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Australian Pest Animal Research Program

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Introduction

Invasive pest animals, such as rabbits, foxes, wild dogs, pest birds and feral pigs have adapted and spread into Australia's agricultural systems and natural environments. They cause considerable economic, environmental and social damage and, despite considerable effort, none have been eradicated from the Australian mainland (Bomford & O'Brien 1995).

Given these established pests cannot be eradicated, effective management is required to reduce their impact on agriculture and the environment. Veterinarians working in agricultural production settings, as well as those interested in conservation biology, play a key role in pest animal management in Australia. For example, practising vets may be required to respond to injured livestock as a result of wild dog predation, treat accidentally poisoned domestic dogs, or advise producers on managing the agricultural impacts of pest animals. Furthermore, a majority of wildlife vets and conservation biologists are very familiar with the impacts of vertebrate pests through their work on Australian native fauna and ecosystems.

Since 2008–09, the Australian Pest Animal Research Program (APARP) has provided funding of \$2.8 million to 38 research projects to improve pest animal management in Australia. These projects cover a variety of pest species and a diverse range of topics. Some of these projects are briefly discussed in this paper.

Pest animal impacts and control

More than 80 exotic vertebrate species have established wild populations in Australia and more than 30 of these have become pests (Bomford & Hart 2002). Invasive species are considered to be pests when they have, or have the potential to have, an undesirable economic, environmental or social/cultural impact. Such impacts may include damage to agricultural crops, livestock predation, soil erosion and land degradation, spread of weeds, pasture/food and habitat competition, and the potential spread of disease. Gong et al. (2009) estimated the overall direct economic impact of several pest animal species (foxes, rabbits, wild dogs, feral pigs, birds and mice) in Australia to be \$740 million annually. This included \$620.8 million of production losses in agriculture (including horticulture) and \$122.7 million on expenditure on pest animal management, administration and research in Australia. Some of the social impacts of pest animals include damage to infrastructure or cultural/historical sites, being 'a nuisance', causing traffic accidents, as well as significant social/psychological impacts on primary producers; for example, through distress of wild dog predation on livestock.

In Australia, on-ground control of pest animals is the responsibility of state and territory governments and individual landholders. The role of the Australian Government, as outlined in the Australian Pest Animal Strategy (APAS), is to coordinate, facilitate and promote strategic and nationally-consistent pest animal management planning, policies and actions; and to provide leadership, coordination and resources for research and development of improved and integrated approaches for effective pest animal management at all levels and for raising awareness about pest animal issues of national significance (NRMMC 2007).

According to the APAS, pest animal management techniques should be cost-effective, target-specific, cause minimal damage to the environment or other assets, and satisfy animal welfare criteria. Common techniques employed in control of pest animal impacts include killing or removal (for example, by baiting, trapping, shooting or mustering); biological control agents; exclusion fencing; habitat manipulation (for example, by removal of surface harbour for rabbits); and changes in land use and practices (NRMMC 2007).

Research into pest animal impacts and control

Several organisations and programs have invested in pest animal research, including the Invasive Animals Cooperative Research Centre (IACRC), the CSIRO, state and territory agriculture and environment agencies, and the Australian Government. APARP was established in 2008–09 under the Australian Government’s Caring for our Country initiative to fund research and extension projects that develop and promote improved approaches to the management and monitoring of agricultural pest animals. APARP is administered through the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), in the Department of Agriculture, Fisheries and Forestry (DAFF).

The focus of APARP is on short-term research, development and extension activities aimed at reducing the agricultural impacts of pest animals. Funding has been provided to state and territory governments, natural resource management groups, the IACRC, universities and the CSIRO to generate results of ‘national significance’. ABARES collaborates closely with the IACRC; the Vertebrate Pests Committee, and through it, the CSIRO; the Department of Sustainability, Environment, Water, Population and Communities; the RSPCA; and state and territory agencies to avoid duplication of effort and to respond to gaps in research and development effort. The APARP application assessment panel also includes representatives from most of these organisations and DAFF.

In summary, the APARP aims to:

- develop integrated, strategic approaches to manage the impacts of nationally significant pest animals on agriculture
- improve the effectiveness of control techniques and strategies for reducing pest animal impacts on agriculture
- produce guidelines and extension materials for the best practice management of nationally significant pest animals
- quantify the benefits of pest animal management.

APARP, together with the IACRC, is one of the major initiatives through which the Australian Government fulfils its coordination, research and development roles in relation to pest animal management under the Australian Pest Animal Strategy.

Outcomes of APARP funding

APARP funds research projects that develop and promote improved approaches to the management and monitoring of agricultural pest animals. Some project examples are summarised below but more information on these or other projects can be obtained directly from project researchers, or by contacting the APARP program managers at ABARES at aparp@daff.gov.au.

Registration of orally-deliverable methaemoglobinaemia antidote

The IACRC has developed a new shelf-stable manufactured bait for wild canid control, incorporating the novel toxicant para-aminopropiophenone (PAPP). Following ingestion this toxin results in a metabolite (para-hydroxy aminopropiophenone, PHAPP) that oxidises haemoglobin to methaemoglobin causing reduced oxygen-carrying capacity of erythrocytes and metabolic anoxia. Clinical signs in affected animals include lethargy, progressing to loss of

consciousness and rapid death (within 1 or 2 hours of initial clinical signs) without accompanying signs of distress. PAPP is particularly toxic to carnivores; humans and birds are less susceptible to toxicity (Eason et al. 2010; Savarie et al. 1983).

One of the major benefits of PAPP, other than its greater welfare outcomes and target-specificity compared with alternative baits such as 1080, is the availability of an antidote for the treatment of accidentally poisoned domestic dogs (pets and working dogs). Methylene blue is registered for use as an intravenously administered product; however, an orally deliverable formulation would allow dog owners to administer the drug to affected dogs, critical for successful treatment in remote areas where veterinary attention is far away.

In 2008–09 and 2009–10, APARP funded two projects with the IACRC to determine the efficacy and safety of methylene blue administered intravenously and orally as an antidote to methaemoglobinaemia caused by lethal PAPP/sodium nitrite poisoning of domestic dogs and to meet the requirements for registration of an oral product with the Australian Pesticides and Veterinary Medicines Authority (APVMA). The oral formulation Bluehealer® is currently going through APVMA registration; the availability of this product in the future should have a positive impact on participation rates within fox and wild dog baiting programs, to improve the effectiveness of landscape-scale wild canid control with benefits for several agricultural industries.

Developing best practice guidelines for using livestock guardian dogs

Livestock guardian dogs (breeds such as the maremma sheepdog, Pyrenean mountain dog and Anatolian shepherd) are used in many parts of the world to protect livestock from predators such as wild dogs, foxes, dingoes, wolves and big cats. The best practice manual for using livestock guardian dogs was developed following concern from producers about lack of information about effective use of guardian dogs in Australia. Production of the manual (van Bommel 2010) was supported through an APARP grant to the IACRC in 2008–09 and presents information from a range of producers, dog breeders and owners to assist prospective owners of guardian dogs to successfully employ these animals in a range of environments and production settings in Australia. The manual can be downloaded from www.invasiveanimals.com/wp-content/uploads/2010/09/Guardian-Dogs-web.pdf.

Calicivirus map of Australia

This project was funded under an APARP grant to the CSIRO in 2011–12 and will collect rabbit serum samples from various sites across Australia to be analysed for the presence of both rabbit haemorrhagic disease virus (RHDV) and Rabbit Calicivirus Australia-1 (RCV-A1). RCV-A1 is a benign calicivirus that has circulated in the Australian wild rabbit population since the rabbit's introduction 150 years ago (Jahnke et al. 2010) and causes a non-pathogenic infection that elicits production of antibodies that cross-react to RHDV and provide partial protection from lethal RHDV infection, interfering with rabbit control in some parts of Australia (Strive et al. 2010).

The results of the serum sample analyses will be used to develop spatial distribution maps of the two caliciviruses, as well as to gain an understanding of the temporal distribution of the benign virus in wild rabbit populations. This information will allow land managers to adopt a more strategic approach to using RHDV as a biocontrol. For example, where both RCV-A1 and RHDV are absent, there is a strong case for RHDV release. On the other hand, where RCV-A1 is present, it may occur at certain times of the year only and therefore may allow 'windows of opportunity' for application of RHDV biocontrol.

In addition, the 'Calicivirus map' will be useful in identifying areas suitable for release of potential new pathogenic strains of RHDV, currently being assessed under the collaborative project 'RHD Boost'. This research is being undertaken through the Australian Government Caring for our Country initiative and is assessing RHDV strains from around the world for their ability to overcome the cross-protection provided by RCV-A1 and complement the existing RHDV biocontrol strain in Australia.

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