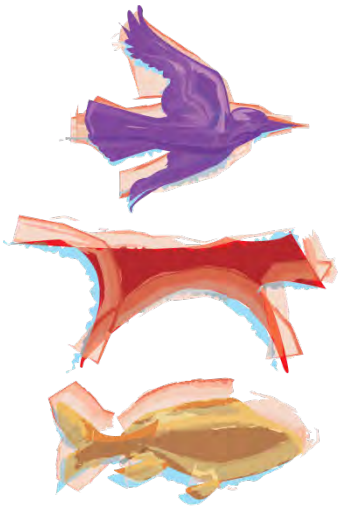
2009-10

Annual Report



Invasive Animals CRC

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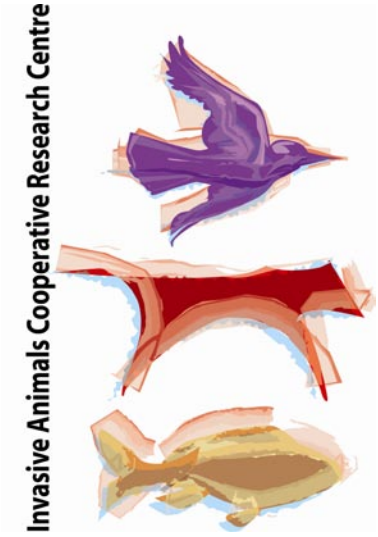

Annual Report 2009–10

Invasive Animals Cooperative Research Centre Annual Report 2009–10
(as per Department of Innovation, Industry, Science and Resources annual reporting requirements)

Disclaimer: While every effort has been made to ensure that the information herein is accurate, the Invasive Animals Cooperative Research Centre does not accept liability for any error of fact or opinion which may be present, nor for the consequences of any financial decision based on this information. The summaries contained within this document are based on reports prepared after consultation with the various researchers in accordance with reasonable standards of scientific endeavour.

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Cover image: Demonstrating satellite GPS tracking technology.

Chair's foreword

Our IA CRC review in June brought together key researchers, industry commercialisers and end-users in an intense forum to take stock of our research program and how we are positioned for our adoption end-game.

With many of our students' PhD theses nearing completion, the review provided a special opportunity to be exposed to their varied research results and to learn how they dovetail into our larger research demonstration projects. Their contribution to fertility control, understanding feral animals as a source of disease, demonstrating the impact of community action, and how natural predators and attractants can be used in control, are just a few areas of value being added to by our fabulous student cohort.

The review also demonstrated the continuing strong progress being made across the board. It was very heartening to see new technology development move from the research phase to the registration and commercialisation phase – such as with our new wild dog and fox chemical control, PAPP. Work on strategic controls also achieved important milestones, such as starting work on integrating the daughterless genetic construct into carp building on many years of work on the model fish species.

All of this underscores that this CRC has been able to unlock historically unprecedented levels of innovation in this sector. It has replaced almost complete lack of innovation for over 30 years from the 1970s to 2000s, with a product innovation spike to be delivered by IA CRC this decade.

The IA CRC has been able to deliver this.

- It is both vertically and horizontally integrated enabling seamless progression from end user investment and involvement in research design, research and development, followed by commercialization and/or adoption.
- It achieves critical mass by bringing together a broad range of partners focused on delivering much needed products and knowledge to improve management.
- It has fostered a strong collaborative culture between researchers, research agencies, investors and commercialisers and government and industry end users.

Earlier this year, the Governing Board decided to apply for a five-year extension bid in 2011 to maintain this momentum, and enable the full delivery of our new key technologies before exiting the CRC Program in 2017.

Our track record to date means that involvement in this extension will be an astute investment, which will ensure the delivery and full roll out of new strategic controls for carp and rabbits (worth more than $1.4 billion over 15 years), next generation genetic techniques to detect new and emerging pests at very low densities, and our new suite of wild dog, fox and feral pig toxins and bait delivery systems.

Leading the CRC into our extension bid process is Andreas Glanznig, the newly appointed CEO. He takes over from ProfessorTony Peacock, who now heads up the CRC Association as their new CEO. On behalf of the Board I thank Tony for his dedication and enormous contribution over the past five years with this CRC.

As a wool producer facing the impacts of pest animals every day, being at the helm of such a high performing CRC is something that I'm very proud of. I look forward to continuing this partnership to ensure that Australia is on a far stronger footing to deal with the some $700 million a year pest animal impact to agriculture, and the immeasurable impacts to the environment and well-being of land managers.

My sincere thanks to all members and staff of the IA CRC for your earnest and dedicated work this year. In particular, thank you to retiring Directors, Atticus Fleming and Chris Hancock. Both have made a valuable contribution with their skills and networks. Finally I would like to recognise and thank the Board for their dedication and thoughtful counsel that underpins the IA CRC.

Helen Cathles
Chair

CEO's foreword

As I write this report, wetter times have hit Australia's eastern seaboard with mice, carp, rabbits and feral pigs to name a few all taking advantage of the land's increased bounty. The larger impacts expected over the next several years provide an additional impetus to deliver our new key technologies.

This has been a critical year for our CRC. We are rapidly moving into the end game for this CRC and are now positioned to work on three fronts: ensuring we continue to deliver our key technologies and other contracted outputs; building a strong adoption platform and network through our *PestSmart* toolkits and roadshow; and planning for the future of national collaborative invasive animal management R&D.

While this CRC is pushing the envelope in many critical areas, two of the exciting developments this year that epitomise our efforts to deliver key technologies are:

- Finalisation and submission of the registration package for the first of our next-generation red blood cell chemical controls—PAPP fox and wild dog baits— for regulatory approval. Importantly, the revival of six accidently poisoned working dogs by the Bluehealer antidote showed its potential in areas where working or pet dogs may be at risk.

- Solid progress in developing strategic solutions to Australia's carp problem highlighted by the first effort to produce daughterless carp, as well as continued positive results in the evaluation of Australia's first potential carp biocontrol: Koi Herpes Virus.

In fact, the CRC achieved all of its seven contracted outputs for this year, and is tracking extremely well to deliver its 2010-11outputs. This strong performance was affirmed by our whole of portfolio review held in June.

Driving this success has been a network of researchers willing to work closely together to deliver results. One of the stand out memories I have of our June review was the very obvious camaraderie between our researchers, and knowing that our CRC has helped foster these researcher networks and broader collaborations with our commercialisers and adoption networks.

A special mention also needs to be made of the ability of this CRC to grow our financial pie, with the agreed seven year cash and non-staff in-kind cash equivalent now set to be exceeded by over $9 million or some 15%. These additional resources have enabled CRC scientists to work on important new projects such as an evaluation of whether new strains of Rabbit Haemorrhagic Disease can boost rabbit biocontrol, to the development of the Bluehealer antidote to our next-generation red blood cell toxicants.

The Governing Board's decision to seek a five year extension through the 2011 CRC Program funding round has triggered management to put together a compelling business case to build on the strong performance of this CRC. The essence of the bid will be maintaining and building new collaborations to both ensure we can ensure strong uptake of those key

technologies that will only be ready as this CRC winds up, as well as taking innovation to the next level with a suite of new outputs that meet the needs of those impacted by invasive animals.

Finally, I would especially like to thank the IA CRC management team, researchers, industry participants and IA CRC board directors for your tireless effort and support in making this such a successful year.

Andreas Glanznig

Chief Executive Officer

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Tables and figures

Executive summary

2009–10 has reinforced the continuing strong achievement of the Invasive Animals Cooperative Research Centre. The raft of research breakthroughs is heartening, particularly in relation to strategic controls that hold the promise of leading to transformational impacts in the way invasive animal control is undertaken in Australia. The commercialization of our intellectual property is also advancing well with the submission of Australia's first pest animal control bait that includes an antidote. This is the first of several products that aim to introduce a new class of humane chemical controls backed up with an antidote for any working or pet dogs that accidently consume these baits.

This success is in a major part due to both the involvement of our 41 participants and high quality of our research leaders and scientists. The deepening of our relationships with several key partners over this reporting period is testimony to the value of the collaborative research approach fostered through this cooperative research centre. The awarding of Australia Day Honours, a Eureka Award, and a prestigious United States Fulbright Scholarship reflect the calibre of our leaders and researchers.

Achievement highlights

Research

- **First effort to integrate daughterless genetic constructs into carp.** Following successful testing of two variants of a prototype sex-determining genetic construct in a test species – medaka – a prototype carp daughterless construct has been built of wholly carp genetic material. This first suite of daughterless carp constructs were inserted into carp eggs with screening now underway to determine if the daughterless genetic construct has been successfully integrated into the test carp.
- **Carp biocontrol agent evaluation on non-target species continue to be positive.** Continued evaluation of non-target species – namely Murray cod, silver perch and golden perch – show that they are not susceptible to infection with Koi Herpes Virus.
- **Genetic DNA fox identification techniques critical to Tasmanian fox eradication program**. This novel scat DNA technique has now identified a total of 51 positive fox scats from over 2,400 samples, which has demonstrated the widespread distribution of this top predator ranging from the central north, to many sites in the east and south east. These findings underpin the implementation of the fox eradication strategy.
- **Demonstrated that cat numbers and impacts increase in the presence of repeated use of baits for fox control**. The major Western Australian demonstration site has shown that mesopredator release of cats occurs in areas that are regularly baited for fox control. Additionally, studies have shown that cats are a major predator of the woylie at an iconic conservation site, and are responsible for their decline after initial increases from fox control.
- **Major project starts to boost impact of rabbit haemorrhagic disease (RHD)**. Building on the discovery of a benign 'RHDV-like' virus that provides a level of immunity in Australian rabbit populations, the IA CRC secured financial and research support to start a new $3 million plus project to boost the effectiveness of the RHDV rabbit biocontrol agent.

Commercialisation, utilization and policy influence

Commercialisation

- **Registration package for new PAPP fox and wild dog baits submitted for government approval**. Following successful field trials demonstrating significant reductions in fox (>65%) and wild dog (>75%) activity after baiting programs, registration packages have been submitted to the Australian Pesticides and Veterinary Medicines Authority for approval. A highlight was the revival of six working dogs accidently poisoned during the field trials by vets using the Bluehealer antidote.
- **New products on track to be submitted for government approval in 2010-11**. Several new IA CRC products, including freeze-dried RHD bait and the carbon monoxide pressure fumigator, are in final stages of trialling and will be submitted for regulatory approval in the 2010-11 financial year.

Utilisation

- **Uptake of cooperative, regional nil-tenure wild dog management demonstrated**. The National Wild Dog Facilitator project continues to promote a nationally consistent strategic approach to wild dog management, which costs Australian agriculture over $50m/year. There has been strong uptake of this approach through the implementation of cooperative regional wild dog plans through bodies such as Flinders Shire Council, Murweh Council and Blackall Tambo Regional Council areas.

Policy influence

- **Landmark report on invasive animal costs launched by Federal Agriculture Minister.** A highlight was the launch of the landmark report, *The Economic Impacts of Vertebrate Pests in Australia*, by then Federal Minister for Agriculture, Fisheries and Forestry, the Hon Tony Burke MP. The findings of this report were extensively reported in the media, and have been also subsequently quoted twice by Ken Henry, Commonwealth Treasury Secretary, and included in the 2010 Coalition pest animal policy statement.

Education

Balanced Scientist PhD program

The Balanced Scientist PhD program continued to make solid progress supported by the fourth intensive development training camp (June 2010), which included customised workshops on Commercialisation and Intellectual Property. All twelve 2006 intake PhD students have now satisfied requirements for the *IA CRC Certificate of Achievement in Research Leadership & Management*.

During this reporting period, six PhD and one MSc theses were submitted giving a cumulative total of eight submissions from the 28 PhD students enrolled in the program. As of the end of the reporting period, five PhDs have been accepted or conferred.

PestPlan diploma

Pest Plan provides vocational education training in pest management under the Australian Qualifications Framework. The pilot fee-paying course started in the 2009-10 financial year with 10 industry-based students from six states and territories.

Public Awareness

The IA CRC continued to have a high mass media profile with media coverage nearly doubling this reporting period to over 900 stories, with strong growth occurring in radio and press. This translated to over 1600 minutes of coverage including about 100 minutes of television and over 1500 minutes of radio. This included high profile stories on *Sixty Minutes*, numerous stories on ABC TV Stateline and LandLine programs, numerous ABC Radio National PM spots, and a multitude of metro and rural press including features in *The Age*.

Over 55 formal publications were accepted or published in the reporting period. This included 27 published articles, 12 accepted papers, two book chapters and 14 conference papers (produced in refereed proceedings).

For further information on specific research achievements, refer to Appendix A: milestone summaries and the IA CRC's research portfolio summary.

Risks and opportunities

Risks

The most significant risk, both in terms of ensuring continued financial support and to research, has been considerably reduced with the breaking of the drought across Australia.

Opportunities

Opportunities include deepening our international collaborations, particularly with the US Department of Agriculture National Wildlife Research Centre.

Awards and Special Commendations

Two IA CRC leaders received awards in the Australia Day Honours List:

- Dr Glen Saunders, Program Leader, Terrestrial Products and Strategies was recognised in the Australia Day honours for his work on biodiversity and vertebrate pest research with an Member of the Order of Australia (AM).
- Dr Helen Scott-Orr, IA CRC Director, was also recognised for service to Veterinary Science with the Public Service Medal in the Australia Day honours.

The two other major awards were:

- Ass. Prof Steve Lapidge was awarded the Fulbright Professional Business/Industry Coral Sea Scholarship, to work with the USDA National Wildlife Research Centre in Colorado, on development of Nitrite for feral pigs and other species. Steve has just returned this week from the US.
- Prof Tony Peacock was awarded the 2010 Australian Government Eureka Prize for Promoting Understanding of Science.

Additionally, the IA CRC-supported student Adriana Ford-Thomson being shortlisted in the Showcasing Early Career Scientists program at the annual CRC Association's Conference in May 2010.

The three recipients of the Invasive Animals CRC annual awards are outlined below.

The Chair's Prize for Scientific Excellence – Prof Rick Shine, University of Sydney, for his substantial contribution to our understanding of ecological conservation and tireless work to present research outcomes from his work, as well as the work of the CRC and the Australian Research Council.

Participant's Prize for Invasive Animal Management – Greg Mifsud, Biosecurity Queensland, Queensland Department of Employment, Economic Development & Innovation. Greg has been working on cooperative pest management programs and continues to do a brilliant job of raising the profile of wild dog issues and co operative management options as the National Wild Dog Facilitator.

Chief Executive's prize for achievement as an IA CRC student – Ms Jessica King, IA CRC-supported student with the University of Sydney (affiliated with the UTS and ANU). Jess has significantly enhanced our knowledge of invasive animals during her candidature. As a 'Balanced Scientist', her work is crucial to our current understanding of the lifecycle of Neospora. She has a remarkably successful publishing record and has actively communicated her findings.

Context and major developments

The IA CRC has the following operational goals (to be delivered by 2012):

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

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

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

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.

5. Deliver innovative, practical control measures against cane toads.

6. Reduced impact of feral cats over five million hectares.

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

8. Reduced risk of disease transfer from invasive animals to livestock and humans.

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

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

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

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

Efficiently manage resources to achieve the CRC's research, education, commercialisation and technology transfer outcomes.

Most agricultural sectors suffer significant economic losses from invasive animals. Most notably, these losses occur through predation of livestock, crop damage, competition for feed, damage to the environment and infrastructure, land degradation impacting sustainability and costs of control. The business case for the IA CRC is based primarily on agricultural benefit; however, as the same products and strategies are generally used to control environmental pests, the nation's environmental and social capital also benefits directly.

Government and private investment in the IA CRC is critical for effective national coordination of research efforts into improved management of invasive and overabundant animals in Australia. The importance of this cannot be overstated, especially as the organisation encompasses all state and territory agencies responsible for invasive and overabundant animal management.

In practice the IA CRC co-invests in research relevant to its participants so that low-margin or non-commercially viable products and services become available to our end-user groups. This market impasse exists because the optimal time to employ invasive species management is when the target species are at low densities. However, this is also the least likely time that resources will be allocated against this exercise because of their low level of impact. Adding to the market challenge is the extremely high compliance costs of delivering products and services to this market, which include significant product development and Australian Pesticide and Veterinary Medicine Authority registration costs, and despite a robust national regulatory process, additional State and Federal government regulation of product end-use.

Because of these market realities, this CRC is critical to the enhancement of Australia's readiness to respond to invasive animals, our agricultural sustainability, our unique biodiversity, and the welfare of all animals.

Market potential

The invasive species management market in Australia and New Zealand can be broadly grouped into three product types:

1. commensal rodent control.
2. larger vertebrate invasive species control that also includes large scale rodent control in agricultural settings, and
3. new niche products.

Foxes are a potential ecological disaster for Tasmania

The commensal rodent control market is dominated by multinational companies such as BASF, BAYER and CropCare who sell their products through national distribution chains such as supermarkets or Rentokil. This segment of the market is highly competitive and very difficult to enter and also less relevant to the research outcomes of the IA CRC. This market is not considered a core business for the IA CRC. Accordingly, we focus on markets encompassing rodent control in agricultural settings (eg mice plague control) and larger vertebrate invasive species control (eg feral cat, fox, wild-dog, feral pig, stoat, ferret, possum) and niche products that grow the overall market potential eg fertility control products.

The total Australasian market equates roughly to the total market turnover of the SME sector (which excludes multinationals) and is conservatively worth $9-10 million dollars annually. The national impact is, or course, much greater.

This is essentially the amount that the remaining market segments allocate to invasive species management, eg commercial, indigenous and NGO land managers, regional and NRM managers and field officers, government natural resource managers and field officers, and government, industry and NGO decision-makers, influencers and networks.

This expenditure does not take into account new niche products being launched that have the potential to grow the total market. Their ultimate market share is the subject of the participant or partnering organisation market research that the CRC relies on in prioritising its co-investing activities.

The regulation of products (destined for this market by state government agencies (licensed officers distributing product) makes monitoring this market and the benefits accruing from the IA CRC relatively straightforward. The regulation of new products is unlikely to substantially change this reality and new product uptake will be readily able to be monitored against forecast performance. Additionally, the IA CRC will be able to directly monitor the performance of specific products based on royalty streams arising from the sale of IA CRC co-developed research outcomes.

Value of outcomes

Monetary outcomes

Working out the projected economic impact of research that delivers economic, environmental and social benefits in varying proportions is inherently difficult. For example, it may seem straight-forward to quantify and monetise the economic benefit to a farmer from reduced fox predation of lambs. But even this relatively simple example is fraught with complexities. Estimating how many lambs would have been lost in the absence of the technology is a matter of conjecture, and setting up a valid experimental control is difficult. Quantifying the environmental impact in terms of reduced predation on native species is even more difficult, and assigning an economic value to such a reduction is problematic. If a control technology developed by the CRC has improved animal welfare outcomes, assigning a monetary value to the net improvement in animal welfare is similarly vexed.

The use of safer and more humane control technologies also reduces Occupational Health and Safety (OH&S)

Using safer and more humane control techniques reduces OH&S risks

Excerpt from the Economic Impact Analysis (CIE 2008)

"…of the 39 key technologies that are the focus for the IA CRC, only 9 were able to be monetised. The quantitative analysis is restricted to:

► Fox and wild dog control activities, in particular the development of a new more humane and target-specific toxin

► Feral pig control activities, in particular the development of new more target-specific pigs baits

► Rabbit control activities, in particular the development of a new freeze-dried rabbit haemorrhagic disease (RHD) product

► Rodent control activities, in particular the development of a new mouse bait that can be used in brassica and root vegetable crops, and

► Early warning detection technologies, in particular the enhancement of a DNA based species identification test to detect new invasive animal incursions.

This study uses an economy-wide approach to estimating the benefits of IA CRC technologies.

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

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

The environmental benefits are also likely to be significant."

risks and stress levels for both the direct users of the control technologies and beneficiaries such as farmers and park rangers. Again, conventional economic tools for measuring such impacts capture only a portion of the value added.

Campbell and Schofield (2007) explore in more detail the issues associated with evaluation of applied research investments, including evaluation of return on investment where substantial non-market benefits are involved. There are two broad options for estimating the economic impact of a portfolio of applied research delivering a mix of economic (market and non-market), environmental and social benefits:

1. Apply conventional benefit-cost analysis for those impacts that can be quantified and monetised with some confidence to determine a minimum estimate for the economic impact; and then describe the envisaged social and environmental impacts that are difficult to quantify, let alone to monetise, in the knowledge that the total benefits will be higher than the quantified estimate.
2. Apply conventional benefit-cost analysis for those impacts that can be quantified and monetised with some confidence; then apply other economic tools such as Contingent Valuation (CV) methodologies (such as Choice Modelling, Willingness to Pay, Hedonic Pricing and Travel Cost Method) to estimate non-market economic benefits for impacts that can be quantified; and then describe the envisaged social and environmental impacts that are difficult to quantify.

For a given research portfolio, the second approach will generate a higher estimate of the total economic return. But Contingent Valuation methodologies are expensive to apply well, are only as good as available data, and involve assumptions that are not as well accepted as the more established conventional benefit-cost analyses. So while the bottom line number may be much higher, so will its error bars and the scepticism with which it is received.

The Invasive Animals CRC adopted the first approach in commissioning the Centre for International Economics (CIE 2008) to estimate the economic impact of its research portfolio, the key findings from which are summarised in Table 1 below. These numbers are more modest than the projections in the original CRC bid and Commonwealth Agreement.

Of the 13 operational goals contained in the IA CRC strategic plan (Schedule 1), three are quantitative:

- Goal 1: A benefit of $29 million per annum by reducing the impacts of foxes and wild dogs by 10 per cent
- Goal 2: A benefit of $16 million per annum by reducing feral pig damage by 15 per cent
- Goal 3: A benefit of $7 million per annum by reducing rodent damage by 20 per cent

Obviously these benefits depend on being able to estimate the

Figure 1: Excerpt from Economic Impact Analysis, CIE 2008

current costs of damage by invasive animals. The figures in the Strategic Plan were derived from a synthesis of costs using environmental valuation tools and aggregating regional estimates of economic impact for eleven selected invasive animals (McLeod 2004[1]), published as Counting the Cost: Impact of Invasive Animals in Australia. A more recent study (Gong, Sinden and Jones 2009[2]), applying a more conventional economic surplus approach, arrived at significantly lower figures for the economic impact of invasive animals. The results of the two studies are compared in Table 1 below.

Schedule 1 Goal Number	Invasive Animals	*Counting the Cost* (McLeod 2004)				*Economic Impacts of vertebrate pests in Australia* (Gong et al 2009)
		Economic costs ($m/yr)	Environmental costs ($m/yr)	Social costs ($m/yr)	Total costs	Economic costs ($m/yr)
Goal 1	Fox	37.5	190.0	not quantified	227.5	21.2
	Wild dog	66.3	not quantified	not quantified	66.3	48.5
Goal 2	Feral pig	106.5	not quantified	not quantified	106.5	9.2
Goal 3	Rodents	35.6	not quantified	not quantified	35.6	22.8

Table 1: Comparison of economic impact reports

There are clearly significant differences between the results reached by the different economic methodologies, particularly in costing the damage caused by foxes and pigs. There is little point doing a comparative analysis of the two methodologies here, except to note that McCleod (2004) arrived at an environmental cost of foxes by estimating that foxes kill 190 million birds per year and assigning a value of one dollar per bird — a method criticised by economists and some biologists, underlining the earlier point about environmental valuation methodologies.

The key point here is that the CIE (2008) Economic Impact Analysis used the more conservative figures from the Gong et al study. The gap between the CRC's original benefit estimates and the CIE (2008) figures is explicable given that CIE attempted to quantify and monetise the benefits from just nine of 39 technologies, and employed conservative assumptions throughout. Apart from using more conservative costings, the CIE report also took a conservative approach to likely future demand for CRC products. For example:

- the CIE (2008) sensitivity analysis highlights that, were 1080 to be banned at some point in the future, the economic benefit of PAPP would increase from $1.1m to $24.3m per year, but the lower figure was used in the report
- the economic benefit from the CRC's strategic intervention to assist to eradicate foxes in Tasmania is under-estimated — the CIE (2008) analysis EIA covers this contribution qualitatively but does not attempt to quantify the benefit, and
- the economic benefit of extending RATOFF registration to plantation crops (particularly teak plantations) is significant (potentially contributing to Goal 3 economic benefit target) but could not be quantified[3].

Table 2 shows the annual economic benefit predicted in the Phase Two variation to the Commonwealth Agreement. These figures are more modest than the projections in the original

[1] *McLeod R (2004) Counting the Costs: Impact of Invasive Animals in Australia. Pest Animal Control Cooperative Research Centre, Canberra.*
[2] *Gong W, Sinden J, Braysher M and Jones R (2009) The economic impacts of vertebrate pests in Australia. Invasive Animals Cooperative Research Centre, Canberra.*
[3] *Trials of the RATOFF® bait to control the cane field rat (Rattus sordidus) in a $4 million teak plantation near Cooktown in Queensland achieved a 90 per cent knockdown within six days. The teak crop would otherwise have been lost. There is no other legal product currently on the market.*

bid. However for the reasons outlined above, they are likely to significantly under-estimate the actual economic impact that will be generated over the next four years of the CRC. Moreover they do not attempt to capture the environmental and social benefits.

Schedule 1 Goal	Invasive species	CRC key technology benefit quantified	Annual economic benefit (2007 $m)	Goal target: Apportioned economic benefit only (McLeod 2004) ($m/yr)	Goal target: Apportioned economic benefit (Gong et al *2009)*($m/yr)
Goal 1	Fox and wild dog	PAPP	1.1		
		Early warning toolkit (Tasmanian fox eradication)	0.2		
		Total	1.3	10.38	6.97
Goal 2	Feral pig	PIGOUT®	0.28		
		HOG-GONE®	1.88		
		Total	2.16	15.98	1.38
Goal 3	Rodent	MOUSEOFF®	0.6	7.12	4.56
Goal 7	Rabbit	TAKE AIM®	7.8		

Table 2: Quantified economic benefits for the key IA CRC technologies analysed

Public Benefits

While economic impacts are crucial and should be quantified where possible, many of the impacts of this CRC fall into the domain of public goods and services that are currently not commoditised.

The environmental benefits of substantially reducing the populations of invasive animals are difficult to quantify and to value, but are nevertheless important. Australia has the worst record of any country for native mammal extinctions, and the major reason for this has been predation by invasive species. Many native species listed as threatened under Commonwealth and State legislation have declined because of foxes and cats. Reductions in biodiversity loss from reduced predation and also from habitat degradation, in both terrestrial and aquatic ecosystems — from, for example, rabbits and carp — are potentially of significant environmental benefit. Climate change raises the stakes and increases the risks for native biota, making control of invasive species even more important to improve the resilience of natural ecosystems. Better control measures for carp and prevention measures for tilapia would make a huge difference to the outlook for native fish species and other aquatic biota, in river systems already stressed through lack of water.

Feral pigs cause massive habitat destruction

The social impacts of invasive animals, again exacerbated in times of drought and economic hardship, are considerable. Farmers who have endured a mouse plague or lost valuable stock to predation from dogs or foxes, particularly if such losses are repeated and sustained, can suffer from debilitating stress and anxiety and consequent health problems. Park managers, community groups, landholders

and the wider community all suffer when dwindling local populations of native species are driven to the brink by the impacts of invasive species through predation, competition or habitat degradation.

Given all of the above, the Invasive Animals CRC is well positioned to deliver economic, social and environmental benefits commensurate with the original bid, and sufficient to deliver an excellent return on the Commonwealth and total investment in the CRC. Furthermore, given the excellent track record of the CRC in bringing products to market and the strengths of its commercialisation approach, the panel is confident that the CRC will maximise the potential commercial economic benefit that can be delivered through new invasive animal control technologies.

Major developments and initiatives

Whole of program review

A whole of program review was undertaken in June 2010. Its objectives were to:

1. undertake a final major review of current projects to enable program and project leaders to use reviewer feedback to amend any projects, as appropriate
2. to expose CRC program investors and other stakeholders to the full range of the CRC program, and provide an opportunity to appraise particular projects within a broader program and whole of CRC context
3. enable CRC researchers the opportunity to network and share findings and experiences.

The review terms of reference are:

1. evaluate project performance in achieving milestones, likelihood of delivering project outputs, robustness of the path to adoption, and identify any major outstanding risks that may impede completion of project
2. identify and make recommendations on any current projects that warrant amendment to increase performance and/or delivery of effective outputs and outcomes
3. assess the extent that the IA CRC's research portfolio will enable achievement of its non-monetised strategy goals (ie. goals 4, 5, 6, 7, 8, 9, 10, 11, and 12)
4. report on any findings considered relevant by the Review Team.

The key findings and conclusions of the review were:

- Solid progress across the portfolio.
- The science being undertaken in the PhD program is high quality, with solid publication record, and some projects also have clear path to adoption (eg. Indian myna project).
- Particular key technologies that will not be finalised within the life of this CRC need to secure champion agencies/governments to drive the finalisation of the research, and adoption of outputs. The two major examples are Koi Herpes Virus and Daughterless technology given the uncertainty surrounding continued MDBA support. On the other hand, RHD Boost, currently enjoys the support of the NSW and Australian Governments as well as in-principle support from the national Vertebrate Pests Committee.

Project specific review summaries are contained in the *2010 Invasive Animals CRC Research Portfolio Summary*.

National research priorities

Most IA CRC's activities address the National Research Priority 'Safeguarding Australia'. Under this Priority, we directly work towards the goal 'protecting Australia from invasive diseases and pests'. Approximately twenty percent of our activities also contribute to the goal of achieving 'sustainable use of Australia's biodiversity'.

The CRC's research brief mirrors the government's objective of 'counteracting the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions'. Reducing the impact of invasive animal pests must be achieved by a combination of technological advances and enhanced on-ground application. This requires partnership between the public and private sectors:

- The public sector manufactures and markets pest control products and manages our primary production industries
- Public sector research agencies undertake most pest animal research and public sector land management is responsible for almost one quarter of Australia's land area.

No individual land manager or agency carries the whole invasive pest animal problem, but all are responsible for making a contribution and a commitment to the solution. State and federal agriculture and natural resource management agencies have a significant role in managing public land and in supporting farmers, graziers, conservation managers and foresters in their efforts to control terrestrial invasive animals. Individual land managers often work to reduce on-site impacts, but the mobility and stealthy nature of these animals makes their local eradication difficult, if not impossible. Similarly, river systems interconnect as do their fish populations. Management of a pest fish in one catchment is meaningless if the pest can quickly recolonise adjacent, unmanaged catchments.

Invasive Animals CRC aims to make an impact via its member organisations. Our members want to improve their innovation rate. They need knowledge in a useable form — synthesized, packaged, and communicated with context. The CRC works at the applied end of the innovation spectrum, providing the 'glue' for our members to work together and share information on agreed priority species. We bring members together, provide an environment and resources to be creative, and recognise and reward innovation.

The CRC's goal is to create new tools and strategies to assist partners in their job. However, the development of tools is not sufficient. The CRC's aim is adoption and therefore new controls must be:

- Socially acceptable
- Ecologically effective
- Commercially viable

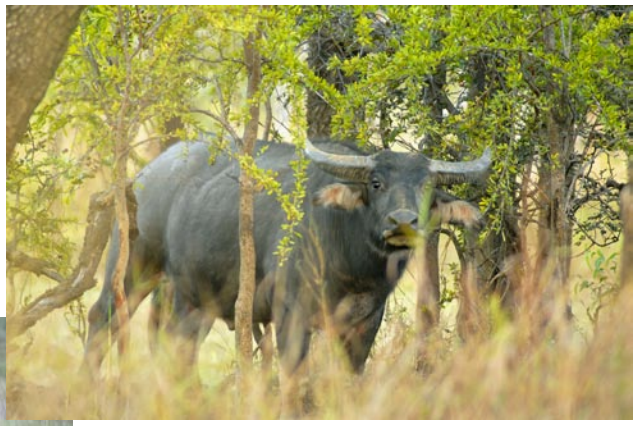
Protecting Australia from invasive diseases and pests

Counteracting the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions

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

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

Table 3: National Research Priorities and CRC research



Governance and Management

In order to achieve the 13 operational goals of the IA CRC (schedule 1), the IA CRC is led by a Board with a wealth of valuable knowledge and experience and supported by a quality management team.

CEO, Governing Board members and Committee members

Name	Organisation	CRC Position / Role	Key Skills
Prof Tony Peacock	Invasive Animals CRC	CEO	Research portfolio management
Ms Helen Cathles	Primary Producer	Board Chair	Grazier and landholder
Dr Dedee Woodside	Consultant	Deputy Board Chair, Director, Audit Committee Chair	Communications, social sciences
Dr Phil Cowan	NZ Landcare Research	Director	R&D management
Mr Atticus Fleming	Australian Wildlife Conservancy	Director	Conservation
Mr Chris Hancock	Aarnet Ltd	Director	Business relations, risk analysis
Dr Mark Lonsdale	CSIRO	Director, Audit Committee member	R&D management
Dr Helen Scott-Orr	Consultant	Director	Disease and animal health research
Betty Ferguson	Consultant	Audit Committee member	CPA, risk management

Table 4: CEO, Governing Board Members and Committee members

The composition of the Board has changed twice since the last reporting period, with the retirements of Professor Joan Dawes and Atticus Fleming.

In the recent financial year, the IA CRC was recognised as one of the 'good guys' by Women on Boards — a national program to improve the gender balance on Australian company boards — for having a minimum of 30 per cent female directors. At the time of reporting, the IA CRC had one of the highest participation rates for women on boards of any CRC, at 42.9 per cent.

Frequency of 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:

Director	Board Meetings		Audit Committee	
	A	B	A	B
Margeurite Helen Reading Cathles	4	4	-	-
Phil Cowan	4	4	-	-
Atticus Richard Fleming (retired 5 May 2010)	3	1	-	-
Chris Hancock	4	2	-	-
William Mark Lonsdale	4	3	4	4
Helen Scott-Orr	4	3	4	3
Dedee Woodside	4	4	4	4

Table 5: Directors' meetings.

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

B: *Number of meetings attended*

Operational structure

The IA CRC operational structure consists of five key program areas, a corporate function (which includes the CEO and Business and Client service functions), a commercialisation manager and dedicated science communicator (aligned with the IA CRC corporate function and the uptake program)

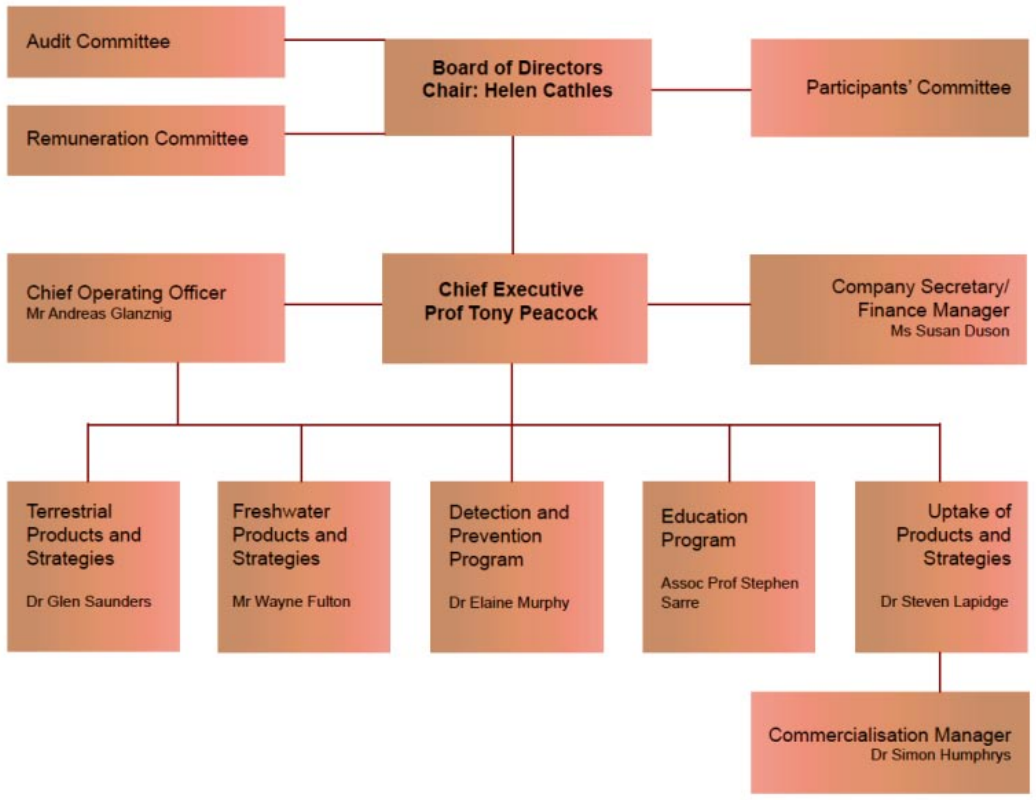


Figure 2: Operational structure

Program management staff are as below.

Name	Organisation	CRC Position / Role
Dr Glen Saunders	Industry and Investment NSW	Program Leader, Terrestrial Products and Strategies
Mr Chris Lane	Industry and Investment NSW	Program Coordinator, Terrestrial Products and Strategies
Mr Wayne Fulton	Vic Department of Primary Industries	Program Leader, Freshwater Products and Strategies
Ms Kylie Hall	Vic Department of Primary Industries	Program Coordinator, Freshwater Products and Strategies
Dr Elaine Murphy	NZ Department of Conservation	Program Leader, Detection and Prevention
Dr Wendy Henderson	Invasive Animals CRC	Program Coordinator, Detection and Prevention
Assoc. Prof Steven Lapidge	Invasive Animals CRC	Program Leader, Uptake
Dr Simon Humphrys	Invasive Animals CRC	Commercialisation Manager
Ms Sascha Rettke	Invasive Animals CRC	Program Coordinator, Uptake
Prof Stephen Sarre	University of Canberra	Program Leader, Education
Dr Tom Heinsohn	University of Canberra	Program Coordinator, Education

Table 6: Program staff members

Business and client services staff are:

Name	Organisation	CRC Position / Role
Mr Andreas Glanznig	Invasive Animals CRC	Chief Operating Officer
Ms Susan Duson	Invasive Animals CRC	Finance Manager/Company Secretary
Ms Alexandra Bagnara	Invasive Animals CRC	Communications Manager
Ms Keryn Lapidge	Invasive Animals CRC	Science Communicator
Ms Kate Lawrence	Invasive Animals CRC	Office Manager
Ms Diane Holloway	Invasive Animals CRC	Executive Assistant

Table 7: Business and Client services staff members

Staff changes

IA CRC staff changes during 2009–10 were Ms Diane Holloway moving to part-time employment, and recruitment of Ms Kate Lawrence.

Changes to participants

There have been no changes to the IA CRC participants during 2009–10. IA CRC Participants are:

Animal and Plant Control Commission of South Australia

Animal Control Technologies Australia Ltd

Australian National University

Australian Veterinary Association Ltd

Australian Wildlife Conservancy

Australian Wool Innovation Ltd

Bureau of Rural Sciences

Carpbusters Inc

Cattle Council of Australia

Central Science Laboratory, UK

CSIRO

Connovation Pty Ltd

Environment ACT (now under Territory & Municipal Services)

K&C Fisheries Global Pty Ltd

Meat and Livestock Australia Ltd

New South Wales Department of Environment and Climate Change

New Zealand Department of Conservation

Pestat Pty Ltd

Queensland Department of Primary Industries and Fisheries

Conservation

State Council of Rural Lands Protection Boards

University of Canberra

University of Newcastle

University of Sydney

University of York

Victorian Department of Primary Industries

Western Australian Department of Environment and Conservation

Grains Research and Development Corporation

Landcare Research International Ltd

Murray-Darling Basin Commission

New South Wales Department of Primary Industries

Parasitech

Queensland Department of Natural Resources and Water

South Australian Department of Land, Water and Biodiversity

South Australian Research and Development Institute

Tasmanian Department of Primary Industries, Water and Environment

University of Minnesota

University of Queensland

University of Western Australia

ValueMetrics Australia

Victorian Department of Sustainability and Environment

WWF-Australia

Core Participants

Supporting Participants

Research Program achievements

Research activities and achievements – key program achievements

The following is a summary of the research activities and achievements of the past year.

For further information on key program achievements, refer to the milestone summary in Appendix A. The IA CRC Research Portfolio Summary (October 2010) also provides information on project progress aligning with IA CRC goals and milestones. See: http://www.invasiveanimals.com/wp-content/uploads/2010/10/IA-CRC-Research-Portfolio-2010.pdf

Specific outcomes from both the education and commercialisation programs are reported on under specific chapters in the report.

Terrestrial Products and Strategies

Terrestrial Program Objective: Improve on existing approaches or develop and deliver new tools and strategies to manage and control invasive animals and reduce their impacts to biodiversity and agricultural industries

The terrestrial products and strategies program has moved a long way towards achieving its outcomes and goals. Work has progressed well on the key technologies that the CRC will leave as a legacy of its tenure.

A list of key outputs and achievements undertaken by the program follows.

- Through the National Wild Dog Facilitator and the NRM Liaison Officer, land managers across Australia have been informed and actively engaged in planning processes and management of target pest species on a local and regional scale.
- Major advances have been made with the submission of registration packages to the APVMA for new rodent control strategies and wild dog and fox toxins.
- Commencement of the RHD Boost project.
- Isolation and identification of a benign form of Rabbit Haemorrhagic Disease – critical to the longer term use of this biological control agent.
- Continuation of the COPs and SOPs process to ensure that invasive animal management is performed humanely across Australia.
- Publication of guidelines for pest bird management.
- Development and registration of new products including the CO fumigator and freeze dried RHD virus.

Specific program achievements follow.

Facilitating Strategic Management of Wild Dogs Throughout Australia (Project 1.T.2)

The National Facilitator was heavily involved in the Agforce Queensland report into the economic cost of wild dog on livestock producers in Queensland. This report revealed that wild dogs cost Queensland producers in excess of $67 million dollars a year through livestock predation, disease transmission and control efforts.

The report also identified that producers believe that in order to overcome wild dog impacts they have to work cooperatively with neighbours and the wider community, and the development of wild dog management plans has the capacity to achieve this objective. Producers also identified that research on wild dog ecology was vital in order to develop effective control programs, while additional control technologies in addition to 1080 poison was imperative in order to achieve greater participation.

Some of the key achievements of the project include:

- Report entitled 'Major Economic Costs Associated with Wild Dogs in the Queensland Grazing Industry'
- Fifteen predator control field days held across wild dog affected regions throughout the state with over 1300 producers attending in total.
- Four-day trapper training course.
- Developed wild dog management plans for seven working groups in the North Flinders region of SA in conjunction with the SAAL NRM Board.
- Continued development of wild dog management plans within local government areas of Queensland including Murweh Shire Council, Balonne Shire Council and Moreton Bay Regional Council.
- A public awareness campaign through the National Facilitator and members of the National Wild Dog Management Advisory Group in regional and urban media.

Towards Best Practice for Wild Canid and Felid Management. (Project 1.T.4)

Monitoring predators is notoriously difficult, which makes the assessment of control programs and new product efficacy difficult. Investigating new remote technologies, including GPS / satellite / radio collars, remote-release cameras and remotely-sourced DNA, which can be used by all collaborators to assess wild canid and felid population changes is of tremendous benefit.

Knowledge of animal dispersals enables strategic planning to occur at the most appropriate scale and we are using the ability of satellite technologies to identify and follow long-distance movements of wild dogs in real time.

Spotted-tailed quolls are considered the native predator most at risk from wild canid control activities. Two different types of models are being developed to investigate population-level responses of spotted-tailed quolls to wild canid control in north eastern NSW and in Victoria.

Key achievements of this project included:

- Deployment of GPS/ satellite/ VHF collars on wild dogs, feral cats, foxes and spotted-tailed quolls at IA CRC field sites.
- Further trapping of quolls was conducted in conjunction with project 10.T.5 to obtain the longer time-series of data required.
- Cameras deployed to assist evaluation of PAPP for wild canid control

Development of Baits with Enhanced Canid Specificity (Project 1.T.3)

This project is delivering new types of registered lethal baits with improved specificity and acceptability for use in control of canid pests (wild dogs and foxes) in Australia. It is the first time in approximately 50 years that a new active has been assessed as a pesticide. Consideration of a new pesticide for use requires many studies and the generation of comprehensive data sets that often needed in vivo experimentation using wild animals and carried out in the field. Key achievements of the project include:

- Effective bait delivered lethal doses determined for foxes and wild dogs.
- Successful field trials demonstrating significant reduction in fox (>65%) and wild dog (>75%) activity after baiting programs.
- Submission of registration packages to the APVMA.

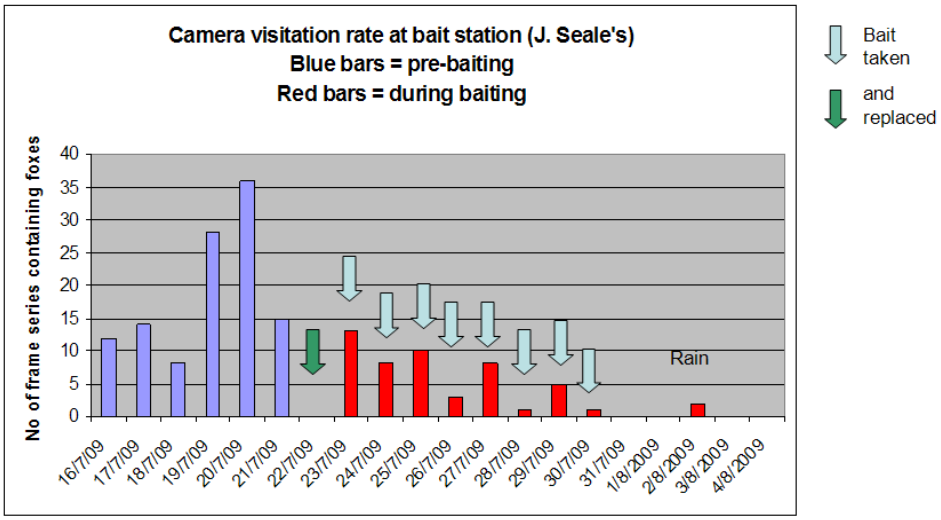


Figure 3: Camera visitation rate at bait stations

There have been some remarkable achievements through this project in the last year, including the successful treatment of working dogs that have accidentally been poisoned with a wild dog and fox (canid-specific) toxin. The new poison will be useful in certain situations, such as farming areas. An article was published by Australian Wool Innovation in issue 42 of 'Beyond the Bale' magazine in February 2010.

Manual for bonding and training guardian dogs (Project 1.T.5e)

Graziers and producers have shown increasing interest in using these dogs to protect livestock given the rise in wild dog issues across the country but have expressed concerns about the lack of information to effectively apply them to their production practices.

The development of a best practice manual for the use of guardian dogs to protect livestock will enable land holders to apply this measure as part of a property-wide approach to fox and wild dog control. The correct use of guardian dogs has been proven to be a cost effective means of managing predation. The development of the best practice manual also aims to address the issues of animal welfare associated with the use of guard dogs. At present no animal welfare codes exist that directly relate to the use of these dogs and in fact under the various states codes most users would be in breach simply by leaving their animals in a paddock unattended.

A draft of the manual was provided to stakeholders in Queensland applying Maremma guardian dogs to their property in early November 2009. The manual was found to be extremely successful and provided sufficient information to bond four pups to 600 wethers in a 900 acre paddock in North Western Qld

"The advice contained in the documents was invaluable for us as we were novice trainers. The material was so comprehensive that we were able to train and bond our dogs without having to contact other breeders and trainers"

...manual reviewer

Canid management, NSW/Qld (Project 10.T.5)

Wild dog and fox predation of livestock are continuing problems in the eastern tablelands and adjacent coastal hinterland regions of north-east NSW. The problem also occurs in the contiguous livestock-producing areas of south-east Queensland. The strategic approach to

managing wild dogs is being progressively embraced in southern NSW and the ACT, and has potential for wild-dog affected areas in northern NSW and neighbouring southern Queensland.

The strategic approach involves defining and quantifying the regional wild dog problem, identifying all stakeholders, and working out the management, research, demonstration, training and education requirements. A series of actions are then planned, recorded and implemented, the results monitored and evaluated, and each component revised and progressed

The key achievements of this project include:

- Review of Armidale Regional Wild Dog Management Plan (now part of Mid-coast Livestock Health and Pest Authority), NSW DECCW and Forests NSW.
- Agreement to Winterbourne Wild Dog Control Association Wild Dog Management Plan by all stakeholders.
- Tanami Downs dingo management plan operational
- Completion of the third year of field research on effectiveness of combined wild dog control techniques.
- Completed field component of Newmont Tanami Operations dingo management project. Newmont Tanami mines dingo management plan operational
- Ran one wild canid monitoring school for stakeholders; Additional 55 participants trained in sandplot monitoring at Vertebrate Pest Management Course, Orange.
- Conducted field trials of PAPP for wild dog and fox control (with project 1.T.3).
- Commenced field work (16 dogs trapped) for Assessment of Aerial baiting rates for wild canids in the demonstration site.
- Commenced field studies of livestock guarding dog (maremmas) movements, and adjacent wild dogs

Enhancing RHDV Effectiveness (Project 7.T.1)

Researcher Tanja Strive discovered and identified a benign calicivirus in Australian wild rabbits[4]. the endemic non pathogenic lagovirus was isolated in Australian wild rabbits during the first phase of this research project. This virus, designated Rabbit Calicivirus Australia 1 (RCV-A1) had long be suspected to impede successful rabbit control in temperate climate zones of Australia, by providing immunological cross protection to RHDV.

A suite of differential diagnostic PCR and Real time PCR tests were developed specific for RCV-A1, RHDV, or all lagoviruses.

A pilot infection study was conducted and we demonstrated that RCV-A1 is able to interfere with RHDV-induced mortality.

Researchers Dr Brian Cooke and Dr Tanja Strive

[4] Strive T, Wright JD, Robinson AJ (2009) Identification and partial characterisation of a new lagovirus in Australian wild rabbits. *Virology*. 384(1): 97-105

RHD Boost (Project 7.T.12e)

RHD Boost aims to select and import genetically and antigenically distinct RHDV strains that are lethal to rabbits immune to endemic Australian Rabbit Calicivirus (RCV-A1) and rabbits resistant to infection with Czech 351 derived RHDV strains. In its concluding year the project will design effective release and monitoring strategies.

Key achievements to date:

- Industry and Investment NSW were able to secure a two year permit to import quarantine material for the Elizabeth MacArthur Agricultural Institute (EMAI) laboratories from AQIS.
- Dr Peter Kirkland and Dr Andrew Read of EMAI, Industry and Investment NSW, travelled overseas during October and November 2009, where part of their trip allowed them to visit key laboratories in Europe to negotiate the supply of strains of RHDV.
- Key European laboratories have made a commitment to supply EMAI with isolates of RHDV from a variety of geographical and temporal locations.
- The OIE Reference Laboratory at Brescia in Italy has agreed to perform much of the antigenic characterisation of these isolates. Genetic characterisation will be undertaken in several overseas laboratories as well as Australia.
- Following initial characterisation of the new viruses, selected viruses will be imported into Australia and used for in vivo studies in rabbits to identify strains that may have higher virulence or other characteristics such as higher levels of excretion or capacity to infect rabbits that have been infected with other strains of either RHDV or RCV.

"This important project, RHD-Boost, could benefit all landowners in NSW. Anything we can do to reduce the number of rabbits is a good thing,"

Former NSW Primary Industries Minister Ian Macdonald

.

Development of a Shelf-Stable Rabbit Haemorrhagic Disease Virus (RHDV) Product (Project 7.T.2)

This project is developing a freeze-dried stock of RHDV that can be easily and safely transported without the need for dry ice, significantly reducing costs and bureaucratic impediments to uptake.

Prototype CO pressure fumigators

Batches of RHDV bulk virus have been produced and several freeze-drying methods (with different protective elements and drying conditions) have been evaluated.

A pilot batch of freeze-dried RHDV product has been incubated at different temperatures to assess stability under real-time and accelerated conditions. Stability studies over 1, 3, 6, 9, 12 months have been completed showing that the virus has a shelf life of greater than 12 months when stored between 2-8°C and remains infective when stored at ambient temperatures (up to 27°C) for 1 month. Product development work for registration completed and preliminary paperwork for Australian Pesticides and Veterinary Medicines Authority (APVMA) sale and distribution approval has been submitted.

Completing the Development of a CO Pressure Fumigator for Integrated Rabbit Management (Project10.U.12)

There is a strong market pull for a fumigation management tool that is portable and humane in action that can be incorporated into integrated rabbit management programs particularly where biocontrols are less effective and poison baiting/warren ripping are precluded.

Following tests from the initial prototype, the fumigator was com re-engineered to improve field reliability and operational perform

Registration application criteria

and data packages have been discussed with the APVMA, and there is international interest in the CO pressure fumigator.

Rabbit project manager (Project 7.T.4)

This project seeks to deal with the growing rabbit problem in two ways. The first, by establishing demonstration sites to provide training and advice for dealing with the immediate problem of keeping rabbit numbers down. Secondly, by developing desktop studies that consider the long-term prospects for rabbit control, especially those that will facilitate control in the future such as new biological control agents. A key outcome of the project will be the contributions made in developing the national rabbit management package, relating to the education and extension goal of end-user capacity building. The production of extension materials is also designed to enhance skills and knowledge to effectively delivery best-practice invasive animal management strategies.

Key achievements of the project in the last year include:

- Completion of field demonstration sites in two states and running of successful field days and a training school to disseminate results.
- Continued input into RHD-Boost project by providing key epidemiological data and likely economic and ecological benefits of improving levels of rabbit control.
- Research on co-evolution of RHD virus virulence and rabbit genetic resistance (includes supervision of IA CRC-supported PhD studies by Peter Elsworth DEEDI Qld).

Above: Demonstration of back-hoe at Smithville road field day

Below: Peter Sandell explains the features of an excavated rabbit warren to illustrate the need for deep ripping and ripping well beyond the apparent warren perimeter

Oral Delivery Chemical fertility control of rodents (Project 3.T.3e)

A new chemical fertility control technology (4-Vinylcyclohexene Diepoxide, (VCD)) that could substantially reduce rodent impacts on rice production in developing countries is being formulated by SenesTech Inc and studies are being conducted in parallel in the USA, Australia and Indonesia.

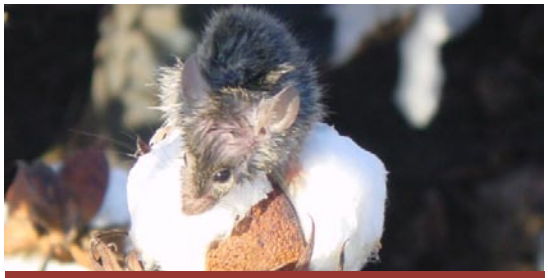
VCD does accelerate ovarian follicle depletion and has a potential to be a chemosterilant in female rats. Food uptake studies in rice-field rats have identified a bait type and formulation that is attractive and palatable.

"The Hattah demonstration site has clarified the level of investment required per hectare to 'knockdown' high rabbit populations to a level which will allow woodland recovery.

It has also helped us ascertain costs and benefits of including oat baiting.

It's key information that will help us plan into the future."

...Peter Sandell
Environment Program Manager,
Parks Victoria



Rodents have major impacts on harvesting industries.

Control of rodent infestations and commercialisation of new rodenticides (Project 3.U.2b)

Currently there are no registered rodenticides for use to control the house mouse in a variety of intensive agricultural crops. Similarly, rodenticide products are required to control rat species in intensive crops and plantations, and to establish improved methods for control in industrial situations. Trials were conducted under pen and field conditions to assess efficacy, palatability, stability and residues in pesticides and bait types.

Overall, the 'Control of rodent infestations in intensive crops, industrial and island situations' project demonstrated the efficacy of rodenticide formulations in a variety of situations where no registered chemical control methods were previously available, or where improved techniques were required.

Minor Use and Emergency Use permits obtained for a variety of crops and rodent species. ACTA are now recognised as a major contributor to innovative rodent control in Australia and hence are approached by a variety of stakeholder when rodent problems emerge, especially in situations where no rodenticides are currently registered.

Codes of practice and standard operating procedures for humane invasive animal control (Project 5.T.6e)

A model has been previously developed to allow an assessment of humaneness using a systematic, comprehensive and transparent process. It is used to assess the humaneness of existing control methods and then make this information available to all those involved in invasive animal management. It has also been formally endorsed by the Vertebrate Pests Committee, the Australian Animal Welfare Strategy Wild Animals Working Group, DAFF and RSPCA Australia. It is currently under consideration by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for incorporation in their product registration process.

All States and Territories have now agreed to the adoption of the COPS and to the phasing out of several techniques categorised in the codes as 'unacceptable'.

During 2009, the humaneness assessment model was used by an expert panel to assess the relative humaneness of currently used control pest animal control methods in Australia. The SOPs were used as the best practice methods during this process. The model has been formally endorsed by the Vertebrate Pests Committee, the Australian Animal Welfare Strategy Wild Animals Working Group, DAFF and RSPCA Australia. It is currently under consideration by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for incorporation in their product registration process.

Systems for Herbivore Management (Project 9.T.1)

The current project has been undertaking the development of oral delivery systems for control agents which could be used to manage herbivores, such as wallabies, kangaroos, horses and camels, in the Australian environment.

The project has recently discovered that adult females vaccinated with GonaCon® are infertile for at least 2.5 years. Juvenile male tammars vaccinated at before the onset of puberty do not become sexually mature for at least 2.5 years after vaccination.

Adult male tammars vaccinated in March 2009 have shown a very rapid decrease in testis volume indicating that testosterone concentrations are decreasing as a result of the production of GnRH antibodies after vaccination.

Improving management of Australia's pest birds (Project 9.T.2)

Bird damage to agricultural production is a growing problem in Australia, with over 100 species that can cause significant losses to fruit, nut, grain, rice and aquaculture industries, create conflicts in urban areas, damage infrastructure, reduce aesthetic values, and pose risks to the environment and to human health.

Key achievements of the project include:

- Methods to reduce pest bird abundance and damage evaluated, with tools developed to improve pest bird management.
- 11 cases studies demonstrating effective local and regional control produced.
- Publication of national management guidelines for pest birds developed in cooperation with the Bureau of Rural Sciences.
- Key national recommendations for future research and development produced with industry and government endorsement.
- National risk-based framework developed for the surveillance of avian influenza in wild birds.
- Costs and benefits of management techniques for pest birds evaluated.
- A simple tool developed to allow land managers to compare the costs and benefits of bird netting over time.
- Implementation of the national risk-based framework for the surveillance of avian influenza in wild birds in cooperation with the Avian Influenza Wild Bird Steering Group.

NRM liaison officer (Project 11.T.1)

The development of the NRM Liaison Project enables the IA CRC to maintain a Liaison Officer who will provide specialist support to NRMs nationally to develop a consistent integrated approach to reducing the impact invasive animals have on natural resources. The Liaison Officer is involved with bringing public and private land managers together to cooperatively and collaboratively manage the impacts of invasive animals with best practice methods.

Key achievements include:

- Border Rivers- Gwydir CMA: A contract to develop an Invasive Species Management Plan for their region was secured. There were four pest management and prioritisation workshops held and the outcomes from these workshops have since been used to formulate a draft regional invasive species plan for the Border Rivers- Gwydir catchment.
- RabbitScan: The NRM Liaison Officer was a critical link between the RabbitScan mapping tool and encouraging the 562 Local government councils and the 56 NRM Boards to participate in the rabbit mapping project.
- National NRM Engagement: Ongoing contact has been made with all NRM regions including the distribution of a selection of current and diverse invasive animal publications and resources. This was followed up by the development and distribution of a newsletter, 'NRM Notes' which provides a channel for direct contact with NRMs on a regular basis across the country.
- PestSmart Toolkit and End- User Workshops: The Lachlan, Desert Channels and Kangaroo Island NRMs were all visited in April/ May 2010 to hold a series of workshops with Dr Lisa Robins that were gathering information on how to address the needs of regional decision makers within NRM groups.
- In the last 12 months, individual contracts to assist NRM regions have been secured in addition to the more informal contact with a wide selection of NRM groups- which is hoped to expand as funding applications are accepted in the near future

"The IA CRC 'Pest Plan' process is a very effective way to engage the community about how we manage invasive species.

"The Regional Strategic Invasive Species Plan produced by the IA CRC will help guide our investment in invasive species management."

... Jonathan Lawson

Catchment Officer Invasive Species

Border Rivers-Gwydir Catchment Management Authority

Freshwater Products and Strategies

The program has seen trials of genetic technology daughterless constructs by CSIRO in carp at Auburn University and screening of these carp as the fish mature to test for efficacy, inheritance and fitness effects, with early results proving promising.

Synthetic pheromone implants have been found to induce the release of a pheromone in both male and female carp for up to two weeks, and the optimal dose for implantation has been determined, and is both cost effective and biologically potent.

Emigration and source-sink dynamics are from carp movement tracking is providing direct input into multi-stock CarpSim models.

A rigorous assessment of KHV in the laboratory against Australian native species and carp strains has demonstrated the susceptibility of smaller Australian carp (approximately 1.8 – 4.4 cm) to KHV and determined the KHV Indonesian strain is the most effective strain. Native species; Murray cod, silver perch and golden perch are not susceptible to infection with KHV and carp-goldfish hybrids appear to be, at the very least, much less susceptible to KHV than pure carp.

The various administrative processes and pathways that need to be undertaken for the practical field use of pest fish control technologies are being mapped and documented.

Acoustic carp attractant and repellent trials are being conducted in two experimental systems, with the development of a functional field-ready recording/playback system.

In Tasmania, integrated carp eradication is continuing at Lakes Sorell and Crescent, where the feasibility of prostaglandin as a chemo attractant is being tested and historical and ongoing radio-tracking data is being reviewed to identify potential environmental and biological cues associated with carp aggregations.

An optimised carp cage and lifting infrastructure has been designed, constructed, installed and evaluated at the Lake Bonney wetland in South Australia – designed to harvest carp attempting to exit the lake during an environmental water allocation.

Draft Standard Operating Procedures and a User Guide (including video guide) for the use of the Lake Bonney WCHS was developed.

In Queensland, the efficacy of integrated management techniques, namely predator introduction and physical removal, to control feral tilapia populations is being investigated and development of a tilapia 'toolkit' is underway to promote a better understanding by natural resource managers and the community of issues related to tilapia biology, management and control. This will be complemented by a web-based decision-support tool, being developed to assist staff in making rapid, effective management decisions once a pest fish incursion has been confirmed.

The role of the community in the effective management of carp has been investigated in Queensland, demonstrating the effectiveness of different management techniques these groups could employ.

Within the Murray-Darling Basin, the status of carp populations and aquatic ecosystem parameters were benchmarked as a phase 1 project (Jan 2007 - Feb 2009) and the River revival: Lachlan River Carp Cleanup held an official project launch in Forbes on the 16th September 2009.

IA CRC developed and other available carp control tools and strategies are now being utilised to remove as many carp as possible from the Lachlan demonstration site with the aim of demonstrating the response of the aquatic ecosystem to reduced carp biomass.

Lachlan River Carp Cleanup

Ian Kiernan (Carp Cleanup Ambassador), Rob Gledhill (Chair, Lachlan CMA), Adrian Wells (National Carp Taskforce), Tony Peacock (IA CRC)

Sexually receptive female carp can be strongly attracted to a male-derived pheromone.

Carp sensory attractants (Project 4.F.4)

Advances in isolating carp and goldfish specific pheromone cues (in the Sorensen laboratory) have led to the possibility of employing sensory attractants (pheromones) for carp control.

As part of its Phase 1 IA CRC project, the Sorensen laboratory discovered that prostaglandin F2α (PGF2α) functions as a key component of a potent ovulatory female sex pheromone which attracts male common carp. A technique was developed in which PGF2α was implanted into female carp in long-lasting drug pumps. The present year-long extension seeks to optimise this technique so that it might be tested and then developed in Australia.

The project has determined that synthetic prostaglandin implants can induce the release of a pheromone in both male and female carp for up to two weeks.

The optimal dose of PGF2α needed for implants has now been determined and is both cost-effective and biologically potent. Higher doses are no more effective and result in mortality.

Results from this project were presented at the 139th meeting of the American Fisheries Society in Nashville, Tennesee, USA (August 30 – September 3, 2009) 'A female sex pheromone in the common carp'

For further information, see page 40 of the IA CRC Research Portfolio Summary.

Daughterless fish technology (Project 4.F.3)

The project has developed a novel genetic approach that causes genetic females to become functional males and that, in theory, will distort population sex-ratios to the extent where models predict pest eradication at practical stocking levels. Work to date has demonstrated that a prototype sex-ratio distorting construct changes genetic females info functional males, as predicted.

A first suite of constructs (Daughterless carp Mark 1, two potential female sterility/lethal gene constructs [aromatase-ricin alpha and vitellogenin-ricin alpha] and Sterile Feral construct mark 4) was electroporated into carp eggs at Auburn University in June 2009. The fish were re-examined in June 2010, after a full years' growth, to determine construct effects on sex ratio and, from genetic samples returned to Hobart, to identify integrated carriers.

A preliminary test of the effects of the VTGN-Ricin alpha female sterile/lethal construct was conducted by dosing the juvenile carp with estrogen. In both of two treatments (different combinations of the vitellogin constructs) dosed with estrogen, the lethality was 30%. Lethality probably relates to the proportion of eggs in which the construct was taken up during electroporation, rather than the strength of the lethal construct. Trials in zebrafish provided similar results.

The first daughter-less carp?
Auburn Univ, 28 Aug 09

The efficacy of the genetic technology was improved by incorporating the latest developments of genetic technology into the construct design. During 2009/10 several up-dated constructs were built for carp, and these were electroporated into carp eggs at Auburn University in June 2010.

Key background information of the physiology and genetics of sexual differentiation in carp has been provided in the completion of Megan Barney's PhD through University of Tasmania.

Cell line trials have been undertaken to test the efficacy of the blocking sequence used in the daughterless construct.

Results from this project were presented at the 139th meeting of the American Fisheries Society in Nashville, Tennesee, USA (August 30 – September 3, 2009) 'Daughterless carp'

Results from this project were presented at the international symposium on the genetic biocontrol of invasive fish in Minneapolis, Minnesota, USA (June 21 – 24, 2010) 'GM Technologies for the Control of Invasive Fishes: Theory and Practice of Constructs to Reduce the Fertility and Viability of Pest Populations'

Integrated tagging for determining movement and migration of carp within the Murray-Darling Basin (Project 4.F.6)

This major, long-term project coordinates a program of marking and recapturing (or re-locating) individual carp to determine temporal and spatial movement patterns of carp. Large-scale and long-range movement of tagged carp has been limited to-date. Low flows, experienced around much of the Murray Darling basin, and particularly in the Murray River valley, may have limited opportunities for many of the tagged carp to move large distances. Although many individuals have so far remained reasonably sedentary their potential longevity means that large-scale dispersal is still a possibility for the remaining duration of the project.

21 pairs of acoustic receiver / data-loggers have been installed in strategic locations around the Murray-Darling Basin and 234 carp have been implanted with passive integrated transponder (PIT) tags and coded acoustic tags (CAT).

Of the 234 tagged carp to date, there have been 2.2 million detections on the VR2 acoustic loggers (32% of tagged carp have been re-detected).

Dispersal beyond the river of release has been rare; only 5% of tagged carp and all males.

Five tagged carp were recaptured and reported (4 angled, 1 electrofished).

Two tagged carp were detected moving through fishways on the Murray River. Some tagged fish are also known to have passed-by weirs with a fishway containing PIT tag detectors while avoiding detection.

Emigration and source-sink dynamics are a key knowledge-gap and required as direct input into multi-stock CarpSim models (6 dimensional, age-based, size structured, spatial population dynamics simulation). Information from this project is starting to fill this gap. Simulation of realistic levels of stock-interaction is now possible.

Results from this project were presented at the 139th meeting of the American Fisheries Society in Nashville, Tennesee, USA (August 30 – September 3, 2009) 'Simulating the population dynamics of carp in Australia and Minnesota with an aim to developing methods for control'

For further information, see page 43 of the IA CRC Research Portfolio Summary.

Koi Herpesvirus (KHV): Its potential as a biological control agent for carp in Australia (Project 4.F.7)

Koi herpesvirus (KHV) or Cyprinid herpesvirus 3 (CyHV-3) has devastated carp populations in the US, Israel, Europe and China. Having not yet presented in Australia, KHV may be a highly effective biocontrol if managed and implemented correctly as opposed to unregulated escape. Overseas evidence is very promising, suggesting KHV is species specific (carp only) and highly effective against carp.

The Fish Diseases Laboratory at the high-security CSIRO Australian Animal Health Laboratory is examining the potential of KHV as a biological control agent for carp in Australia, undertaking a rigorous assessment of KHV in the laboratory against Australian native species and carp strains.

The project has established methods for isolation and growth of KHV in cell culture and methods for detection and identification of KHV by PCR to international standards.

Results from the project have demonstrated that the KHV Indonesian strain is the most effective strain. The susceptibility of smaller Australian carp (approximately 1.8 – 4.4 cm) to KHV has been demonstrated.

Immunocytochemical studies on KHV in tissue culture were conducted, with preliminary studies indicating that viral antigens in tissue culture can be localised using the same commercial antibody that is also used for immunohistochemistry.

Molecular and histopathological data have demonstrated that Murray cod, silver perch and golden perch are not susceptible to infection with KHV.

Susceptibility studies have revealed that carp-goldfish hybrids appear to be, at the very least, much less susceptible to KHV than pure carp

For further information, see page 38 of the IA CRC Research Portfolio Summary.

Path to adoption for pest fish control technologies (Project 4.F.8)

The project is identifying and documenting the various administrative processes and pathways that need to be undertaken for the practical field use of pest fish control technologies.

Reviewing the legislative framework is a relatively straightforward process. The difficulty comes in determining the various policy aspects and how the intra- and inter- state and national jurisdictions interact. Determining whether an approval is a statutory or a policy requirement is not straightforward. Similarly where public consultation and referral processes sit and how and when should these be undertaken is also highly relevant.

The project is not designed to develop policy but to clarify the pathways that need to be followed for the implementation of a control strategy.

Initial detailed work has concentrated on the legislation covering the use of genetically modified fish.

Results from this project were presented at the international symposium on the genetic biocontrol of invasive fish in Minneapolis, Minnesota, USA (June 21 – 24, 2010) 'The Australian Gene Technology Regulatory Framework

For further information, see page 39 of the IA CRC Research Portfolio Summary.

Managing carp via acoustic attractants and repellents (Project 4.F.14)

The project is a scoping study into the possibilities of using acoustics and telemetry to better manage carp (and other invasive freshwater fishes).

The project has developed a functional field-ready recording/playback system. Appropriate reference sounds have been identified i.e. constant pitch/level.

A library of potential attractant and repellent/herding sounds has been collected.

Preliminary attractant trials have been conducted in two experimental systems. Advanced Eonfusion (a software tool for analysing and visually exploring time-varying spatial data) training has been completed by project staff.

For further information, see page 42 of the IA CRC Research Portfolio Summary.

Integrated carp eradication. Demonstration site – Lakes Sorell and Crescent, Tasmania (Project 4.F.16)

The project is testing the feasibility of prostaglandin as a chemo attractant in the field to facilitate capture of carp and reviewing historical and ongoing radio-tracking data to identify potential environmental and biological cues associated with carp aggregations. This will contribute to the management of carp populations and support eradication procedures, as part of an integrated pest fish strategy. It will also provide a method for assessing carp in large water bodies with low population densities.

Recording and mapping of all transmitter fish movement during three preliminary trials has been completed. Potential improvements in experimental design have also been identified. Documentation of processes and procedures has been completed and water samples and trial results have been provided to IACRC project number 4.F.13 (Aaron Elkins).

Results from this project were presented at the 139th meeting of the American Fisheries Society in Nashville, Tennesee, USA (August 30 – September 3, 2009) 'An integrated approach to eradicating carp in Tasmania'

For further information, see page 40 of the IA CRC Research Portfolio Summary.

Optimised wetland carp separation cages (WCSC) (Project 4.F.17)

The project involved the design, construct, installation and evaluation of an optimised carp cage and lifting infrastructure set-up at the entrance to Lake Bonney – a set-up designed to harvest carp attempting to exit the lake during an environmental water allocation.

The WCSC is safe, effective (in lifting up and down and emptying carp - carp capture is yet to be demonstrated), easy to operate, vandal resistant and (somewhat) transferable.

Quantitative data on the lateral movement of carp and large-bodied native fish was obtained.

Quantitative data on the proportion of the lake's carp population removed was obtained (albeit by commercial fishers).

Draft Standard Operating Procedures and a User Guide (including video guide) for the use of the Lake Bonney WCHS was developed.

For further information, see page 37 of the IA CRC Research Portfolio Summary.

Both the jumping and pushing traps proved a great success in removing large numbers of carp (around 8 tonne in 4 months) and both show great promise for wider application in fishways and irrigation channels.

Management strategies for the control and eradication of feral tilapia populations in Australia (4.F.18)

During the first phase of the IA CRC work on tilapia control and management, effort was concentrated on documenting the biology and ecology of Australian populations of T. mariae and *O. mossambicus*, investigating the efficacy of various control strategies through simulation modelling and limited trialling of integrated control strategies. A comprehensive literature review of the biology, distribution and control of feral populations of *O. mossambicus* was also produced.

The phase 2 project is evaluating of the efficacy of integrated management techniques, namely predator introduction and physical removal, to control feral tilapia populations and developing a tilapia 'toolkit' for promoting a better understanding by natural resource managers and the community of issues related to tilapia biology, management and control.

The project is continuing and extending the current integrated control trial in the Herberton weir. The monthly electrofishing program is continuing to physically remove tilapia, and an additional native predator (*Lates calcarifer*) is to be stocked into the weir to assess their predatory impact on the remaining *O. mossambicus* population (particularly the juveniles).

A one day workshop of end-users was held in Gladstone in conjunction with the Queensland Pest Animal Symposium (3-5 August, 2010) to determine the type of information to include in the 'toolkit' and in what format it should be presented.

Tilapia can be a major problem in waterways. (image courtesy of Qld Department of Primary Industries)

For further information, see page 49 of the IA CRC Research Portfolio Summary.

Decision-support tool for management of freshwater fish incursions (4.F.18)

The project is developing a web-based decision-support tool to assist staff in making rapid, effective management decisions once a pest fish incursion has been confirmed. The user will answer a series of questions (with drop down boxes) and follow steps to ensure all appropriate issues are considered in a logical sequence. This process will guide managers through the options and feasibility of eradication, containment and control techniques.

A Steering Committee and a Technical Advisory Group have been appointed with appropriate representatives from all States and Territories. The Steering Committee will oversee the direction of the project, its content and progress towards milestones, and the Technical Advisory Group will provide specific expertise to assist in development of the tool.

A review of relevant existing international and national invasive species websites and decision-support tools has been undertaken to assess and summarise their structure, components and approaches, strengths, weaknesses, gaps, implementation etc.

Carp Control in the Logan and Albert Rivers Catchment (10.F. 8)

The project investigated the role of the community in the effective management of carp and demonstrated the effectiveness of different management techniques these groups could employ.

Outputs of the project include a report on the role of fishing competitions in pest fish management; guidelines for planning and running carp fishing competitions; a report on the social drivers behind participation in pest fish-out competitions; a report comparing the

effectiveness of carp removal techniques (an assessment of techniques suitable for local governments and community groups) and four annual reports.

Three surveys of carp distributions in the Logan and Albert Catchment were completed..

For further information, see page 45 of the IA CRC Research Portfolio Summary.

River Revival – Lachlan River Carp Cleanup Demonstration Reach Project (10.F.9)

A demonstration site for the implementation of carp control strategies has been established within the Murray-Darling Basin where the status of carp populations and aquatic ecosystem parameters were benchmarked (Jan 2007 - Feb 2009).

IA CRC developed and other available carp control tools and strategies are now being utilised to remove as many carp as possible from the Lachlan demonstration site with the aim of demonstrating the response of the aquatic ecosystem to reduced carp biomass.

The River revival: Lachlan River Carp Cleanup held the official project launch in Forbes on the 16th September 2009.

Priority activities under the draft carp control plan include limiting or preventing migration of large carp into known carp recruitment hotspots (project 4.F.5) within the demonstration reach using trap designs developed under project 4.F.12; using fishway William's Carp Separation Cages to harvest carp migrating within the river channel; using pheromone traps developed under project 4.F.4; using the Judas carp approach to maximise the commercial harvest and removal of carp from Lake Cargelligo and comparing the efficiency of pheromone traps in lake versus flowing water environments.

Success of the project will be gauged through ongoing implementation of the monitoring program established during the benchmarking phase.

Continuing otolith micro-chemical analysis is being used to gauge changes in the contribution of recruits from the Lake Cargelligo hotspot to the broader lower Lachlan system following implementation of management actions, and identify additional hotspots within the demonstration site.

The cost-effectiveness of each carp removal strategy will be determined and compared using a basic financial analysis.

Community education and engagement will be facilitated by following the projects community engagement strategy.

For further information, see page 46 of the IA CRC Research Portfolio Summary.

Detection and Prevention program

The Detection and Prevention (D&P) Program primarily address CRC Outcomes 8 (reducing disease), 9 (reducing risks) and 12 (national benchmarking). Over the past year the program has focused on building information on the whereabouts, impacts and risks of invasive animals in Australia.

The D&P Program has had another varied and productive year! Highlights include the much-awaited release of the report costing invasive animals and their impacts: *Economic impacts of vertebrate pests in Australia*, and the PestMaps website going live with national and regional maps of key pest animals.

From a biosecurity perspective, our major DAFWA project completed risk assessments for 40 exotic vertebrate species, to validate the latest nationally used Bomford models and to highlight high-risk species that could be Australia's next pests. The project's final report was published in May this year. The CRC also made submissions on: the proposal for novel biota to be a Key Threatening Process, the review of the Environment Protection and Biodiversity Conservation Act 1999 and to the Biosecurity Advisory Council. We also helped organise the Global Biosecurity 2010 conference in February.

Social research has continued, with the community awareness survey highlighting the public's top perceived pests, and attitudes to control options. We have also conducted social research into end-user's preferences for capacity-building tools, and barriers to their use of new products. This research will help inform how the CRC shapes its R&D into user-friendly pest management information products ('PestSmart' toolkit).

Our interest in islands has also continued this year, with an international workshop held in New Zealand to discuss rabbit eradications on islands. We have also continued with our islandNet network and newsletter, linking pest management professionals and others interested in island conservation issues.

The genotyping facility at the University of Canberra has continued to play a crucial role in the ongoing Tasmanian fox eradication program. It has also been involved in a couple of regional-level programs assessing genetic linkage between animal populations, to help inform pest management strategies in the NSW Blue Mountains and on Kangaroo Island.

Finally, our national mapping project has continued to engage state and territory agencies, and received outside funding for developing community-based reporting of various pest animals, based on the success of RabbitScan.

Further information on key achievements follows.

Validating and refining risk-assessment models (Projects 9.D.1 and 9.D.9)

An influential report on risk assessment models was published, and is continuing to be used by Commonwealth and state agencies in decisions to import and keep exotic vertebrate species.

Reports from these projects have been used for public awareness campaigns and CRC submissions and to advise the VPC.

Following from the models developed by Bomford, 40 species were assessed by the Department of Agriculture and Food WA. The 40 species assessed comprised 17 mammals, one bird, 11 reptiles and 11 amphibians, from species internationally recognised as invasive to species perceived to present low risks. The variety of species include animals that have not yet entered Australia, animals currently kept in Australia as pets, livestock or in zoos, and animals that are already widely established in the wild here. Livestock species assessed were chital, red and fallow deer, domestic sheep and ostrich.

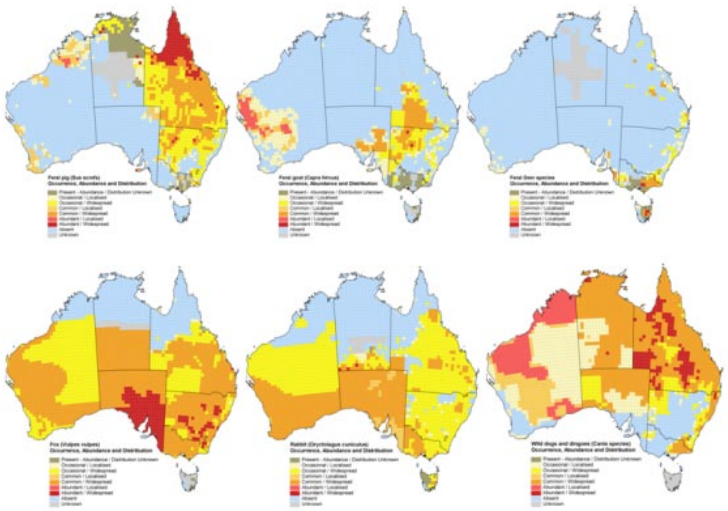
"It is always difficult to get magistrates to understand the impact of pest species when applying penalty for an offence. The risk assessment was an important part of the supporting sentencing statement provided.

This is a practical example of how the risk assessments can be used to achieve a statutory outcome. Thanks for your help."

Mark Williams, SA Department of Water, Land and Biodiversity Conservation.

The assessments have been used for prosecution cases regarding the import and keeping of high-risk species.

For further information, see page 89 of the IA CRC Research Portfolio Summary.



Mapping invasive animals of Australia (Project 12.D.1)

The major project outputs to date have been the production of national, state and NRM region maps that show the distribution and abundance of ten key pest animal species (feral pigs, feral goats, rabbits, foxes, feral cats, wild dogs and dingoes, common carp, starlings, cane toads and feral deer). These maps and case studies of pest animal impacts were published as a joint NLWRA/CRC report Assessing invasive animals of Australia 2008 and the maps are now published on the 'PestMaps' website within www.feral.org.au.

For further information, see page 113-114 of the IA CRC Research Portfolio Summary.

National Genotyping project (Projects 10.D.12b and 12.D.8).

This project aims to establish a national facility using cutting-edge DNA technology to identify and genetically characterise key invasive species from tissue or trace samples collected in the field. The applications for this technology include detection of cryptic species, defining units of control, determining barriers to dispersal, estimating population size and other population-level studies for management purposes.

Through the project, the IA CRC is assisting the identification of individual foxes in Tasmania from analysed scats, and is also conducting a large-scale sampling of cats across the continent. A short course in genetic applications to wildlife management has also been developed, with the first course to be conducted in October 2010.

IA CRC Program Leader, Prof Stephen Sarre, checks samples at the National Genotyping Facility

For further information, see page 91 of the IA CRC Research Portfolio Summary.

Socio-economic costs of invasive animals (Project 12.D.6)

This project assessed a range of impacts attributable to vertebrate pest animals throughout Australia. The information obtained from these impact analyses will allow a better understanding of the range of impacts vertebrate pests have on our economy, people and biodiversity. The reports will also provide tools for leveraging for further resources for pest management.

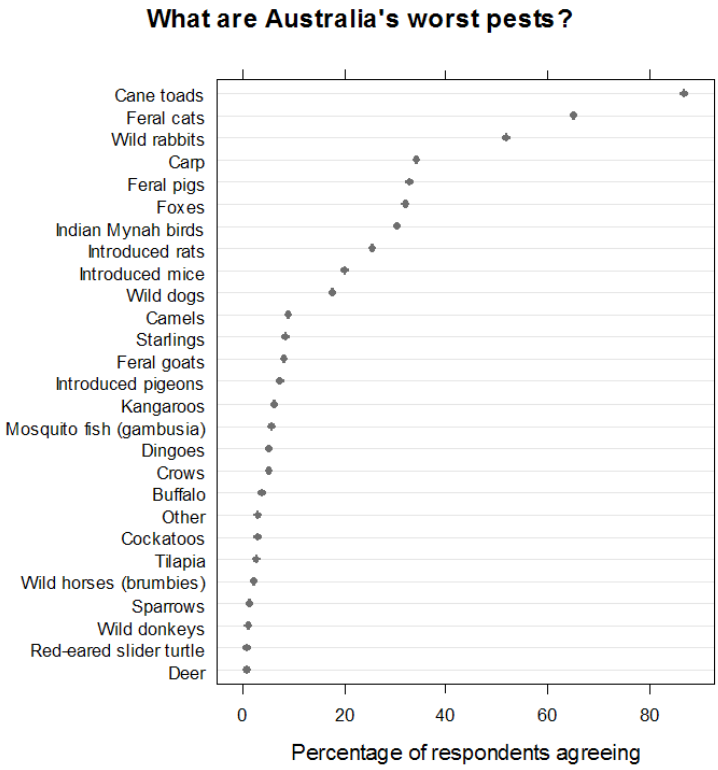
The report was published and launched by the then Minister for Agriculture, Fisheries and Forestry, the Hon Tony Burke MP, in August 2009. The launch resulted in widespread media coverage.

For further information, see page 94 of the IA CRC Research Portfolio Summary.

National Community Awareness survey (Project 10.D.12b)

This project with ValueMetrics Australia and Julian Cribb and Associates uses an internet-based survey to determine community awareness of and attitudes to pest animal issues. It aims to provide an ongoing community assessment and help the CRC to fine tune its communication strategy by identifying community concerns.

The survey has now been running three years and shows that Australians are generally well aware of the threat posed by introduced pests and strongly support the development of improved methods for controlling them. Main findings of the survey to date are:



- the 'top five' invasives are cane toads, cats, rabbits, carp and foxes followed by feral pigs and Indian mynah birds
- cane toads are ranked one of the worst pests by 80 per cent of respondents, feral cats are ranked one of the worst by two thirds of respondents and rabbits are ranked one of the worst by almost half of respondents — these three have been consistently ranked as Australia's three worst invasive animals
- issues of concern to members of the public regarding the control of pest animals include humaneness, ethics of 'right to kill' and non-target effects.

The final quarterly report was submitted in June 2010 and a culmination report is now in development.

For further information, see page 117 of the IA CRC Research Portfolio Summary.

islandNet network for island conservation (Project 3.D.1)

The islandNet network was established by the IA CRC with funding support from the Australian Department of Environment, Water, Heritage and the Arts (DEWHA), primarily to help facilitate the conservation management of Australia's offshore islands. The network aims to bring together people and organisations with a common professional interest in island conservation issues, with a focus on eradication of rodents, and includes researchers, field officers, government employees, consultants, companies with commercial interests involving islands, indigenous and island community representatives.

The network is provided with a quarterly newsletter, providing snapshots of island research, relevant national and international news and upcoming events. An islandNet website has been developed on www.feral.org.au. The site hosts a resources database containing articles, reports, policy documents and images of island-related research and management.

islandNet

"Thank you for this fantastic edition of the islandNet newsletter. As usual, it is full of great snippets of information!"

Shyama Pagad, Manager, Information Services, Regional Office for the Pacific (New Zealand), IUCN SSC Invasive Species Specialist Group.

"Thank you, and a great initiative. It's amazing how effective such methods of communication can yield so much information and awareness, well done."

Paul Meek, NSW Department of Environment and Climate Change.

Uptake program

The Uptake of Products and Strategies Program bridges the research-to-market gap by coordinating national and international registrations, commercialisation, market research and delivery of IA CRC market ready products to industry partners. Demonstration sites directly engage local communities and showcase new ways of looking at cross-tenure and cross-discipline pest animal control techniques. The Program is aligned with all IA CRC Outcomes to some extent, except 3 (rodents) and 5 (cane toads), but principally focuses on Outcomes 1 (canids), 2 (feral pigs), 4 (carp), 6 (feral cats), and 10 (industry growth).

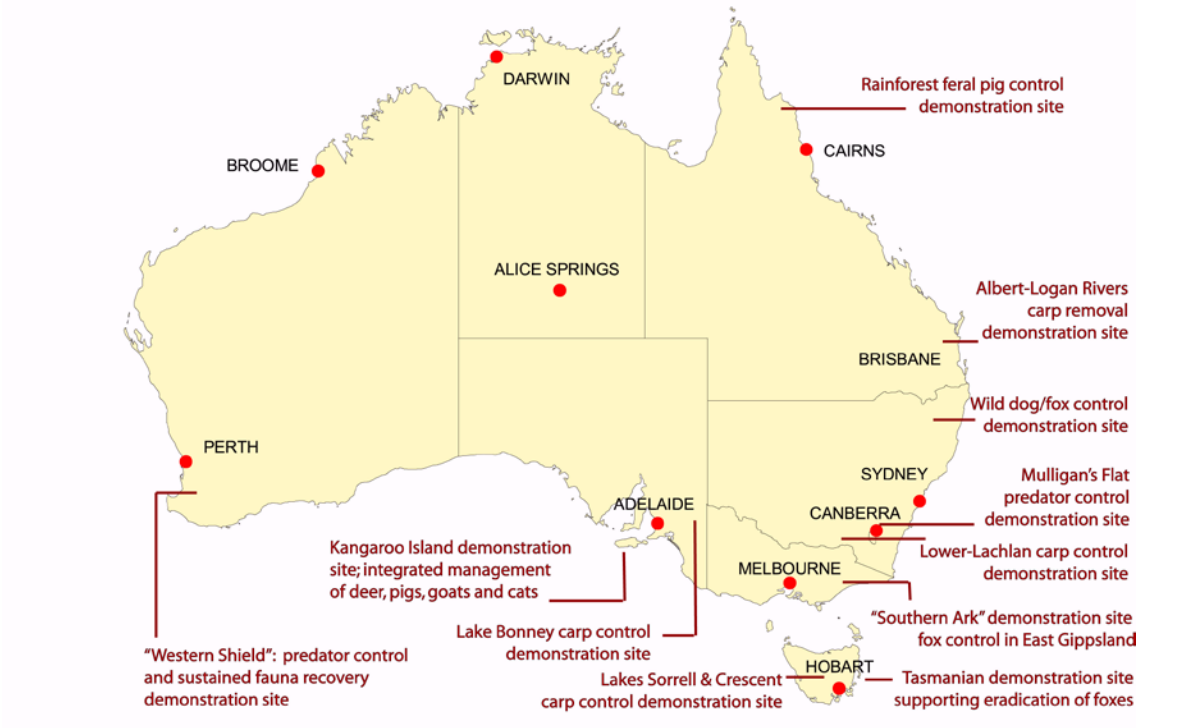


Figure 4: IA CRC demonstration sites

The Uptake of Products and Strategies Program has been highly productive during 2009/10, managing the HOG-GONE®, HOG-HOPPER™, RHD, PAPP, Carbon Monoxide Fumigator and BLUE HEALER projects.

Management of IP and commercialisation processes (ie. prosecution of the nitrite patent internationally) continues, and the program staff have also been proactively searching for international partners to sub-licence nitrite IP for the benefit of an Australian SME participant.

Some of the specific outputs and achievements include:

- The "Review of cat ecology and management strategies in Australia" report prepared by Dr Elizabeth Denny and Prof. Christopher Dickman being launched by the Invasive Animals CRC and the RSPCA in February 2010.
- 2010 Fulbright Professional Business/Industry Scholarship being awarded to the Uptake Program Leader A/Prof Steven Lapidge and his posting at USDA's National Wildlife Research Centre in Ft Collins, Colorado.
- Attendance at the 7th European Vertebrate Pest Management Conference in Lyon, France in September 2009, the International Wild Pig Conference, in Pensacola, Florida, USA in April 2010 and the Global Biosecurity 2010 Conference, in Brisbane, QLD in February 2010.

Feral pig control solutions (Project 2.U.1)

Results from the feral pig projects were presented at the Wild Pig Conference, in Pensacola, Florida, USA in April 2010 as well as at the 7th European Vertebrate Pest Management Conference in Lyon, France in Sept 2009.

The project trialled a number of different formulations for the HOG-GONE® bait, with the process ongoing. The project was successful in attracting funds for the nitrite humaneness assessment (conducted by the Institute of Medical and Veterinary Science, Adelaide) as well as a non-target risk assessment by Connovation and Landcare Research in New Zealand. Funding was provided by the Federal Department of the Environment , Water, Heritage and the Arts.

""It would be a really good thing to have access to baits like these. From the tests, they seem effective, they're humane and there could be an antidote for working dogs which is the best thing about it. The biggest thing the pig does is carry the leptospirosis virus which can cause abortions and fertility problems in cattle."

Brett Schiffmann, Manager of 'Glenrock', near Scone, NSW, on HOG-GONE®."

Extensive pen and field testing of the HOG-HOPPER™ was completed, and an optimal unit design established. During the final field efficacy trial, the HOG-HOPPERTM reduced feeding feral pig populations by 90-100 per cent when delivering 1080 laced grain or PIGOUT®. In addition, the HOG-HOPPER™ was able to successfully exclude all non-target species, meaning no bait was wasted or non-target species harmed.

For further information, see Goal 2 in the IA CRC Research Portfolio Summary.

"The HOG-HOPPER™ will be a valuable tool to add to our existing pig control. It is a unique and time saving system. The HOG-HOPPER™ has the potential to be used in environmentally sensitive areas."

Garry Hall, landowner of 'The Mole', near Warren, NSW

Right: Jason Wishart setting up the HOG-HOPPER™ feral pig-specific bait delivery device

Controlling feral pigs in tropical rainforest (project 10.U.6b)

Feral pigs are regarded as one of the most important vertebrate pests of the WTWHA. They have, or can have, substantial deleterious impacts on a range of important environmental, economic, human health and social values in the WTWHA. Frequently cited environmental impacts include: predation of native plant and animal species, disruption of trophic webs, weed and pathogen transmission, and erosion and water quality deterioration.

Specific achievements of this project include:

- 3 international peer reviewed papers submitted by Andrew Bengsen.
- Presentations by PhD students, Amanda Elledge and Andrew Bengsen, delivered at the International 24th Vertebrate Pest Conference in the USA.
- Surveys and interviews of stakeholders undertaken for evaluation of socio-economic study of feral pigs by Masters student, Kana Koichi.
- Andrew Bengsen completed and submitted his feral pig control products' thesis.
- Field work completed by both feral pig impacts and feral pig sociology PhD students, Amanda Elledge and Carla Meurk, with thesis preparation underway.

For further information, see page 24 in the IA CRC Research Portfolio Summary.

"Total goat eradication on Kangaroo Island is now more a question of 'when' rather than 'if', thanks to the combined efforts of Kangaroo Island NRM Board, Department for Environment and Heritage, the Invasive Animals Cooperative Research Centre and the Kangaroo Island community."

Dr Pip Masters

Kangaroo Island (Project 10.U.2)

The Kangaroo Island demonstration site has accomplished eradication of feral goats from four of their seven management units (MU's).

Kangaroo Island is on track to achieve the world's largest island goat eradication program attempted so far, whilst continuing its efforts to eradicate deer and better manage feral cats and pigs on the island.

Other achievements within this project include:

- Goat impact monitoring in place and sites surveyed annually.
- Completed community survey of residents to determine attitudes to biosecurity measures for domestic goats.
- Fallow deer monitoring in place which identifies the probability of detection.
- Domestic deer biosecurity strategy developed and waiting on Ministerial approval.
- Implemented pig management in one catchment area which is being used to trial new methods of destruction including PIGOUT® and Judas pigs.

For further information, see page 23 of the IA CRC Research Portfolio Summary.

Before and after goat removal on Kangaroo Island

Western Australia Demonstration site (Project 10.U.1)

Findings from the project will provide managers of conservation estate (in WA and elsewhere), and managers of privately owned estate managed for conservation purposes, with a better understanding of the implications of controlling, or not controlling, one or more predators and the importance and value of integrated control.

The project has successfully demonstrated:

- Foxes and cats can be identified and genotyped to individual level, from DNA recovered from hair collected from both species through a single hair collection device.
- How this technique can be used to quantify sandplot data and derive estimates of abundance for both species.
- Mesopredator release of cats in the presence of repeated use of baits for fox control.
- Through the use of the molecular techniques, that it is possible to identify the predator species and the individual predator responsible for predation events.

- Through the above that cats are a major predator of the woylie at an iconic conservation site which is baited for fox control

For further information, see page 61 of the IA CRC Research Portfolio Summary.

Feral cat bait uptake in Eastern Australia (Project 6.U.1)

Trials of the Curiosity® cat bait have been conducted at the Australian Wildlife Conservancy's Scotia Sanctuary (western NSW) and on Kangaroo Island. Results indicated that baits are generally consumed by non-target species on the mainland. Findings are currently being prepared for journal publication.

The report "Review of cat ecology and management strategies in Australia" by Dr Elizabeth Denny and Prof. Christopher Dickman was published and launched in February 2010.

The launch of this report, with the RSPCA, generated a great deal of media interest, and has resulted in many follow up articles on the impact of feral cats.

Report authors Liz Denny and Chris Dickman at the report launch

For further information, see pages 59-60 of the IA CRC Research Portfolio Summary.

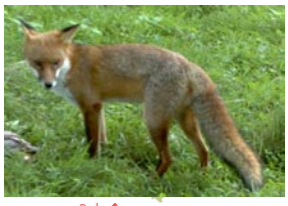
Tasmanian Fox eradication (Projects 10.U.3 and 10.U.21)

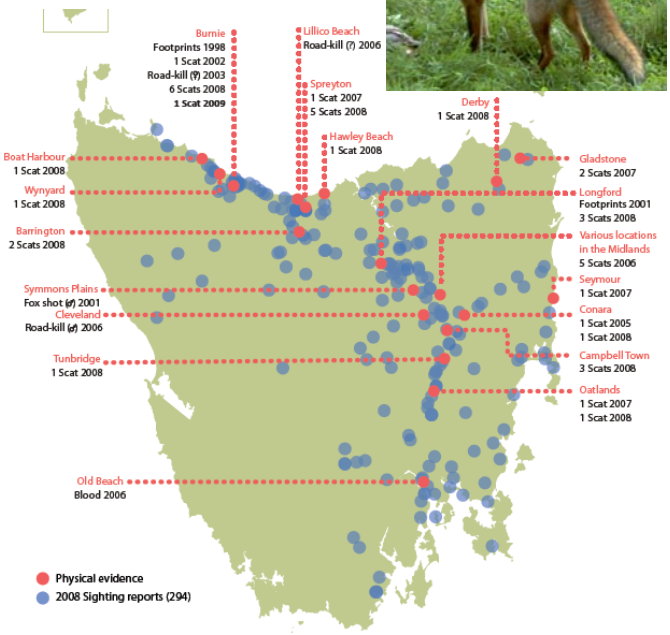
The Tasmanian carnivore scat analysis project is being coordinated by the University of Canberra and the Fox Eradication Program (FEP).

In the last 12 months over 2,400 potential fox scats have been sent to Canberra Uni for species identification — in addition to the 3000 analysed previously from phase 1 of the project.

Findings give the FEP an indication of where to target its detection and eradication activities in the future to ensure the best chance of fox eradication in Tasmania.

The identification of a total of 51 scats as being positive for fox DNA and demonstrating a widespread distribution for this top predator ranging from the central north, to many sites in the east and south east of Tasmania





For further information, see page 91 of the IA CRC Research Portfolio Summary.

Southern Ark: Benefiting Biodiversity through Fox Control (Project 10.U.4b)

Southern Ark is a major conservation initiative that aims to facilitate the recovery of a suite of native mammals, birds and reptiles by significantly reducing foxes across approximately one million hectares of public land in Far East Gippsland

PhD student Alex Diment completed and submitted his fox ecology thesis "Monitoring the ecological impacts of invasive predator control" and PhD student Anthony Buckmaster completed his feral cat fieldwork and commenced thesis assembly

Dr Liz Denny completed the feral cat control review and two large-scale Curiosity® cat bait field trials (Scotia Sanctuary, NSW and Kangaroo Island, SA) (refer 6.U.1 project).

For further information, see page 12 of the IA CRC Research Portfolio Summary.

Commercialisation Management

The commercialisation management project within the uptake program aim is to accelerate the transfer of IA CRC's research outputs into marketable outcomes and their adoption by end-users. To advance the adoption of IA CRC research outputs and outcomes, this project's objectives are to:

- attract additional grant funds leveraging CRC resources
- professionally negotiate research and commercial agreements and contracts
- effectively manage projects, regulatory work and intellectual property, and
- provide market analysis (barriers and drivers) and business development/management expertise

These objectives will result in:

- value adding to IA CRC and participant intellectual property
- coordinated national and international registrations that reduce research replication
- more efficient commercialisation, market delivery and uptake of IA CRC products, and
- the implementation of social and economic instruments that promote regional scale coordinated and integrated invasives management.

This project contributes positively toward a primary aim of the IA CRC, which is to deliver new, innovative, market researched products that meet a market need and have been demonstrated in practice with scientific rigour to be welcomed additional tools in reducing the impacts of invasive animals.

Education program

The IACRC Education Program has four major initiatives which together, target research, professional and community elements of the invasive animal problem. Through these initiatives, the IA CRC aims to establish a legacy of research and industry leadership combined with sustainable and easily accessible educational pathways that will build Australian capacity for strategic invasive animal management. This past year has seen much progress towards these goals.

Included but not managed by the education program, is a National Natural Resource Manager (NRM) facilitator position and a National Wild Dog Facilitator (reported under the Terrestrial Program section). Note that progress on Education Program outcome relating to student progress are reported under section 2.6.c

Education program target: Increased professional and practical skills-base for invasive animal management through education, training and community awareness.

Balanced Scientist

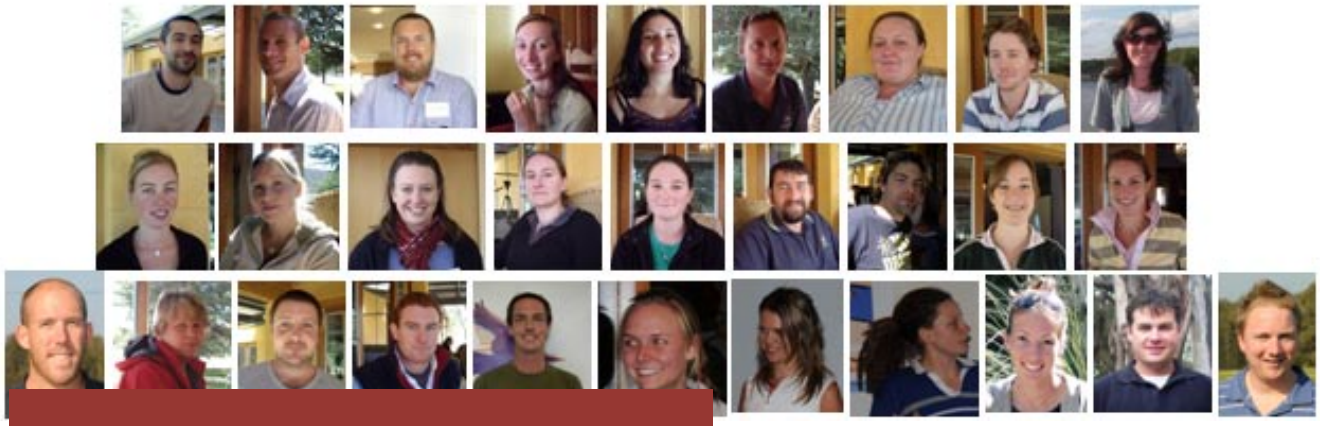
The Education Program currently supports 29 PhD candidates and two Masters level students. The Program assists students through a structured training and development program called the Balanced Scientist Program in which students plot their future career choices through a personal training and development plan and engage with industry partners through collaborations and strategic placements. Common training needs in key skills such as leadership, IP and commercialisation, grant writing, journal article writing, environmental ethics, team skills, strategic pest management and career planning are provided at the annual

postgraduate training camps and elsewhere as required.

To date the Education Program has run four annual training camps, including Wee Jasper (2007), Kangaroo Island (2008), Kioloa (2009) and a commercialization boot-camp held in conjunction with the IA CRC whole-of-program review in June 2010. Three of the students have so far submitted and one has graduated.

At the end of the reporting period, the Education Program was right on target, with 8 out of 12 (66%) of Cohort One (2006 intake) PhD candidates having submitted, and the remaining 4 at an advanced stage of writing-up with submission imminent. Five of the Cohort 1 PhDs had their PhDs awarded. During the reporting period all 10 Cohort Two (2007 intake) PhDs progressed into their 7th or 8th semester of study, with many approaching final writing-up stage. All 6 Cohort Three (2008 intake) PhDs successfully progressed into their 4th or 5th semesters of study with many having already collected and partially analysed significant data sets. Of the two Cohort Four MSc candidates, one successfully completed and had her degree awarded during the reporting period, while the other, a later starter, was making substantial progress. Thus the Education Program appears on target for 28 PhDs, 2 MSc and 2 BSc Honours candidates completed within the life of the CRC. This is 4 PhDs ahead of the actual target of 24 PhD completions.

Scientists and land managers from industry partners, including CSIRO, and various state agencies (DPIs and Environment Departments) in Queensland, NSW, Victoria and Western Australia provided significant supervisory input across the PhD programs



'Balanced Scientist' PhD participants

PestPlan Professional Development

A major initiative of the Program is the development of a diploma level training course in Strategic Pest Management. Our diploma brings an innovative approach to the delivery of regional training using on-line approaches to teaching and learning in association with short workshops and hard-copy and electronic resource materials. The skills set provided by the Diploma will promote a strategic approach to managing pest animal damage and will target land management professionals in all states. An accredited pilot version of the Diploma course was run in 2008 following successful recruitment of 11 candidates from 6 states and territories. This was followed up with a fee-paying version of the course, run in the 2009 academic year, to test the market, with 10 interstate students currently enrolled. The Education Program also funded the adaptation and trialling of a NSW DPI training course in Vertebrate Pest Management Training package that complements, and will act as a feeder to, the Diploma Course.

Online information and learning

www.feral.org.au

We have continued to maintain and develop this site. The site has undergone several rebuilds to enhance usability, including the migration of the site from the Cold Fusion platform, the inclusion of a new search function to enhance the search quality and speed, and the addition of an image gallery containing more than 200 images and sort options for search results. The site has around 8000 records, including web-links, maps, manuals, guides, scientific papers, grey literature and images) and averages around 9000 visits per month. Search Engine Optimisation has led the site to a greater presence on the web with higher google and bing search rankings.

Legacy planning for housing www.feral.org.au beyond the life of the IA CRC is being undertaken, and the site is being remapped in order to house the resulting products from the PestSmart toolkit project.

PestSmart toolkit

The exciting challenge ahead is ensuring product uptake and blending this brainpower into our PestSmart toolkits and training programs. It's important to give considered time to mapping out how we do ensure that this new knowledge is packaged so that our end users — the farmers, rangers, program planners, and policy analysts — pick up the resulting knowledge from our CRC. The web platform will be a major channel for delivery of this information, but face-to-face education and training avenues will also provide a key focus for this knowledge transfer and adoption.

An options paper on capacity building for pest animal control, has been prepared for focus groups. Three focus groups were then held (Lachlan NSW (Forbes), Desert Channels Qld (Longreach) and Kangaroo Island, SA (Kingscote) and an IA CRC occasional report, *Enabling Regional Pest Animal Control*, was published. The research aims to better understand the requirements of these end-users in terms of their information requirements and preferred pathways for communication and capacity building.

Schools Education (feral focus and PestTales)

The Education Program has developed an online school and community based education program. In its current form, this online teacher's resource is principally aimed at highschool years 8 to 10. The Feral Focus and secondary school teachers' resource pack has been complemented with Pest Tales, the primary school teacher and student online resource. Both are now linked to from the feral.org site and have stand-alone domain names (www.feralfocus.org.au and www.pestales.org.au).

Teachers examine the Feral Focus secondary school resource.

Consultancies

Undertaking consultation work has fostered collaborative linkages and contributed to stakeholder understanding of invasive pest issues. The CRC has benefitted from additional income, and our profile has been raised as a service provider and source of expertise in our field. The CRC only undertakes consultancies that clearly contribute to our own strategic plan.

During this financial year, no relevant consultancy contracts were entered into.

Prof Tony Peacock was commissioned by the Department of Environment, Water, Heritage and Arts to develop a Threat Abatement Plan for Cane Toads. This work has culminated in 2009.

Research collaborations

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

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

Australian collaborations:

- CSIRO - sharing of expertise and facilities.
- Australian Wildlife Conservancy - trial sites.
- National Wild Dog Management Advisory Group - development of wild dog management plans.
- Rabbit Free Australia – RABBITSCAN / RABBITING ON / RHD BOOST
- Australian Hydatids Control & Epidemiology Program.
- Douglas Shire Council - participation in demo site trials.
- Kingfisher Research Pty Ltd - production/trial of cages.
- Kangaroo Island NRM board - field trial sites and staff.
- Lachlan and Central West CMAs - integrated carp and wild dog management plans.
- Namoi Catchment - PestPlan workshop (March 2008).
- Robert Wicks Pest Animal Research Centre - facilities and animals for trial, shared research.
- SA NRM Boards (2) - establishment of local run trials.
- State Water Corporation (Vic) - access to water reserves.
- TAS DPIW - collaborative development of fox detection program.
- WA DEC - consultancy - community cane toad control report.
- Wet Tropics Management Authority - feral pig control in the Wet Tropics World Heritage Area.
- DEWHA (for Cane Toad Threat Abatement Plan)
- International collaborations:
- University of Minnesota - trialing of sensory attractants for carp.
- IZS (Brescia, Italy) - supplied monoclonal antibodies for ELISAs to confirm indigenous lagovirus.
- Central Science Laboratories UK - fertility control research; diagnostics for fox scat identification.
- Connovation NZ - PAPP and HOG-GONE® development.
- Fitzgerald Applied Sociology - social research project.
- INSERM (Nantes, France) - supplied rabbit DNA serology tools.
- Israel National Parks Authority - improving tools for wild pig management.
- New Zealand Landcare Research - development of new toxicant.
- New Zealand Department of Conservation - testing of PAPP.

- USDA - supply of Gonacon® for testing in Australian wallabies as a fertility control; testing of PIGOUT® baits; trials of CO fumigator.
- UK Dept of Environment, Food and Rural Affairs - product development and formulation expertise sharing.
- University of York - supervision of PhD candidates.
- SenesTech - agreement signed to enable ContraPest (fertility control for rats) to be trialled in Indonesia.

Linkages with other CRCs

Linkages with Plant Biosec CRC, Australian Biosecurity CRC for development of Global Biosecurity Conference 2010. The CEO participated in the organising committee and support for specific events and the overall program was provided by the Chair, Communications Manager and Program Coordinator for the Detection and Prevention program.

Grant sources

The IA CRC applies for funding from competitive grant sources to support specific project outcomes. A total of $1,941,500 was secured this financial year from Caring for our Country (CfoC) funds administered by the Department of Agriculture, Fisheries and Forestry; and the Australian Pest Animal Management Program (APAMP) funding administered by the Bureau of Rural Sciences within the Department of Agriculture, Fisheries and Forestry.

The specific program funding is spelt out below.

Funding program	Administrator	Value	Description
CfoC	Department of Agriculture, Fisheries and Forestry	$1,515,000	RHD Boost
APAMP	Department of Agriculture, Fisheries and Forestry	$61,000	Registering Oral Methaemoglobin inducers
APAMP	Department of Agriculture, Fisheries and Forestry	$114,500	PestSmart toolkits
APAMP	Department of Agriculture, Fisheries and Forestry	$193,000	Facilitating the strategic management of wild dogs throughout Australia
APAMP	Department of Agriculture, Fisheries and Forestry	$58,000	Trapping introduced predators for the protection of biodiversity and livestock DVD

Table 8: Competitive grant sources

Commercialisation and Utilisation

Strategies and activities

The IA CRC comprises 41 members from community groups, SMEs, industry investment and representative corporations, Government agencies, educational and training institutions, research providers and international agencies.

The IA CRC business model has been designed to overcome current market failure and weaknesses that impede the development and adoption of new invasive animal management technologies. The commercialisation role is built in to the CRC's operational structure.

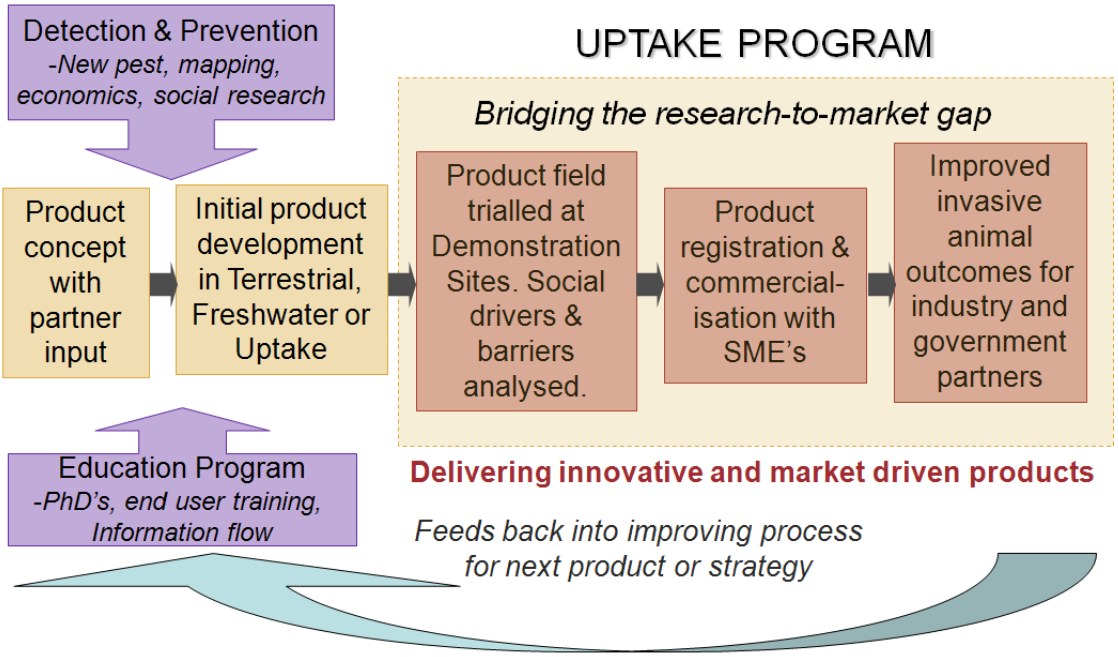


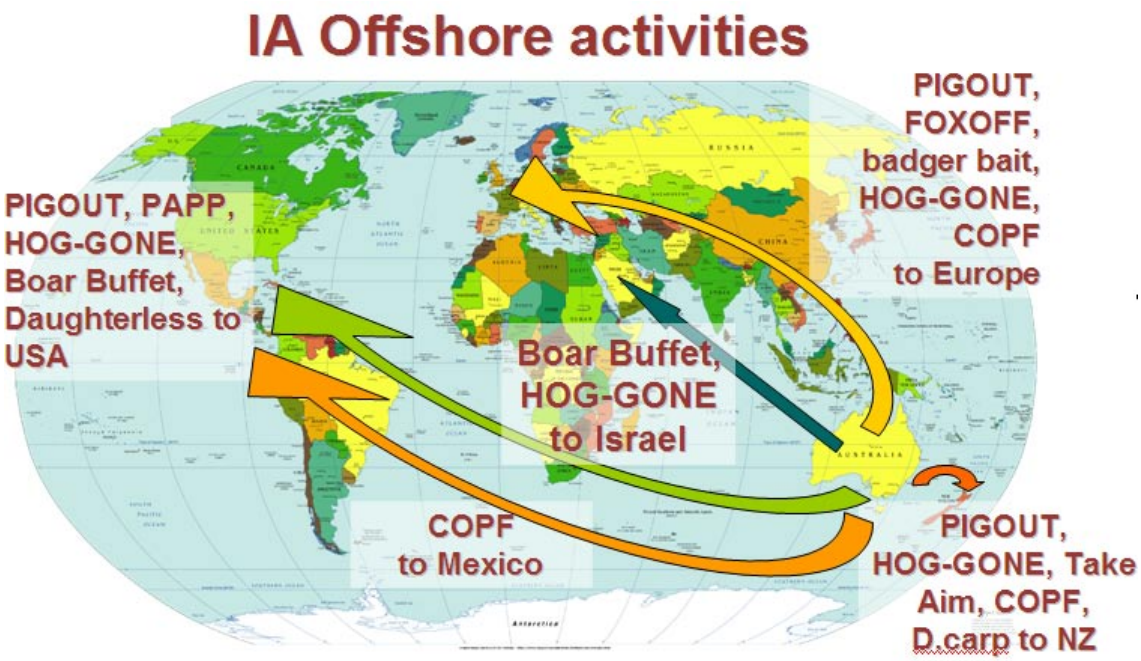
Figure 5: IA CRC product development strategy schema

The IA CRC commercialisation strategy is built on two fundamental principles: each commercial project has at least one commercial participant involved in managing the research and a dedicated commercialisation resource within the CRC whose aim is to add and capture value from centre activities. The advantages of this strategy within this CRC's field are:

- The most significant imposts (research and registration costs) to SMEs launching innovative products into niche 'public good' markets are shared.
- The commercialisation critical path, commercialisation arrangements and appropriate business plans are agreed upon early in the development of research projects.
- Commercial partners that will ultimately launch and support products and services in the market place are active participants in the development of the product – often with the assistance of individuals or organisations that will be key influencers to end-users.
- The critical mass that partnering with the IA CRC brings to research, registration and commercialisation activities adds significant value and credibility to research development and market acceptability of products and services.

The commitment of the IA CRC to this commercialisation strategy is reflected in the appointment of a dedicated Commercialisation Manager with technology transfer, negotiating commercial arrangement/agreement, project management and regulatory expertise.

Along with focusing on making IA CRC products available to participant organisations and taking products to the domestic market ,Commercialisation Manager Simon Humphrys, concentrates on development of off-shore markets.



Intellectual property management

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

- resources
- maximising value of the CRC to participants
- benchmarking background IP and maximising the added value to centre IP
- priority for CRC IP management
- enhancing commercial awareness of centre staff and students
- minimising the risk of inappropriate IP disclosure.

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

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

Broadly speaking, managing IP can be divided into internal and external IP management. In the context of the CRC operations, internal IP management encompasses all activities required to audit, assess, develop, protect and exploit BIP and CIP, while external IP management encompasses all activities required to identify, evaluate and interpret the relevance of global non-participant IP to the BIP and CIP. Depending on the field and jurisdiction of the relevant global non-participant IP, it will be interpreted as an opportunity or a threat to centre activities and potential CIP. In this way, the CRC can readily pinpoint its IP strongholds and weaknesses within the relevant global IP environment and plan strategically how best to establish a world-leading footprint within the field of invasive animal control techniques—not only in Australia, but on a global scale. This has the advantage that the CRC can be confident that the value it adds to participant BIP in progressing projects is not placed at unacceptable risk. Also that it builds the profile and brand of the CRC in attracting new research partners and with them opportunities.

For the purposes of the IA CRC's IP Management Plan, IP is defined by the following eight asset classes:

- technologies
- manuals, protocols and processes
- training programs and associated training manuals
- employees' expertise and experience or know-how
- databases of information; marketing and promotional materials
- software
- photographs and other creative designs.

Effectively managing information relevant to IP within an organisation that has 41 participants relies on excellent communication and compliance to procedures designed to minimize identified risks. IA CRC has a tailored project/information management system – CRC-Centric. This information management system is an excellent platform from which to effectively manage the information regarding BIP and all emerging CIP as project milestones are accomplished.

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

Not applicable

Benefits to Australia of IP arrangements

CRC IP arrangements require a return on investment from the assignee that to date have taken the form of increasing royalties on future product sales. This approach maximises the value of centre IP and the benefits that flow back to Australia, because it recognises that the potential markets and product margins for pest animal management products are comparatively small, minimises the upfront capital outlay for entering a market for assignees, and maintains an upside should product sales exceed forecasts.

Income from licences or options on intellectual property contracted between the IA CRC, industry and other end-users totals at $7,000 for the reporting period. Income is primarily generated from royalties from products developed by the IA CRC in conjunction with core participant Animal Control Technologies Australia.

Patents:

No new patents were filed in the reporting period. The CRC maintained one patent.

Maintained patent: Feral omnivore bait and uses thereof (International patent application number PCT/AU2008/000260)

Communications strategy

Strategies and activities

To maximise its impact the IA CRC needs to influence key groups of people. The IA CRC Strategic Communications Plan (SC Plan) aims to position the institution so that over its life, relationships are sustained with these key groups, through face-to-face communications supported by CRC and Participant information, and mass media. The two primary desired outcomes of this integrated approach are to firmly establish a view that the IA CRC is a solutions-oriented, effective and accountable organization, and increase awareness and knowledge of invasive animal impacts and strategies to reduce them.

The Governing Board places great importance on the delivery of this Plan, and will closely monitor and review its implementation and achievements. The Board has resolved that the CRC play a strong and active leadership role in promoting invasive animal issues as well as the benefits of applied science in developing effective products and strategies that lead to increased agricultural productivity and conservation outcomes.

The Strategic Communications Plan is closely related to the Commercialisation and Utilisation Plan, and as they share a number of target groups their implementation will be mutually reinforcing. They can be distinguished by their focus. The SC Plan is focused on encouraging underlying policy and financial support for invasive animal research and management. The Plan is focused on the innovation and adoption of CRC products, strategies and services.

The IA CRC's Strategic Communications Plan (the SC Plan) aims to position the organization so that it plays a leadership role in achieving four general objectives:

1. Raise awareness and knowledge of invasive animal issues and solutions
2. Engage in dialogue with government leaders on strategies needed to enable more appropriate, effective and efficient national and regional invasive animal management
3. Increase support for enhanced invasive animal management, particularly the research, development and uptake of new technologies and strategies
4. Ensure a coordinated and efficient whole of IA CRC approach to communications delivery.

The desired outcomes of the IA CRC Strategic Communications Plan are:

1. IA CRC perceived as a solutions-oriented, effective, and accountable organisation
2. IA CRC recognized as a credible, influential and respected source of information on invasive animals and their control by the key target groups
3. IA CRC strategic communications are based on a consistent set of messages and corporate identify
4. IA CRC participants and HQ effectively coordinate their communication activities and enabled to build intellectual and scientific synergies, increase capacity to respond to threats and build a lasting network focused on invasive animals
5. Routine internal information flows effectively within the IA CRC
6. IA CRC contributes strategically to the implementation of Australian Pest Animal Strategy Objective 1.3
7. IA CRC enabled to deliver its strategic plan through a favourable funding and regulatory environment.

This Plan is a living document and may be adapted to changing circumstances and opportunities.

Three broad target audiences and seven specific target groups are the focus of the SCP:

- High level policy and funding decision-makers, namely government leaders and IA CRC participant board members and executives
- Influencers, namely animal welfare NGO advocates, conservation and industry NGO advocates, key journalists, and urban and peri-urban Australians
- Intermediaries, namely researchers in IA CRC participant organisations.

The main message to be communicated about the IA CRC is based on 4Ps:

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

The SCP also provides the overarching framework to manage the communication aspects of the strategic risks identified by the Board, and the concomitant emergency response plan.

CRC in the media

The CRC has an important role to play in both science communication and broader public awareness and stakeholder engagement platforms

Media engagement is a core part of IA CRC's communications function.

The 'hot issue' in the second half of 2009 coincided with the launch of the economic impacts of pest animals report in August 2009. The launch was conducted by the then Minister for Agriculture, Fisheries and Forestry the Hon Tony Burke MP. This campaign was instrumental in the high instances of media coverage for the quarter, and was responsible for the dramatic increase in media coverage instances from the previous financial year.

Media focus returned to feral cats in the first half of 2010, leveraging from the joint launch with the RSPCA of the publication: review of cat ecology and management strategies in Australia'.

Pest focus

Press coverage has increased over the past year, with the pest focus remaining on rabbits (to support the IA CRC's RHD-Boost bid and resulting from increased publicity from the economic impact report launch in August 2009), returning to focus on cats (in conjunction with the cat review launch in early 2010) and culminating in dogs (due to efforts relating to the National Wild Dog Management Facilitator project and other wild dog initiatives).

Oct09	Nov09	Dec09	Jan10	Feb10	Mar10	Apr10	May10	Jun10
Rabbits	Rabbits	Rabbits	Rabbits	Cats	Cats	Dogs	Dogs	Dogs

Table 9: Top species by month (according to media analysis)

Media releases

Three specific IA CRC corporate media releases were issued:

- Rabbits and wild dogs biggest feral pest cost to agriculture: new report (19 August 2009). This release, and publicity efforts conducted in conjunction with the media adviser for the Minister for Agriculture, Fisheries and Forestry led to national publicity in both broadcast and print media. The revised economic impact figures have been quoted extensively by IA CRC participants and broader stakeholders.
- A joint IA CRC/RSPCA media release — Report Reveals Australia's Feline Folly — issued nationally on 23 February, to promote the launch of the IA CRC report on cat ecology and management strategies. The launch was held in conjunction with the RSCPA's Annual Scientific Seminar and generated extensive media coverage.
- The IA CRC welcomed the Western Australian Government's announcement of an injection of $8.82 million into the fight against wild dogs (6 April 2010).

Media exercises:

The IA CRC also participated in several media efforts with partner agencies throughout the year. These included:

- a media release on the successful HogGone baiting trials with Meat and Livestock Australia (15 July 2009),
- efforts to publicise fox and dog baiting trials with the NSW Livestock Health and Pest Authorities in August 2009,
- media efforts with Industry and Investment NSW regarding RHD-Boost,
- the release of preliminary RabbitScan maps by Minister Burke,
- media activities relating to the Lachlan River Carp Cleanup Launch (16 September 2009),
- involvement in publicising specific invasive animal issues in preparation for the Global Biosecurity 2010 conference (undertaken by the Kondinin Group) including:
    - The fight against feral disease focuses on Dr Wendy Henderson's review of disease agents found in feral animals in Australia.
    - New tools on the horizon for exotic disease control in feral pigs. Dr Steven Lapidge focuses on feral pig diseases and the consequences for human and animal health.
    - Domestic animals: pets or pests? Focuses on Tony Peacock's presentation.
    - Wild Dog Disease to blame for cattle miscarry? Focuses on Jess King (IA CRC PhD candidate) and her research into Neospora
- continuing media inquiry coordination with the RSPCA on the cat ecology report,
- efforts to publicise fox and dog baiting trials,
- rabbit control efforts with the NSW Livestock Health and Pest Authorities,
- publicity efforts relating to RabbitScan, RHD-Boost and the benign calicivirus with both CSIRO and NSW Industry and Investment
- increased reportage of impacts of wild dogs (due to continued reportage on the role of our National Wild Dog Management Facilitator, Greg Mifsud; commentary on 'wild dog vs dingo' issues; a new wild dog control program in Southern NSW; and reportage of AWI's continued investment in R&D regarding wild dog management).
- promotion of field trials to test the most effective rates for 1080 aerial baiting of wild dogs,
- promotion of the consultation period for the draft Threat Abatement Plan (TAP) for cane toads,
- commentary on the ABC's Stateline program on fox bounties in Victoria, and
- goat eradication efforts conducted on Kangaroo Island.

Program publicity:

Program and project publicity efforts continued to be undertaken by the communications manager, the science communicator (Keryn Lapidge) as well as IA CRC staff and participants and included:

- 60 Minutes: Tony Peacock was interviewed for a story on the role of recreational hunting. The 60 Minutes blog returned hundreds of public comments (compared with an average of 5-10 comments)
- Oceania biodiversity: Tony Peacock commented on the UNSW report which received good science and mainstream coverage.
- Feral Peril: This award-winning documentary, focusing on the debate regarding evidence of foxes in Tasmania, was aired on ABC television on Thursday 16 July.
- Release of preliminary RabbitScan maps by Minister Burke.
- NSW Farmers Association announced that it supported further investment in rabbit control, which also contributed to the rabbit focus.
- Leading Sheep's 'webinar' on the Overview of Queensland Wild Dog Offensive Group (QDOG) was promoted.

- Rex Airlines' in-flight magazine did a balanced feature on conservation hunting in November, for which we provided input.
- 'The Land' included a feature on rabbits and has resulted in coverage in other press regarding the IA CRC project 'RHD-Boost'.
- The release of the review of the Tasmanian Fox Eradication Program has also resulted in extensive coverage.
- Media engagement activities undertaken by Steve Lapidge relating to the HogGone feral pig bait trials in the Kimberley.
- Greg Mifsud, the IA CRC supported National Wild Dog Facilitator, secured a front page article with the Bairnsdale Advertiser on his recent trip to Victoria's Gippsland region. There has also been coverage in other broader circulation outlets promoting the work of the National Wild Dog Management Advisory Group (refer to the March media report).
- Livestock guardian dog promotion (eg: 'Tracking a Maremma's Nightlife' on interactions between guardian dogs and predatory invasive animals).
- Dr Ken Henry AO, Secretary of the Australian Treasury, mentioned invasive animal impacts, quoting figures published in the IA CRC economic impact report issued in August 2009, in several speeches relating to the concept of an Environmental Tax.
- Industry and Investment NSW's 'NRM on Farms' monthly email news summary included a blurb on the 'NRM Notes' newsletter produced by Jessica Marsh (nee Gibson), the IA CRC's NRM Facilitator.
- Issue 42 of AWI's 'Beyond the Bale' includes an IA CRC feature story on PAPP and the BlueHealer antidote that is in development.
- The consultation period on the Federal Government's Threat Abatement Plan closing during this period and a small population of toads discovered in Sydney.
- Several community carp clean-up events were highlighted in Qld and in NSW.
- IA CRC participant, Animal Control Technologies, actively communicating escalating mouse numbers and control options.
- Feral cat impacts on wildlife.
- Feral pig control efforts and feral pig impacts.
- The eradication effort conducted on Macquarie Island;.
- Risks associated with feral animals spreading diseases such as rabies.
- Tony Peacock conducted specific media interviews on local Canberra ABC radio, as well as to select media outlets on the following topics (amongst others):
    - the Threat Abatement Plan for cane toads
    - the brumby cull issue in south-east NSW
    - 'Pets to pests' media interviews
    - Carp issues in the US (promoting our international linkages)
    - black-spined toads detected by Cairns port stevedores
    - the National Biodiversity Strategy

Commendations

As part of this year's Australia Day awards, IA CRC Terrestrial Products and Strategies Program Leader, Assoc Prof Glen Saunders was inducted as a member of the Order of Australia. Rabbit Free Australia's Nicholas Newland was also awarded an AM, and IA CRC Director, Helen Scott-Orr, received a Public Service Medal for service to agricultural and veterinary science. IA CRC Uptake Program Manager, Steven Lapidge, was also promoted to Associate Professor within the University of Canberra and received a prestigious Fulbright Scholarship to undertake work with the USDA on feral pig control. He travelled to the US to commence his scholarship at the end of June.

Three champions of pest management have been acknowledged for the significant contributions they have made, through the annual IA CRC prizes. These individuals are: Rick Shine (Chair's Prize for Scientific Excellence), Greg Mifsud (Participants' Prize for Invasive Animal Management) and Jessica King (CEO's Prize for Achievement as an IA CRC Student).

IA CRC-supported student Adriana Ford-Thomson being shortlisted in the Showcasing Early Career Scientists program at the annual CRC Association's Conference in May.

These announcements resulted in moderate coverage in related regional and university press.

Coverage over the quarterly reporting periods of 2009-10 follow.

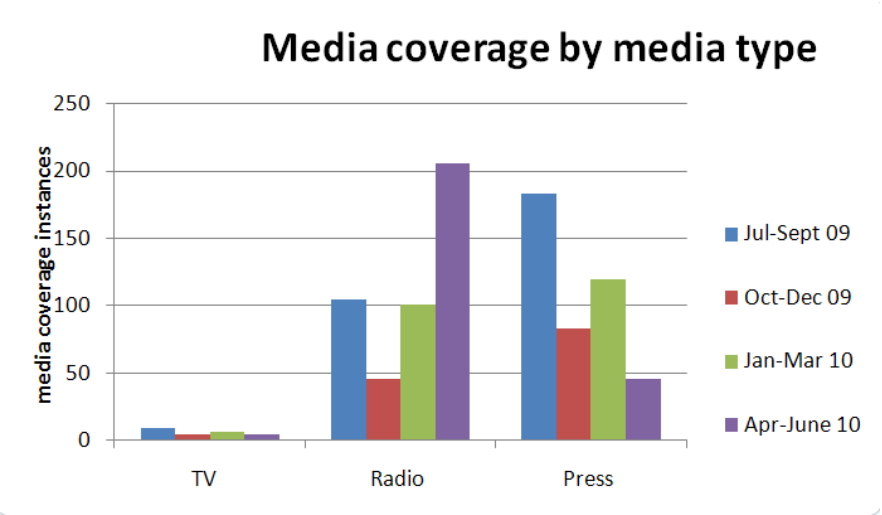


Figure 6: Media coverage by media type

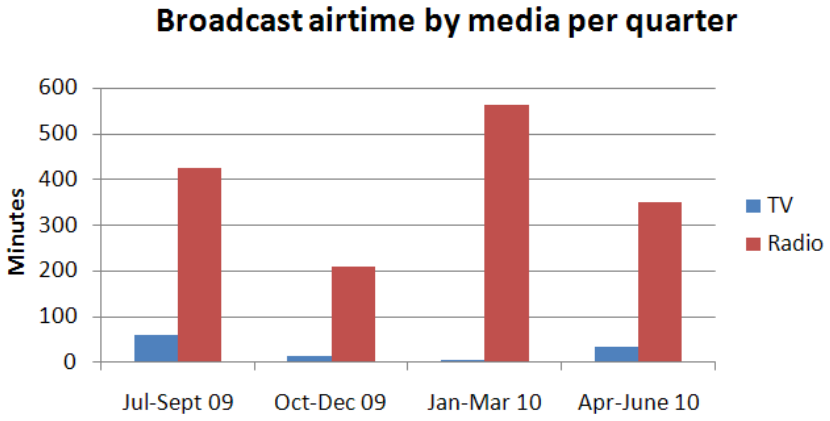


Figure 7: Broadcast airtime for TV and Radio

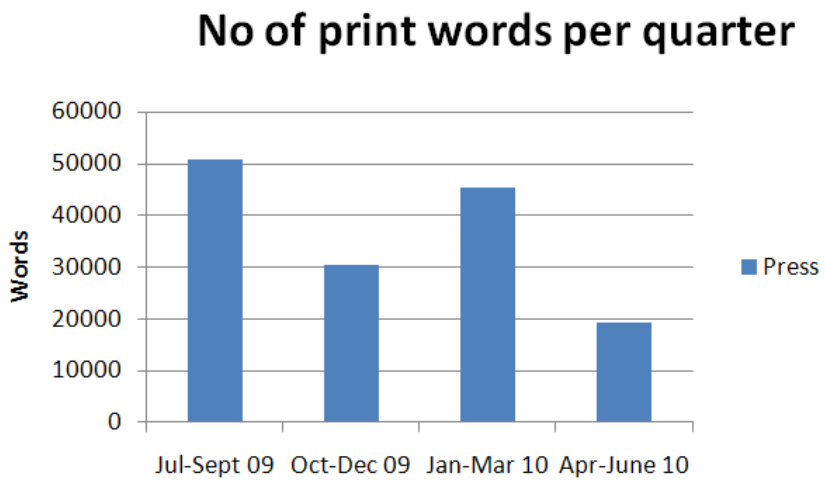


Figure 8: Number of print words monitored each quarter

Media coverage progress over the past several financial years follows.

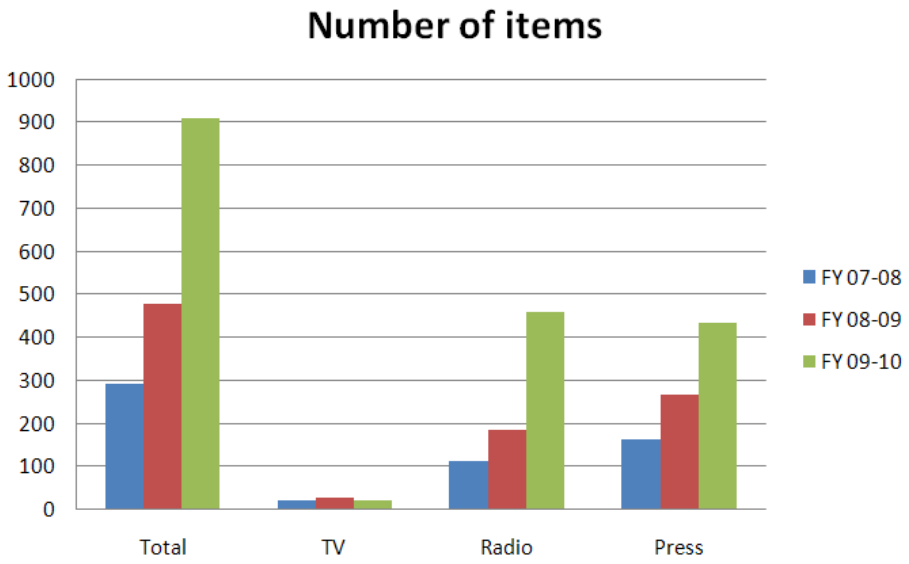


Figure 9: Number of media items over the past three financial years

Website Hosting and Monitoring

The IA CRC website has successfully migrated to a new platform and content management system (to be shared with www.feral.org.au. Funds are being saved by amalgamating the two websites onto the same publishing platform and server. IA CRC Website usage averaged at approximately 700 visitors per day. This rate increased from 550 visitors per day in 2008-09 and 450 visitors per day from 2007-08.

Internal communications and governance

To meet our objective of 'ensuring effective internal communications and a sense of corporate identity' corporate style guides, a media strategy and engagement and publication guidelines and procedures have been developed and promoted to staff and project participants to ensure compliance with branding and acknowledgement requirements.

Direct marketing

The IA CRC provides electronic subscription to several news and communications products including:

The Feral Flyer
Invasive Animals CRC e-newsletter

The IA CRC's fortnightly electronic newsletter

Uptake Update

an occasional newsletter providing updates on our uptake program. Each issue features a different demonstration site or specific aspect of the program

News from the Invasive Animals CRC
Contributors: Staff from the Invasive Animals CRC

an informative and entertaining blog from contributors from the IA CRC

islandNet

a quarterly newsletter including research and up-coming meetings relevant to offshore islands

Media Releases

breaking news from the IA CRC

Education and training

The IACRC's Education Program has a strong focus on education and training development of its balanced scientists and PestPlan graduates. More detailed project progress follows.

Balanced Scientist Program cohort progress

Milestone/Objective	Start date	Outcome/Output	Key Responsibility	Progress
Recruit Cohort 1 students	July 05	11 PhD candidates and 1 Honours candidate enrolled at partner universities on CRC projects	Sarre	Completed
Recruit Cohort 2 students	July 06	11 PhD candidates and 2 Honours candidates enrolled at partner universities on CRC projects	Jenkins	Completed
Recruit Cohort 3 students	July 07	5 PhD candidates enrolled at partner universities on CRC projects	Jenkins/ Heinsohn	Completed
Recruit Cohort 4	July 08	2 affiliated PhD candidates in support of CRC outcomes	Heinsohn	Completed

Table 10: Balanced Scientist Program cohort progress

Cohort 1

All twelve students from C1 PhDs (2006 intake) have completed requirements for the IA CRC Certificate of Achievement in Research Leadership & Management, awarded June 2010.

All C1 scholarships given out and in final 8th semester; 8 out of 12 (66%) C1 PhDs submitted; 5 out of 12 (42%) C1 PhDs accepted (others submitted still being marked).

Invasive Animals CRC PhD Program Cohort 1					
Student	Uni	Project	Supervisor	Affiliation	Progress
Cohort 1					
John Abramyan	UQ	Daughterless cane toads: Sex determination and development in Bufo marinus	Peter Koopman David Booth	Terrestrial	PhD submitted January 2010, and accepted in July 2010.
Andrew Bengsen	UQ	Controlling feral pigs in tropical rainforest	Ian Gordon Luke Leung Steven Lapidge	Uptake	Submitted in June 2010
Tony Buckmaster	USYD	Responses of feral cats to broad scale fox control in East Gippsland, Victoria	Chris Dickman Gordon Friend	Uptake	
Tarnya Cox	UQ	Carnivore odours as repellents: effects of diet and evolution	Peter Murray Graham Hall Xiuhua Li Andrew Tribe	Terrestrial	Progressing towards submission.
Jennyffer Cruz-Bernal	UQ	Effects of predation and resource availability on western	Luke Leung Paul de	Uptake	Submitted in February 2010.

		brushtail possum populations	Tores Duncan Sutherland Nicky Marlow		
Alex Diment	USyd	Fox ecology in response to lethal control.	Chris Dickman Gordon Friend	Uptake	Submitted in March 2010.
Amanda Elledge	UQ	Environmental impacts of feral pigs (*Sus scrofa*) on lowland rainforests	Iain Gordon Clive McAlpine Peter Murray	Uptake	Progressing towards submission.
Gwilym Haynes	USyd	Population genetics of an invasive species	Frank Nicholas Peter Grewe Dean Gilligan	Freshwater	Submitted thesis in June 2008 and PhD conferred in 2009.
Maija Marsh	York	Transmission and effectiveness of RHDV infections in rabbit populations at different spatial scales	Piran White Steve McLeod Mike Hutchings	Terrestrial	Submitted in December 2009.
Eve McDonald-Madden	UQ	Modelling optimal monitoring	Hugh Possingham	Detection / Prevention	PhD accepted June 2010.
Carla Meurk	UQ	Social aspects of feral pig management in the Wet Tropics of North Queensland	Iain Gordon Wolfram Dresler	Uptake	Submitted PhD thesis in July 2008 and PhD conferred in 2009.
CRC Linked PhD Student					
Megan Barney	UTas	Sex Determination and Differentiation in carp, *Cyprinus carpio*	Jawahar Patil Chris Carter	Freshwater	Submitted in August 2009. PhD conferred in August 2010.
Honours Cohort 1					
Ben Allen	UQ	Urban dingoes and zoonotic diseases	Luke Leung	Terrestrial	Completed at end of 2006

Table 11: Summary data for Cohort 1 PhD candidates

Cohort 2

10 out of 11 (91%) remain enrolled (after one dropped out due to illness); All 10 are in or approaching 7th semester with substantial progress in Balanced Scientist Program including having completed their 3rd annual PhD camp (June 2010).

Invasive Animals CRC PhD Program Cohort 2					
Student	Uni	Project	Supervisor	Affiliation	Progress
Cohort 2					
Katie Doyle	UQ	Impact of increased predator presence through stocking on carp populations and the implications for	Darryl McPhee Andrew Norris Michael	Freshwater	Commenced February 2007. Currently in mid stages of PhD.

		management	Hutchinson		
Aaron Elkins	ANU	Environmental Attractants for Carp	Russell Barrow Simone Rochfort	Freshwater	Commenced 2007 and currently in 7th semester. About to transition into 8th semester. Fully-IACRC-funded 8th semester extension approved.
Peter Elsworth	UC	Development of genetic resistance to Rabbit Haemorrhagic Disease in wild rabbits *Oryctolagus cuniculus*	Brian Cooke Stephen Sarre Brett Lidbury	Terrestrial	Commenced 2007 and currently in 7th semester. About to transition into 8th semester. Fully-IACRC-funded 8th semester extension approved.
Jess King	USyd	Investigating the role of wildlife and wild canids in transmission of *Nesospora caninum*	Peter Windsor David Jenkins Peter Fleming Jan Slapeta John Ellis	Terrestrial	Commenced 2007 and currently in 7th semester. About to transition into 8th semester
Penelope Marshal	ANU	The social impacts on Australian farm families of wild dog predation on agricultural stock	John Dryzek Jenny Andrew Linda Botterill Carolyn Hendriks	Terrestrial	Commenced late 2006, currently in 8th semester, and approaching submission.
Lindsey McFarlane	UQ	Characterisation of RNA silencing pathways in the common carp (*Cyprinus carpio* L.)	Jawahar Patil Peter Koopman	Freshwater	Fully-IACRC-funded 8th semester extension approved.
Tom Newsome	USyd	Strategic management of wild dogs: how it affects ecosystems in north eastern NSW	Chris Dickman Peter Fleming	Terrestrial	Commenced 2007 and currently in 7th semester on RSSS, ANU Finishing Scholarship.
Hayley Pearson	USyd	Understanding and mitigating domestic pig and wildlife interactions	Jenny-Ann Toribio	Terrestrial	Commenced 2007 and currently in 7th semester. About to transition into 8th semester.
Kylie Singh	UC	Conservation benefits resulting from the commercial use of kangaroos and feral goats in the Australian rangelands	Jim Hone Steve McLeod Tony Pople	Terrestrial	Fully-IACRC-funded 8th semester extension approved.
Danielle Stephens (nee Carey)	UWA	Developing DNA-based monitoring techniques for improved management of wild dog	Mike Johnson Oliver Berry Peter Fleming Alan Wilton	Terrestrial	Commenced 2007 and currently in 7th semester. About to transition into 8th semester.
Scott van Barneveld	USyd	What makes a species invasive? An assessment of invasive capability in a model genus Lampropholis (De Vis 1888)	Michael B. Thompson Elaine Murphy Dieter Hochuli	Prevention and Detection	Fully-IACRC-funded 8th semester extension approved.
Honours Cohort 2					

Melissa Snape	ANU	Assessment of the effects of VCD, and of behavioural responses to novel bait items for brushtail possums	Bill Foley Paul Cooper	Terrestrial	Completed Honours at end of 2007. Progressed on to PhD with IACRC cohort 3.

Table 12: Summary data for Cohort 2 PhD candidates

Cohort 3

The intake of six C3 candidates are progressing well and are in 4th or 5th semester. All six are making strong progress in Balanced Scientist Program, having completed their 2nd or 3rd annual PhD camp (June 2010).

Invasive Animals CRC PhD Program Cohort 3					
Student	Uni	Project	Supervisor	Affiliation	Progress
Cohort 3					
Adriana Ford	York	People, Pests and Conflict: community participation in invasive deer management in Australia	Piran White Carolyn Snell Glen Saunders	Terrestrial	Commenced in 2008 and currently in 5th semester. About to transition into 6th semester. Fully-IACRC-funded 4th year extension package at APAI rate approved as add-on agreement.
Kate Grarock	ANU	Removal of the pest bird – Indian Myna (*Acridotheres tristis*) and its impacts and implications for native Australian birds	David Lindenmayer Chris Tidemann Jeff Wood	Terrestrial	Commenced in 2008 and currently in 5th semester. About to transition into 6th semester.
Melissa Snape	ANU	Effects of vaccination against gonadotrophin releasing hormone (GnRH) on the behaviour and fertility of macropods	Lyn Hinds William Foley	Terrestrial	Commenced in 2008 and currently in 5th semester. About to transition into 6th semester.
Crystal Kelehear	USyd	Host-parasite ecology during a biological invasion: the potential of Rhabdias as a biocontrol	Ric Shine	Freshwater	Commenced in late July 2008 and currently in 4th semester. About to transition into 5th semester.
Ian McDonald	UQ (APA)	GnRH constructs for oral delivery: effects on immune responses and reproductive function	Lyn Hinds Michael D'Occhio Helle Bielefeldt-Ohmann Peter Murray Andrew Tribe	Terrestrial	Commenced in 2008 and currently in 5th semester. About to transition into 6th semester.
John Tracey	York	Evaluating Management Strategies for Pest Birds of Horticulture	Piran White Glen Saunders	Terrestrial	Commenced in Dec 2008. Rapid progress into mid stage of PhD. Currently in 4th semester.

Table 13: Summary data for Cohort 3 PhD candidate

Cohort 4

Intake of two C4 Masters candidates as affiliated postgraduate students included in annual postgraduate camp training. 1 out of 2 (50%) has completed and accepted, the other is making strong progress towards completion. 1 took part in 2009 annual postgraduate camp group training prior to completion in early 2010. The other took part in June 2010 annual postgraduate camp group training.

Invasive Animals CRC PhD Program Cohort 4					
Student	Uni	Project	Supervisor	Affiliation	Progress
Cohort 4					
Marlene Jahnke	Uni of Konstanz & CSIRO Entomology	M.Sc. Project: Genetic diversity and evolution of a non-pathogenic calicivirus in wild rabbit populations in Australia	Dr. Tanja Strive Prof. Steven Sarre Martin Wikelski	Terrestrial	Commenced 2009 and submitted January 2010. M.Sc. accepted.
Kana Koichi	James Cook Uni, Townsville	M.Sc. Project: Socio-economic and ecological costs and benefits of feral pigs in the Wet Tropics	Iain Gordon (CSIRO) Kamaljit Kaur (JCU) Alison Cottrell (JCU)	Terrestrial	Commenced in 2010. Strong progress.

Table 14: Summary data for Cohort 4 PhD candidates

Postgraduate Skills Training (within the Balanced Scientist Program)

Aims:

1. Development of the Balance Scientist Model for postgraduate training and development
2. Provision of specific training and development for CRC postgraduate students.
3. Students to undertake industrial placements as part of their PhD training.

Outcomes:

1. Students complete their PhD training as 'industry ready' graduates with a set of balanced skills and expertise in all aspects of invasive animal management.
2. Four year PhD programme with a certificate in Research Leadership and Management.

Training Course	Start date	End Date	Description	Key Responsibility	Progress
Wee Jasper postgraduate training course	03/03/07	11/03/07	Postgraduate skills training for 23 CRC students in management teamwork and leadership.	Jenkins	Completed
MARK training course	02/08/06	12/08/06	Modelling and program MARK workshop by Anderson and White	Jenkins	Completed
Environmental Statistics - SAS	02/02/07	30/09/07	Online training course in the use of SAS for data analysis	Jenkins	Completed
An introduction to 'R' and it's application in modelling	02/07/07	06/07/07	Residential training course introducing the statistical package 'R' and its use in modelling and data analysis.	Jenkins	Completed
Kangaroo Island postgraduate training course	05/05/08	11/05/08	Postgraduate skills training for 20 CRC students in management teamwork and leadership.	Heinsohn	Completed
Kioloa postgraduate training course	02/05/09	09/05/09	Postgraduate skills training for 24 CRC students in science journal article writing, grant application writing, and strategic career	Heinsohn	Completed

			development.		
Eaglehawk postgraduate training course combined with Whole of IA CRC Review Conference participation.	14/06/10	18/06/10	Postgraduate skills training in Commercialisation and Intellectual Property, Project Review and Governance, and Review Conference Participation.	Heinsohn	Completed as of 18 June 2010.

Table 15: Balanced Scientist Program activities

PestPlan: Professional Development

Aims/Summary

1. Develop Diploma level training course in strategic invasive animal management.
2. Train land managers in strategic pest management.
3. Improve invasive animal management through advocacy of a strategic, community owned approach.

Outcomes

1. Increased capacity of land managers to plan and undertake strategic invasive animal management.

Milestone/Objective 11E6e Pestplan	Start date	Outcome/Output	Key Responsibility	Progress
Development of Diploma level training course in Invasive Animal Management	Jan 06	Diploma level course available online for land managers across Australia and roll out overseas	Sarre/Jenkins/Braysher/ Dalla Costa/ Heinsohn	Pilot course with 11 industry-based students successfully completed in 2008 was followed by fee-paying version of the course in 2009 with 10 industry-based students.

Table 16: PestPlan program progress

Community Education

Aims/Summary

1. Community awareness
2. Provision of school curriculum based primary and secondary education packages.

Outcomes

1. Increased public awareness of invasive animal issues.
2. School based education introduces key issues and concerns over invasive animal management leading to a better informed public.

Milestone/Objective Community education	Start date	Due Date	Outcome/Output	Key Responsibility	Progress
Updating and maintenance of www.feral.org.au website	Jan 06	Dec 12	Up to date information and resources on Invasive Animals and their management available for public access.	Sarre/ Braysher/ Lapidge/ Bagnara	Ongoing maintenance; 8000 documents; rebuilding in PHP, additional 200+ plus photographs; FeralFocus and PestTales teacher resources linked in 2009-10.
Development of School	Mar	Dec	Resources and activity	Sarre/	FERAL FOCUS for years 8-10

curriculum based Invasive animal education activities and resources	07	10	packs available and used by schools to address curriculum areas on invasive animals.	Keogh/ Braysher	was followed by the launch of Pest Tales for years 4-6.

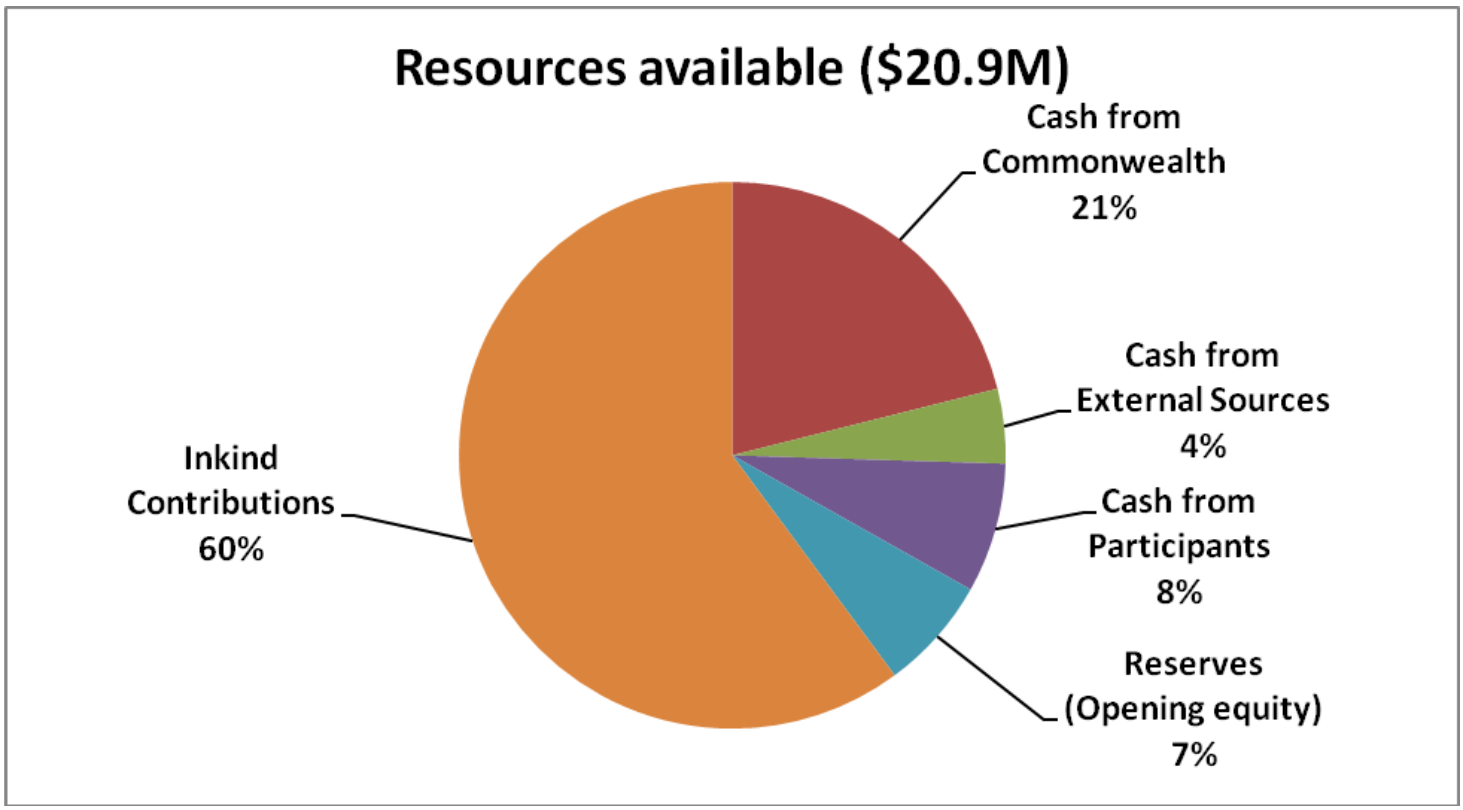
Table 17: Community education program progress

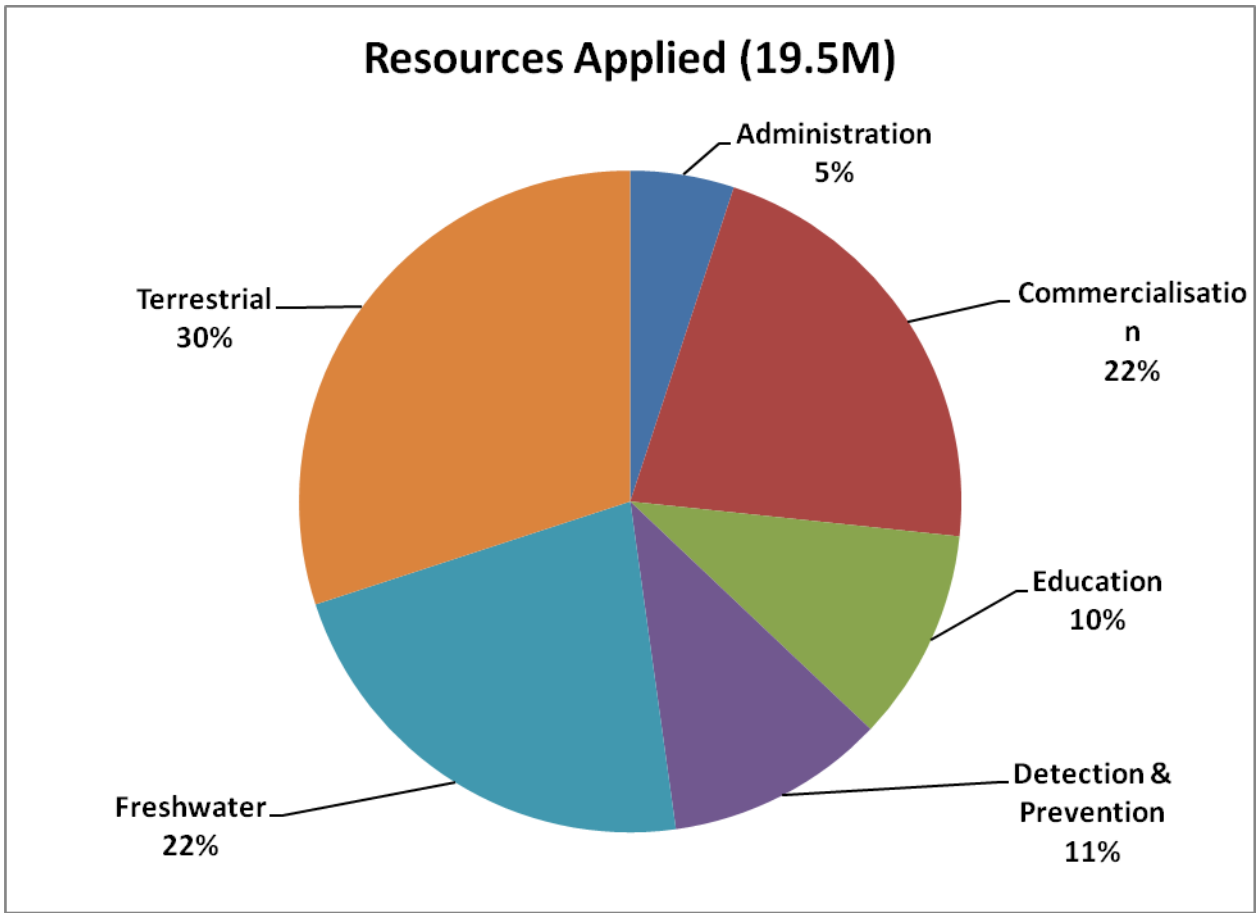
Financial information

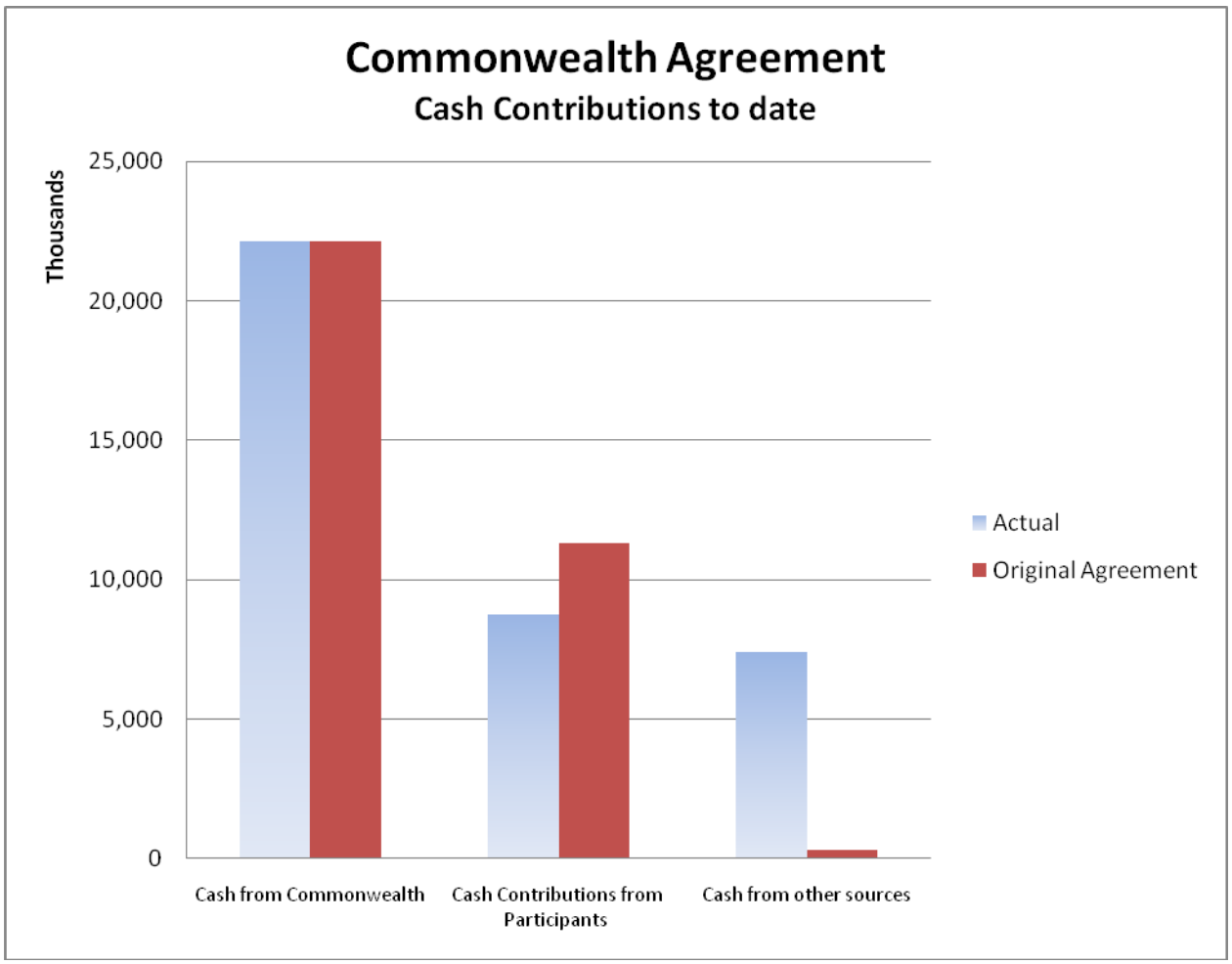
This information supplements the DIISR on-line reporting requirements. Full financial tables have been included in the online reporting. Complete audited Financial Statements for Invasive Animals Cooperative Research Centre (the CRC Participants' unincorporated joint venture) and Invasive Animals Ltd (the governance and management company) are available for download from www.invasiveanimals.com

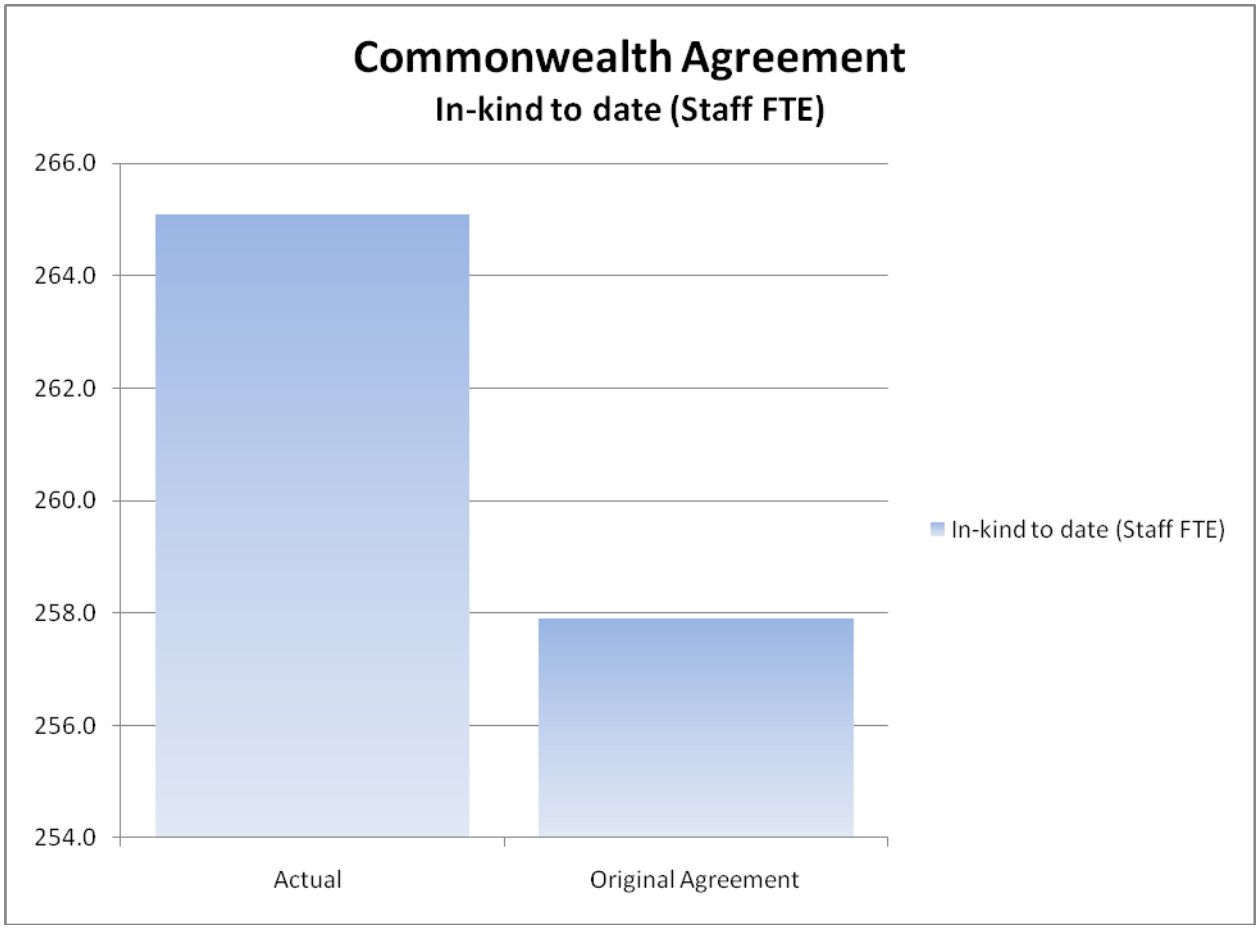
Highlights:

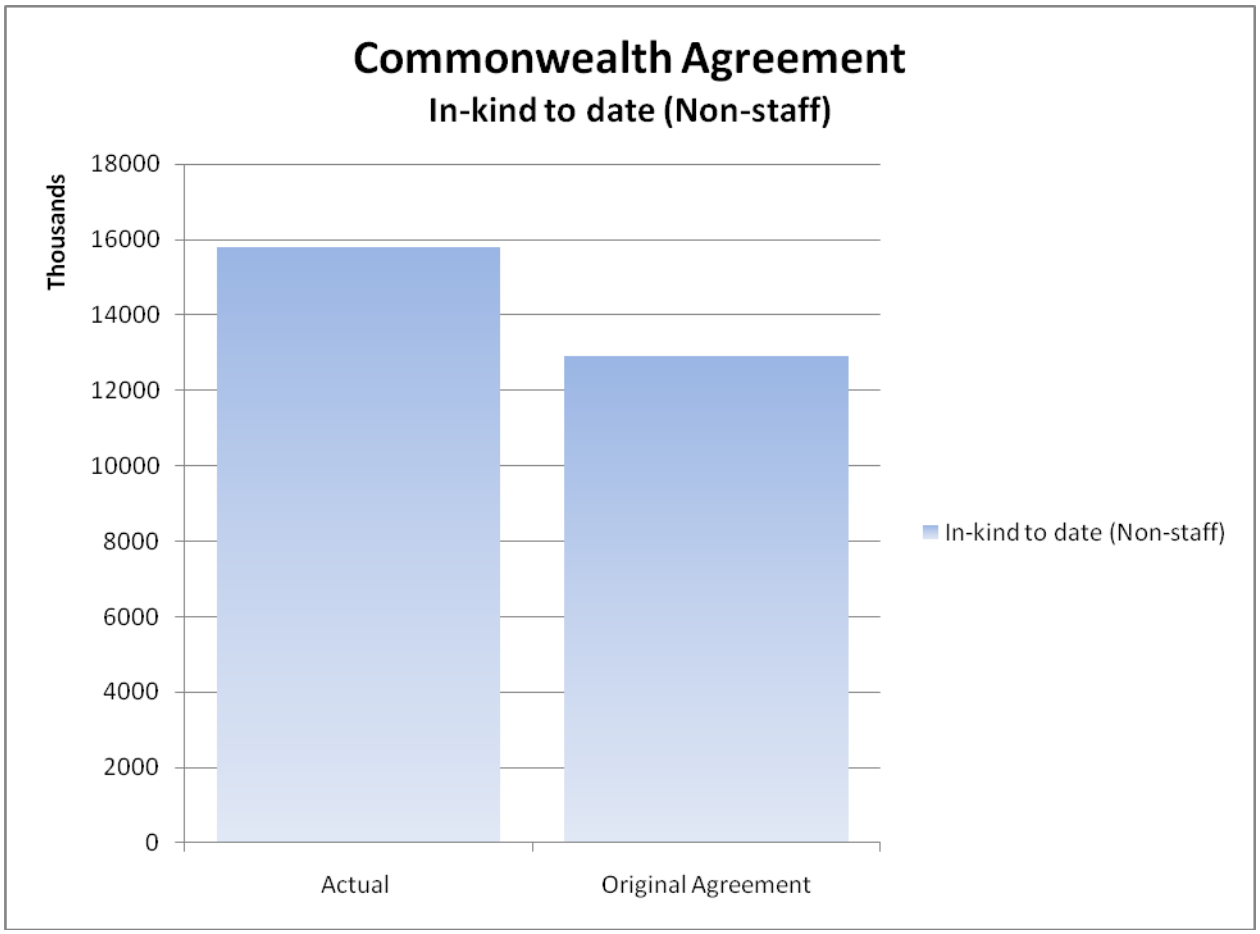
- Unqualified Audit Reports have been received for both the Invasive Animals CRC, and Invasive Animals Ltd - the management company. ('Unqualified' in this context is a good thing!)
- Current equity (accumulated surplus) at 30 June 2010 is $1.4M.
- The CRC Operational Budget anticipates $13M of Revenue and $14.4M of cash expenditure over the final two years of this CRC, which will fully expend available resources.
- Underspends and any other freed up funding will be utilised to fund a priority list of extension focused projects – developed to maximise the adoption of CRC strategic knowledge and products.
- A modest amount has been set aside as a contingency to cover wind-up expenses if necessary.
- Identifying and reporting In-kind contributions (particularly FTE) remains imperative to fulfil our participant obligations under the Commonwealth Agreement




Resources Applied (19.5M)
Administration 5%
Commercialisation 22%
Education 10%
Detection & Prevention 11%
Freshwater 22%
Terrestrial 30%


Commonwealth Agreement
Cash Contributions to date
Thousands
25,000
20,000
15,000
10,000
5,000
0
Cash from Commonwealth
Cash Contributions from Participants
Cash from other sources
Actual
Original Agreement


Commonwealth Agreement
In-kind to date (Staff FTE)
266.0
264.0
262.0
260.0
258.0
256.0
254.0
Actual
Original Agreement
In-kind to date (Staff FTE)


Commonwealth Agreement
In-kind to date (Non-staff)
Thousands
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Actual
Original Agreement
In-kind to date (Non-staff)

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INDEPENDENT AUDITOR'S REPORT

To: Department of Innovation, Industry, Science and Research (the Department)

CRC: Invasive Animals Cooperative Research Centre (the Centre)

Scope

We have audited the financial information of the Invasive Animals Cooperative Research Centre as set out in Tables 1 to 5 to be lodged with the Department of Innovation, Industry, Science and Research for the year ended 30 June 2010. The parties to the Cooperative Research Centre are responsible for the preparation and presentation of the financial information. The parties to the Cooperative Research Centre have determined that the accounting polices used and described in Note 1 to the financial information are appropriate and meet the requirements of the Agreement between the Commonwealth of Australia and the parties in relation to the Invasive Animals Cooperative Research Centre ("the Agreement"). The extent to which Accounting Standards and other mandatory professional reporting requirements in Australia have been applied is set out in Note 1. We have conducted an independent audit of the financial information in order to express an opinion on it to the Department.

The financial information has been prepared in order to meet the annual reporting requirements of the Department. We disclaim any assumption of responsibility for any reliance on this report or on the financial information to which it relates to any other person other than those mentioned above, or for any other purpose other than that for which it was prepared.

Our audit has been conducted in accordance with the Australian Auditing Standards to provide reasonable assurance as to whether the financial information is free of material misstatement. Our procedures include examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial information, and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion as to whether in all material respects, the financial information is presented fairly in accordance with Australian accounting concepts and standards as described in Note 1 to the financial information, and the Department's annual reporting guidelines, so as to present a view of the sources and application of funding that is consistent with our understanding of the Centre's activities.

We have not performed any audit procedures upon the estimates or budgets for future periods included in the financial information and therefore, do not express any opinion on them.

The audit opinion expressed in this report has been formed on the above basis.

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MOORE STEPHENS
ACCOUNTANTS & ADVISORS

Independence

In conducting our audit, we followed applicable independence requirements of Australian professional ethical pronouncements.

Audit Opinion

In our opinion, for the year ended 30 June 2010;

- the financial tables presented by Invasive Animals Cooperative Research Centre (the Centre) give a true and fair view of the revenue and expenses, both cash and in-kind;
- proper accounting standards and controls have been exercised by the Centre, in accounting for the Commonwealth funding and Contributions;
- the Centre has met its obligations in relation to the treatment of capital items;
- the cash contributions and Commonwealth funding have been paid into and expended from the Centre's account and all interest on the balance of the account has been credited to the account;
- the financial tables are presented in accordance with the Department's annual reporting guidelines;
- Commonwealth Funding and the Contributions have been expended solely for the Activities and in accordance with Schedule 3 of the Contract and Australian accounting concepts and applicable Australian Standards as set out in Note 1 to the financial information; and
- that all transactions have been conducted through the account.

Emphasis of Matter

The Centre's participants' cash and in-kind contributions are to be made in accordance with the budgets set out in the Commonwealth Agreement. Variations from budget in the form of cash and in-kind contributions are disclosed within each of the audited tables.

Selina Stanford
Director
MOORE STEPHENS

27 October 2010

Publications listing

The full publication listing (formal scientific papers only) is included at Appendix B.

Glossary

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

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

APPENDICES

APPENDIX A: Online milestone reporting

APPENDIX B: Publications listing