

Surveillance



INSIDE:

Weaner pig mortality rates on New Zealand farms affected by PMWS

Animal welfare in New Zealand – the important role of non-governmental organisations

Quarterly review of diagnostic cases – October to December 2004

Quarterly report of investigations of suspected exotic diseases

Surveillance index – 2004

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- 3 Weaner pig mortality rates on New Zealand farms affected by PMWS
- 7 Animal welfare in New Zealand – the important role of non-governmental organisations

Contents

- 11 Quarterly review of diagnostic cases – October to December 2004
- 16 Quarterly report of investigations of suspected exotic diseases
- 21 *Surveillance* index – 2004

Weaner pig mortality rates on New Zealand farms affected by PMWS

Post-weaning multisystemic wasting syndrome (PMWS) in pigs was first reported in New Zealand in September 2003⁽¹⁾. PMWS was declared unwanted under the Biosecurity Act 1993 on 1 October 2003, and MAF's response has been to de-limit the distribution of affected farms and apply movement controls pending the development of an industry control scheme⁽²⁾. By December 2004, 130 pig farms throughout New Zealand had been investigated using a standard procedure. Twenty-five North Island farms were put under movement restrictions as a result of these investigations, and as of 31 January 2005 controls remained in place on 14 farms (nine classified as PMWS positive and five as PMWS suspect). There was no evidence of PMWS in the South Island.

PMWS generally affects four- to 12-week-old weaned pigs. Overseas, morbidity can be as high as 40% in susceptible pigs on affected farms, with case fatality rate close to 80%⁽³⁾⁽⁴⁾⁽⁵⁾. Porcine circovirus type 2 (PCV-2) is a necessary aetiological component, but on its own may not be sufficient to cause the disease⁽⁶⁾⁽⁷⁾. Other unknown components, or perhaps another agent, are believed to contribute to cause PMWS⁽⁸⁾⁽⁹⁾⁽¹⁰⁾.

The diagnosis of PMWS remains difficult because of uncertainty as to its aetiology and the absence of a diagnostic gold standard. MAF developed a case definition for farm-level diagnosis⁽²⁾. As with other case definitions developed for PMWS⁽¹¹⁾, it combined farm-level characteristics, in particular morbidity and mortality rates in the target age group, with individual case characteristics, in particular histology. Application of the case definition required accurate measurement of the farm-level characteristics, which proved difficult during the MAF investigation. Estimating the accuracy with which farms can be classified using the case definition requires an understanding of the expected morbidity and mortality rates in affected and non-affected populations and the associated variability.

The objective of this study was to estimate mortality rates in the

This article reports on weaner pig mortality rates in eight pig farming enterprises classified as positive for PMWS as part of MAF's PMWS investigation. The mean post-weaning mortality rate on the PMWS positive properties was 25.3% (standard deviation 20.4%; range 5.7-59.7%).

target age group of pigs on PMWS affected farms to provide a quantitative benchmark to assist diagnosis of PMWS on farms of interest.

Methods

The study population consisted of the nine pig farms classified by MAF as PMWS positive, and identified by the order in which they were identified and placed under Restricted Place Notice (ie RP1, RP2 and so on). The data for the farms RP7 and RP8 were combined, and this farm pair was treated as a single enterprise because of the farms' proximity and their frequent exchange of pigs and other risk goods. The farms were all situated in the Waikato. All enterprises were farrowing and finishing operations, although two were also significant purchasers of weaners for finishing, and one also sold weaners. Farm data are presented in Table 1, including the original estimate of post-weaning mortality derived from the original farm assessment.

The study period was from 26 January until 6 December 2004. During this time, all farms were under movement control and were visited weekly to record births, deaths and changes in numbers of piglets, weaners, growing pigs, sows, boars and gilts. The cause of death was not recorded. Pig movement on to and off the property was regulated by permit. Terminally ill pigs were euthanased on welfare grounds. A monthly census was undertaken to reconcile the population data. MAF did not direct interventions in farm management that were likely to affect mortality rates in resident pigs, although general advice on PMWS and its control was made available to all farmers.

Weekly records of mortality in weaners were combined with monthly census data to calculate a weekly weaner mortality rate.

Table 1: PMWS affected farms making up the study population

Farm	Enterprise type	Date of initial investigation	Estimated weaner mortality rate	Sow numbers at first census	Weaner numbers at first census	Suggested clinical onset
RP1	Farrow to finish	4/09/2003	14-23% in recent batches	133	244	Aug 02
RP2	Farrow to finish and purchasing weaners to finish	16/10/2003	Up to 50% in some batches	47	102	Feb 03
RP4	Farrow to finish	4/12/2003	30% in recent batches	163	368	Aug 03
RP5	Farrow to finish and purchasing weaners to finish	8/01/2004	15-35%	104	608	2001
RP7 and 8	Farrow to finish and selling weaners	13/01/2003	25%	218	248	Nov 03
RP12	Farrow to finish	22/01/2004	7.1% during previous year	135	380	Jul 02
RP16	Farrow to finish	6/02/2004	No reliable estimate	95	242	Unknown
RP24	Farrow to finish	11/03/2004	25% in recent batches	61	120	Jan 04

Table 2: Summary results of cumulative 8-week rolling average mortality rate in post-weaning period

Farm	Number of values	Mean	Standard deviation	Minimum	Maximum	Range
RP1	22	17.11%	4.18%	10.28%	23.97%	13.69%
RP2	37	7.06%	7.20%	0.00%	20.10%	20.10%
RP4	37	16.75%	6.28%	10.33%	31.45%	21.12%
RP5	16	54.01%	13.41%	35.67%	84.33%	48.66%
RP7 and RP8	37	18.98%	7.20%	9.63%	32.28%	22.65%
RP12	36	5.66%	1.33%	3.91%	9.56%	5.65%
RP16	8	59.68%	16.60%	37.97%	80.00%	42.03%
RP24	28	23.29%	10.86%	6.77%	41.64%	34.87%

The weekly rates were smoothed using a cumulative eight-week rolling average mortality rate (C8MR), as below:

$$C8MR (\%) = \frac{100 \times (\text{sum of 4- to 12-week-old pigs dying or euthanased in an 8-week period})}{(\text{average of 4- to 12-week-old pigs from all censuses in this period})}$$

For each farm, C8MR was first estimated eight weeks after instigation of weekly recording. Statistics for the individual farm C8MRs were tabulated, and the data explored graphically. Aggregated statistics for the group of farms were produced.

Results

Statistics for individual farms are presented in Table 2. Across all farms, the mean of the individual farm mean C8MRs was 25.3% (standard deviation 20.4%; range 5.7-59.7%). Box plots and line graphs demonstrate variability of C8MR rates over time on individual farms (Figures 1 and 2).

Discussion

The cumulative eight-week rolling average mortality rate (C8MR) was selected as the variable for reporting and comparison between farms because it is a statistic that accounts for the eight-week period that pigs were in the PMWS target age group (four to

12 weeks of age). It can be compared directly with other aggregate mortality statistics, for instance the total mortality in a single cohort with no addition or removal for purposes other than mortality, or total mortality for a farm over a whole year.

It accounts for the fact that on most of the study farms the population of post-weaning pigs is dynamic because of continuous flow systems (as compared with 'all-in-all-out' systems), without individual animal identification. Seasonal and longer term influences in the rates of entry and exit of pigs into and from farm populations would introduce time-related biases to mortality rates calculated by counting or estimating numbers entering and exiting. Such variations occur as a result of commercial factors but may also have been in response to the MAF-imposed movement controls.

However, the method is susceptible to measurement bias in other ways. Data for this study were collected within the established management regime of the study farms. Age at weaning and the duration of the weaner phase vary between farms. For instance, the average weaning age in New Zealand is 27.3 days, but it ranges from 19.7- 40.0 days⁽¹²⁾. The days and weeks immediately after weaning are a period when pigs are particularly

susceptible to stress-related disease, and mortality typically peaks during this period. Management factors can have a large impact on this mortality and therefore on total mortality during the weaner phase. Early weaning exposes younger pigs to this high stress event and could result in higher mortality rates. A management regime that increased the proportion of days at risk that just-weaned pigs contributed within the weaner groups (ie short weaner phase, with quicker movement into grower phase) could bias the C8MR upwards when compared with farms that managed all pigs as weaners up until 12 weeks of age or longer. Ideally, estimates of incidence of mortality would use 'days at risk' to account for such dynamics in the study population but such a measure was not practical during this study.

A recent benchmarking study collected data from 33 pig farms that responded to a questionnaire⁽¹²⁾. The overall response rate was low (9%) but the 33

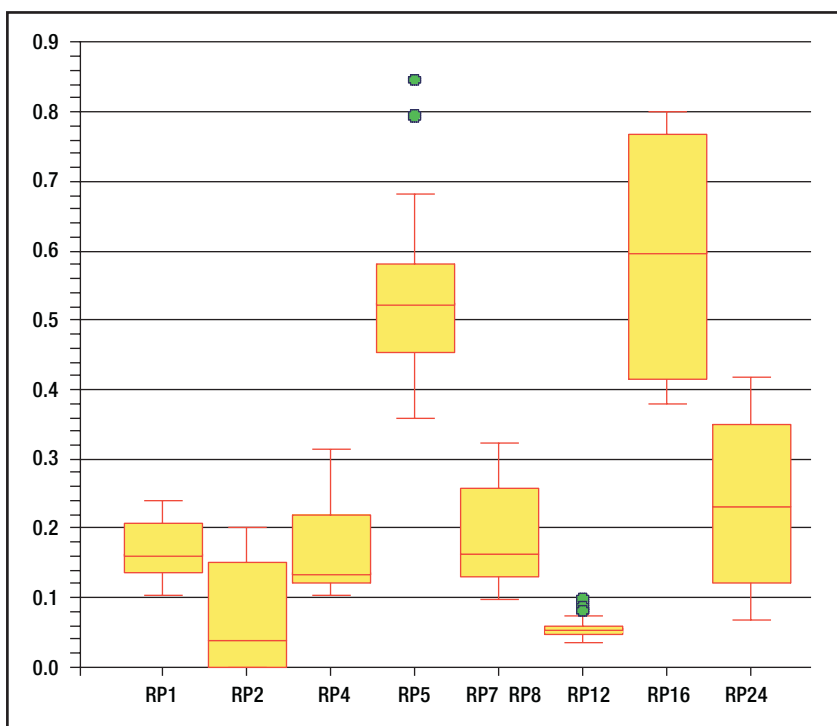
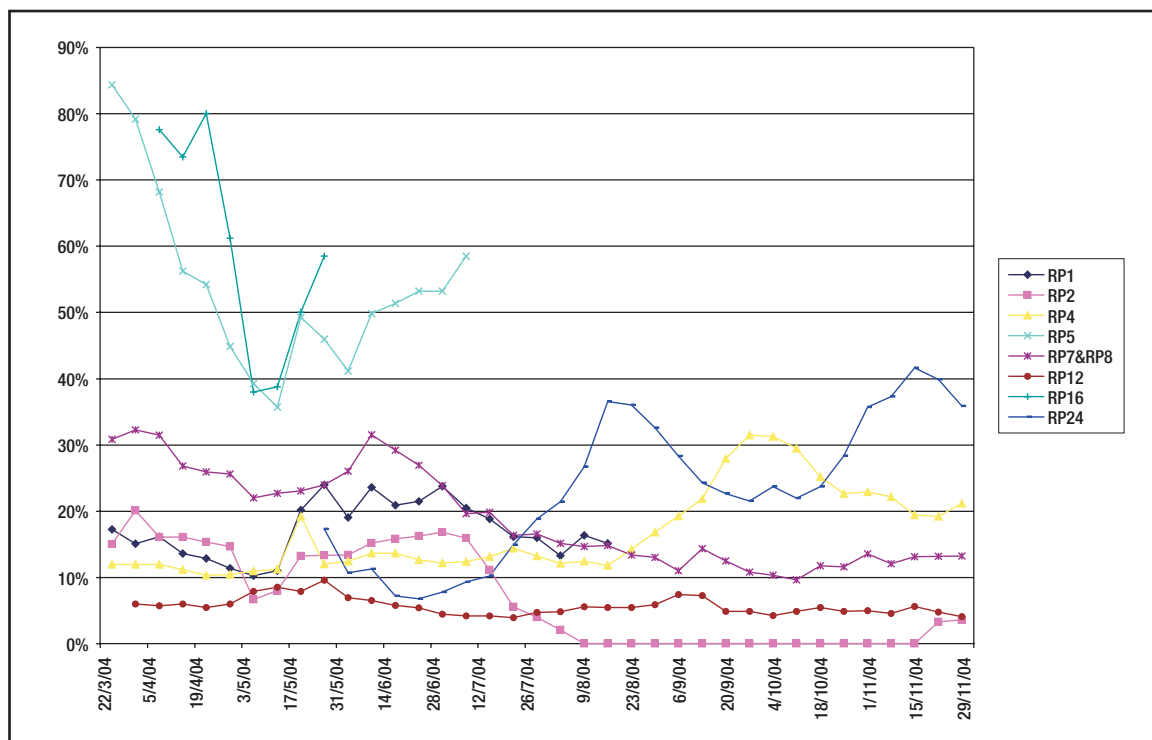


Figure 1: Box-plots of cumulative 8-week rolling average mortality rates of weaner pigs (C8MR) by farm

Figure 2: Cumulative 8-week rolling average mortality rates of weaner pigs (C8MR) by farm over time



farms from which usable responses were obtained represented 28.5% of sows on pig farms in New Zealand. Post-weaning mortality was calculated by subtracting pigs killed as porkers and baconers from the estimate of weaners produced, rather than from a count of mortalities. The mean post-weaning mortality was 4.44% (standard deviation 8.0%; range 0-39%), after correcting negative mortality rate values to zero (such impossible values were considered to have resulted from the time-related bias discussed above). Post-weaning mortality rates on PMWS farms were compared with the corrected data from this study. The Mann-Whitney U test for difference in medians indicated a statistically higher mortality rate on PMWS farms when compared with the benchmark study population ($p < 0.001$).

The range of estimates of post-weaning mortality rates on PMWS farms in New Zealand was consistent with those from observational studies in other countries. A study of 15 farms in USA with confirmed PMWS found mean post-weaning mortality of 6.5%, and 18.3% in the most severely affected herd⁽⁵⁾. A questionnaire survey of veterinary practitioners collected data on 62 PMWS affected farms in the UK, and analysis showed mean post-weaning mortality rates of 3.7% prior to the recognition of the problem, 19.9% at the peak of the outbreak, and 9.8% after the outbreak⁽¹³⁾. In Denmark, post-weaning mortality rates in six PMWS affected farms in the year 2000 ranged between 4% and 18%⁽¹⁴⁾. Within a large cohort of pigs ($n=3078$) on 12 French farms severely affected by PMWS, overall mortality from weaning to slaughter was 11%⁽¹⁵⁾.

Estimates of mortality rates on PMWS farms in this and overseas studies vary, and the range overlaps with that for New Zealand farms not considered affected by PMWS. Many factors contribute to post-weaning mortality on commercial pig farms, including

management, facilities, diet and the presence of other infectious diseases. None were controlled within the present study. Not all of the recorded deaths in this study were directly attributable to PMWS, and the direct impact of PMWS on post-weaning mortality cannot be ascertained independently of these confounding influences.

The time at which the New Zealand farms first became affected by PMWS was difficult to estimate. In the UK study, outbreaks were characterised by a significant and prolonged rise in mortality rates, peaking at about 159 days, then declining to a level that remained significantly above that observed before the outbreak⁽¹³⁾. Attempts to discern such a trend by visual comparison of longitudinal mortality data for the New Zealand farms, in Figure 2, in light of the estimated date of first infection for some farms, in Table 1, have not been convincing.

Two farms (RP5, RP16) with very high post-weaning mortality rates merit specific explanation. RP5 regularly purchased weaners from suppliers who had been investigated and considered negative for PMWS. It has been hypothesised that sustained high mortality rates on RP5 resulted from continually bringing naïve stock into an infective environment.

The farm has also had ongoing problems controlling leptospirosis. Substandard facilities, management and diet are believed to contribute to the high mortality on RP16. The extended period of zero mortality on one farm (RP2) is explained by the absence of target age pigs during this period.

MAF classified farms as PMWS positive, suspect or negative based on interpretation of evidence obtained during the farm investigation and the subsequent period under movement control.

The PMWS status of some farms investigated was difficult to determine. All farms placed under movement control were subjected to a case review process in which all diagnostic evidence was considered against the case definition. Re-classification has occasionally occurred, and because the initial decision-criteria for application of movement controls were risk averse, this re-classification typically, but not always, resulted in a down-graded status. Review during August 2004 resulted in five properties previously considered suspect for PMWS being re-classified as negative, three previously considered positive being downgraded to suspect, and one suspect farm becoming a positive. A further review during December 2004 resulted in four properties previously considered suspect being re-classified as negative, one previously considered positive being downgraded to suspect. Only farms considered positive as of December 2004 are reported in this paper. Any subsequent re-classifications of farms would affect the estimates of post-weaning mortality rate on PMWS farms presented here, although this is now considered unlikely within this group.

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Animal welfare in New Zealand – the important role of non-governmental organisations

To be effective, legislation, particularly that which sets standards for potentially emotive issues in a society, must necessarily involve cooperation amongst groups that may well have differing philosophies. Animal welfare legislation is a prime example, and the relationships between governmental and non-governmental organisations, both here and overseas, have been highlighted in a number of papers⁽¹⁾⁽²⁾⁽³⁾. In New Zealand, the administration and effective working of the Animal Welfare Act 1999 depends on organisations that include government departments, animal welfare advocacy groups and the veterinary profession. This paper looks at how these groups, with their different aims and approaches, collaborate to enable the legislation to work effectively.

Background

The relatively recent phenomenon of societal concern for animal welfare has led to major changes in legislation in many countries around the world. In New Zealand, as elsewhere, recent years have seen increasing scrutiny of farming practices and the way we care for our animals, from society and consumers both within the country and overseas. As Professor Bruce Ross, former Director-General of Agriculture and Forestry, has said: 'Attitudes to animals and the way people use them are evolving rapidly, both within New Zealand and in the countries with which we trade. We are constantly confronted with new challenges – to justify the way we manage animals and to develop animal welfare practices that meet or exceed changing consumer expectations.'⁽⁴⁾

New Zealand legislation

In response to this evolution in attitudes towards animal wellbeing, the New Zealand Animals Protection Act 1960, with its focus on punishment for a range of unacceptable or cruel practices, was replaced at the end of 1999 by the Animal Welfare Act. The newer Act takes a general view of welfare based around the five internationally recognised basic needs – proper and sufficient food and water, adequate shelter, opportunity to display normal patterns of behaviour, physical handling in a way that minimises the likelihood of unreasonable or unnecessary pain or distress, and protection from, and rapid diagnosis of, any significant injury and disease. Detailed requirements of individual species and circumstances are contained in a series of codes of welfare that underpin the legislation. The Animal Welfare Act, by promoting a duty of care, introduces the concept of ethical responsibility as opposed to the more simplistic view of anti-cruelty that was the basis of the previous legislation.

The rise of ethics

The idea of ethical responsibility for animals has grown alongside the greater focus on animal welfare. Animal ethicist Professor

Three organisations – MAF, the NZVA and the RNZSPCA – have a common goal in improving the welfare of animals in New Zealand, and a willingness to work with each other towards that goal.

Bernard Rollin, of the Colorado State University College of Veterinary Medicine, sees the 'significant emphasis on the treatment of animals used by society for various purposes' as a major social ethical concern that has developed over the last three decades⁽⁵⁾. In his view, this concern has arisen because of the changes in the nature of agriculture and the increase in use of animals in research and testing. He sees this as requiring 'new moral notions to talk about the treatment of animals in today's world, where cruelty is not the major problem but where such laudable, general human welfare goals, such as efficiency, productivity, knowledge, medical progress, and product safety, are responsible for the vast majority of animal suffering'.

While debate on moral issues used to be seen as belonging to a large extent within religious or philosophical circles, the appeal of logical argument has seen ethical discussion become much more widely accepted and utilised in many levels of society. The growing acceptance of the place of ethics can be seen in a number of areas in the animal welfare field. Clear evidence can be seen in the following extract from the report from the Chair of the National Animal Welfare Committee (NAWAC) in the 2003 Annual Report⁽⁶⁾:

'However, although knowledge and experience of science, technology, practicality and professional care of animals are the major factors in determining what good practice is, those determinations are undertaken within a context of thought about what, generally, are and are not considered to be acceptable ways of treating animals. Such thinking evolves gradually within stakeholder groups and society at large, and excludes capricious surges in public sentiment. Accordingly, NAWAC considers that another feature of good practice is that – *good practice also takes account of the evolution of attitudes about animals and their care.* Consideration by NAWAC of these matters is allowed for in the Act [section 73(2)(b and d)]. Moreover, the fact that the Act also requires the Minister to appoint members of NAWAC with knowledge and expertise of ethical standards and conduct in respect of animals, animal welfare advocacy, the public interest in respect of animals, and environmental and conservation management [section 58(f-1)], indicates a desire of Parliament that this breadth of expertise be applied during NAWAC deliberations.'

The other ministerial advisory committee, the National Animal Ethics Advisory Committee (NAEAC), is also required to have a membership similar to that referred to in the extract above, and the committees set up to consider applications to use animals in research, testing and teaching are called animal ethics committees. In scientific publications both internationally and in New Zealand

there has also been a surge in the number of papers concerning animal ethics, with the focus mainly in the area of the science-ethics interface; the use of animals in research, testing and teaching; and animal welfare standards, ethics and regulation.

In education, too, there is an emphasis on ethics. Most undergraduate programmes relating to animals now include courses in animal welfare and ethics. At postgraduate level, institutions such as Massey University offer animal-focused programmes while others offer more general training such as the Diploma in Professional Ethics offered at the University of Auckland.

However, an increasing focus on ethics does not confer a consensus on animal welfare issues. There are a number of ethical theories that do not necessarily provide similar solutions for particular issues, and the roles – and therefore the ethical stances – of those involved in animal welfare administration do not always coincide, so once again we are faced with the need for collaboration to allow effectiveness.

Contributors' roles

Governmental responsibility for administering the Animal Welfare Act lies with the Ministry of Agriculture and Forestry (MAF), through Biosecurity New Zealand (BNZ) – in particular its Animal Welfare Group. While enforcement of the Act falls within MAF's remit through the Compliance and Enforcement Group, this role is not restricted to the Ministry. Police are automatically deemed inspectors under the Act, while the legislation also allows for animal welfare organisations that have been approved by the Minister to be able to recommend their staff for appointment. Animal welfare inspectors, whether from within MAF or outside it, are required to complete the National Certificate in Compliance and Regulatory Control (Animal Welfare). This certificate requires not only education in animal welfare but also in the legislative framework and objectives, and the court process, from collection of evidence through to acting as a witness.

While both MAF and approved animal welfare organisations such as the Royal New Zealand Society for the Prevention of Cruelty to Animals (RNZSPCA) are intimately involved with the administration of the Animal Welfare Act, a third group whose involvement is essential to the success of the legislation is the veterinary profession. Although only those veterinarians who have undergone the required training can be animal welfare inspectors, it is the veterinary profession that has the necessary scientific training to judge the physical or health status of animals and whether they are suffering 'unreasonable or unnecessary pain or distress'. Veterinary expertise and advice is essential in determining whether prosecutions should proceed and veterinarians play important roles as expert witnesses.

All three main groups – a government department, a professional group and an animal welfare advocacy group – have a stated focus

on the welfare of animals, but their philosophies, and therefore their ethical viewpoints, do differ.

Contributors' ethical viewpoints

MAF's animal welfare mission is a two-pronged one. Firstly, it aims to reflect societal values relating to animal welfare. However, the Ministry also has a major role in ensuring the market success and profitability of the agricultural sector. In an international context, and in acknowledgement that animal welfare has the potential to play an increasingly influential role in international trade, MAF's role in supporting the development of animal welfare standards in New Zealand agriculture has a wider aim of contributing to market success and optimum product positioning for New Zealand animal products and animals⁽⁴⁾.

It is also clear from the legislation MAF administers that there are considerations other than animal welfare per se that must be accounted for – practicalities, cultural differences and economics – that mean decisions on animal welfare issues necessarily involve the weighing up of interests that is typical of Utilitarian ethics, focused as it is on the 'greatest good for the greatest number'.

The veterinary profession, too, can be seen as taking a Utilitarian stance. Within the context of seeing itself as having a special responsibility for animal welfare, the profession also has wider roles in maintaining and enhancing the health, productivity and wellbeing of animals, and in contributing to the maintenance of high standards in public health, animal product safety and certification and to New Zealand's biosecurity⁽⁷⁾. In accepting the need for society to make use of animals for companionship, work, production, teaching, research, recreation and sport, the profession aims to use good science to encourage good welfare and to relieve or minimise pain and suffering.

There are two approved animal welfare organisations – the RNZSPCA and the Animal Welfare Institute of New Zealand (AWINZ). The former, being larger and a national as opposed to a local group, is used as the example here. Unlike MAF and the New Zealand Veterinary Association (NZVA), the RNZSPCA has a narrower focus in that its mission is simply to advance the welfare of all animals in New Zealand (Mason P, personal communication). With its statement that 'all animals are equally deserving of our compassionate consideration', the RNZSPCA's stance ascribes 'inherent value' to animals as its philosophy.

So although all three institutions share an animal welfare focus, only the RNZSPCA has this as its *raison d'être*. This would appear to create the potential for disagreement. However, if we look at the ethical strategies articulated by Mellor and Stafford⁽⁸⁾ in terms of making effective progress with animal welfare issues, it would seem that all three institutions ascribe to the 'incremental improvement' strategy, rather than the 'gold standard' approach. This in no way denies the desirability of reaching the gold standard, even though all three organisations might set that bar a little differently.

However, there appears to be general agreement that 'the 'incremental improvement' approach encourages participation (ownership, buy-in) by setting reachable targets, which are part of a planned sequence designed to enhance animal welfare progressively. Significant welfare advances, a sense of achievement, a willingness to recruit other participants and/or openness to ways of making further improvements are common outcomes.'⁽⁹⁾

The rate of that incremental change does, at times, seem frustratingly slow, not just to the RNZSPCA but to the other groups as well. However, a further constraining factor lies in the legislation itself. Those who work to improve animal welfare from within the system soon come face to face with the reality that the Animal Welfare Act contains certain provisions that widen the required considerations beyond the ethical and welfare implications to animals of various procedures. The feasibility and practicality of effecting a transition from current to new practices and the adverse effects that may result from that transition; the requirements of religious and cultural practices; and the economic effects of any transition from current to new practices must legally also be considered under the Animal Welfare Act. In effect, this means that any procedure must be looked at in the wider public policy context.

Other areas of potential conflict lie in the discomfort that veterinarians, particularly those from country areas where there are few veterinary practices, may feel at being seen as 'policing' those who may also be clients.

Effective cooperation

The essence of effective cooperation among the organisations involved in administration of the Animal Welfare Act 1999 lies in consultation. The Animal Welfare Group, the NZVA and the RNZSPCA all have Memoranda of Understanding, each with the other. This means that regular formal and informal discussions take place at an organisational level, and while there is acknowledgement that philosophies might differ, there is also understanding that the broad aims are to improve animal welfare and that that is best achieved by cooperation.

The veterinary discomfort referred to above can be taken as an example. Concerns raised by veterinarians over this issue in the last couple of years have resulted in extensive consultation between NZVA and the MAF Compliance and Enforcement Group resulting in statements of clarification of the responsibilities of veterinarians in animal welfare investigations, and the development of a 'Vetpak' containing extensive general and specific information that is given to veterinarians who are asked to assist in such investigations.

Direct consultation aside, members or nominees from each of the three groups share major roles on committees involved in animal welfare. These include:

- the Animal Behaviour and Welfare Consultative Committee (ABWCC), which exists to provide a forum for the exchange of information among New Zealand animal industry sector

representatives, government department representatives and researchers on animal behaviour and welfare and related issues. It is also a forum for feedback from other relevant national organisations/committees, including the MAF Animal Welfare Group, the NZVA, and the RNZSPCA. Such groups are encouraged to promote the results of research on animal welfare within their own groups, with the aim of increasing education on science-based welfare research;

- the National Animal Welfare Advisory Committee (NAWAC), which advises the Minister of Agriculture on any matter relating to the welfare of animals in New Zealand as well as the issue, amendment, suspension, revocation or review of codes of welfare;
- the National Animal Ethics Advisory Committee (NAEAC), which advises the Minister on ethical and animal welfare issues arising from the use of live animals in research, testing and teaching;

(Both NAWAC and NAEAC are required to include members with experience in veterinary science and in animal welfare advocacy. These members are appointed not as representatives of their parent bodies, but as individuals with appropriate experience and expertise and are chosen from candidates including those nominated by the NZVA and animal welfare organisations.)

- Animal Ethics Committees, which scrutinise all research, testing and teaching involving live animals, are appointed by institutions under their Code of Ethical Conduct. Each committee is legislatively required to appoint a veterinarian nominated by the NZVA and an animal welfare advocate nominated by an approved animal welfare organisation, as well as a third lay person nominated by a territorial authority or regional council;
- code-writing groups are put together to assist in the development of codes of welfare, and are made up of people drawn from all organisations and sectors having an interest in the particular species or issue, emphasising the legislative requirement for a consultative approach to animal welfare issues in developing sound, science-based policy and standards. These groups usually include nominees of the NZVA and RNZSPCA.

Conclusion

Other considerations notwithstanding, it seems clear that all three organisations – MAF, the NZVA and the RNZSPCA – have a common goal in improving the welfare of animals in New Zealand, and a willingness to work with each other towards that goal.

The strategic importance of animal welfare from MAF's point of view is shown in the following statement: 'However, although productivity and health will quite rightly continue to receive significant attention for many years, animal welfare thinking and practice are developing to such an extent that they will clearly be

major foci internationally for the foreseeable future.⁽¹⁰⁾ MAF Animal Welfare Group Director Dr David Bayvel also recently posited: 'the assertion that animal health and production is a direct proxy for acceptable animal welfare is no longer fully credible in relation to animal use in agriculture.'⁽¹¹⁾ He also emphasised that the direct linkage between good laboratory animal welfare and quality scientific outcomes is a much more significant relationship.

The emphasis the veterinary profession places on animal welfare can be seen by the fact that in defining the role of veterinarians in society, primary position is given to the prevention and relief of animal suffering. Evidence of the importance of animal welfare is shown by the fact that the NZVA is one of only a few veterinary associations in the world to fund a veterinarian whose specific task is to deal with animal welfare issues.

The RNZSPCA, of course, exists for the purpose of prevention of animal suffering. Its continued involvement in the process of animal welfare reform, despite its discomfort with some of the practices that continue to be allowed and its frustration at the seemingly slow rate of change, can, then, be seen as a recognition of both the constraints of the legislation, and of the validity of working with the industries involved rather than alienating them with the leap for the gold standard.

Acknowledgements

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Quarterly review of diagnostic cases – October to December 2004

Cattle

A Taranaki veterinarian investigating the death of a three-month-old Jersey heifer calf noted an abnormal appearance of the lungs. Histologically most bronchi and bronchioles were filled with abundant necrotic debris including sloughed respiratory epithelial cells, the nuclei of some of which had basophilic, poorly defined, inclusion bodies. Necrosis and inflammation also spilled into alveoli. This pattern of inflammation and necrosis is typical of **adenoviral pneumonia** in calves. This ubiquitous infection is exhibited only in immunodeficient calves, or calves ingesting insufficient colostrum. Damage to bronchi probably allows bacterial superinfection as well.

A veterinarian in Taranaki examined a mob of four-month-old Friesian heifers with periocular alopecia and found that alopecia, skin thickening and scab formation was widespread through the mob, with varying severity. A skin biopsy of the worst affected calf confirmed **dermatophytosis**.

Calves on a hill country Rangitikei beef cattle breeding property were born dead, or died soon after birth. Histology on fixed tissues did not reveal any pathology but culture of stomach contents isolated *Bacillus licheniformis* – an abortifacient bacterium.

Two cases of **lymphosarcoma** were investigated. An eight-year-old cow of undetermined breed killed at a Horowhenua abattoir had markedly enlarged lymph nodes, spleen, liver and kidneys. Sheets of neoplastic lymphocytes effaced the normal architecture of the lymph node. There were up to 20 mitoses per hpf. In the second case, in Hawke's Bay, a two-year-old Charolais heifer with severe ventral oedema died during veterinary examination. A large bloody mass filled the cranial third of the thorax. Histologically it was composed of extensive coagulative necrosis and a thick supporting stroma heavily infiltrated by large numbers of anaplastic round cells. Hence this was most likely a thymic lymphosarcoma. Both cattle were negative serologically for enzootic bovine leukosis.

Skin disease in spring is colloquially known as 'spring eczema' and varies in prevalence and severity from year to year. Taranaki often has cases in dairy cattle. Fewer cases than normal were recorded this year. In a typical case, serum samples from a recumbent three-year-old Friesian cow with peeling skin revealed elevated bilirubin (99.5 µmol/l, reference range 0-15), glutamate dehydrogenase (GLDH) (2918 IU/l, range 8-41), and gamma glutamyl transferase (GGT) (229 IU/l, range 9-39), confirming hepatobiliary damage and a secondary dermal **photosensitisation**. The toxin has not been identified.

Cases of chronic udder oedema, also known as 'leatherbag', were investigated in two separate cases in the Taranaki region. Both had

Each quarter, *Surveillance* publishes a review of selected diagnostic cases handled by New Zealand's veterinary diagnostic laboratories owned by Gribbles Veterinary Pathology. These cases do not necessarily reflect the national disease profile but they do represent diseases of interest to the livestock industry or of significance to wildlife.

marked hypomagnesaemia with mean serum magnesium concentrations of 0.24 and 0.26 mmol/l (reference range 0.6-1.23). One cow was also anaemic with a haematocrit of 0.19 l/l (reference range 0.24-0.4). Hypomagnesaemic induced anaemia is common in this district and is known as 'Taranaki anaemia'. **Chronic udder oedema associated with hypomagnesaemia** eventually leads to udder skin thickening and a characteristic leathery feel although the pathophysiology is unknown. (Reference: Hicks JD, Pauli JV. Chronic udder oedema: clinical aspects of the syndrome and its connection with hypomagnesaemia and anaemia. New Zealand Veterinary Journal 24, 225-7, 1976.)

Four four-month-old dairy calves from Inglewood died over a 24-hour period. The calf necropsied had been seen down and then later in a drain, where it was presumed to have drowned. Brain sections showed no abnormalities, ruling out the initial diagnosis of polioencephalomalacia. However, the heart showed moderate mixed perivascular and interstitial infiltrates of inflammatory cells and occasional granular necrosis of myofibres. Mild pulmonary oedema and rumen content were seen in the lung. The calves had access to foxglove (*Digitalis purpurea*), which contains a cardioglycoside that slows the heart and causes death by ventricular fibrillation and arrest. Although difficult to differentiate, it seems likely the calf died of acute heart failure from **cardioglycoside toxicity** and rolled into the drain rather than drowned in it.

There were two cases of **Salmonella Brandenburg** in cattle in Southland in early October. One involved an eight-year-old dairy cow with sudden onset of a watery diarrhoea and condition loss. The other was an outbreak in 15 of 20 brought-in one- to two-week-old beef calves being hand-reared on a dairy farm and found pyreptic with a severe watery diarrhoea containing blood. Six calves died after a couple of days. *Salmonella* Brandenburg was isolated from all faecal samples cultured and significant numbers of Cryptosporidia were also identified in the faeces. The farmer had had no problems in rearing homebred dairy calves earlier in the season.

Animal health problems from lush summer grass occurred on some farms throughout Otago and Southland. These included small outbreaks of primary photosensitisation and polioencephalomalacia in young calves, and on one understocked dairy farm in Otago 50 of 400 cows on lush pasture developed a severe laminitis, most likely caused by a subacute rumen acidosis resulting from an all grass diet containing highly fermentable

carbohydrates. Some of the cows also developed photosensitisation in white areas on the dorsal surfaces of the body.

Two of 50 dairy cows were found dead on a Southland dairy farm. Necropsy of both showed a congested abomasal and intestinal mucosa and blue coloured intestinal fluid. Kidney copper concentrations were $>1000 \mu\text{mol/kg}$ confirming **acute copper toxicity**. An opened drum of copper sulphate was found tipped over and the contents spilt in an area accessible to the cows.

A yearling freemartin heifer was found dead within two hours of being noticed off colour on a large station in western Southland. A necropsy showed about 100 litres of urine in the abdominal cavity and the bladder mucosa contained a small number of raised haemorrhagic circular masses up to 30 mm in diameter, some of which appeared to have perforated. Histological examination confirmed areas of full-thickness necrosis and haemorrhage of the bladder wall. Although bracken fern exposure was not mentioned in the history, the most likely cause of the bladder lesion is a low level chronic exposure to ptaquiloside, the agent causing **bracken fern toxicity**. Death may have resulted from a combination of anaemia, from a chronic haematuria, and the eventual development of an acute uroabdomen from a perforated bladder.

Over a two-week period, four of a mob of 100 two-month-old crossbred calves on a Central Otago beef property developed signs of muscular weakness, stiffness and eventual recumbency. Two calves necropsied showed pale streaks in the myocardium and skeletal muscles. **White muscle disease** was confirmed by histological examination and a liver selenium concentration of 300 nmol/kg (adequate >600). WMD is a rare finding in sheep and cattle in Central Otago these days.

In Otago there were a number of cases of **cerebral listeriosis** in dairy cows being fed poor quality silage in December.

Probably because of poor weather conditions in Southland in December, there were a number of outbreaks of illthrift and diarrhoea caused by *Yersinia pseudotuberculosis* in recently weaned or transported dairy calves.

Deer

Eight red deer calves died in each of two mobs of about 40 one- to three-week-old calves on an Ashburton farm. The hinds were unaffected but the calves had diarrhoea. Tissues from one calf examined histologically showed severe **cryptosporidiosis**.

At slaughter an aged stag from Southland was found to have an abnormal swollen testis. No *Brucella ovis* was isolated on culture but there was a light growth of an organism resembling *Corynebacterium renale*. This is occasionally reported in association with genitourinary disease (particularly pyelonephritis) in cattle, sheep and horses in New Zealand.

White-spotted kidneys were seen at meat inspection in a line of yearling deer sourced from a deer farm in western Southland.

Leptospirosis was suspected and a number of workers at the slaughter plant had developed acute leptospirosis caused by *Leptospira interrogans* serovar *hardjo*. Histological examination of three kidneys revealed a chronic interstitial nephritis of varying severity but leptospire were not seen in silver stained sections. However, serological testing of 15 yearlings from the same age group on the farm showed all had high titres to *Leptospira pomona* but titres to *L hardjo* were all negative. The farm had had no outbreaks of clinical disease in young deer.

There were two small outbreaks of **malignant catarrhal fever** on deer farms in Central Otago in late spring. In one, three adult hinds in good condition were found dead over a week, and in the other seven yearlings in a large mob destined for slaughter were found dead over a short period. A necropsy on one found a severe congestion of the mucosa of the caecum, small intestine and omasum. Histological examination of brain and tissues from animals necropsied in both outbreaks confirmed the diagnosis.

Sheep

Postmortem examination of a lamb found collapsed in the sheep yards on a Rangitikei property showed white striations throughout the diaphragm and lumbar musculature suggesting **white muscle disease**. Histology confirmed necrosis, fibrosis and early muscle regeneration of muscle bundles. Diffuse mineralisation was revealed throughout affected muscle groups using calcium specific stains. Liver selenium concentration was $360 \mu\text{mol/kg}$ (adequate level is greater than 400). This year the farmer had chosen not to use selenium-supplemented vaccines, despite having done so for the past ten years. White muscle disease (nutritional myopathy) had been diagnosed in the past.

Copper deficiency causing leg fractures and hindlimb ataxia of two- to four-month-old lambs occurred on properties in the southern Taranaki, Wanganui, Rangitikei, Manawatu and Wairarapa regions in the early summer period. In one case, samples of brain and spinal cord from an ataxic lamb revealed peripheral neuronal chromatolysis in collicular nuclei, spongiosis in mid brain white matter and spinal cord hypomyelination. Liver copper concentrations were $22 \mu\text{mol/kg}$ (adequate levels are $300\text{--}3000$). In other cases, histological examination of sections of bone from lambs that fractured limbs during mustering or yarding revealed extensive haemorrhage throughout the bone marrow contiguous with the fracture site. Thin osteoid seams separated by connective tissue were poorly mineralised and, in some, irregular cartilage columns persisted in the metaphysis, changes consistent with osteopenia. Liver copper concentrations were severely deficient, some $<11 \mu\text{mol/kg}$, others $24 \mu\text{mol/kg}$ and up to $130 \mu\text{mol/kg}$, all markedly below the adequate concentration. Copper deficiency results in bone weakness because of failure of cross-linking of collagen supporting bone formation. It is not known why so many cases have occurred this year but the excessive rainfall recorded throughout the region in 2004 may have

contributed by decreasing copper availability, or increasing molybdenum and sulphur availability.

A group of 16 two-month-old lambs from a mob of 500 in Taranaki were severely lame and had hyperkeratotic raised, bleeding, nodular lesions on the skin of the coronets, elbows and face. Necropsy of one severely affected animal showed lesions characterised by a thick crust of wet, faecal stained debris firmly adherent to the underlying oedematous epidermis, extending from the coronet to the fetlock. Histological changes were consistent with parapoxvirus infection (**contagious ecthyma**). Lesions are usually confined to the face but can affect the feet and legs in severe cases. Viral infection of the epithelial cells results in oedema, necrosis and eventually severe inflammation and crusting.

Acute deaths in lambs in the Wairarapa and Rangitikei were associated with haematuria, anaemia and jaundice. Blood samples collected from one lamb before death revealed marked anaemia: haematocrit 0.13 l/l (normal range 0.22-0.4) and total erythrocyte count $3.7 \times 10^{12}/l$ (normal 9-15). In most cases postmortem findings included white foci on the kidneys, red urine, with yellow fat in subcutaneous tissues. Renal tubules were attenuated and filled with erythrocyte fragments and homogeneous debris. The white foci were dense interstitial infiltrates of lymphocytes. Around central veins in the liver, hepatocytes were degenerate – a feature of anoxia. *Leptospira pomona* serology ranged from 1:200 to 1:1600, confirming a diagnosis of **leptospirosis**. Infected sheep become leptospiraemic one to two days after infection but seroconversion does not occur until four to eight days after infection. Lambs may die early in the course of infection before seroconversion occurs. (Reference: Mackintosh CG, Marshall RB, Thompson JC. Experimental infection of sheep and cattle with *Leptospira interrogans* serovar *balcanica*. New Zealand Veterinary Journal 29, 15-9, 1981.)

A King Country sheep farmer lost several 12-month-old sheep under *Pinus radiata* trees. The animals showed brown mucous membranes and died suddenly. Nitrate poisoning was suspected but there was no response to methylene blue administration. On postmortem the carcass was jaundiced with swollen, dark, soft kidneys and urine was dark and red. Bloods from one downer animal revealed a haemolytic disease, with extensive inflammation (ghost erythrocytes, haemolysis and white cell count of $133 \times 10^9 /l$; reference 4-12). The differential diagnoses were narrowed to leptospirosis and copper toxicity. The trees had recently been sprayed with copper oxychloride for fungi, but the farmer had suffered losses before this. Histologically the kidneys had masses of globular eosinophilic material in tubules. The liver had bile pigment accumulation in canaliculi. Two animals tested showed high serum and liver copper levels (38 and 40 $\mu\text{mol}/l$; ref range 11-21) and one had a kidney copper of 860 $\mu\text{mol}/\text{kg}$ (reference range 63-157), confirming **copper toxicity**.

Two aborted lambs from the Manawatu had grossly enlarged,

polycystic kidneys. Histologically there was generalised dilation of tubules throughout the cortex, the glomeruli were small and lay within distended Bowman's capsules and a few markedly dilated tubules had a loose primitive stroma in the medulla. The liver had generalised intracanalicular bile stasis and some portal areas lacked bile ductules. Larger bile ducts were present but did not contain bile. The brain showed chronic encephalopathy. **Polycystic kidney** disease was confirmed. There was also biliary atresia. Encephalopathy has not been recorded previously in cases of polycystic kidney disease.

A small number of three-month-old lambs on an Otago sheep farm developed an ataxia that progressed to hindlimb paresis. Affected lambs were bright and alert. A necropsy of one showed no gross lesions but liver copper was very low at 39 $\mu\text{mol}/\text{kg}$ (adequate >95) and histological sections of the spinal cord showed changes typical of **enzootic ataxia**. This is a rare disease in this area.

A number of hand-reared orphan lambs a few days old and housed in a shed on an Otago sheep farm became off-colour and developed hot oedematous swellings of all four limbs below the hock and carpal joints. A necropsy of one showed no gross lesions apart from a severe haemorrhagic subcutaneous oedema of the affected areas of lower legs. Fixed sections of tissue showed a severe leucocytoclastic **cutaneous vasculitis**. The cause was not established but was probably a response to an infectious agent.

A Southland commercial sheep farm lost about 100 of 2000 newborn lambs. Most appeared to have died as a result of **dystocia** caused by an, often severe, subcutaneous oedema (the farmer called them 'pulpy lambs') over the head, trunk and limbs. They all had noticeably undershot lower jaws and the live affected lambs often showed an apparent joint laxity. Bone density was normal and there were no fractures as seen in osteogenesis imperfecta, outbreaks of which are occasionally seen in this area. The more mildly affected lambs mostly survived. The lambs were all from mature ewes of a wide age range but none from the two-tooth mobs. A genetic cause was suspected. The base breed was Romney but over the last ten years the farmer had been using white-headed Marsh rams. Progeny testing of two most recently brought-in rams, first used this season, against affected lambs produced equivocal results. One of the rams was the sire of only two of the 11 affected lambs tested; there were no matches for the other ram.

Horses

On a Canterbury farm with 34 horses, ten developed severe acute diarrhoea and four died. Seven of 20 yearlings, two of eight two-year-olds and one of six three-year-olds were affected. The first cases occurred over about a week in early December, another occurred three weeks later and no cases have occurred since. Clinically, the horses had acute diarrhoea, were febrile, anorexic and dehydrated. Those that survived have recovered well. Histologically, the small intestine and stomach were normal but all the large intestinal sections had the same changes: loss of the superficial

crypt and surface epithelium (not artefactual), fibrin thrombi in a few superficial lamina propria capillaries and one small area of necrotic and suppurative debris on the surface. The horses were all vaccinated against *Salmonella* and no *Salmonella* were isolated. Histologically, the lesions of **acute superficial necrotising colitis** suggested a toxic insult to the superficial mucosa. The gut contents were negative for *Clostridium difficile* toxin, although the result is suspect as testing was three days after collection and the toxins are labile.

A ten-year-old miniature mare with a two-week-old foal showed tetanic muscle tremors and was found to have marked serum hypocalcaemia (1.23 mmol/l, normal range 2.79-3.39) supporting the clinical diagnosis of **eclampsia**. Appropriate calcium therapy gave immediate resolution of the clinical signs. This condition, common in some other species, is apparently seen only rarely in horses.

Dogs

Two six-week-old Airedale pups from a litter of nine from Dairy Flat, Auckland, died acutely with severe jaundice and abdominal pain. Bloody discharge was found issuing from the anus, nose and mouth of both. Examination of fixed tissues from one pup revealed a cholestatic hepatopathy and a tubulo-interstitial nephritis. The morphologic findings are typical of acute **leptospirosis** caused by infection with *Leptospira interrogans* serovar *copenhageni*. This is the second case of acute leptospirosis seen in neonatal pups from this area. Both litters were raised outside, one in a woolshed, the other a detached shed, so exposure to infection from rats could explain the source of infection. In the one case for which the vaccination history was available, the bitch's vaccination programme had lapsed.

An eight-year-old Yorkshire terrier from Auckland presented with chronic pruritic skin crusts, alopecia and erythema. Biopsies revealed a thickened dysplastic epidermis and adnexal structures densely infiltrated by monomorphic lymphocytes. The dermis was not affected. Cutaneous lymphoma is highly pleomorphic and is normally classified as non-epitheliotropic or epitheliotropic. It is unusual to see exclusive infiltration of the epidermis as in this **epitheliotropic lymphoma**.

A six-year-old male heading dog was presented because it had been reluctant to jump fences for the last few days. An abnormal hind limb gait became more pronounced over the next few days until the dog was reluctant to move and held its neck in ventroflexion. Any movement appeared painful but he was still eating. There was no response to high doses of steroids. As the dog's condition was deteriorating, the owner elected euthanasia. A necropsy showed no abnormalities. The entire spinal cord was removed and histological examination revealed at all levels a severe **non-suppurative polyradiculoneuritis**, a condition similar to coonhound paralysis reported in the USA and considered to be caused by exposure to either racoon bites or saliva. Toxoplasma has also been implicated

but no Toxoplasma (or Neospora) cysts or other infectious agents were detected in the sections of spinal cord from this dog.

Infectious canine hepatitis has been diagnosed only three times in the last ten years at Gribbles-Alpha. A case was diagnosed in Waikato in a four-month West Highland White terrier recently imported from Australia. It presented with diarrhoea and ataxia, which progressed to seizures, coma and death over 48 hours. At necropsy, there were haemorrhages in the gastric mucosa, on the serosa of the ileum and pulmonary haemorrhages within the left apical and cardiac lobes. Histologically there was a multifocal hepatitis, severe generalised vasculitis and large numbers of intranuclear inclusions within endothelium and hepatocytes. The incubation period for infectious canine hepatitis is four to nine days, which meant the pup became infected in New Zealand as it had been in this country for four weeks.

Cats

Ethylene glycol toxicity is a relatively common cause of toxic nephrosis in cats in Auckland, often involving multiple cats from discrete areas. Sometimes it is possible to define the area from the street addresses of affected cats. It seems unlikely that cats from a particular area would just happen to find a common source of ethylene glycol in the environment, which suggests the poisoning is malicious. Recently, we encountered a toxic nephrosis suspected to result from malicious poisoning by a pigeon fancier in Whangarei. The owner's previous three cats all died prematurely, the first one ten years ago. A pigeon fancier from the South Island has just been convicted of malicious poisoning of cats, which he claimed were killing his birds. It appears that cats will readily drink milk spiked with ethylene glycol, and one clinician recalls an owner reporting seeing his cat drinking green milk prior to its death. The significance of the green colour did not register with him at the time. Many losses are not investigated because the owners do not wish to investigate the death or cannot afford a necropsy. It is therefore likely the problem is more widespread than realised.

A six-year-old male stud Persian cat had two episodes of 'episodic rage', attacking its owner and other cats in the household. The cat appeared normal (described as cuddly by the veterinarian) on clinical examination, and renal cysts were found on ultrasound examination. Because of this finding (and the cat's behaviour) the breeder elected euthanasia. A necropsy showed renal cysts and a mild enlargement of the liver. Histological examination of the brain revealed a severe, chronic encephalopathy with vacuolation and accumulation of material in some of the vacuoles. These findings are suggestive of an **inherited storage disease**.

Birds

Layer hens from a shed of 5000 on a poultry farm had been dying at a rate of ten per day for a week when investigations started. Necropsies showed fatty liver and a **feed formulation problem** was suspected as the cause. Culture of liver from three birds did not reveal any pathogens, reinforcing the suspected feed association.

A **budgerigar** of unknown age was fluffed out and passing frequent faecal material with lots of fluid over about two days. Cytology of faeces showed large rod-shaped organisms with a thick capsule that resembled a megabacterium. **Megabacteria** have been isolated from colonies of budgies. They have been seen in birds that show signs of going light. There is some debate over whether they are pathogenic or if they multiply in birds affected by other diseases.

A young **ostrich** in good condition sent to a Southland meat plant

was condemned because of large, multiple, caseating lesions in the wall of the intestine and caecum and involving the spleen, liver, lungs and kidneys. Histological examination of one lesion in the spleen showed a typical mycobacterial granuloma containing small numbers of acid-fast bacteria in clumps. This was probably a case of **avian tuberculosis**.

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Quarterly report of investigations of suspected exotic diseases

Exotic disease investigations are managed and reported by MAF's National Centre for Disease Investigation (NCDI). The following is a summary of investigations of suspected exotic disease during the period from October to December 2004.

Transmissible spongiform encephalopathy ruled out

The case reported in this section is the most significant suspected transmissible spongiform encephalopathy investigations for the quarter.

An eight-year-old red deer showed illthrift and was euthanased. Transmissible spongiform encephalopathy was ruled out with histological immunostaining techniques on brain tissue undertaken at Veterinary Laboratory Agencies, UK, and a negative Prionics western blot test at NCDI.

Bluetongue and Akabane disease ruled out

A Gribbles pathologist reported two stillborn beef calves with front leg deformities. Bloods submitted to NCDI tested negative for bluetongue using the ELISA and for Akabane disease using the virus neutralisation test. Possible non-infectious causes of arthrogryposis are trace element deficiencies and genetic predisposition.

Infectious bovine rhinotracheitis investigated

On a single property approximately 2% of calves less than one week old died of scouring that was unresponsive to veterinary treatment. Postmortem examination showed an abomasitis, and histological examination of tissues by a regional laboratory suggested an infectious agent, possibly a virus although no unequivocal inclusion bodies were seen. An infectious bovine rhinotracheitis (IBR) polymerase chain reaction (PCR) test on abomasal tissue was negative, as was virus isolation. Similar lesions were seen in calf abomasal tissues submitted from five other regions of New Zealand. Where serum was submitted, calves were found to be IBR ELISA positive. GGT levels indicated not all calves had received adequate colostrum. Some calves also had rotavirus and cryptosporidial infections. As the IBR serostatus of unaffected calves was not determined, no association can be drawn between the lesions and the calves' immune status. The 2005 calving season may produce similar submissions and the opportunity for on-farm investigation.

Q fever investigated

A tick sent to France as part of a Massey University rickettsia research project gave a positive PCR for *Coxiella burnetii*. The tick had been collected one year earlier from a lamb off a farm near Kaitaia. MAF Exotic Disease Investigators and AgriQuality livestock technicians visited the property and bled livestock and dogs for a serological survey using an epidemiologically designed stratified sampling regime. This provided negative results to the Bommeli Chekit-Q-Fever ELISA (sensitivity 93%; specificity 100%) for blood

samples from 156 sheep (n=4300), 196 cattle (n=2000), 150 deer (n=750) and 22 dogs (n=22, using a modified ELISA employing protein A conjugate). The survey can be interpreted as providing 95% confidence of the absence of antibodies in the total susceptible animal population on the farm, down to an assumed 1% prevalence level. Ticks (n=81) collected from the farm during the field operations and from mobs sent to slaughter have all tested negative by PCR for Q fever at NCDI. More detail on this case will be presented later in *Surveillance*.

Exotic *Mycoplasma* in cattle ruled out

A veterinarian involved in supervision of *Mycoplasma mycoides mycoides* (Large Colony) (MmmLC) research at Flock House, Bulls, became concerned by three unexplained polyarthritis cases in adult dairy cattle on a nearby farm. During investigation of a two-year-old spring-calving cow in September, the sharemilker described two similar cases in his autumn-calving mob in June. The veterinarian submitted aspirated joint fluid for bacterial culture, which was negative. Despite antibiotic (Tylan) and anti-inflammatory treatment the cow deteriorated and was euthanased. An Exotic Disease Investigator attended the necropsy, which showed markedly thickened joint capsules in the hocks of all four limbs, with cloudy joint fluid and fibrin clots. No significant gross pathology was seen in the lungs or other internal organs. Samples collected into Friis broth for mycoplasma culture and into phosphate buffered saline for PCR gave negative results for mycoplasmas, including MmmLC. Bacterial septicaemia was diagnosed histologically, with lesions affecting the kidney, liver, lungs and connective tissues around the joints. *Fusobacterium necrophorum* was considered the most likely agent.

After attending a presentation by a foreign expert on pneumonic diseases, a Massey University pathologist reported a suspect case of *Mycoplasma bovis* in a 22-month-old Dexter cow with chronic pneumonia. The cow had been necropsied and tissues examined histologically several months earlier after it died while under treatment at the Massey University referral clinic. Laboratory tests at NCDI ruled out *M bovis* and suggested that death was caused by the bovine virus diarrhoea virus (BVD)/*Mannheimia haemolytica* disease complex. A *Mycoplasma* generic PCR gave a suspicious result from one of three paraffin embedded block samples tested, but the sample was negative when tested by PCR using a primer specific for *M bovis*. The animal was found to have been persistently infected with BVD based on a strong positive BVD antigen ELISA carried out at the NCDI and read in conjunction with a negative antibody ELISA carried out previously by a private

practitioner. The pneumonia observed clinically and at postmortem fits the BVD/*Mannheimia haemolytica* disease complex described in the literature.

A veterinarian reported a clinical case of mastitis with joint involvement in dairy cattle. The presentation was considered similar to *Mycoplasma* mastitis seen in the US, where the veterinarian had practised. *Mycoplasma* mastitis was excluded by a negative generic *Mycoplasma* PCR test on a pre-treatment milk sample.

Mycoplasma agalactiae ruled out

An outbreak of clinically severe pinkeye occurred on a Manawatu sheep farm, with 12% morbidity in the mob of mixed age ewes. Signs varied from conjunctivitis with slight keratitis to severe keratitis, chemosis, congestion of scleral blood vessels, neovascularisation and in some cases hypopyon. Conjunctival swabs were collected in Friis broth, phosphate buffered saline and chlamydial transport media. PCR for *Mycoplasma conjunctivae* was positive in all samples tested (14/14). PCR for *Mycoplasma agalactiae* was negative. No *Mycoplasma* or *Chlamydia* was isolated. The clinical signs, location, morbidity and PCR positive result for *M conjunctivae* are consistent with what has been described as 'atypical pinkeye' or ovine infectious keratoconjunctivitis (OIKC) in New Zealand.

Equine viral arteritis, equine infectious anaemia and equine influenza ruled out

A horse trainer phoned the 0800 number reporting unusual signs in horses under his care. They had been in contact with an imported horse in the three weeks before the appearance of oedema, anaemia, coughing and jaundice. On examination by an AgriQuality veterinarian the two horses were clinically well, although one had pale mucous membranes. Bloods from both horses were tested at NCDI for equine infectious anaemia (EIA) using the gel diffusion (GD) test, equine viral arteritis (EVA) using the virus neutralisation (VN) test and equine influenza (EI) using the haemagglutination inhibition (HI) test, with negative results. Additional tests were requested to rule out rodenticide and selenium poisoning as the trainer suspected the horses may have been the victims of malicious poisoning. The serum biochemistry, clotting tests and blood selenium levels were within expected normal ranges. The cause of the clinical signs was not established.

EVA and EIA ruled out

A veterinary practitioner reported a six-year-old thoroughbred gelding with oedema of all four lower limbs. The horse had been brought onto the property one month earlier. No other horses had moved on in this period. The other nine horses on the property were clinically normal, as were the horses from the farm of origin. Blood samples from the affected horse tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. Blood film and molecular screening techniques were negative for haemoparasites. Bone marrow biopsy identified acute

lymphoblastic leukaemia, associated with a grave prognosis, and the horse was euthanased when its condition worsened.

A Gribbles pathologist reported an 18-year-old thoroughbred gelding with anaemia and an inflammatory leucogram. A blood smear did not reveal any blood parasites. Blood samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. The horse deteriorated rapidly and was euthanased, with no diagnosis reached.

A Gribbles pathologist reported a two-year-old thoroughbred gelding with severe anaemia and an inflammatory leucogram. A blood smear did not reveal any blood parasites. Peritoneal fluid was normal. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. The horse was euthanased and a necropsy performed by the veterinarian, with no gross abnormalities detected. No diagnosis was established.

A Gribbles pathologist reported a two-year-old standardbred mare with anaemia and an inflammatory leucogram. The mare was resident on a property with, but had not been mated by, an EVA shedder stallion. A blood smear did not reveal any blood parasites. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. Leukaemia was eventually diagnosed on necropsy specimens.

A Gribbles pathologist reported a 20-year-old pregnant thoroughbred mare with oedema involving all four limbs and the brisket. A blood smear did not reveal any blood parasites. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. The oedema resolved rapidly after the mare gave birth to a large foal.

A Gribbles pathologist reported a mare with oedema and bruising around the vulva and ventral abdomen, sudden onset lameness, and low serum protein. Blood cytology was normal and negative for blood parasites. The mare was run with several other paddock mates, had no history of fever or cough and no contact with horses from other countries. Serum was collected for the VN test for EVA and the GD test for EIA. The mare died suddenly the day following blood collection, but no necropsy was undertaken. When the death was reported two days subsequently, an AgriQuality veterinarian visited the property and found no clinical signs in the in-contact horses. Blood smears from the original submission were negative for *Bacillus anthracis* and negative on EVA and EIA antibody tests. No diagnosis was established, although a paddock accident was suspected by the owner.

A Gribbles pathologist reported a one-year-old filly with oedema. Haematology showed a neutropenia possibly due to acute inflammation. A blood smear did not reveal any blood parasites. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. The horse was referred to Massey University, where the oedema resolved although no diagnosis was reached.

A Gribbles pathologist reported a ten-year-old thoroughbred mare with anaemia and an inflammatory leucogram. A blood smear did not reveal any blood parasites. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results. The horse died a week later and no cause of death was established.

A Gribbles pathologist reported a six-year-old thoroughbred horse with dependent ventral oedema involving the sheath and brisket, which spread to include all four limbs. The horse was not anaemic, and no blood parasites were seen on slides. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results.

A Gribbles pathologist reported a three-year-old thoroughbred mare with oedema of all four limbs. Biochemistry results were unremarkable, while a stress leucogram suggested a possible viral aetiology. No blood parasites were seen on slides. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results.

A Gribbles pathologist reported a 20-year-old gelding with dependent ventral oedema involving the sheath and brisket. Samples tested at NCDI for EIA by the GD test and EVA by the VN test gave negative results.

Brucella canis excluded

A veterinarian reported severe suppurative epididymitis in a working dog. A serum sample tested at NCDI was negative on the *Brucella canis* card agglutination test.

Ehrlichia canis investigated

A dog was positive on the immunofluorescent antibody test (IFAT) for *Ehrlichia canis* when tested as part of pre-export test before travel to Australia. The titre was 1:20, just on the threshold for certification. The clinical history of the two-year-old, spayed female Cairn terrier indicated it had been a regular patient of a Mosgiel veterinary practice. There was no clinical history compatible with canine monocytosis, or any opportunity for exposure to the vector tick, *Rhipicephalus sanguineus*. The dog was not available for re-testing because the owner could not be contacted.

Canine heartworm ruled out

A veterinarian submitted to NZ Veterinary Pathology bloods from a dog with anorexia, weight loss, gastrointestinal lymphadenopathy, chronic gastrointestinal disease and lethargy. Several microfilariae were seen on blood smear and after concentration using the Knott's test. The microfilariae had an average length of 280 microns, and this and their appearance suggested they were microfilaria of the parasite *Dipetalonema reconditum*. This parasite occurs in northern parts of New Zealand but is clinically insignificant. Serum was tested at NCDI for *Dirofilaria immitis*, the exotic unwanted organism that causes canine heartworm, using the DiroCHEK ELISA, with a negative result. The dog had spent most of its 13 years in Bay of Plenty, with occasional excursions to Northland and

Waikato. The clinical signs had developed since the dog sustained an injury eight years earlier. On parasite morphology, serology and epidemiology the case was considered negative for *Dirofilaria immitis*.

A veterinarian reported to the 0800 number an 11-year-old boxer dog with liver failure and ascites, clinical signs suggestive of heart failure. The dog had been imported from Melbourne one month earlier. Serum tested at NCDI for *Dirofilaria immitis* using the DiroCHEK ELISA gave a negative result.

Clinical Neospora caninum infection confirmed in a dog

A dog died with neurological and muscular signs, and clinical *Neospora caninum* infection was diagnosed at Massey University. Serum was positive to the *N caninum* immunofluorescent antibody test. The possible source of infection was a raw beef diet from a home kill operation. Although antibodies are common in dogs, particularly farm dogs, clinical disease is comparatively rare.

Exotic ticks detected

A MAF Quarantine Service veterinarian phoned the 0800 number after the discovery of a dead tick on a greyhound dog coming into Wellington Airport from Australia. The tick was submitted to NCDI for identification. Parasitologist Alan Heath, AgResearch, identified the tick as a brown dog tick, *Rhipicephalus sanguineus*. The owner regularly imported from and exported racing dogs to Australia, and no ticks were found on a follow-up kennel inspection to rule out the possibility of previous incursions.

A brown dog tick, *R sanguineus*, was discovered at necropsy of a recently imported dog with a transmissible venereal tumour. On inspection of the house where the dog had been living since importation some months earlier, numerous brown dog ticks were found in the dog's bedding and on furniture and carpets. The property was placed under Restricted Place notice, with restrictions on the movement of household goods and animals. The house was emptied, the contents fumigated and the interior sprayed with pyrethrins, with the owners relocated for one week. Surveillance of dogs in the local area, and at places where movements of dogs and people from the treated house had occurred, found no ticks.

A Gribbles parasitologist reported an adult female brown dog tick (*R sanguineus*) submitted by a Dunedin veterinarian who found the tick on the outer ear of her nine-month-old retriever bitch. Both had returned from Australia approximately six weeks earlier. The dog travelled daily to work with the veterinarian. Inspection of the home and work properties and detailed examination of the dog and the cat at the home property by a MAF inspector and a veterinary parasitologist found no further ticks or evidence of tick infestation. *Babesia* infection of the dog was ruled out using molecular tests carried out at NCDI. Chemical prophylaxis of the dog and cat was instituted to continue for six months.

Exotic ticks excluded

A member of the public contacted the MAF 0800 number to report large numbers of ticks on her dog after a visit to farmland on Waiheke Island. The area was part of a property investigated by NCDI in December 2002 following sheep deaths attributed to severe tick infestation. No association with imported goods was identified, but as part of enhanced surveillance for ticks samples were submitted to NCDI for identification. The endemic tick *Haemaphysalis longicornis* was identified.

Infectious bronchitis investigated

A poultry industry veterinarian and Gribbles pathologist reported to NCDI the possibility of an exotic strain of infectious bronchitis (IB) virus in 50-week-old broiler breeders. The birds had dropped in production by 2-3% over the previous weeks, and had watery diarrhoea. Mortality had risen from a baseline of one or two per day up to five per day over the last week. Histological examination had revealed chronic nephritis and urate deposits in tissues, pathology reported on rare occasions in IB virus infections overseas. Infectious bronchitis virus is endemic in New Zealand and live vaccine is used routinely to prevent disease expression. The birds had been vaccinated with live vaccine every ten weeks, with the last vaccination six weeks before the investigation. No viruses were isolated from faeces and fresh kidney samples submitted to NCDI. The cause of the clinical signs and pathology was not established, and the flock will be subject to ongoing monitoring by the poultry industry. Any IB virus isolated would need to be distinguished from vaccine or endemic strains by nucleotide sequencing of the S1 glycoprotein.

Psittacine poxvirus excluded

Information received anonymously suggested a disease causing weepy eyes in aviary-bred birds in Waikato. The property was visited by an exotic disease investigator, and no clinical evidence of psittacine poxvirus infection or psittacosis was found.

Salmonella gallinarum (fowl typhoid) ruled out

A Gribbles laboratory isolated two species of *Salmonella* from young ducks showing signs of clinical salmonellosis during a visit by a poultry veterinarian. The isolates were forwarded to Environmental Science and Research Ltd (ESR) where they were found to be *Salmonella* Typhimurium phage type 160 and *Salmonella anatum*. No exotic salmonella species were found.

Tracheal mites of honey bees ruled out

A hobby beekeeper reported dying bees, and an AgriQuality Apiary Officer investigated. A sample of bees was submitted to National Plant Pest Reference Laboratory (NPPRL) for dissection and microscopic examination for tracheal mites (*Acarapis woodi*). No mites were found after examination of sufficient bees to provide 99% confidence of detecting a 5% prevalence (ie 90 bees).

Beekeepers claiming compensation for movement restrictions

imposed during the suspect varroa response in North Canterbury in July 2004 subsequently reported high hive losses in approximately 20 local apiaries on colder sites. A honeybee expert from HortResearch investigated on behalf of MAF, and considered the most likely cause for the colony deaths was behavioural changes brought about by testing hives under cold conditions. Other possible but unlikely causes included queen related problems, delays in moving to warmer sites, starvation, poisoning, and opening the hives in cold conditions. Tracheal mites were excluded by sampling bees for laboratory testing. On ten apiary sites, three dead hives were sampled. A total of 78 hives were examined from ten sites. Sixty bees from each hive were dissected for tracheal examination at NPPRL to provide a 95% confidence of detection, with negative results. It was concluded that testing for varroa had caused disruption to the hive, and behavioural changes that made the bees susceptible to the very cold weather present at the time.

An AgriQuality apiary advisory officer phoned the exotic disease hotline after investigating an apiary that appeared to have been affected by spray poisoning. The signs were also consistent with a tracheal mite (*A woodi*) infestation, and so adult bee samples were submitted to NPPRL for dissection and examination. All bees examined were negative for *A woodi*.

A member of the public noted an unusually large number of dead and dying bumble bees and contacted the MAF exotic disease hotline. Samples of dead bees were submitted to NPPRL. No tracheal mites (*A woodi*) were found on dissection of a sample of bees. A considerable number of mites were found on the external bodies of many bumble bees and were identified as *Kuzinia laevis* and *Pneumolaelaps* sp (probably *P bombicolens*). Both are known to occur on bumble bees in New Zealand but are not believed to be harmful. The cause of death in the submitted sample of bumble bees could not be determined.

European foulbrood ruled out

An AgriQuality Apiary Officer phoned the 0800 number when examining a brood disease that looked like European foulbrood (EFB). Samples of brood submitted to NCDI were negative on culture and PCR testing for *Melissococcus pluton*. The cause of the signs was most likely half-moon syndrome, in which the efficiency of the adult bees influences the nutrition of the brood.

EFB was excluded by negative culture and PCR at NCDI following submission by an AgriQuality Apiary Officer. The hive had non-specific brood signs consistent with EFB, but was most likely half-moon disease.

Tropilaelaps bee mites excluded

A HortResearch researcher reported finding a suspected exotic mite on a sample of brood sent in by a beekeeper after pupal deaths in four hives. Bee and mite samples were sent to NPPRL for identification, in particular *Tropilaelaps*. A brood sample was sent to NCDI for bacteriological assessment. Bacterial culture of the

brood was sterile and the mites on the affected brood were identified as *Melittiphis alvearius* and *Typhlodromus pyri*, neither a recognised pest of bees.

Varroa in South Island excluded

A swarm of bees found on the wharf at Picton, and therefore possibly from the North Island, was captured by a beekeeper and put into a hive. Testing for *Varroa* by Apistan and sticky board test was negative.

Bacterial kidney disease and exotic viruses of salmonids ruled out

A Gribbles pathologist reported necrosis of the renal tubules in fish from a farm experiencing increased mortality rate in salmon fry. The blocks and slides were submitted to NCDI for examination by a fish pathologist, and the structures seen in the kidneys were identified as rodlet cells, which are found in the kidneys of teleost fish under stress. The increased mortality, from the usual 0.02% on the farm to 0.2%, indicated the need for further testing to rule out

exotic infectious causes. Affected and unaffected salmon fry were submitted to NCDI. The diseases bacterial kidney disease (BKD), *Flavobacterium psychrophilus*, proliferative kidney disease (PKD), and *Myxobolus cerebralis* were ruled out using histology, bacterial culture and PCR testing. Virus isolation also gave negative results. Transfer to sea cages was authorised, and mortalities subsequently declined. The exact cause of the increased mortality and observed renal rodlet cells is not known. Water quality problems could cause these signs, and is consistent with the improvement subsequent to transfer to sea water.

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Surveillance index – 2004

A

Abomasal bloat, sheep 31(1), 23
Abomasal ulceration, cattle 31(1), 21; 31(3), 22
Abortion, fungal in cattle 31(3), 21; goat, *Bacillus licheniformis* 31(3), 24; *Klebsiella pneumoniae* in cattle 31(3), 21; leptospiral in cattle 31(4), 31; listerial in dog 31(1), 24; *Neospora* in cattle 31(2), 29; 31(3), 21; sheep 31(4), 32
Adenomatosis, intestinal, pig 31(3), 24
Addison's disease, dog 31(3), 24
Alpacas, *Camelostromylus mentulatus* 31(3), 17; exotic nematode 31(4), 35; ionophore toxicity 31(1), 23; *Mycobacterium bovis* 31(1), 23; parasitism 31(4), 34; sporidesmin toxicity 31(2), 30; toxic hepatopathy 31(4), 34
Alpha mannosidosis, cattle 31(3), 22
American foulbrood, Annual Report 31(2), 23
Anaemia, haemolytic in red deer 31(3), 5
Animal disease surveillance, Annual Report 31(2), 9
Animal welfare, Annual Report 31(2), 16
Annual Report 2003 31(2), 3
Anthrax, ruled out 31(4), 35
Apicultural exotic disease surveillance report 31(4), 26
Arthritis, purulent in sheep 31(2), 30
Atypical interstitial pneumonia, cattle 31(2), 28
Atypical mycobacterial infection, cat 31(3), 25
Aujesky's disease, ruled out 31(1), 26
Avian influenza, ruled out 31(1), 26; 31(2), 34; 31(3), 27; 31(4), 37
Avian virus survey in pigeons 31(4), 20

B

Babesiosis, ruled out in ostriches 31(1), 27
Bacillus licheniformis, goat, abortion 31(3), 24; sheep 31(4), 33
Bees, apicultural exotic disease surveillance report 31(4), 26; identifying viruses causing mortality in colonies infested with *Varroa destructor* 31(4), 22
Biliary coccidiosis, rabbit 31(1), 25
Black disease, sheep 31(3), 23
Bloat, abomasal, sheep 31(1), 23; cattle 31(3), 22
Blue duck, tapeworm 31(3), 17
Border inspection, Annual Report 31(2), 8
Bovine brucellosis ruled out 31(2), 32
Bovine cysticercosis, Annual Report 31(2), 20
Bovine tuberculosis, Annual Report 31(2), 21
Bovine virus diarrhoea, 31(2), 28; mucosal disease 31(3), 21; persistent infection 31(1), 22; virus exposure 31(3), 21
Bronchiolitis, proliferative, foal 31(1), 24
Brucella abortus, seropositivity in Hector's dolphin 31(3), 29
Brucella canis, ruled out 31(1), 26; 31(2), 33; 31(3), 27; 31(4), 36
Brucella ovis flock accreditation scheme, Annual Report 31(2), 25
BVD, persistent infection 31(1), 22; mucosal disease 31(3), 21
Brucella suis, ruled out 31(3), 27

C

Calf diarrhoea, infectious agents 31(3), 22
Camelostromylus mentulatus, alpaca 31(3), 17
Canine herpes virus, pups 31(3), 24
Capillaria, shore plover 31(3), 18
Carbon dioxide, use for euthanasia and anaesthesia 31(4), 28
Cardiomyopathy, cattle 31(1), 22; monkey 31(4), 34
Cats, atypical mycobacterial infection 31(3), 25; *Cryptococcus* 31(3), 25; 31(4), 34; disseminated intravascular coagulation 31(3), 25; dual FIV/FelV infection 31(4), 34; ethylene glycol toxicity 31(2), 31; mycobacterial infection 31(2), 31; polymyopathy and hypokalaemia 31(1), 25; *Salmonella* Typhimurium 31(3), 25; *Salmonella* Typhimurium phage type 160 31(4), 33; *Spirometra erinacei* 31(4), 18
Cattle, abomasal ulceration 31(1), 21; 31(3), 22; acorn poisoning 31(3), 23; alpha mannosidosis 31(3), 22; atypical interstitial pneumonia 31(2), 28; bloat 31(3), 22; BVD 31(1), 22; 31(2), 29; calf diarrhoea 31(3), 22; 31(4), 31; downer cows 31(4), 32; ergotism 31(3), 22; fungal abortion 31(3), 21; *Fusobacterium* 31(4), 31; hypocalcaemia and hypophosphataemia 31(3), 21; hypomagnesaemia 31(3), 22; ionophore toxicity 31(1), 21; jejunal haemorrhage syndrome 31(1), 21; *Klebsiella*

pneumoniae 31(3), 21; leptospiral abortion 31(4), 31; leukaemia 31(4), 32; liver necrosis 31(3), 22; malignant catarrhal fever 31(3), 21; 31(4), 31; metabolic disease 31(4), 31; *Mortierella* pneumonia 31(4), 31; mucosal disease 31(2), 29; 31(3), 21; neoplasia 31(2), 29; *Neospora* abortion 31(2), 29; 31(3), 21; neosporosis 31(1), 22; nitrate toxicity 31(3), 22; oleander toxicity 31(1), 22; photosensitivity 31(2), 29; 31(3), 21; polioencephalomalacia 31(1), 21; 31(2), 28; portocaval syndrome 31(1), 22; renal interstitial fibrosis and tubular atrophy 31(4), 31; rumen acidosis 31(2), 28; 31(3), 22; *Salmonella* Brandenburg 31(4), 31; *Salmonella* Typhimurium 31(1), 21; salmonellosis 31(2), 28; selenium deficiency 31(2), 29; 31(3), 22; 31(4), 31; skeletal and cardiomyopathy 31(1), 22; thrombocytopenia 31(3), 21; verminous pneumonia 31(2), 29; yersiniosis 31(1), 21; 31(2), 28

Cheyletiella, dog 31(2), 31

Circovirus II, pig 31(3), 24

Cobalt deficiency, deer 31(2), 29

Coccidia, kokako 31(3), 17

Coccidiosis, biliary in rabbit 31(1), 25; intestinal in dog 31(2), 31

Conjunctivitis, sheep 31(4), 32

Copper deficiency, deer 31(1), 22; 31(2), 29; sheep 31(1), 23

Copper poisoning, acute, deer 31(4), 32; chronic, sheep 31(3), 23; injectable copper toxicity, goats 31(4), 33

Cryptococcus, cat 31(3), 25; 31(4), 34

Cushings syndrome, horse 31(1), 24

D

Deer, cobalt deficiency 31(2), 29; copper deficiency 31(2), 29; acute copper poisoning 31(4), 32; enzootic ataxia 31(1), 22; haemolytic anaemia 31(3), 5; leptospirosis 31(3), 23; lung abscesses 31(4), 32; stress and exhaustion 31(2), 29

Deficiency, cobalt in deer 31(2), 29; copper in deer 31(1), 22; 31(2), 29; sheep 31(1), 23; selenium in cattle 31(2), 29; 31(4), 31

Degenerative spinal myelopathy, sheep 31(1), 23

Dermatitis, spongiotic vesicular, horses 31(1), 24

Diarrhoea, calf, infectious agents in 31(3), 22; calf 31(4), 31

Disseminated intravascular coagulation, cat 31(3), 25

Distemper, dog 31(3), 25

Do chain springs on leghold traps reduce injuries to captured possums? 31(1) 19

Dogs, Addison's disease 31(3), 24; *Cheyletiella* 31(2), 31; coccidial infection 31(2), 31; distemper 31(3), 25; fungal rhinitis 31(4), 33; hepatitis 31(1), 25; herpesvirus infection 31(1), 24; 31(3), 24; infectious canine hepatitis 31(1), 24; 31(4), 33; listerial abortion 31(1), 24; monensin toxicity 31(3), 24; nodular granulomatous episclerokeratitis 31(1), 24; phosphorus toxicity 31(3), 25; poisoning 31(2), 31; *Toxoplasma* 31(3), 25; *Trichuris* 31(2), 31; yeast infection 31(4), 33; yersiniosis 31(1), 25

Dolphin, Hector's, *Brucella abortus* seropositivity 31(3), 29

Donkeys, hyperlipidaemic syndrome 31(2), 31; *Strongyloides* infection 31(2), 31

Downer cows 31(4), 32

Duck, blue, tapeworm 31(3), 17

Duckling, *Pasteurella multocida* 31(3), 25

E

Echinococcus-hydatidosis eradication scheme, Annual Report 31(2), 12

Ehrlichia canis, ruled out 31(2), 33

Encephalitic listeriosis, sheep 31(3), 23

Encephalopathy, hepatic, horse 31(1), 24

Enteric listeriosis, sheep 31(3), 23

Enzootic ataxia, deer 31(1), 22; sheep 31(1), 23

Enzootic bovine leucosis eradication scheme, Annual Report 31(2), 24

Enzootic bovine theileriosis, ruled out 31(1), 25; 31(2), 32

Eosinophilic epitheliotropic disease, multisystemic, horse 31(1), 24

Eperythrozoon ovis, sheep 31(2), 29

Episclerokeratitis, nodular granulomatous, dog 31(1), 24

Equine herpesvirus abortion, ruled out 31(1), 26

Equine infectious anaemia, ruled out 31(2), 32; 31(3), 26; 31(4), 36

Equine influenza, ruled out 31(2), 31; 31(2), 32

Equine viral arteritis, ruled out 31(2), 31; 31(2), 32; 31(3), 26; 31(4), 36

Equine viral arteritis control scheme, Annual Report 31(2), 26

Ergotism, gangrenous, cattle 31(3), 22

Ethylene glycol toxicity, cat 31(2), 31

European foulbrood, ruled out 31(1), 27; 31(3), 28

Exotic bee mites, ruled out 31(1), 27

Exotic diseases, apicultural surveillance report 31(4), 26; suspected, quarterly reports of investigations 31(1), 25; 31(2), 32; 31(3), 26; 31(4), 35

Exotic fish viruses, ruled out 31(3), 29

Exotic mites of bees, ruled out 31(2), 34

Exotic systemic mycosis, excluded 31(2), 33

Exotic ticks identified 31(3), 27

Exotic ticks investigated 31(4), 36

F

FeLV, cat 31(4), 34

Fibroma, juvenile equine ossifying 31(1), 24

FIV, cat 31(4), 34

Fish, exotic viruses ruled out 31(3), 29

Fowl cholera, laying hens 31(2), 31

Fungal rhinitis, dog 31(4), 33

Fusobacterium, cattle 31(4), 31

G

Gastrointestinal parasitism, alpacas 31(2), 30; sheep 31(2), 30

Goat, abortion, *Bacillus licheniformis* 31(3), 24; copper toxicity 31(4), 33; polyarthritis 31(2), 30; ruptured abomasa 31(4), 33

H

Haematozoa, North Island robin 31(3), 18, 28

Haemolytic anaemia, undiagnosed in red deer 31(3), 5

Haemophilus somnus, cattle 31(1), 21

Hairy shaker disease, sheep 31(1), 22; 31(2), 30

Health assessment of wallabies from Kawau Island 31(1), 16

Hepatic encephalopathy, horse 31(1), 24

Hepatitis, canine 31(1), 25; infectious canine 31(1), 24; 31(4), 33

Hepatitis E virus, swine 31(3), 4

Hepatopathy, alpaca 31(4), 34

Herpesvirus infection, pups 31(1), 24; 31(3), 24

Hogget foetal loss 31(4), 32

Honey bees, apicultural exotic disease surveillance report 31(4), 26; identifying viruses causing mortality in colonies infested with *Varroa destructor* 31(4), 22

Horses, Cushings syndrome 31(1), 24; hepatic encephalopathy 31(1), 24; hyperlipidaemia and hypoglycaemia 31(4), 33; juvenile ossifying fibroma 31(1), 24; multisystemic eosinophilic epitheliotropic disease 31(1), 24; proliferative bronchiolitis 31(1), 24; spongiotic vesicular dermatitis 31(1), 24; *Trichinella* investigated 31(4), 36; *Trichinella spiralis* monitoring 31(1), 3

Hyperlipidaemic syndrome, donkey 31(2), 31; horse 31(4), 33

Hypocalcaemia and hypophosphataemia, cattle 31(3), 21

Hypokalaemia, cat 31(1), 25

Hypomagnesaemia, cattle 31(3), 22

Hypotrichosis, lambs 31(1), 22

I

IBD, seropositivity investigated 31(3), 28

Identifying the viruses causing mortality of honey bees in colonies infested with Varroa destructor 31(4), 22

Industry surveillance and disease control programmes, Annual Report 31(2), 24

Infectious bursal disease, ruled out 31(4), 37

Infectious bursal disease eradication programme, Annual Report 31(2), 27

Infectious canine hepatitis 31(1), 24; 31(4), 33

International animal trade, Annual Report 31(2), 4

Intestinal adenomatosis, pig 31(3), 24

Investigation, Trichinella spiralis 31(1), 5

Investigation of post-weaning multisystemic wasting syndrome 31(1), 11

Ionophore toxicity, alpacas 31(1), 23; cattle 31(1), 21

Isospora, kokako 31(3), 17

J

Jejunal haemorrhage syndrome, cattle 31(1), 21

Johne's disease, diagnosis 31(3), 8

Juvenile ossifying fibroma, horse 31(1), 24

K

Kawau Island, health assessment of wallabies from 31(1), 16

Klebsiella pneumoniae, cattle 31(3), 21

Kokako, Isospora 31(3), 17

L

Leptospira pomona, deer 31(3), 23

Leptospirosis, cattle 31(4), 31

Leptospirosis, deer 31(3), 23

Leukaemia, cattle 31(4), 32

Libyostrongylus douglassii in *New Zealand ostriches* 31(3), 14, 17, 28

Listerial abortion, dog 31(1), 24

Listeriosis, sheep 31(3), 23

Liver necrosis, cattle 31(3), 22

Llama, Trichuris tenuis 31(3), 17; *Oesophagostomum venulosum* 31(3), 17

Lung abscesses, deer 31(4), 32

Lymphosarcoma, cattle 31(2), 29

M

Malignant catarrhal fever, cattle 31(3), 21; 31(4), 31

Metabolic disease, cattle 31(4), 31

Monensin toxicity, suspected, dog 31(3), 24

Monitoring, Trichinella spiralis in pigs and horses 31(1), 3

Monkey, cardiomyopathy 31(4), 34; yersiniosis 31(4), 34

Mortierella, pneumonia in cattle 31(4), 31

Mucosal disease, cattle 31(2), 28

Multiple myeloma, cattle 31(2), 29

Multisystemic eosinophilic epitheliotropic disease, horse 31(1), 24

Mycobacterial infection, cat 31(2), 31; atypical, cat 31(3), 25

Mycobacterium avium subsp paratuberculosis, diagnosis 31(3), 8

Mycobacterium bovis, alpaca 31(1), 23

Mycotic abortion, cattle 31(3), 21

Myelopathy, degenerative spinal, sheep 31(1), 23

Myopathy, skeletal and cardio- in cattle 31(1), 22

N

National Centre for Disease Investigation, Annual Report 31(2), 14

National Chemical Residue Programme, Annual Report 31(2), 18

National Pest Management Strategies, Annual Report 31(2), 21

Nematode, exotic in alpaca 31(4), 35

Neoplasia, cattle 31(2), 29

Neospora, abortion in cattle 31(2), 29; 31(3), 21

Neosporosis, cattle 31(1), 22

New Zealand Food Safety Authority, reports in Annual Report 31(2), 18

Newcastle disease, ruled out 31(1), 26; 31(2), 34; 31(3), 27; 31(4), 37

Nitrate toxicity, sheep 31(2), 30; cattle 31(3), 22

Nodular granulomatous episclerokeratitis, dog 31(1), 24

North Island robin, haematozoa 31(3), 18, 28

O

OIE risk analysis framework: a flexible model for pest risk analysis 31(1), 8

Oleander toxicity, cattle 31(1), 22

Omasal and abomasal ulceration, cattle 31(3), 22

Ossifying fibroma, juvenile equine 31(1), 24

Ostriches, Libyostrongylus douglassii 31(3), 14, 17, 28

P

Parasite, new host records 31(3), 17

Parasitism, alpaca 31(4), 34

Parrot, polyoma virus 31(4), 34

Pasteurella multocida, ducklings 31(3), 25

Pasteurellosis, pneumonic in sheep 31(2), 30

Pathology of post-weaning multisystemic wasting syndrome in New Zealand pigs 31(4), 3

Pest risk analysis, OIE risk analysis framework a flexible model 31(1), 8

Pheasant, ventricular septal defect 31(2), 31

Photosensitivity, cattle 31(3), 21; hepatogenous in cattle 31(2), 28; primary in sheep 31(2), 30

Pigeons, avian virus survey 31(4), 20

Pigs, circovirus II 31(3), 24; diagnosis of PMWS 31(1), 26; intestinal adenomatosis 31(3), 24; investigation of PMWS 31(1), 11; pathology of PMWS 31(4), 3; *Pneumocystis pneumonia* 31(1), 23; response to PMWS diagnosis 31(4), 8; serological survey for PRRS during PMWS response 31(4), 15; *Serpulina pilosicoli* 31(2), 30; swine dysentery 31(1), 23; swine hepatitis E virus 31(3), 4; *Trichinella spiralis* disease investigation 31(1), 5; *Trichinella spiralis* monitoring 31(1), 3

Phosphorus toxicity, dog 31(3), 25

Plover, shore, *Capillaria* 31(3), 18

PMWS, diagnosed 31(1), 26; investigation 31(1), 11; pathology in NZ pigs 31(4), 3; response to first diagnosis 31(4), 8

Pneumocystis pneumonia, pigs 31(1), 23

Pneumonia, atypical interstitial in cattle 31(2), 28; *Mortierella* in cattle 31(4), 31; pasteurellosis in sheep 31(2), 30; verminous in cattle 31(2), 29

Poisoning, dog 31(2), 31

Polioencephalomalacia, cattle 31(1), 21; 31(2), 28; sheep 31(2), 29; 31(4), 32

Polyarthritis, goat 31(2), 30

Polymyopathy, cat 31(1), 25

Polyoma virus, parrot 31(4), 34

Poroporo toxicity, sheep 31(1), 23

Portocaval syndrome, cattle 31(1), 22

Possums, chain springs on leghold traps to reduce injuries 31(1), 19

Post-weaning multisystemic wasting syndrome, diagnosed 31(1), 26; investigation 31(1), 11; pathology in NZ pigs 31(4), 3; response to first diagnosis 31(4), 8

Poultry health surveillance, Annual Report 31(2), 27

Proliferative bronchiolitis, foal 31(1), 24

PRRS, serological survey for during response to PMWS 31(4), 15

Psittacine poxvirus, ruled out 31(3), 28

Q

Quarterly report of investigations of suspected exotic diseases 31(1), 25; 31(2), 32; 31(3), 26; 31(4), 35

Quarterly review of diagnostic cases – April to June 2004 31(3), 21

Quarterly review of diagnostic cases – January to March 2004 31(2), 28

Quarterly review of diagnostic cases – July to September 2004 31(4), 31

Quarterly review of diagnostic cases – October to December 2003 31(1), 21

R

Rabbit, biliary coccidiosis 31(1), 25

Red blood cell inclusions in a North Island robin 31(3), 28

Register of new host-parasite records 31(3), 17

Renal interstitial fibrosis and tubular atrophy, cattle 31(4), 31

Response to first diagnosis of post-weaning multisystemic wasting syndrome 31(4), 8

Review of diagnostic cases 31(1), 21; 31(2), 28; 31(3), 21; 31(4), 31

Rhinitis, fungal, dog 31(4), 33

Rinderpest, ruled out 31(4), 35

Risk analysis, OIE framework a flexible model for pest risk analysis 31(1), 8

Rumen acidosis, cattle 31(2), 28; 31(3), 22

Ruptured abomasa, goats 31(4), 33

S

Salmonella, Brandenburg, cattle 31(4), 31; sheep 31(4), 32; Enteritidis, cattle 31(2), 29; Hindmarsh, sheep 31(1), 23; sheep 31(2), 30; Typhimurium, cat 31(3), 25; cattle 31(1), 21; *Salmonella* Typhimurium phage type 160, cat 31(4), 34

Salmonellosis, cattle 31(2), 29; sheep 31(2), 30; 31(3), 23

Sarcocystis, sheep 31(3), 24

Selenium deficiency, cattle 31(2), 29; 31(3), 22; 31(4), 31

Serological survey for PRRS during a response to PMWS 31(4), 15

Serpulina pilosicoli, pigs 31(2), 30

Sheep, abomasal bloat 31(1), 23; abortion 31(4), 32; arthritis 31(2), 30; *Bacillus licheniformis* 31(4), 32; Black disease 31(3), 23; conjunctivitis 31(4), 32; copper poisoning 31(3), 23; degenerative spinal myelopathy 31(1), 23; enzootic ataxia 31(1), 23; *Eperythrozoon ovis* 31(2), 29; gastrointestinal parasitism 31(2), 30; hairy shaker disease 31(1), 22; 31(2), 30; hogget foetal loss 31(4), 32; hypotrichosis 31(1), 22; listeriosis 31(3), 23; nitrate toxicity 31(2), 30; pneumonic pasteurellosis 31(2), 30; primary photosensitisation 31(2), 30;

polioencephalomalacia 31(2), 29; 31(4), 32; poroporo toxicity 31(1), 23; *Salmonella* Brandenburg 31(4), 32; *Salmonella* Hindmarsh 31(1), 23; 31(2), 30; salmonellosis 31(3), 23; *Sarcocystis* 31(3), 24; toxic plant ingestion 31(4), 33

Shore plover, *Capillaria* 31(3), 18

Skeletal myopathy, cattle 31(1), 22

Spirometra erinacei tapeworm in a feral cat 31(4), 18

Spongiotic vesicular dermatitis, horses 31(1), 24

Sporidesmin toxicity, alpaca 31(2), 30

Stress and exhaustion, deer 31(2), 29

Strongyloides infection, donkey 31(2), 31

Surveillance, apicultural exotic disease surveillance report 31(4), 26; *Trichinella spiralis* in horses and pigs 31(1), 3

Survey, serological for PRRS 31(4), 15; avian virus in pigeons 31(4), 20

Swine dysentery 31(1), 23

Swine hepatitis E virus in New Zealand 31(3), 4

T

Taenia saginata investigated 31(3), 27; 31(4), 35

Tapeworm, blue duck 31(3), 17; *Spirometra erinacei* in a cat 31(4), 18

Theileriosis, enzootic bovine ruled out 31(1), 25

Thrombocytopaenia, cattle 31(3), 21

Ticks, exotic, identified 31(3), 27

Toxic hepatopathy, alpaca 31(4), 34

Toxicity, acorn 31(3), 23; copper, deer 31(4), 32; copper, goats 31(4), 33; copper, sheep 31(3), 23; ethylene glycol in cat 31(2), 31; ionophore in alpacas 31(1), 23; in cattle 31(1), 21; monensin in dog 31(3), 24; nitrate in sheep 31(2), 30; in cattle 31(3), 22; oleander in cattle 31(1), 22; phosphorus in dog 31(3), 25; poroporo in sheep 31(1), 23

Toxoplasma, dog 31(3), 25

Tracheal mites of bees, ruled out 31(4), 37

Transmissible spongiform encephalopathy, ruled out 31(1), 25; 31(2), 32; 31(3), 26; 31(4), 35

Traps, chain springs on leghold traps to reduce injuries to possums 31(1), 19

Trichinella, investigated in horses 31(4), 36

Trichinella spiralis disease investigation 31(1), 5

Trichinella spiralis monitoring in pigs and horses 31(1), 3

Trichinella spiralis, ruled out 31(3), 27

Trichuris, dog 31(2), 31; new species in llama 31(3), 17

TSE programme, Annual Report 31(2), 19

U

Ulceration, abomasal in cattle 31(1), 21

Use of carbon dioxide for euthanasia and anaesthesia 31(4), 28

V

Varroa, identifying viruses causing mortality in honey bees in infested colonies 31(4), 22; ruled out in South Island 31(4), 37

Varroa in the South Island investigated 31(3), 29

Varroa Management Programme, Annual Report 31(2), 12

Ventricular septal defect, pheasant 31(2), 31

Verminous pneumonia, cattle 31(2), 29

Vertebrate toxic agents, welfare assessment 31(3), 19

Vesicular diseases, ruled out 31(1), 25; 31(2), 32; 31(3), 26

Viral haemorrhagic septicaemia in marine fish, investigated 31(2), 34

Viruses, causing mortality of honey bees in colonies infested with *Varroa destructor* 31(4), 22

W

Wallabies, health assessment Kawau Island 31(1), 16

Wasting syndrome, investigation of PMWS 31(1), 11

Welfare assessment of vertebrate toxic agents 31(3), 19

Wireworm, ostriches 31(3), 14, 17, 28

Y

Yeast infection, dog 31(4), 33

Yersiniosis, cattle 31(1), 21; 31(2), 28; dog 31(1), 25; spider monkey and golden lion tamarins 31(4), 34

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