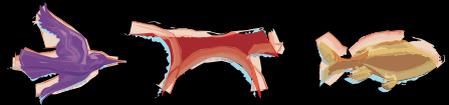




**TOGETHER**



An Australian Government Initiative



**INVASIVE ANIMALS COOPERATIVE RESEARCH CENTRE**  
**ANNUAL REPORT 2013**  
**2014**



**CREATE & APPLY**



**SOLUTIONS**





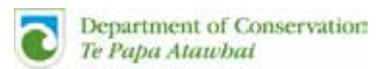
An Australian Government Initiative



Invasive Animals Cooperative Research Centre

Established and supported under the Australian Government's Cooperative Research Centres Program

# OUR PARTICIPANTS



Invasive Animals CRC gratefully acknowledges the Australian Government's financial contribution through the Cooperative Research Centres Program.

Invasive Animals Limited – Governing and managing the  
Invasive Animals Cooperative Research Centre

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# OUR PURPOSE

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

## OUR OUTCOMES

1. No new vertebrate pests established in Australia
2. Improved prediction and control of emerging outbreaks
3. Recovery of key land and water regions from rabbit, wild dog and carp impacts
4. Strengthened social networks and institutions around pest animal control
5. An enduring organisation dedicated to innovative pest animals control research and training

## OUR RESEARCH PROGRAMS

### Land Pests

- National incursions response system technologies
- Long-term Tasmanian fox incursion response technologies and strategies.
- Rabbits: RHD Boost – roll-out of new RHDV strain
- Rabbits: RHD Accelerator platform technology
- Wild Dogs: Strategic wild dog control

### Land Pests (Commercial Products)

- Avicide
- Rodenticides
- Feral pig management products
- Fertility control

### Inland Water Pests

- Genetic tools for detection of pest fish at low densities
- Carp biocontrol: Cyprinid Herpes Virus 3 or Koi Herpes Virus (KHV) evaluation and roll-out

### Community Engagement

- Facilitate collective action
- Triggers for effective action
- Reduction of legal and institutional impediments
- Balanced Researcher Program
- Vocational Education Training



### “Together, create and apply solutions”

The Invasive Animals CRC (IA CRC) is critical in efforts to combat the threat of pest animals by developing new technologies that are more humane, target specific and effective. We develop landscape-scale strategies, tools and products based on solid scientific research and offer a suite of *PestSmart* products and services for best practice action in pest animal management.

After almost a decade of operation we have developed a strong culture of industry-focused research and development, knowledge exchange and technology adoption, as well as a valuable portfolio of innovative and expert knowledge and products.

Our extension to 2017 is a \$72.5 million, 27 member partnership to develop new knowledge, products, strategies and services that deliver more strategic and efficient pest animal control.

The collaborative structure of the IA CRC makes it uniquely able to bring together a broad and diverse range of key partners and groups to ensure a holistic approach to education, engagement and best practice pest animal management techniques.

The collaboration involves:

- a powerful mix of industry investors, research providers, commercial businesses and extension organisations that cover all key points on the value chain from R&D to adoption,
- industry and government investors to ensure a strong and practical end-user focus,
- deep research capability in a variety of key areas including ecology, biocontrol, environmental genomics, modelling, new toxin development, and community engagement,
- key overseas research and commercial partners in New Zealand, US and the UK to facilitate knowledge and technology transfer, and build critical mass to tackle problems of shared concern; and
- commercial businesses to take new products to market and grow jobs.



## Problems: Invasive Animals

- Food and fibre security is undermined through the loss of billions of dollars annually in reduced agricultural productivity and increased control costs.
- The environment is hugely impacted, including whole landscapes, waterways and hundreds of threatened species.
- Continued risk of new pest animal incursions, particularly new invasive birds, reptiles and fish.
- Social impacts from killing and mauling of livestock, pets and native wildlife.





# CHAIR'S FOREWORD

**“Invasive species are not bound by government policy or by stakeholder resourcing, they are bound by their resourcefulness and capability to meet that challenge, as are we.”**

‘Together Create & Apply Solutions’ is a tagline that continues to accurately represent the extraordinary Invasive Animals Ltd (IAL) and IA CRC people and their dedication. Our strong culture of collaboration and cooperation across highly divergent organisations and levels of the community continues to deliver results through our research programs, our market ready products and programs, enabling real impact on the ground anywhere in Australia.

Our success has been met with some ongoing challenges, namely the very tight 2014 fiscal environment which is tougher than the research and development sector has ever experienced before. The necessary supplementary funding for us to optimise research uptake has vanished and the demand for short-term results has increased. This scenario places at risk any appetite for the long-term research that delivers substantial transformational changes.

In the last 12 months Australia has moved from a nation proudly leveraging science to relegating science to a back row position. This very disappointing move means that we must be more innovative and clever than ever before in order to create and develop all the necessary resources needed for success.

Our four research programs have made good progress this past year as you will read in the body of this report and in the Research Portfolio, placing the IA CRC in a good position for our 3rd Year Review in June 2015. The high profile wild dog, rabbit and carp problems have all received good media attention and while that is very pleasing the value of the IA CRC is far greater than 3 species.

IA CRC, and IAL into the future, is all about the whole spectrum of what tackling invasives means and why it is so important. Invasive species severely impact the environment, unreasonably limit the success of agricultural production and play a major role as vectors that challenge human health and social wellbeing. These are ongoing national issues, problems that need innovative and effective solutions.

Simply put the breadth and depth of this complex matrix begins with understanding invasives biology, habits and needs to be able to predict their distribution and outbreaks under different circumstances, in order to be able to manage and restrict their presence in key landscapes, plus control them when and where eruptions occur. At this point science needs to be ready with new information, innovative technologies and methods to enable national collaboration that engages the community for effective management of all lands across the rural, peri urban and urban zones, thus leading to protection of the environment, agricultural production and the interface with human health. All this happens continuously and simultaneously. Conducting this orchestra of complexities and collaboration is the vital value of the IAL and IA CRC.

A continuing frustration for us all is the time it takes to complete the important approval process through the Australian Pesticides and Veterinary Medicines Authority (APVMA). The IA CRC looks forward to the time when the APVMA resources are increased to enable more timely reviews creating a smoother value chain for products without any loss in the rigour of the review process.

Together the IAL Board and Management have maintained a strong collaborative process to draw on the wisdom and identify the needs of stakeholders in the creation of an enduring organisation. The constructive feedback from stakeholders continues to hone the business case, business model and business plan, working toward implementing the business' trial phase in July 2015. Recently the Board invited stakeholders and all Participants to contribute to a Strategic Reference Group. 21 responded and the workshop outcomes will be supplied to all Participants as a forerunner to the forthcoming Participant Committee meeting discussions in November 2014. It is essential that stakeholders fully support the final business for without your full support there will not be an enduring organisation to tackle the above scenario.

It is important to note that while IAL has maintained the role of the managing company for the IA CRC, it is well placed to develop into a more substantial and enduring collaborative organisation. This is important as we refine our strategies for the future and look to design an organisation that continues to serve all its members, investors and end users.

In looking to the future we need to match the challenge at hand and it is often said that if you want to catch a wild dog you have to think like one. So in reflecting on invasive species it is worth noting that invasive species are driven by survival, they are clever, ever cunning and resilient, or they are dead. Invasive species are not bound by government policy or by stakeholder resourcing, they are bound by their resourcefulness and capability to meet that challenge, as are we.

Finally, I want to acknowledge and sincerely thank our retired Directors Dr Phil Cowan and Manfred Claasz, our new Directors Murray Rankin and David Palmer and express my sincere appreciation to my Deputy Chair, Dr Dedee Woodside, all my fellow Board members and to Andreas Glanznig and the entire management team for their enthusiasm and efforts on behalf of the IA CRC.

**Helen Cathles**

Chair

Invasive Animals CRC

## Together, create and apply solutions

“Wool growers need the new control products and management strategies developed through the unique Invasive Animals CRC collaboration. Their leadership in promoting smarter regionally coordinated wild dog control, helping produce the science to underpin effective wild dog baiting rates, and developing new control tools are critical to the future of our wool industry. The IA CRC was also the perfect organisation to implement the industry led initiative being the National Wild Dog Action Plan. They already work with all of the industry, government and researchers needed to ensure its success and impact.”

**Jane Brownbill**  
CEO, WoolProducers Australia



Photo: Dave Robinson

“The Invasive Animals CRC is working side by side with the agricultural industry to develop better solutions to control wild dogs, foxes, feral pigs and rabbits. Farmers will be better placed to control pest animals with these new products and we need to keep this momentum so we can turn the tide on pest animal problems.”

**Michael McCormack**  
Chair, National Wild Dog Advisory Committee



“Rabbits are Australia’s most costly vertebrate pest and are the principal reason for establishment of Rabbit Free Australia (RFA) in 1991. Through the Invasive Animals CRC, researchers discovered why rabbit calicivirus didn’t work so well in higher rainfall areas of Australia and have used this knowledge in their global search to make our rabbit biocontrol agents even more effective. This is critically important and innovative work for Australia’s primary producers and biodiversity.”

**Nicholas Newland AM**  
Chairman, Foundation for Rabbit Free Australia



“Producers cannot afford to lose rabbit haemorrhagic disease. The work of the Invasive Animals CRC over the next three years is vital to the successful roll-out of a new RHDV strain.”

**David Lord**

Chairman, Australian Wool Innovation Rabbit Advisory Group



“The incursion of foxes in Tasmania had the potential to cause massive losses in our agricultural sector and devastate our wildlife. The DNA based surveillance technique developed through the Invasive Animals CRC provided us with a breakthrough technology to efficiently detect foxes at low densities over large areas of the State and support the eradication effort.”

**Craig Elliott**

Director (Biosecurity Operations), Biosecurity Tasmania



“Options available to manage pest animals were reported to have been improved over the last five years, in large part due to the Invasive Animals CRC.”

“Stakeholders reported significant achievements in pest animal preparedness and management driven by the Invasive Animals CRC. The Invasive Animals CRC was highly regarded through all consultations and was reported to be doing significant work that benefits Australia’s approach to pest animal management.”

#### Independent Review of the Australian Pest Animal Strategy





# CEO'S REPORT & EXECUTIVE SUMMARY

**The Invasive Animals CRC has made impressive progress during the year. Our pest animal management innovation program is well underway, outputs are being delivered, and we are on track to deliver major technologies over the next three years. Our first year review also affirmed that we have built a strong basis for success.**

This has been achieved against a turbulent operating environment for the IA CRC and its participants. Some of our partners have undergone significant funding and staff changes, and while some projects were delayed, it is a testimony to our participant researchers and managers that we have been able to work together to adapt to these changes. This team approach is our strength, and our annual participant's survey underscored that our partners feel strongly engaged in the IA CRC and its program.

The IA CRC strategic plan, as set out in the Commonwealth Agreement, remains unchanged. The following pages outline a multitude of recent developments towards delivery of our outputs, and highlights the scope of technologies that sit within the IA CRC's national challenge to reduce pest animal impacts to agriculture, the environment and social well-being. Additional cash and in-kind investments from our partners has leveraged our performance.

The 16th Australasian Vertebrate Pest Conference also provided an important opportunity to showcase these developments to a broader audience, including the work of our new community engagement program. I was particularly impressed by the enthusiastic presentations from our doctoral students.

At the policy level, an important industry led initiative – the National Wild Dog Action Plan – was launched. Many IA CRC partners and staff were involved in its development, and this cooperative process provides a model for future collaborative national efforts, for example rabbits.

The year ahead will see the management team working to position our innovation program for strong delivery by navigating the complex regulatory and policy requirements that need to be met before some outputs can be released, and working with our partners to efficiently promote the uptake of our new technologies through our collaborative PestSmart adoption approach. We will also continue to work closely with our partners to enable a successful transition to a collaborative innovation vehicle beyond the CRC program.

After a 40 year pest animal research career, Dr Glen Saunders AM recently retired from the NSW Department of Agriculture. In his role as the former IA CRC Research Director, Dr Saunders was pivotal in working with our partners to shape the high impact innovation program of this and the previous CRC. I would like to sincerely thank Glen for his drive, tenacity and commitment to the vision of the IA CRC and its people.

I commend this Annual Report to you.

**Andreas Glanznig**  
Chief Executive Officer  
Invasive Animals CRC

## Major Achievements

**Significant strides have been made towards achieving the IA CRC's pest animal management innovation program set out under the Commonwealth Agreement.**

### Research & Collaboration Highlights

#### *MouseAlert mobile website prototype for emerging National Mouse Plague Surveillance Platform*

In response to a grain industry need, a new MouseAlert mobile website has been released to enable grain growers and agronomists Australia-wide to take part in recording evidence of mouse activity, which in turn will contribute to developing mouse plague forecasts.

#### *New rabbit biocontrol agent selected and regulatory assessment underway*

Scientific evaluation of potential new strains of Rabbit Haemorrhagic Disease Virus (RHDV) from Europe and Asia have been completed, with one of the Korean RHDV strains (RHDV K5) demonstrating most promise in reducing rabbit impacts in higher agricultural production and biodiversity regions.

Progressing regulatory approval of the RHDV K5 strain has been endorsed by the national government Vertebrate Pests Committee, and consequently a regulatory package has been submitted to the Australian Pesticide and Veterinary Medicines Authority (APVMA) for assessment. There has been pleasing progress: the registration package recently passed the screening stage and is now under full assessment. In tandem, a national government taskforce has been established to ensure a coordinated government approach to the roll out of RHDV K5. This important regulatory and policy effort, has been complemented by our national rabbit facilitator who is working with communities and industries to catalyse community innovation, learning and network development in anticipation of the release of the new RHDV strain. An important milestone has been the launch of the Victorian Rabbit Management Collaboration, which supports regional community led action for sustainable and effective rabbit management in Victoria. Learnings from this initiative aim to be shared with other regions and States.

#### *Wild dog 1080 aerial baiting trial shows that current regulated bait rate leads to reduced wild dog control*

Regional aerial wild dog and fox baiting is an important pest animal control tool. There have been concerns that the current national regulated rate of 10 baits per kilometre has markedly reduced the effectiveness of aerial baiting in some regions. This has been confirmed by a new NSW Department of Primary Industries (DPI) study done in

northern NSW of this and a higher bait application rate, which found that wild dog control is more than one and a half times effective (about 90 per cent of wild dogs killed compared with about 55 per cent) with a higher bait rate of 40 baits per kilometre. Funded by Australian Wool Innovation, the study drew on data produced by the IA CRC. NSW DPI is now seeking approval to allow bait rate application of 40 baits per kilometre from the national regulator – the APVMA – to enable land managers to better control wild dogs in this key sheep production region.

## Commercialisation & Utilisation Highlights

The IA CRC's commercialisation activities have focussed on consolidating the US research and legal framework to underpin our cooperative US based innovation activities with the US Department of Agriculture and Texas Parks and Wildlife Department. A highlight was the granting of a US patent for nitrite salts as poisons in baits for omnivores, which provides patent protection for our key feral pig control technology in this important international market.

At the domestic level, our Australian commercial partner – Animal Control Technologies Australia – and the management team continue to work with the Australian Pesticides and Veterinary Medicines Authority to progress the assessment and registration of new toxins developed in the previous CRC.

With most of our new products under regulatory assessment or in the final stages of development, our utilisation activities have focussed on promoting regional collaboration and coordinated pest animal management through our national facilitators. Their active involvement in the development of the National Wild Dog Action Plan and the Victorian Collaborative Rabbit Management Initiative are a testimony to their leadership.

## Education and Training Highlights

The innovative hands-on Balanced Researcher Program continues to be an education success, underpinning the long-term viability of Australia's invasive animals research capability:

- 17 doctoral research students in the extension CRC are now enrolled in partner universities and actively engaged in IA CRC projects, including four professional doctorate students and 13 traditional PhD students.
- 93% of the 29 PhD students in the former CRC have been awarded their PhD with only one thesis remaining to be submitted.

## 16TH AUSTRALASIAN VERTEBRATE PEST CONFERENCE

The world-class research of the IA CRC was on show at the 16th Australasian Vertebrate Pest Conference held in Brisbane, May 2014.

CEO of the IA CRC, Andreas Glanznig, gave a keynote presentation about 'Staying ahead of the curve in pest animal management and innovation in an age of smaller government and fewer land managers'.

Thirteen past and present PhD students, and three students working on IA CRC affiliated research projects, presented their research about IA CRC based projects or research they have conducted since having commenced work in the invasive species sector.

Other IA CRC highlights at the Conference included Jason Wishart presenting 'The effectiveness of integrated exotic predator control for the conservation of the endangered malleefowl populations near Mount Hope, NSW', our Community Engagement experts presenting 'The Human Dimensions of Invasive Animals Management' and 'The Traps of Camera Traps' – an overview of research testing numerous applications of using camera traps in wildlife investigations - presented by Paul Meek in collaboration with Guy Ballard, Peter Fleming, Karl Vernes and Greg Falzon.



Andreas Glanznig, IA CRC CEO gives a keynote presentation at the 16th Australasian Vertebrate Pest Conference.

## Reviews

The IA CRC First Year Review, held on 19 March 2014, affirmed that the CRC has established a strong basis for success. Discussion focussed on governance and management structures, participant engagement, external engagement, status of the CRC's activities and transition planning.

**“The Invasive Animals CRC has established a strong basis for success in its current funding period...The CRC benefits from its strong participant, end-user and stakeholder engagement, and stands to make some significant impacts in the ongoing challenge of invasive animals and their impacts on the Australian environment and economy.”**

Neville Stephens AO, Chair CRC Committee

### Transition planning

The Governing Board has worked hard throughout the year to drive the transition planning process. A draft business model was discussed with Participants in 2013, which was then developed further in 2014 with the aim of discussing a draft business case with Participants in late 2014.

### Appointment of Key Staff

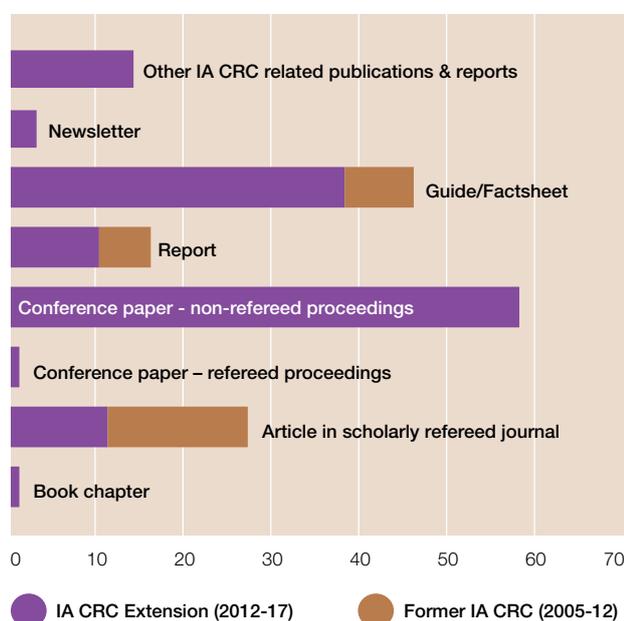
Mrs Carolyn Campbell-Wood – a very experienced and capable CPA and Chartered Secretary – joined Invasive Animals Ltd as our new Business Manager and Company Secretary, and Tim Blackman moved to a new Commercialisation and Marketing Director role.

### Publications Summary

The IA CRC continues to have high profile publications published and distributed, including 11 journal articles and 48 of the popular PestSmart suite of publication materials.

For a full list of Publications see Appendix B of this report.

#### Invasive Animals CRC Publications 2013-14



### Communications

The IA CRC continues to successfully engage the broader public through both traditional and social media. This includes achieving Top 10 news for 2013 on ABC Radio National with a story about wild dogs and the sheep industry.

### Risks & impediments

The major risk to timely delivery of outputs continues to be the uncertainty around the timeframes for obtaining government policy and regulatory approval, particularly in relation to our portfolio of viral biocontrol agents and new toxins. This has been accompanied by on-going technical challenges in formulating or engineering two of our control products, and government staff freezes that have delayed appointment of key project staff. These latter risks have been essentially resolved. In relation to navigating a new product through a multi-layered regulatory and policy pathway, Invasive Animals Ltd management continues to regularly communicate and consult with government regulators and was instrumental in the establishment of a national vertebrate pests biocontrol taskforce under the joint Commonwealth-State Vertebrate Pests Committee to provide strategic oversight and coordination for the approval of new IA CRC biocontrol products.

### End-user environment

The IA CRC's strategy and innovation program are the culmination of a strong end-user driven planning process. In 2013-14 there have been no changes to our strategic direction and innovation program scope. Wild dogs, rabbits, carp, feral pigs and mice remain major pest priorities for the IA CRC's industry and government end-users.

The capacity for improved large scale coordinated action to manage wild dogs has taken a big step forward with the finalisation and launch of the National Wild Dog Action Plan. The Plan is a great example of an industry-catalysed initiative that has worked closely with government and community representatives. It has attracted seed funding from the Australian Government, which is administered by Invasive Animals Ltd. The IA CRC is also the R&D representative on its steering committee, which is chaired by former National Farmers' Federation President, Duncan Fraser.

## AUSTRALIA'S FIRST NATIONAL WILD DOG ACTION PLAN LAUNCHED

The Invasive Animals CRC showcased a suite of wild dog management solutions at the official launch of the National Wild Dog Action Plan in Armidale on the 4th July 2014.

Agriculture industry representatives, including the Minister for Agriculture Barnaby Joyce, were presented with new approaches to wild dog management such as the use of computer assisted technology, for example facial recognition of wild dogs as a surveillance tool to enable pre-emptive wild dog control. The IA CRC showcase was presented by Guy Ballard, Paul Meek, Greg Mifsud (National Wild Dog Facilitator) and Greg Falzon.

The Minister for Agriculture also announced a \$280,000 grant, to be used for initiating the implementation of the wild dog action plan.



**Launch of the National Wild Dog Action Plan: Pictured (l-r) Guy Ballard, Greg Mifsud, Peter Fleming, Minister for Agriculture Barnaby Joyce, Greg Falzon and Paul Meek** Photo: Dave Robinson

## Impacts

The IA CRC's risk-adjusted expected economic impact from only five potential outputs – two new rabbit biocontrol agents (RHD Boost, RHD Accelerator, a new feral pig toxin (HOGGONE), a new rodenticide and a new bird toxin) has been estimated at more than \$1.2 billion, with a benefit-cost ratio of 14.27 to 1. Other major planned IA CRC outputs, such as the benefit from Australia's first potential carp biocontrol agent, could not be readily converted into monetary terms and as such were excluded from the IA CRC economic impact assessment.

The very large economic return on investment and benefit-cost ratio is mostly due to the development of strengthened biocontrol agents for rabbits – Australia's most costly vertebrate pest. This economic benefit builds on the immense economic benefit of rabbit biocontrol to Australian agriculture to date – \$70 billion over 60 years from the release of the myxoma virus in the 1950s and introduction of Rabbit Haemorrhagic Disease Virus (RHDV) in the 1990s.

The IA CRC economic impact assessment will be reviewed in 2014-15 to take into consideration changes in risk probabilities, and product release timetables. This includes positive changes (eg. the successful completion of the RHD Boost scientific evaluation project), offset by some delays to expected release date due to technical challenges (eg. in formulating our new feral pig toxin) and additional research requirements (eg. the opportunity to also test new Chinese and Spanish RHDV variants in the RHD Boost scientific evaluation project, which ensured that the best option was selected).



The malleefowl (*Leipoa ocellata*) is an endangered ground-dwelling native bird that is under threat from pest animals such as foxes and feral pigs. Images captured using monitoring cameras at Mt Hope, New South Wales.

## MALLEE RECOVERY – REDUCING THE IMPACTS OF INTRODUCED PREDATORS ON MALLEEFOWL

Mallee Recovery is an Invasive Animals Ltd led *Biodiversity Fund* project that aims to reduce the impacts of introduced predators on malleefowl (*Leipoa ocellata*) near Mount Hope, NSW. The project builds on early work undertaken by the Lachlan Catchment Management Authority (now Local Land Services) and links with predator management being undertaken on several adjoining Nature Reserves.

Mallee Recovery initially focused on several core properties, where the largest tracts of remnant mallee habitat existed. Since then, we have attracted the involvement of all surrounding landholders which has increased the predator control area to over 500,000 hectares. This provides a large buffer around the core mallee habitat, and offers even greater benefits to biodiversity and agriculture. The project also enables us to incorporate newly developed pest control products such as the HogHopper™, and provides an ideal testing site for emerging innovations including sodium nitrite based feral pig baits.



Last year's aerial survey revealed over 50 active malleefowl mounds in the project area. We hope a re-survey later this year will show a stable breeding population, particularly now we have undertaken several rounds of coordinated predator control. It's unlikely that significant increases will be detected, due the reproductive biology of the malleefowl. Therefore, our biggest challenge now is securing ongoing funding, so that the benefits of our work can be realised and we see recovery of malleefowl in the area.



Photo: Julianne Farrell

# STRUCTURE AND GOVERNANCE

## Structure

The Invasive Animals CRC is a joint venture arrangement between the Participants, which includes the Management Company, Invasive Animals Ltd.

Invasive Animals Ltd is a public company limited by guarantee incorporated and domiciled in Australia. It has been endorsed by the Australian Taxation Office as a tax concession charity and is exempt from income tax.

The structure and governance of the Invasive Animals CRC provides strong support to its operations. The CRC is led by a Board of 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 both Australian Charities and Not-for-Profit Commission and the Australian Security & Investments Commission Corporate Governance Principles and Recommendations.

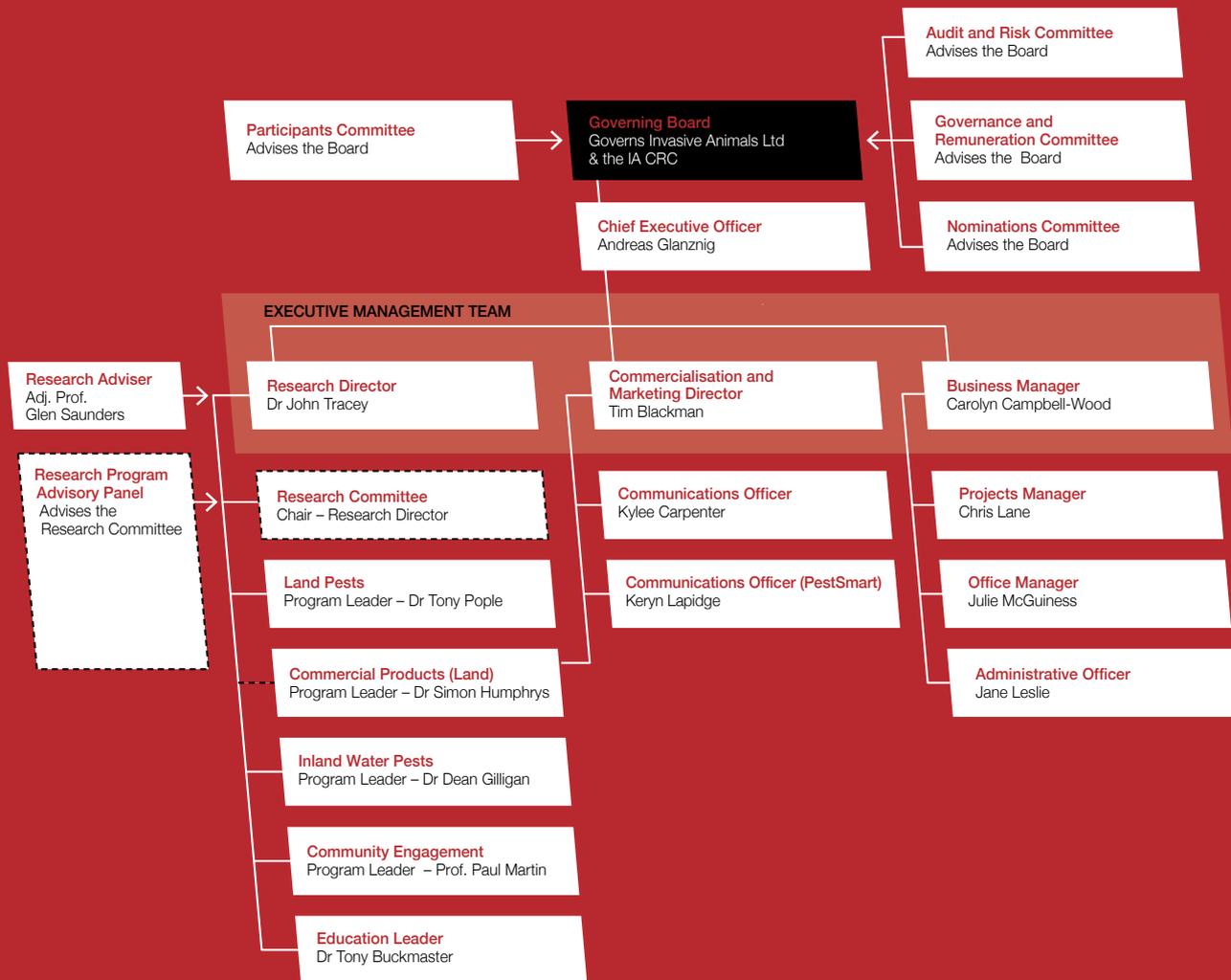
In carrying out its governance role, the main task of the Board is to drive the CRC strategy, to develop policies and monitor and review performance to ensure that the CRC achieves its research and commercialisation/ utilisation goals. The Board also approves the CRC budget and ensures the Company complies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



## IA CRC Board members

Governing Board: (l-r) Dr Deedee Woodside (Deputy Chair), Murray Rankin (Director), Dr Helen Scott-Orr (Director) Helen Cathles (Chair), David Palmer (Director), Prof. Dave Choquenot (Director)

## IA CRC Management Structure as at June 2014



The names and details of the Directors in office during the financial year and up to the date of this report are as follows:

Directors	Role	Key Skills	Independent/Organisation
Helen Cathles	Chair	Director since 2005. Corporate Governance, Primary Production, Pest Animal Control	Independent
Dr Dedee Woodside	Deputy Chair	Director since 2005. Conservation, Social Sciences, Business & Commercial	Independent
Dr Helen Scott-Orr	Director	Director since 2007. Primary Production, Pest Animal Control, R&D Management	Independent
Prof David Choquenot	Director	Director since October 2012. Corporate Governance, R&D Management	Institute of Applied Ecology, University of Canberra
Dr Phil Cowan	Director	Elected October 2008 and resigned November 2013. Corporate Governance, Pest Animal Control, R&D Management	Landcare Research NZ
Manfred Claasz	Director	Elected October 2010 and resigned November 2013. Communication, Business and Commercial, Risk Analysis	Independent
David Palmer	Director	Elected November 2013. Governance, Management & Policy Development	Independent
Murray Rankin	Director	Elected November 2013. Governance, Communication, Business & Commercial	Independent
<b>Public Officers</b>			
Tim Blackman	Company Secretary	Appointed October 2012, resigned March 2014.	
Carolyn Campbell-Wood	Company Secretary	Appointed March 2014.	

## Committee Members

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.

### Audit & Risk Committee Members

Name	Role	Key Skills	Independent/Organisation
Dr Dedee Woodside	Chair ARC	Director since 2005. Conservation, Social Sciences, Business & Commercial	Independent
Prof David Choquenot	Director	Director since October 2012. Corporate Governance, R&D Management	Institute of Applied Ecology, University of Canberra
Manfred Claasz	Director	Elected October 2010 and resigned November 2013. Communication, Business and Commercial, Risk Analysis	Independent
Murray Rankin	Director	Elected November 2013. Governance, Communication, Business & Commercial	Independent

The Governance & Remuneration Committee has responsibility for Invasive Animals Ltd governance policy and procedures and remuneration policy. Responsibility for the Board Directors nomination process has been moved to the Nomination Committee and facilitating the Director nominations process.

### Governance & Remuneration Committee Members

Name	Role	Key Skills	Independent/Organisation
Dr Helen Scott-Orr	Chair GRC	Director since 2007. Primary Production, Pest Animal Control, R&D Management	Independent
Helen Cathles	Board Chair	Director since 2005. Corporate Governance, Primary Production, Pest Animal Control	Independent
Dr Phil Cowan	Director	Elected October 2008 and resigned November 2013. Corporate Governance, Pest Animal Control, R&D Management	Landcare Research NZ
David Palmer	Director	Elected November 2013. Governance, Management & Policy Development	Independent

## Director's Meetings

The number of Director's meetings and number of meetings attended by each of the Directors of the Company during the financial year are presented in the table opposite.

A: Number of meetings attended

B: Number of meetings held during the time the Director held office during 2013-14

### Director's Meetings

Name	Board Meetings		Audit and Risk Committee		Governance & Remuneration Committee	
	A	B	A	B	A	B
Director						
Helen Cathles	4	4	-	-	4	4
Manfred Claasz	2	2	2	2	-	-
Dr Phil Cowan	2	2	-	-	2	2
Prof. David Choquenot	4	4	4	4	-	-
David Palmer	2	2	-	-	2	2
Murray Rankin	2	2	-	-	2	2
Dr Helen Scott-Orr	4	4	-	-	4	4
Dr Dedee Woodside	4	4	3	4	-	-

## Key Staff

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

### Invasive Animals CRC Management and Invasive Animals Ltd Staff

Name	Organisation	CRC Position/Role	Time Committed
Mr Andreas Glanznig*	Invasive Animals Ltd	CEO	100%
Mr Tim Blackman*	Invasive Animals Ltd	Commercialisation and Marketing Director	60%
Mrs Carolyn Campbell-Wood*	Invasive Animals Ltd	Business Manager	100%
Dr John Tracey*	NSW Primary Industries	Research Director	60%
Dr Tony Pople	Qld Agriculture, Forestry and Fisheries	Program Leader, Land Pests	75%
Dr Simon Humphrys	Invasive Animals Ltd	Program Leader, Land Pests (Commercial Products)	100%
Dr Dean Gilligan	NSW Primary Industries	Program Leader, Inland Water Pests	50%
Prof Paul Martin	University of New England	Program Leader, Community Engagement	51%
Dr Tony Buckmaster	Invasive Animals Ltd	Education Leader	40%
Mr Chris Lane	NSW Primary Industries	Project Manager	100%
Ms Keryn Lapidge	Invasive Animals Ltd	PestSmart Officer	60%
Ms Kylee Carpenter	Invasive Animals Ltd	Communications Officer	100%
Ms Julie McGuinness	Invasive Animals Ltd	Office Manager	100%
Ms Jane Leslie	Invasive Animals Ltd	Administration Assistant	100%

## Staff Changes

Mr Glenn Conroy – contract expired on 31 May 2014.

Ms Kylee Carpenter – appointed on 23 May 2014.

Mrs Carolyn Campbell-Wood – appointed 3 February 2014.

Ms Jane Leslie – appointed 1 May 2014.

## Essential Participants

Name	Type	ABN or ACN
Commonwealth of Australia through the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)	Australian Government	ABN 24 113 085 695
Commonwealth of Australia represented by the Murray-Darling Basin Authority (MDBA)	Australian Government	ABN 13 679 821 382
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Australian Government	ABN 41 687 119 230
ACT Environment and Sustainable Development Directorate	State Government	ABN 31 432 729 493
ACT Territory and Municipal Services Directorate	State Government	ABN 37 307 569 373
Landcare Research New Zealand Limited	International	NZCN 546064
Local Land Services (formerly Livestock Health and Pest Authority State Management Council (NSW))	State Government	ABN 57 876 455 969
State of Queensland acting through its Department of Agriculture, Fisheries and Forestry; and Biosecurity Queensland	State Government	ABN 66 934 348 189
State of South Australia through the Department of Primary Industries and Regions (SARDI and Biosecurity SA)	State Government	ABN 53 763 159 658
State of Tasmania acting through its Department of Primary Industries, Parks, Water and Environment	State Government	ABN 58 259 330 901
State of Victoria through its Department of Environment and Primary Industries; and Biosecurity Victoria	State Government	ABN 90 719 052 204
State of Western Australia as represented by the Director-General of the Department of Agriculture and Food	State Government	ABN 18 951 343 745
The Crown in Right of the State of New South Wales acting through the Department of Primary Industries, an office of the Department of Trade and Investment	State Government	ABN 72 189 919 072
Animal Control Technologies (Australia) Pty Ltd	Industry/ private sector/SME	ABN 25 137 868 449
Australian Wool Innovation Ltd	Industry/ private sector/SME	ABN 12 095 165 558
Grains Research and Development Corporation (GRDC)	Industry/Private Sector/SME	ABN 55 611 223 291
Meat and Livestock Australia Limited	Industry/Private Sector/SME	ABN 39 081 678 364
The University of Adelaide	University	ABN 61 249 878 937
The University of Newcastle	University	ABN 15 736 576 735
University of Canberra	University	ABN 81 633 873 422
The University of Queensland	University	ABN 63 942 912 684
University of New England	University	ABN 75 792 454 315
Connovation Ltd	International	NZCN 831417
Department of Conservation, New Zealand	International	Not Applicable
<b>Other Participants</b>		
Penn State University, USA	International	Not Applicable
United States Department of Agriculture	International	Not Applicable
The Food and Environment Research Agency (Fera), UK	International	Not Applicable
<b>Third party project participants</b>		
Braysher Consulting	Industry/private sector/SME	ABN 35 078 050 718
Brisbane City Council	Other	ABN 72 002 765 795
Far North Queensland Regional Organisation of Councils	Other	ABN 52 034 736 962
Gold Coast City Council	Other	ABN 84 858 548 460
Griffith University	University	ABN 78 106 094 461
Instituto Zooprofilattico Sperimentale della Lombardia d dell'Emilia Romagna	Other	Not Applicable
James Cook University	University	ABN 46 253 211 955
Logan City Council	Other	ABN 21 627 796 435
Moreton Bay Regional Council	Other	ABN 92 967 232 136
Somerset Regional Council	Other	ABN 77 195 375 530
Sunshine Coast Regional Council	Other	ABN 37 876 973 913
The University of Sydney	University	ABN 15 211 513 464
Terrain Natural Resource Management	Industry/private sector/SME	ABN 53 106 385 899



# RESEARCH ACHIEVEMENTS

The IA CRC has research projects in four key outcomes areas with the goal of delivering economic, environmental and social benefits to Australia. With a focus on end-user driven research partnerships, these outcome areas are:

**Outcome 1:** No new vertebrate pests established in Australia

**Outcome 2:** Improved prediction and control of emerging outbreaks

**Outcome 3:** Recovery of key land and water regions from rabbit, wild dog and carp impacts

**Outcome 4:** New social networks and institutional 'architecture' around pest animal control

*The Programs to achieve these Outcomes:*

**Program 1:** Land Pest Products and Strategies

**Program 2:** Land Pests (Commercial Products)

**Program 3:** Inland Pests Products and Strategies

**Program 4:** Community Engagement

The following is a summary of key research highlights in 2013-14. A Milestone Report that details progress against the Commonwealth Agreement is at Appendix A: Milestone Report. For complete details about the IA CRC's research activities and achievements, refer to the Research Portfolio Summary 2013-14: [www.invasiveanimals.com/publications/research](http://www.invasiveanimals.com/publications/research).

## Our Research Leaders

**Our research would not be possible without the dedication and commitment of key experts in the field of invasive animal management, biosecurity and community engagement. Meet just some of our research leaders.**



**Dr John Tracey**  
Research Director

*"I'm passionate about improving the way pests are managed through science based decision making."*

For the last 20 years John has managed a wide range of invasive species management and research programs. John's research career is focussed on improving scientific based decision making for sustainable agriculture and the adaptive management of wildlife populations. His projects have explored the dynamics, ecology, impacts and management of invasive species and exotic and endemic diseases, with an emphasis on pest management, pest birds, wildlife survey and avian influenza.



**Adj. Prof. Glen Saunders**

Research Advisor

*"My work in pest animal management is driven by first hand experiences of the impacts that they cause, particularly to agricultural producers."*

Glen has 40 years experience in pest animal management and research and has made a significant impact on the science and implementation of wildlife management in Australia. He has conducted field based projects focused on improving pest management in line with best practice and with an ongoing theme of providing cost/benefit information appropriate for decision making. He has also contributed to the understanding of pest animal impacts on agricultural production and population ecology. At a more applied level, he has targeted individual control practices with the intent of improving their efficacy and humaneness.



**Dr Tony Pople**

Leader, Program 1: Land Pests

*"One of the great advantages of working in invasive species management is that your input is invariably welcomed. It is a field that is conducive to a cooperative and constructive work environment."*

Tony is an ecologist with a strong interest in the effects of predation on the dynamics of wildlife populations. Predation may be commercial and recreational harvesting, culling or baiting programs, or exotic predators killing endangered prey species. Other interests include aerial survey, deer management and mouse population dynamics. He also manages Invasive Plants and Animals Research at Biosecurity Queensland.



**Dr Simon Humphrys**

Leader, Program 2: Land Pests  
(Commercial Products)

After graduating with an honours degree in Agricultural Science Simon was awarded a PhD scholarship in the Department of Medicine, University of

Adelaide, where he investigated ways of accelerating wound healing using growth factors. Since then he has worked within human and veterinary pharmaceutical/biotechnology industries before taking on the management of R&D and commercialisation within the IA CRC. He is an author of four patents, several scientific papers and has brought several new products to market. Five years ago he was nominated to manage the development of a new poison as a predacide and its antidote for wild dog and fox control in Australia.



**Dr Dean Gilligan**

Leader, Program 3: Inland Water Pests

*"I have seen first-hand how alien fish dominate freshwater ecosystems. I want to be part of the solution to controlling their impacts and returning rivers, lakes and wetlands to healthy aquatic ecosystems filled with a diverse community of native fish and other aquatic life."*

Dean is a senior research scientist in the NSW Department of Primary Industries Freshwater Ecosystems research team. He joined NSW Fisheries in 1998 and has undertaken research into fish passage, state-wide freshwater fish monitoring, environmental flows, threatened species biology and recovery in carp. Dean is a member of the NSW Government Fisheries Scientific Committee and a NSW representative on the Australian Society for Fish Biology's Threatened Fishes Committee.



**Professor Paul Martin**

Leader, Program 4: Community Engagement

*"To achieve improvement in how we manage invasive species requires that we overcome institutional and behavioural problems that prevent us*

*dealing with the most difficult problems we face. For this reason our research is important to many other areas of social improvement including climate change, addressing social injustice, and making our governance systems more effective and more fair."*

Paul is the Program Leader for the IA CRC Community Engagement program. He is the director of the Australian Centre for Agriculture and Law at the University of New England. He is also the Deputy Head of the School of Law and the co-chair of the IUCN World Commission for Environmental Law Specialist Group on Soils and Agricultural Systems Governance. The AgLaw Centre, under his leadership, has become a world leading centre on rural law and policy reform. A significant part of the research which he has led is focused upon the reform of natural resource governance. Paul has had a successful career in venture capital and strategic advising, whilst maintaining an active role in scholarly research.



**Dr Tony Buckmaster**  
Leader, Education

*“My interest in pest species management has arisen from research into interactions between small native mammals and invasive predators and that feral cats are one of the greatest threats to native small mammal populations.”*

Tony is the Education Leader for the Education Program. He runs the Balanced Researcher Program designed to enhance and increase the skill levels of the IA CRC's PhD researchers beyond what they would get through a traditional research based PhD program. Tony was also one of the first cohorts of PhD students to take part in the CRC's Balanced Scientist Program so can offer insights from both as a participant and now as course provider. Tony's PhD examined the ecology and movement patterns of feral cats in the tall forest of Far Eastern Victoria and he is now also working part time as a post doc to determine appropriate sized management units for rabbits.

## Outcome 1: No new vertebrate pests established in Australia

### *National incursions response system and enabling technologies*

- **National incursion response system.**  
Developing an incursion response decision support system and tools, including pathway analysis and risk modelling, for a nationally coordinated, efficient and effective response to new invasive animal incursions.
- **Citizen science mapping.**  
Creating new phone and web mapping technology for pest management that will build stronger community involvement in citizen science mapping.

#### 2013-14 Highlights

- A National Incursions Response Facilitator recruited.
- 'Eradications of vertebrate pests in Australia: A review and guidelines for future best practice' published.
- A prototype version of MouseAlert ([www.mousealert.org.au](http://www.mousealert.org.au)) is providing a national mouse plague surveillance tool that enables grain growers and agronomists Australia-wide to record evidence of mouse activity and contribute to mouse plague forecasts.
- 'Field Guide to Pest Animals of Australia' app produced, which contains 22 additional pest animals bringing the total species to 53. Version 2.0 provides better links to online resources and includes advice for when high risk species are detected. The app has attracted 8,600+ downloads.
- Risk-based predictive pathways for transportation and introduction of future wildlife trade and emerging vertebrate invaders into Australia constructed.

## MOBILE APPS AND ON-FARM SURVEILLANCE



**MouseAlert project leader, Peter West (left), demonstrates MouseAlert**

(Photo: Grains Research Development Corporation)

Growing community participation has been a focus for the popular FeralScan pest animal surveillance website ([www.feralscan.org.au](http://www.feralscan.org.au)), which has now attracted more than 26,000 pest animal records from the community. The website supports landholders, farmer groups and local governments with a free web and mobile mapping service to record pest animal sightings, impacts and control activities.

Mobile device users are actively using FeralScan for field surveillance, and a new feature enables landholders to come together in online groups to work together. The data entered in FeralScan is shared across platforms with other key organisations and is helping to establish community-government partnerships for regional pest control.

The latest addition to the FeralScan project is the development and launch of MouseAlert ([www.mousealert.org.au](http://www.mousealert.org.au)) for on-farm surveillance and mouse monitoring. This new tool offers grain producers and agronomists Australia-wide with a method of recording and monitoring mouse activity on-farm. Mouse data contributes to regional mouse plague modelling and provides an early warning system for future mouse plagues.

Australia's first 'Field Guide to Pest Animals of Australia' App has also recently been updated and now hosts information for 53 of Australia's worst pest animals. Over 11,000 people have downloaded the App since it was launched in 2013. The free App contains species descriptions, maps, audio calls, links to key resources, and a comprehensive image gallery including photos of animals, footprints and scats.

## Technologies and strategies for long-term Tasmanian fox incursion response

- **Next generation invasive carnivore detection tool, techniques and strategies.**  
Developing an optimal strategy to eradicate foxes from Tasmania through the development of next-generation invasive carnivore detection tools, techniques and strategies using DNA and other detection techniques. Risk and long-term strategic planning to minimise impact to native species and the sheep industry.

### 2013-2014 Highlights

- Reference tissue collection initiated and developed for Tasmanian and related mammals and reptiles with over 793 samples collected so far.
- Next generation sequencing of wild and known origin scats has been undertaken using Illumina technology. Preliminary results suggest that the Illumina technology will provide a strong platform for scat DNA analysis.
- Field collection of scats has been completed with 2,885 scats collected in the 'Great Poo hunt' from 241 survey units, covering 4,167.4 km and 610 properties.

## GENETIC TESTING AND COMMUNITY PARTICIPATION IN THE 'GREAT POO HUNT'

The 'Great Poo Hunt' is a scientific survey to collect predator scats and use genetic testing to identify the animal each scat came from (eg devil, quoll, cat, dog or fox).

As part of an expanded monitoring program to help manage invasive species in Tasmania, the Invasive Species Branch in partnership with the IA CRC, carried out a predator scat survey in eastern Tasmania during March-June 2014. This follows on from a survey done in 2008-2010.

Sites were selected from those that were used during phases 1 and 2 of the first survey and all sites in which fox positive scats were located during the first survey will be resurveyed in 2014. By re-visiting sites that were previously surveyed, important information can be gained about changes in predator and prey distributions in Tasmania. This is particularly important with the decline of Tasmanian devil populations and the potential increase of introduced predators in their place.



**The 'Great Poo Hunt' in Tasmania** (Photo: Robyn Everist)

## Forecasting and adaptive management and planning

- **Strategic forecasting and planning to enable pre-emptive invasive animal management.**  
Enabling priority regions to use macro-ecological modelling to assess potential patterns of biological invasion under extreme weather events and climate change, and to determine the most cost-effective pest management strategies.

### 2013-2014 Highlights

- A prioritisation analysis has been completed with workshops involving 47 participants. A total of 27 habitat distribution models were developed under current conditions and climate change scenarios, with 11 strategies identified by stakeholders for prioritisation.
- An individual based simulation model of spatial pig population dynamics, resource usage and management actions completed, incorporating dynamic resource availability, climate drivers and spatial management actions.
- A dynamic network modelling framework has been completed. The model parameterization has been updated to use detailed stakeholder occupancy data to adapt to new ecological insights uncovered during parameterization of the network model.

## Pest fish incursion detection technologies

- **Developing pest fish detection tools.**  
Supporting a national incursions response system, through an efficient and accurate field surveillance technique to detect national and state priority pest fish at low densities.
- **Tilapia containment.**  
Assisting government agencies to more efficiently detect tilapia spread in order to prevent invasion of both Gulf catchments and the Murray-Darling Basin.

### 2013-2014 Highlights

- eDNA method applied to look for evidence of tilapia in Eureka Creek, the location of a previous infestation that was the focus of an eradication program by Queensland Department of Agriculture, Fisheries and Forestry.
- Laboratory manual and field use protocols for eDNA technology developed.
- Species specific molecular markers developed for the European perch, common carp and oriental weatherloach using tissue samples and comparing sequences of the three species on the National Centre for Biotechnology Information GenBank, all fish species of the Murray-Darling River Basin and any closely related species that potentially co-occur in Australia.
- Aquarium trials established to test a range of parameters that can impact on the efficacy of eDNA as a detection tool.

## Outcome 2: Improved prediction and control of emerging outbreaks

- **More efficient and sustained control of mouse outbreaks.**  
Enabling local preparation of grain-based bait; research and development of a new humane rat and mouse toxin; and development of a mouse outbreak response system.
- **Advancing a new pest bird toxin.**  
Reducing the impact of starlings on intensive agriculture.
- **Fertility control.**  
Better managed peri-urban and urban kangaroo and wallaby populations through registration of an injectable fertility control GonaCon™; developing species-specific fertility control that can be applied to better and humanely manage those species where lethal control is not socially acceptable; and research and development of oral delivery of fertility control.

### 2013-2014 Highlights

- A rodent monitoring system in use across the major grain-growing regions. Progress collating long-term data sets and setting up computational requirements for developing new models for forecasting mouse outbreaks.
- Achilles heel review of starlings completed and a physiological behaviour identified that may pre-dispose starlings to consuming a lethal dose of sodium nitrite formulated as a drink.
- Two contraceptive vaccine prototypes were compared via two routes of administration (injection versus intranasal) in male mice. When injected, one vaccine prototype induced a strong immune response that depressed sperm production and reduced testis weight. The same prototype delivered intranasally stimulated similar immune responses and also reduced testis weight in 4 out of 6 mice. This is a first because up until now all contraceptive vaccine prototypes have had to be injected into animals to induce a strong enough immune response to affect testis function.



## Outcome 3: Recovery of key land and water regions from rabbit, wild dog and carp impacts

### *Landscape control – rabbits*

- **Regulatory approval for new effective Rabbit haemorrhagic disease (RHD) Boost strain.**  
Gaining regulatory approval for the release and monitoring of new effective RHD Boost strains as part of a government-agreed integrated rabbit control implementation plan with the goal of reducing rabbit impacts for over two-thirds of Australia.
- **RHD resistance model.**  
Creating a comprehensive RHD resistance model and strategic knowledge to maintain RHD as an effective biocontrol agent in Australia.
- **Strategic rabbit control.**  
Undertaking strategic, efficient and effective implementation of new and existing rabbit control methods through Rabbit Decision Support System and National Rabbit Facilitator.

### 2013-2014 Highlights

- The evaluation of naturally occurring overseas strains of rabbit haemorrhagic disease virus (RHDV) has been completed and a candidate strain has been selected for potential release. Experimental methodology for determining the requirement for a new RHDV vaccine for domestic rabbits has been decided.
- New RHDV strain release protocols agreed and adopted by participating agencies.
- Two research papers published in international scientific journals on the epidemiology of RHD, which provides a major step forward towards developing a comprehensive understanding of interactions between RHDV and wild rabbits.
- Diagnostic techniques to detect benign rabbit caliciviruses and antibody responses in field samples have been established in New Zealand. Collections of field samples from rabbits have been completed and the samples from more than 400 rabbits have been archived.
- A review of the impacts of rabbits on biodiversity values with the information informing future large scale rabbit management programs completed.

### *Landscape control – wild dogs*

- **Researching the impacts of wild dogs on agri-ecosystems.**  
Determining if regional control of wild dogs influences populations of quolls, foxes, feral cats and native prey species. This will enable improved strategic wild dog management in sheep and cattle regions of Australia.
- **Improve policy for wild dog management across Australia.**  
Determining the legislative and policy incentives for, and barriers to, effective co-management of wild dogs.
- **Wild dogs in peri-urban areas.**  
Improving understanding of the ecology of peri-urban wild dogs in coastal eastern Australia and the most effective management strategies and product mix to reduce wild dog impacts.
- **Nil-tenure management.**  
Increasing adoption of regional nil-tenure wild dog management and integrated use of existing and new wild dog products and techniques.

### 2013-2014 Highlights

- Aerial baiting efficacy determined showing that wild canid control efficacy of aerial baiting varies with linear rate of application. A rate of 40 baits/km achieved ~90% mortality of collared wild dogs, whereas 10 baits/km killed ~55% of collared wild dogs and ~90% of collared red foxes. This provides vital insight into likely impacts of primary control strategies used by managers at treatment sites.
- Construction of a collaborative team has brought in students on associated projects, including: rabies preparedness in Australia; interactions between feral cats and spotted-tailed quolls in areas where wild canid control occurs; feral cat and spotted-tailed quoll ecology; brush-tailed rock-wallaby decline; media presentation of wild dog issues; communication among predators.
- The National Wild Dog Facilitator played an integral part in the development and sign off of the National Wild Dog Action Plan which was launched by the Federal Minister for Agriculture, July 2014.
- Wild dog 'impacts map' describing locations of reported impacts from peri-urban dogs, diet analysis and ejector testing completed.
- Delivered a cross border wild dog management program funded through Caring for Our Country, in cooperation with Granite Borders Landcare, NSW Local Land Services, Queensland Department of Agriculture, Fisheries and Forestry, Southern Downs Regional Council and the Tenterfield wild dog working group.
- The National Wild Dog Facilitator has been involved in delivering over 25 wild dog management field days and planning meetings around the country, in collaboration with industry and government agencies within each state.

## Catchment recovery after carp control

- **Carp biocontrol.**  
Evaluating Cyprinid herpesvirus-3 (CyHV-3) as a potential biological control agent for carp in Australia with the expected outcome being reduction in carp populations over most of the Murray-Darling Basin.

### 2013-2014 Highlights

- Clinical and laboratory work has been completed on the susceptibility to CyHV-3 of three further fish species, chickens, mice and a crustacean (yabbies) and there was no evidence of CyHV-3 replication in any of the fish and yabbies examined in this non-target species trial.
- CyHV-3 has been transferred to a non-secure area at the Australian Animal Health Laboratories (AAHL) in preparation for freeze-drying.
- A conceptual model for CyHV-3 in the Lachlan River Catchment is at an advanced stage of preparation.
- A cold-temperature mutant of CyHV-3 has been developed, and batches of viral DNA from this mutant and from wild-type virus (C07 strain) have been prepared for sequencing.

## BIOCONTROL FOR CARP

Carp in Australia is a major introduced pest, and koi herpesvirus represents one of a number of potential weapons that might be used in a multi-pronged attempt at controlling them. The specificity of the koi herpesvirus, and the sensitivity and high mortality in the target species makes this virus a potentially good biological control agent. For these reasons, the IA CRC funded this important research, aiming to develop a comprehensive understanding of the epidemiology of the disease caused by koi herpesvirus. This biocontrol is now in the final stages of testing with no evidence of any impact on non-target species in trials.



**Dr Ken McColl is leading the team researching a carp-specific herpesvirus.**

Disease associated with koi herpesvirus was first described in common carp in Germany and Israel. Most outbreaks of disease were associated with a very high mortality of 70–100%. Since the initial outbreaks, the virus has spread throughout much of Europe and Asia, and to South Africa and the USA.

By contrast, Australia and New Zealand remain free of the disease. Here in Australia the Common carp is now widely established throughout the Murray-Darling Basin. Carp made up 80% of the fish biomass within the basin during the 2010-13 period and up to 93% in several catchments. While total removal of carp may not be possible, numbers could be reduced to the extent that they do not have an environmental impact.

This is a research collaboration between the CSIRO and NSW Department of Primary Industries through the IA CRC.

## Outcome 4: New social networks and institutional 'architecture' around pest animal control

- Improving agricultural productivity from accelerated adoption of pest animal control strategies and technologies through facilitation of collective action, triggers for effective action and reduction of legal and institutional impediments.

### ZOOMING IN ON COMMUNITIES OF PRACTICE

The Community Engagement teams have contributed to the development of a number of active Communities of Practice (CoPs) for behavioural science and communication, and citizen engagement practice in New South Wales, Victoria and Western Australia. These CoPs aim to regroup people and front-line practitioners facing similar issues in invasive animals work to develop information tools and resources and share them across organisations.

The 'learning together' and 'sharing knowledge' aspects of this format is key to engage communities on invasive animal issues and deliver an ongoing, ready-to-use and relevant supporting system for front-line practitioners. Through different activities (e.g. workshops, meetings, online tools), CoPs intend to equip researchers, state agencies, rural natural resource managers and front-line practitioners with new tools and approaches for thinking differently about the human and community engagement dimension of the invasive animal challenge.



Department of Agriculture and Food Western Australia (DAFWA) Communities of Practice members attending a systems mapping exercise facilitated by Dr. Lyndal Joy-Thompson.

### 2013-2014 Highlights

- 12 participants completed the Certificate in Leadership and Community Engagement course run at Penn State University.
- An online Community Engagement Toolbox was developed by the Penn State University team and reviewed in Australia by project stakeholders.
- A behaviour impact analysis was undertaken to identify target behaviours for the Tasmanian cat management project.
- Consolidated collaborations with stakeholders on the peri-urban wild dog management behaviour change project using Community Based Social Marketing.
- Successful 'road trip', building relationships and cementing research plans between our international collaborators, research team, and our frontline partners.

### 'TOOLBOX TOUR' WITH US COMMUNITY ENGAGEMENT EXPERTS

An international team of researchers and facilitators worked with teams on the pest animal 'frontline' across Australia during May and June 2014, to identify what these teams need to improve community participation.

Community engagement experts included Lyndal Joy-Thompson from the IA CRC and UNE, IA CRC National Facilitators Jessica Marsh, Greg Mifsud and Lisa Adams, and collaborators from Pennsylvania State University, Bill Shuffstall and Walt Whitmer. Bill and Walt are developing an online Toolbox to provide resources for Australian community engagement practitioners.

The team was learning how we do things in Australia, and identifying opportunities for more useful community engagement, techniques, tools, training, practices and processes. Workshops were held in, Armidale, Melbourne, Orange, Perth, Swan Hill and Toowoomba. Participants included Local Land Services (NSW) staff, biosecurity officers, Landcare & NRM coordinators, National Parks and Wildlife Services officers, government professionals, landholders and researchers – a good mix of perspectives and experiences.

The workshops uncovered a vast amount of knowledge and generated a list of toolkit 'wishes' and needs. The importance of issues like trust, building relationships, conflict resolution skills, good facilitation skills, mentoring in engagement and the need to plan for and evaluate engagement activities emerged as key themes from the workshops.



# RESEARCH COLLABORATIONS

**“More than 80 Australian and overseas industry, research, natural resource management and catchment management authority groups and government departments collaborate on research with IA CRC.”**

A compulsory investment criterion for every project funded is that at least two IA CRC participants are involved in the project and at least one of these participants must be a technology end-user. In setting up the IA CRC, the Board took the view that the IA CRC would have low entry requirements (for example no entry fees) to encourage participation. End-users improve the research process as well, so that technology or processes developed are more likely to be adopted. Key national and international collaborators beyond the collaboration between IA CRC partners are outlined in this section.

Project No.		Organisation
<b>Outcome 1: No New Vertebrate Pests Established In Australia</b>		
1L1	National Incursions Response Facilitator	New Zealand Department of Conservation New Zealand Ministry for Primary Industries Landcare Research New Zealand Department of Agriculture and Food WA Vertebrate Pest Committee Department of Primary Industries and Regions South Australia
1L2	Pest-Information Hub (Pest iHub)	University of Adelaide University of Queensland Arthur Rylah Institute Victoria Department of Agriculture and Food WA Department of Environment and Primary Industries Victoria Department of Primary Industries NSW Landcare Research New Zealand Department of Conservation New Zealand
1L4	Exotic vertebrate risk analysis and complex invasion pathway framework	University of Adelaide Biosecurity South Australia Department of Environment and Primary Industries Victoria Department of Agriculture and Food WA Department of Primary Industries NSW Landcare Research New Zealand
1L5	Mobile devices and web-mapping tools for pest species	Department of Primary Industries NSW NewtonGreen Technologies University of Adelaide University of Western Sydney University of New England Atlas of Living Australia Vertebrate Pest Committee National Indicators Working Group Clarence Valley Conservation in Action Landcare Group Upper Murrumbidgee Demonstration Reach Murrumbidgee Landcare Group Wollongong City Council (NSW) Canberra Indian Myna Action Group Inc. Granite Borders Landcare group NSW Local Land Services Tenterfield Wild Dog Control Group Australian Bureau of Agricultural and Resource Economics and Sciences CSIRO Grains Research and Development Corporation Department of Agriculture and Food WA Landcare Research New Zealand
1L11	Prioritising adaptation actions for managing invasive animals under climate change	CSIRO University of Queensland Department of Agriculture, Fisheries and Forestry QLD Terrain Natural Resource Management Far North Queensland Regional Organisation of Councils
1L21	Mechanised extraction and next generation sequencing for the analysis of trace dna in predator scats	University of Canberra Department of Primary Industries, Parks, Water and Environment Tasmania Queen Victoria Museum Tasmanian Museum and Art Gallery Illumina
1L22	Detection and monitoring for fox incursion in tasmania	Department of Primary Industries, Parks, Water and Environment Tasmania Landcare Research New Zealand
1L23	Risk assessment for new fox control techniques	Charles Sturt University Nick Mooney (private) Cawthron Institute NZ
1L24	Long-term strategy for the tasmanian fox program	University of Queensland CSIRO Department of Primary Industries NSW University of Tasmania Landcare Research New Zealand

Project No.		Organisation
1W1	The Utility of eDNA as a Tilapia surveillance tool	Queensland Department of Agriculture, Fisheries and Forestry James Cook University
1W2	New eDNA surveillance for multiple high risk invasive aquatic species	University of Canberra CSIRO Primary Industries & Regions South Australia NSW Department of Trade & Investment Cawthron Institute NZ University of Waikato, NZ The Nature Conservancy, USA
<b>Outcome 2: Prediction and Control of Emerging Outbreaks</b>		
2C1	Avicides	Meat and Livestock Australia Feed lot & piggery managers Grains Research and Development Corporation Grain storage facilities Australian Pork Limited United States Department of Agriculture
2C2	Rodenticides	Grains Research and Development Corporation Animal Control Technologies Australia University of Queensland United States Department of Agriculture Landcare Research New Zealand
2C3	Surveillance and forecasts for mouse outbreaks in Australian cropping systems	CSIRO Grains Research and Development Corporation Department of Primary Industries NSW Landcare Research New Zealand
2C4	HOGGONE – USA field trials and US registration	Animal Control Technologies Australia Queensland Murray Darling Committee Animal and Plant Health Inspection Service, United States Department of Agriculture Texas Parks and Wildlife Department
2C5	Managing finalisation of new tactical tools	Department of Primary Industries NSW Livestock Pest and Health Authority State Management Council WB&G Manufacturing Ecological Horizons General Dogs Body University of New England Gavin Hall National Parks and Wildlife Service NSW
2C12	Fertility control oral delivery	CSIRO Meat and Livestock Australia United States Department of Agriculture
2C13	Development of reagents for the sterilisation of pest animal species	University of Newcastle University of Queensland
<b>Outcome 3: Recovery of Key Land and Water Regions from Rabbits, Wild Dogs and Carp</b>		
3L1	RHD Boost: roll-out of new RHDV strains	Department of Primary Industries NSW Department of Primary Industries and Regions South Australia Department of Agriculture and Food WA CSIRO Queensland Department of Agriculture, Fisheries and Forestry Australian Wool Innovation Meat and Livestock Australia ACT Government Environment and Planning Directorate ACT Government Territory and Municipal Services

Project No.	Organisation
3L2 Comprehensive RHD resistance model	Department of Primary Industries and Regions South Australia CSIRO Department of Primary Industries NSW University of Adelaide Meat and Livestock Australia The University of Sydney Landcare Research New Zealand Istituto Zooprofilattico Sperimentale, Brescia, Italy CIBIO, Universidade do Porto, Portugal
3L3 Non-pathogenic rabbit calciviruses	CSIRO Landcare Research New Zealand University of Otago AgResearch
3L4 RHD Accelerator	CSIRO University of Canberra Department of Primary Industries NSW Australian Wool Innovation Meat and Livestock Australia Istituto Zooprofilattico Sperimentale della Lombardia d dell'Emilia Romagna (IZS), Brescia, Italy
3L5 New potential rabbit biocontrol agent prospecting and assessment	Department of Primary Industries and Regions South Australia University of Canberra Wildlife Health Australia CSIRO Penn State University, USA Istituto Zooprofilattico Sperimentale della Lombardia d dell'Emilia Romagna (IZS), Brescia, Italy Rabbit Genome Biology Network (RGB-Net), Europe
3L6 Decision support systems for effective rabbit management	Department of Primary Industries NSW Queensland Department of Agriculture, Fisheries and Forestry Department of Primary Industries Victoria ACT Government Territory and Municipal Services Meat and Livestock Australia Landcare Research New Zealand
3L11 Co-management solutions for wild dogs in agri-ecosystems: predators, prey, plants and the triple bottom line	Department of Primary Industries NSW University of New England NSW Local Land Services Australian Wool Innovation Meat and Livestock Australia Wild Dog Associations / Livestock Producers National Parks and Wildlife Service NSW National Wild Dog Management Advisory Group
3L13 Limiting the source – peri-urban wild dog control	Queensland Department of Agriculture, Fisheries and Forestry Department of Primary Industries NSW Meat and Livestock Australia Moreton Bay Regional Council Somerset Regional Council Logan City Council Sunshine Coast Regional Council Brisbane City Council Gold Coast City Council United States Department of Agriculture, National Wildlife Research Center, Colorado, USA

Project No.	Organisation
3L14 Facilitating strategic management of wild dogs throughout Australia	Australian Wool Innovation Meat and Livestock Australia ACT Government Territory and Municipal Services Australian Bureau of Agricultural and Resource Economics and Sciences Queensland Department of Agriculture, Fisheries and Forestry Department of Primary Industries NSW Department of Environment and Primary Industries Victoria Department Primary Industries and Regions South Australia Department of Agriculture and Food WA NSW local Land Services NSW Farmers Wool Producers Australia Queensland Parks and Wildlife Service (Queensland Department of National Parks, Recreation, Sport and Racing) AgForce Queensland Granite Borders Landcare Victoria River District Conservation Association Gulf Rivers Landcare Territory Natural Resource Management Western Catchment Management Authority Rangelands Natural Resource Management WA Northern New England Landcare Northern Territory Cattlemen's Association Tilpa Progress Association Wanaaring Wild Dog Committee Northern Territory Government Barrier Ranges Landcare Penn State University, USA
3W1 Koi herpesvirus (Cyprinid herpesvirus-3; CyHV-3): its potential as a biological control agent for carp in Australia	CSIRO Department of Environment and Primary Industries Victoria Department of Primary Industries (Fisheries NSW) Murray-Darling Basin Authority Department of Conservation, New Zealand
<b>Outcome 4: New Social Networks and Institutional Architecture Enhanced Around Pest Animal Control</b>	
4E1 Facilitate Collective Action	University of New England Meat and Livestock Australia Australian Wool Innovation Queensland Murray-Darling Committee Department of Primary Industries, Parks, Water and Environment Tasmania Department of Agriculture and Food WA Department of Primary Industries NSW Queensland Department of Agriculture, Fisheries and Forestry Department of Environment and Primary Industries Victoria Penn State University, USA Cornell University, USA Sam Houston State University, USA
4E2 Triggers for Effective Action	University of New England Department of Primary Industries, Parks, Water and Environment Tasmania Department of Primary Industries NSW Queensland Department of Agriculture, Fisheries and Forestry Queensland Murray-Darling Committee Griffith University
4E3 Reduction of Legal and Institutional Impediments	University of New England Griffith University Penn State University, USA

Project No.	Organisation
4E4 Action Driven Coordination	University of New England Meat and Livestock Australia Department of Primary Industries NSW Department of Primary Industries, Parks, Water and Environment Tasmania Griffith University Queensland Murray-Darling Committee Department of Agriculture and Food WA Penn State University, USA Sam Houston University, USA
4E6 Facilitating Community Led Rabbit Management in Australia	Department of Environment and Primary Industries Victoria University of New England Queensland Department of Agriculture, Fisheries and Forestry Rabbit Free Australia Meat and Livestock Australia Australian Wool Innovation Victorian Catchment Management Authorities Victorian Landcare Networks and Groups Parks Victoria Victorian Farmers Federation Penn State University, USA
4E11 VET Training Packages on Strategic Pest Management	Department of Primary Industries NSW Braysher Consulting AgriFood Skills Australia University of Canberra – Education, Science, Technology and Mathematics Faculty & University of Canberra College
4E12 National NRM Facilitator	Department of Primary Industries NSW South Coast Natural Resource Management WA Northern Territory Natural Resource Management Adelaide and Mt Lofty Ranges Natural Resource Management Queensland Murray Darling Committee Border Rivers Gwydir Catchment Management Authority Lachlan Catchment Management Authority Murrumbidgee Catchment Management Authority NSW Local Land Services Office of Environment and Heritage NSW West Gippsland Catchment Management Authority Agforce Queensland Department of Environment and Primary Industries Victoria Braysher Consulting Western Catchment Management Authority Northern and Yorke Natural Resource Management South West Natural Resource Management North East (NSW) Pest Animal Steering Group Riverina Local Land Services Central Tablelands Local Land Services Western Local Land Services Penn State University, USA
4E21 Balanced Researcher Program	Plant Biosecurity CRC



# EDUCATION & TRAINING

This section focuses on our successful PhD training initiative, the *Balanced Researcher Program*, and the *Vocational Education and Training* theme that sits within the Community Engagement program. The program is accelerating the uptake of innovations generated by the IA CRC through institutional, policy and adoption processes.

## **BALANCED RESEARCHER CAMP: LAUNCH PAD FOR INDUSTRY READY DOCTORAL STUDENTS**

The first Balanced Researcher Program student camp was held at Kioloa on the south coast of New South Wales in October 2013, joined by students from the Plant Biosecurity CRC and from projects affiliated with the IA CRC core research outputs. This camp allowed students to start forming long lasting networks and collaborations with other researchers within the IA CRC and from other institutions. Students undertook training in team building, team management, media training and introductory grant writing.



Balanced Researcher Program students at camp in Kioloa, NSW (Photo: T. Buckmaster).

## Postgraduate Education

The Balanced Researcher Program aims to create multi-skilled industry ready graduates from the IA CRC's PhD program. Doctoral students undertake the 80 day professional development program over the course of their four year research project and obtain skills that would not normally be possible through a traditional 'research only' PhD program.

Skills are developed in areas such as leadership, management and stakeholder engagement. Training is also provided in statistical analysis and strategic communications. Students undertake at least twenty days placement within industry to gain experience, and also to form enduring networks and linkages that add further depth to their research projects and intended careers.

To ensure that this additional training load does not adversely impact on the student's ability to produce an exceptional quality research thesis, the IA CRC fully funds an eighth semester of scholarship.

There are 17 doctoral research students enrolled in partner universities and actively engaged in IA CRC projects including four professional doctorate students and 13 traditional PhD students. Professional doctorate and traditional PhD students have the same status under level 10 of the Australian Qualifications Framework. Recruitment for students in two additional projects is on-going.

Theme	Doctoral students
Theme 1: Incursion response and pest intelligence systems	5
Theme 3: Fertility controls	2
Theme 4: Strategic rabbit control	2
Theme 5: Strategic wild dog control	2
Theme 7: Community engagement	6
<b>Total</b>	<b>17</b>



Learning about leadership (Photo: T. Buckmaster)

## Student Progress

The IA CRC has exceeded its Commonwealth milestone target of 10 doctorate by research enrolments by June 2014. While all doctoral students that were selected for research positions have been exceptional applicants, there has been an overall decline in the number of appropriate applicants for PhD projects when compared with the previous CRC. Several PhD students who were selected for projects withdrew prior to commencing their studies. This has resulted in the RHD Boost student research project being withdrawn.

The *Balanced Researcher Program* has commenced with all IA CRC traditional students enrolled in the program. A student camp was held at Kioloa in October 2013 as part of the students professional development program. While only 18 months into the program, several students have nearly completed their requisite 80 days of additional training with one also having completed industry placement.

## INDUSTRY READY GRADUATES: BALANCED RESEARCHER PROGRAM

The Balanced Researcher Program produces industry ready graduates who become the future of invasive species management. Pablo Garcia Diaz (pictured) from Spain completed a 24 day industry placement at Primary Industries and Regions South Australia (Biosecurity South Australia), under the supervision of Dr John Virtue (Manager NRM Biosecurity).



Pablo said, “The Balanced Researcher Program has given me the opportunity to get real practical experience. I assisted the National Vertebrate Pest Committee (VPC) Incursions Working Group, undertook risk assessments and evaluated potential impacts of species and also looked at

the possibility of eradication if a new pest species got established. This was to populate a Category 1 (National Surveillance) from the National Invasive Species Categorisation System. I also assisted in reviewing the VPC List of Exotic Vertebrate Animals in Australia. It was really helpful and I learnt a lot by working with experienced people from the Vertebrate Pest Committee, Federal and State governments.”

“Part of the research I conducted during my industry placement was presented by Dr Virtue to the Vertebrate Pest Committee and presented at the Australasian Vertebrate Pest Conference in Brisbane.”

“Moreover, the Balanced Researcher Program provided me with additional funding to attend the ‘Bayesian modelling using R workshop’ held at the University of Queensland. I found the workshop about statistical modelling, particularly helpful. When I have finished this PhD I would like to continue to research invasive species.”

“The Balanced Researcher Program is really helpful. Now I have experience in how government works and what they need from researchers to better manage and control invasive species. It has been a great learning experience by helping me to apply research to real life situations to prevent exotic species.”

Link in at: <http://www.invasiveanimals.com/education/balanced-researcher-program/>

## Current IA CRC Doctoral students

NAME	DRAFT THESIS TITLE	IA CRC RESEARCH PROJECT	THEME	COMMONWEALTH AGREEMENT OUTPUT	PARTNER UNIVERSITY	COMMENCEMENT DATE
Pablo Garcia-Diaz	Exotic vertebrate risk analysis and invasion pathway analysis	1.L.4	Theme 1	1.1	University of Adelaide	28/02/2013
Rheyda Hinlo	Parameterisation of eDNA detection probabilities for the identification of aquatic invasive species	1.L.4	Theme 1	3.1	University of Canberra	20/01/2013
Jonas Bylemans	Monitoring freshwater fish communities using eDNA metabarcoding	1.L.4	Theme 1	3.1	University of Canberra	06/12/2013
Elodie Modave	Distribution density in space and time and phylogeny of Tasmanian rodents using DNA in predators' scats and Next Generation Sequencing	1.L.21	Theme 1	1.2	University of Canberra	06/05/2013
Catriona Campbell	Using next generation sequencing to determine ecosystem change and species interaction in Tasmania	1.L.21	Theme 1	1.2	University of Canberra	07/01/2013
Aleona Swegen	Identification of targets for immunocontraceptive fertility control in horses	2.C.13	Theme 3	2.4	University of Newcastle	21/02/2013
Sally Hall	Phage peptides fertility control for the non-surgical sterilisation of feral horses	2.C.13	Theme 3	2.4	University of Newcastle	28/02/2013
Amy Iannella	Rabbit genetic resistance to RHDV variants in Australia	3.L.2	Theme 4	1.3	University of Adelaide	01/02/2013
Nadya Urakova	Identifying molecular virulence factors of RHDV	3.L.4	Theme 4	1.4	University of Canberra	01/02/2013
Helen Morgan	Management of wild canids and trophic cascades: is vegetation influenced by top-order predators	3.L.11	Theme 5	1.5	University of New England	05/08/2013
Michael Mielak	The community ecology of threatened, critical weight range, terrestrial mammals in response to wild canid and feral cat control	3.L.11	Theme 5	1.5	University of New England	01/05/2013
Darren Marshall		4.E.1	Theme 7	4.1	University of New England	
Katrina Dickson	Transformative learning in human dimensions in organisations involved in invasive animal control	4.E.1	Theme 7	4.1	University of New England	04/02/2013
Bernadette York	Wild dog aware	4.E.2	Theme 7	4.2	University of New England	02/2013
Roxane Blackley	mApps for rangeland decision makers	4.E.2	Theme 7	4.2	University of New England	01/07/2013
Lynette McLeod	Improving the behavioural effectiveness of cat management programs	4.E.2	Theme 7	4.2	University of New England	25/02/2013
Lisa Yorkton	Social media: achieving active engagement	4.E.2	Theme 7	4.2	University of New England	2013

## Postgraduate program review

To ensure the education program meets the needs of end-users, a longitudinal study on the long term benefits of the enhanced skills program enabled through the Balanced Researcher Program has been undertaken. The review showed that the program was valuable and created a strong feeling of cohesion among the students, facilitated the formation of linkages and collaborations and contributed to the high completion rates of the IA CRC students. The investment by the IA CRC in the program was considered to be an important advantage for the IA CRC students when compared with a conventional PhD program.

The findings of the report have been used to fine tune the current Balanced Researcher Program to ensure that the program continues to provide benefit to the PhD students.

## IA CRC 2005-2012

The Balanced Scientist Program has an exceptional completion to conferral rate for our students. 93% of our PhD students have been awarded their PhD with only one thesis remaining to be submitted. This completion rate is well above the national average of 60% and above the 75% completion rate for the broad study area of science. The majority of completing students have entered Australian or international research organisations with several having entered academic based positions.

## Vocational Education & Training

The aim of the training and capacity building program is to develop revised and nationally accredited Vocational Education and Training (VET) pest training material that is consistent with the Australian Pest Animals Strategy and the new operating environment and to promote the adoption of the revised packages to current and future pest managers. Highlights for 2013/14 include:

- The revised job roles for pest managers (both weeds and pest animals) have been endorsed and Agrifood has commenced preparation of the competency units for the new qualifications. A small team has been assembled to assist with the writing of the new units. It is anticipated that national endorsement of the new qualifications will happen in late 2014.
- A successful transition for delivery of the VET Diploma from University of Canberra College to the Riverina Institute is underway. Riverina Institute will deliver the Diploma and to cooperate in developing courses based on the new national training qualifications. Mike Braysher will mentor Riverina staff regarding the delivery of the course leading to a full handover in 2017.

## INVASIVE ANIMALS CRC GOES HAWAIIAN

A small contingent from the IA CRC visited Hawaii in the United States to attend the 26th US Vertebrate Pest Conference. The conference is held every two years and is one of the largest and most widely attended conferences of its type worldwide. IA CRC's Annette Brown and Mike Braysher presented a paper on the soon-to-be revised national training qualifications for vertebrate pest managers in Australia, and emphasised the need for relevant vocational education and training qualifications and competency standards that are consistent with the Australian Pest Animal Strategy's goals and objectives. University of New England PhD Candidate and IA CRC Affiliate, Frances Zewe also presented her work on feral cat research and former IA CRC PhD student Andrew Bengsen presented on feral pig management in Australia.



Frances Zewe and Annette Brown at the 26th Vertebrate Pest Conference in Hawaii (USA) in March 2014.



**The IA CRC has formulated and adopted a strategy that ensures robust and constructive engagement between the IA CRC management company, its two participant SME's Animal Control Technologies Australia and Connovation, together with other Participants.**

## **Commercialisation & Utilisation**

The commercialisation and utilisation strategy adopted by Invasive Animals Ltd (IAL) is focused on IAL playing a brokering role to secure co-investment and partnerships in commercially focussed R&D projects. The IA CRC's two SME Participants, Animal Control Technologies Australia and Connovation, take a lead role in commercialising these opportunities and are also heavily involved in the research and development phase.

This strategy diversifies key risks involved in innovation in this field such as:

- Research/technical failure
- Development of low cost products to meet the market need and avoid market failure
- Development of products to meet market needs in terms of effectiveness, ease of use, animal welfare and human health concerns

This brokering and co-investment approach improves end-user, CRC participant and SME engagement and builds trust and credibility in research outputs and products to market.

The following Commercialisation and Utilisation projects are examples of this strategy in action:

- Development of a new humane poison and bait for feral pig control in Australia.

*Status:* In research phase with the latest formulations and trials showing promising results that we are close to being able to start a registration for use application.

- Development of a new humane poison and bait for feral pig control in the USA.

*Status:* through a contract with the US Department of Agriculture and arrangements with Texas Parks and Wildlife Authority we are conducting trials with these partners in the USA and hope to soon apply for USA permits to use the new baits/formulation in field trials. Timeframe on USA Feral Pig bait registration and sale is still a number of years away.

- Development of a lethal trap device to reduce animal welfare concerns over leg-hold trapping of wild dogs, foxes and feral cats.

*Status:* A number of prototypes have been built and field trials are underway with a final version expected for production use soon.

- Development of a new bait and toxin, PAPP, for the humane management of wild dogs and foxes.

*Status:* This project has been in the pipeline for a number of years. The Baits and Toxin package were submitted with the Australian Pest and Veterinary Medical Authority (APVMA) for registration in 2012.

- Development of a new rabbit virus delivery mechanism, Freeze Dried RHD Boost, which when registered for use will allow Land Managers to apply the rabbit virus in the field without the heavy costs of transporting the rabbit virus in its current liquid form.

*Status:* Will soon be submitted to the APVMA for registration

- Research into new rodenticides that can be safely used by land managers/producers to batch mouse control products.
- Research into new avicide products for pest bird management.

In conjunction with the product initiatives above a Community Engagement (CE) research program has been integrated into the structure of this IA CRC extension program. The CE research outputs will be used to improve the adoption of our project outputs.

## Intellectual Property (IP) Management

### IP from previous CRC's

#### *(IA CRC 2005-2012 and Pest Animal Control CRC pre-2012)*

Licensed IP that generates royalties from the sale of products from the Pest Animals Control (PAC) CRC (pre 2012) is disbursed to IP owners from that PAC CRC. Licenced IP that generates royalties from the sale of products developed through the IA CRC (2005- 2012) is reinvested into the current extension IA CRC. IP novated and/or managed by IAL in this extension is related to the commercialisation of:

1. PIGOUT® – 2013-14 financial year royalty of \$6,720 – distributed to Pest Animal Control (PAC) CRC Participants
2. HOGHOPPER™ – 2013-14 financial year royalty \$13,617 – retained by IAL
3. PAPP – 2013-14 financial year royalty \$0 – yet to be released to the market
4. RODEMISE® – 2013-2014 financial year royalty of \$298 – retained by IAL

### IP strategy in this IA CRC

IP has been split into IP for public good and IP with commercial potential. Public good IP will continue to be managed in the same way as the previous CRC, that is all public good IP is available to all CRC Participants for their own use in research, training and adoption.

IP with commercial potential will be managed as follows:

- Co-investors (participants) in a project will be allowed to legally and beneficially co-own project IP.
- Specified Project and IP is classified as Specified Project IP rather than Centre IP.
- Specified Project IP ownership is determined based on a process that is agreed to by the participants directly involved in the project.
- All investors in a Specified IP project have a say in developing the terms under which project IP will be commercialised, where possible.

This approach is consistent with national principles for the management of IP generated using publicly-funded research and ensures that R&D that is commercialised benefits Australia and Australian investors in innovation in pest animal management.

## IP currently held for Commercial purposes

IP description and product name	IP creation date	IP owners and ownership splits	Licence nature (exclusive/non-exclusive)
Blue-Healer trademark	Sep 2005	100% IAL	N/A
HogHopper design, manufacturing specifications	2010	100% IAL	Exclusive (worldwide)
HogHopper trademark	2010	100% IAL	Exclusive (worldwide)
Rodenticide pen/ field efficacy studies	2005-2008	100% IAL	Exclusive (in Australia)
Nitrite based pesticide products: Commercialisation of granted patents (Aus, NZ, USA) and pending patent applications (Canada, China) (see Patents – below)	Feb 2007	100% IAL	Exclusive (worldwide)
PestSmart trademark	Jan 2012	100% IAL	N/A
PIGOUT pen/field efficacy studies	2003-2005	50% PAC CRC 50% Meat & Livestock Australia Novated to IAL	Exclusive (in Australia)
PAPP wild dog and fox bait and toxin	2005-2014	95% Australian Wool Innovation 5% IAL	Exclusive (worldwide)

## Patents

IAL has maintained and managed patents and patent applications for the use of nitrite salts as poisons in baits for omnivores. The development work in nitrite salts is focused on feral pig control, though the application for the use of nitrite salts in the control of rodents and invasive birds and potentially other feral animals is being researched. Patented IP managed during the reporting period includes:

- Australian granted patent 2008221237 – Nitrite Salts as Poisons in Baits for Omnivores.
- New Zealand granted patent 579357– Nitrite Salts as Poisons in Baits for Omnivores.
- United States of America granted Patent No. US 8,795,649 B2 – Nitrite Salts as Poisons in Baits for Omnivores.
- International Published Patent Application (WO/2008/104028) which includes Canada – Nitrite Salts as Poisons in Baits for Omnivores.
- International Published Patent Application (WO/2008/104028) which includes China – Nitrite Salts as Poisons in Baits for Omnivores.

IAL did not file any new patent applications in the reporting period. Note the United States of America Patent for Nitrite Salts was granted in July 2014.

## Community Engagement

**“Pests?...It is not about the animals, it is about the people....and people are key to invasive animal control and management successes...”**

*Sally Dakis, 'It's not just about the (feral) cats'  
(ABC Rural, 12 November 2013)*

### Pests, people and the community engagement program

One of the toughest challenges in managing invasive animals is finding ways to involve people when there are less and less resources, and more emerging pest threats. Another is supporting front-line practitioners who know so much about pests and people, but who need help with the 'tricks of the trade' of community engagement. These are key issues for the research team of Program 4: 'Facilitating effective community action' led by Professor Paul Martin. The program is bringing the knowledge of Australian and US experts in community engagement to community groups and front-line practitioners throughout Australia.

This program aims for partnerships between our researchers, 'technical' researchers, state agencies and rural natural resource managers, and particularly, communities attempting to control wild dogs, pigs, rabbits and other species. This includes providing access to the best available knowledge and 'tools' to improve community participation; helping communities make use of behavioural science to improve their communication strategies; and working on ways of reducing the institutional barriers that they face.

*Living and collaborating together to create mutual opportunities in pest management*

Scientists, extension officers, program managers, farmers, animal control experts and many others need to form a seamless "web", supporting each other so as to be able to succeed under often very difficult conditions. The Invasive Animals CRC is about doing all we can to support the work of those at the front line of invasive animal control by making available to them better ways of dealing with the human aspects of their work. Reflecting a philosophy that the most important issue is the effectiveness and motivation of the citizens who must support and implement practice" control, the programme is about providing access to the best available science for motivating and supporting community groups to do the work that they must do.

Over the last two years, Program members have been working with groups across the country to apply "best practice" community engagement and behaviour change methods. The issues we are working on with community groups include improving their ability to recruit and retain members, managing the problem of "non-involvement" by some land holders, creating better community communication tools, and using the Internet more effectively. We have begun looking at ways to reduce the legal and administrative difficulties that frustrate community groups in trying to implement effective control programs.

Over two years, more than 200 people have attended discussions, forums, workshops and seminars and more than 50 people are involved in ongoing collaborations with Program. An important development is the involvement of three major US universities, who bring specialist expertise. Leading this involvement is Penn State University, with specialists from Sam Houston University and Cornell University. The US specialists are working with colleagues from the University of New England, Griffith University and our various partners to identify research and frontline supports that can be used to help with community action to control invasive animals.

## FAMILIARISATION TOUR

Invasive Animals CRC specialists, colleagues from our partner organisations, Penn State's rural engagement specialists, and researchers from Cornell and Sam Houston universities were involved in a familiarisation tour of invasive animals control programs in eastern Australia. This gave an opportunity discuss issues and opportunities with the people who are leading invasive animal programs in rural and urban communities.



Associate Professor Paul Curtis (Cornell University), Community engagement experts Bill Shuffstall and Walt Whitmer (Penn State University), Professor Michael Fortunato (Sam Houston University) and Harley West from Queensland Murray-Darling Committee.

## National Facilitators

There is a need for coordinated and strategic management of pest animals at appropriate scales and a need for engaging and empowering communities of best practice to cost-effectively manage pest animal damage risks. National Facilitators promote the development of nationally-consistent approaches to pest animal management. The IA CRC and participants are investing in National Facilitators in four keystone fields – natural resource management (NRM), wild dogs, wild rabbits and incursions.

## Report from Jess Marsh, National NRM Facilitator



My role is about bringing public and private land managers together. We want them to be able to reduce the impact of invasive animals by adopting best practice management and working together. There is a really strong emphasis on capacity building – helping people to do good work themselves with ongoing outcomes that eventually become self-sustaining.

There have been many highlights this year. I worked with the North West LLS to develop the 'Gwydir wetlands coordinated pest animal program' and delivered a pest animal seminar for the Weddin Shire in Grenfell, NSW that resulted in 6 groups forming, each with a volunteer coordinator. This has now led to practical pig trapping demonstrations on local properties and a coordinated approach to feral pig and fox management, which are really great outcomes. Community engagement 'toolbox workshops' have helped develop an online engagement toolbox, which is going to be really useful for those in NRM and community engagement.

Developing new ways to increase awareness and engagement are always a priority for me and this year I have created a pest animal 'Enviro-stories program'. This will result in 5 story books, created by school kids and local communities on the pest animals that are most relevant to their area. Regional NRMs that are participating include Wheatbelt NRM in WA, QMDC in Qld, Central Tablelands LLS in NSW, North East CMA in Victoria and AW Lands in South Australia.

## Report from Greg Mifsud, National Wild Dog Facilitator



It has been a full on year in the world of wild dog management. Over the past year I have been working with industry and government agencies delivering over 25 wild dog management field days and planning meetings around the country. An important part of the year was my involvement in the development

of Australia's first National Wild Dog Action Plan. This development of the action plan was industry driven however the approach taken included involvement and endorsement by at all levels of government with the backing of state and national industry groups. This is a real opportunity to get on top of the wild dog problem at a landscape scale. The action plan was launched by the Minister for Agriculture Barnaby Joyce in July 2014.

## Report from Michelle Christy, National Incursions Response Facilitator



I was appointed to the newly created position of National Incursions Response Facilitator in July 2014 – a highlight for me personally and hopefully for our Incursion Response Theme collaborators. This Invasive Animals CRC project is based at the Department of Agriculture WA.

My focus will be to research and develop a nationally recognised incursion response system that can respond to pre-incursion (preventing vertebrate pests from entering Australia) and early post-incursion (following entry into Australia) events. The key to the program's success relies on incursion prevention, early detection, and rapid response to invasion. Once implemented, the system should provide productive tools to decrease invasive vertebrate species establishment in Australia.

After an extended stint working overseas, I am happy to be back in Australia and keen to bring the knowledge and experience I have attained during my career to this fantastic position.

## Report from Lisa Adams, National Rabbit Facilitator



This project has been established to be a catalyst for more effective community-led action on rabbit management across Australia.

Some highlights for the reporting year for me have included supporting community led action for more sustainable and effective rabbit

management across Victoria leading to negotiations within DEPI to implement the strategy options under the banner of the Victorian Collaborative Rabbit Management Initiative.

There have been two learning groups in community engagement being piloted in Victoria with early positive feedback. Workshops to develop an on-line toolbox for community engagement were successfully delivered in Queensland, NSW, WA and Victoria. This initiative, which involved collaboration among the Community Engagement Program team members, has raised the profile of community engagement and community led action on invasive species at a national scale.

## End-user collaborations

### SME's and R&D Corporations

The IA CRC's strategy has been deliberately designed to promote end-user/SME engagement in the development of R&D outputs by directly involving organisations and individuals that manage public and private natural resources in development projects.

### Land managers

Private land managers, are engaged in feedback and product testing, which will encourage greater product familiarity, acceptance and credibility. These mechanisms help build trust and importantly establish local product champions who are more likely to be early adopters and whose testimonials generally influence uptake by later adopters.

The place stories (case studies) that create engagement and trust are captured in the PestSmart Toolkits produced by the IA CRC. PestSmart provides tools such as factsheets and case studies that explain integrated pest animal management for each species of interest and how new products can be integrated into conventional management practice.

### Government

Commonwealth and State Government stakeholders are actively engaged due to their key roles in funding, assessing, approving, regulating and auditing the use of many of the control tools this IA CRC extension is commercialising and promoting the utilisation of these products and tools such as:

- Biocontrols for European carp and wild rabbits.
- Lethal control tools for wild rabbits, foxes, wild dogs, rodents and European starlings.
- Fertility control tools for over-abundant herbivores including native animals, for example kangaroos.
- Tools that facilitate communities of best practice being established and or strengthened so that participation rates in pest animals management programs can be optimised at appropriate scales.

## Communications

IA CRC communications activities support establishing effective corporate and external communications and community engagement with the aim of continuing to establish the organisation as a respected and trusted leader in invasive animal research and technologies.

### Media

Elevating the problem of invasive animals and the profile of the IA CRC's research was a target of the media strategy during the reporting year. The IA CRC has a large number of media enquiries every year in response to invasive animal issues. The CRC is also proactive in media relations and issued 6 media releases over the year.

Media highlights include:

- 'Dogs that ate a sheep industry' was a top 10 radio story on ABC Radio National for 2013, a real achievement for science and agriculture based news.
- Media monitoring in 2013-14 counted 520 mentions of the Invasive Animals CRC.
- The most popular IA CRC story was 'Dingo plague threatens sheep' (58% of yearly total), resulting from the release of an IA CRC report by Ben Allen, PhD candidate at the University of Queensland and IA CRC researcher at Biosecurity Queensland.
- Wild dogs were high on the IA CRC media agenda with 34% of wild dog stories for the year mentioning Invasive Animals CRC.



Top IA CRC media story about wild dogs and sheep.



## Online communications

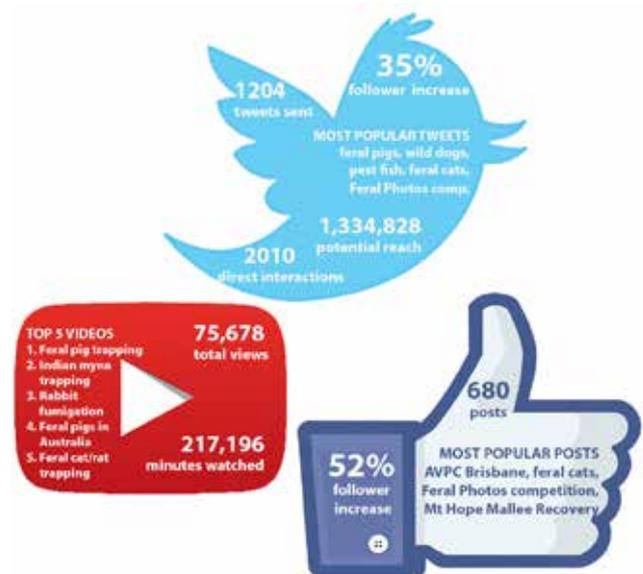
The IA CRC has three active websites and a daily presence on social media as part of a strategic approach to engagement with our target audiences:

- **feral.org.au** – houses the popular PestSmart toolkit resources for a variety of invasive animals, as well as publications. A total of 7,112 documents were downloaded from the site over the year. The top five most downloaded documents in the period were the general PestSmart factsheets on foxes, rabbits, pigs, cats and the PestSmart Glovebox Guide for Managing Foxes.
- **invasiveanimals.com.au** – the IA CRC corporate website housing corporate publications and media.
- **feralscan.org.au** – a website based interactive community tool for mapping sightings of a range of pest animals.

Domain	Total site visitation 2013-14
Feral.org.au	99,468
Invasiveanimals.com.au	35,290
Feralscan.org.au	24,782

## Social Media

The aim of using social media as a communications tool is to increase the profile of the IA CRC with a wider audience, to act as a service for information sharing and to use as vehicle for community engagement.



Social media highlights include:

- **Twitter** – followers on [twitter.com/PestSmartCRC](https://twitter.com/PestSmartCRC) increased 35% over the reporting year. A total of 1,204 tweets were sent. This resulted in 2010 direct interactions (mentions, replies and re-tweets) and a combined potential reach of 1,334,828 for the year. Tweets that were most engaged with by followers included posts about feral pigs, wild dogs and pest fish, the Feral Photos competition and posts linking to feral cat PestSmart publications and news.
- **Facebook** – followers on [www.facebook.com/PestSmart](https://www.facebook.com/PestSmart) increased 52% from 313 to 474 during the reporting period. There were two main peaks in Post Reach and engagement. The first in April 2014 coincided with a photo post about the Mt Hope Mallee Recovery project. The second (May 2014) coincided with posts during the Australasian Vertebrate Pest Conference in Brisbane, links to a news story about feral cats in Northern Australia, and posts about the launch of the 2014 Feral Photos competition.
- **YouTube** – the PestSmart YouTube channel, [www.youtube.com/PestSmart](https://www.youtube.com/PestSmart), received 75,678 views with 217,196 minutes of video watched during the reporting year. The five most watched videos during the year were:
  - Trapping for feral pig control
  - Cage trapping of Indian Myna birds
  - Fumigation with phostoxin for rabbit control
  - Feral Pigs in Australia – part 1
  - Cage trapping for feral cats and rats



Photo: Felicity Hatton

The winning entry of the 2013 Feral Photo competition of a wedge-tailed eagle flying away from a fox eyeing off a kangaroo carcass, by Felicity Hatton.

### Other communications

- **Email newsletters** – thirteen issues of the IA CRC's e-Newsletter 'Feral Flyer' were sent to subscribers. At the end of the reporting year, there were 1,868 email subscribers, receiving Feral Flyer, Media Releases or both. The quarterly e-Newsletter 'NRM Notes' went out through the National NRM Facilitators networks to 659 subscribers.
- **'Feral Photo's competition** – in 2013 the third annual Feral Photo's competition saw a total of 392 entries (up from 245 in 2012) received from budding photographers around the nation, with lots of media and social media buzz created that helped get across the message of the invasive animal problem.
- **Publications** – a total of 60 PestSmart publications including technical reports, fact sheets, case studies and Standard Operating Procedures, were produced during 2013-14. A full list of all IA CRC publications are detailed in Appendix B.

### Communicating with Staff & Participants

- **Staff** – the 'Around the Traps' internal e-Newsletter is an opportunity for staff and researchers to raise awareness of matters of interest internally or changes to corporate policies or procedures.
- **Participants** – representatives from Participant organisations gathered in Canberra in November 2013 for the annual IA CRC Participants Forum where the Annual Report and the Research Portfolio Summary were presented, highlighting our achievements, progress and aims for the coming year.
- **Researchers** – each of the four Themes has face-to-face meetings annually to facilitate cross-collaboration, discussion of research projects and team-building.
- **Industry** – this year the Australasian Vertebrate Pest Conference was held in Brisbane in May 2014. The IA CRC was a major sponsor and used the opportunity to exhibit our resources and showcase our research. There were over 300 attendees from industry, government and academia. IA CRC staff, researchers and PhD students (past and present) presented 17 presentations and CEO Andreas Glanznig gave a keynote address.



IA CRC staff go 'wild' at the Australasian Vertebrate Pest Conference.



# FINANCIAL PERFORMANCE

Photo: Shaun Reynolds

**Invasive Animals Limited's (IAL) dual purpose is to pursue and promote world class research and education in the invasive pest animal field, with an approach which is disciplined and cooperative, and to manage and govern the Invasive Animals Cooperative Research Centre (IA CRC), in accordance with the Commonwealth Agreement and Participants Agreement.**

## **Financial performance**

The Invasive Animals Ltd's (IAL) dual purpose is to pursue and promote world class research and education in the invasive pest animal field, with an approach which is disciplined and cooperative, and to manage and govern the IA CRC, in accordance with the Commonwealth Agreement and Participants Agreement.

The IA CRC, a 27 member collaboration, is now in its second extension year to 2017. IAL's strong and effective financial management with a demonstrated commitment to continual development and strong fiscal stewardship underpins the broader strategic objectives of the IA CRC.

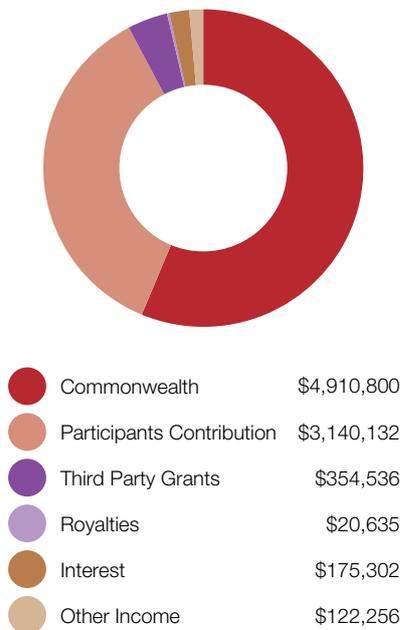
For the 2014 financial year there has been a strengthening of internal control systems, a review of policies and procedures, in particular finance and risk management, and an unrelenting enthusiasm to support the IA CRC program of work through best practice financial administration.

The total revenue for the 2014 year was \$8,723,660 with \$4,910,800 being provided by the Commonwealth, \$3,140,132 being invested by the Participants and the balance from sources as listed below in the graph. Third party revenues secured by Invasive Animals Ltd (IAL) continue to be sourced to support collaborative research initiatives.

The total 2014 year In-kind contributions, provided by the Participants in support of IA CRC activities, were \$11,725,000.

The following graphs broadly summarise the financial performance of IAL and the IA CRC.

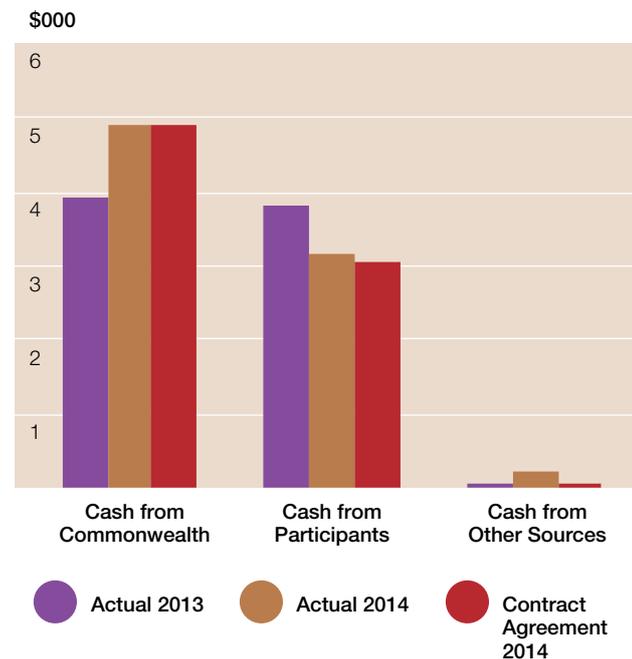
**Revenue 2013-14 (Cash)**



**ACHIEVEMENT AGAINST COMMONWEALTH CONTRACT BUDGET**

CRC activities were supported by the Australian Government and Participants to the level as shown.

**Commonwealth Agreement Cash Contributions**

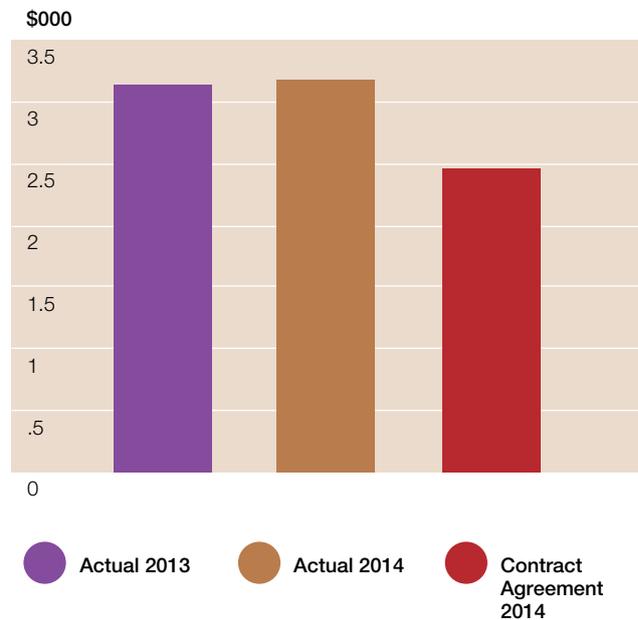
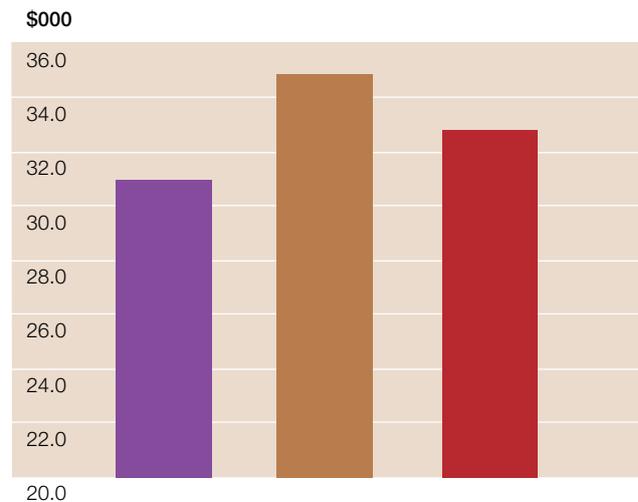


For the 2013–14 Financial Year our target for contributions of personnel time was 32.8 full time equivalents (FTE). The actual level of contributions obtained reached 34.9 FTE, reflecting the commitment of the participants.

The target of \$2,455,000 for non personnel In-kind contributions in 2013–14 was well exceeded, with \$3,172,000 of contributions confirmed by participants.

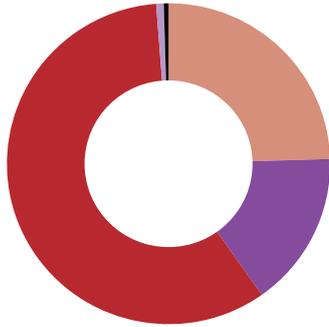
Participants have also exceeded their commitment to making cash contributions to the Invasive Animals CRC.

**In-kind (STAFF) and (Non-Staff)**

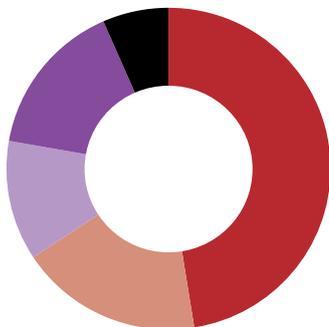


## FINANCIAL STRATEGY AND MANAGEMENT

The available resources were derived and applied to the four main areas of CRC focus: (1) Land Pests Program; (2) Land Pests (Commercial Products) Program; (3) Inland Water Pests Program (4) Community Engagement Program and to Network Governance and Management.



<span style="color: red;">●</span> In kind Contributions	59%
<span style="color: #C85A3D;">●</span> Cash from Commonwealth	25%
<span style="color: #6A329F;">●</span> Cash from Participants	16%
<span style="color: #A9A9C8;">●</span> Interest	1%
<span style="color: black;">●</span> Other income	1%

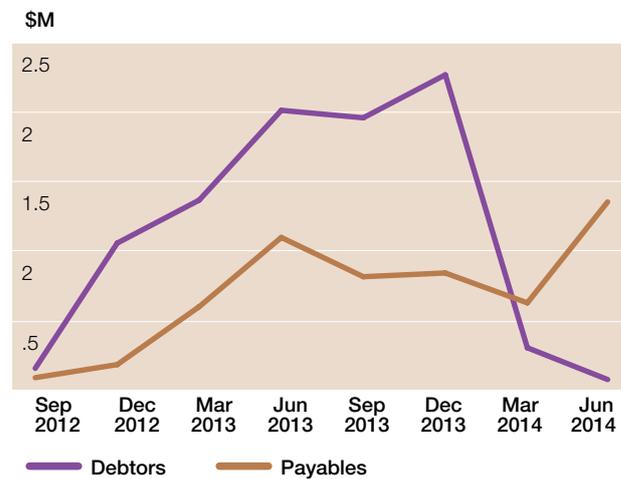
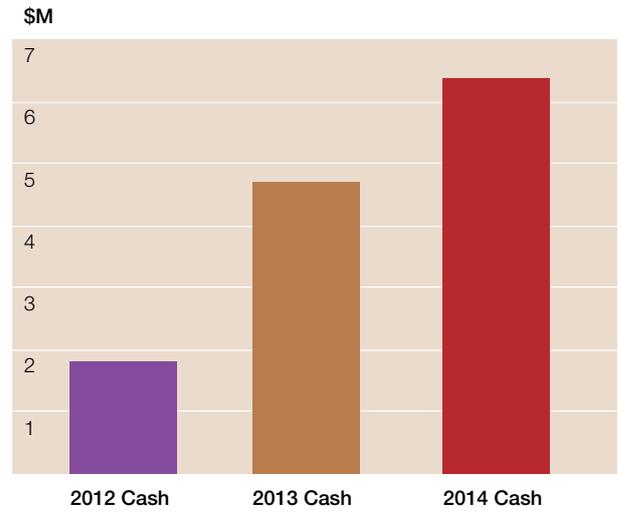


<span style="color: red;">●</span> Land Pests Program	47%
<span style="color: #C85A3D;">●</span> Land Pests (Commercial Products) Program	18%
<span style="color: #6A329F;">●</span> Community Engagement Program	16%
<span style="color: #A9A9C8;">●</span> Inland Water Pests Program	12%
<span style="color: black;">●</span> Network Governance and Management	7%

The positive financial position with combined cash position, at June 2014 of \$6,362,010 represents sufficient cash flow to meet all liabilities of \$5,791,547. The current asset ratio (a measure of liquidity) was 1.18.

The levels of Receivables and Payables reflect the funding and milestone delivery cycles of the Research Agreements. Few receivables were outstanding at June and payables represent milestone reports, with associated invoices, to be approved.

### Cash at Bank and Combined Receivables and payables



Information used in compiling these graphs has been derived from the complete Audited Financial Statements, which are available for download from [www.invasiveanimals.com](http://www.invasiveanimals.com).

A photograph of a pig in a field, with a red overlay at the top of the page. The pig is in the foreground, and there are other animals in the background. The text 'OTHER ACTIVITIES & GRANTS' is overlaid on the image in large white letters.

# OTHER ACTIVITIES & GRANTS

## Other activities

Invasive Animals Limited (IAL) has agreed to undertake one new research services contract, which is outside the Commonwealth Agreement '*The scientific evaluation of hunting in NSW*', funded by the NSW Department of Trade and Investment, Regional Infrastructure and Services (NSW Department of Primary Industries Game Licensing Unit Division).

The objectives of the project are to:

- conduct research to evaluate the efficacy of hunting in NSW;
- study designs established for and risk analysis of, recreational hunting and game bird management; and
- undertake field surveys for hunting and game bird management.

## Grant sources

IAL received one new grant during the reporting period, '*Wild Dog Management*', funded by the Commonwealth Department of Agriculture.

The objectives of the project are:

- National Coordination – National Wild Dog Action Plan to work with key stakeholders to identify priorities for community-based landscape wild dog management activities.
- Provision of specialised skills training – providing land managers with the appropriate skills and competencies for relevant forms of wild dog management.
- Revision and production of existing extension materials.

## APPENDIX A: MILESTONE REPORT

Progress against Commonwealth Agreement Schedule 1 Milestones					
Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
<b>Output R1.1 National incursions response system technologies</b>					
R1.1.1	National incursions response system technologies writing group and Terms of Reference established.	30 June 2013	In Progress	Due to WA Government staff freeze, Project Leader appointed June 2014.	Project Leader appointed and Steering Group in place. Milestone will be achieved by 31 December 2014.
R1.1.2	Incursion risks prioritised.	30 June 2013	Yes	Provision of list of ten Category 1 national surveillance targets presented to Vertebrate Pest Committee (VPC) in May 2014. Waiting VPC endorsement.	
R1.1.3	Cost-sharing agreements and current incursion response strategies reviewed and gaps in documentation defined.	30 June 2013	In Progress	Due to WA Government staff freeze, Project Leader appointed June 2014.	Project Leader in place and milestone will be achieved by 31 December 2014.
R1.1.4	Scoping of requirements for mobile applications and devices, and web-mapping tools completed.	30 June 2013	Yes	End-user needs identified.	
R1.1.6	One pilot incursion response plan for identified priority species produced.	30 June 2014	In Progress	Due to WA Government staff freeze, Project Leader appointed June 2014.	Progress of milestone R1.1.2 and imminent endorsement by VPC provides a list of identified priority species from which to develop pilot incursion plan. Milestone will be achieved by 30 March 2015.
R1.1.7	Incursion response strategy reviewed and nationally endorsed by Vertebrate Pests Committee.	30 June 2014	In Progress	Due to WA Government staff freeze, Project Leader appointed June 2014.	The development of a surveillance and diagnostics implementation plan by the VPC Incursions Working Group in August 2014. Milestone will be achieved by 30 March 2015.
R1.1.8	Incursion response training program developed	30 June 2014	In Progress	Due to WA Government staff freeze, Project Leader appointed June 2014.	Scoping of program well advanced and milestone will be achieved by 30 March 2015.
R1.1.9	One case study on pest movement and detection at low density completed.	30 June 2014	Yes	In collaboration with a management agency, models were developed to detect an invasive vertebrate pest at very low density, enabling the agency to optimise their island eradication efforts.	

### Progress against Commonwealth Agreement Schedule 1 Milestones

Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
<b>Output R1.2 Technologies and strategies for long-term Tasmanian fox incursion response</b>					
R1.2.3	Robotic extraction for trace DNA developed and implemented.	30 June 2013	In Progress	Robot purchased and approach developed. Approach being trialed on scats collected during current survey work and validation has commenced.	Currently testing swab survey results against the usual fox test of scat DNA and through the use of Next Generation Sequencing of targeted scats. Milestone will be achieved by 31 December 2014.
R1.2.5	Study site for detection probability experiment selected.	30 June 2014	Yes	Study site determined with a total of 32 monitoring units selected at random to undertake scat detection trials.	
R1.2.6	Risk assessment completed.	30 June 2014	Yes	Risk assessment completed with manuscript drafted and in review.	
R1.2.7	Long term response strategy development started.	30 June 2014	Yes	The response strategy has been workshoped and a conceptual model is being considered.	
R1.2.8	Next generation sequencing approaches for detection of Tasmanian specific prey from scats developed.	30 June 2014	In Progress	Proof of concept completed. Further refinement in the laboratory has commenced.	This approach needs to be evaluated as it's more broadly applied to scats collected in Tasmania. Initial results suggest that this technology will achieve the milestone by 30 March 2015.
R1.2.9	Detection experiments started.	30 June 2015	Yes	Achieved one year ahead of schedule.	
<b>Output R1.3 RHD Boost: roll-out of new RHDV strains</b>					
R1.3.2	Requirement for a new RHD vaccine for domestic rabbits determined.	30 June 2014	In Progress	Study delayed pending selection and endorsement of preferred new RHDV strain.	Experimental design determined. Milestone will be achieved by 31 December 2014.
R1.3.3	Pre-release monitoring sites identified and collection of baseline data started at selected sites.	30 June 2014	Yes	Pre-release monitoring is being undertaken at intensive sites.	
R1.3.4	Critical experiments needed to develop new RHD model identified.	30 June 2014	Yes	Experiments identified.	
U1.3.1	Pre-release monitoring protocols agreed and adopted by participating government agencies.	30 June 2014	Yes	Protocols agreed and adopted.	
U1.3.2	New RHDV strain release protocols agreed and adopted by participating agencies.	30 June 2014	In Progress	Agencies carefully considering how to achieve a measureable release.	Monitoring and release protocol will be achieved by 31 December 2014.
U1.3.3	Application to APVMA to enable release of new RHD Boost RHDV strain submitted.	30 June 2014	Yes	Application submitted.	

Progress against Commonwealth Agreement Schedule 1 Milestones					
Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
<b>Output R1.4 RHD Accelerator platform technology</b>					
R1.4.1	Six different RHD monoclonal antibodies sourced or developed.	30 June 2013	Yes	Seven monoclonal antibodies available for the subsequent rounds of selection.	
R1.4.2	One rabbit cell line with compromised interferon-response established and tested for ability to support RHDV replication.	30 June 2013	In Progress	Preliminary results suggest that cells lose their receptor for RHDV when in culture.	A different strategy should be pursued first – cloning and expression of the RHCV genome in a plasmid to overcome the receptor problem. Once achieved, the milestone will be on track to be delivered by 30 March 2015.
R1.4.4	Four different cell lines and primary cell cultures assessed for their ability to support RHDV replication.	30 June 2014	Yes	Five different primary cell lines have been assessed and none supported replication of RHDV.	
R1.4.5	Virus passaged in vivo and in vitro (if available) in presence of monoclonal antibodies.	30 June 2014	Yes	Virus was passaged 4 times in rabbits in the presence of monoclonal antibodies. More passages will follow.	
<b>Output R1.5 Strategic wild dog control</b>					
R1.5.1	Stakeholder advisory committee established, At least two PhD students enrolled (covering ecological mesopredator interactions, prey-plant interactions and social/economics).	30 June 2013	Yes	PhD student Helen Morgan appointed, commenced August 2013. PhD student Michal Smielak appointed, commenced May 2014.	
R1.5.4	Data from year 1 collated, and preliminary analyses completed and reviewed by advisory committee.	30 June 2014	Yes	Movement data collated from local government areas and preliminary analyses completed and reviewed by advisory committee. Collared dogs have exhibited a variety of 'typical' and also 'unexpected' movement behaviours.	
R1.5.5	Stage 2 field study (repeat stage 1 field study) undertaken.	30 June 2014	Yes	Field study undertaken. Collation of updated and additional data from local government areas will continue over the next reporting period.	
U1.5.2	Second annual update provided to stakeholders.	30 June 2014	Yes	Achieved May 2014.	
<b>Output R2.1 Avicide</b>					
R2.1.1	Achilles' heel review for potential new starling actives/avicides completed.	30 June 2013	Yes	Achilles heel review of chemicals that might be useful as an avicide for starlings was completed in parallel with the screening of the US database of chemicals.	

**Progress against Commonwealth Agreement Schedule 1 Milestones**

Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
R2.1.2	Proof of concept studies with existing options, including nitrite-enriched water completed.	30 June 2014	Yes	Gavage and free choice studies were completed in April and May 2014.	
U2.1.1	Results of Achilles' heel search and proof-of-concept study published, and presented and promoted to end-users, stakeholders and potential investors.	30 June 2014	In Progress	Result analysis to be finalised.	Results to be considered by funders prior to release. Milestone will be achieved by February 2015.
<b>Output R2.2 Rodenticide</b>					
R2.2.1	Achilles' heel review for potential new rodenticides completed.	30 June 2013	Yes	Achilles' heel review complete.	
R2.2.2	Proof of concept studies completed with existing options, including microencapsulated sodium nitrite.	30 June 2014	In Progress	Research plan completed. Project plan approved.	Studies to be completed June 2015.
U2.2.1	Results of Achilles' heel search and proof-of-concept studies if a promising active exists published, and presented and promoted to end-users, stakeholders and potential investors.	30 June 2014	In Progress	Dependent on study outputs and strategy for protecting any IP that could be commercialised.	Milestone to be achieved by June 2017
<b>Output R2.3 Feral pig management products</b>					
R2.3.1	Non-toxic field trials of feral pig baits in the USA completed.	30 June 2013	In Progress	The development of a complete HOGGONE® bait formulation that is stable and effective has proven challenging. Solid versus paste baits have recently been tested.	Non-toxic field trials have been completed. Non-target issues with bait take. Semi-solid paste product in new delivery device being trialed in USA and Australia. Milestone to be achieved by 31 December 2014.
U2.3.1	HOGGONE® and a nitrite concentrate registration package submitted to APVMA in Australia.	30 June 2013	In Progress	The development of a complete HOGGONE® bait formulation that is stable and effective has proven challenging. Solid versus paste baits have recently been tested.	Nitrite concentrate product prototypes not performing satisfactorily. A registration package will be prepared based on development of a successful prototype product. Testing of prototype continues. Milestone to be achieved by 30 June 2015.
R2.3.2	Initial data submission to US EPA to obtain an Experimental Use Permit completed (minimum one year approval process).	30 June 2014	In Progress	The US EPA submission is dependent on the results of pen studies.	Milestone expected to be achieved by June 2015.
U2.3.2	Initial feral pig bait (HOG-GONE® or similar) registration package submitted 30 June 2014 to US EPA to obtain an Experimental Use field trial permit.	30 June 2014	In Progress	The US EPA registration submission is dependent on the results of pen studies and securing an Experimental Use field trial permit.	Milestone expected to be achieved by June 2015.

Progress against Commonwealth Agreement Schedule 1 Milestones					
Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
<b>Output R2.4 Fertility control</b>					
U2.4.1	GonaCon™ registration package prepared and submitted to APVMA.	30 June 2013	In Progress	The GonaCon™ registration packages approved by the Environmental Protection Agency USA are now available to the project. Under the Australian regulatory system, this product will need to be assessed as an animal drug by the APVMA. Internal negotiations will be required between the Agchem and Vet drug divisions before this can be progressed.	Milestone will be achieved by June 2015.
<b>Output R3.1 Genetic tools for detection of pest fish at low densities</b>					
R3.1.2	Field testing of efficacy of eDNA detection method completed.	30 June 2013	Yes	Field testing at Eureka Creek has been completed. No evidence of tilapia eDNA was detected.	
R3.1.5	Field use protocols and laboratory manuals developed.	30 June 2014	Yes	The MEEL eDNA protocols and laboratory manual has been developed and undergoing final approval.	
R3.1.6	Development of molecular markers for required species completed.	30 June 2014	Yes	Species specific molecular markers have been developed.	
R3.1.7	Evaluation of two methods of eDNA detection started.	30 June 2014	Yes	Methods have been trialed for two species.	
<b>Output R3.2 Koi Herpes Virus (KHV) evaluation and rollout</b>					
R3.2.3	KHV susceptibility trials completed.	30 June 2014	In Progress	The absence of carp (as positive controls for the virus) has delayed milestone achievement.	The milestone will be achieved by 31 December 2014.
U3.2.1	Preparation of KHV registration package started.	30 June 2014	Yes	Data requirements for each of the three applications has been collated and data compilation begun.	
<b>Output R4.1 Facilitate collective action</b>					
R4.1.1	IA CRC internal report identifying community partner groups' support needs and support plans, based on needs assessment, completed.	30 June 2013	Yes	Implementation plan for the toolkit now being rolled out.	
R4.1.2	Community engagement research hypotheses and methodologies for action research documented.	30 June 2013	Yes	Scoping report completed.	
R4.1.4	IA CRC internal report scoping the online and other support mechanisms that may be effective in supporting engagement, and associated evaluation protocols, based on stakeholder consultation, completed.	30 June 2014	Yes	Workshops with key partners across Australia have been held, and the scoping reports have completed for community engagement for invasive animals management in Australia. Consultation with stakeholders will be an ongoing process.	

**Progress against Commonwealth Agreement Schedule 1 Milestones**

Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
R4.1.5	Agreed components of a web-supported engagement program for community stakeholders in invasive animal control deployed.	30 June 2014	Yes	Online communities of practice around community engagement have been established.	
<b>Output R4.2 Triggers for effective action</b>					
R4.2.1	Literature review and initial theories documented as a technical paper or publication.	30 June 2013	Yes	"Behaviourally Effective Communications for Invasive Animals Management: A Practical Guide" completed.	
R4.2.3	Internal IA CRC report of options for improving behavioural effectiveness of invasive animal management communications completed.	30 June 2014	Yes	Audits have been completed. Final reports in review.	
<b>Output R4.3 Reduction of legal and institutional impediments.</b>					
R4.3.1	Working paper or technical report on the legal and institutional arrangements for invasive animal control completed.	30 June 2013	Yes	Working paper completed and circulated to government stakeholders. Feedback has been incorporated into the technical report.	
R4.3.2	One PhD student enrolled.	30 June 2013	In Progress	No suitable candidates for institutional research have been identified to date.	Promote the opportunity again in late 2014. Expect to deliver by 31 December 2014.
R4.3.3	One peer reviewed journal paper submitted and/or technical report on institutional pathways and invasive animal control published.	30 June 2014	Yes	Report published: 'Improving Invasive Animal Institutions: A Citizen focused Approach'.	
R4.3.4	Technical report on how relevant stakeholders perceive and respond to invasive animal control institutional arrangements published.	30 June 2014	In Progress	Problem solving/Scenario Workshops with community scheduled for later 2014.	Report will be finalised by 30 March 2015.
<b>Output R4.4 Balanced Researcher program</b>					
R4.4.3	At least 10 PhD students and at least five post-doctoral fellows selected and started on basis of suitability to individual projects.	30 June 2014	Yes	Achieved one year ahead of schedule – 30 June 2013.	
R4.4.4	Balanced Researcher program started.	30 June 2014	Yes	Achieved one year ahead of schedule – 30 June 2013.	
U4.4.1	At least 10 PhD students started training program through Balanced Researcher program.	30 June 2014	Yes	The Balanced Researcher Program commenced in 2013 and currently there are 12 PhD students enrolled in the program.	
<b>Output R4.5 Vocational Education and Training (VET)</b>					
U4.5.1	Partnerships established with Vertebrate Pests Committee (VPC) agencies, Natural Resource Management Boards, NSW Department of Primary Industries and TOCAL Agricultural College to enable development of training packages.	30 June 2013	Yes	There has been wide consultation with the agencies through AgriFood Skills Australia's revision of the AHC10 training package.	

Progress against Commonwealth Agreement Schedule 1 Milestones					
Output/ Milestone Number	Description	Contracted Achieved date	Achieved	Reason/Details	Strategies to achieve unmet milestone
U4.5.2	Complementary market analyses of training needs and likely utilisation undertaken in NSW Department of Primary Industries in conjunction with TOCAL College, and other state pest management agencies.	30 June 2013	In Progress	An analysis of the market has been undertaken and a survey on training needs and response to the new qualifications is underway.	The report and milestone will be achieved by 31 December 2014.
R4.5.2	Development of appropriate courses, skill sets and training packages started.	30 June 2014	Yes	Working closely with NSW DPI and Tocal College to develop training material to support delivery of the revised training package.	
R4.5.3	Training of trainers at higher education level to deliver courses started.	30 June 2014	Yes	Finalisation of arrangement continue with Riverina Institute (TAFE NSW), who will deliver the course from October 2014.	
<b>Other Milestones</b>					
O1.3	Operational performance of rabbit warren fumigator determined under field simulated conditions.	30 June 2013	In Progress	The engineering of a working prototype is complete. CO emissions consistently meet or exceed an operating specification of approx. 5%. Other exhaust emissions that might adversely affect animal welfare outcomes are below acceptable standards. Delivery of prototypes for field testing is contingent on legal negotiations over project IP ownership and commercial arrangements for market delivery.	Field testing of prototype units will be completed within 45 days of receiving them from the manufacturer.
O1.4	National APVMA registration package for rabbit warren fumigator submitted.	30 June 2013	In Progress	Delivery of prototypes for field testing is contingent on legal negotiations over project IP ownership and commercial arrangements for market delivery.  Whilst these are being finalised a comprehensive submission has been made to the APVMA for the waiving of significant data packages given the units will run on BBQ/LNG for which an Australian Standard exists.	Animal Ethics approval extended. Complete within 90 days of finishing field trials.
T.1.3	Transition plan revised and submitted to Commonwealth.	30 June 2014	Yes	Transition plan submitted.	

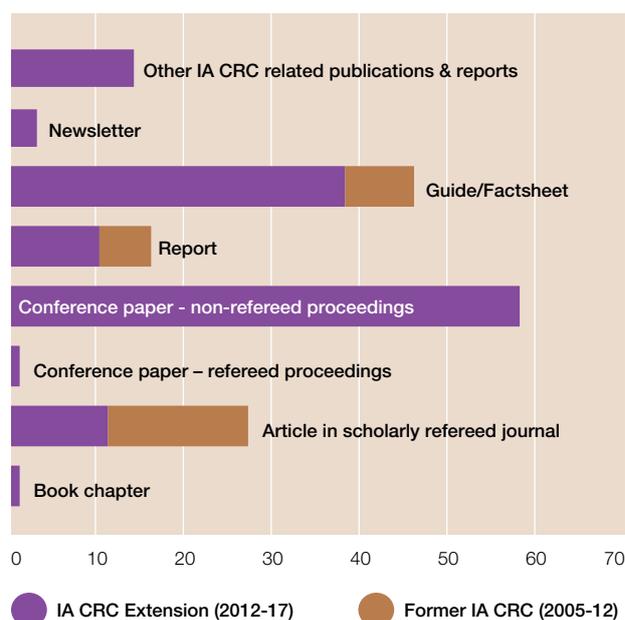
## APPENDIX B: PUBLICATIONS

### 1.0 Formal publications

- 1.1 Book
- 1.2 Book chapter
- 1.3 Article in scholarly refereed journal
- 1.4 Conference paper – refereed proceedings

### 2.0 Publications and reports for end-users

- 2.1 Conference paper – non-refereed proceedings
- 2.2 Report
- 2.3 Guide/Factsheet
- 2.4 Multimedia product (computer programs, videos, DVDs, web portals, blogs, websites)
- 2.5 Newsletter
- 2.6 Other IA CRC related publications & reports



Invasive Animals CRC Publications 2013-14

### Invasive Animals CRC extension publications 2013-14

Date Published	Title	Publisher/Title	Authors	Project
<b>OUTCOME 1: NO NEW VERTEBRATE PESTS ESTABLISHED IN AUSTRALIA</b>				
<b>1.2 Book chapter</b>				
2014	The Biogeography of Avian Invasions: history, accident and market trade	Biological Invasions in Aquatic and Terrestrial Systems: Biogeography, Ecological Impacts, Predictions and Management, (ed) Canning-Code, J. Versita, Poland.	Cassey P, Vall-Llosera Camps M, Dyer E & Blackburn T.M.	1.L.4
<b>1.3 Article in scholarly-refereed journal</b>				
Feb 2014	Patterns of transport and introduction of exotic amphibians in Australia.	Diversity and Distributions, 20, 455-466	García Díaz P & Cassey P.	1.L.4
April 2014	Patterns of non-randomness in the composition and characteristics of the Taiwanese bird trade	Biological Invasions, doi: 10.1007/s10530-014-0686-1.	Su S, Cassey P. & Blackburn T.M.	1.L.4
May 2014	A population model for predicting the successful establishment of introduced bird species.	Oecologia, 175 (1) pp 417-428	Cassey P, Prowse T.A.A. & Blackburn T.M.	1.L.4
<b>2.1 Conference paper – non-refereed proceedings</b>				
July 2013	Species from faeces: metabarcoding to detect vertebrate prey from predator scats	Genetics Society of Australasia, Sydney.	MacDonald A, Gleeson G, Bunce M & Sarre S.	1.L.21
July 2013	Are Macropodoidea in Tasmania genetically distinct from their mainland counterparts?	Genetics Society of Australasia, Sydney.	Campbell C, MacDonald AJ, Gruber B, Harris S & Sarre S.D.	1.L.21
July 2013	Poster presentation: eDNA Detection Parameters	Genetics Society of Australasia, Sydney.	Furlan & Gleeson	1.W.2
August 2013	Poster presentation: eDNA Detection Parameters	Conference of NZ Freshwater Science Society, NZ Marine Science Society, Australian Society for Fish Biology, University of Waikato.	Furlan, Duncan & Gleeson	1.W.2
January 2014	Species from faeces: metabarcoding to detect vertebrate prey from predator scats.	Biodiversity Genomics Conference, Canberra.	MacDonald AJ, Gleeson D, Bunce M & Sarre SD.	1.L.21

Date Published	Title	Publisher/Title	Authors	Project
May 2014	The social implications of a Predator-Free New Zealand	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Byrom AE, Greenaway A, Holland P, Majchrzak A, Niemiec R, Warburton B & West P.	1.L.5
May 2014	Mobile device apps and real-time web-mapping of pest animals in Australia	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	West P, Crawford R & O'Reilly R.	1.L.5
May 2014	A long-term assessment of methods to reduce bird damage to fruit	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Tracey J, West P, Lukins B & Saunders G.	1.L.5
May 2014	Understanding population level interactions between spatial distributions of management and pig populations in the Wet Tropics	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Fletcher CS, Dryden B & Westcott DA.	1.L.11
May 2014	The final needles in the haystack – moving to Stage 3 of the Tasmanian Fox Eradication Program.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Elliott C & Harris S.	1.L.24
May 2014	Environmental DNA for low-density species detection	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Furlan, Hardy, Duncan & Gleeson	1.W.2
<b>2.2 Report</b>				
Feb 2014	Eradications of vertebrate pests in Australia	Invasive Animals CRC	Gregory S.D, Henderson W, Smee E & Cassey P.	1.L.4
<b>2.3 Guide/factsheet</b>				
Aug 2013	Ground shooting of camels (Standard Operating Procedure – SOP)	Invasive Animals CRC	Sharp, T.	
Aug 2013	Mustering of feral camels (SOP)	Invasive Animals CRC	Sharp, T.	
Aug 2013	Ground shooting of hares (SOP)	Invasive Animals CRC	Sharp, T.	
Aug 2013	Ground shooting of feral horses (SOP)	Invasive Animals CRC	Sharp, T.	
Aug 2013	Mustering of feral horses (SOP)	Invasive Animals CRC	Sharp, T.	
Aug 2013	Trapping of feral horses (SOP)	Invasive Animals CRC	Sharp, T.	
<b>2.5 Newsletter</b>				
2013	FeralScan newsletter	Invasive Animals CRC	West, P.	1.L.5
<b>2.6 Other IA CRC related publications &amp; reports</b>				
June 2013	Priority threat management of invasive plant species in the Lake Eyre Basin (project report)	CSIRO	Firn J, Martin T, Walters B, Hayes J, Nicol S, Chades I & Carwardine J.	1.L.11
June 2014	How can science guide best practice pest management? (pest research newsletter)	Landcare Research NZ	Anderson D, Byrom AE, Baxter P, Cassey P, Ramsey D, & Woolnough A.	1.L.2
<b>OUTCOME 2: PREDICTION AND CONTROL OF EMERGING OUTBREAKS</b>				
<b>1.3 Article in scholarly-refereed journal</b>				
May 2014	Parenteral administration of GnRH conjugates and adjuvants: immune responses and effects on reproductive tissues of male mice	Vaccine (Journal)	Sharma S, McDonald I, Miller L & Hinds LA.	2.C.12
<b>2.1 Conference paper – non-refereed proceedings</b>				
Sep 2013	Proceedings of the National Feral Cat Management Workshop	Invasive Animals CRC	Lane C, Bengsen A. & Murphy E. (Eds)	
Nov 2013	Evaluation of Amorphous Silica Nanoparticles for Mucosal Delivery of Vaccines (poster presentation)	American Association of Pharmaceutical Scientists Conference, Austin, Texas, USA.	Sharma S, McDonald I, Knight S, Barbe C, Finnie K, Khatri A, Somerville J & Hinds LA.	2.C.12
March 2014	Long term effects of GonaCon™ vaccination in two Australian macropodid marsupials	26 <sup>th</sup> US Vertebrate Pest Conference, Hawaii, USA.	Hinds LA, Snape M, Davey C, Henry S, Fletcher D, Wimpenny C & Miller L.	2.C.12
March 2014	Optimisation of formulations for the lethal control of feral pigs	26 <sup>th</sup> American Vertebrate Pest Conference, Hawaii, USA.	Foster, J.	2.C.4

Date Published	Title	Publisher/Title	Authors	Project
April 2014	Optimisation of formulations for the lethal control of feral pigs	International Wild Pig Conference, Montgomery, USA.	Foster, J	2.C.4
May 2014	Development of a toxicant for the lethal control of feral pigs	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	VerCauteren, K.	2.C.4

## 2.2 Report

Aug 2013	Aerial shooting of camels (SOP)	Invasive Animals CRC	Sharp T.	
Aug 2013	Trapping using soft net traps (SOP)	Invasive Animals CRC	Sharp T & McLeod L.	
Aug 2013	Feral deer eradication on Kangaroo Island (Case Study)	Invasive Animals CRC	Invasive Animals CRC	

## 2.3 Guide/Fact Sheet

Nov 2013	By-laws for management of cats ( <i>Felis catus</i> ) on Kangaroo Island, South Australia (Case Study)	Invasive Animals CRC	Invasive Animals CRC	
Nov 2013	Feral cat spray tunnel trials on Kangaroo Island (Case Study)	Invasive Animals CRC	Invasive Animals CRC	
Feb 2014	Aerial and ground shooting for feral pig control (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
Feb 2014	Feral pig HOGGONE baiting trials in Goondiwindi Queensland (Case Study)	Invasive Animals CRC	Invasive Animal CRC	
Feb 2014	Poison baiting for feral pig control in Australia (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
Feb 2014	Rapid response to pest fish incursions (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
Feb 2014	Trapping for feral pig control in Australia (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
March 2014	Common (Indian) Myna ( <i>Acridotheres tristis</i> or <i>Sturnus tristis</i> ) (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
March 2014	Distribution of the black mangrove cichlid ( <i>Tilapia mariae</i> ) in Australia (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	
April 2014	Tilapia control methods and their effectiveness (Fact Sheet)	Invasive Animals CRC	Invasive Animal CRC	

## OUTCOME 3: RECOVERY OF KEY LAND AND WATER REGIONS AFTER HUMANE CONTROL OF RABBITS, WILD DOGS AND CARP

### Rabbits

#### 1.3 Article in scholarly-refereed journal

Feb 2014	Molecular epidemiology of Rabbit Haemorrhagic Disease Virus in Australia: when one became many	Molecular Ecology. Volume 23 Issue: 2 Pages: 408-420 DOI: 10.1111/mec.12596	Kovaliski J, Sinclair R, Mutze G, Peacock D, Strive T, Abrantes J, Esteves P.J. & Holmes E.C.	3.L.2
March 2014	Is increased juvenile infection the key to recovery of wild rabbit populations from the impact of rabbit haemorrhagic disease?	European Journal of Wildlife Research 60, 489-499. DOI 10.1007/s10344-014-0811-6	Mutze G, Sinclair RG, Peacock DE, Capucci L & Kovaliski J.	3.L.2

#### 2.1 Conference paper – non-refereed proceedings

Aug 2013	Rabbit Haemorrhagic Disease and Myxomatosis in an Ongoing 17 Year Study of an Australian Rabbit Population	6 <sup>th</sup> Workshop on Regional Surveillance & Research for Wildlife-Borne Diseases, Fort Collins, Colorado, USA.	Sinclair R, Peacock D, Kovaliski J, Mutze G, Chiari M & Capucci L.	3.L.5
Sep 2013	Current Situation with Rabbit Disease in Australia	Wildlife Disease Association, Australasian Section 2013 Conference & Biodiversity/Disease Ecology Workshop	Peacock D, Sinclair R, Kovaliski J, Mutze G, Chiari M & Capucci L.	3.L.5
Nov 2013	Evolution and Phylo-geography of a non-pathogenic calicivirus in wild rabbits in Australia	Australasian Wildlife Management Conference, New Zealand.	T. Strive	3.L.4

Date Published	Title	Publisher/Title	Authors	Project
Dec 2013	Identifying molecular virulence factors of Rabbit haemorrhagic disease virus by comparing proteins of pathogenic and non-pathogenic rabbit caliciviruses (poster presentation)	Australasian Virological Society Conference, New Zealand.	Urakova N, Matthaei M, Frese M & Strive T.	3.L.4
Dec 2013	The RHD-Boost project: An update on the hunt for improved rabbit biocontrol	Australasian Wildlife Management Conference, New Zealand.	Cox T, Cooke B, Kirkland P, Read A, Saunders G & Strive T	3.L.1
Dec 2013	Evidence of increased virulence in Rabbit Haemorrhagic Disease Virus associated with genetic resistance in rabbits	Australasian Virological Society Conference, New Zealand.	Elsworth P, Cooke BD, Kovaliski R, Sinclair R & Strive T.	3.L.4
May 2014	The current status of antibodies to pathogenic and benign caliciviruses in selected rabbit populations	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Cox T, Liu J & Strive T	3.L.1
May 2014	Identifying molecular virulence factors of Rabbit haemorrhagic disease virus.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Urakova N, Matthaei M, Frese M & Strive T.	3.L.4
May 2014	RHD-Accelerator	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Matthaei M, Kerr PJ, Capucci L & Strive, T.	3.L.4
May 2014	Biological Control of Vertebrate Pests in Australia (Keynote presentation)	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Strive T.	3.L.4
July 2013	Can New and Translocated Species of Eimeria Assist in the Management of Australia's Pest European Rabbit ( <i>Oryctolagus cuniculus</i> ) Population?	62 <sup>nd</sup> Wildlife Disease Association Conference & 2013 USA Wildlife Veterinarian Meeting, Knoxville, USA.	Peacock D & Chiari M.	3.L.5
July 2013	Seeking additional biological control agents to augment rabbit haemorrhagic disease virus (RHDV) and myxomatosis: Managing Australia's recovering <i>Oryctolagus cuniculus</i> pest population (poster presentation)	62 <sup>nd</sup> Wildlife Disease Association Conference & 2013 USA Wildlife Veterinarian Meeting, Knoxville, USA.	Peacock D & Mutze G.	3.L.5
<b>2.2 Report</b>				
March 2014	Benefits of Rabbit Biocontrol in Australia	Invasive Animals CRC	Cox T, Strive T, Mutze G, West P & Saunders G.	3.L.4
March 2014	The role of rabbit and other invasive herbivore control in reducing Australia's greenhouse gas emissions	Invasive Animals CRC	Bengsen A & Cox T.	3.L.1
<b>2.3 Guide/Fact Sheet</b>				
2013	Inoculation of rabbits with rabbit haemorrhagic disease virus (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Ground baiting rabbits with 1080 (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Aerial baiting of rabbits with 1080 (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Ground baiting of rabbits with pindone (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Diffusion fumigation of rabbit warrens (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Rabbit warren destruction by ripping (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Rabbit warren destruction using explosives (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Trapping of rabbits using padded-jaw traps (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Ground shooting of rabbits (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Bait delivery of Rabbit Haemorrhagic Disease Virus (SOP)	Invasive Animals CRC	Sharp, T.	
<b>2.6 Other IA CRC related publications and reports</b>				
May 2014	The European rabbit ( <i>Oryctolagus cuniculus</i> ) – A model species for exploring the genetics of de-domestication?	COST action 'Rabbit Genome Biology Network (RGB-Net)', Zagreb, 6 May 2014.	Thulin CG, Alves PC, Andersson L, Carneiro M, Djan M, Fontanesi L & Peacock D.	3.L.5

Date Published	Title	Publisher/Title	Authors	Project
2014	Feral Rabbits in Australia	COST action "Rabbit Genome Biology Network (RGB-Net)", Zagreb, May 6, 2014	Peacock D.	3.L.5
June 2014	A review of rabbit impacts on Australian biodiversity		Glen A.	3.L.6
<b>Wild Dog</b>				
<b>1.3 Article in scholarly-refereed journal</b>				
July 2013	The influence of dingoes on sheep distribution in Australia	Australian Veterinary Journal	Allen B & West P.	1.L.5
2013	Cautionary considerations for positive dingo management: a response to the Johnson and Ritchie critique of Fleming et al. (2012).	Australian Mammalogy 35, pp 15-22. <a href="http://dx.doi.org/10.1071/AM12036">http://dx.doi.org/10.1071/AM12036</a>	Fleming P, Allen B & Ballard G.	3.L.11
Feb 2014	The short-term effects of a routine poisoning campaign on the movements and detectability of a social top-predator	Environmental Science and Pollution Research, 21:2178-2190 DOI 10.1007/s11356-013-2118-7	Allen B, Engeman R & Leung L.	3.L.13
<b>2.1 Conference paper – non-refereed proceedings</b>				
July 2013	Use of a restraining board for safe and humane processing of wild dogs, red foxes and feral cats without sedation	Proceedings of the Australian Institute of Animal Management Annual Conference.	Ballard G, Fleming P, Doak S & Meek P.	3.L.11
July 2013	When wild dogs come to town: management in peri-urban areas where dogs, policy and people meet	Proceedings of the Australian Institute of Animal Management Annual Conference.	Fleming P, Ballard G, Meek P.D, Allen B, Gentle M & Mifsud G.	3.L.11
July 2013	Everybody needs good neighbours: how do dingoes, foxes, cats and quolls interact in North East NSW?	Conference handbook of the 59th scientific meeting of the Australian Mammal Society, University of NSW, Sydney.	Ballard G, Fleming P, Meek P, Doak S, Koertner G, Nolan H, Sparkes J, Zewe F, Forge T, Vernes K & Reid N.	3.L.11
July 2013	Ecology of the spotted-tailed quoll ( <i>Dasyurus maculatus</i> ) in North East NSW.	Conference handbook of the 59th scientific meeting of the Australian Mammal Society, University of NSW, Sydney.	Forge T, Koertne, G, Zewe F, Ballard G, Fleming P & Vernes K.	3.L.11
July 2013	Dietary overlap of free-roaming domestic dogs and dingoes: humans and their role as trophic regulators.	Conference handbook of the 59th scientific meeting of the Australian Mammal Society, University of NSW, Sydney.	Newsome T, Ballard G, Crowther M, Dickman C & Fleming P.	3.L.11
July 2013	Letting the cat out of the bag: feral cat ecology in mesic environments	Conference handbook of the 59th scientific meeting of the Australian Mammal Society, University of NSW, Sydney.	Zewe F, Ballard G, Koertner G, Forge T, Fleming P & Vernes K.	3.L.11
Nov 2013	Developing monitoring methods for a challenging species, the spotted-tailed quoll.	26th Australasian Wildlife Management Society Conference, New Zealand.	Forge T, Ballard G, Koertner G, Fleming P. & Vernes K.	3.L.11
May 2014	Wild dog aware: understanding the influence of media and public perception.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	York B, Fleming P & Hine D.	3.L.11
May 2014	The traps of camera traps	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Meek P, Ballard G, Fleming P, Vernes K & Falzon G.	3.L.11
May 2014	Managing wild canids in mesic environments: predators, prey, plants and people.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Fleming P, Ballard G, Morgan H & Reid N.	3.L.11
May 2014	Population activity responses of feral cats to wild canid control in north eastern New south Wales.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Zewe F, Ballard G, Koertner G, Forge T, Vernes T & Fleming P.	3.L.11
May 2014	Which aerial baiting rate is better for wild dog control.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Ballard G, Fleming P, Doak S & Meek P.	3.L.11
May 2014	M-44 ejector activation by red foxes ( <i>Vulpes vulpes</i> ) in agri-ecosystems.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Osbourne E, Ballard G, Vernes K & Fleming P.	3.L.11
May 2014	Canine rabies will alter how we manage wild dogs in Australia.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Sparkes J, Ballard G, Fleming P & Brown W.	3.L.11

Date Published	Title	Publisher/Title	Authors	Project
May 2014	Distress vocalisations in wild dogs.	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane.	Nolan H., Brown W, Ballard G, McDonald P & Laegel T.	3.L.11
May 2014	Signalling Systems in Australian Wild Dogs: Who's Calling and Who Cares?	4 <sup>th</sup> International Canine Science Forum, Lincoln, UK.	Nolan H, Brown W, Ballard G, McDonald P & Laegel T.	3.L.11
May 2014	The impacts and management of peri-urban wild dogs	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Gentle M, Allen B, Speed J & Allen L.	3.L.13
May 2014	How to collect, store and query pest animal data: A tutorial for practitioners	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Allen B.	3.L.13
May 2014	Disease prevalence and public health risks of peri-urban wild dogs	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Harriott L, Gentle M, Traub R, Soares-Magalhaes R & Cobbold R.	3.L.13
May 2014	Improving vertebrate pest management in peri-urban areas through technological and methodological advances	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Alle, B & Gentle M.	3.L.13

### 2.3 Guide/Fact Sheet

2013	Trapping of wild dogs using padded-jaw traps (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Trapping of wild dogs using cage traps (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Ground shooting of wild dogs (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Ground baiting of wild dogs with 1080 (SOP)	Invasive Animals CRC	Sharp, T.	
2013	Aerial baiting of wild dogs with 1080 (SOP)	Invasive Animals CRC	Sharp, T.	
Feb 2014	Wild dogs & transmission of Neospora caninum in Australia (Case Study)	Invasive Animals CRC	Invasive Animals CRC	

### European Carp

#### 1.3 Article in scholarly-refereed journal

March 2014	Viral biocontrol of invasive vertebrates: lessons from the past applied to cyprinid herpesvirus-3 and carp ( <i>Cyprinus carpio</i> ) control in Australia	Biological Control 72:109-117 <a href="http://dx.doi.org/10.1016/j.biocontrol.2014.02.014">http://dx.doi.org/10.1016/j.biocontrol.2014.02.014</a>	McCull K, Cooke B & Sunarto A	3.W.1
April 2014	Characteristics of cyprinid herpesvirus 3 in different phases of infection: implications for disease transmission and control	Virus Research 188:45-53. <a href="http://dx.doi.org/10.1016/j.virusres.2014.03.024">http://dx.doi.org/10.1016/j.virusres.2014.03.024</a>	Sunarto A, McCull K, Crane M, Schat K, Slobedman B, Barnes A & Walker P.	3.W.1

#### 2.2 Report

2013	Carp survey of the Logan & Albert rivers	Invasive Animals CRC	Norris A, Chilcott K, Hutchison M & Stewart D.	
July 2013	Social drivers behind participation in pest fish-out competitions	Invasive Animals CRC	Norris A & Ballard G.	
April 2014	Pathways to adoption of Cyprinid herpesvirus 3 as a biological control agent for carp in Australia	Invasive Animals CRC	Fulton W.	

### OUTCOME 4: NEW SOCIAL NETWORKS AND INSTITUTIONAL 'ARCHITECTURE' ENHANCED AROUND PEST ANIMAL CONTROL

#### 1.4 Conference paper – refereed proceedings

May 2014	Entrenching scientific continuous improvement in the human issues of invasives management (Keynote presentation)	Weed Society of Victoria Annual Conference, Geelong Victoria.	Martin, P.	4.E.3
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#### 2.1 Conference paper – non-refereed proceedings

May 2014	New settlers on the fringe: Demystifying peri-urban myths (Keynote presentation)	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Low Choy D.	4.E.3
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Date Published	Title	Publisher/Title	Authors	Project
May 2014	The human dimensions of invasive vertebrate pest control: innovating for effective community-wide action	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Fortunato M, Smith-Herron A, Beach, Chapman B, Ellis C, Prelog A, Theodori G, Martin P, Alter T.	4.E.3
May 2014	Application of a systems mapping tool to support community led action on rabbit management	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Adams, L., Martin, P. and Woolnough, A	4.E.6
May 2014	Community engagement for effective and sustainable vertebrate pest management	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Shuffstall W, Whitmer W, Adams L & Thompson L.	4.E.6
May 2014	Updated national training qualifications for vertebrate pest managers in Australia	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Brown A. & Braysher M.	4.E.11
May 2014	More than factsheets – Effective community engagement is needed to achieve eradication outcomes	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Elliott C, Braysher M & Marrison M.	4.E.11
May 2014	Increasing the capacity of regional groups to manage vertebrate pest impacts (poster presentation)	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Marsh, J & Brown, A	4.E.12
May 2014	The Balanced Scientist Program: Enhanced PhD candidate training	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Buckmaster, T. Sarre, S.	4.E.21
May 2014	Reducing institutional impediments to community-based invasives control	16 <sup>th</sup> Australasian Vertebrate Pest Conference, Brisbane	Martin P, Low Choy, D. & Le Gal, E.	4.E.3
<b>2.2 Report</b>				
May 2014	Improving Invasive Animal Institutions: A citizen focused approach.	Invasive Animals CRC	Martin, P., Le Gal, B., Low Choy, D., Marshall, G. and Dickson, K	4.E.3
June 2014	The Balanced Scientist Program Review Report (Internal Report)	Invasive Animals CRC	Blackman D, Buckmaster T & Sarre S.	4.E.21
<b>2.3 Guide/Fact Sheet</b>				
July 2013	Understanding the capacity of NRMs to manage invasive animal impacts: 2013 National NRM Survey	Invasive Animals CRC	Marsh J & Brown A.	4.E.12
May 2014	Principles of pest animal management (Fact Sheet)	Invasive Animals CRC	Brown A.	4.E.11
May 2014	Planning a strategic approach to pest animal management (Fact Sheet)	Invasive Animals CRC	Brown A.	4.E.11
May 2014	Monitoring and evaluation of pest management programs (Fact Sheet)	Invasive Animals CRC	Brown A.	4.E.11
May 2014	Legislation and management of pest animals (Fact Sheet)	Invasive Animals CRC	Brown A.	4.E.11
May 2014	Rabbit eradication on Australia's offshore islands (Case Study)	Invasive Animals CRC	Brown A.	4.E.11
<b>2.5 Newsletter</b>				
2013-14	NRM Notes (Newsletter – 4 Issues)	Invasive Animals CRC	Marsh J.	4.E.12
2013-14	Feral Flyer ( Newsletter – 13 Issues)	Invasive Animals CRC	Invasive Animals CRC	
<b>2.6 Other IA CRC related publications and reports</b>				
Dec 2013	Rabbit Management System Workshop Briefing Paper: Record of key informant interviews that document the rabbit management system in Victoria	Briefing paper produced for rabbit management stakeholders in Victoria	Adams L.	4.E.6
Jan 2014	Rabbit Management System Workshop Discussion Record	Discussion record produced for rabbit management stakeholders in Victoria	Adams L.	4.E.6

Date Published	Title	Publisher/Title	Authors	Project
Feb 2014	Briefing paper: Strategy to support community led action for more sustainable and effective rabbit management in Victoria. Preliminary ideas on strategy principles and options.	Briefing paper produced for rabbit management stakeholders in Victoria	Adams L.	4.E.6
March 2014	Leadership in Community Engagement Panel Discussion, Melbourne & transcript of a debrief interview with Professor Ted Alter	Transcript produced as an extension and learning tool for invasive species management practitioners	Adams L.	4.E.6
March 2014	Leadership in Community Engagement Panel Discussion, Melbourne: Discussion record	Extension and learning tool produced for invasive species management practitioners	Adams L.	4.E.6
April 2014	Briefing paper: Results of an online survey to review strategy options to support community led action for more sustainable and effective rabbit management in Victoria	Briefing paper produced for rabbit management stakeholders in Victoria	Tamara Van Polanen, T. and Adams, L.	4.E.6
June 2014	Development of an online toolbox to support community engagement in invasive species management: Record of workshops held in Victoria	Workshop record produced for invasive species management practitioners in Victoria and to be used to develop a national on-line toolbox for community engagement by invasive species management practitioners	Adams L.	4.E.6
July 2014	Development of a strategy to support community led action for more sustainable and effective rabbit management in Victoria: Progress report and next steps	Progress report produced for rabbit management stakeholders in Victoria and CRC stakeholders	Adams L.	4.E.6
Dec 2013	Feral Photos Calendar	Invasive Animals CRC	Marsh J & Brown A.	4.E.12

#### Previous Invasive Animals CRC (2005-2012) publications 2013-14

Date Published	Title	Publisher/Title	Authors	Project
<b>OUTCOME 1: A BENEFIT OF \$29 MILLION P.A. BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%</b>				
<b>1.3 Article in scholarly-refereed</b>				
2013	Home range, activity and sociality of a top predator, the dingo: a test of the Resource Dispersion Hypothesis.	Ecography 36, 914-925	Newsome T, Ballard, G, Dickman C, Fleming P & van de Ven R.	10.T.5
Dec 2013	A vertical bait station for black rats ( <i>Rattus rattus</i> ) that reduces bait take by a sympatric native rodent	Australian Mammalogy, 36, 67-73 <a href="http://dx.doi.org/10.1071/AM13010">http://dx.doi.org/10.1071/AM13010</a>	Zewe F, Meek P, Ford H & Vernes K.	
2014	Dietary niche overlap of free-roaming dingoes and domestic dogs: the role of human-provided food.	Journal of Mammalogy 95, 392-403. <a href="http://dx.doi.org/10.1644/13-MAMM-A-145.1">http://dx.doi.org/10.1644/13-MAMM-A-145.1</a>	Newsome T, Ballard G, Crowther M, Fleming P & Dickman, C.	10.T.5
2014	Human-resource subsidies alter the dietary preferences of a mammalian top predator.	Oecologia 175, 139-150.	Newsome T, Ballard G, Fleming P, van de Ven R, Story G & Dickman C.	10.T.5
Jan 2014	Slow recruitment in a red-fox population following poison baiting: a non-invasive mark-recapture analysis	Wildlife Research, 40, 615-623 <a href="http://dx.doi.org/10.1071/WR13073">http://dx.doi.org/10.1071/WR13073</a>	Berry O, Tatler J, Hamilton N, Hilmer S, Hitchen Y & Algar, D.	
April 2014	Recommended guiding principles for reporting on camera trapping research	Biodiversity Conservation, DOI 10.1007/s10531-014-0712-8	Meek, P, Ballard G, Claridge A, Kays R, Moseby K, O'Brien T, O'Connell A, Sanderson, Swann D, Tobler M & Townsend S.	

Date Published	Title	Publisher/Title	Authors	Project
<b>OUTCOME 2: A NATIONAL BENEFIT OF \$16 MILLION P.A. BY REDUCING FERAL PIG DAMAGE BY 15%</b>				
<b>1.3 Article in scholarly-refereed journal</b>				
July 2013	Effectiveness and target-specificity of a novel design of food dispenser to deliver a toxin to feral swine in the United States	International Journal of Pest Management, 59:3, 197-204, DOI: 10.1080/09670874.2013.815830	Campbell T, Foster J, Bodenchuk M, Eisemann J, Staples L & Lapidge S.	2.U.5e
Feb 2014	The econo-techno-social design of Invasive Animal Management: costs and benefits of beneficiaries and benefactors?	Australian Geographer, 45:1, 37-52, DOI: 10.1080/00049182.2014.869295	Meurk, C.	10.U.6
Feb 2014	Pathogen presence in feral pigs and their movement around two commercial piggeries in Queensland, Australia	Veterinary Record, Vol174, Issue13, pp. 325+ DOI; 10.1136/vr.102019	Pearson H, Toribio M., Hernandez-Jover M, Marshall D & Lapidge S	PhD
<b>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</b>				
<b>1.3 Article in scholarly-refereed journal</b>				
June 2013	Demographic effects on the use of genetic options for the control of mosquitofish, <i>Gambusia holbrooki</i>	Ecological Applications, 23(4), 2013, pp.801-814	Thresher R, Canning, M & Bax N.	4.F.16
March 2014	Management of alien fishes in the Murray-Darling Basin	Ecological Management and Restoration, Vol 15, NO S1, March 2014 Doi: 10.1111/emr.12095	Barrett, J., Bamford, H. and Jackson, P.	
May 2014	Sex-ratio-biasing constructs for the control of lower vertebrates	Nature Biotechnology, Vol 32, Number 5 Doi:10.1038/nbt.2903	Thresher R, van de Kamp J, Campbell G, Grewe P, Canning M, Barnet M. Bax N.J, Dunham R, Su B. & Fulton W.	4.F.16
June 2014	Genetic control of invasive fish: technical options and its role in integrated pest management	Biological Invasions. Volume 16, Issue 6, pp1201-1216	Thresher R, Hayes K, Bax N, Teem J, Benfey T & Gould F.	4.F.16
<b>2.2 Report</b>				
2013	Exploitable biological vulnerabilities of common carp	Invasive Animals CRC	Gehrig S & Thwaites, L.A.	
2013	Cyprinid herpesvirus 3(CyHV-3): its potential as a biological control agent for carp in Australia	Invasive Animals CRC	McCull K & Crane M.S.J.	
July 2013	Role of fishing competitions in pest fish management	Invasive Animals CRC	Norris A, Chilcott K & Hutchison M.	
Jan 2014	Exploitable biological vulnerabilities of common carp	Invasive Animals CRC	Gehrig SL & Thwaites LA.	
<b>2.3 Guide/Fact Sheet</b>				
Jan 2013	Pheromone attractants as a means of carp control (Fact Sheet)	Invasive Animals CRC	Invasive Animals CRC	
Jan 2014	Carp pheromone attractant trials (Fact Sheet)	Invasive Animals CRC	Invasive Animals CRC	
Feb 2014	Carp removal in Tasmania (Case Study)	Invasive Animals CRC	Invasive Animals CRC	
March 2014	Carp weaknesses and vulnerabilities (Fact Sheet)	Invasive Animals CRC	Invasive Animals CRC	
April 2014	Native fish predators as a biological control method for carp (Fact Sheet)	Invasive Animals CRC	Invasive Animals CRC	
April 2014	Queensland carp fishing competitions (Case Study)	Invasive Animals CRC	Invasive Animals CRC	
April 2014	Radio tracking as a support tool of carp control methods (Fact Sheet)	Invasive Animals CRC	Invasive Animals CRC	
April 2014	Using a carp separation cage at Lake Bonney, South Australia (Case Study)	Invasive Animals CRC	Invasive Animals CRC	

Date Published	Title	Publisher/Title	Authors	Project
<b>OUTCOME 8: DELIVER IMPROVED AND HUMANE APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVERABUNDANT AND WIDESPREAD SPECIES</b>				
<b>1.3 Article in scholarly-refereed journal</b>				
Nov 2013	Using invasion process theory to enhance the understanding and management of introduced species: A case study reconstructing the invasion sequence of a common myna ( <i>Acridotheres tristis</i> )	Journal of Environmental Management, 129 (2013) 398-409 <a href="http://dx.doi.org/10.1016/j.jenvman.2013.08.005">http://dx.doi.org/10.1016/j.jenvman.2013.08.005</a>	Garrock K., Lindenmayer D.B., Wood J.T. and Tidemann C.R.	PhD
Nov 2013	Understanding basic species population dynamics for effective control: a case study on community-led culling of the common myna ( <i>Acridotheres tristis</i> )	Biological Invasions DOI 10.1007/s10530-013-0580-2	Garrock K., Tidemann C.R., Wood J.T. and Lindenmayer D.B.	PhD
June 2014	Creating new evolutionary pathways through bio-invasion: the population genetics of brushtail possums in New Zealand	Molecular Ecology, 23(14):3419-33 Doi: 10.1111/mec.12834	Sarre S.D., Aitken N., Adamack A., MacDonald A.J., Gruber B. & Cowan, P.	

## GLOSSARY

AAHL	Australian Animal Health Laboratories
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antibodies	also called immunoglobulin, a protective protein produced by the immune system in response to the presence of a foreign substance, called an antigen
biodiversity	the number, variety, and genetic variation of different organisms found within a specified geographic region
biosecurity	the protection of the economy, environment and public health from negative impacts associated with pests, diseases and weeds
canid	a mammal of the dog family (Canidae)
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.
CyHV-3	Cyprinid herpesvirus-3
eDNA	environmental DNA
efficacy	the ability to produce a desired or intended result
IA CRC	Invasive Animals Cooperative Research Centre
IAL	Invasive Animals Ltd
invasive animal	non-native (introduced) species that are, or have the potential to become, established in the wild through escape from captivity, deliberate or accidental release and accidental or illegal importation
KHV	koi herpes virus
mesopredator	a medium-sized predator which often increases in abundance when larger predators are eliminated
myxomatosis	a virus specific to rabbits causes by the myxoma virus
PAPP	para-aminopropiophenone
pathogenic	causing or capable of causing disease
pheromone	a chemical substance that is usually produced by an animal and serves especially as a stimulus to other individuals of the same species for one or more behavioral responses
RHD	rabbit haemorrhagic disease
RHDV	rabbit haemorrhagic disease virus
SMEs	small to medium enterprises
threatened	at risk of becoming endangered (plant or animal)
toxin	poisonous substance produced by living cells or organisms





Photo: Wayne Hillier

