editorial : Introduction to Possum Research</i>	1
<i>Vaccine Reduces Fertility of Possums</i>	2
<i>IVF and Key-hole Surgery for Possums</i>	4
<i>Bait Stations Using 1080 Give High Possum Kills</i>	5
<i>Possum Impacts and Control in the Hunua Ranges</i>	6
<i>Changing Prevalences of Bovine Tuberculosis</i>	8
<i>International News - Browsing Animal Problems in Tasmania</i>	9
<i>Conference</i>	9
<i>Comings</i>	10
<i>Book reviews - Birds and small mammals: A pest control manual</i>	10
<i>Proceedings of the science workshop on 1080</i>	11
<i>Goings</i>	11
<i>Landcare Research</i>	
<i>Contacts and Address</i>	12
<i>Effective Possum Management Steps</i>	12



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Landcare Research
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Introduction to Possum Research

Kia ora koutou - Greetings to you all

Possums are a threat to conservation and primary production in New Zealand - they browse native bush (20 000 tonnes of foliage per night or 7 million tonnes per year), prey upon some native birds and snails, and are the primary vectors in transmitting bovine Tb (threatening our \$5 billion export market for beef and dairy products). As these impacts become clearer and as the public increasingly debates control measures, particularly the use of 1080, we thought it timely to launch *He Kōrero Paihama - Possum Research News*. This publication will address key questions that land managers and the public want to know about, detailing the research required to produce prudent, timely, cost-effective, and publicly acceptable pest management. Accurate information is vital to informed discussion and decision-making. This was stressed by the Parliamentary Commissioner for the Environment in her recent report 'Possum Management in New Zealand'.

Possums are the most troublesome vertebrate introduced into New Zealand, and the focus of a major national research effort. Approximately \$27 million was spent in 1993/94 controlling possums over 1.8 million ha (1.9% of NZ). At the same time, around \$5 million was spent on research on possums. Closer to home, present contracts for possum research in Manaaki Whenua - Landcare Research total about \$3.6 million annually, funded principally by the Foundation for Research, Science and Technology (FRST), the Animal Health Board (AHB), and the Department of Conservation (DoC). The work spans studies on long-term population trends and impacts of possums, the role of movement patterns and other behaviours in Tb spread, research on new humane toxins and their fate in the environment, improved strategies for using traditional toxins, the development of humane traps and trapping systems, as well as a major effort towards biological control.

These research projects and others will be featured in this and subsequent issues of *He Kōrero Paihama - Possum Research News* which we intend to produced 2-3 times each year. We hope that the publication

will keep you better informed on the progress and outcomes of our research, and enable you to pass on information to others.



Oliver Sutherland
General Manager
Weeds and Pests
Landcare Research.

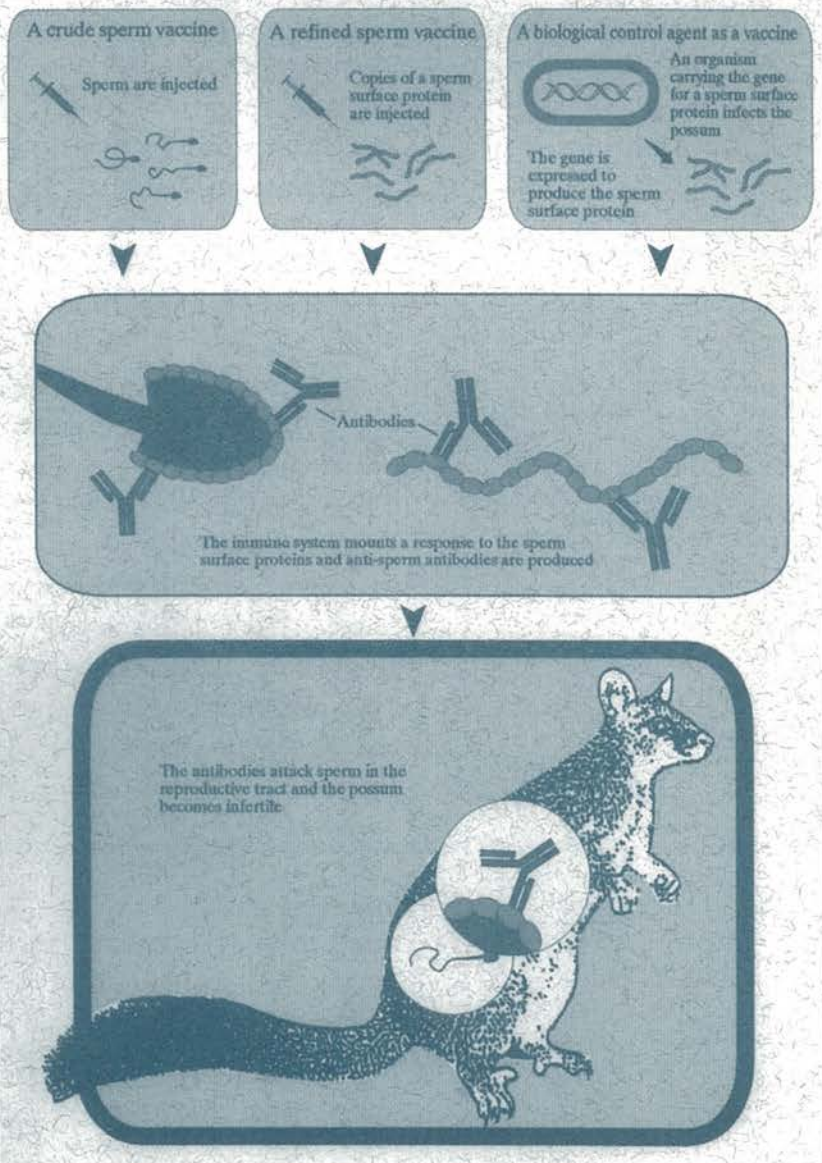
Vaccine Reduces Fertility of Possums

An experimental contraceptive vaccine shows exciting potential for controlling possums. In trials conducted by Ilam-based scientists, Janine Duckworth and Simon Jolly (now based in Melbourne), vaccinated females were five times less likely to produce offspring than untreated females.

“We have demonstrated that a sperm vaccine is capable of preventing breeding in possums. This vaccine contained whole sperm but we will be refining the vaccine by identifying a specific protein from the surface of the sperm critical for fertilisation,” says Janine. Ideally, the chosen protein should not occur elsewhere in the body (so the vaccine will act only against sperm) and should only occur in possums.

While these early tests have been successful, they are only the beginning of the research programme. “The completed contraceptive vaccine may take 10 to 15 years to develop as we want a contraceptive vaccine

Developing contraceptive control for possums



which will affect only possums”.

Once a vaccine is developed, the problem arises of distributing it throughout the possum population. One possibility is to use a modified non-lethal virus or parasitic organism that is specific only to possums, and which carries an extra modified gene to produce the specific sperm protein. When the organism infects the possum the extra gene would cause it to produce copies of the sperm protein. The possum's immune system would then produce antibodies against this foreign protein, sperm would be attacked in the reproductive tract, and infected female possums would be rendered infertile. Male possums may also be rendered infertile but trials so far have had no success.

The vaccine makes the possum infertile by tricking its immune system into treating the sperm as a foreign body. Antibodies attack the sperm and prevent fertilisation of the egg. Possums sterilised by this modified organism could eventually regain their fertility. However, levels of organism antibodies and sperm antibodies would probably wane at a similar rate so that possums would be susceptible to reinfection and consequent re-immunisation. The contraceptive effect could be longer lasting in females as each new mating would act as a

booster vaccination with a new dose of sperm surface proteins.

Ideally the organism chosen to transmit the sperm vaccine would be humane, possum specific, spread by close contact between possums, and not survive long in the environment (to avoid spread of the vaccine across the Tasman). An alternative approach is to deliver the vaccine in a bait, i.e., as an oral contraceptive.

For a more comprehensive article, see the May 1994 issue of *Forest and Bird* p.26-31.

Janine Duckworth and Simon Jolly are part of a long-term collaborative research project between scientists at Landcare Research in Christchurch, AgResearch Wallaceville, and the University of Newcastle in Australia. This research on an environmentally friendly method to control possums is supported by Tasman Forestry Limited, the Foundation for Research, Science and Technology, and the Lottery Board.



Janine Duckworth



Simon Jolly

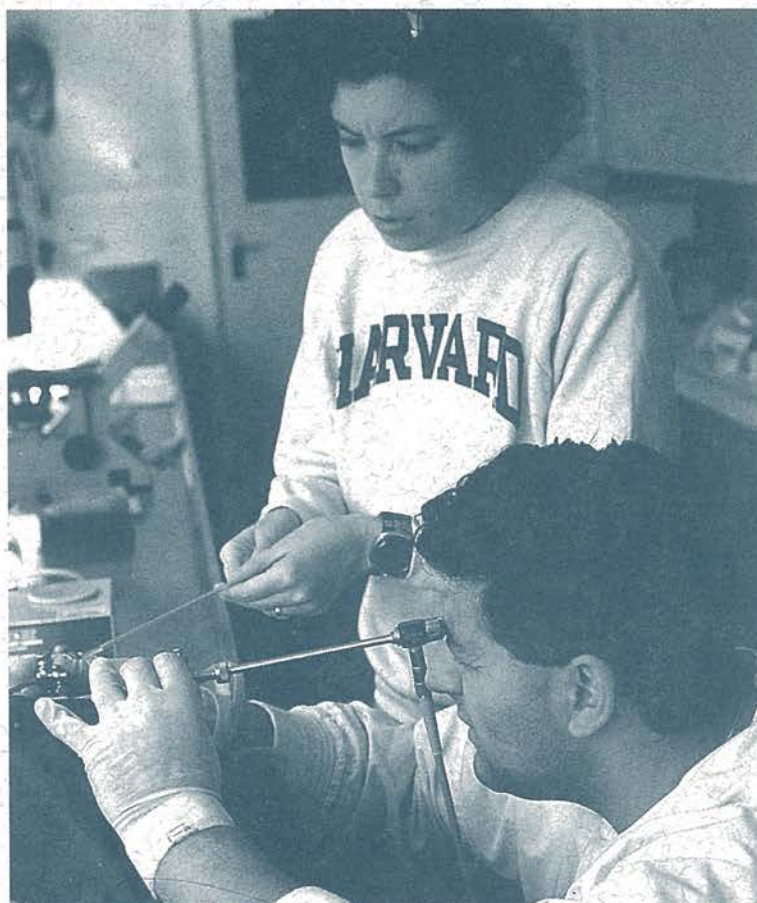


IVF and Key-hole Surgery for Possums

A major aspect of biocontrol of possums is studying events surrounding fertilisation and the early development of embryos. This research can be very difficult however. Possums breed only at certain times of the year, and although they will breed in captivity, it is difficult to schedule matings to fit in with research timetables.

Landcare Research scientists Simon Jolly and Janine Duckworth, in collaboration with the University of Newcastle, have two approaches to making the fertilisation process and surrounding events easier to study.

One approach is to develop *in-vitro* fertilisation systems (IVF) so that interactions between sperm and eggs can be studied in a test-tube. Although IVF is now routinely used in human and veterinary medicine, these techniques have not been applied successfully to marsupials. The trans-Tasman team is hoping to have possum IVF systems running by the middle of next year. This will assist in many areas of research but especially in developing and testing vaccine antibodies to block fertilisation. The second approach involves using key-hole surgery. This allows the events surrounding



Frank Molinia, with the assistance of Karen Mate, uses a laparoscope to inspect the reproductive tract of an anaesthetised possum.

fertilisation to be studied *in-vivo*, that is, in the living animal. Frank Molinia from the University of Newcastle recently spent two weeks at Ilam pioneering this work. He was able to work through an incision only a few millimetres long in the abdominal wall of an anaesthetised possum. Using an instrument known as a laparoscope (fibre optic cable), Frank was able to examine possum reproductive tracts closely, determine when ovulation was about to occur, and inject sperm directly into the

uterus. With this technology, researchers will not have to wait for natural matings, and they will be able to examine reproductive tracts in living possums with only minor surgery.

Simon Jolly and Janine Duckworth are reproductive physiologists in Landcare Research's Bovine Tuberculosis Team and are working on the contraceptive control of possums. This collaborative trans-Tasman project is supported by MAF Policy funding.



Bait Stations Using 1080 Give High Possum Kills

Aerial application of 1080 continues to arouse widespread public concern over contamination of soil, plants, and waterways, risks to native species, and risks to farm animals. This is despite the scientific evidence that it is a cost-effective method, removing up to 95% of possum populations from areas as large as 20 000 ha, without significant environmental damage or build-up of toxins.

Bait stations (feeders), an alternative technique to aerial application, are used widely in pest control for dispensing toxic bait. Landcare Research's Malcolm Thomas with the help of local DoC staff at Pureora, have been trialing bait stations using 1080 baits. Malcolm believes bait stations can address some of the objections levelled at aerial application of 1080, without significantly increasing control costs. He sees bait stations having significant advantages, in some situations, over aerial application, as they are designed specifically for possums and limit access by non-target species. They can also be placed to avoid waterways and areas used by



Malcolm Thomas

the public. The bait stations protect baits from the rain and any unused poison baits can be removed. Control programmes using bait stations are suited to Taskforce Green labour as the technique requires less specialised skill than other methods such as trapping.

The research this year in Pureora was conducted with the help of government-subsidised labour and was an excellent example of research by management whereby DoC successfully controlled possums over several thousand hectares, and Landcare Research gained valuable data on the best ways of using 1080 in bait stations in native forests.

Over 90% of possums in the study area were killed by using bait stations containing 1080 baits, and placed in a 150-m square grid throughout the forest. Possums were prefed with non-toxic bait before being fed the poison baits. When there was no prefeeding, a kill of only 70% was achieved.

Malcolm compared bait stations with aerial application and found that costs were similar, provided bait stations were used on easily accessible flat terrain. However, aerial application was considerably more cost-effective on inaccessible steep terrain.



A possum feeding at a bait station in the pens at Landcare Research, Rangiora.

The development of this method has provided an additional technique for controlling possums in forest and is especially suited to areas where more controlled use of 1080 is considered necessary. A major benefit from using bait stations is that the amount of 1080 used is 90% less than the amount currently used in aerial applications for an equivalent kill. DoC are also keen to use Malcolm's method because of reduced risks to rare birds such as North Island kaka and yellow crowned parakeets.

This research is funded by DoC Science and Research Division.

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



Possum Impacts and Control in the Hunua Ranges

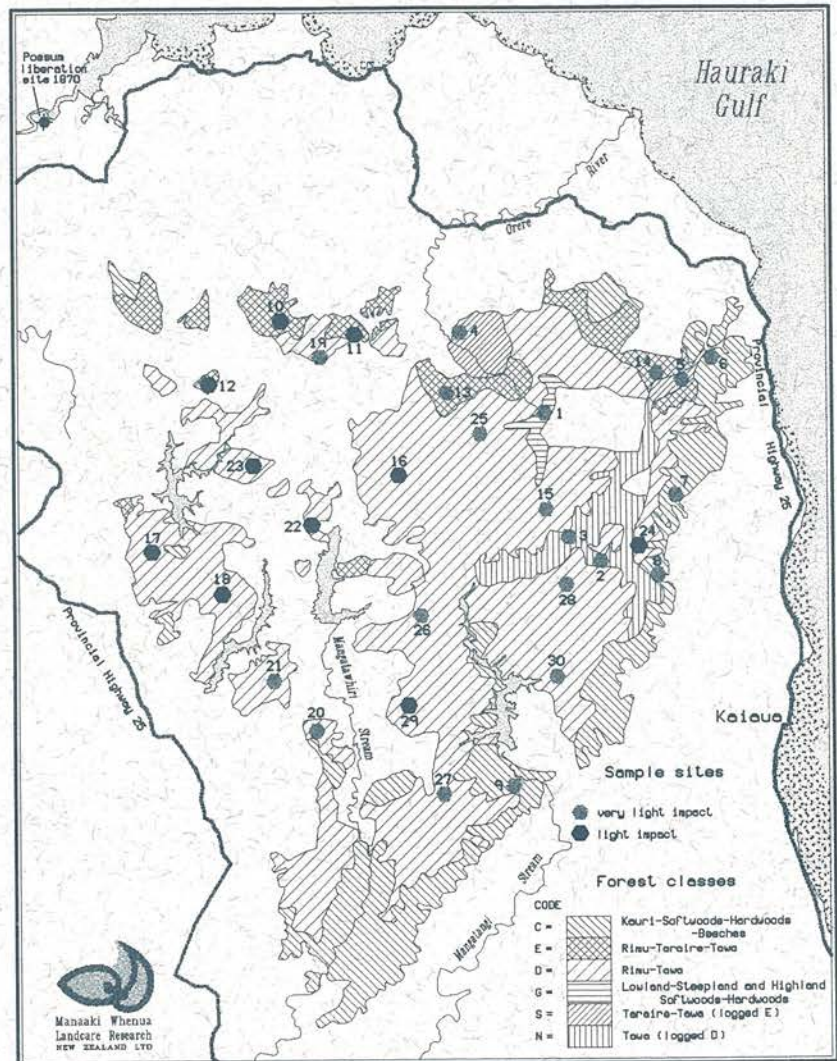
Ilam-based researchers Case Pekelharing and Peter Sweetapple have been monitoring the impact of possums in the Hunua Ranges and the effectiveness of a control operation carried out by the Auckland Regional Council (ARC) in June 1994. The Hunua Ranges, close to Auckland City, contain 19 650 ha of indigenous forest and scrubland and 2350 ha of exotic plantation forest, and provides 60% of Auckland's water supply.

The area is important to kokako, Hochstetters frog, kaka, possibly long-tailed bat, and many species of threatened plants. The ARC used aerial 1080 baits to reduce the threat posed by possums.

This was one of the largest aerial possum control operations to date as it covered the whole of the Hunua Ranges. Cereal baits loaded with 1080 were sown at 5 kg/ha by two helicopters using satellite navigation equipment. Peter, Case and the ARC assessed possum densities and forest condition in four areas over four main forest types, before and after control.

Possum Impacts on Forest Canopy

The impact of possums was assessed by observing foliage



Distribution of forest types and sample sites in the Hunua Ranges. The darker dots indicate very light impact and the pale dots indicate light impact.

densities and possum browse on favoured tree species. Damage was patchy and most obvious on kohekohe trees and associated forest types. The overall impact on another seven "indicator" species (species favoured by possums) appeared light, surprising considering the relatively long history of possum occupation of the area. Most canopy dieback seen was old and involving northern rata

and kohekohe. The latter although still relatively abundant, may have been even more so in the past.

The team believes that controlling possum populations in areas with a long history of possum occupation may not be justified on flora conservation grounds alone.



Possum densities and kill rates

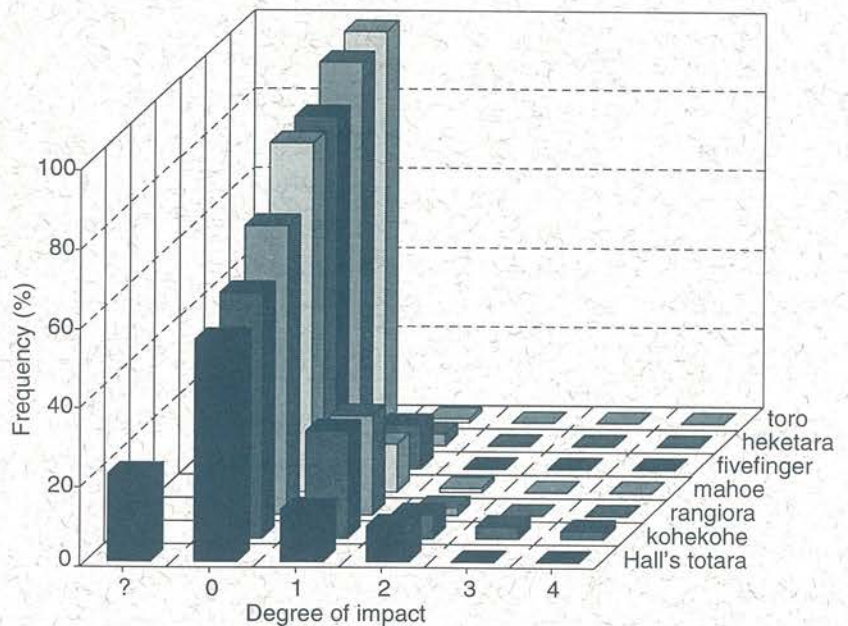
Possum densities were estimated from capture rates of possums using leghold traps. Peter and Case report that pre-poison possum densities were relatively low (compared with other uncontrolled possum populations in New Zealand): about 2 possums/ha in tawa forest, and about 3 possums/ha in forest types such as kauri and tawa/kohekohe.

As a result of the poison operation, overall possum densities declined by a very satisfactory 85.6%. However, possum kill in kauri forest (70%) was somewhat lower than in the other forest types (88-98%), apparently due to poor distribution of bait in the eastern parts of the ranges where kauri predominates.

Rat densities declined

The number of rats caught in leghold traps set for possums, declined by 83% following the control operation. Peter and Case believe that in many areas of New Zealand a major reduction in rats is a regular spin-off of aerial baiting for possums.

This research was supported by the Regional Parks Service of the Auckland Regional Council and by DoC Waikato.



Condition of indicator species in Hunua forests as determined by frequency of crowns in each browse impact class. The animal species responsible for the "?" category of Hall's totara was unable to be determined.

Peter Sweetapple is currently working on impacts of introduced herbivores on forest, including the diets of possum and deer, and availability of forage. Case Pekelharing also works in this area but specializes in aerial surveillance and mapping of forest die-back.

He is developing ground-based methods for quantitative assessment of impact and it's long-term effect on the plants. Both are researchers in Landcare Research's Ecological Impacts Team



Case Pekelharing



Peter Sweetapple



Changing Prevalences of Bovine Tuberculosis

The maintenance of tuberculosis-free cattle and deer herds in New Zealand continues to depend largely upon eliminating the disease from adjacent possum populations. Landcare Research has ongoing studies in the King Country and Westland which document the occurrence and changing patterns of tuberculosis in possum populations. Baseline information from these studies is being used to model the patchy but persistent nature of the infection, and determine the threshold levels below which the disease dies out naturally.

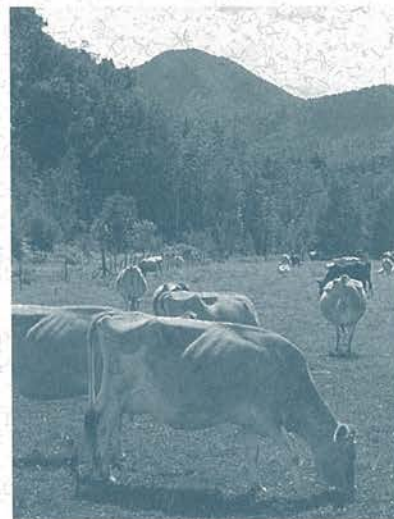


Tb lesions in liver, lungs and spleen of an autopsied possum.

Central Westland is home to one of the possum populations being studied by an Ilam-based team led by Jim Coleman, with veterinary and laboratory support from researchers at

Massey University, and funding from the Foundation for Research, Science and Technology and the Animal Health Board. Each year on a river flat used for rough grazing, the study monitors the prevalence and spatial distribution of tuberculosis in possums trapped on permanently marked lines along forest-pasture margins. The first survey of these trap lines was by MAF in 1980, following an outbreak of tuberculosis in cattle there. MAF recorded about 7% of possums infected. Since then, Jim and his team have recorded 60%, 17%, and 12% of all possums infected with Tb in 1992, 1993, and 1994 respectively.

Although there are now fewer possums actually infected compared to 1992, pockets of infection in the study's possum population have grown and coalesced each year so that Tb now occurs throughout the area. Not surprisingly, the cattle herds grazing the river flats also remain infected! In 1992, a separate survey of possums in forest within 1.5 km of the river flats revealed 28% of them were infected. The team has also recorded tuberculosis in locally trapped cats, stoats, and, for the first time, in hares. Levels of infection that are present now show a downward



Farmed animals are at risk where pastures are bordered by forest containing Tb infected possums.

trend to more normal prevalences but the pattern of infection and spatial distribution appears to have no parallels elsewhere in New Zealand. Jim suggests that "farming cattle at this site must be one of the poorer examples of sensible land use in Westland".

Jim Coleman works on long-term changes in possum populations, and management techniques and strategies in possum control. He is Team Leader of the Integrated Pest Management Team.



Jim Coleman



International News: Browsing Animal Problems in Tasmania

Landcare Research's involvement in improving management of browsing vertebrate pests in New Zealand, has led Ilam-based researchers John Parkes, Chris Frampton (now based at Lincoln University), and Manjula Arulchelvam to similar work on the other side of the Tasman Sea. For several years, they have assisted APM Forests in Victoria with establishing and monitoring long-term trials on the browsing levels of wallabies, possums and rabbits on newly-planted seedlings in plantation forests.

Weed & Pest's General Manager, Oliver Sutherland and colleague Jim Coleman extended this link when they visited Tasmania in October. They were invited by the local Browsing Animal Research Council (BARC) to assist with establishing research priorities for the improved management

of browsing vertebrate pests throughout the State. Oliver and Jim spent a week talking to groups interested in vertebrate pest control about the continued use and environmental safety of 1080. The groups included plantation forest owners, farmers and graziers, hunters, state land management agencies, and animal welfare and conservation interests. Oliver and Jim quickly realised that pest concerns in Tasmania largely parallel those in New Zealand. The main difference is that in Tasmania, most of the major browsing vertebrate pests are native animals so they are more highly valued than possums or rabbits are in New Zealand.

Oliver and Jim gave BARC a list of key local pest management issues, the most important of these being the need to gather and publicise better data on :

1. Cost and impact of browsing pests
2. Level of non-target deaths following toxic control
3. Humaneness of current control technologies
4. Need to retain the use of 1080 until more environmentally acceptable techniques become available.

These are all issues that continue to bedevil pest managers in New Zealand.

Jim returned to Tasmania in November to audit the management operations carried out against vertebrate pests in plantation forests by North Forest Products, the largest tree farm grower in Australia.

Oliver Sutherland is General Manager of Weeds and Pests and Jim Coleman is Team Leader of Integrated Pest Management within Weeds and Pests.

Conference - May 1995

The 10th Vertebrate Pest Control Conference is to be held in Hobart, Tasmania, from May 29th to June 2nd, 1995. This conference enables those involved in research, management, and administration of vertebrate pest control from Australia and New Zealand to exchange

information covering a wide range of species, methodologies and control strategies.

The conference will be held at the Wrest Point Hotel Casino convention centre Hobart. Registration fees are \$310 (Aus) and registration forms and

conference flyers are available from :

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Environmentally Friendly Control methods

New Book : Birds and small mammals:
A pest control manual
by R.E.R.Porter, M.R.Rudge & J.A.McLennan

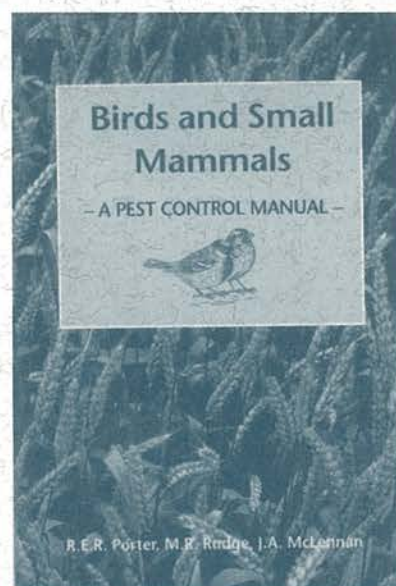
The effect of birds and small mammals on crops, stored foods, buildings, and urban gardens, and on the health of stock, pets, and their human owners, has generated an enormous amount of concern and control activity throughout the world. A recent book written by Landcare Research ecologists and published in-house by Manaaki Whenua Press goes some way to answering concerns specific to home and landowners in New Zealand.

Dick Porter and John McLennan of Havelock North, and Mike Rudge, formerly of Taita but now working for the National Museum, have put together a small, well-illustrated manual which summarises the risk to various crops posed by small pest animals (including possums), practical advice on what can be done, what is worth trying, what is ineffective, and the source of control products. The text concentrates on environmentally-friendly pest control methods and is intended for commercial growers and home owners, rather than for managers of pests on agricultural or forested lands. The authors do, however, offer new and practical insights into wider pest management, and thus provide relevant comment for all involved in pest control.

Price : \$35
(incl. GST, postage and handling, airmail extra)

Available from:

Manaaki Whenua Press,
PO Box 40,
Landcare Research,
Lincoln 8152,
New Zealand
ph +64 03 325 6700
fax +64 03 325 2127



Comings

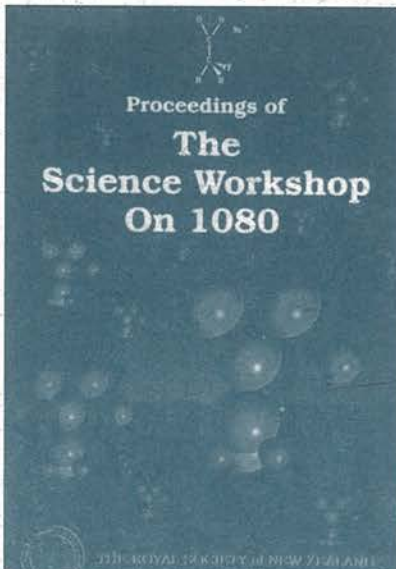
We welcome **Jenny Brown**, who has just been appointed biometrician in the Integrated Pest Management Team at Landcare Research, Ilam. She joins Manjula Arulchelvam in catering for most of Weeds and Pests statistical needs. At the moment she is working part time, completing her doctorate on population sampling.

We also welcome **Phil Knightsbridge**, who has joined the Ecological Impacts Team in Palmerston North as a technician working on animal census. He was previously with the Tasman District Council working on pollution control.



Update on New Zealand's most widely used vertebrate pesticide

New Book : Proceedings of the science workshop on 1080
 Edited by A.A Seawright and C.T.Eason



An international workshop to review the environmental toxicology of 1080 was convened in Christchurch in December 1993 by Landcare Research's toxicologist Charlie Eason, and the Royal Society of New Zealand. The workshop focused on environmental concerns and issues arising from current pest control. It brought together 70 scientists and other delegates from wildlife management, animal welfare, and conservation backgrounds from Australia, South Africa, the United States of America, and New Zealand.

The Proceedings contains 20 papers divided into 5 sections based around different research or management themes. Major topics include the rationale behind the use of 1080 in New Zealand (the scale of the pest problem, alternative techniques, risk perception and public involvement); and its fate in the environment (effect on 1080 of soil microorganisms, fate in water and soil after baiting, and natural levels of fluoroacetate in common substances). Other topics covered include 1080 poisoning in target animals (effect of sub-lethal doses on animals consuming baits, and potential antidotes); in non-target animals (species susceptibility and impacts on native bird and invertebrate populations); and its effectiveness and safety (improving toxin delivery, and comparison with other vertebrate pesticides).

Charlie Eason believes this text is essential reading and reference for all researchers or pest managers wanting up-to-date research information on 1080.

Price : \$45:
 (incl. GST, postage and handling, airmail extra)

Available from:

SIR Publishing,
 PO Box 399,
 Wellington
 ph +64 04 472 7421
 fax +64 04 473 1841

Goings

Simon Jolly, a reproductive physiologist in the Bovine Tb Team at Landcare Research, Ilam, for the last three years, has just left for Melbourne, Australia. Simon has done a lot of valuable work on the contraceptive control of possums and the physiological action of toxins, and has recently been researching lactation and ovulation in possums, and the behavioural consequences of reproductive control. His expertise will be greatly missed but we wish him well in Melbourne.



Contacts and Addresses

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Effective Possum Management Linking Management & Research

Landcare Research can provide supporting research for each of the following steps:

Define Management Goals

- identify native plants, animals, and ecosystems at risk
- assess pest impacts, including bovine Tb
- consult Māori in accordance with Treaty of Waitangi obligations



Select Management Technologies & Strategies

- plan strategies at national, regional, and local levels
- develop species-specific toxins and control technologies
- identify appropriate biological control agents
- prepare environmental impact assessments



Undertake Control

- provide quality assurance for bait

Identify Environmental Effects

- provide environmental monitoring, such as residue analysis
- identify any effects on animal welfare
- assess effects on non-target species



Measure Performance

- monitor efficiency of control
- monitor recovery of resource



Determine Cost-Effectiveness

- determine duration of benefits
- assess cost-effectiveness of control

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