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Opossums and Tuberculosis in NZ

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Opossum

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Since Man came to his own upon the earth, he has exercised with little restraint the power of his wisdom over all created things. So widely and deeply has his influence spread during the hundreds of thousands of years of his wandering, that it is well nigh impossible to gauge its effects or to distinguish them amidst the workings of nature as a whole.

Richie 1920

There is today no country in which man has not acted either as an agent of destruction or creation. New Zealand is no exception. In the early 1840's man once again started to influence the environment with the introduction of animals into New Zealand.

The natural environment of New Zealand prior to this period lacked natural predators. Any threat to the natural environment at that time was man himself. The lack of natural resources to exploit for capital gain induced early settlers to import and liberate species of animal that would enhance lifestyle and supply the necessary ingredients for a lifestyle they were accustomed to before colonisation. The species included sheep, cattle, goats, deer and possums.

The wildlife problems in New Zealand today are the legacy left by those settlers.

One predator that is causing a lot of concern today and threatens our wellbeing as an export primary producing nation is the Bushtail Possum or Australian Phalanger, commonly known in New Zealand as the "Coon".

The possum was introduced and liberated mainly for material gain.

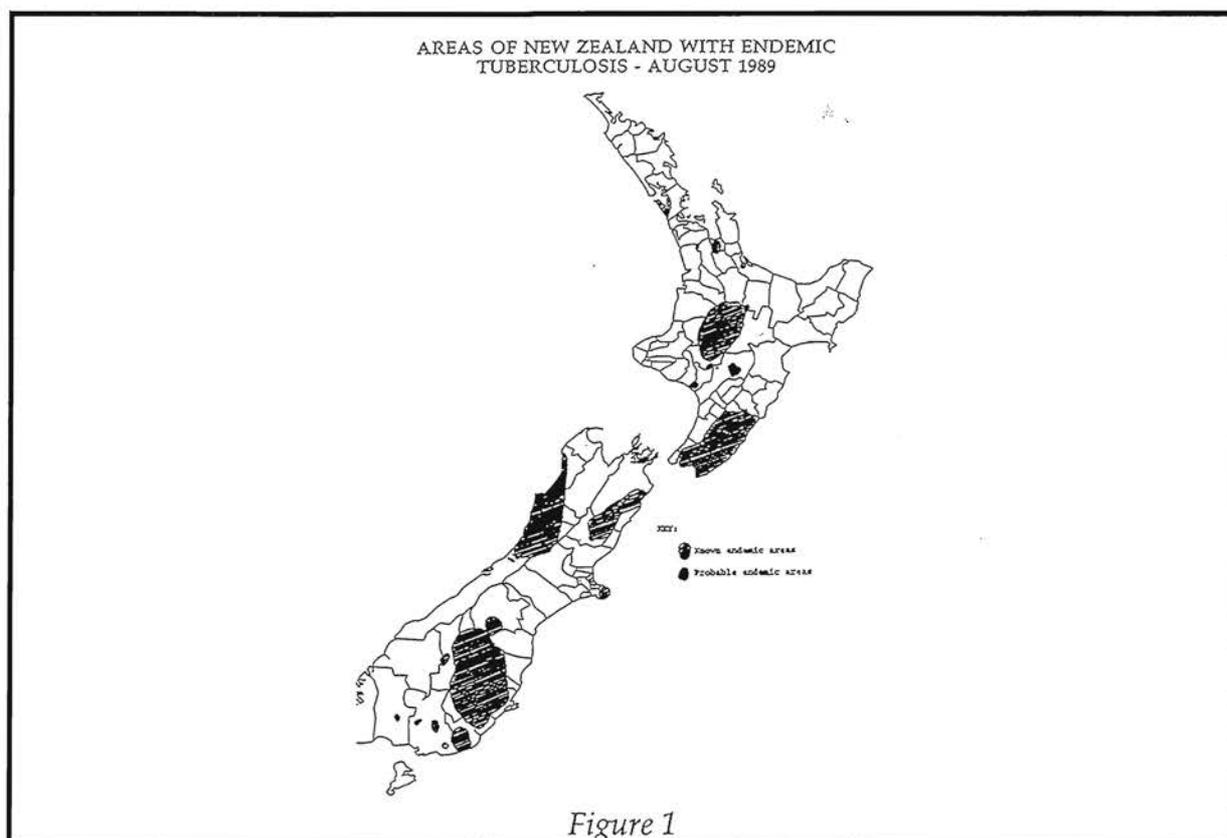
It was thought at the time that the possum would enhance the environment and provide a much needed income as well, through its capture and sale of fur.

The Acclimatisation Societies played the main part in establishing the possum in New Zealand.

Liberated pets played a very small part.

Mr Christopher Bastain is credited with the first successful liberation of the possum in South Riverton in 1858. This was confirmed in an annual report of the Wellington Acclimatisation Society in 1893. From research there are very few precise records of importations due to them being lost or destroyed.

Early liberations in Southland and Otago by Sir George Grey and the Auckland Acclimatisation Society were made by importing stock from Victoria, Australia and Tasmania.



The Tasmanian black and Mainland grey were the two colours preferred by the newly formed and lucrative fur industry.

The inbreeding of the species has led to a varied mosaic of fur varieties differing in colour, type and commercial value.

The prevalence of the possum and their general distribution indicated that they are perhaps the only marsupials successfully adapting themselves to various new ecological conditions.

The possum is now regarded not only as a destroyer of our flora in indigenous forests but a major source of Bovine Tuberculosis among dairy, beef and deer in many areas of New Zealand. Areas within New Zealand considered to harbour substantial infection are called "endemic areas". Endemic areas as at August 1989 (*shown in Fig 1*) show areas of real concern now.

The goal of the newly formed Animal Health Board and MAF Qual is not to eradicate the possum, which of course would be an impossible task, but to eradicate tuberculosis in possums.

To really understand the problem you have to understand the animal and its habits. To man it is largely a hidden enemy because of its nocturnal habits, thus it is not visibly seen to be a menace.

Extensive field research is needed in the future as the epidemiology of the possum is not well understood, according to Prof. Roger Morris, who is currently involved with possum research in the Wairarapa.

THE BUSH TAILED POSSUM (Trichosurus Velpecula)

The bush tailed possum - 'coon' or technically known as *Trichosurus Velpecula* is a marsupial mammal or pouched animal. Being nocturnal it is rarely seen in the daytime unless it is a tuberculosis infected animal in its advanced state.

The possum is an import from Tasmania and mainland Australia. There are eight subspecies or varieties in a variance of colours and size.

The weight can vary from 2.5kg up to 4.0kg depending on climate and feeding.

BREEDING

Female possums normally breed once a year, conceiving between March and May, and produce one young at a time. Twinning does occur but is not common. In eastern regions with favourable climate and feeding, they can breed again in the spring. Research in the North Island indicated 1.4 births average per female per year. Possum young are born only seventeen days after conception and immediately claw themselves to a teat in the pouch. The first 20 minutes are critical to its survival. They remain attached to the teat for about 70 days and in the pouch for three months before 'piggybacking' on the mother for a couple of months. The phenomenon of the young possum being born out of the pouch is very interesting.

An extract from field notes is quoted:

"April 14 1947, 10.25am. Opossum seen in peculiar position in Trap 39, Line 2. On closer inspection I observed a small kitten or new-born 3/8" in length, approximately one third of the distance from the vent to the pouch. Time to cover the distance when first observed to the lip of pouch was 7 minutes approx. Opossum caught by hind leg in sitting position on tail, leaning in ground fork of two trees, when kitten disappeared into pouch. I left the vicinity of the trap and returned 20 minutes later. After killing the female I inspected the pouch and found the kitten firmly attached to one of the two teats. When observing young crawling to the lip a track licked and dampened by the mother was observed from the vent to the lip of the pouch. The forepaws required for crawling are perfectly formed, although the hind legs are only rudimentary."

The manner of birth which is common to marsupials has been known for over 300 years, but in view of the belief that the young are born in the pouch not out.

The young are independent by 12 months of age. The females mate with different partners and they don't have any bond or family ties.

The possum has been known to live up to the ripe old age of 14 but very few reach it.

FEEDING

Being herbivorous they eat leaves, new shoots, and have a passion for fruit, fodder crops, flower gardens, trees and graze and do very well on farm pasture. Their favourite food species include Fuchsia, Rata, Kamahi, Wineberry, Five Fingers, Mahoe, Totoki and Pohutukawa. The high possum densities are found in the Rata-Kamahi association according to experienced trappers. Most food is found and preferred amongst the smaller trees, the quick growing ones around the edges of clearing. The possum prefers the warmer slopes facing north. They will only move onto shady slopes during the summer months but desert them for the bulk of the year. On wet nights their feeding activity lessens because they don't like being wet or cold.

HABITS

Possum nesting sites are places like hollow logs, fallen trees or under bushes such as flax. It has been reported the possum use six or seven dens a year moving frequently from one to the others. Up to five possums will share a den site sometimes with dead or dying possums.

The possum is territorial like most mammals and usually stick to their 'patch', with the young or juvenile possums moving from 2km to 10km a year in search of their own territory. Tree marking or scent gland marking is used to establish territory boundaries. Tree marking is not harmful to the tree but defoliation by continuous stripping of leaves for food is.

HISTORY OF INTRODUCTION AND LIBERATIONS IN THE NELSON AREA

<i>Place</i>	<i>Date</i>	<i>Number released</i>	<i>Colour</i>	<i>Liberators</i>
Buller River	1890	4	Black	Buller Acc Soc
Takaka River	1890	4	Grey	J Franklyn
Buller River	1898	9	Grey	Buller Acc Soc
Nine Mile Creek	1898	6	Black	Buller Acc Soc
Pretty Bridge Belgrove	1901	?	Grey	Thomas
Pakiki Creek	1924	?	?	Mead
Craigieburn Creek				
Takaka River	1925	7	Mixed	J Franklyn
Blue Creek Whangapeka	1925	?	Black	Buller Acc Soc
Lake Rotoiti	1927	26	Grey	Coote
Springs Junction	1929	?	Black	Unrecorded
Maruia (ex Rai Valley)	1937	2	Grey	Lester
Murchison	1937	?	?	Unrecorded

In 1881, 11 pair were released by Nelson Acc Soc presumably Australian Grey.

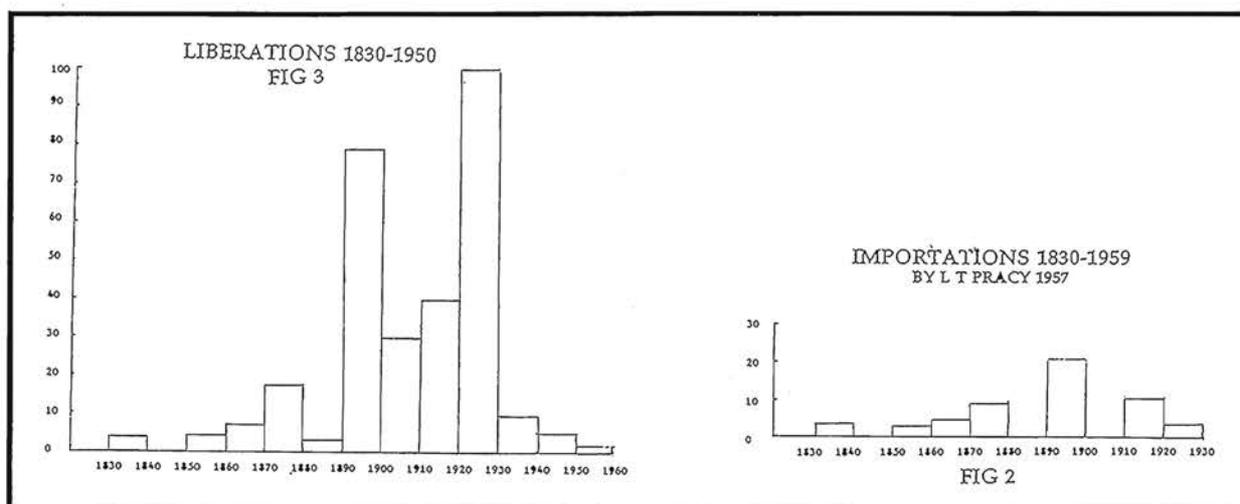
The peak introduction of the possum was between 1890 and 1898 with the main being liberated by Acclimatisation Societies. The bulk of the importations in 1898 of the Tasmanian Black, were released in the Westland, Grey and Buller Acclimatisation Districts within or near the constituency of the Rt Hon R J Seddon (Premier 1890 - 1906) who took a personal interest in the establishment of the animal. (Researched by Pracy). Importations were made to improve the breed between the period 1915 - 1940. In 1936 the North Island Acclimatisation Council recommended the introduction of the grey possum, to improve the breeding strain, and because the grey was a very marketable fur colour. See Fig 2 for Importation period 1830 - 1959.

Records show that 1895 - 1906 was the period when the government played an active part in acclimatisation of the possum.

The table, Fig 3 indicated that the governments of the past were not directly responsible for the introduction of the possum in New Zealand, opossums were well established by private enterprise prior to any government action.

From 1890 - 1900 is historically the most interesting period in that the acclimatisation societies were very active. In this period 86 liberations were made. Form 1900 - 1910 there was a recession of releases.

Owing to the increasing destruction of possums in established areas the government of the time was brought under pressure by the Acclimatisation Societies.



The result was that in 1911 the Animals Protection Act 1908 made it illegal to trap and destroy them. At this time trapping was very profitable because of fur prices and settlers asked that restrictions be lifted. Severe crop damage was becoming apparent. In 1912 the protection was removed but in 1913 an order of council declared possums to be absolutely protected in certain specified areas, mainly bush covered districts. This position of absolute protection, with wholesale poaching going on remained until 1921.

The possum regulations 1921, sanctioned the following methods for control:

- (1) A running noose.
- (2) The American jump trap.
- (3) The box trap.
- (4) Ordinary rabbit trap.

According to Pracy (1946) four other methods were in use:

- (1) Snaring.
- (2) Hunting with dogs.
- (3) Shooting.
- (4) Poisoning.

Shooting and Poisoning were illegal at this time.

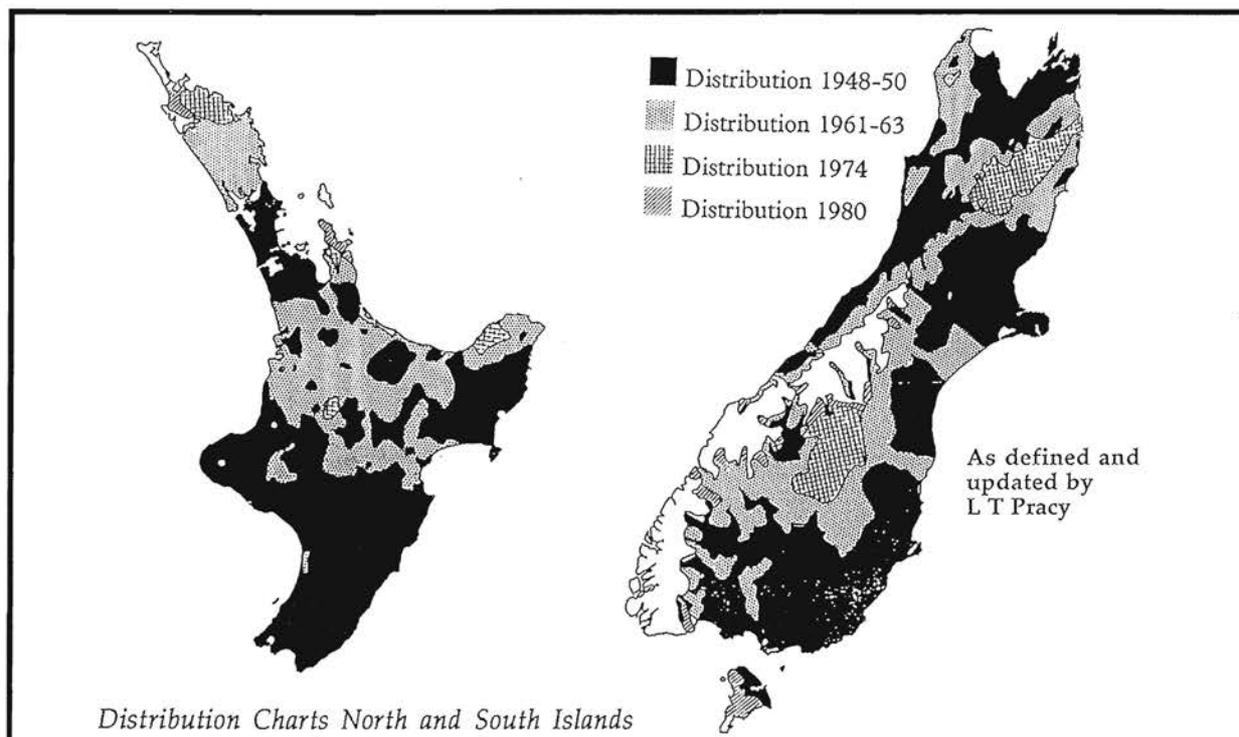
It was on the 5th May 1921 that legislation was passed to help control the possum. Possum trapping was to be legal and open season proclaimed annually on the say so of the Minister of Internal Affairs. The legislation with its do's and don'ts remained until 1946.

The State Forest Service in their annual reports from 1926 to 1931 made statements to the effect that "this important fur producing animal has assisted unemployment during the slack periods of the winter months."

The opinion expressed by L Cockayne (1926) states that the possum do little or no damage to forests, prevailed while the revenue from possum skins can largely be devoted towards the destruction of deer, goats and pigs throughout New Zealand.

In 1929 the reports stated "Yearly depreciation owing to poor breeding stock will not improve until fresh breeding stocks are released in 1930." In 1932 evidence against the possum was being published and between 1935 to 1942 damage was

being reported by the conservancys. At the same time Catchment Boards were reporting damage to river protection, willows and newly planted trees. In 1947 drastic amendments were made and gazetted in the Possum Regulations on 23rd April. The regulations retained the system of licences and permits to take possums but discarded the licencing of brokers, the stamping of skins and paying a royalty to the crown.



The harbouring or liberating of possums was made unlawful and heavy penalties applied. After an extensive survey by the Department of Internal Affairs on the effects of possum damage, it was recommended that a bounty of 2/6 a head be paid throughout the country. In 1951 this measure was adopted and a bounty phase of control began. By 1956 a million possums were being destroyed per year but this did not restrict the natural dispersion of the possum. In 1956 government approved in principal that the then rabbit boards be given authority to destroy possums. It was not until 1960 that the agreement on policy and funding was agreed to. The bounty was then discontinued and rabbit boards were allowed to increase rates for possum control.

The interesting thing was that the then New Zealand Forest Service agreed that they would deal with possums on all unoccupied Crown and Maori land. These areas are of the greatest concern today.

In 1967 out of a total of 214 rabbit boards, 75 declared no interest in possum control. These were mainly the South Island rabbit boards. Also in 1967 the first possum was found with Bovine tuberculosis in Westland.

In the 1970's it was commonly being identified in possums throughout much of North Westland, Wairarapa, Taupo and elsewhere, a total of 23 localities in all.

In the 1970's the then New Zealand Forest Service and Pest Destruction Boards became involved in extensive poisoning operations. By the 1980's the policy was changed to one of supposed cost effective control. Government at that stage reduced their input.

There is no closed seasons now for possums - they may be taken at any time of the year and no license is required. Permission is needed for entry onto properties though. Trapping and poisoning are the main means of hunting possums. In modern times we now have two terms used to describe possum hunters - the trapper who uses traps and possumer who uses poison.

There is a legal as well as a moral requirement that unnecessary cruelty should not be used. Traps must be set so that they fall to the ground and snares must be set to ensure hanging and death immediately. All methods need to be inspected each day. All poisoners must be licensed today and the hunter must rely on market returns for his income.

TB AND THE POSSUM LINK

For the past 250 years Tuberculosis has been a worldwide problem. The disease in man at that time, was a mixture of Bovine and Human tuberculosis. Human tuberculosis spread from human to human and Bovine tuberculosis from cattle to human, particularly those people working with cattle. Tuberculosis from cattle was being transmitted by the drinking of milk from infected cattle. This problem has been largely eliminated by the pasturisation of milk consumed by humans.

The importance of tuberculosis will rank higher in human diseases throughout the world in the next ten years. Tuberculosis is an insoluble disease problem.

On the world scene some countries have been successful in eradicating Bovine Tuberculosis, namely Denmark and Sweden. The less successful countries are small areas of Australia, Southwest England, Ireland, New Zealand and Africa which has a major problem. In the least successful countries they have a wildlife host. In New Zealand this wildlife host is the possum. The seemingly obvious approach to eradicating tuberculosis would be the large scale destruction of the possum.

WHAT IS TUBERCULOSIS AND HOW DOES IT EFFECT ANIMALS?

Tuberculosis is caused by the organism *Mycobacterium Bovis* and before the introduction of the eradication schemes affected about 10% of cattle in the North Island and 2% of cattle in the South Island. It is more common in older cows. It is believed that the main route of infection is by inhalation via the respiratory tract. Infection is spread by eating food, contaminated by infected animals, rarely by the calf drinking milk from a tuberculosis infected cow. It is not common to see lesions along the digestive tract.

Stock can be contaminated by animal waste products present on pasture. The organism also affects human beings, children being particularly susceptible to infection from milk. This infection from milk to humans is controlled by the pasturisation of all milk before consumption.

The animal affected shows no symptoms, but there may be slowly progressive, painless enlargement of the lymph glands on the surface of the body, particularly in the region of the head. The animal may cough, lose condition, have difficulty breathing and some animals show bloating and diarrhoea. Sometimes the brain is affected causing the animal to circle, have convulsions and stagger around. Possum may also be seen wandering aimlessly in the daytime indicating tuberculosis infection. Unfortunately there is no treatment for the disease and the animal will eventually die.

TUBERCULOSIS IN POSSUMS

The possum can become infected with cattle Tuberculosis, a problem not only for cattle farmers but also for the possum hunter.

Photos show small sores and lesions under the front and the groin area of the possum.



The sores could have green yellowish fluid weeping from them. They can be as large as a 20 cent coin with the skin off, round swellings containing grey green pus may be found.

Other lesions can also be found internally but these will generally go unnoticed by the hunter and pose no risk unless the carcass is opened and examined.



WARNING You could become infected by contact with weeping sores or by inhaling the organism while handling the infected possum.

CONTROLLING AUTHORITIES

The newly formed Animal Health Board has formally existed since the end of October 1989. The Animal Health Board is made up of the following industry representatives:

- Two (2) Dairy Industry Representatives - 1 Federated Farmers, 1 New Zealand Dairy Board
- One (1) Deer Industry Representative
- Two (2) Meat Industry Representatives
- Two (2) MAF - Chief Veterinary Officer, Director of Operations
- The General Manager

The Board is based in Wellington and has 14 regional committees based on the same representation. The regional committees are the eyes and ears of the Animal Health Board, keeping the board informed on regional problems.

Over the past four years the farming industry has been expected to pick up an increasing share of the funding of the disease control scheme. The Animal Health Board was formed to monitor/audit the spending of industry funds for disease control. The Animal Health Board does not have any statutory powers or legal powers at the time of writing. The Animal Health Board is currently a well informed pressure group with a limited amount of funds available for control measures and research. The Animal Health Board requested a levy increase from \$2.50 per head to \$4.20 per head, the 1989-90 budget being based on the assumption that this increase would take effect before the bulk of the killing occurred. However a protracted discussion with Treasury over the one third Government, two thirds industry funding ratio for the disease control scheme meant that the levy increase did not take effect until 26th March 1990. The result is that the Animal Health Board is forecasting a \$2 million deficit for the 1989-90 financial year. The projected budget for the 1990-91 financial year is in the order of \$17.5 million. This will require the disease eradication levy to be raised to at least \$5.60 to meet the funding ratio requirements. This figure does not include funding for tuberculosis research.

Deer farmers make their contribution to the disease control scheme through payment of testing fees and by foregoing compensation.

Increases in disease control incomes is forecast by:

- 1) Cattle kill is currently two million head or less. It is expected that in four to five years the income to the disease control scheme from levy payments will increase because the cattle kill is projected to increase over that period. To cover the control programme, plus research, the levy will have to increase over five years to \$10.00 per head.
- 2) There will also be potential to reduce disease control expenditure by reducing compensation payments.
- 3) The 40,000 head of cattle exported live form New Zealand each year should be subject to a levy.

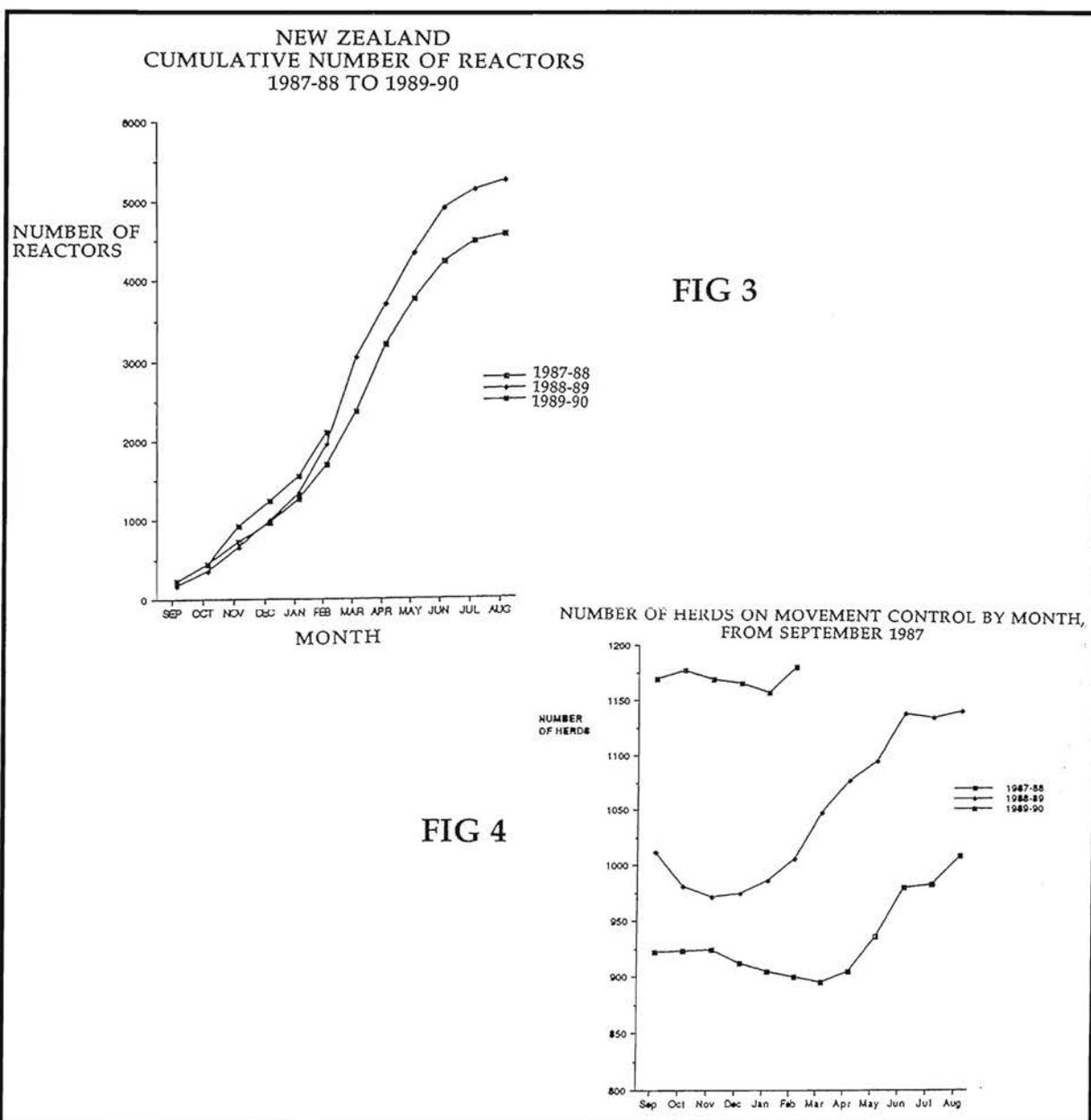
The Animal Health Board believes that the taxpayer input to the disease control scheme should be returned for the following reasons:

- 1) Public Health

- 2) Agricultural security disease surveillance
- 3) Government has a responsibility to contribute to pure research

Approximately \$299 million is spent each year by the deer and cattle industries in new market research, compared with \$8.4 million protecting current markets. Currently \$4.4 million is spent on possum control.

Regional government input for pest control through general rating, reflects that pest destruction is the responsibility of the general community, not just the farmer. The Animal Health Board will try to convince other researching bodies to co-operate and improve communication so that we get better value for money. Co-ordination between research activities is essential. Separation of Department of Conservation and MAF possum control activities is not an ideal situation to achieve value for limited dollars available. The Animal Health Board initiated a standing committee to co-ordinate spending and ensure research and control work is co-ordinated where possible between MAF and DOC.



THE CURRENT TB SITUATION IN NEW ZEALAND

Supplied by PG Livingstone National Manager TB Control

<i>Veterinary District</i>	<i>Number of TB Reactors</i>			<i>Number of Herds on Movement Control</i>		
	<i>Sept-Aug 1987-88</i>	<i>Sept-Aug 1988-89</i>	<i>% Diff</i>	<i>Sept-Aug 1987-88</i>	<i>Sept-Aug 1988-89</i>	<i>Diff</i>
Whangarei	63	32	-49%	8	1	-7
Auckland	113	101	-11%	31	28	-3
Tauranga	21	50	138%	2	3	1
Rotorua	175	321	83%	45	41	-4
Hamilton	790	407	-48%	60	59	-1
Taumaranui	1695	1926	14%	238	242	4
Hastings	1	1	0%	1	2	1
Gisborne	2	3	50%	2	3	1
Dannevirke	165	205	24%	16	25	9
Masterton	635	847	33%	240	297	57
New Plymouth	3	2	-33%	1	2	1
Hawera	6	0	-100%	2	0	-2
Wanganui	33	43	30%	28	34	6
Palmerston North	11	21	91%	9	8	-1
Rangiora	68	113	66%	28	34	6
Lincoln	36	3	-92%	4	2	-2
Timaru	22	49	123%	14	16	2
Blenheim	77	170	121%	11	24	13
Greymouth	398	454	14%	151	169	18
Dunedin	298	259	-13%	58	84	26
Alexandra	67	120	79%	39	48	9
Invercargill	37	38	3%	15	12	-3
REGION						
North	2857	2837	-1%	384	374	-10
North Central	856	1122	31%	299	371	72
South Central	601	789	31%	208	245	37
South	402	417	4%	112	144	32
New Zealand	4716	5165	10%	1003	1134	131

CONTROL TECHNIQUES

PRIVATE TRAPPERS:

It has been stated by experts in possum control techniques that the private hunter is not cost effective and tends to farm possums. They move into an area and only work long enough to get a majority kill, thus as soon as their daily catch reduces to what they consider uneconomic, they quit and move to another area. They only return when numbers build up again. It has been stated that if possum hunters work could be co-ordinated and be put under the direction of the regional pest authorities to work where they had the most effect, then they could have a place. The problem is that trappers are in most cases individualists and like working on their own. If possum trappers could be controlled and highly organised, then their expertise could be very valuable. The control experts say that there is a place for them by lowering possum numbers on the boundaries of control operations. They must be convinced to pre-feed prior to using poison, to obtain a higher percentage kill, although this is a practice not always preferred by trappers. Tauranga is trying a contract system and employing private trappers. It is hoped that under contract the trapper will hunt until the daily kill is minimal. If this is successful then it could create a lot of employment for the unemployed persons in rural areas.

LARGE SCALE POISONING OPERATIONS:

Peter Nelson, Consultant to the Animal Health Board believes controlled large scale poisoning operations are the most cost effective means of control. A large area can be done in a short space of time. The best toxin available is 1080 poison. It is tasteless - odourless - mixes readily with water - is biodegradable - and occurs naturally in some plant species. It is considered the most humane toxin available for possums and most wildlife. The only other humane toxin available is cyanide. The problem with this toxin is that the possum gets bait shy quickly. The remaining toxin must be destroyed after several days use. The only other toxin available is phosphorus. While this toxin is effective it is not humane in the way it works. Currently no other effective humane toxins are available. Most other poisons either do not work or they require continuous feeding of the bait over 15-20 days. This is extremely expensive, both on labour, bait and toxin. Until other toxins or biological forms of control are found, 1080 remains our one and only hope in the short term.

TUBERCULOSIS CONTROL SCHEME

The control of Bovine Tuberculosis began in 1945 with a voluntary scheme for town supply herds which by 1961 had developed into compulsory testing of dairy cattle under an area scheme.

The testing of beef cattle became compulsory on an area basis in 1971 and all beef cattle were under surveillance or test by 1977.

Initial progress of control was encouraging but was bound to be unsustainable. Areas within New Zealand where the disease situation did not respond to normal testing procedures, suggested that a non-cattle source of infection was responsible for the maintenance of the disease in some herds.

Tuberculosis was discovered in a West Coast possum in 1967. The results of the survey and autopsies of possums indicated that the possum was the source of the infection for cattle. The goal of the tuberculosis control scheme is to restrict infected possums to the known endemic areas.

Cattle are regularly tested for tuberculosis in New Zealand. Testing is done from yearly to tri-annually depending on the area status of the farm. A few problem herds are tested once every three months. Reactors to the tuberculosis test are compulsory slaughtered as soon as identified. Compensation was paid up to 95% of the fair market value of the reactor to the farmer, plus transportation and killing costs, until 1990.

For every four reactors discovered in the testing programme, another tuberculosis infected animal is discovered during slaughter of animals at the works. Farmers are paid no compensation for these animals at all. Any herds found to have tuberculosis, either through the result of testing or discovered at slaughter, are placed under movement control. This means that all stock 6 weeks and older are prevented from leaving the property without permission from MAF. This is designed to stop the spread of tuberculosis to clean or non-endemic areas.

The herd does not become clear of movement control until there has been two successive clear tests, at least sixty days apart. After three clear tests, two at the minimum of six monthly intervals and the third twelve months later, the herd is declared an accredited herd.

Bovine Tuberculosis was not a problem for the majority of farmers in a tuberculosis endemic area. That was because there was very little direct cost for a farmer who received compensation for a tuberculosis reactor. Consequently there was little incentive for a farmer to commit time and effort on tuberculosis control. This has changed because it was felt that farmers were farming tuberculosis. In 1990 the compensation changed to make farmers more conscious. The compensation is now 45% of the fair market value of the first two reactors in any one year then 90% for the rest.

CONTROL AREA DEFINITIONS

New Zealand in an attempt to control and isolate problem areas had adopted a strategy that puts areas into special categories. These are as follows:

ENDEMIC AREA:

In this area tuberculosis is in the feral population and annual testing of cattle is carried out in an effort to stop cattle to cattle infection. This is one area where control or eradication of tuberculosis is being attempted. Reactors in cattle to tuberculosis testing are slaughtered and possum control operations undertaken to reduce population and prevalence of tuberculosis infections.

THE FRINGE AREA:

Surrounds an endemic area.

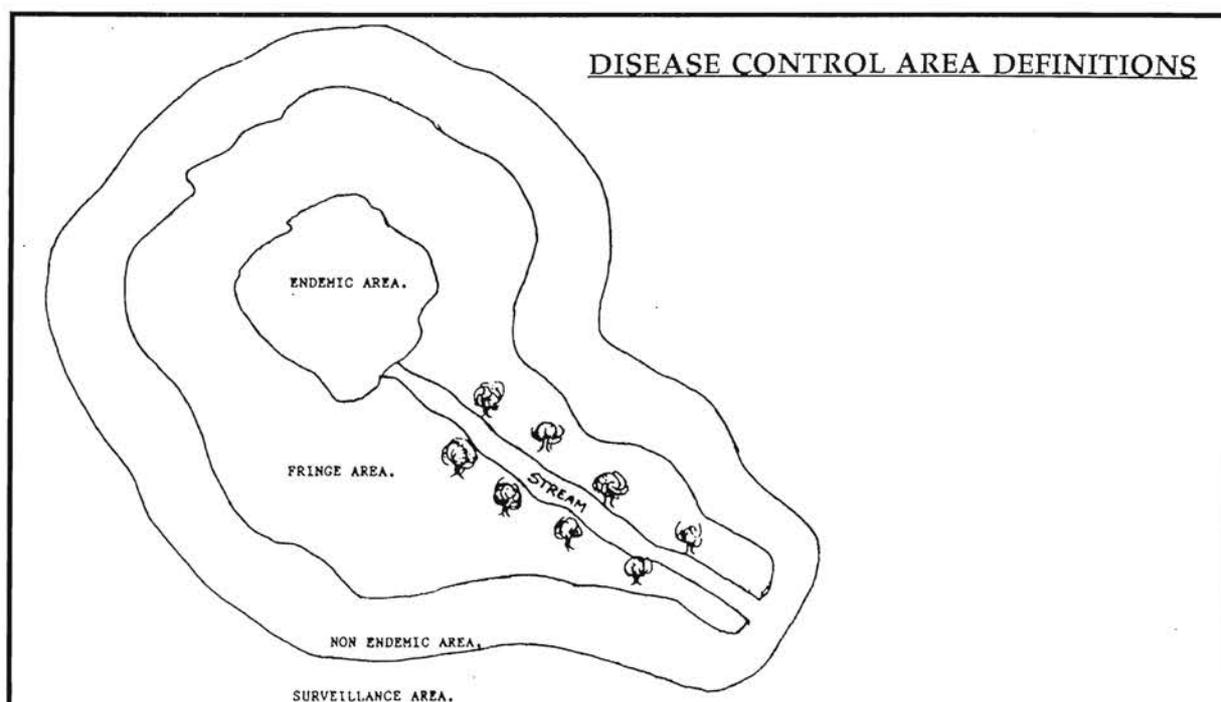
The fringe area needs to be sufficiently wide to ensure diseased possums don't encroach on non-endemic areas. The finding of infected cattle in the fringe area may be the only evidence to suggest that tuberculosis possums have moved from the endemic areas. The fringe area is the "most important area". In this area the movement of the tuberculosis infection is monitored. Possum control has a high priority when cattle herd breakdowns occur here, which could be caused through possum related infection. NB. As it is at present, possum operations in the Endemic area is of rather low urgency.

NON ENDEMIC AREA:

This area is a low intensity zone to detect tuberculosis possums before they spread in the surveillance area. It is more likely in the near future, "fringe" and "non endemic" areas will be one. Some people believe now that there is little distinction between the two.

SURVEILLANCE AREA:

80% of New Zealand farmland falls into this area. This area is considered free of tuberculosis. The herds in this area are termed accredited and testing is done on a tri-annual basis.

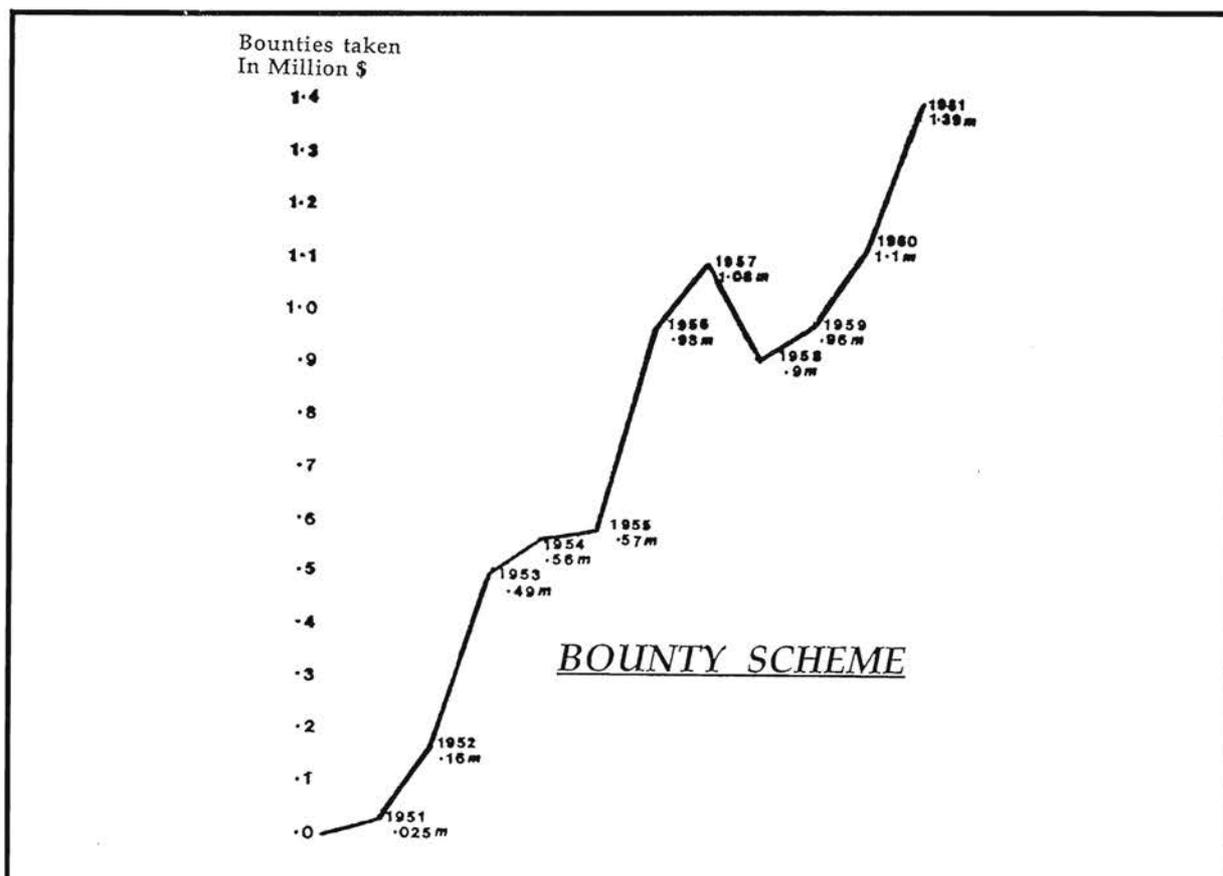


THE BOUNTY SCHEMES

The Bonus, Bounty or Token system may be defined as a payment of a reward to hunters for killing animals regarded as pests. Payments being made in cash or other commodities such as ammunition. Bounties have been around for more than 3000 years as man has tried to reduce animals he considered pests.

Ancient Greeks paid bounties on wolves and since then bounties have been paid on a large variety of animals over the years, ranging from wolves, dingoes, through to emus, seals and crows to name a few.

A bounty scheme was introduced into New Zealand, this operated between 1951 and 1961. The scheme paid two shillings and sixpence per token presented. The token varied from an possum tail to only the tip of the tail. Over this period 8.2 million possums were destroyed. Only two years during the eleven year period did bounties actually drop. The main object of a bonus or bounty system is to reduce the target population and to alleviate whatever problem the animal may be causing. However, when the aim is to alleviate the problem then the bounty system must be counter productive. When the bounty offered is large enough to warrant the effort required to trap the possum, high population areas become the target, often not an endemic area. The incentive is to get the scalp or tail regardless of whether the individual animal was causing a problem or not. The bounty scheme tended to tempt people to defraud the organisations paying out the bonus. Some counties required only the tip of the tail, then the trapper would take the remaining part of the tail to another county thus claiming the bounty twice on the same animal.



RESEARCH INTO TUBERCULOSIS

In the past decade extensive research has and still is being done to understand the breeding, movement and control of the possum.

The Ecology division of the DSIR, Forest Animal Ecology Section, Joint Massey and MAF Qual study, and Department of Conservation (DOC) are all doing research in this area.

The following means have been used to get an indepth understanding of the possum:

- 1) Electric fencing of a property. Found to be expensive, it restricted movement of adults by 76-86%. A tool for reducing tuberculosis transmission. In absence of electrification a nine wire fence was no real barrier.
- 2) Spotlight counting on farmland and ecology of farmland possums.
- 3) Trials to assess opossum control endemic Bovine Tuberculosis areas and effectiveness of bait stations for control.
- 4) Comparison trials to assess the effectiveness of hunting and 1080 poisoning, coupled with aerial poisoning, evaluation of a navigational guidance system for improving sowing techniques. Helicopter and fixed wing aircraft used as a means of application. A non treatment area was used to monitor treatments.

On reading all research data available, I found a lot of duplicating of research which made the breeding and feeding habits of the possum very clear. However the tuberculosis transmission problem from possum to possum or possum to cattle transfer was not done in detail. The latest trial being done in the Wairarapa by Professor Roger Morris and University Graduates will hopefully clarify the problem and possible solutions. The study will take two men, five years to complete. This will be at no cost to the farmer because of World Bank funding plus funding from West Germany. It is a worldwide problem and New Zealand provides a good study environment. The study involves 20Ha on Waio Farm, Castlepoint in the Wairarapa. A computer model is shown of the area concerned, mapping terrain of the farm. (Fig 5). This is a combined MAF Qual/Massey study. About 400 opossum and 30 cattle are involved. Some 80 possum have to be radio tagged to monitor their movements. Infected possums number about 20% of the population with an estimated 20% becoming infected each year. Over 30% of cattle exposed to the area become infected. These are only rough figures and intense laborious trial data will be collected over the next five years to find a pattern.

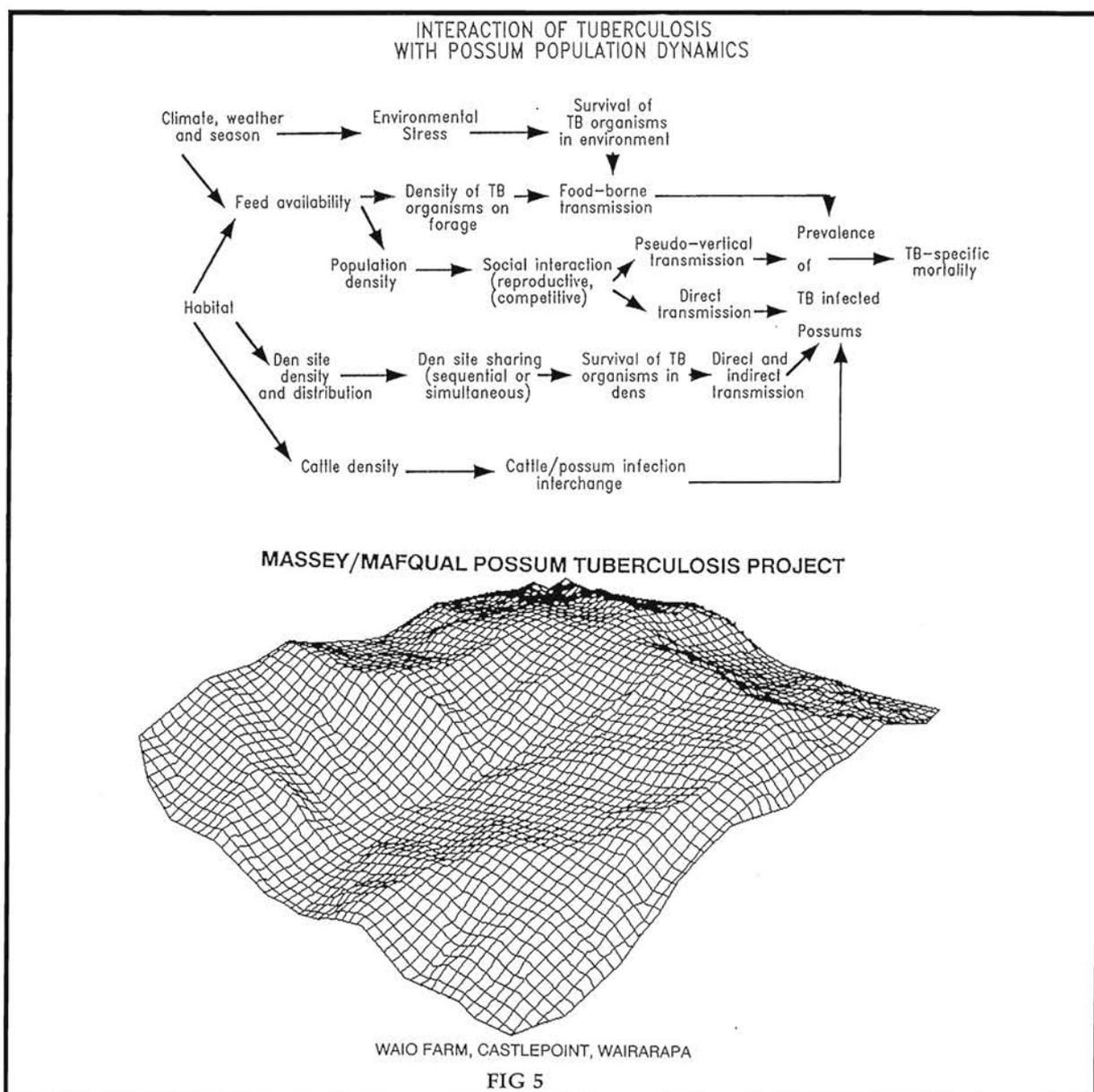
The research done to date left a lot of unanswered questions below which need answering before we can really get down to solving the tuberculosis problem.

- 1) Is the spread of tuberculosis from the female to kitten by way of breast feeding?
- 2) Is the juvenile born to a tuberculosis infected female the transferor of tuberculosis into other areas? We know that the juvenile is the mobile link in the chain as it searches for its own territory.
- 3) Are we poisoning the right areas for the most effective control and cost efficiency?
- 4) Are dead tuberculosis infected possums causing the spread of tuberculosis to possums and cattle? How is the transfer done?
- 5) Is the greatest transfer of tuberculosis at mating time?

- 6) Are we poisoning at the right time of year? At the moment winter time is the main poisoning time. The possum feed is short and at this time they are more likely to take poisoned bait. Poisoning in the winter may not break the tuberculosis cycle because tuberculosis possums die in the winter due to cold, wet conditions and feed shortages anyway. Moving the poisoning date may catch the survivors.
- 7) Do the low numbers of infected survivors carry infection over summer and start the next cycle in the autumn?

Professor Roger Morris listed control methods now and into the future.

- 1) Trapping not 100% effective.
- 2) Infectious baits - using cyanide
- using 1080
- sterile pill to upset mating
- 3) Dispersal reduction.
- 4) Vaccine for cattle - possible trade sanction in line with growth promotents.
- 5) Oral vaccine for possums - genetic engineering.
- 6) Introduction of possum Aids - promiscuous mating habits.



PERSONAL OVERVIEW

The current situation in New Zealand is that the infected area is progressively expanding. Tuberculosis is not rampant yet, prevalence is low but persistent. Buffer zones that have been set up are being penetrated and the endemic areas expanding slowly but surely.

The seemingly obvious approach to eradicating this problem is large scale destruction of the possum who is the host animal in New Zealand. This is an impossible task when you look at New Zealand geographically, its terrain is steep, inaccessible and the wildlife reservoir covers such a large percentage of the land mass. To adopt such a programme would be too costly and environmentally hazardous with the use of wholesale poisoning. I say poisoning because to date no other effective means of biological or other control method has evolved through the limited research data to date.

The goal of the Animal Health Board and Control Agencies is to stop the geographical spread, contain the infection in the boundaries of the big endemic areas and work on the small ones for total eradication of the disease.

Unless we do something constructive now the outlook for the future is bleak. We will have more and enlarged endemic areas, rising tuberculosis reactors in cattle, growing human health concerns and export restrictions likely.

The tuberculosis problem in New Zealand is regarded a farmer problem by politicians and people who hold the public purse strings, Treasury. Both are determined to cut Government financial input. The farmer is to fund two thirds of all control and the government one third. Government funding is predicted to reduce and farmer input to rise by way of levies in the future. Levies at the moment have risen from \$2.60 per head to \$4.20 per head with a predicted rise over the next few years to a levy of \$10.00 per head if we are to support research. Governments may for political expediency from time to time throw extra money into areas of concern, like marginal seats to show that it is doing more than it is. Such is the case recently with \$1.1 million being made available for areas that are not considered top priority but are considered marginal seats. If politicians visions were further out that their life expectancy in parliament, then the possible restrictions likely in 1992 imposed by the EEC countries should be of grave concern.

In the future the Animal Health Board and Regional Committees must, by necessity, become effective lobby groups in their efforts to convince the government and public on the importance of possum control and tuberculosis eradication. They must convince them on the need for agricultural security, public health, threat to earnings from exports, and that tuberculosis is a country problem, not just a farmer problem. The government incidentally is the largest land owner and most of the problem is on their land. The Conservation Department are the managers of that land and they have a decreasing amount of funds available from government each year to control tuberculosis.

The government being the representative of the people of New Zealand has the great responsibility for making sure the income of New Zealanders is secure and must take appropriate measures to make sure it is. The city people will in time be rated by local government to increase funds.

In the future we may not be able to trade products from tuberculosis infected farms, although this may appear to be emotive, it is a distinct possibility. Ireland who has a big tuberculosis problem is currently spending \$80-100 million per annum in an attempt to eradicate tuberculosis and is failing miserably. New Zealand is regarded a rival in the agricultural export scene and Ireland will want New Zealand to suffer as well, if it is not allowed to export it's own products to EEC compatriot countries.

Let us look at the dairy industry as an example in New Zealand. If some Murchison dairy farms were to become infected with tuberculosis and put on movement control can you imagine tankers moving down the same road twice to pick up milk? One tanker for clean milk for export and a high priced market. The other tanker picking up the tuberculosis infected milk that can only be sold as stock food or exported to a low priced market in a third world country. It would have a terrible effect on payout to shareholders, thus an adverse effect on the rural economy which eventually boils over to the whole economy. How would you pay the infected farmer? Discount his stock more than it is now at sales? Do we pay the farmer what his milk is worth and penalise him for what is a country problem, for he may be unlucky to border indigenous government owned land. How do we approach this problem with very limited finances? Clearly we need a medium to long term strategy. We need to look out ten to fifteen years and progress towards effective control. Active control is necessary now to contain the disease with the methods of control we know, but move to more effective control with better techniques found by long term research. We must get better control with less dollars because the farmers financial resources are stretched now.

A limited budget of \$18-20 million is available for 1990, not nearly enough to achieve eradication of tuberculosis. A political point that will be used by our competitors will be our level of funding not level of control.

Research to understand the epidemiology of the disease and the MAF Qaul study is underway now in the Wairarapa. Its study base behaviour is the epidemiology, ecology, transmission of infection and behaviour of the possum. This study is very complex and will take at least five years before conclusive results emerge. Computer modelling from the results will be a benefit in evaluating areas of infection where eradication is being considered. Computer modelling according to Professor Roger Morris who is heading the study will be "the cheapest tool available."

Whatever methods of control are adopted in the future, we must never underestimate the cunning and adaptability of this mammal to the changing environment it will be forced to live in.

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