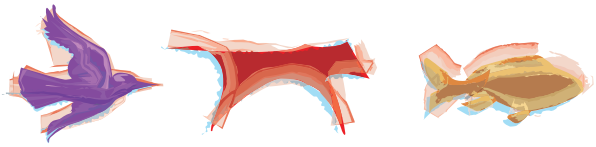
Invasive Animals Cooperative Research Centre

ANNUAL REPORT 10–11

An Australian Government Initiative

CRC AUSTRALIA



Invasive Animals Cooperative Research Centre

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Covershot: Juvenile carp aggregating at the Menindee dam wall, Darling River, NSW in September 2011. Picture by Nigel Harriss, NSW Office of Water.

OUR PURPOSE

To counteract the impact of invasive animals through the application of new technologies and by integrating approaches across agencies and jurisdictions.

OUR PARTICIPANTS

THIRD PARTY PARTICIPANTS

During the reporting period The Kangaroo Island Natural Resources Management Board provided significant in-kind contributions to the Kangaroo Island Demonstration Site project. Contributions were also received from the US Department of Agriculture who have generally supported and collaborated with the CRC for several years in areas of shared interest including pig control solutions and fertility control developments.

CHANGES TO PARTICIPANTS

The University of Western Australia gave notice and withdrew from the CRC effective from 16 November 2010. The past involvement of UWA with the CRC resulted in some excellent science, including an attempt to deliver an immunocontraceptive vaccine for the control of mouse plagues, improving understanding of the molecular ecology of wild dogs in Australia and the evaluation of the implementation of DNA technologies to better inform our management of wild dogs. The current research program does not offer synergies between our activities and the interests of UWA, so a withdrawal was mutually agreed.

During the year some formal amendments were recognised through a Deed of Variation to the Commonwealth Agreement, to reflect changes to the names of State Departments and Statutory Authorities.

Participants currently parties to the Invasive Animals CRC

Participant Name	Participant Type	Organisation Type
Animal Control Technologies (Australia)	Core	SME
Australian Veterinary Association	Core	Industry/Private Sector
CSIRO	Core	Australian Government
Environment ACT	Core	State Government
Dept of Employment, Economic Development and Innovation QLD	Core	State Government
Department of Environment & Conservation WA	Core	State Government
Dept of Environment, Climate Change & Water NSW	Core	State Government
Department of Primary Industries Victoria	Core	State Government
Murray-Darling Basin Authority	Core	Australian Government
NSW Department of Industry & Investment	Core	State Government
Parasitech Pty Ltd	Core	SME
Pestat Pty Ltd	Core	SME
SA Department of Primary Industries (SARDI and NRM Biosecurity Departments)	Core	State Government
University of Canberra	Core	University
University of Newcastle	Core	University
University of Queensland	Core	University
University of Sydney	Core	University
Valuemetrics Australia	Core	SME
Australian National University	Supporting	University
Australian Wildlife Conservancy	Supporting	Industry/Private Sector
Australian Wool Innovation	Supporting	Industry/Private Sector
Bureau of Rural Sciences	Supporting	Australian Government
Carpbusters	Supporting	Industry/Private Sector
Cattle Council of Australia	Supporting	Industry/Private Sector
Connovation	Supporting	International
Grains Research & Development Corporation	Supporting	Industry/Private Sector
K&C Fisheries Global PL	Supporting	SME
Meat & Livestock Australia	Supporting	Industry/Private Sector
New Zealand Department of Conservation	Supporting	International
New Zealand Landcare Research	Supporting	International
QLD Department of Primary Industries	Supporting	State Government
State Management Council of NSW Livestock, Health and Pest Authorities	Supporting	State Government
Tasmanian Department of Primary Industries, Water & Environment	Supporting	State Government
UK Central Science Laboratory (FERA)	Supporting	International
University of Minnesota	Supporting	International
University of York	Supporting	International
Victorian Dept of Sustainability and Environment	Supporting	State Government
WA Department of Agriculture and Food	Supporting	State Government
WWF Australia	Supporting	Industry/Private Sector

During the year some formal amendments were recognised through a Deed of Variation to the Commonwealth Agreement, to reflect changes to the names of State Departments and Statutory Authorities.

Participant Name	Retiring or New	Department Approval Yes/No
State of Qld through the Department previously known as Natural Resources & Mines	Retiring	Yes
State of SA through the Department previously known as Water, Land and Biodiversity Conservation for the Animal and Plant Control Commission of SA	Retiring	Yes
State of WA through the Department of Conservation and Land Management	Retiring	Yes
Murray-Darling Basin Commission	Retiring	Yes
Animal Control Technology Holdings	Retiring	Yes
University of Western Australia	Retiring	No
State of Qld through the Department of Employment, Economic Development and Innovation	New	Yes
State of WA through the Department of Environment and Conservation	New	Yes
Murray-Darling Basin Authority	New	Yes
Animal Control Technology (Australia)	New	Yes

NATIONAL CHALLENGE: Reducing the impacts of invasive animals

CEO, Mr Andreas Glanznig

Rabbits, foxes, wild dogs, carp, feral pigs and other invasive animals are an insidious threat to Australia's food and fibre security, our globally significant biodiversity and social well-being.

Around the turn of this century in the midst of a severe prolonged drought, invasive animals cost Australia at least $740 million every year in lost agricultural production and control costs. With current wetter conditions and access to more food, invasive animal numbers have swelled leading to increasing impacts. For instance, the widespread mouse plague in 2010–11 alone cost graingrowers more than $200 million in lost crop production.

Invasive animals are among the biggest threats to the conservation of Australia's wildlife and the environment. Foxes, feral cats, rabbits and rats have contributed to numerous mammal and bird extinctions and still impact on hundreds of threatened plant and animal species. The rabbit, for example, impacts 156 threatened species and native vegetation over two-thirds of Australia.

New and emerging pests, combined with new challenges posed by established pests have created a dynamic and constantly changing situation.

This is all compounded by the nature of this challenge.

It is chronic, diffuse, lacks clear ownership and responsibilities, all of which have led to market failure. This state has stymied innovation in many areas of invasive animal management, particularly in the development of new control technologies.

Furthermore, the reduced effectiveness of rabbit biocontrol technologies, societal demand for more humane controls and the global trend restricting or withdrawing currently used control products underscore the imperative for ongoing innovation.

The response to this national challenge: the Invasive Animals Cooperative Research Centre.

Andreas Glanznig
Chief Executive
Invasive Animals CRC

CONTENTS

01 CHAIR'S FOREWORD

Invasive Animals CRC at a crossroad

The Invasive Animals CRC is at an extremely important crossroad. We have made it to the final stage (the interview) of the Round 14 CRC program selection process in a bid for a five-year extension. While it is fantastic that we have made it this far, the final stage is incredibly competitive.

What does this mean? It means that our CRC is one of 10 applicants vying for between three to five final places. Our bid coincides with mouse plagues and surging carp and pig numbers all of which pose significant threats to our country's long-term sustainability and prosperity. These issues have heightened awareness of invasive animals and lifted the profile of our CRC, strengthening our case that invasive animals have the capacity to affect all aspects of Australian productivity, trade, environmental and social well being.

No magic bullets

Nationally and internationally the control of invasive animals is a never-ending challenge. Experience has shown that there are no magic bullets in terms of reducing damage caused by pest species and in many cases there are no permanent solutions. This area of research will always be needed if we are to protect our biodiversity from invasions by pest species, reduce impacts on agricultural production, help prevent invasions in our urban centres and ease associated burdens on families whose enterprises supply food and fibre to the nation.

Invasive animals destroy livelihoods

Today on the national stage, sheep numbers are at a record low. Across Australia, millions of hectares have been decommissioned due to the impacts of wild dogs. In Queensland wild dogs are cited to be the most important cause of the dramatic decline of sheep flocks and associated infrastructure from 16 million in the late 1980s to approximately 3 million sheep today. Wild dogs are literally driving sheep out of Queensland.

Adding to these statistics are demographic and other environmental trends. Rural demographics have had a major shift with fewer experienced and knowledgeable people to do the work and new people who have no knowledge and little understanding that animals sometimes do have to be killed. This places enormous pressure on invasive and pest animal management. It also places pressure on the environment, such as our management of landscape erosion caused by escalating pig and rabbit numbers, continues to underpin Australia's status in the trading arena. Few commodities are sold today without some reference to their environment and how it is impacted, preserved or enhanced by production.

Pressure on land use has also heightened the need to use our resources well. Globally, in an effort to satisfy a demand for higher protein diets and green energy for the production of ethanol, we are experiencing an unsustainable growth trend (in the millions of hectares) planted to coarse grain. In just 20 years, an additional 75 million hectares have been planted to crops and there is a predicted increase in 2012 alone of a further 14 million hectares. Concurrently the average yield has increased by 0.72 tonnes per hectare. To meet world grain demands and lower the environmental impact from new areas being cleared, lowering crop damage is essential.

Commitment to tackling invasive animals

With all this in mind, the Invasive Animals CRC Board has looked to the long-term structure of our sector to help draft the shape of the next stage of our CRC and to pinpoint how we can continue to build on the investment we have all made, the outstanding collaboration of scientists, commercial partners, communities and government.

Chair, Ms Helen Cathles

Our goal is to ensure that there is an enduring organisation committed to tackling these issues and to lead the international charge through excellent science and collaboration. The Board is focused and working to achieve our goal.

Commendations

The tremendous success of the Invasive Animals CRC to date is a reflection of excellent leadership by our CEO, Andreas Glanznig, program directors Glen Saunders and Steve Lapidge, our Program Leaders and our partner organisations.

Also integral to our successes has been the outstanding governance and financial management of the Invasive Animals CRC by Susan Duson. The Board acknowledges the outstanding service of Susan including year-on-year of unqualified audits and smooth running financial systems. Susan will be presented an award by the Board acknowledging her performance.

Thank you

To all Invasive Animals CRC members and staff, to the Board, and the Audit and Risk Committee, I sincerely thank you for your enthusiasm, hard work, time and commitment to the extension bid. Business 'as usual' along with an extension bid equates to a significant workload and despite the additional challenge for some from earthquakes and floods, you have embraced this challenge.

I would also like to thank our retiring Director, Mark Lonsdale, who has always strengthened our Board with his insights and considered contributions.

Outcome orientated

As we enter the end-game of the existing Invasive Animals CRC, do reflect on the many outstanding PhDs, awards and prizes that have been received and given within the Invasive Animals CRC and externally to our Invasive Animals CRC colleagues. Coupled with the new products, technologies and delivery to end users that your work has enabled, the Invasive Animals CRC has 'delivered in spades' on the trust placed in us by the Department of Innovation, Industry, Science and Research (DIISR) and the CRC Program, congratulations.

The dawning of a new era

What does the future hold? Will our extension bid be successful - can we change the history of invasive animal pest management?

Our future is making its way onto the horizon. Just how it will evolve is yet to be determined. November this year is the month when this Round of bids are considered and the future of our CRC will be announced early 2012.

I, like many end users, have been in that place of great despair and have experienced pest dilemmas of increasing magnitude while being ill-equipped to deal with such dilemmas.

Right now, as the Invasive Animals CRC Chair and an end user, I have a great sense of excitement by the potential that is opening up before us. I see the dawning of an entirely new approach to pest animal management in our extension bid.

However, it is just that: it is the first rays of the sun as day breaks, when the sun's rays hit the ground and on their own are not yet strong enough to promote growth. This is exactly where the Invasive Animals CRC is — we must go forward.

02 EXECUTIVE SUMMARY

The Invasive Animals CRC made exceptional progress in the 2010–11 financial year and is now strongly positioned to deliver its key technologies and ensure their strong uptake through its PestSmart toolkits and roadshow initiative. This high level of performance has seen Invasive Animals CRC staff win a number of prestigious international and national awards and also resulted in industry and government end-users increasing their investment levels in the five-year extension bid.

MAJOR RESEARCH ACHIEVEMENTS

Outcome 1: A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%

Strategic and systematic Tasmanian fox detection effort was achieved during the reporting period. As part of Tasmanian fox detection demonstration site and the Tasmanian fox eradication program, the Tasmanian *Great Poo Pick–up* event was held during the year and 9,009 potential fox scats were genetically screened for fox DNA using a technique developed by the Invasive Animals CRC and the University of Canberra. Fifty–nine of these were positives and provided the CRC team with invaluable information. The project has significantly increased our understanding of where foxes reside in Tasmania.

All additional studies completed to enable Australian Pesticides and Veterinary Medicines Authority (APVMA) full regulatory assessment of new DOGABATE® and FOXECUTE® products. In response to an APVMA requirement for additional toxicological studies, follow–up research has been completed to enable APVMA to start their full assessment process of our two new PAPP product applications – DOGABATE® and FOXECUTE® – from Animal Control Technologies.

Outcome 2: A national benefit of $16 million per annum by reducing feral pig damage by 15%

The Daintree Queensland demonstration site project was completed during the year and more than 20 scientific papers are now in the pipeline. The project assessed the impacts of feral pigs on the conservation value of the Wet Tropics World Heritage Area and aimed to develop acceptable means to enhance feral pig control in this sensitive Area. The demonstration project produced three PhD graduates, one MSc graduate and one Honours graduate. Information gleaned from these will significantly improve our understanding of the impact of feral pigs in the Daintree rainforest and how management can be improved.

The HogHopper™ was launched in December 2010 subsequently won an award for ‘Best Australian Made Machine’ at the Toowoomba Agricultural Show. The HogHopper™ is a low maintenance, target specific bait hopper for population level feral pig management using PIGOUT® or HOG-GONE® baits. Uptake has been strong and the device is selling well through Animal Control Technologies Australia.

Outcome 4: A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species

Daughterless platform technology was demonstrated to be inheritable and a prototype female–lethal (daughterless) construct was successfully tested during the year. The prototype was tested through three generations of zebrafish, with marked effects on offspring sex ratios. A prototype female–lethal carp construct, built wholly of native carp genetic material, was also successfully tested.

Outcome 6: Reduced impact of feral cats over five million hectares

The southern Western Australia demonstration site is near completion with more than 20 scientific journal papers in the pipeline. Based on DNA recovered from collected hair, the project demonstrated mesopredator release of cats in the presence of repeated use of baits for fox control, which in turn was the major predator of the woylie at an iconic conservation site that is baited for fox control. Using molecular techniques, predator species and the individual predators responsible for predation events were identified.

Outcome 7: Increased agricultural profitability through improved integration of existing biological, conventional and newly–developed control options for rabbits

Two larger-scale infection studies were conducted to assess the extent of cross protection that RCV– A1 provides to lethal RHDV infection. Preliminary results indicate that the protection can be up to 40% but varies, and may depend on a variety of factors such as challenge dose of RHDV, the particular strain of benign calicivirus used and, most importantly, the time between infections with the two viruses. The latter finding is of particular importance as it indicates that the protection conveyed by RCV–A1 may be temporal, and that there may be a window of opportunity for RHDV to be applied effectively in populations that carry the benign calicivirus.

As part of the RHD Boost Project, strains of RHDV have been selected and imported from France, Spain and South Korea. Genetic and antigenic comparisons of these imported RHDV strains have been conducted and five candidate strains have been selected for further evaluation. Master virus stocks for the candidate strains have been produced and a regime for testing for freedom from adventitious agents is under negotiation with Biosecurity Australia and Australian Quarantine and Inspection Service (AQIS). Real time Polymerase Chain Reaction (PCR) assays for assessing virulent and benign rabbit caliciviruses have also been produced.

EDUCATION TRAINING SUMMARY

The Invasive Animals CRC education program consists of 29 PhD students, two Masters students and two Honours students. During 2010–11, six PhD theses were submitted. No Masters or Honours were submitted during 2010–11. Cumulatively, 12 PhD students have now had their awards conferred, three have submitted their theses and are awaiting acceptance and 14 are still in progress. Of the two Masters students, one has had their award conferred and one is still in progress, while both Honours degrees have been awarded.

To date, Doctors of Philosophy have been conferred to 91% of Cohort 1 students. This completion rate is far above the reported national average (64% overall and 75% in Natural Sciences). The one remaining student is on track to complete their PhD by the end of November 2011.

PUBLICATIONS SUMMARY

During 2010–11, the Invasive Animals CRC published:

- one formal book
- three formal book chapters
- 18 refereed articles
- four refereed proceedings
- 33 publications for end users.

AWARDS — RECOGNITION FOR EXCELLENCE IN RESEARCH AND EDUCATION

External awards of note during the year to be received by the Invasive Animals CRC were the **National Award for Excellence in Innovation** and an award for science promotion at the **Australian Museum Eureka Prize Awards**.

The Invasive Animals CRC won an Award for Excellence in Innovation for their outstanding performance in the area of innovation in education and training and public outreach activities, in particular for bringing together farmers, the community, school students and researchers in a campaign against rabbits (**see Awards Story Highlight**). The Award was officially given at the Annual Invasive Animals CRC Awards night in May 2011.

AWARDS STORY HIGHLIGHT

INVASIVE ANIMALS CRC WINS AWARD FOR EXCELLENCE IN INNOVATION

The Invasive Animals CRC was presented with an Award for Excellence in Innovation in May 2011. The Award was for innovation in education and training and public outreach activities, in particular for bringing together farmers, the community, school students and researchers in a campaign against rabbits.

Through websites, the media, a national story-telling competition and toolkits, the Invasive Animals CRC has constructed partnerships with community, industry and landholders, unlocking the power of Australians to work together.

The public awareness programs include RabbitScan which helps landholders map rabbit hotspots on their property, and pinpoint the areas where they have rabbit control programs in place. The website *www.feral.org.au* is a key to the CRC's fight against the rabbit. It is an interactive, online resource providing a central reference point for pest animal research. People can search for maps, fact sheets, articles and photos, any information relevant to their own region.

Mr Andreas Glanznig, CEO of the Invasive Animals CRC, said that the project, RHD Boost, aims to identify new and more effective rabbit haemorrhagic disease virus (RHDV) strains and potentially save the Australian economy $1.4 billion over 15 years.

Professor Margaret Sheil (left), CEO of the Australian Research Council, presents the Award for Excellence in Innovation to Invasive Animals CRC Chair Helen Cathles and CEO – Andreas Glanznig at the CRC Association Awards Dinner.

"There seems to be a rising genetic resistance to the original calicivirus and the Invasive Animals CRC is screening new candidates which work better in cooler, wetter regions. A broad range of programs need to be in place if rabbits can be brought under control," he said.

Past CEO, Professor Tony Peacock, was recognised at the Australian Museum Eureka Prize Awards held in August 2010. He took out the gong for the highly contested category 'Promoting Understanding of Science' (**see Media Release Highlight in the Communications section of this report**).

Eve McDonald-Madden, 2006–08 Invasive Animals CRC Postgraduate Grant winner, won one of three **L'Oreal Australia Women in Science Fellowships in 2011 (picture story page 38**).

Internally, the Annual Invasive Animals Awards was a big success. The three Awards and background on recipients follow.

The Chair's Prize for Scientific Excellence – Dr Brian Cooke, University of Canberra, for his outstanding 45-year career as a wildlife scientist specialising on the management of Australia's most invasive pest animal – the European wild rabbit. Specific contributions have included rabbit management for the conservation of native fauna and flora; physiology, ecology and rabbit population dynamics and the biological control of rabbits.

At a time in his career when other scientists begin to wind back, Brian has shown amazing dedication and stamina to continue contributing to our country's scientific knowledge. Brian has been instrumental in developing a major research project into new and more efficacious strains of rabbit haemorrhagic disease to be released in Australia. Brian is recognised as Australia's foremost expert on rabbits and rabbit management.

Participant's Prize for Invasive Animal Management – Professor Linton Staples, Managing Director — Animal Control Technologies Pty Ltd for his distinguished and continuing career contribution to the control of invasive animals. Linton has contributed some 100 scientific papers, chapters and published conference proceedings.

In 2010 and 2011 one of Australia's worst mouse plagues affected parts of NSW, VIC and SA. Damage at sowing time 2011 was particularly severe and the demand for mouse bait product exceeded all expectations. Animal Control Technologies Pty Ltd (ACTA), as the major supplier of registered bait, responded to the crisis with an equally exceptional effort. ACTA's pre-emptive stockpiling of bait product and manufacturing capacity allowed the majority of farmers to effectively prevent crop damage this season, as in past mouse plagues. ACTA's MOUSEOFF® ZP product has been the frontline offensive that farmers have used to prevent mouse damage to crops for over a decade. The value of grain saved from ravenous mice since MOUSEOFF® ZP was launched runs into the hundreds of millions. This current season was exceptional with more than 3,000 tonnes of bait used, effectively protecting crops with a gross value of $2.5-3 Billion AUD. The Invasive Animals CRC is proud to acknowledge the commitment of its key commercial participant to the effective management of one of the most

damaging invasive animal problems Australian farmers have to deal with — mouse plagues.

Current R&D projects are run in partnership with the Invasive Animals CRC and include the development of preparedness for rabies incursions into Australia, new methods of control of rats in industrial situations and in grain storages and the development of user-friendly baits for feral pig control (PIGOUT®) and a newer version of this bait to be called HOG-GONE®, and a new type of fox and wild dog control bait based on the novel active PAPP (FOXECUTE® and DOGABATE® products).

Chief Executive's prize for achievement as an Invasive Animals CRC student – Ms Crystal Kelehear, Invasive Animals CRC-supported postgraduate student with the University of Sydney. Crystal has significantly enhanced our knowledge of a lungworm that infects cane toad as a potential biocontrol measure.

PUBLICITY HELPS ENSURE PEST EVENT IS WELL ATTENDED

The Invasive Animals CRC co-hosted the 15th Australasian Vertebrate Pest Conference in Sydney from 20-23 June 2011. The Invasive Animals CRC communications staff played a major role in organising and promoting the event which attracted scientists and others involved in pest management from Australian and abroad.

L-R in the Adoption Group are Chris Lane, Heleena Bamford, Kylie Hall, Wayne Fulton, Blair Brice, Ian Evans. Keryn Lapidge, David Dall, Darryl Green, Steve Lapidge (Chair), Phil Morrow, Mike Braysher and Suzy Balogh (Project Officer). (Group members Jess Marsh and Greg Mifsud were absent).

ADOPTION GROUP TO ORGANISE PESTSMART ROADSHOW

The 15 member Invasive Animals CRC Adoption Steering Group was formed in late 2010 and first met in January 2011. The group has since met three additional times and is in the final stages of organising the upcoming national PestSmart Roadshow to be held during January to May 2012. The event will showcase best practice pest animal management, including the latest innovations, delivered by species experts. Members are drawn from the Murray-Darling Basin Authority, Meat and Livestock Australia, Australian Wool Innovation, Animal Control Technologies and the Australian Pest Animal Strategy (APAS) National Coordinator.

PRESTIGIOUS CHURCHILL FELLOWSHIP WINNER

Paul Meek, a wildlife expert from the NSW Department of Primary Industries won in July 2011 a prestigious Churchill Fellowship to study remote camera trapping technology. Paul works in wild canid ecology with NSW DPI's Vertebrate Pest Research Unit and the Invasive Animals CRC.

As part of his Churchill Fellowship, Mr Meek will spend six weeks in the United States, the United Kingdom, Switzerland and The Netherlands.

"Wildlife research, monitoring and management is increasingly difficult to achieve in Australia as the costs are high," Mr Meek said. "We need to assess new technologies to improve our management of resources while making sure the science is right. Remote cameras are increasingly being used in Australia to collect valuable data to improve fauna management however their use is often misguided".

Mr Meek said it was critical for greater knowledge to be collected and shared on camera use through the provision of guides, training courses and standards. The Churchill Fellowship will facilitate his collection of knowledge from experts and manufacturers that will be essential for advancing the successful selection and accurate use of remote cameras in Australia.

03 END-USER ENVIRONMENT

The breaking of the drought as Australia shifted into a *La Niña* weather cycle has led to increases in agricultural productivity, with bumper grain harvests as well as increases in wool production (2010–11 forecast is 350 million kg of greasy wool from 75 million sheep shorn, up from 340 million kg from 73 million sheep short in 2009–10).[1]

The changed weather cycle has also increased the productivity of public lands and inland waters, in particular a rejuvenation of many high conservation wetlands that have triggered breeding events for many bird, fish, amphibian and other species.

The past year also coincided with several extreme weather events such as widespread floods, particularly in Queensland and Victoria.

The changed weather patterns have also resulted in surging pest animal numbers and increased impacts. Australia is currently in the grip of one of its worst pest animal onslaughts, with mouse plagues in four States, surging rabbit numbers in response to increasing RHD resistance and food availability, large-scale livestock predation by growing numbers of wild dogs and feral pig and carp numbers exploding post floods.

As an example of the scale of these increases, recent monitoring by NSW Department of Primary Industries has confirmed a 4,000% increase in carp numbers in the Menindee area of the Darling River. This is starkly illustrated by dramatic images of juvenile carp aggregating at the base of the Menindee dam.

This situation elevated pest animals as an issue in the agricultural sector, and contributed to their interest in shaping and investing in the Invasive Animals CRC extension bid.

OUTCOMES

The Invasive Animals CRC has 12 Outcomes that aim to be delivered through 40 key technologies.

Outcome 1: A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%

Outcome 2: A national benefit of $16 million per annum by reducing feral pig damage by 15%

Outcome 3: A benefit of $7 million per annum by reducing rodent damage by 20%

Outcome 4: A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species

Outcome 5: Deliver innovative, practical control measures against cane toads

Outcome 6: Reduced impact of feral cats over five million hectares

Outcome 7: Increased agricultural profitability through improved integration of existing biological, conventional and newly–developed control options for rabbits

Outcome 8: Deliver improved and humane approaches to reduce the production and biodiversity impacts of expanding or other overabundant and widespread species

Outcome 9: Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new or emerging invasive animal problems

Outcome 10: Growth in Australian invasive animal pest control industries. Through industry collaboration on the registration, marketing, export and community uptake of new products the CRC will enhance control of problem species

Outcome 11: Increased professional and practical skills base in invasive animal management through education, training and community awareness

Outcome 12: Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed.

[1] *Australian Wool Innovation wool production summary (http://www.wool.com/Media-Centre_Australian-Wool-Production.htm)*

The Invasive Animals CRC Economic Impact Assessment undertaken by the Centre for International Economics used an economy-wide approach to estimate the national economic benefit terms for nine of the 40 key technologies for which value could be sensibly monetised. The assessment covered:

- fox and wild dog control activities, in particular the development of a new more humane and target specific toxin, the effects of which can be reversed with an antidote
- feral pig control activities, in particular the development of new more target specific pigs baits, that again have the added safety of an antidote
- rabbit control activities, in particular the development of a new freeze-dried rabbit haemorrhagic disease (RHD) product
- rodent control activities, in particular the new application of a mouse bait that can be legally and safely used in brassica and root vegetable crops
- early warning detection technologies, in particular the enhancement of a DNA based species identification test to detect new invasive animal incursions.

Based on the economy-wide analysis and despite the omission of many of the benefits from the quantitative analysis, the assessment estimated that Invasive Animals CRC outputs will deliver benefits to the community worth around $142 million in present value terms over 30 years (in 2007 dollars, using a discount rate of 5%). This exceeds the Australian Government's investment in the Invasive Animals CRC of around $24.9 million in comparable terms, by around $117 million. This equates to $5.70 value to the community for every dollar invested by the Australian Government. The internal rate of return on the Government's investment is estimated at 32.4%.

When all funding sources are considered, the new technologies developed by the IA CRC are estimated to generate net benefits of $58 million over the 30 year period (in 2007 dollars, using a discount rate of 5 per cent). The benefit-cost ratio is estimated at 1.7:1, with an internal rate of return of 10.5%.

The environmental benefits, although not estimated, are also expected to be significant. This includes the environmental benefits to be delivered through the potential release of Australia's first carp biocontrol agent – Cyprinid herpes virus 3 – which has devastated common carp populations overseas with no non-target species impacts. In Indonesia for example, common carp numbers were reduced by 80 to 95% within two years of the accidental introduction of the virus. Environmental benefits will include improved water quality and ecological health over most of the 1 million sq. km Murray-Darling Basin.

Other environmental benefits include the avoided conservation impacts to 78 native species that are vulnerable to fox impacts if this pest establishes in Tasmania. The Invasive Animals CRC has developed the DNA detection technology that underpins the Tasmanian government's fox eradication campaign. On the mainland, the impact of Invasive Animals CRC technologies will also contribute to the conservation of many nationally listed threatened species, including the 156 threatened by rabbits and 76 threatened by foxes.

The social impacts of invasive animals, particularly wild dogs, are considerable and will be reduced through the Invasive Animals CRC's new control products and its validation and promotion of regional nil-tenure wild dog management.

To secure these outcomes, the Invasive Animals CRC has increased its capacity to develop the product registration packages needed to enable the APVMA to assess and register our new control products, as well as develop robust exit plans for uncompleted key technologies (particularly daughterless platform technology and Cyprinid herpes virus 3) as part of our Wind-Up process, and seek additional funds through the Invasive Animals CRC's extension bid to allow the finalisation of the scientific research to enable a robust registration package to be submitted for Cyprinid herpes virus 3 that will facilitate its assessment, approval and release within the lifetime of the proposed extended Invasive Animals CRC.

04 NATIONAL RESEARCH PRIORITIES

The Invasive Animals CRC aims to create new tools and strategies to assist partners and the Australian community at large to manage invasive animals. However, the development of tools is not sufficient. The Invasive Animals CRC must ensure that any outcomes are:

- socially acceptable
- ecologically effective
- commercially viable.

Most or our activities address the National Research Priority 'Safeguarding Australia'. Under this Priority, the Invasive Animals CRC works directly towards the outcome of 'Protecting Australia from invasive diseases and pests'. About 20% of our activities also contribute to the outcome of achieving 'Sustainable use of Australia's biodiversity'.

The Invasive Animals CRC's broad membership assembles a unique partnership, creating critical mass to address this national priority — it brings together private and public land managers to integrate approaches to invasive animal management. The Invasive Animals CRC is committed to delivering the means to deal with existing high profile invasive animal pests as well as those that have the potential to cause catastrophic impacts in the future.

National Research Priorities	CRC Research 2010–11
An Environmentally Sustainable Australia – Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies.	
Sustainable use of Australia's biodiversity.	20%
Safeguarding Australia – Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems.	
Protecting Australia from invasive diseases and pests.	80%

05 STRUCTURE & GOVERNANCE

The structure and governance of the Invasive Animals CRC provides strong support to its operations. The CRC is led by a Board of seven skills-based Directors, the majority of whom are independent from the Participants of the CRC. The Governing Board meets at least four times a year and is committed to compliance with the Australian Securities Exchange (ASX) Corporate Governance Principles and Recommendations.

In carrying out its governance role, the main task of the Board is to drive the strategy of the CRC, and to develop policies and monitor and review performance to ensure that the CRC achieves its research and adoption/utilisation goals. The Board also approves the CRC budget and ensures the Company complies with its contractual, statutory and other obligations.

BOARD MEMBERS

Name	Role	Key Skills	Independent/Organisation
Helen Cathles	Chair	Corporate governance, Primary Production, Pest Animal Control	Independent
Dedee Woodside	Deputy Chair	Conservation, Social Sciences, Business & Commercial	Independent
Helen Scott-Orr	Director	Primary Production, Pest Animal Control, R&D Management	Independent
Mark Lonsdale	Director	Corporate Governance, R&D Management, Risk Analysis	CSIRO
Phil Cowan	Director	Corporate Governance, Pest Animal Control, R&D Management	Landcare Research NZ
Manfred Claasz (from November 29, 2010)	Director	Communication, Business and Commercial, Risk Analysis	Independent
Arthur Georges (from November 29, 2010)	Director	Conservation, Pest Animal Control, R&D Management	University of Canberra
Chris Hancock (to 13 October 2010)	Director	Social Sciences, Business and Commercial, Risk Analysis	Independent

The Audit & Risk Committee has a documented charter, approved by the Board. The Audit & Risk Committee has responsibility for the oversight of fiscal and legal matters, and ensuring appropriate procedures and internal controls are in place. The Committee is responsible for the independence of the external auditors, and also manages the internal audit program.

The members of the Audit Committee during the year were:

COMMITTEE MEMBERS

Audit & Risk Committee

Name	Role	Key Skills	Independent/Organisation
Dedee Woodside	Chair	Conservation, Social Sciences, Business & Commercial	Independent
Mark Lonsdale	Director	Corporate Governance, R&D Management, Risk Analysis	CSIRO
Helen Scott-Orr	Director	Primary Production, Pest Animal Control, R&D Management	Independent

Ms Betty Ferguson, Certified Public Accountant (CPA), acts as a independent advisor to the Board and the Audit & Risk Committee in the fields of Finance and Risk.

Pictured are back row (L to R): Dr Phil Cowan, Mr Manfred Claasz, Prof Arthur Georges, Dr Helen Scott-Orr
Front row (L to R): Dr Deedee Woodside and Ms Helen Cathles
Absent (inset): Dr Mark Lonsdale

The composition of the Board has changed in the reporting period with the retirement of Mr Chris Hancock at the last AGM, and the appointment of Mr Manfred Claasz and Professor Arthur Georges. Mr Hancock served on the Board from its inception in July 2005 and provided a valuable contribution to the CRC during his term of service. The Board we pleased to welcome Mr Manfred Claasz and Professor Arthur Georges who were appointed through a participant vote in November 2010. Mr Manfred Claasz has a wealth of experience in finance and the commercialisation of research. Professor Arthur Georges brings valuable research and conservation skills to the Board table.

The number of Director's meetings and number of meetings attended by each of the Directors of the Company during the financial year are:

Directors' meetings

	Board Meetings		Audit Committee	
Director	A	B	A	B
Helen Cathles	5	5	-	-
Manfred Claasz	3	3	-	-
Phil Cowan	5	5	-	-
Arthur Georges	3	3	-	-
Chris Hancock	2	1	-	-
Mark Lonsdale	5	4	3	3
Helen Scott-Orr	5	5	3	3
Dedee Woodside	5	5	3	3

A: Number of meetings held during the time the Director held office during the year.

B: Number of meetings attended.

KEY STAFF

Key staff sit on the Executive Committee. This committee continually assesses the activities and performance of the CRC, and provides management information to support the decision making of the Governing Board.

Name	Organisation	CRC Position/Role	Time Committed
Mr Andreas Glanznig	Invasive Animals Ltd	CEO	100%
Ms Susan Duson	Invasive Animals Ltd	Business Manager/Company Secretary	100%
Ms Tracey Lianos	Invasive Animals Ltd	Communications Manager	100%
Dr Glen Saunders	NSW I&I	Program Leader, Terrestrial	60%
Mr Chris Lane	NSW I&I	Program Coordinator, Terrestrial	100%
Mr Wayne Fulton	Invasive Animals Ltd	Program Leader, Freshwater	50%
Ms Kylie Hall	Invasive Animals Ltd	Program Coordinator, Freshwater	100%
Dr Elaine Murphy	NZ Dept of Conservation	Program Leader, Detection & Prevention	30%
Dr Wendy Henderson	Invasive Animals Ltd	Program Coordinator,Detection & Prevention	80%
Assoc. Prof Steven Lapidge	Invasive Animals Ltd	Program Leader, Uptake	100%
Dr Simon Humphrys	Invasive Animals Ltd	Commercialisation Manager	100%
Ms Sascha Rettke	Invasive Animals Ltd	Program Coordinator, Uptake	100%
Prof Stephen Sarre	University of Canberra	Program Leader, Education	30%
Mr Tony Buckmaster	Invasive Animals Ltd	Program Coordinator, Education	40%

SUPPORT STAFF

Name	Organisation	CRC Position/Role	Time Committed
Ms Keryn Lapidge	Invasive Animals Ltd	Science Communicator	60%
Ms Kate Lawrence	Invasive Animals Ltd	Office Manager	60%
Ms Melanie Allan	Invasive Animals Ltd	Executive Assistant	60%
Ms Diane Holloway (on LWOP)	Invasive Animals Ltd	Executive Assistant	0%

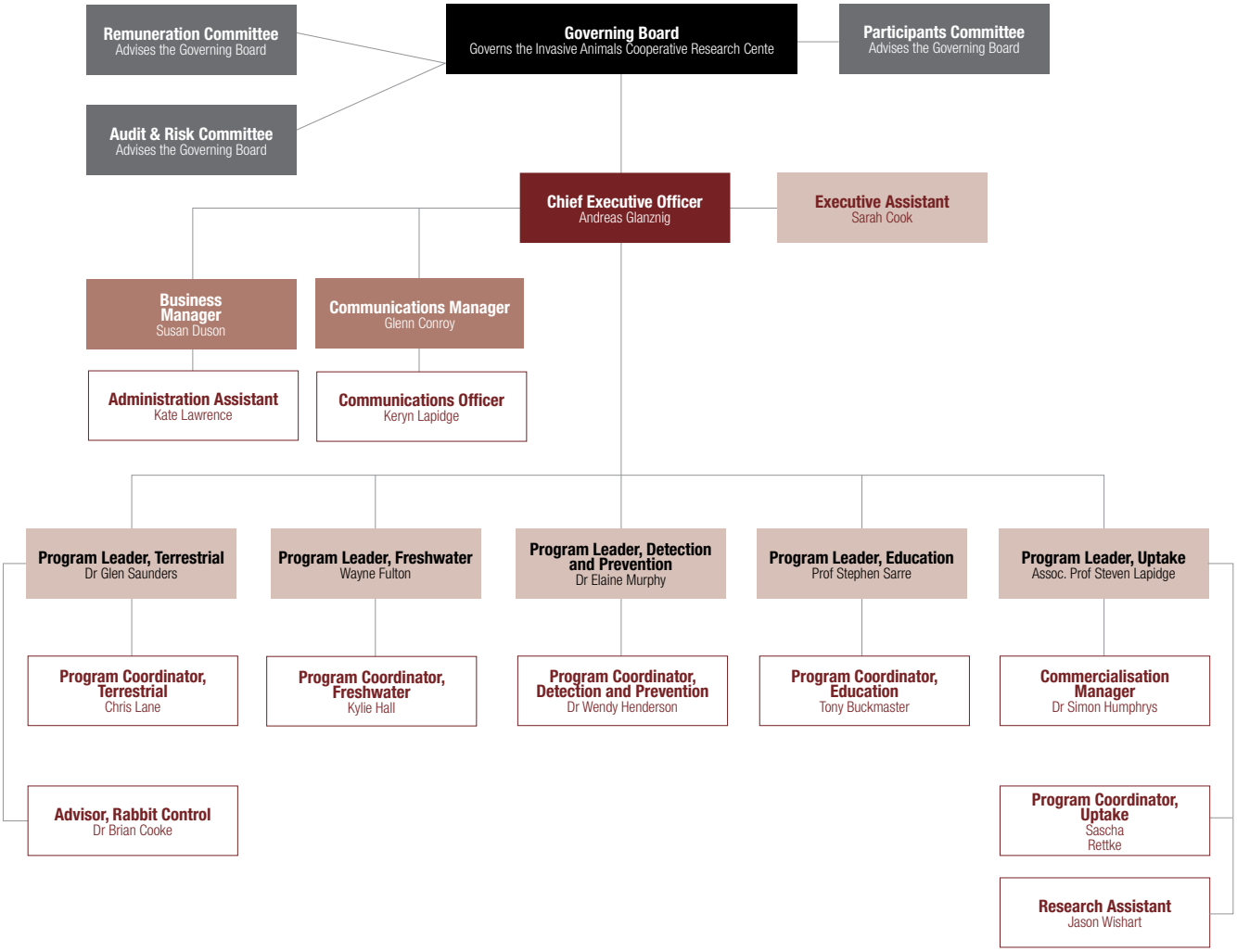
STAFF CHANGES

During the year Ms Alexandra Bagnara left the post of Communications Manager. Mr Glenn Conroy is the current Communications Manager. Dr Tom Heinsohn left the post of Program Co-ordinator Education. Ms Diane Holloway was on leave without pay, and Ms Sascha Rettke was on maternity leave at the end of the reporting period.

STRUCTURE

The Invasive Animals CRC is a joint venture arrangement between the Participants, which include the Managing Company, Invasive Animals Ltd. Invasive Animals Ltd is a public company limited by guarantee. It has been endorsed by the Australian Taxation Office as a tax concession charity and is exempt from income tax.

The Invasive Animals CRC organisational structure consists of five key program areas, a corporate function (including the CEO and Business and Client service functions) and a Commercialisation Manager.



06 RESEARCH ACHIEVEMENTS

The following is a summary of the research achievements obtained during the reporting year under relevant Activity Outcomes. Activity Outcomes that relate to commercialisation and utilisation (Outcome 10) and education and training (Outcome 11) are detailed under their own discrete sections.

For further information on the CRC's research activities, refer to the the Invasive Animals CRC Research Portfolio Summary (October 2011), which provides more detailed information on project progress aligning with the CRC's goals and milestones. Download from: *http://www.invasiveanimals.com/publications/research/* .

OUTCOME 1: A BENEFIT OF $29 MILLION PER ANNUM BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on fox and wild dog biology, ecology and ecological interactions at landscape scales
- developing a new fox and wild toxin (PAPP) and bait that includes an antidote (Blue Healer™) to increase the effectiveness of 1080-based regional fox and wild dog control programs
- validating and promoting regional nil–tenure control approaches
- developing and promoting best–practice management strategies and tools.

2010–11 Highlights

- strategic and systematic Tasmanian fox detection effort achieved. As part of Tasmanian fox detection demonstration site and the Tasmanian fox eradication program, the *Tasmanian Great Poo Pick–up* event was held during the year and 9,009 potential fox scats were genetically screened for fox DNA. Fifty–nine of these were positives and provided the team with invaluable information. The project has significantly increased our understanding of where foxes reside in Tasmania
- all additional studies were completed to enable the APVMA full regulatory assessment of new DOGABATE® and FOXECUTE® products. In response to an APVMA requirement for additional toxicological studies, follow–up research has been completed to enable APVMA to start their full assessment process of our two new PAPP product applications – DOGABATE® and FOXECUTE® – from Animal Control Technologies
- all studies completed to enable submission of new Blue Healer™ – veterinary antidote to APVMA. All efficacy and safety studies completed for the submission of a vet–only antidote product
- new Lethal Trap Device prototype tested for effectiveness in the field
- new coordinated community action on wild dogs was facilitated. The National Wild Dog Facilitator motivated and provided technical assistance to facilitate the establishment of nine regional wild dog working groups inside the wild dog barrier fence in South Australia as part of Operation Bounceback, as well as five working groups in the north–east Flinders area and four in the Kingoonya area.

OUTCOME 2: A NATIONAL BENEFIT OF $16 MILLION PER ANNUM BY REDUCING FERAL PIG DAMAGE BY 15%

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on feral pig biology, ecology and ecological interactions at landscape scales to identify vulnerabilities that can be exploited in feral pig management
- developing a first generation 1080 based feral pig bait (PIGOUT®)
- developing a new second generation sodium nitrite based feral pig toxin and bait (HOG-GONE®) that includes an antidote (Blue Healer™)
- developing efficient and target species delivery systems (HogHopper™)
- developing and promoting best–practice management strategies and tools.

2010–11 Highlights

- the Daintree Queensland demonstration site project has resulted in the development of more than 20 scientific papers. The project assessed the impacts of feral pigs on the conservation value of the Wet Tropics World Heritage Area and aimed to develop acceptable means to enhance feral pig control in this sensitive area. The demonstration site project has produced three PhD graduates (Andrew Bengsen – feral pig control, Amanda Elledge – feral pig environmental impacts, Carla Meurk – feral pig management anthropology); one MSc graduate (Kana Koichi – socioeconomics) and one Honours graduate (Dominique Taylor– effects of exclosures). Information gleaned from this research Daintree project will significantly improve our understanding of the impact of feral pigs in the Daintree rainforest and how management can be improved
- the HogHopper™ was launched in December 2010 and subsequently won an award for ‘Best Australian Made Machine’ at the Toowoomba Agricultural Show. The HogHopper™ is a low maintenance, target-specific bait hopper for population level feral pig management using PIGOUT® or HOG-GONE® baits. Uptake has been strong and the device is selling well through Animal Control Technologies Australia.

FULBRIGHT AWARD

Assoc. Prof. Steve Lapidge, the Uptake Program Leader, won the prestigious Fulbright Professional Business/ Industry (Coral Sea) Scholarship and spent July to October 2010 based at the United States Department of Agriculture National Wildlife Research Centre in Fort Collins, Colorado. The time was spent developing the HOG-GONE®/HogHopper™ project in the US, which is now undergoing non–toxic trials in six US States, as well as investigating other potential pesticide uses for sodium nitrite (new active ingredient in HOG-GONE®).

Mice have caused severe damage to canola crops this season

OUTCOME 3: A BENEFIT OF $7 MILLION PER ANNUM BY REDUCING RODENT DAMAGE BY 20%

The strategy to achieve this outcome is based on:

- developing a mouse immuno-contraceptive virus that can be transmitted naturally (project ceased)
- broadening the legal use of the existing zinc phosphide toxin to brassica, forestry plantation and industrial situations.

This outcome has been constrained by the cessation of the mouse immuno–contraceptive project, which would have been able to significantly reduce the impacts of mouse plagues.

2010–11 Highlights

- completed field trial studies now enable Animal Control Technologies to submit a registration application to the APVMA that will permit end–users to use their zinc phosphide rodenticide products in new situations (brassicas and plantation crops).

OUTCOME 4: A CAPACITY TO DELIVER IMPROVED QUALITY AND AVAILABILITY OF INLAND WATER THROUGH REDUCED IMPACTS AND RATES OF SPREAD OF CARP AND OTHER PEST FISH SPECIES

The strategy to achieve this outcome is based on developing an integrated carp and pest fish management approach, comprising of the following:

- strengthening strategic knowledge on carp and tilapia biology, ecology and ecological interactions to identify vulnerabilities that can be exploited in integrated carp and/or tilapia management programs
- developing and/or determining the potential of two strategic control technologies: daughterless carp platform technology and Cyprinid herpes virus 3 (Australia's first potential carp biocontrol agent)
- validating tactical control technologies, such as carp separation cages, fish down methods, and undertaking investigation of the potential of various fish-specific biocides for use in Australia
- developing and/or determining the potential of carp sex, environmental and acoustic attractants as well as acoustic repellents
- developing a freshwater fish incursion decision support tool.

2010–11 Highlights

- daughterless platform technology demonstrated to be inheritable. A prototype female–lethal (daughterless) construct was successfully tested. The prototype was tested through three generations of zebrafish, with marked effects on offspring sex ratios. The project published one peer-reviewed article in this reporting period. Testing of a prototype female–lethal carp construct, built wholly of native carp genetic material, also proved successful
- two plants have been shown to have some attractant properties for juvenile carp. As part of a PhD study, these plant–based attractants have been chemically isolated and identified
- control strategies for tilapia in Queensland have been developed based on an integrated management experiment in the Herberton Weir from 2008 to 2011. The experiment proved successful in reducing tilapia numbers, and formed the basis of two peer reviewed journal articles published in the reporting period

- a draft web–based-freshwater fish incursion decision support tool developed.

Progress on the scientific study of Cyprinid herpes virus 3 was impeded by the serious illness of the key researcher during the reporting period. He has since recovered and the project is proceeding.

OUTCOME 5: DELIVER INNOVATIVE, PRACTICAL CONTROL MEASURES AGAINST CANE TOADS

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge of cane toad ecology and control, particularly through parasites
- investigating the potential of applying daughterless platform technology to cane toads
- assessing cane toad impacts and developing a national action plan.

2010–11 Highlights

- PhD student, Crystal Kelehear, was awarded the Invasive Animals CRC CEO's Prize for achievement as an Invasive Animals CRC student. Ms Kelehear's research has enhanced our knowledge of a lungworm *Rhabdias* that infects cane toads, as a potential biocontrol measure. Her peer-reviewed articles have already been published in prestigious journals such as *Ecology*
- literature was collated to assist in the publication of the Commonwealth Threat Abatement Plan (TAP) for the 'Biological Effects, Including Lethal Toxic Ingestion, Caused by Cane Toads'. The TAP is focused on the protection of key biodiversity assets and is the foundation of a national strategy to guide investment and management efforts by the Australian Government, state agencies, research organisations and community groups to abate the impacts of cane toads
- draft standard operating procedure (SOP) for the Field Euthanasia of Cane Toads developed. Funded under the Australian Government's *Caring for our Country* program, this document contains background information, applications, and animal welfare considerations for target and non–target animals along with health and safety considerations. The SOP provides detailed guidelines on how to perform acceptable euthanasia techniques and discusses why some methods are not acceptable.

OUTCOME 6: REDUCED IMPACT OF FERAL CATS OVER FIVE MILLION HECTARES

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge of regional feral cat control by obtaining the field data essential for the registration of the Curiosity PAPP feral cat bait, and investigating the relationships between introduced predators (mainly fox and cat), their control and sustained fauna recovery in southern Western Australia
- investigating the potential of spray tunnel technology as a feral cat control tool.

2010–11 Highlights

- the southern Western Australia demonstration site is near completion with more than 20 scientific journal papers in the pipeline. Based on DNA collected hair, the project demonstrated mesopredator release of cats in the presence of repeated use of baits for fox control, which in turn was the major predator

of the woylie at an iconic conservation site that is baited for fox control. Using molecular techniques, predator species and the individual predators responsible for predation events were identified.

OUTCOME 7: INCREASED AGRICULTURAL PROFITABILITY THROUGH IMPROVED INTEGRATION OF EXISTING BIOLOGICAL, CONVENTIONAL AND NEWLY DEVELOPED CONTROL OPTIONS FOR RABBITS

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on the biodiversity impacts caused by rabbits, as well as the mechanisms behind the lack of effectiveness of rabbit haemorrhagic disease
- enabling the RHD virus (RHDV) disease suspension product to be available to end–users
- investigating the potential of new RHDV strains to boost biocontrol of wild rabbits in Australia
- developing a freeze–dried RHD bait delivered product
- developing a tactical rabbit warren pressure carbon monoxide fumigator
- developing strategies for optimal use of RHDV and conventional controls.

2010–11 Highlights

- research was published that shows that the native benign virus RCV–A1 arrived in Australia together with the first rabbits 150 years ago. An evolutionary study of 36 different isolates of the benign calicivirus RCV–A1 was conducted during the year. In addition, the evolutionary history of the virus reflects the recorded history of the rabbit host in Australia, in particular the two rabbit population bottlenecks induced by the two biocontrol agents, myxoma virus and rabbit haemorrhagic disease virus (RHDV)
- studies are now underway to determine where in Australia the benign virus is present. A series of serological tools for the detection of RCV–A1 was developed, including specific ELISAs for IgG, IgA and IgM antibodies as well as two different competition ELISAs. One of the competition ELISAs allows the specific detection of the benign calicivirus RCV–A1 and does not cross react with RHDV– antibodies. The other assays allow the study of infection dynamics of the benign virus RCV–A1. Longitudinal samples from selected sites are also being analysed to study potential seasonal dynamics of RCV–A1
- two larger-scale infection studies were conducted to assess the extent of cross protection that RCV–A1 provides to lethal RHDV infection. Preliminary results indicate that the protection can be up to 40% but varies, and may depend on a variety of factors such as challenge dose of RHDV, the particular strain of benign calicivirus used and, most importantly, the time between infections with the two viruses. The latter finding is of particular importance as it indicates that the protection conveyed by RCV–A1 may be temporal. There may be a window of opportunity for RHDV to be applied effectively in populations that carry the benign calicivirus
- as part of the RHD Boost Project, strains of RHDV have been selected and imported from France, Spain and South Korea. Genetic and antigenic comparisons of these imported RHDV strains have been conducted and five candidate strains have been selected for further evaluation. Master virus stocks for the candidate strains have been produced and a regime for testing for freedom from adventitious agents is under negotiation

with Biosecurity Australia and Australian Quarantine and Inspection Service (AQIS). Real time Polymerase Chain Reaction (PCR) assays for assessing virulent and benign rabbit caliciviruses have also been produced

- all regulatory studies required to submit a new product application for the Freeze–dried RHDV bait have been completed.

OUTCOME 8: DELIVER IMPROVED AND HUMANE APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVERABUNDANT AND WIDESPREAD SPECIES

The strategy to achieve this outcome is based on:

- providing leadership in implementing welfare-based invasive animal control practices
- strengthening strategic knowledge of the social impacts of invasive animals
- developing management packages to reduce pest bird impacts and improve herbivore management.

2010–11 Highlights

- existing Codes of Practice and SOPs for the humane control of invasive animals were reviewed. Revised versions include new information and methods or changes to procedures. Additional SOPs and COPs for pest species not included in the original set have also been drafted. A system to allow their periodic review and modification is being devised. The updated versions of the animal welfare documents will be published on the feral.org.au website and will be presented in the PestSmart format
- adult wallabies vaccinated once or twice with GONACON® have now been infertile for four years.

OUTCOME 9: REDUCED RISKS OF ECONOMIC LOSSES, ENVIRONMENTAL DAMAGE AND SOCIAL STRESS BY FORECASTING AND RESPONDING TO POTENTIAL, NEW OR EMERGING INVASIVE ANIMAL PROBLEMS

The strategy to achieve this outcome is based on:

- validating risk models, systems and assessments
- developing cost–effective early warning detection and response options to restrict introductions or the range of invasive animals
- developing packages for managing invasive animal species that are hosts for pathogens that threaten humans, livestock or native fauna.

2010–11 Highlights

- first national official record of previous vertebrate incursions and interceptions, and identification of high–risk species to target future biosecurity action. The study was prepared in close consultation with the national Vertebrate Pests Committee Incursions Working Group.
- a better understanding of the fox incursion in Tasmania was formed along with the government and community response to the incursion (through social and genetic analysis)
- international collaboration assisted in the development of recommendations for best practice in relation to rabbit eradication on islands such as Macquarie Island.

OUTCOME 10: OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES.

SEE COMMERCIALISATION AND UTILISATION PAGES 42–45

OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS

SEE EDUCATION AND TRAINING PAGES 35–41

OUTCOME 12: ESTABLISHED NATIONAL AND LOCAL BENCHMARKS FOR INVASIVE ANIMAL IMPACT, DENSITY AND DISTRIBUTION FROM WHICH PERFORMANCE ON DELIVERY OF ALL OUTCOMES CAN BE ASSESSED

The strategy to achieve this outcome is based on:

- establishing biophysical and economic benchmarks of invasive animal impacts
- assessing the impact of Invasive Animals CRC technologies and adoption.

2010–11 Highlights

- national community attitudes survey completed. Undertaken by SME Participant, Valuemetrics, the two-and-a-half year study found that the worst five perceived invasive animals are cane toads, feral cats, rabbits, carp and feral pigs. The survey also elucidated contrasting attitudes among different demographic groups
- climate change modelling predicts induced distribution and abundance of pest animals in NSW. The published study tested four different climate models on 10 pest species to generate maps of predicted distributions
- independent economic impact of National Wild Dog Facilitator project determined to have a Net Present Value of $6.7 million.

GOAT-FREE OUTCOME HELPS TO SHOWCASE CRC SUCCESSES

Stories released throughout the year helped to showcase the incredible research undertaken by the Invasive Animals CRC and the many benefits to flow on from the CRC's work. The story of the near complete eradication of goats on Kangaroo Island was one of several highlights during the year.

GOAT-FREE KANGAROO ISLAND BY END 2012

For the first time in almost 200 years, there are no feral goats in six of Kangaroo Island's seven management units. The island should be free of feral goats in 2012 making it one of the largest islands to have successfully eradicated feral goats in the world.

The near complete eradication has been undertaken by using Judas goats which are feral goats that have been caught and fitted with a radio collar so they can be tracked down using a radio receiver. Goats are gregarious and once released they join up with feral mobs which allows the control officers to easily locate the feral goats and destroy them.

Nick Markopoulos, NRM Board Feral Animal Control Officer, with a feral goat while a white Judas goat looks on.

The demonstration site started in 2006 and operated by the Invasive Animals CRC has accomplished the virtual eradication of feral goats so reducing their destructive impact on native vegetation and increasingly eroded coastal dunes and cliff lines.

Partners in the project are the Kangaroo Island Natural Resources Management Board, the Department for Environment and Natural Resources and local landholders. The program used local knowledge from the local community to identify goat distribution.

07 RESEARCH COLLABORATIONS

Collaborative links across the Invasive Animals CRC are a major focus of activities given the very large number of parties involved. A compulsory investment criterion for every project funded is that at least two Invasive Animals CRC participants are involved in the project, and at least one of these participants must be a technology end-user. Even when projects have a relatively long time frame and are close to the 'research' end of the 'research and development' spectrum, the Invasive Animals CRC's approach is that the direct involvement of end-users is invaluable to achieving outcomes.

More than half the participants in the Invasive Animals CRC are end-users of research. In setting up the Invasive Animals CRC, the Board took the view that the CRC would have low entry requirements (for example no entry fees) to encourage participation. Thus, our end-users are generally directly involved in many of the projects of interest to them, in an attempt to have a technology transfer process that is as seamless as possible. We believe the end-users improve the research process as well, so that technology or processes developed are more likely to be adopted. The key national and international collaborators are outlined below.

Australian collaborations:

- CSIRO — sharing of expertise and facilities
- Australian Wildlife Conservancy — trial sites
- National Wild Dog Management Advisory Group — development of wild dog management plans.
- Rabbit Free Australia — RABBITSCAN / RABBITING ON / RHD BOOST
- Australian Hydatids Control & Epidemiology Program
- Douglas Shire Council — participation in demo site trials
- Kingfisher Research Pty Ltd — production/trial of cages
- Kangaroo Island NRM board — field trial sites and staff
- Lachlan and Central West CMAs — integrated carp and wild dog management plans
- Namoi Catchment — PestPlan workshop (March 2008)
- Robert Wicks Pest Animal Research Centre — facilities and animals for trial, shared research
- SA NRM Boards (2) — establishment of local run trials
- State Water Corporation (Vic) — access to water reserves
- TAS DPIW — collaborative development of fox detection program
- WA DEC — consultancy — community cane toad control report
- Wet Tropics Management Authority — feral pig control in the Wet Tropics World Heritage Area
- DEWHA (for Cane Toad Threat Abatement Plan)

International collaborations:

- University of Minnesota — trialling of sensory attractants for carp
- IZS (Brescia, Italy) — supplied monoclonal antibodies for ELISAs to confirm indigenous lagovirus
- Central Science Laboratories UK — fertility control research; diagnostics for fox scat identification
- Connovation NZ — PAPP and HOG-GONE® development
- Fitzgerald Applied Sociology — social research project
- INSERM (Nantes, France) — supplied rabbit DNA serology tools
- Israel National Parks Authority — improving tools for wild pig management
- New Zealand Landcare Research — development of new toxicant
- New Zealand Department of Conservation — testing of PAPP
- USDA-supply of GONACON® for testing in Australian wallabies as a fertility control; testing of PIGOUT® baits; trials of CO_2 fumigator

- UK Dept of Environment, Food and Rural Affairs-product development and formulation expertise sharing
- University of York — supervision of PhD candidates
- SenesTech — agreement signed to enable ContraPest (fertility control for rats) to be trialled in Indonesia

OUTCOME 1: A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%

- Australia Bureau of Agricultural Resource Economics and Sciences
- Biosecurity Queensland
- Queensland Department of Environment and Resource Management
- NSW Department of Primary Industries
- Forests NSW
- NSW Office of Environment and Heritage (National Parks & Wildlife Service)
- NSW Wild Dog Advisory CommitteeSouth Australian Farmers Federation
- South Australian Department of Water, Land and Biodiversity Conservation
- South Australian Arid Lands NRM
- Victorian Department of Primary Industries Victorian Farmers Federation
- Department of Agriculture and Food WA
- WA Pastoralists and Graziers Association Western Australia Farmers Federation
- Australian Wool Innovation
- Wool Producers Australia
- Cattle Council of Australia
- ACT Department of Territory and Municipal Services
- NSW Livestock Health and Pest Authorities
- NSW Management Council for Livestock Health and Pest Authorities
- AgForce Queensland, Gippsland Wild Dog Advisory Group
- Victorian North-East Wild Dog Advisory Group
- Low Ecological Services
- WA Department of Environment and Conservation
- University of Western Australia
- Vic Department of Sustainability and Environment
- Meat and Livestock Australia
- Caring For Our Country — Department of Agriculture, Fisheries and Forestry
- University of Canberra
- Border Rivers-Gwydir Catchment Management Authority
- 56 NRMs and CMAs across Australia

OUTCOME 2: A benefit of $16 million p.a. by reducing feral pig damage by 15%

- Australian Bureau of Agricultural and Resource Economics and Sciences
- Animal Control Technologies Australia
- Meat and Livestock Australia
- Central West CMA
- Biosecurity Qld
- Connovation (NZ)
- Landcare Research (NZ)
- Kangaroo Island NRM board
- CSIRO
- ACT Department of Territory and Municipal Services
- NSW Livestock Health and Pest Authority
- US Department of Agriculture National Wildlife Research Center and Wildlife Service
- Texas Parks and Wildlife
- Department of Sustainability, Environment, Water, Population and Communities
- NSW Primary Industries

- SA Department of Environment and Heritage
- SA Department of Water, Land and Biodiversity Conservation
- Kangaroo Island Landholders
- University of Qld
- James Cook University

OUTCOME 3: A benefit of $7 million p.a. by reducing rodent damage by 20%

- Grains Research & Development Corporation
- University of WA
- University of Qld
- Grains Research and Development Corporation
- Indonesian Centre for Rice Research
- Northern Arizona University (under contract to Senes Tech)
- NZ Department of Conservation
- Animal Control Technologies Australia
- CSIRO

OUTCOME 4: A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species

- K&C Fisheries
- Industry and Investment NSW
- NSW State Water
- SA Research and Development Institute
- Qld Department of Employment, Economic Development and Innovation
- Qld Department of Natural Resources & Water
- Victorian Department of Primary Industries
- Victorian Department of Sustainability and Environment
- Inland Fisheries Service, Tasmania
- Murray–Darling Basin Authority
- Lachlan Catchment Management Authority
- CSIRO Marine
- Australian National University
- University of NSW
- University of Queensland
- Deakin University
- University of Tasmania
- University of Minnesota
- Michigan State University
- Auburn University Alabama
- US Geological Survey

OUTCOME 5: Deliver innovative, practical control measures against cane toads

- NSW Department of Primary Industries
- NSW Office of Environment and Heritage (National Parks & Wildlife Service)
- University of Wollongong.
- National Cane Toad Advisory Group
- University of Sydney
- University of Queensland
- Department of Sustainability, Environment, Water, Population and Communities
- Department of Primary Industries and Resources SA
- Department of Employment, Economic Development and Innovation — Biosecurity Queensland
- NT Department of Natural Resources, Environment, the Arts and Sport
- Australian Pest Animal Strategy
- WA Department of Environment and Conservation

OUTCOME 6: Reduced impact of feral cats over five million hectares

- Meat and Livestock Australia
- University of Sydney
- University of WA
- Australian Wildlife Conservancy

- Federal Department of Environment
- Water, Heritage and Arts, Vic Department of Sustainability and Environment
- Vic Department of Primary Industries
- WA Department of Environment and Conservation
- Connovation (NZ)
- Animal Control Technologies Australia
- Ecological Horizons
- Desert Recovery (Roxby Downs)
- General Dogs body
- Murdoch University
- Alcoa World Alumina
- ACT Government Planning
- Conservation and Land
- Environment and Sustainable Development Directorate
- Land Development Agency
- Economic Development Directorate
- Kangaroo Island NRM board
- RSPCA Australia
- ACT RSPCA

OUTCOME 7: Increased agricultural profitability through improved integration of existing biological, conventional and newly developed control options for rabbits

- CSIRO Entomology
- SA Department of Water, Land and Biodiversity Conservation
- NSW Department of Primary Industries
- Australian Wool Innovation
- Victorian Department of Primary Industries
- Meat and Livestock Australia
- Foundation for a Rabbit Free Australia
- Australia Bureau of Agricultural Resource Economics and Sciences
- Parks Victoria
- SA Arid Lands Natural Resource Management Board
- Animal and Plant Control Group
- SA Department of Land, Water and Biodiversity Conservation
- Western Australian Department of Agriculture
- Queensland Department of Natural Resources and Water
- IZS of Brescia, Italy
- INSERM, Nantes, France

OUTCOME 8: Deliver improved and human approaches to reduce the production and biodiversity impacts of expanding or other over-abundant and widespread pest species

- Australian Bureau of Agricultural and Resource Economics and Sciences
- CSIRO
- University of Newcastle
- NSW Department of Primary Industries
- USDA NWR
- Australian National University
- University of Queensland
- ACT Government: Planning, Conservation and Land
- Environment and Sustainable Development Directorate
- Land Development Agency
- Economic Development Directorate
- RSPCA Australia
- ACT RSPCA
- National Vertebrate Pests Committee

OUTCOME 9: Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new, expanding or emerging invasive animal problems

- Victorian Department of Sustainability and Environment
- Victorian Department of Primary Industries (Biosecurity Victoria)
- Tasmania Department of Primary industries, Parks, Water and Environment
- Primary Industries and Resources of South Australia
- Western Australian Department of Agriculture and Food
- New South Wales Department of Environment, Climate Change and Water
- New South Wales Department of Primary Industries
- Qld Department of Employment, Economic Development and Innovation (Biosecurity Queensland)
- Northern Territory Department of Natural Resources, Environment, The Arts and Sport
- Department of Primary Industries and Resources SA (Biosecurity SA)
- Australian Capital Territory Department of Territory and Municipal Services
- Australian Capital Territory Department of the Environment, Climate Change, Energy and Water
- Australian Government Department of Sustainability, Environment, Water, Population and Communities
- Australian Customs and Border Protection Service
- Australian Government Department of Agriculture, Fisheries and Forestry (including Australian Quarantine and Inspection Service)
- Zoo and Aquarium Association
- Vertebrate Pests Committee
- University of Adelaide
- University of Canberra
- New Zealand Dept of Conservation

OUTCOME 10: Growth in Australian invasive animal pest control industries. Through industry collaboration on the registration, marketing, export and community uptake of new products the CRC will enhance control of problem species

- Meat and Livestock Australia
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Pestat
- Senes Tech
- Bioquiv
- University of Newcastle
- Industry and Investment NSW
- Qld Department of Employment
- Economic Development and Innovation
- University of Sydney
- Vic Department of Sustainability and Environment
- Vic Department of Primary Industries
- CSIRO
- Connovation (NZ)
- Animal Control Technologies Australia
- NSW Livestock Health and Pest Authority
- Animal Control Technologies Australia

OUTCOME 11: Increased professional and practical skills base in invasive animal management through education, training and community awareness

- University of Canberra (Institute for Applied Ecology)
- University of Canberra College
- Australian Bureau of Agricultural and Resource Economics and Sciences

OUTCOME 12: Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed

- Victorian Department of Sustainability and Environment and Parks Victoria
- Victorian Department of Primary Industries (Biosecurity Victoria)
- Tasmania Department of Primary industries, Parks, Water and Environment
- Primary Industries and Resources of South Australia
- Western Australian Department of Agriculture and Food
- Western Australian Department of Environment & Conservation
- New South Wales Department of Environment, Climate Change and Water
- New South Wales Department of Primary Industries
- Qld Department of Employment, Economic Development and Innovation (Biosecurity Queensland)
- Northern Territory Department of Natural Resources, Environment, The Arts and Sport
- Department of Primary Industries and Resources SA (Biosecurity SA)
- South Australian Department of Environment and Heritage
- South Australian Arid Lands NRM
- Australian Capital Territory Department of Territory and Municipal Services
- Australian Capital Territory Department of the Environment, Climate Change, Energy and Water
- Australian Government Department of Sustainability, Environment, Water, Population and Communities
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Toshiba
- Woolworths
- Landcare Australia
- CSIRO
- New Zealand Dept of Conservation
- Vertebrate Pests Committee
- ValueMetrics

08 EDUCATION & TRAINING

Outcome 11: Increased professional and practical skills base in invasive animal management through education, training and community awareness.

This segment of the annual report focuses on key areas of education and training research and student involvement during 2010–11 as they relate to Outcome 11.

Education has four main initiatives to extend information and interactive opportunities that evolve from this CRC. Initiatives include: Balanced Scientist Program, a Vocational Education and Training Diploma in Conservation and Land Management, an educational web site (*www.feral.org.au*) including Feral Focus and Pest Tales, and the PestSmart toolkit.

Objectives

Education objectives include:

- produce market-ready, balanced and exceptional graduates, who in addition to their specialised PhD research experience, also emerge with broad skills in areas such as research leadership and management, stakeholder and community engagement, project management, innovation and development, effective communication and media awareness
- train graduates that are better prepared for the workforce and have developed collaborations and industry based networks prior to graduation and who are able to match their research efforts with the priorities of their chosen industry
- increase the capacity of land managers to plan and undertaken strategic invasive animals management through the development of a Vocational Education and Training level course
- develop and maintain a centralised, publicly accessible repository of invasive animal resources and management information
- provide curriculum-based teaching resources to primary and secondary schools based on invasive animal education activities and resources.

The **Balanced Scientist Program** is a hands-on approach that supports the CRC's PhD, Masters and Honours level students through scholarship funding and additional training that students would not normally receive while enrolled in standard award courses (see **Picture Story One**).

The program includes a fully-funded eighth semester for PhD students to enable additional training to take place without adversely impacting on a student's capacity to undertake cutting-edge research.

The **Vocational Education and Training Diploma in Conservation and Land Management** (Strategic Pest Management) employs innovative on-line learning techniques. The delivery of the course content on-line through **Moodle** allows participants to study remotely and facilitates the effective delivery of the course to students across Australia.

The Diploma course is offered through the University of Canberra College. Six students were enrolled for the 2010 academic year and seven for 2011. Student enrolments came from across the country with all students attending the intensive residential components of the course in Canberra. This facilitated networking and collaborations between the students.

During the reporting year, **the on-line information and learning site** *www.feral.org.au* continued to provide a one-stop shop for information on invasive animals for teachers and community alike. The site includes an extensive image gallery and more than 8,000

Adriana Ford-Thompson is now a Teaching Fellow at the University of York

accessible records such as report, manuals, guides, grey literature and web-links to external resources.

The web site also hosts school- and community-based education packages – **Feral Focus and Pest Tales.** These packages are designed in accordance with school science curriculum and allow teachers to deliver lessons on common pest animal problems to primary and secondary level students.

Feral Focus (*http://www.feralfocus.org.au/*) uses real-life situations involving invasive animals to enhance the understanding of these issued and problem solving capacity of secondary school students, specifically years 8, 9 and 10 in the areas of Science, Studies of Society and Environment (SOSE) and Geography. Sixteen packages are available, including five on-line scenarios, together with teacher instructions and plans.

Pest Tales (*http://www.pestales.org.au/)* contains nine educational packages for primary school and includes lesson plans for teachers, activities and interactive scenarios for students that have strong links to curriculum profiles including the new Australian curriculum. These packages utilise real-life situations to engage students and guide them through problem solving activities.

The **PestSmart toolkit** and **training programs** facilitate delivery of the acquired knowledge of the Invasive Animals CRC to end users. Provision of this content on-line is enhanced through targeted face-to-face education.

PICTURE STORY ONE

INTERNATIONAL STUDENT PRAISES BALANCED SCIENTIST PROGRAM

Having investigated how social factors affect invasive deer management in the Royal National Park near Sydney, Adriana Ford-Thompson has submitted her PhD thesis. 'Conservation, Society and Invasive Species'.

Adriana says she particularly benefited from the Invasive Animals CRC Balanced Scientist Program. As part of the initiative, Adriana was able to meet experts in the field and other students studying invasive species. "As well as being great for exchanging ideas and knowledge, this made me feel part of the team. The Invasive Animals CRC has a really supportive attitude towards their students and the annual camps were an invaluable part of my PhD."

Adriana's research highlights the pivotal role of community participation in invasive species management and the different ways this can be implemented. Her experience also reveals how conflicts between people, and interactions that people have with invasive species such as deer, influence the ability of wildlife managers to achieve their objectives. Her findings help direct management efforts for the benefit of native species conservation and society.

Adriana is now a Teaching Fellow at the University of York where she teaches undergraduate modules in environmental policy and management and ecological economics.

STUDENT PROGRESS

POSTGRADUATE RESEARCH EDUCATION

The Invasive Animals CRC had 17 PhD students and one Masters student actively engaged in research during 2010-2011 across all of the CRC's programs. Of these, six PhD students submitted their theses for marking. To date, in total 15 PhD students have completed their research and submitted theses and 12 have been accepted. The remaining three are being marked.

To date, the completion rate for Cohort 1 (see **KEY ACHIEVEMENTS LIST**) is far above the reported national average (64% overall and 75% in Natural Sciences)(Sinclair 2004). Doctors of Philosophy have been conferred to 91%. The one remaining student is on track to complete their PhD by the end of November 2011.

Twelve Invasive Animals CRC students, from across all three cohorts, were accepted to give presentations at the 15th Australasian Vertebrate Pest Conference in Sydney in June 2011. These students were either primary author or co-author on 17 separate presentations given at the conference.

The postgraduate program is ahead of the expected targets in student numbers with a total of 29 PhD students, two Masters and two Honours students either currently supported or who have graduated with their awards. One PhD student withdrew from the program and her studies due to on-going illness.

An Invasive Animals CRC PhD student, Eve McDonald-Madden, (see **Picture Story Two**) who was awarded her doctorate in 2009, received a prestigious L'Oreal Australia Women in Science Fellowship in 2011. This was one of only three L'Oreal fellowships awarded in 2011.

KEY ACHIEVEMENTS LISTING

As of 30 June 2011, of the 29 PhD students, 12 have had their awards conferred, three have submitted their theses and are awaiting acceptance, and 14 are still in progress. Of the two Masters students, one has had their award conferred and one is still in progress, while both honours awards have been awarded.

Key achievements PhD Cohort 1

- 11 out of 12 (92%) C1 PhDs have submitted their theses (one extended until November 2011 and is well on track for completion).
- 10 out of 11 (91%) C1 submitted PhDs accepted (remaining one still being marked).

Key achievements PhD Cohort 2

- Four out of 11 (36%) C2 PhDs have submitted with the balance making strong progress towards completion and submission of their theses.
- Two out of four (50%) C2 submitted PhDs have been accepted (remaining still being marked).

Key achievements PhD Cohort 3

- All six C3 PhDs have completed the requirements of the Balanced Scientist Program.
- All six C3 PhDs are making strong progress towards completion and submission of their theses.

Key achievements Masters Cohort

- One of two Masters students have submitted their thesis and have had it accepted. The remaining student is progressing strongly towards completion and is expected to submit in September 2011.

PICTURE STORY TWO

L'OREAL AUSTRALIA WOMEN IN SCIENCE

Eve McDonald-Madden, 2006–08 Invasive Animals Cooperative Research Centre Postgraduate Grant winner, is one of three L'Oreal Australia Women in Science Fellowships in 2011. Fellowships are run globally by L'Oréal in partnership with UNESCO and celebrate the achievements of the world's finest women scientists. Her area of research is how turning to mathematics can allow managers to make smarter conservation decisions when available information is limited. For further information go to *www.scienceinpublic.com/loreal/fellows/eve-mcdonald-madden*.

Current Invasive Animals CRC students

Name	Degree	Activity Output	Topic	Supervisors	University (scholarship)	Affiliated IA CRC Program
Jennyffer Cruz-Bernal	PhD	1.1	Effects of predation and resource availability on western brushtail possum populations	Luke Leung Paul de Tores Duncan Sutherland Nicky Marlow	UQ (APA)	Uptake
Katie Doyle	PhD	4.1	Impact of increased predator presence through stocking on carp populations and the implications for management	Gimme Walter Daryl McPhee	UQ (APA)	Freshwater
Aaron Elkins	PhD	4.4	Environmental attractants for carp	Russell Barrow Simone Rochfort	ANU (UPA)	Freshwater
Peter Elsworth	PhD	7.2	Development of genetic resistance to Rabbit haemorrhagic disease in wild rabbits *Oryctolagus cuniculus*	Brian Cooke Stephen Sarre Brett Lidbury	UC (IA CRC)	Terrestrial
Penelope Marshal	PhD	8.2	The social impacts on Australian farm families of wild dog predation on agricultural stock	John Dryzek Jenny Andrew Linda Botterill Carolyn Hendriks	ANU (IA CRC — scholarship ended)	Terrestrial
Lindsey McFarlane	PhD	4.2	Characterisation of RNA silencing pathways in the common carp (*Cyprinus carpio* L.)	Jawahar Patil Peter Koopman	UQ (APA)	Freshwater
Hayley Pearson	PhD	9.4	Understanding and mitigating domestic pig and wildlife interactions	Jenny-Ann Toribio Steve Lapidge	USYD (Pork Industry Scholarship + IA CRC)	Uptake

EDUCATION & TRAINING (continued)

Name	Degree	Activity Output	Topic	Supervisors	University (scholarship)	Affiliated IA CRC Program
Danielle Stephens	PhD	1.1	Developing DNA-based monitoring techniques for improved management of wild dog (submitted August 2011)	Mike Johnson Oliver Berry Peter Fleming Alan Wilton	UWA (APA)	Terrestrial
Adriana Ford-Thompson	PhD	8.2	People, pests and conflict: community participation in invasive deer management in Australia	Piran White Carolyn Snell Glen Saunders	York	Terrestrial
Kate Grarock	PhD	8.3	Removal of the pest bird – Indian Myna (*Acridotheres tristis*) and its impacts and implications for native Australian birds	David Lindenmayer Chris Tidemann Jeff Wood	ANU (UPA)	Terrestrial
Melissa Snape	PhD	8.4	Effects of vaccination against gonadotrophin releasing hormone (GnRH) on the behaviour and fertility of macropods	Lyn Hinds William Foley	ANU (UPA)	Terrestrial
Crystal Kelehear	PhD	5.1	Host-parasite ecology during a biological invasion: the potential of a lungworm *Rhabdias* as a biocontrol against cane toads.	Rick Shine	USYD (APA)	Freshwater
John Tracey	PhD	8.3	Evaluating management strategies for pest birds of horticulture	Piran White Glen Saunders	University of York	Terrestrial
Ian McDonald	PhD	2.1	GnRH constructs for oral delivery: affects on immune responses and reproductive function	Lyn Hinds Michael D' Occhio Helle Bielefeldt-Ohmann Peter Murray Andrew Tribe	University of Queensland	Terrestrial
Kana Koichi	Masters	2.1	Socio-economic and ecological costs and benefits of feral pigs in the Wet Tropics	Iain Gordon Kamaljit Kaur Alison Cottrell	JCU	Uptake

Completed Invasive Animals CRC students and their employment

Name	Cohort and year completed	Award	Activity Output	Title of Thesis	Employment on graduation	
Scott van Barneveld	Cohort 2 2011	PhD	9.2	What makes a species invasive? An assessment of invasive capability in a model genus Lampropholis (De Vis 1888)	USYD (IA CRC)	Prevention and Detection
Eve McDonald-Madden	Cohort 1 2008	PhD	9.1	Optimal decision-making in conservation: management, uncertainty and monitoring	University of Queensland	Australian research
Gwyllm Haines	Cohort 1 2008	PhD	4.1	Population genetics of common carp (*Cyprinus carpio L.*) in the Murray-Darling Basin	University of Wisconsin	International research
Maija Marsh	Cohort 1 2008	PhD	7.2	Transmission and effectiveness of RHDV infections in rabbit populations at different spatial scales	Natural England	International industry
Megan Barney	Cohort 1 2009	PhD	4.2	Sex determination and differentiation in carp, cyprinus carpio	CSIRO	Australian research
Alex Diment	Cohort 1 2010	PhD	1.1	Monitoring the ecological impacts of invasive predator control	Flora and Fauna International	International industry
Andrew Bengsen	Cohort 1 2010	PhD	2.1	Target-specific vertebrate pest control in complex faunal communities: feral pig baiting in the wet tropics of Queensland, Australia	Kangaroo Island Natural Resources management Board	Australian Industry
John Abramyan	Cohort 1 2010	PhD	5.1	Biology of sex determination and sexual development in the cane toad (*Bufo marinus*)	University of California Riverside	International research
Tarnya Cox	Cohort 1 2010	PhD	8.4	Predator faecal odours as repellents to manage feral goats and kangaroos	NSW Industry and Investment	Australian Industry
Amanda Elledge	Cohort 1 2011	PhD	2.1	Habitat preferences and environmental impacts of feral pigs (*Sus scrofa*) in lowland tropical rainforests of north-eastern Australia	Department of Environment and Resource Management QLD	Australian Industry
Carla Meurk	Cohort 1 2011	PhD	2.6	Loving nature, killing nature, and the crises of caring: An anthropological investigation of conflicts affecting feral pig management in Queensland, Australia	University of Queensland	Australian research
Tony Buckmaster	Cohort 1 2011	PhD	6.1	Ecology of the feral cat (*Felis catus*) in the tall forests of Far East Gippsland	University of Canberra and IA CRC	Australian academia
Jessica King	Cohort 2 2010	PhD	9.4	Investigating the life cycle and transmission of *Neospora caninum* in Australia	University of Sydney	Australian research

Name	Cohort and year completed	Award	Activity Output	Title of Thesis	Employment on graduation	
Paul de Torres	Cohort 2 2011	PhD	1.1	Native fauna response to large scale fox control in the northern jarrah forest of south-west Western Australia: Operation Foxglove	Department of Environment and Conservation Western Australia	Australian industry
Tom Newsome	Cohort 2 2011	PhD	1.1	Ecology of the dingo (*Canis lupus dingo*) in the Tanami Desert in relation to human-resource subsidies	Low Ecological Services Pty Ltd	Australian industry
Marlene Jahnke	Masters 2010	Masters	7.2	Genetic diversity and evolution of a non-pathogenic calicivirus in wild rabbit populations in Australia	Not known	Not known
Ben Allen	Honours 2006	Honours	9.4	The spatial ecology and zoonoses of urban dingoes – a preliminary investigation	South Australian Arid Lands NRM Board	Australian Industry
Melissa Snape	Honours 2007	Honours	8.4	Assessment of the effects of VCD, and of behavioural responses to novel bait items for brushtail possums	Continued to PhD project with IA CRC	Australian Research

PICTURE STORY THREE

CRC BUILDS ONGOING COOPERATIVE PARTNERSHIPS

Bill Crisp — former 2009 Invasive Animals CRC student in Mike Braysher's University of Canberra College's Vocational Education and Training Diploma in Conservation and Land Management (Strategic Pest Management) — believes that Training and Remote Area Conservation Services (TRACS) has established ongoing cooperative partnerships with multiple stakeholders, regardless of land tenure, to design and implement strategic management plans focused on invasive species. These relationships have been developed with key members of local, state and federal government, conservation groups, primary industry, pastoralists, aboriginal communities and the general public.

TRACS and Skill Hire WA recently joined forces to deliver a training program for indigenous jobseekers from the Carnarvon area. The two-month program involved nine indigenous men to learn skills in invasive species management, soft jaw trapping and remote cameras among other natural restoration topics.

Pictured are: Bill Crisp (centre in blue shirt) TRACS team photo, Elles Camp, Warroora Station Ningaloo WA

09 COMMERCIALISATION & UTILISATION

Outcome 10: Growth in Australian invasive animal pest control industries. Through industry collaboration on the registration, marketing, export and community uptake of new products the CRC will enhance control of problem species

COMMERCIALISATION

Strategy

Innovation in the field of pest animal management is challenged by high development, regulatory costs and a commercial imperative to keep the costs of goods and margins for new products low. These challenges or obstacles, very often result in market failure where the costs of developing and launching a new product are too high compared to the returns to warrant commercial investment. The Invasive Animals CRC's commercialisation strategy is to invest expertise and dollars into innovation gaps that otherwise prevent the development and adoption of new invasive animal management technologies. The strategy is not to bridge these gaps alone, but to partner with at least one commercial participant and several end-user participants in developing technologies.

The advantages of this strategy in this field are:

- front-end costs of development are shared such that small to medium enterprise (SME) investment risks are lowered
- the path to market and business plans are formulated and agreed upon in early-stage development
- commercialisers are active participants in the development of products and work closely with individuals or organisations that are end-users or will be key influencers of end-users, which is a driver of innovation adoption
- the network that is built around the development/commercialisation opportunity creates critical mass that adds value and credibility to the innovation outputs and outcomes.

The commitment of the Invasive Animals CRC to this commercialisation strategy is reflected in the resourcing of the Uptake of Products and Strategies Program, which has a strong and proven technology transfer, negotiation, project management, regulatory and product delivery track record.

The value of this expertise supported by the greater CRC management and participant fraternity is acknowledged by Australian and overseas agencies/organisations involved in pest animal management as a key national resource. The strong focus and appropriate resourcing of Utilisation and Commercialisation by this CRC also underscores its commitment to successfully achieving the CRC operational goals and contracted milestones, many of which are achieved in collaboration with CRC SMEs.

SME Engagement

Analytical due diligence on the sector-led Invasive Animals CRC management to adopt a business model which is strongly aligned with that of a key CRC SME – Animal Control Technologies Australia (ACTA). Dr Simon Humphrys and Associate Professor Steven Lapidge have fostered a robust, well integrated and collaborative relationship with Professor Linton Staples (the managing director and founder of ACTA) and key ACTA staff so that technology transfer is seamless, end-users are incorporated within product development and on-ground testing.

This approach to commercialisation and utilisation also has the advantage of consolidating SME commercial participants in the market compared to

an approach that relies on spinning out intellectual property (IP) into start-up companies that would effectively spread critical mass and further fragment the market participants, undermining key SME viability. The CRC acknowledges that this approach is tailored specifically to this market segment, which generally lacks critical mass and maximises the probability that value can be captured from centre IP through the benefit to Australian enterprises.

Australian focused with international scope

To achieve our goals and milestones the Invasive Animals CRC has engaged in excellent Australian focused science over the past six years and during the reporting period. Where applicable this science excellence is framed in the context of global research initiatives in the field of wildlife management. This encompasses an understanding of how research in Australia and on Australian wildlife can have utility in overseas markets and how innovation and intellectual property generated in Australia might by valued overseas and used to generate greater economies of scale for Australian SMEs.

The value of this approach was in evidence during the reporting period where $30,000 of in-kind resources was committed by the United States Department of Agriculture in support of Associate Professor Steve Lapidge's Fulbright scholarship research. This research collaboration was underpinned by Invasive Animals CRC patented IP and has created a foundation of networks that the CRC aims to build on in future collaborations. The practical benefit of this growing relationship is apparent in USDA's pledged commitment to this CRC's extension bid, which includes more than US $3M of in-kind resources. These opportunities highlight the importance of robust IP management that is used strategically to create value.

Intellectual property management

The CRC's management of IP encompasses a balanced strategy based on:

- resources and the probability of significant return on investment
- maximising value of the CRC to participants
- benchmarking background IP and maximising the added value to centre IP
- enhancing commercial awareness of centre staff and students
- minimising the risk of inappropriate IP disclosure.

IP Management adheres to the Invasive Animals CRC Board approved plan that was tailored to take into account the unique qualities of the CRC and the focus of its activities. This strategy balanced a requirement for IP identification, while recognising that university researchers commonly saw little prospect of their outputs having value which required IP protection.

Effectively managing the intellectual property of the CRC is critical to achieving an organisation that maximises the value created through applied research and innovation. For this to occur, a capacity to foster invasive animal research and development must be created, whereby innovative methods of controlling invasive animals within Australasian communities and ecosystems are brought to market for the benefit of all stakeholders. The CRC Board and Executive recognise this key dynamic of value-adding to participant background IP in creating centre IP that is valued by its participants by resourcing the Uptake Program to effectively plan for and manage the IP encompassed within all projects.

Effective management of IP relies on both internal and external IP management processes. Internal IP (Centre and Background IP) management encompasses IP audits, assessment, development, and protection. External (non CRC related) IP management encompasses all activities required to identify, evaluate and interpret the relevance of non-participant and non-centre IP. Analysing internal CRC IP can readily pinpoint its IP strongholds and weaknesses in the context of global IP. This has two advantages. Firstly, that the CRC can be confident that the investment risk it takes in adding value to participant IP is not unacceptably high and secondly that the CRC can confidently establish a research footprint on which an internationally renowned wildlife management cluster can be built.

New IP developed and sold, transferred or licensed for commercialisation during the reporting period

Regulatory pivotal studies that will facilitate applications to the APVMA for the use of rodenticide products in new agricultural/ horticultural/industrial settings.

The licensing of patented IP 'Nitrite salts as poisons in baits for omnivores' that provides a CRC SME with the Freedom to Operate to commercialise new feral pig and rodenticide products containing a new pesticide active.

Impact: Benefits to Australia of IP arrangements

Royalty revenues are currently very modest ($4,400 p.a. in 2010–11) but are generated from only the first of 10 products, which will result from project IP during the CRC's tenure. This royalty stream is forecast to grow to approximately $240,000 p.a. by the time all new products are approved by the Australian Pesticides and Veterinary Medicines Authority.


STANDARD PATENT

2008221237

Dated this 31st day of March 2011

Fatima Bestile
Commissioner of Patents

Patents:

The CRC was granted the Australian Patent 2008221237 'Patent Nitrite Salts as poisons in baits for omnivores'

The CRC was granted the New Zealand Patent 579357 'Patent Nitrite Salts as poisons in baits for omnivores'

The CRC continued to prosecute this patent in Canada, China, EU, India, and USA.

Cowled, BD; SJ Lapidge, S. Humphrys, L Staples (2008). "Nitrite Salts as Poisons in Baits for Omnivores". International Patent WO/2008/104028. *http://www.wipo.int/patentscope/search/en/WO2008104028*.

UTILISATION

End-User Engagement

The Invasive Animals CRC has effectively planned for two phases of end-user engagement that address both early and late stages of the product development pipeline and are aimed at fostering technology transfer and greater adoption of CRC innovations. The first phase of end-user engagement has been achieved via their direct involvement in the on-ground testing of CRC products that are required for the regulatory approval of new pesticide products. End-users participating in product testing results in greater product familiarity, acceptance and credibility and importantly establishes local product champions who are more likely to be early adopters and who's testimonials generally influence later adopters such that adoption of innovation dynamics are positively affected.

The second phase of end-user engagement is aimed at reducing the barriers and increasing the drivers for adoption. The most effective way of enhancing adoption of new management practices is through community led initiatives. Initiating and establishing community led integrated pest management is more successful when local champions have a dedicated resource to call upon for support. The CRC and its industry participants acknowledge the value in providing this key resource and have committed to both a National Natural Resource Management Facilitator and a National Wild Dog Facilitator. These individuals provide a point of reference for information, integrated pest animal management planning and are armed with the knowledge about the best tools and approaches to achieve desired outcomes at a local, regional and landscape scale.

Looking forward, the role of the national coordinators will be supplemented by a second complementary strategy to drive adoption of CRC innovations, the generation of PestSmart Toolkits and the planned Australian PestSmart Roadshow. The delivery of the Toolkits and Roadshow is being coordinated through the Invasive Animals CRC Adoption Steering Group. The 15 member Steering Group was formed in late 2010 and includes members from the Murray-Darling Basin Authority, Meat and Livestock Australia, Australian Wool Innovation, Animal Control Technologies, the Australian Pest Animal Strategy National Coordinator, the National Wild Dog Facilitator and the Invasive Animals CRC NRM Facilitator.

The bulk of the CRC's innovations require APVMA approval. This assessment process takes anywhere from six to eight months for a product containing a currently registered active, eg ejector capsule containing 1080, right up to 18-20 months for products containing new chemical actives, eg baits containing a new poison. These timeframes will mean that many of the products generated by the Invasive Animals CRC will only be launched into markets in its final year of operation or after its current grant period. Therefore it is critical that the CRC has a strategy to enhance end-user awareness of the key pest animals in Australia and how new CRC developed products that will be coming on-line can best be used in an integrated management program in its last six months in order to assist as much as practicable the efforts of the SMEs in launching products into this market.

10 COMMUNICATIONS

Communications activities are undertaken in accordance with the Invasive Animals Strategic Communications Plan.

COMMUNICATIONS: 2010–2011 ACHIEVEMENTS

The aim of Communications is to establish the Invasive Animals CRC's credibility as a solutions-oriented, effective and accountable organisation and to increase awareness and knowledge of invasive animal impacts and the strategies being researched and developed to reduce them.

The Invasive Animals CRC's messages are based on the four 'P's:

- promise — the promise of good science
- people — synergies among and between participants, end-users and public policy makers — the team is definitely greater than the sum of its parts
- processes — new processes including education, interagency and landscape management
- pests — reduced pest impacts leading to better farm productivity and more secure wildlife populations and landscapes.

The following summary outlines communications activities and outcomes during 2010–2011 and features some of the year's communication highlights.

STRONG WWW PRESENCE

On 9 June 2011, the PestSmart facebook page was launched *http://www.facebook.com/pages/PestSmart/229562487054192* to provide another communications platform to launch publications and new PestSmart products, alert the public and media to Invasive Animals CRC or partner events and to encourage education on, and participation in, invasive animal management in Australia.

The DVD produced as part of winning the CRC Association's Award for Excellence in Innovation was posted on YouTube on 29 June 2011. The three-minute video is posted at *http://www.youtube.com/watch?v=xKf6q4zOsC4*.

MEDIA COMMUNICATIONS ACHIEVES BROAD COVERAGE

Media engagement continued to play a vital role during the year with a broad cross-section of coverage achieved across the Invasive Animals CRC's key research areas. Following is a summary of media publicity achieved during the reporting period.

Species	TV # Stories	TV Minutes	Radio # Stories	Radio Minutes	Press # Stories	Press Words	Internet # Stories	Internet Words
Foxes	9	47	124	269	45	11,843	5	1,494
Wild Dogs	14	16	53	296	48	15,161	41	11,918
Pigs	0	0	133	246	6	1,267	7	2,257
Rodents	3	32	169	495	6	2,160	28	9,908
Pest Fish	1	17	110	145	31	10,940	13	7,519
Feral Cats	0	0	8	19	0	0	3	1,179
Cane Toads	39	109	84	276	35	12,258	0	0
Rabbits	5	24	43	190	33	11,324	20	5,467
Birds	0	0	0	0	0	0	0	0
Other	61	84	273	948	36	14,941	21	9,174
Total	**132**	**329**	**997**	**2,884**	**240**	**79,894**	**138**	**48,916**

MEDIA RELEASES

To help gain media coverage throughout the year, the following media releases were issued by the Invasive Animals CRC.

- NRM organisations: essential in the fight against pest animals — 22 June 2011
- Facilitating change: wild dog management in Australia — 22 June 2011
- PestSmart thinking in practical pest animal management — 21 June 2011
- Staying one hop ahead of the rabbits — 21 June 2011
- Assessing the humaneness of pest animal control — 20 June 2011
- New website key to managing pest birds in Australia — 3 May 2011
- HogHopper™ — serving it up to feral pigs — 24 November 2010
- New manual guides livestock's furry guardians — 7 September 2010
- Media alert: Guardian dog manual launch — 7 September 2010
- Feral professor wins Oscar of Australian Science — 18 August 2010

PRESTIGIOUS COMMENDATION FOR SCIENCE PROMOTION

The Invasive Animals CRC has been fortunate to benefit from the skill and enthusiasm of one of Australia's leading-edge communicators of science, Professor Tony Peacock. Professor Peacock's talent was commended during the year at the August 2010 Australian Museum Eureka Prize Awards (see 'Media Release Highlight').

MEDIA RELEASE HIGHLIGHT

FERAL PROFESSOR WINS OSCAR OF AUSTRALIAN SCIENCE

Professor Tony Peacock, the previous CEO of the Invasive Animals CRC now CEO of the CRC Association, was among some of Australia's top scientists celebrated at the Australian Museum Eureka Prize Awards in August 2010. He took out the gong for the highly contested category 'Promoting Understanding of Science'.

Feral animal management is a sensitive and controversial topic in Australia. It is his willingness to tackle this difficult and emotive issue that makes Professor Peacock so unique and worthy of recognition.

According to the professor, many scientists, particularly in this field, find it difficult to talk to the public about their work.

"It's nice for me to be recognised on this level for helping to make sure the community hears about feral animals and the interesting activities undertaken by the Invasive Animals CRC to hinder their impacts," said Professor Peacock.

A report released last year by the Invasive Animals CRC revealed the economic impact of rabbits, wild dogs, mice, foxes and feral pigs and pest birds is estimated at over $740 million per year.

"The figure is just the tip of the iceberg. It doesn't consider the environmental or social costs of invasive animals. We haven't attempted to estimate the costs on our fragile biodiversity by putting a dollar figure on our precious native species that are killed by animals like foxes or cats," he said.

The Eureka Prize for Promoting Understanding of Science is sponsored by Australian Government Department of Innovation, Industry, Science and Research.

PICTURE STORY BOOKS TO BOOST COMMUNITY INVOLVEMENT

In the Northern Territory, there are many challenges associated with feral animal management. One of the current key issues being faced is a lack of understanding about the environmental, cultural and economic damage caused by feral animals and the different management techniques that can be applied to manage feral populations.

With information, guidance and advice from the Invasive Animals CRC, the Department of Natural Resources, Environment, the Arts and Sport (NT Government) produced a series of picture books on invasive animals during the reporting year. A series of five storybooks (pigs, buffalo, cats, dogs and horses/donkeys) were published to facilitate communication between program coordinators and the wider community. The books are almost entirely made up of photos depicting damage caused by these animals and the associated humane management techniques. The advantage of this approach is that they can be used to educate a wide variety of different groups, each with differing literacy and numeracy skills, age groups or cultural backgrounds.

The approach is that these books will enable those working in this area to begin discussions with community groups and cultural groups about feral animals, with the intention that in the long term, these books will lead to greater community involvement and action to manage feral animals.

L-R Jessica Marsh (Invasive Animals CRC's NRM Liaison Officer), Dr Anne Walters (Manager, Wildlife Programs, Department of Natural Resources, Environment, the Arts and Sport) and Melissa Farrelly (Wildlife Ranger, Department of Natural Resources, Environment, the Arts and Sport) pictured at the Territory Natural Resource Management and Landcare Forum, October 2011.

COMMUNICATION MANAGEMENT CHANGE

From 29 November 2010 to 1 March 2011 and 3 August to 12 August 2011, the Invasive Animals CRC was without a Communications Manager. The current Communications Manager – Glenn Conroy commenced on 15 August 2011.

11 ADDITIONAL ACTIVITIES & GRANTS

The Invasive Animals CRC is involved in two significant activities that are outside those specified in the Commonwealth Agreement. Both activities are funded through the Commonwealth Governments Caring for Our Country Initiative.

RHD BOOST; IMPORT AND EVALUATE NEW RHD VIRUS STRAINS TO STRENGTHEN RABBIT BIOCONTROL

The objective of the RHD Boost project is to identify new RHDV strains with high lethality to rabbits immune to endemic Australian Rabbit Calicivirus (RCV-A1), and rabbits resistant to infection with Czech 351 derived RHDV strains. Research is being conducted by CSIRO and NSW Industry and Investment. Funding is being provided by the Commonwealth, Australian Wool Innovation, Meat & Livestock Australia, and the Foundation for Rabbit Free Australia.

BUILDING CAPACITY FOR THE MANAGEMENT OF INVASIVE ANIMAL IMPACTS ON AGRICULTURE

The project brings together private and public land managers to manage the impacts of invasive animals with best practice methods in accordance with established animals and weed prioritisation training tools. Research is being conducted by NSW Industry & Investment, State Management Council of NSW Livestock, Health and Pest Authorities, through engagement with Catchment Management Authorities, Natural Resource Management Units, and private landholders across Australia. Funding is being provided by the Commonwealth.

GRANT SOURCES

The Invasive Animals CRC did not receive any new competitive grants during the reporting period.

12 FINANCIAL PERFORMANCE

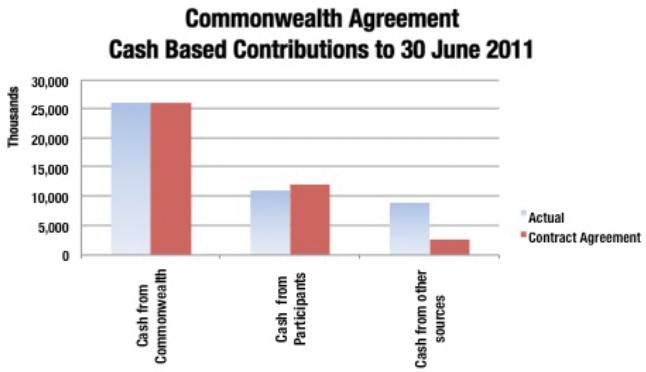
The Invasive Animals CRC continues to deliver financial achievements exceeding the level of cash and in-kind contributions committed under the Commonwealth Agreement, which is a testament to the ongoing engagement of our Participants.

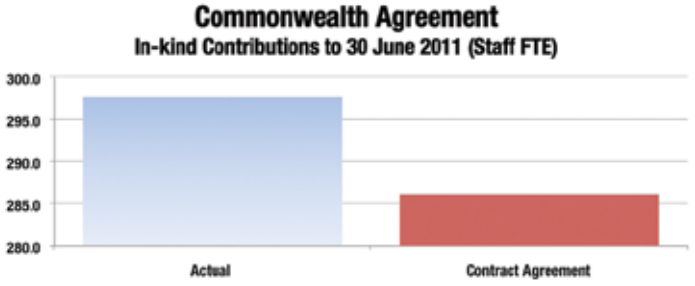
ACHIEVEMENT AGAINST COMMONWEALTH CONTRACT BUDGET

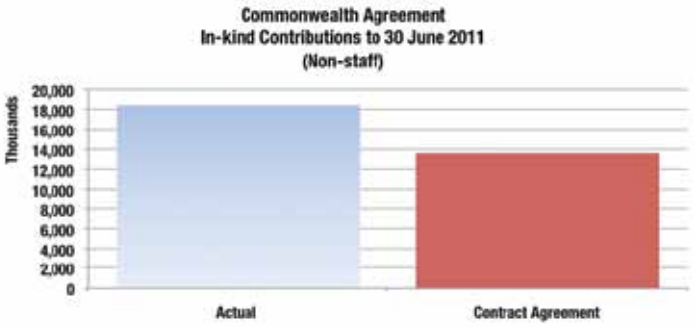
For the 2010–11 Financial Year our target for contributions of personnel time was 24.7 Full Time Equivalent (FTE). The actual level of contributions obtained reached 32.6 FTE. The incremental amount of six years of contributions at June 2011 now totals 297.7 FTE, which already exceeds the 296.5 FTE contributions required for the seven years under the Contract.

The target of $1,533,000 for non personnel in-kind contributions in 2010–11 was well exceeded, with $2,705,000 of contributions confirmed by participants. The incremental value of six years of contributions to June 2011 is $18,499,000, so Invasive Animals CRC delivery will comfortably exceed the $14,435,000 of contributions required for the seven years.

Participants also continued to fulfill their commitment to making cash contributions to the Invasive Animals CRC and in fact provided additional cash investment to further support research projects and enhance delivery and utilisation. By June 2012 more than $50,000,000 will have been invested in the pursuit of our objectives, significantly higher than the $45,867,000 stated in the Commonwealth Agreement Budget.





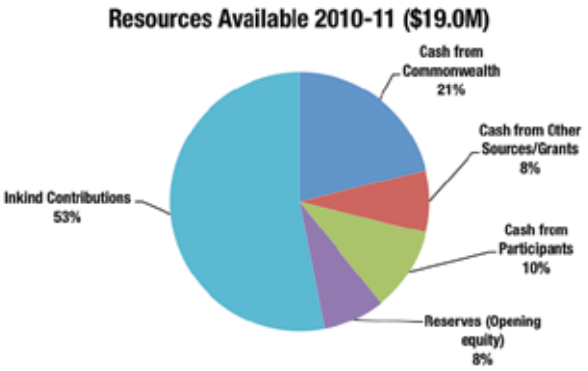


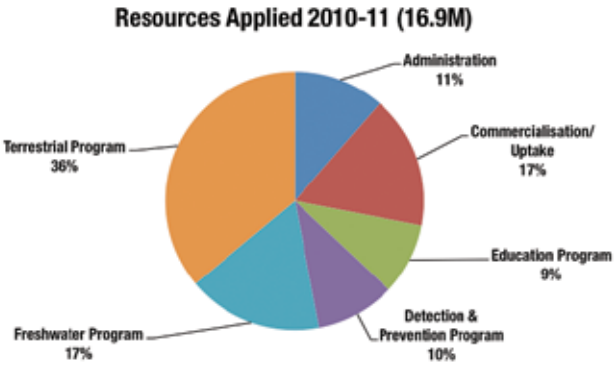
FINANCIAL STRATEGY AND MANAGEMENT

During this financial year we increased our investment in ensuring the effective uptake of Invasive Animals CRC products and strategies. Existing and Invasive Animals CRC-developed information on key pest species has been packaged into *PestSmart Toolkits*. To enhance the uptake of these products and strategies, a national *PestSmart Roadshow* series of events is being funded to directly demonstrate the use and benefits of new products and strategies to graziers and other land managers. Additional investment has also been made in measuring and evaluating the impacts of pest animals and the effectiveness of our controls.

At June 2011 the Invasive Animals CRC had built up equity of $2,078,626. Revenues will fall in 2011–12 whilst the level of expenditure will be maintained, so this equity is expected to be appropriately utilised within the life of the Invasive Animals CRC. Financial planning has been carefully undertaken to ensure the Invasive Animals CRC will meet all its financial obligations and maintain sufficient funds to undertake a professional wind-up of the current Invasive Animals CRC, whilst ensuring available resources are fully utilised in the pursuit of our objectives.

The following graphs broadly summarise the financial performance of the Invasive Animals CRC. Information used in compiling these graphs has been derived from the complete Audited Financial Statements and Tables, which are available for download from www.invasiveanimals.com. These figures include other Commonwealth Grants to the Invasive Animals CRC (such as the RHD Boost Project) which cannot be included in reporting under the Contract Agreement with DIISR.





13 GLOSSARY

adventitious	coming from another source and not inherent or innate
annulus	Latin for 'ring — in fish research refers to annual rings that form in fish scales or bone sections (otoliths)
antibodies	an immunoglobulin, a specialised immune protein produced because of the introduction of an antigen into the body and which combines with the very antigen that triggered its production either destroying the antigen directly or facilitating the white blood cells to destroy it
avirulent	not virulent — refers to an infectious agent that does not produce pathological (disease manifestation) effects
biodiversity	variety of taxonomic life forms
biosecurity	protective measures to prevent a country from the entry and spread of unwanted animals pests diseases and weeds
canid	members of the family Canidae (carnivorous mammals) which includes the foxes, wolves, dogs, jackals and coyotes
calicivirus	a genus in the family Caliciviridae, a family of RNA viruses. They possess a characteristic six-pointed starlike shape whose surfaces have cup-shaped (chalice) indentions. Caliciviruses include the hepatitis E virus a form of swine virus, feline calicivirus and RHDV. We refer to the latter.
CIP	Centre Intellectual Property
cohort (student)	an organisational group defined to facilitate the analysis of student progression comprising programmes commencing in a particular academic year
CRC	Cooperative Research Centre
daughterless	genetic engineering technique using species-native genes that are inheritable and bias offspring sex ratios towards males
DNA	deoxyribonucleic acid
efficacy	the ability to produce a desired amount of a desired effect
endemic	unique to its own place or region – found only there and not naturally anywhere else
EPBC	Environmental Protection Biodiversity Conservation
eutherian	mammals having a placenta
exotic	introduced — not native to Australia
felid	members of the family Felidae (carnivorous mammals) which includes the big cats and domesticated cat
invasive	usually non-indigenous species that adversely effect the habitats they invade economically environmentally or socially. We include some native animals where altered environments have caused their numbers or range to increase artificially
IA	short form of 'Invasive Animals'
hybrid	something of mixed origin or composition. (Genetics) the offspring of genetically dissimilar parents or stock especially the offspring produced by breeding plants or animals of different species or races
judas	captive animal used to attract others or which is fitted with a transmitter and release leading researchers or hunters to a herd



GLOSSARY (continued)

KHV	koi herpes virus
KTP	Key Threatening Process
macropod	member of the Macropodidae family which includes kangaroos, wallabies, tree-kangaroos, pademelons and several others
macro-invertebrate	refers to aquatic invertebrates, including insects, crustaceans, molluscs and worms
mesopredator	a medium-sized predator which often increases in abundance when larger predators are eliminated; eg. raccoons, skunks, snakes, cats, foxes.
monoclonal	of forming or derived from a sincle clone
myxomatosis	a virus specific to rabbits causes by the myxoma virus otolith structure in the inner ear (see annulus above)
PAPP	para-aminopropiophenone
pathogenic	capable of causing originating or producing disease
pathological	of or relating to causing disease
PCR	polymerase chain reaction
pheromone	chemical that triggers an innate behavioural response in another member of the same species
RHD	rabbit haemorrhagic disease (see caliciviruses)
RHDV	rabbit haemorrhagic disease Virus
RSPCA	Royal Society for the Prevention of Cruelty to Animals
scat	faeces, droppings
shelf-stable	(non formal) a product that has been altered so it can be safely stored and sold in sealed containers at room temperature while still having a useful shelf life (quality for a suitable time)
SMEs	small to medium enterprises
spawning	production or depositing of large quantities of eggs in water
specificity	intended for applying to or acting on a particular thing (species)
sylvatic	referring to diseases or pathogens affecting only wild animals terrestrial land based
threatened	at risk of becoming endangered (plant or animal)
toxin	poisonous substance produced by living cells or organisms
virulence	a. extremely infectious malignant or poisonous. Used of a disease or toxin.
	b. capable of causing disease by breaking down protective mechanisms of the host. Used of a pathogen.

Invasive Animals Cooperative Research Centre

14 APPENDICES

Appendix A
Milestone Report

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
1 Outcome	A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%				
1.1 Output	New knowledge on fox and wild dog biology, ecology, impact, management, and the ecological interactions of control methods.	2011	In progress		
1.1.2	Ecological experiments and large scale demonstration projects completed.	30-Jun-11	In progress	The IA CRC's three large-scale ecological experiments and demonstration sites are complete, but final reports are still pending. They are: 10.U.1— WA fox/cat mesopredator release demonstration site, 10.U.3 — Tasmania fox DNA mapping demonstration site and 10.U.4- Southern Ark fox/cat ecology demonstration site. To date, more than 30 international scientific journal papers have/will be produced by the three projects.	Final reports due by Dec. 2011.
1.1.3	Estimation of fox and wild dog abundance using DNA-based technologies implemented.	30-Jun-11	Yes	This milestone has been definitively met through four projects: 10.U.1 and 10.U.3 (listed above), 10.U.21- 'A Strategic Approach — The Molecular Ecology of wild canids in Australia' and Danielle Stephens' PhD project: 'Developing DNA-based monitoring techniques for improved management of wild dogs'. All projects have been completed/PhD submitted and are in final report and manuscript production phase. Numerous journal articles have already been published.	
1.2 Output	New humane fox and wild dog toxin and antidote	2011			
1.2.4	Laboratory experiments and pen trials completed for new antidote to methaemglobin-inducers.	31-Dec-10	In progress	Vet only intravenously administered registration package near completion. Ongoing technical problems with oral formulation efficacy is delaying the re-initiation of the antidote/toxic pen studies.	Additional presentation/formulations being trialed for efficacy. Buccal cavity pouch, and suppository methods currently being tested and experiments due for completion Jan. 2012.
1.2.5	National APVMA registration package submitted for new toxin for foxes.	30-Sep-10	In progress	Full PAPP active package submitted end of August 2010. APVMA required additional toxicological data. Final field trial reports received late September 2011, enabling application to be submitted by end October 2011.	Additional data procured, package updated with required toxicology data and will be submitted by end October 2011. This will allow fox product – FOXECUTE® – to be fully assessed by APVMA.
1.2.6	National APVMA registration package submitted for new toxin for wild dogs.	30-Sep-10	In progress	Full PAPP active package submitted end of August 2010. APVMA required additional toxicological data. Final field trial reports received late September 2011, enabling application to be submitted by end October 2011.	Additional data procured, package updated with required toxicology data and will be submitted by end October 2011. This will allow wild dog product – DOGABATE® – to be fully assessed by APVMA.

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
1.2.7	New product registration applications and new registration applications of existing toxins submitted to the APVMA. One new chemical toxicant registration application submitted. One synergist to 1080 tested and assessed for registration. If the new chemical toxicant is successfully registered, the market for the synergist may be reduced, as the new active will reduce demand for products containing the 1080 toxin.	31-Oct-10	In progress	Research on 1080 synergist completed.- determined to be nonviable. Research demonstrated limited synergistic efficacy and poor humaneness profile. This work was abandoned in favour of developing a new chemical active — PAPP in project EC470 (IA CRC Project Code 1.T.3).	Full PAPP active dossier will be submitted by end October 2011. This will allow wild dog product — DOGABATE® and new fox product — FOXECUTE® — to be fully assessed by APVMA.
1.2.8	National APVMA registration package submitted for [antidote for] working and pet dogs	31-Dec-10	In progress		Minor use registration package currently being prepared. And will be submitted in November 2011
1.3 Output	New approved fox and wild dog lures and new toxin delivery methods.	2011			Lethal trap devices and mechanical ejectors
1.3.3 (b)	National APVMA registration package submitted (if necessary) for delivery systems and multiple canid lure devices that will increase canid detection and bait uptake.	30-Jun-11	In progress	Minor use permit for use of 1080 ejectors now granted for NSW National Parks Service. National cyanide ejector registration package is due to be submitted in October 2011. This will also allow 1080 ejector approval to be extended nationally. Multiple ejector work, outside of the IA CRC.	National cyanide ejector registration package due to be submitted in Oct. 2011.
1.4 Output	Fox and wild dog management packages that include new and existing toxins, application strategies and end-user training	2012			
1.4.2 (c)	Education and training package linked to demonstration sites developed for end-users.	30-Jun-11	In progress	Content for wild dog and fox toolkits currently being reviewed by expert partners and staff of CRC and due for completion Dec. 2011. Toolkit information that has already published is being showcased at CMA/NRM forums and agricultural field days with good feedback from land managers and school teachers. Examples include Canid trapping instructional DVD with some 1000 DVDs distributed across Australia, and the Guardian Dog Best Practice Manual.	All toolkit products will be produced and available by end December 2011.
1.4.3c Milestone	Management-scale (end-user) assessment of new wild dog and fox strategies commenced at demonstration sites in different states with different stakeholders.	31-Jul-09	Yes	Final wild dog field trial site completed during 2010. Milestone completed for foxes. Project 1.T.3e — Southern Ark PAPP trials on foxes completed. NSW Goonoo/Dubbo fox trial using PAPP baits completed. Hathead NP PAPP bait fox trials completed. San Remo Vic PAPP bait fox trial completed. Kumbarilla State Forest QLD wild dog PAPP bait trial completed. Quinyambie Station PAPP bait trial completed.	
1.4.4	Education and training packages for new fox and wild dog strategies completed.	30-Jun-11	In progress	PestSmart toolkits, mini-workshop held at AVPC June 2011. Content for wild dog and fox toolkits currently being reviewed by expert partners and staff of CRC. Toolkit information that has already published is being showcased at CMA/NRM forums and agricultural field days with good feedback from land managers and school teachers.	All toolkit products will be produced and available by end December 2011.
1.4.6 (c)	National recommendations for improved fox and wild dog control practices drafted and finalised.	30-Jun-11	In progress	Improving Fox Management Strategies in Australia publication completed. Wild Dog and Fox PestSmart extension packages (1T1) currently being drafted and will be available December 2011. Revision, update and addition of new COPs and SOPs currently progressing and will be available December 2011 (8T1).	National recommendations will be produced and available by end December 2011.

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
2 Outcome	A benefit of $16 million p.a. by reducing feral pig damage by 15%				
2.1 Output	New knowledge on feral pig ecology and impacts	2011			
2.1.3	Large-scale ecological experiments and demonstration projects completed.	30-Jun-11	In progress	The two demonstration sites that involved feral pig research will be completed in February 2012 (10.U.2- KI) and November 2011 (10.U.6- Qld). All new IA CRC feral pig management innovations have been tested on Kangaroo Island and a feral pig management plan has been produced. 10.U.6 has produced three PhDs, one MSc and an Hons student, with 20+ journal articles expected (8 published or in press).	To be completed by Feb. 2012.
2.3 Output	HOG-GONE® — Second generation feral pig toxin with improved humaneness profile	2012			
2.3.2	Target-specific 'Achilles Heel' feral pig bait formulated, if suitable toxicants are identified and successfully tested.	30-Jun-10	Yes	Milestone met on time. Near final formulation was developed in early 2009, but has been refined following subsequent field trials. Final formulation will shortly enter the registration phase.	
2.3.3	Field trials of new toxin conducted in association with demonstration sites, commercial partners and/or end users (subject to State and Federal approval).	31-Dec-10	Yes	HOG-GONE® field trials have been conducted on Kangaroo Island (10.U.2) and with end users: LHPA in NSW; ACT PCL in Namadgi NP; DAFWA at Fitzroy Crossing; QMDC at Goondiwindi; Biosecurity Qld at Lassie Creek Station; MLA at Byrne Valley Station.	
2.3.4	National registration package submitted to APVMA for HOG-GONE® feral pig baits.	30-Jun-11	In progress		HOG-GONE® registration dossier currently in preparation and will be submitted in Nov. 2011.
2.5 Output	Feral pig baits with capacity to carry contraceptives and/or vaccines (in collaboration with USA and UK scientists).	2012			
2.5.2	Feral pig contraceptive and/or vaccine baits promoted for regions/countries that do not allow broad-scale lethal control, if PIGOUT® proves suitable.	30-Jun-11	No	Milestone will not be met. Non-toxic PIGOUT® lacked target specificity on its own in USA field trials, and USDA could not develop suitable oral vaccines/ contraceptives. As such they are now testing the HOG-GONE®/HogHopper™ combination in eight states. UK FERA also tested PIGOUT® as a potential delivery tool for an oral GnRH vaccine but found then to be unappealing to European boar. As the UK will not register a lethal chemical for wild boar control, they remain hopeful for an oral GnRH vaccine.	
2.6 Output	Feral pig management packages that include new and existing toxins, application strategies and end-user training.	2012			
2.6.2 (b)	Rapid adoption of new management strategies to reduce agricultural and environmental impacts ensured through demonstration sites and collaborative field-based projects with end-users.	30-Jun-11	Yes	Three products have been delivered under Outcome 2 thus far — PIGOUT®, the HogHopper™ and management unit research. All outputs have been rapidly adopted, with over 200,000 PIGOUT® baits sold, 200 HogHoppers™ (@$1,000 each) and many NRM/CMA boards using the feral pig management unit research. Additional deliverables will be HOG-GONE®, Econobait and a nitrite concentrate. These products are being developed due to a clear market need. Promotion of the benefits of each of these products has commenced and rapid adoption is anticipated.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
2.6.5 (b)	National recommendation for improved practices for feral pig control drafted and finalised.	30-Jun-10	In progress	National recommendations — in the form of PestSmart Toolkit documents — are currently being prepared, published, and made available early 2012. Improved management recommendations will also be a core deliverable of the PestSmart Roadshow in early 2012.	To be available by early 2012.
3 Outcome	A benefit of $7 million p.a. by reducing rodent damage by 20%.				
3.5 Output	Improved and/or new rodent control options to protect produce in agricultural areas.	2012			
3.5.1 (b)	Extent of problem and market opportunities scoped for new products and/or strategies.	31-Dec-10	Yes	Currently there are no registered rodenticides for use to control mice in a variety of intensive agricultural crops. There is also a requirement for a mouse control technique that can be applied in industrial and intensive livestock situations to bring about immediate population knockdowns. Similarly, rodenticide products are required to control rat species in intensive crops and plantations and to establish improved methods for control in industrial situations. Trials have been conducted under pen and field conditions to assess efficacy, palatability, stability and residues of existing and new ACTA products where use extensions into new markets are possible.	
3.5.3 Milestone	Applications to the APVMA submitted for the commercial use of MOUSEOFF® ZP and RATOFF® ZP to extend their use and current label claims.	30-Jun-10	In progress	MOUSEOFF® ZP and RATOFF® ZP use extension applications are yet to be submitted to the APVMA as ACTA/IA CRC registration emphasis is currently on PAPP then nitrite/HOG-GONE®. MOUSEOFF® ZP Bromadiolone and Difenacoum bait block applications have been submitted with the APVMA, and recently passed screening.	Additional capacity has been secured to accelerate registration package development t ensure all packages are submitted before June 2012.
3.5.5 Milestone	A business plan showing economic viability and strategic uses for new and improved rodent control methods.	30-Jun-11	In progress		A business plan will be jointly developed by ACTA and IA CRC Commercialisation Manager for applications of MOUSEOFF® ZP and RATOFF® ZP in novel crop settings by June 2012.
4 Outcome	A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species				
4.1 Output	New knowledge on carp and tilapia biology and/or ecological interactions and control options.	2012			
4.1.4 Milestone	Baseline information on tilapia life history consolidated. Investigation of tilapia dispersal in Queensland commenced.	31-Dec-09	Yes	"4.F.10 (tilapia life history vulnerabilities) completed, but further work is being undertaken to achieve this milestone. Baseline information has been consolidated. Dispersal project fieldwork has been completed.	4.F.18 (management strategies for control and eradication of feral tilapia) commenced in 2010 for completion by Dec 2011.
4.1.5 Milestone	Information on carp population dynamics and vulnerability consolidated	30-Jun-10	In Progress	Minor project delays	Draft report has been received and will published by end 2011.
4.2 Output	Knowledge of the potential of daughterless platform technology.	2012			
4.2.3 Milestone	Experiments completed to examine whether daughterless technology works to drive a model fish population to extinction.	31-Dec-10	In progress	A successful female lethal construct has been developed and trialed through three generations of a laboratory fish species, and verified as effective in carp. Integrated lines are being developed and further evaluated in carp as a prelude to possible field trials. Predictive models have been updated to assess alternative management options, and the framework for a robust risk analysis framework established.	Experiment due for completion May 2012.

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
4.2.4 Milestone	Commence work on the development of a daughterless construct for carp.	31-Dec-10	Yes	A prototype carp daughterless construct was built wholly of native carp genetic material. The daughterless project also commenced trials of the genetic technology in carp, through an already established collaboration with fisheries geneticists at Auburn University (USA). The existing daughterless carp prototype (DC-1) was tested for effects on sex determination, along with complementary genetic constructs that hypothetically also distort operational sex ratio. Testing of the effect of the technology on laboratory fish populations was continued by assessing the long-term patterns of inheritance and effectiveness of sex-determining constructs at altering sex in a model fish species. This work was supported by two PhD projects that investigated the physiological and genetic basis of sex determination and RNA interference (the key gene blocking technology being used in this study) in fish.	
4.2.5 Milestone	Analysis of the international, national and State policy and regulatory frameworks regarding the use of control technologies against invasive fish undertaken to guide and enable the implementation of various control options, particularly daughterless technology and CyHV-3.	31-Dec-10	In progress	This project had a budget allocation, and was to have been undertaken by contract with Vic DPI, it has not formally commenced. The project has benefited from the delay by allowing a better understanding of where this project can be of greatest benefit, and an opportunity for completion with cost savings.	New arrangements are being made for the project to be undertaken within the auspices of the NSW Fisheries project 10.U.8 (Identifying and implementing targeted carp control options for the lower Lachlan River catchment). Information from the daughterless and KHV projects will be integrated into this project to ensure that all appropriate issues for the development and release of a daughterless carp construct and KHV will be addressed by the IA CRC well before implementation. Project due for completion May 2012.
4.3 Output	Knowledge on the potential of Cyprinid herpes virus 3 (CyHV-3) as a biocontrol agent for carp in Australia.	2012			
4.3.2 Milestone	Complete carp susceptibility trials to CyHV-3 to determine the most vulnerable carp stages.	31-Dec-10	In progress	Preliminary trials have been undertaken of the susceptibility of carp of different age-classes sourced from Australian waterways, but completion of this work was delayed due to illness of the primary researcher.	The primary researcher is now back at work after extended leave, and work plans are being revised to complete these experiments by April 2012.
4.5 Output	Adaptive management framework for assessing national control options for pest fish.	2012			
4.5.7 Milestone	Produce practical manual for carp control using sustained fishdown methods.	30-Jun-11	Yes	A manual of carp control methodologies based on the Tasmanian model' draft report received, to be published by Dec 2011.	
4.5.8 Milestone	Produce practical manual for carp control using barrier traps.	30-Jun-11	Yes	Proof of concept of a Novel Wetland Carp Harvesting Set-up at Lake Bonney, South Australia' report published in March 2011.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
4.7 Output	Integrated pest fish management package	2012			
4.7.2 Milestone	Risk analyses, community consultation and management strategy evaluation of control options selected from scoping studies for detailed evaluation and development completed.	30-Jun-11	In progress	This project had a budget allocation, and was to have been undertaken by contract with Vic DPI, it has not formally commenced. The project has benefited from the delay by allowing a better understanding of where this project can be of greatest benefit, and an opportunity for completion with cost savings.	New arrangements are being made for the project to be undertaken within the auspices of the NSW Fisheries project 10.U.8 Identifying and implementing targeted carp control options for the lower Lachlan River catchment. Information from the daughterless and KHV projects will be integrated into this project to ensure that all appropriate issues for the development and release of a daughterless carp construct and KHV will be addressed by the IA CRC well before implementation. Project due for completion April 2012.
4.7.4 (f) Milestone	Annual consultations with VPC fish working group, Australian Fisheries Management Forum, and MDBA pest fish working group, held to facilitate development of the policy and legislative frameworks required to make management package operational.	30-Jun-11	Yes	Annual consultations have been held to update stakeholders on the latest developments in carp management. In the final year of the program, in addition to PestSmart public forums, specific carp and tilapia forums will be held for fisheries managers.	
4.7.5 (b) Milestone	Input into the MDBA Basin Alien Fish Plan.	30-Jun-11	Yes	In addition to consultation re milestone 4.7.4 (f) the Freshwater Program Leader has had input to, and provided review comments on a Draft Basin Alien Fish Plan for the MDBA.	
6 Outcome	Reduced impact of feral cats over five million hectares				
6.1 Output	New knowledge on feral cat ecology, and ecological interactions of control methods.	2012			
6.1.3 Milestone	Ecological studies on the movement patterns and habitat use of feral cats, and ecological interactions of control methods, including evidence of meso-predator release.	30-Jun-11	Yes	The 10.U.1 (WA), 10.U.2 (KI) and 10.U.4 (Victoria) have all studied the movement of feral cats in very different habitats, as well as tested CURIOSITY (PAPP based) baits. 10.U.1 and 10.U.4 have taken these studies further to examine the behaviour of cats subjected to lethal fox control. 10.U.1 has clearly shown that mesopredator release of feral cats can and often does follow effective fox control, and that feral cats can subsequently have a devastating impact on threatened fauna such as the woylie.	
6.3.1	Field effectiveness of non-toxic CURIOSITY feral cat baits for reducing the impact of predation on threatend wildlife measured.	31-Dec-10	Yes	CURIOSITY feral cat baits were trialled at Scotia Sanctuary (Aus. Wildlife Conservancy) and on Kangaroo Island (10.U.2) in seasonal trials. KI trials saw some uptake by cats, but notwithstanding 90% of baits at both locations were taken by non-target species. As such, the impact of the baits would be far greater than the impact of cats on local wildlife.	
6.3.4	Data package provided to assist DEWHA and other project partners develop the registration package for a new or improved feral cat toxin.	31-Dec-10	Yes	The Scotia and Kangaroo Island CURIOSITY bait trial reports have been provided to DEWHA and partners for registration purposes if required.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
6.4 Output	Education and management package	2012			
6.4.2 (b) Milestone	Education and training package linked to demonstration sites launched for end-users.	30-Jun-11	In progress		Feral cat PestSmart toolkit materials are currently being prepared, in particular for the 10.U.1 mesopredator release site and 10.U.2 KI site. They are due for completion early 2012. Additionally, the Denny and Dickman (2010) 'Review of Cat Ecology and Management Strategies in Australia' was recently published and has been well adopted by end-users.
7 Outcome	Increased agricultural profitability through improved integration of existing biological, conventional and newly-developed control options for rabbits				
7.4 Output	Freeze-dried Rabbit Haemorrhagic Disease bait delivered product made available to end users.	2011			
7.4.1 Milestone	The use of freeze-dried Rabbit Haemorrhagic Disease virus on baits demonstrated in laboratory and field studies	31-Dec-10	Yes	The stability of freeze-dried RHDV at -20oC, 4-8°C and 24-27°C storage conditions has been assessed, and it is stable for 24 months when stored at -20°C and 4-8°C. Freeze Dried RHDV stored at -20°C has also been applied to carrot chunks and oats and was as pathogenic as the same dose of RHDV viral suspension product that is currently registered. The study report detailing stability and efficacy was submitted to the IA CRC in late September 2011 and will be incorporated into the Freeze-dried RHDV registration data package before end of October 2011. The full registration package will be submitted to the APVMA in November 2011.	
7.4.2 Milestone	National APVMA registration package submitted	30-Dec-10	In progress		Drafts of Pt 1 Overview, 2 Chemistry and Manufacturing, and 8 Efficacy completed. Study reports for stability study and efficacy study are all that are required to complete the registration applications. These are being prepared by project staff to enable milestone completion by early 2012.
7.4.3 Milestone	Protocols for delivery of freeze-dried Rabbit Haemorrhagic Disease Virus on baits to landholders established in consultation with state agencies responsible for pest management.	30-Dec-10	Yes	Protocols remain similar to existing virus distribution except no longer considered as dangerous goods ie. cheaper and no dry ice required.	
7.5 Output	Rabbit warren pressure CO fumigator	2012			
7.5.1 Milestone	Operational performance of fumigator determined under field simulated conditions.	30-Jun-11	In progress	10 complete fumigator units were recently manufactured but are now undergoing modification. Once complete, the modified units will be field tested in late 2011/early 2012, although IP protection needs finalising before beginning trials. NSW DII AEC have approved the trial.	Milestone to be achieved by late 2011/early 2012.
7.6 Output	Optimal strategy for bait delivered RHD Virus	2012			
7.6.1 (b) Milestone	Windows of opportunity for bait product deployment determined based on studies of the virus.	30-Jun-11	Yes	Recommendations included in draft IA CRC publication 'RHD Boost — decision framework and monitoring and evaluation plan' May 2011.	
7.6.2 Milestone	Results of field trials analysed and built into an optimal RHD bait delivery strategy.	30-Jun-11	In progress	Field sites nominated across Australia as part of RHD Boost monitoring and release strategy and trials to commence after June 2012.	This milestone will be delivered as part of implementation of RHD Boost monitoring and release strategy after June 2012.

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
7.8 Output	Strategies for optimal use of Rabbit Haemorrhagic Disease (RHD) and conventional controls.	2012			
7.8.3 Milestone	Optimal control strategies incorporating natural outbreaks of Rabbit Haemorrhagic Disease (RHD) and bait delivery of RHD delivered to end users.	30-Jun-11	In progress		Rabbit PestSmart information toolkits currently being drafted and will be available December 2011.
8 Outcome	Deliver improved and humane approaches to reduce the production and biodiversity impacts of expanding or other overabundant and widespread pest species				
8.2 Output	A better understanding of the social impacts of animal invasions to improve priority setting, design of control programs and remove blockages to innovation or control.	2011			
8.2.3 Milestone	Social dynamics to invasive animal management studied.	30-Jun-11	Yes	This milestone is being primarily achieved through three PhD studies: PhD Thesis (Carla Meurck) Social aspects of feral pig management in the wet tropics of North Qld (complete). 2. PhD Thesis (Adriana Forde) Social Impacts in Australia: Case Study Deer. 3. PhD Thesis (Kate Grarock) Community Management of Indian Mynas.	
Output 8.4	Management packages for improved herbivore management	2012			
8.4.2 Milestone	Studies that demonstrate the circumstances in which commercial harvesting contributes to production and biodiversity outcomes completed.	30-Jun-11	Yes	Field work studies in NSW, SA and QLD completed. Final report due February 2012.	
8.4.7 (f) Milestone	National workshops held to describe pest problems, share knowledge, recognise gaps and agree on coordinated actions.	30-Jun-11	Yes	National workshop was held with end users and scientists to develop an agreed forward research program on rabbit control that formed the basis of the IA CRC extension bid.	
8.4.8 Milestone	Best pratice herbivore control options which incorporate lethal and non-lethal options developed.	30-Jun-10	In progress	Projects including Fertility Control of Large Herbivores, Review of COPS/SOPS for Human Invasive Animal Control and Commercial Use, and the Fertility Control Options for Camels Report are still in progress. They will converge to deliver this milestone.	Relevant feed-in projects will be completed by March 2012.
9 Outcome	Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new or emerging invasive animal problems				
9.1 Output	The development of information systems that improve coordination and evaluation of effort on a national, regional and local level.	2012			
9.1.5 (b) Milestone	Data-capture tools for distribution and abundance of invasive animals developed, tested and implemented, and web-based information systems for invasive species evaluated.	30-Jun-11	Yes	Multi-scale invasive animals database for reporting on species extent, distribution & abundance refined. Development and trial of customised login facilities for community groups. Development, launch and promotion of Feral Scan websites for rabbits, foxes, feral camels and common mynas.	
9.1.6 (e)	Pest density-damage relationship for at least one invasive animal assessed to optimise benefits from control.	30-Jun-10	Yes	IA CRC Publication 'Planning landscape-scale rabbit control' authored by Dr Brian Cooke.	
9.2 Output	Validated risk models, systems and assessments	2010			
9.2.3b Milestone	Risk assessments conducted on farming species with the potential to establish feral populations, and ensure this information is given to appropriate government agencies to act on.	1-Jul-09	Yes	A final report assessing risks of 40 exotic vertebrate species (including farming species) has been published ad distributed.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
9.3 Output	Cost-effective early warning detection and response options to restrict introductions or the range of invasive animals.	2011			
9.3.2(d) Milestone	A national pest animal genotyping facility developed and reviewed annually.	30-Jun-11	Yes	Multiplex microsatellite genotyping for foxes, cats, fallow deer and pigs has been developed and/ or optimised. Ongoing support to the Tasmanian fox eradication project through technical advice, DNA primer development, project direction, facility development, facility acquisition and sample storage.	
9.5 Output	Management recommendations for endemic and exotic diseases of invasive animals.	2011			
9.5.2(b) Milestone	National recommendations for improved practices to reduce the impact of endemic and exotic disease infections carried by invasive animals produced.	30-Jun-11	Yes	IA CRC Report 'Pathogens of Vertebrate Pests in Australia' published.	
11 Outcome	Increased professional and practical skills-base in invasive animal management through education, training and community awareness				
11.1 Output	Postgraduate training: 24 PhD candidatures completed in support of CRC outcomes and fully integrated with a Certificate of Achievement in Research Leadership and Management.	2012			
11.1.2 (b) Milestone	A four-year, instead of the typical three-year, PhD program implemented for each student to enable scholars to complete their parallel Research Leadership and Management Certificate of Achievement without disadvantaging their research studies. Completion date for each cohort of PhD students expected: June 2010, June 2011, June 2012.	30-Jun-11	Yes	All students have completed a Research Leadership and Management Certificate of Achievement. 15 of 29 students have submitted their theses, with the remainder expected to submit before June 2012.	
11.1.3 (b) Milestone	Students placed in industry at a time best suited to the research program of the student and the timetable of the most appropriate industry partner. Each full-time PhD cohort to have undertaken their industry placement by December of their final year: December 2009, December 2010, December 2011.	31-Dec-10	Yes	All Cohort 1 (due December 2009) and Cohort 2 (due December 2010) students have completed Industry Placements as a requirement of obtaining an 8th Semester of Scholarship Funding.	
11.2 Output	Manager and field officer training: Graduates of PESTPLAN — new diploma level training course in strategic invasive animal management, and Conservation and Land Management Level 2-4 course.	2012			
11.2.1 (f) Milestone	Consultation with partners to develop training courses and management packages to ensure rapid and correct uptake of products delivered to national and international stakeholders and end-users, as new IA CRC products, technologies, techniques and strategies are developed (in conjunction with each program and demonstration sites).	30-Jun-11	Yes	Course developed in consultation with state agencies and pest managers and accredited nationally. Currently in its fifth year of delivery. Employer and student evaluations have been extremely positive.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
11.2.4 (e) Milestone	A series of five courses, delivering consistent national approaches to knowledge, management and practical skills training, presented to facilitate a rapid uptake of new technologies, and provide the opportunity for two-way information flow.	30-Jun-11	Yes	Graduate Certificate in strategic pest management approved by UC Academic Board in 2010 and offered in 2011. Graduate Diploma and MSc developed and expected to be approved by University of Canberra in February 2012 and offered on-line, both nationally and internationally in 2012.	
11.3 Output	Enhanced professional and skill development for partner agencies to produce benefits through reduced on-ground costs and increased productivity from invasive animal control.	2012			
11.3.1 (e) Milestone	Appropriate education and training packages produced.	31-Jan-11	Yes	Graduate level best practice pest animal management courses have been developed and are being taught through the University of Canberra and University of Canberra College.	
11.4 Output	End-user capacity-building: increased knowledge and skills	2012			
11.4.5b	Development and maintenance of online educational and practical resources through feral.org.au for schools, managers and landholders.	30-Jun-11	Yes	The primary and secondary school resources, Feral Focus and Pest Tales, are completed. Presented to the Annual Science Teachers Conference and to selected CMAs. Extremely positive response and increasing use by teachers.	Managers & landholders component (PestSmart Toolkit) is ongoing.
11.5 Output	Increased stakeholder and community awareness.	2012			
11.5.1 (b) Milestone	Mass media coverage of invasive animal issues, impacts and solutions obtained.	30-Jun-11	Yes	Media coverage of Invasive Animals CRC research and activities has been consistently good with a strong trend of increasing media coverage achieved.	
12.1 Output	Assessment of the overall impact of the IA CRC throughout its life, and recommended directions and requirements into the future.	2012			
12.1.1 (e) Milestone	Agreed benchmarks established for invasive animal impacts, density and distribution in Australasia, this information portrayed to the public and changes in community attitudes to invasive animals monitored.	30-Jun-11	Yes	This milestone has been achieved through three projects published as 'Assessing invasive animals in Australia 2008' (West 2008), 'The Economic Impacts of Vertebrate Pests in Australia' (Gong et.al 2009), 'National Community Awareness Survey' (Fisher and Cribb In Press).	
12.1.2 (e) Milestone	Community attitudes towards current and potential invasive animal species and control methods monitored and evaluated.	30-Jun-11	Yes	The Valuemetrics 'Community Attitudes' survey has been submitted. The Report will be published.	
12.1.3 (e) Milestone	Reductions in pest animal impacts (and associated gains in production) through the various activities of the IA CRC demonstrated through rigorous assessment.	30-Jun-11	Yes	This milestone has been achieved through the published 'IA CRC Economic Impact Assessment' (2008).	

Appendix B
Publications Listing

The full publication listing follows.

2.1.1 Formal books – Authored Research (unweighted)
2.1.2 Formal book chapters
2.1.3 Formal articles in scholarly refereed journals
2.1.4 Formal full written conference paper – refereed proceedings
2.2 Publications and reports for industry and other end users
2.2.1 Conference abstract in a non-refereed proceedings publication
2.2.2 Invasive Animals CRC technical report
2.2.3 PestSmart report / factsheet / brochure
2.2.4 PestSmart case study
2.2.5 Other agency report

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 1: A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%					
2.1.3 – Formal articles in scholarly refereed Journals	July 2010	The management of foxes and their impacts in Australia	Mammal Review 40: 181-211.	Saunders, G.R., Dickman, C. and Gentle, M.	11.T.1
2.1.3 – Formal article in scholarly refereed journals	August 2010	Comparative diets of the chuditch, a threatened marsupial carnivore, in the northern and southern jarrah forests, Western Australia	Journal of Zoology, Volume 282, pp. 276-283.	Glen, A.S., Wayne, A., Maxwell, M. and Cruz, J.	10.U.01b
2.1.3 – Formal articles in scholarly refereed Journals	November 2010	Measuring recruitment in an invasive species to determine eradication potential	Journal of Wildlife Management, 74, Issue 8, pages 1661-1670.	Berry, O. and Kirkwood, R.	10.U.21
2.1.3 – Formal articles in scholarly refereed Journals	December 2010	The potential for participatory landscape management to reduce the impact of the red fox (*Vulpes vulpes*) on lamb production	Wildlife Research 37: 695-701.	McLeod, L., Saunders, G., McLeod, S., Dawson, M. and van de Ven, R., Alen B.L., Fleming, P.J.S.	1.T.1
2.1.4 – Formal full written conference paper – refereed Proceedings	Accepted July 2010	Six important considerations when evaluating dingoes (*Canis lupus dingo*) as potential biodiversity conservation tools in Australia	56th Scientific Meeting and Rock-Wallaby Symposium	Allen, B.L. and Ballard, G.	10.T.5
2.2 – Publications and reports for industry and other end users	December 2010	Controlling introduced predators in the rangelands – the conclusion	Landscope – Western Australia, pages 17-23.	Algar, D. and Richards, J.	10.U.01b
2.2.1 – Conference abstract in a non-refereed proceedings publication	June 2011	Putting the pest management puzzle together — landholder perspectives on national coordination and the necessity to access information in order to facilitate change in wild dog management	15th Australasian Vertebrate Pest Management Conference Proceeding and Abstract — Non Refereed	Mifsud, G. and Fraser, B.	1.T.2
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted July 2010	Predation by foxes and cats, the ubiquitous threat to biodiversity conservation in Australia. Is it made worse or ameliorated by mesopredator release?	Threatened Species Research Forum Proceeding and Abstract — Non Refereeds	de Tores, P., Marlow, N., Algar, D., Morris, K., Glen, A., Sutherland, D. and Berry, O.	10.U.01b

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted September 2010	Gone to the dogs: socio-political realities of managing free-ranging dogs in eastern Australia.	40th Anniversary Symposium South African Wildlife Management Association	Ballard, G. and Fleming, P.	10.T.5
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted December 2010	Field of view: F-stop inappropriate use of remote cameras in the field of wildlife management!	Proceedings of the 23rd Australasian Wildlife Management Society Conference, Torquay, Victoria	Meek, P., Ballard, G., Fleming, P. and Vernes, K.	10.T.5
2.2.1 –Conference abstract in a non-refereed proceedings publication	Accepted December 2010	Are we barking up the wrong tree? Observations on community co-management of wild dogs in NSW, Australia.	Proceedings of the 23rd Australasian Wildlife Management Society Conference, Torquay, Victoria	Ballard, G. and Fleming, P.	10.T.5
2.2.1 – Conference abstract in a non-refereed proceedings publication	Poster Accepted June 2011	Wild dogs and barrier fences in NE NSW	15th Australasian Vertebrate Pest Management Conference Proceeding and Abstract — Non Refereeds	Ballard, G., Doak, S., and Fleming, P.	10.T.5
2.2.1 – Conference abstract in a non-refereed proceedings publication	Poster Accepted June 2011	Wolfing them down. How many 1080 meat baits do individual wild canids consume during baiting programs?	15th Australasian Vertebrate Pest Management Conference Proceeding and Abstract — Non Refereeds	Ballard, G., Doak, S. and Fleming, P.	10.T.5
2.2.2 – Publications and reports for industry and other end users — Invasive Animals CRC report	June 2011	Economic analysis of the National Wild Dog Facilitator Project	Invasive Animals CRC report	Chudleigh, P., Simpson, S. and Lai, J.	1.T.2
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	January 2011	European red fox (*Vulpes vulpes*)	PestSmart toolkit, — fox factsheet 1. Biology & Ecology.	Invasive Animals CRC	11.D.1
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	May 2011	Fox bounties	PestSmart fox factsheet — bounties	Invasive Animals CRC	11.D.1
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	April 2011	CASE STUDY: Coordinated group fox programs	PestSmart case study — fox	Invasive Animals CRC	11.D.1
OUTCOME 2: A benefit of $16 million p.a. by reducing feral pig damage by 15%					
2.1.3 – Formal Articles in Scholarly Refereed Journals	October 2010	Artificial illumination reduces bait-take by small rainforest mammals eg baits for feral pigs	Applied Animal Behaviour Science, 127: 66-72.	Bengsen, A.J., Leung, L.K., Lapidge, S.J. and Gordon, I.J.	10.U.06b
2.1.4 – Formal Full Written Conference Paper – Refereed Proceedings	Submitted For Review August 2010	Development of a humane feral pig toxicant and its potential for other vertebrate pests	The Wildlife Society — 17th Annual Conference Proceedings and Abstract — Refereed	Lapidge, S.	02.U.01
2.2.1 – Conference abstract in a non-refereed proceedings publication	Submitted For Review August 2010	The development of HOG-GONE®, a new lethal control option for the management of feral pigs in Australia	Queensland Pest Animal Symposium Proceedings and Abstract — Non Refereed	Smith, M., Lapidge, S., Wishart, J. and Staples, L.	02.U.05e
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	May 2011	Frequently asked questions about HOG-GONE®	PestSmart factsheet — feral pig. HOG-GONE® FAQ	Invasive Animals CRC	11.D.1
OUTCOME 3: A benefit of $7 million p.a. by reducing rodent damage by 20%					
2.1.2 – Formal book chapters	2010	Rodent outbreaks in Australia: mouse plagues in cereal crops	'Rodent outbreaks: ecology and impacts' (Editors: G.R. Singleton, S.R. Belmain, P.R. Brown and B. Harcourt). Los Banos, Philippines, International Rice Research Institute. pp 225-238	Brown, P.R., Singleton, G.R., Pech, R.P., Hinds, L.A. and Krebs, C.J.	3.T.3e

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.1.2 – Formal book chapters	2010	Response options to rodent outbreaks following extreme weather events: cyclone Nargis, a case study	'Rodent outbreaks: ecology and impacts' (Editors: Singleton G.R. Belmain, S.R., Brown, P.R. and Harcourt, B.). Los Banos, Philippines, International Rice Research Institute. pp 171-189	Singleton, G.R., Htwe, N.M., Hinds, L.A. and Soe, W.	3.T.3e
2.1.3 – Formal article in Scholarly Refereed Journals	February 2011	Comparative pathology of pulmonary hydatid cysts in macropods and sheep.	Journal of Comparative Pathology, pp. 144: 113-122	Barnes, T.S., Hinds, L.A., Jenkins, D.J., Bielefeldt-Ohmann, H., Lightowlers, M.W. and Coleman, G.T.	3.T.3e
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Effect of different periods of treatment with 4-vinylcyclohexene diepoxide on fertility of female rats	15th Australasian Vertebrate Pest Management Conference Proceeding and Abstract — Non Refereeds	Tran, T.T, Lyn, Hinds, A. and Blome, A.K.	3.T.3e
OUTCOME 4: A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species					
2.1.2 – Formal book chapters	January 2011	Book chapter on 'Common carp'	The Encyclopedia of Biological Invasions, D Simberloff and M Rejmanek (Eds), University of California Press, pages 100-104	Sorensen, P.W. and Bajer, P.	04.F.4
2.1.3 – Formal article in Scholarly Refereed Journals	July 2010	Cognitive aspects of food searching behaviour in free-ranging wild common carp	Environmental Biology of Fish, 88: 295-300.	Bajer, P.G., Lim, H., Travaline, M.J., Miller, B.D. and Sorensen, P.W.	04.F.4
2.1.3 – Formal article in Scholarly Refereed Journals	July 2010	Off-stream movements of fish during drought in a regulated lowland river	River Research and Applications, DOI: 10.1002/rra.1419	Conallin, A., Hlllyard, K., Walker, K., Gillanders, B. and Smith, B.	04.F.12
2.1.3 – Formal article in Scholarly Refereed Journals	February 2011	Isolation and characterisation of koi herpesvirus (KHV) in Indonesia: identification of a new genetic lineage	Journal of Fish Diseases, 34: 87-101.	Sunarto, A., McColl, K.A., Crane, M.S., Sumiati, T., Hyatt, A.D., Barnes, A.C. and Walker, P.J.	04.F.7
2.1.3 – Formal article in Scholarly Refereed Journals	February 2011	An evaluation of electrofishing as a control measure for an invasive tilapia (*Oreochromis mossambicus*) population in northern Australia	Marine and Freshwater Research, 62:110-118	Theusen, P.A., Russell, D.J., Thomson, F.E., Pearce, M.G., Vallance, T.D. and Hogan, A.E.	04.F.10
2.2.3 – Publications and reports for industry and other end users — PestSmart report	October 2010	Making and using female sex pheromone implants which attract mature male common carp	PestSmart report	Lim, H. and Sorensen, P.	04.F.4
2.2.5 – Publications and reports for industry and other end users – Other agency report	March 2011	Baseline trials of carp control technologies in wetlands of the lower Lachlan River	SARDI report	McNeil, D., Hartwell, D., Conallin, A. and Stuart, I.	10.F.09
2.2.5 – Publications and reports for industry and other end users – Other agency report	March 2011	Proof of concept of a novel wetland carp separation cage at Lake Bonney, South Australia	SARDI report	Thwaites, L.	04.F.20
OUTCOME 5: Deliver innovative, practical control measures against cane toads					
2.1.3 – Formal articles in scholarly refereed journals	September 2010	The ecological impact of invasive cane toads (*Bufo Marinus*) in Australia	The Quarterly Review of Biology Volume 85, No. 3	Richard, S.	5.T.1
2.1.3 –Formal articles in scholarly refereed journals	October 2010	Nematode larvae (*Order Spirurida*) in gastric tissues of Australian anurans: a comparison between the introduced cane toad and sympatric native frogs.	Journal of Wildlife Diseases: 46: 1126-1140.	Kelehear, C. and Jones, H.I.	5.T.1
2.1.3 – Formal articles in scholarly Refereed journals	March 2011	Influence of lung parasites (*Rhabdias pseudosphaerocephala*) on growth rates of free-ranging and captive adult cane toads (*Bufo Marinus*)	Oecologia	Kelehear, C, Brown, G.P. and Shine, R.	5.T.1

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 6: Reduced impact of feral cats over five million hectares					
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Enabling effective feral cat control on Kangaroo Island	15th Australasian Vertebrate Pest Management Conference Proceeding and Abstract — Non Refereed	Bengsen, A., Butler, J. and Masters, P.	10.U.2c
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	June 2011	Feral cat (*Felis catus*)	PestSmart factsheet 1. Biology & ecology of feral cats	Invasive Animals CRC	11.D.1
OUTCOME 7: Increased agricultural profitability through improved integration of existing biological, conventional and newly developed control options for rabbits					
2.1.3 – Formal articles in scholarly refereed journals	December 2010	Evoluation and phylogeography of the non-pathogenic calicivirus RCV-A1 in wild rabbits in Australia.	Journal of Virology 84(23):12397-404	Jahnke M, Holmes EC, Kerr PJ, Wright JD, Strive T.	7.T.1
2.1.3 – Formal articles in scholarly refereed journals	June 2011	Histo-blood group antigens act as attachment factors of rabbit haemorrhagic disease virus infection in a virus strain-dependent manner	PLOS Pathogens	Nyström, K., Le Gall-Reculé. G., Grassi, P., Abrantes, J., Ruvoën-Clouet, N., Le Moullac-Vaidye B., Lopes, A., Esteves, P.J., Strive, T., Marchandeau, S., Dell, A., Haslam, S. and Le Pendu, J.	7.T.1
2.1.3 – Formal articles in scholarly refereed journals	October 2010	The effect of rabbit population control programs on the impact of rabbit haemorrhagic disease in south-eastern Australia	Journal of Applied Ecology	Mutze, G, Kovaliski, J, Butler, K., Capucci, L. and McPhee, S.	7.T.9
2.1.3 – Formal Articles in Scholarly Refereed Journals	December 2010	An economic decision model of wild rabbit *Oryctolagus cuniculus* control to conserve Australian native vegetation	Wildlife Research 37, 558 — 565	Cooke, B.D., Jones, R. and Gong, W.	7.T.4
2.2.1 – Conference abstract appearing in a non-refereed proceedings publication	June 2011	Preliminary characterisation of the Australian non-pathogenic calicivirus RCV-A1 and implications for biocontrol	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Strive, T., Kerr, R.J. Jahnke, M. and Holmes, E.C.	7.T.1
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted Poster June 2011	Towards a cell culture system for rabbit caliciviruses	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Matthaei, M., Kerr, P.J. and Strive T.	7.T.12
2.2.1 – Conference abstract appearing in a non-refereed proceedings publication	Accepted August 2010	Virulence of field strains of rabbit haemorrhagic disease virus	3rd Queensland Pest Animal Symposium, Gladstone, Australia.	Elsworth, P.G.	7.T.5
2.2.2 – Publications and reports for industry and other end users – Invasive Animals CRC report	December 2010	Workshop proceedings: improving the efficiency of rabbit eradications on islands	Invasive Animals Cooperative Research Centre, international workshop, New Zealand, February 2010.	Murphy, E., Crowell, M. and Henderson, W.	9.D.11
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	June 2011	European rabbit (*Oryctolagus cuniculus*)	PestSmart factsheet — rabbit biology & ecology	Invasive Animals CRC	11.D.1
OUTCOME 8: Deliver improved and human approaches to reduce the production and biodiversity impacts of expanding or other over-abundant and widespread pest species.					
2.1.1 – Formal books – authored research (unweighted)	Accepted June 2011	A model for assessing the relative humanness of pest animal control methods (second edition)	Research Book	Sharp, T. and Saunders, G.	8.T.1
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Assessing the humaneness of invasive animal control methods	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Sharp, T., Saunders, G. and Jones, B.	8.T.1

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Integrating animal welfare into pest animal control: work in progress	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Jones, B. and Sharp, T.	8.T.1
OUTCOME 9: Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new, expanding or emerging invasive animal problems					
2.1.4 – Formal full written conference paper – refereed proceedings	Accepted July 2010	Fertility control – an option for managing overabundant native species.	56th Meeting of the Australian Mammal Society	Hinds, L	9.T.1
2.1.4 – Formal full written conference paper – refereed proceedings	Accepted July 2010	Effects of GnRh-targeted immunocontraception on male behaviour in a model macropodid species, the tammar wallaby, *Macropus eugenii.*	56th Meeting of the Australian Mammal Society	Snape, M., Hinds, L. and Miller, L.	9.T.1
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Effects of GnRH-targeted immunocontraception on female fertility in two species of macropod.	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Snape, M., Hinds, L., Fletcher, D., Wimpenny, C. and Miller, L.	9.T.1
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Assessment of an oral delivery system for immunocontraceptive vaccines.	15th Australasian Vertebrate Pest Management Conference Proceedings	McDonald, I., Knight, S., Finnie, K., Barbé, C. and Hinds, L.	9.T.1
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	June 2011	New & emerging pest species	PestSmart factsheet — new & emerging toolkit	Invasive Animals CRC	11.D.1
OUTCOME 10: Growth in Australian invasive animal pest control industries. Through industry collaboration on the registration, marketing, export and community uptake of new products the CRC will enhance control of problem species					
Nil publications					
OUTCOME 11: Increased professional and practical skills base in invasive animal management through education, training and community awareness					
2.2.1 – Conference abstract in a non-refereed proceedings publication	Accepted June 2011	Exploring the capacity of NRM organisations to support invasive animal management now and into the future	15th Australasian Vertebrate Pest Management Conference Proceedings and Abstract — Non Refereed	Marsh, J., Brown, A. ad Lane, C.	11.T.1
2.2.3 – Publications and reports for industry and other end users – PestSmart brochure	June 2011	Tools for pest management	PestSmart DL Brochure — general toolkit	Invasive Animals CRC	11.D.1
OUTCOME 12. Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed					
2.1.3 – Formal articles in scholarly refereed journals	April 2011	Estimating the costs of protecting native species from invasive animal pests in New South Wales, Australia	Environ Resource Econ (2011) 50: 203-226	Sinden, J., Gong, W. and Jones, R.	12.D.6
2.2.3 – Publications and reports for industry and other end users — PestSmart report	June 2011	Modelling the distribution of vertebrate pests in New South Wales under climate change	PestSmart report on behalf of the NSW Department of Environment, Climate Change and Water	Caley, P., Tennant, P. and Hood, G.	12.D.7e

15 INVASIVE ANIMALS CRC ANNUAL REPORT INDEX

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S

T

U

V

W

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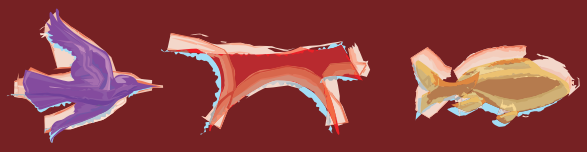

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