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Rabbit Haemorrhagic Disease in Australia and New Zealand

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It is now seven years since rabbit haemorrhagic disease (RHD) became established in Australia. The causative rabbit haemorrhagic disease virus (RHDV) escaped from a quarantine compound on Wardang Island off the coast of South Australia. It rapidly spread throughout southern Australia, including Tasmania, in later stages helped by deliberate releases. Soon after, the virus was introduced illegally to New Zealand and is now established on both the North and South islands.

The sudden spread of the virus in both instances meant that research workers were generally ill prepared for monitoring the initial impact of the virus on rabbit populations. Indeed, existing studies on rabbits, set up to monitor seasonal changes in rabbit populations or to measure the success of applied controls such as warren ripping, were severely disrupted when the disease first spread. Nevertheless, these studies became focal points for investigating the epidemiology of RHD, because the abundance of rabbits was measured before and after the spread of the disease. The best early estimates of the impact of RHD on wild rabbit populations came from such studies.

The spread of RHD across the Australian continent and its impact on rabbit populations and the environment were carefully monitored through a collaborative program in which all States and Territories participated. The program provided an unprecedented opportunity to record the initial behaviour of the disease, which would have been impossible to assess once the virus became widely established. In both New Zealand and Australia, these preliminary studies gave the first insights into likely regional variations in the efficacy of this new biological control agent and into the mechanisms that might explain its rapid spread. In particular, the role that insects such as flies played in the initial spread was elucidated.

The seventeen papers in this special issue of *Wildlife Research* further advance our knowledge of RHD. They answer some of the questions thrown up by initial observations, and give insight into the changing epidemiology of RHD. After the initial spread of the virus through largely naïve rabbit populations, the epidemiology of RHD took on a new form as the virus became a persistent biological control agent within rabbit populations in which many surviving rabbits were immune. On a broad scale, RHDV now causes regular annual outbreaks in both Australia and New Zealand; however, the details differ from one locality to another. For example, outbreaks may occur in winter in some areas but during summer in others, or they may be erratic and not always occur in successive years.

Interestingly, much of the work reported in these papers has relied heavily on ELISA methods to detect virus and antibodies in rabbits that recover from infection. Some of these methods were developed at the Australian Animal Health Laboratory, Geelong, but a major breakthrough was achieved by using ELISAs developed when RHD first spread through rabbits in Europe some years earlier. In particular, the expert advice and collaboration of Dr Lorenzo Capucci and his colleagues within the RHD World Reference Laboratory in Italy is widely acknowledged in both New Zealand and Australia.

Research into RHD is clearly moving on from the purely descriptive phase. The questions being asked and analyses being done are becoming increasingly complex. Four papers provide useful models, both analytical and predictive, that illustrate how RHD research is contributing to a detailed understanding of its epidemiology. Conceptual models to describe the likely interactions between RHDV and the myxoma virus, or interactions between RHDV and putative RHDV-like viruses, also provide a first step towards more-detailed hypothesis testing.

The spread of RHD has also provided a large-scale natural experiment that gives unique insight into a problem that has long interested ecologists: namely, the interactions between predators and their prey. The importance of rabbits in supporting populations of introduced predators such as feral cats and foxes is becoming clearer from this work. Likewise, the interactions between predation and disease in the population dynamics of rabbits are being experimentally explored.

Importantly, many of the papers are of an applied nature and ask what the release of a biological control agent has achieved in terms of increased agricultural production or benefits to native vegetation and other conservation values. They also provide recommendations for capitalising on the substantial benefits of RHD by ensuring that rabbit numbers are kept low for as long as possible. Ripping of largely deserted rabbit warrens to remove residual populations and slow down future resurgence is a case in point.

Dr Michael Holland first suggested the idea of bringing together recent research on RHD in a single volume. However, this came to fruition only because the Rabbit Calicivirus Program and Rabbit Calicivirus Disease Management Group were prepared to support it financially, and because David Morton of CSIRO Publishing provided a major input as Managing Editor of *Wildlife Research*.