

2008-09

Annual Report

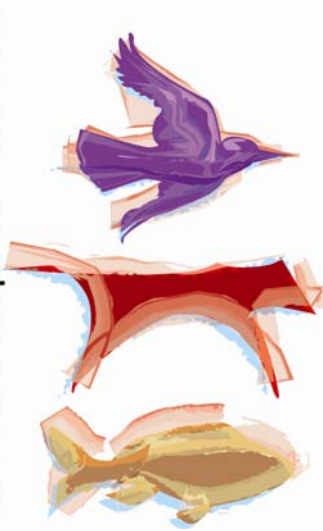


Invasive Animals CRC



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Invasive Animals Cooperative Research Centre



Annual Report 2008–09

Invasive Animals Cooperative Research Centre Annual Report 2008–09
(as per Department of Innovation, Industry, Science and Resources annual reporting requirements)

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Published by: Invasive Animals Cooperative Research Centre.

Postal address: University of Canberra, ACT 2600.

Office Location: University of Canberra, Kirinari Street, Bruce ACT 2617.

Telephone: (02) 6201 2887

Facsimile: (02) 6201 2532

Email: contact@invasiveanimals.com

Internet: www.invasiveanimals.com

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Cover image: Pestplan pilot course participants

Chair's foreword

Now that we're just beyond halfway in the life of the Invasive Animals Cooperative Research Centre (IA CRC), our attention is focused on the home straight. We have consolidated and built on existing knowledge in 2009, and are now increasing end-user adoption-related research in 2010 so that the results feed into the development of our management and education packages in 2011.



IA CRC Chair, Ms Helen Cathles

In regards to the outcomes from our third year review, I'd like to provide congratulations to all researchers, students and CRC staff and thanks to our reviewers. The recommendations were nearly all adopted by the Board.

The IA CRC continues to play an important role in educating the public and influencing national policy decisions. The ban on the importation of Savannah cats yields immediate and long term benefits at low cost. These achievements were not envisaged in the strategic and operational plans, but add value to what the CRC is delivering.

Our experience in getting our first commercial product — the world's first manufactured pig bait — into the Australian market was characterised by an uncertain and lengthy regulatory assessment and registration process, impacting on the bottom line of our SME commercialisation partner and our end users. This is an issue of concern for me given that we have several new commercial products in the final R&D stages and will be submitted for registration over the next year or two. Time, registration costs and uncertainty are three major issues that stifle pest animal control innovation and therefore effective management. As such I welcome the Council of Australian Governments (COAG) efforts to streamline the registration process by developing a single, national framework to improve the efficiency and effectiveness of the regulation of agricultural and veterinary chemicals. This is an opportunity that needs to be strongly grasped to ensure that the aspired goal is actually realised in the final outcome.

This report sets out a range of important highlights for the CRC.

I have continued to be impressed by the CRC ethic of collaboration. For example, the Freshwater Program joint meeting with the New Zealand Lake Ecosystem Restoration Program sharing of research results across the Tasman; our Australian work with the University of Minnesota, and with Auburn University and others; our work with end-users such as Lachlan River Catchment Management Authority, AgForce and Queensland councils, Rabbit Free Australia and others.

To maximise our very limited resources in the Social Research Program the Board's strategic discussion revealed the best bang for our social investment buck is to focus on an end-user adoption research program, assisting speedier uptake of CRC key technologies. The in-depth and much needed social research, on the 'social white-anting' from invasive animal impact, will have to be carried out by industry.

IA CRC is more relevant today than when first envisaged, with emerging threats in wildlife diseases, increasing rabbit problems, mouse plagues and wild dog issues. We have serious bird problems, and in our stressed rivers we have carp and the growing threat of tilapia. While we are looking at solutions at species and regional levels, there is an urgent need to establish early warning systems for emerging pests and continue efforts to commercialise our products. Our biggest challenge into the future is not just the science, but working successfully with the community in the application of control measures in coordinated ways across landscapes.

On behalf of the Board I would like to thank Chief Executive Tony Peacock, and all the management and communications team for their outstanding work and assistance to the Board over the past year.

When reading through this report I find myself saying what a remarkable group of people we have, who have come together at all levels to form the IA CRC. Thank you to our management, program and project teams, and to each of our participants, for your outstanding commitment and work towards our common goal: developing initiatives, new technologies and tools to cut through the costs of invasive animal impacts.



Helen Cathles
Chair

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Executive summary

2008–09 has been a busy and productive year. The transition of our investment policy from a rolling three-year plan to a two-phase research and development strategy has enabled us to make better judgements about research progress and also take into account new developments.

The Third Year Review, the major external look at our CRC, pointed out:

- the CRC's tightly focused suite of effective research outputs tailored to end-user needs,
- exemplary education program
- strategic approach to animal welfare issues, and
- contribution at a wider policy and community level.

The review recommended our education program be rolled out as a template for other CRCs.

In response to the research developments of the IA CRC so far, proposals were developed — Islands Secure and RHD Boost — for new areas of work and sought funding through Round 11 of the CRC Program and the Caring for our Country Program.

The success achieved through 2008–09 is in a major part due to the support of our 41 participants. Although funding constraints on several of our participants has continued impact on the CRC, they have worked supportively to help reach our operational goals.

Some important milestones were reached during the year; for example:

- **Validating risk-assessment models**

An influential report on risk assessment models was published, and is now being used by Commonwealth and state agencies in decisions to import and keep exotic vertebrate species. 40 species were assessed against the models and the assessments are already being used for prosecution cases regarding the import and keeping of high-risk species.

- **Field trials for new humane pig baits successful.**

Pen trials of new nitrite / HOGGONE formulations conducted in Queensland, New Zealand and South Australia as well as field trials on Kangaroo Island, Glenrock Station (NSW, where an 89 per cent population knockdown was achieved) and in Namadgi National Park (ACT). A species-specific delivery system, Boar Buffet, has also been trialled.

- **PAPP canid bait and BlueHealer antidote trial success.**

Completed broad-acre PAPP bait efficacy field trial for fox control on land managed by Melbourne Water (Werribee) covering 600 hectares, in Hat Head National Park (Kempsey shire NSW) covering 7,400 hectares, in the Goonoo lands (central west NSW - Dubbo) involving 142 landholders, covering 150,000 hectares and in SE Queensland (portion of Kumbarella state forest) covering 2,500 hectares. During one trial veterinarians successfully treated accidentally poisoned working dogs using the Bluehealer antidote.



Boar Buffet trials have occurred in Paroo-Darling, Namadgi, Daintree and Macquarie National Parks



Field trials have shown that these traps can remove more than 80% of migrating carp at some sites

- **Optimised wetland carp separation cages (Project 4.F.12)**

A prototype wetland carp separation cage has been built based on designs resulting from research completed.

- **Positive proof of six foxes in Tasmania determined by the National Pest Animal Genotyping Facility.**

Analysis of all scats collected in phase 1 of the survey was completed by the University of Canberra. A total of 2685 scats were analysed with six identified as fox-positive. In addition to continuing its PC2 accreditation, the Wildlife Genetics Laboratory at the University of Canberra has a number of additions under construction. These include a trace DNA laboratory, separate DNA extraction and PCR room, teaching facilities, a microscope laboratory, and a tissue storage room.

- **Regional nil-tenure wild-dog management approaches secured.** Over the past year regional wild dog management plans have been finalised and agreed by stakeholders for Niangala, Barnard River, Kempsey, Flinders Shire Council, Murweh Council and Blackall Tambo Regional Council areas.
- **Education achievements:**
 - Two PhDs have been conferred. Gwilym Haynes and Eve McDonald-Madden from the first student cohort submitted during the reporting period.
 - 11 PESTPLAN (Diploma level training course in strategic invasive animal management) graduates
 - 55 people have so far undertaken the conservation and land management course, with 47 successfully completing the three assessed competencies of Certificate II (Apply animal trapping techniques) and Certificate IV (Developing pest management plan)

Communications continues to be a focus of our activities. Having such a large number of participants, as well as many other interested parties, we see a major role of the CRC as being simply to promote interaction across agencies. *Feral Flyer*, our fortnightly email newsletter, has increased in popularity and is supplemented by an ongoing publication the *Uptake Update*, providing progress on work at the various demonstration sites.

The Chief Executive continues to increase the profile of the IA CRC and its research programs and projects through concerted publishing efforts on his blog, through twitter and through regular talk-back radio opportunities. Efforts in regards to the Savannah cat ban and increasing rabbit problems have also led to increased publicity and has secured national press and broadcast coverage. The IA CRC has also issued a media release and has participated in press interviews regarding a proposed bill to the NSW Parliament, which outlines the establishment of game reserves amongst other measures and contravenes best-practice risk-mitigation policies.



"The Community's top 5 pests are: cane toads, feral cats, rabbits, carp & foxes, followed by feral pigs & Indian mynahs"

The IA CRC Detection and Prevention program's Community Awareness Survey is an Internet-based survey to identify awareness levels and concerns regarding invasive animals.

Above: Glenn McGrath AM at the RabbitScan launch

Stakeholder engagement remains a core part of IA CRC business. The CRC has produced a high volume of quality, peer-reviewed journal articles, research related books, book chapters and conference papers over the reporting period.

Over 75 formal publications were produced within the reporting period. This included 37 published articles, 12 accepted papers, ten research-related books, two book chapters and 13 conference papers (produced in refereed proceedings). In conjunction with the formal publications, the IA CRC produced close to 90 unpublished reports for stakeholders and around 75 communications products (publications, professional training courses, seminars, conferences symposia and workshops) with the aim of transferring know-how or practical information to industry and other end-users.

Due to the large extent of materials published by researchers through the CRC, awards to recognise accomplishments are provided at our annual participants' committee meetings. In October 2008 winners of the prizes were: Dr Tanja Strive, for the Chair's prize; Dr Mary Bomford, for the Participants' Committee Prize; and Al Glen for the Chief Executive's prize for achievement as an IA CRC-supported student.

Along with the CRC awards, some of our colleagues and researchers received accolades throughout the year, including Professor Dickman who won the Whitley Medal, which is the most sought after prize in Australian zoological publishing.

For further information on specific research achievements, refer to Appendix A: milestone summaries and the IA CRC's research portfolio summary. Also refer to Appendix B: outcomes of the third year review.



Tanja Strive, CSIRO researcher, has confirmed that a non-pathogenic or benign 'RHDV-like' virus exists in Australian rabbit populations, providing a level of immunity.

Tanja received the 2008 IA CRC Chair's prize for scientific excellence. (Virology. 384(1): 97-105

Risks and opportunities

Risks

The most significant potential risk remains how the drought and consequent reduced funding levy payments to some of our industry participants could lead to requests for reduced investment levels for the remaining years.

Opportunities for new and additional resources

A number of opportunities to source external and additional CRC Program resources were pursued over the year. This resulted in successful grants worth \$490,000 being awarded to the IA CRC. A supplementary bid for Round 11 CRC Program was also prepared and submitted in this reporting period, comprising two elements: *RHD Boost* (to import and evaluate new RHDV strains to enhance rabbit biocontrol efforts) and *Islands Secure* (to produce strategic knowledge and technologies vital to enhance the probability of successfully eradicating rats and mice from high priority Australian islands). While the supplementary bid made it to the second stage of the selection process, it was unsuccessful. This was offset by news that *RHD Boost* had successfully secured funding from the Caring for our Country Program.

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.

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, of 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.



Foxes are a potential ecological disaster for Tasmania

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) 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.



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.”

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 Box 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 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

Figure 1: Excerpt from Economic Impact Analysis, CIE 2008

animals (McLeod 2004¹), published as *Counting the Cost: Impact of Invasive Animals in Australia*. A more recent study (Gong, Sinden and Jones 2009²), 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	<i>Counting the Cost</i> (McLeod 2004)				<i>Economic Impacts of vertebrate pests in Australia (Gong et al 2009)</i>
		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 quantified³.

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 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.

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.

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		

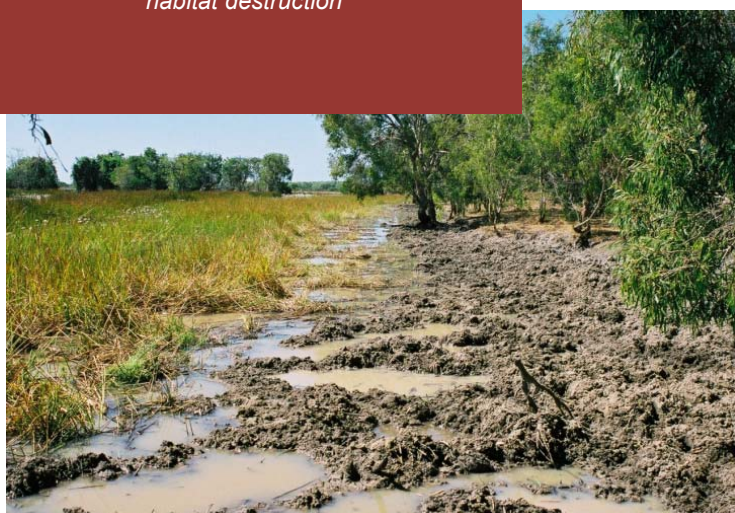
Table 2: Quantified economic benefits for the key IA CRC technologies analysed

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

External third year review of the CRC

The outcomes of the third year review are discussed in Appendix B.

Third year education program review

A review of the education program was conducted in October 2008. The review stated that overall, the Education Program is meeting its objectives and has met or is likely to meet most milestones. Two milestones will not be met: 11.1.5 (Honours students) and 11.2.13 (offshore courses) and it is recommended that these not be progressed by the IA CRC.

The Balanced Scientist Program is clearly the outstanding project of the Education program. The Education Program and IACRC should seek to capitalize on this project by measuring its outcomes, promoting it as best practice and seeking to get it published in the educational literature. Stakeholder training and delivery and public education contain a mix of effective and less effective projects. The Education Program should review these projects and the resource mix with a view to ensuring they deliver outcomes to the IA CRC.

It was apparent in the review that coordination of activities within the Education Program and its articulation with other Programs within the IACRC could be improved. Action is being taken by the Education Program leadership to ensure a coherent program that is inclusive of others in the CRC working in education or community engagement and which delivers the desired outcomes.

The Education Program and the IACRC are also giving consideration to exit strategies for projects. The IA CRC is establishing partnerships and investigating other means of ensuring the resources created continue to be used well after the CRC has run its course.

Freshwater program review

A review of the freshwater program was undertaken in June 2009. This followed an independent external review conducted in May 2008. A focus of the 2009 review was to appraise project performance of projects, particularly their path to adoption. At a more systemic level, the review also re-examined the entire program's path to adoption including making slight refinements to the target end-users. It also facilitated critical reflection and discussion on the strategic context and direction of the freshwater program beyond the life of the current CRC. The review report was completed in October 2009, and the Program Leader will shortly provide the CRC's response for presentation to the Board. The Board's approved strategy to respond to the review will be outlined in the next annual report.

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



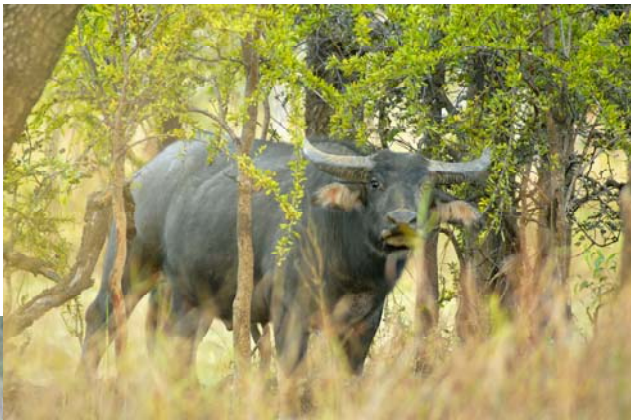
Counteracting the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions



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 – <i>Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies</i>	
Sustainable use of Australia's biodiversity	20
Safeguarding Australia – <i>Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems</i>	
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 changed since the last reporting period. Prof Joan Dawes resigned as a Board Director and was replaced by Dr Phil Cowan, NZ Landcare Research. The Board consists of 4 private sector directors which comprises 57 per cent of membership.



IA CRC Board members at Australian Wildlife Conservancy's Scotia Sanctuary, August 2008

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	5	5	-	-
Phil Cowan	3	3	-	-
Joan Dawes	2	2	1	1
Atticus Richard Fleming	5	3	-	-
Chris Hancock	5	3	-	-
William Mark Lonsdale	5	4	2	2
Helen Scott-Orr	5	5	-	1
Dedee Woodside	5	4	2	2

Table 5: Directors' meetings.

A: Number of meetings attended

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

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)

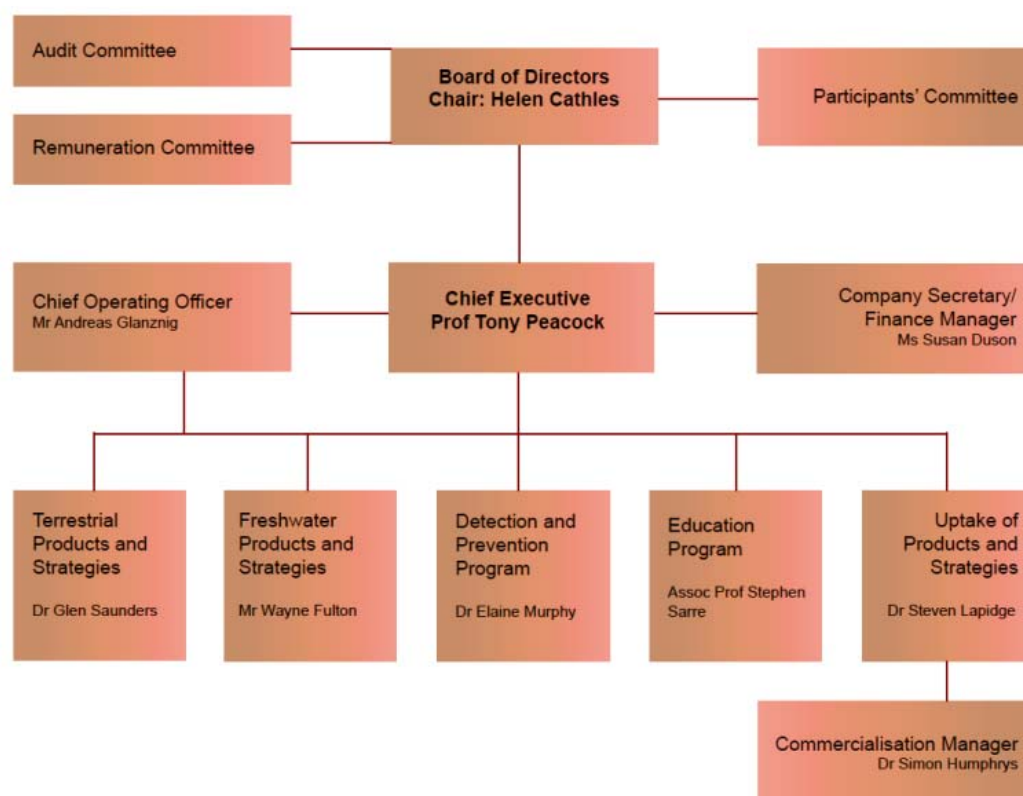


Figure 2: Operational structure

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
Dr Steven Lapidge	Invasive Animals CRC	Program Leader, Uptake
Dr Simon Humphrys	Invasive Animals CRC	Commercialisation Manager
Ms Sascha Groeneweg	Invasive Animals CRC	Program Coordinator, Uptake
Assoc 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 Diane Holloway	Invasive Animals CRC	Office Manager

Table 7: Business and Client services staff members

Staff changes

Ms Alex Bagnara (Communications Manager) was appointed in March 2009 following the departure of Kerry Molloy in November 2008.

Changes to participants

There have been no changes to the IA CRC participants during 2008–09. 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
Commonwealth Scientific and Industrial Research Organisation	Connovation Pty Ltd
Environment ACT (now under Territory &	Grains Research and Development

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

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

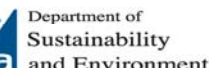
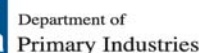
University of Queensland

University of Western Australia

ValueMetrics Australia

Victorian Department of Sustainability and
Environment

World Wildlife Fund



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 2009) also provides information on project progress aligning with IA CRC goals and milestones. See:

http://www.invasiveanimals.com/publications/downloads/IA-CRC-Research-Portfolio_Final_011009.pdf

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

Terrestrial Products and Strategies

The program delivers national control strategies for fox, wild dog, herbivore, pest birds and feral pigs and is working to increase effectiveness of Rabbit Haemorrhagic Disease (RHD).

The program supports registration of new management techniques and toxins, while exploring commercial harvesting options for reducing the impact of pest wildlife, enhancing existing and exploring new and novel welfare-based solutions to pest animal management problems.

Specific program achievements include:

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

Following the formation of the National Wild Dog Management Advisory Group in December 2008, the National Wild Dog Management Facilitator has promoted the application of the strategic approach to wild dog management in Queensland and South Australia by developing local area wild dog management plans. In states where the strategic approach to wild dog management has been implemented, the facilitator has assisted in the development of regional planning processes that integrate all levels of wild dog planning. The facilitator has also promoted the development of a nationally consistent approach to wild dog management in accordance with the aims of the Australian Pest Animal Strategy, developed strong networks for the dissemination of information relating to wild dog management, research and control, highlighted the need for collaborative research programs and facilitated the development of a nationally consistent training and extension package for wild dog control.

For further information, see page 15 of the IA CRC Research Portfolio Summary.

*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 National Wild Dog Management
Advisory Group was formed in
December 2008*



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

Collaborations were fostered through a workshop for developing the use of remote technologies, including remote release cameras, GPS collars and remotely-sourced DNA (from hair, saliva and faeces) to monitor wild dog, fox and cats. GPS/ satellite/ VHF collars were deployed on wild dogs, feral cats, foxes and spotted-tailed quolls at IA CRC field sites.

Two draft population dynamics models were constructed and data gaps identified from spotted-quoll DNA capture data. Further trapping of quolls was conducted in conjunction with project 10.T.5 to obtain the longer time-series of data required. (Data are being collated for use in population dynamics models.)

For further information, see page 6 of the IA CRC Research Portfolio Summary.

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

This project aims to deliver a complementary lethal bait that can be used in cost-effective broad-acre fox and wild dog control. Its specific objectives are:

- delivery of a new type of registered lethal baits with improved specificity and acceptability for use in control of canids (foxes and wild dogs) in Australia
- to provide new toxicants and toxicant formulations, as well as new bait matrix compositions and systems for the novel delivery of the new toxicant to relevant pests through CRC participants, and
- to provide an antidote to the primary toxicant for use in case of accidental poison of, for example, working and companion dogs (see Bluehealer® project)

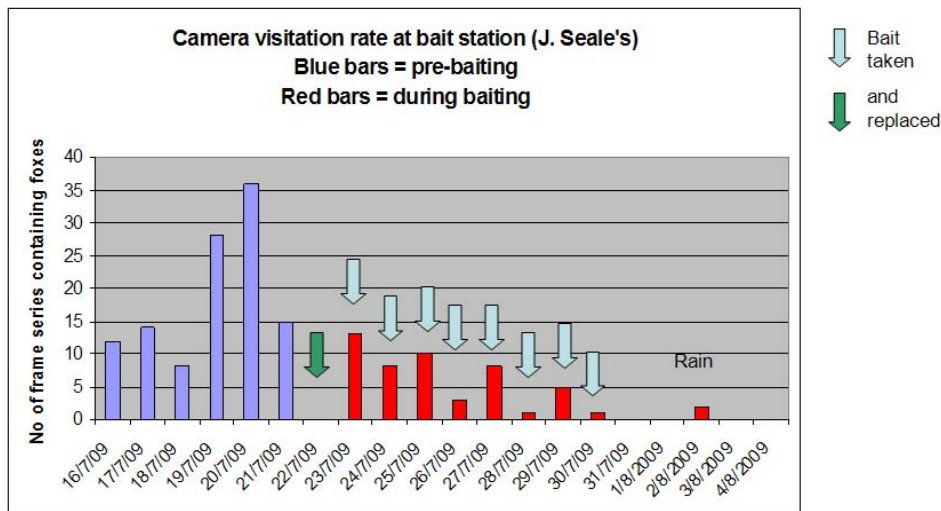


Figure 3: Camera visitation rate at bait stations



The project has accomplished several achievements including:

- Completed dose ranging studies (foxes and wild dogs) confirming that manufactured fox and wild dog baits containing para-aminopropiophenone (PAPP) are lethal and humane.
- Completed studies determining the sensitivity/risk of Australian non-target species to PAPP, including environmental fate and toxicity studies.
- Completed broad-acre PAPP bait efficacy field trial for fox control on land managed by Melbourne water (Werribee) covering 600 hectares, in Hat Head National Park (Kempsey shire NSW) covering 7,400 hectares, in the Goonoo lands (Central West NSW - Dubbo) involving 142 landholders, covering 150,000 hectares and in SE Queensland (portion of Kumbarrilla state forest) covering 2,500 hectares

Veterinarians also successfully treated accidentally poisoned working dogs during field trials using BlueHealer® antidote (see project 10.U.14c).

For further information, see page 9 of the IA CRC Research Portfolio Summary.

Researchers Dr Brian Cooke and Dr Tanja Strive

Enhancing RHDV Effectiveness (Project 7.T.1)

Researcher Tanja Strive discovered and identified a benign calicivirus in Australian wild rabbits⁴. Its similarity to RHDV and ability to convey cross-immunoconceptions will have wide-ranging impacts on rabbit management in areas where the new virus is present. The project is built on with the IA CRC's phase 2 RHD Genetic Resistance project.

RHD Genetic Resistance (Project 7.T.5)

This project provides crucial knowledge for development of future rabbit control plans as it investigates levels of effectiveness of RHD by analysing development of resistance in wild rabbits.

Rabbits from nine sites across Australia have been tested and results indicate different levels of resistance related to the past frequency of RHD outbreaks. Comparisons with experimental controls indicated resistance to infection. Specifically, results showed rabbits in some regions are now more resistant to infection with Czech strain 351 RHDV than was previously the case.

A wide-ranging review is in development which focuses on the current efficacy of RHD as a biological control agent, including an assessment of the future prospects for control based on the rate or evolution of genetic resistance to the disease. It allows us to assess how much more rabbit control remains to be done and also enable us to calculate the losses that would accrue if rabbits were allowed to return to former numbers.

For further information, see goal 7 of the IA CRC Research Portfolio Summary.

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.

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

For further information, see page 59 of the IA CRC Research Portfolio Summary.

Completing the Development of a CO Pressure Fumigator for Integrated Rabbit Management (Project 10.U.12)

With the value of warren fumigation in integrated management of rabbits clearly identified, this project seeks to demonstrate an improved approach to warren fumigation with respect to efficacy, ease of use, fumigator portability, logistical use and the humaneness of the lethal outcome.

Following tests from the initial prototype, the fumigator was completely re-engineered to improve field reliability and operational performance. A commercial manufacturer is being commissioned to make ten prototypes for field trials.

For further information, see page 60 of the IA CRC Research Portfolio Summary.



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

Oral Delivery 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 tammar vaccinated at before the onset of puberty do not become sexually mature for at least 2.5 years after vaccination.

Adult male tammar 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.

For further information, see page 69 of the IA CRC Research Portfolio Summary.

Freshwater Products and Strategies

The IA CRC freshwater products and strategies program addresses IA CRC strategic goal 4: reducing carp and other pest fish impacts. Its target is to develop the capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species.

Following on from the 2008 meeting, the 2009 annual review of the Freshwater Program was held in conjunction with the New Zealand Lake Ecosystem Restoration Program at the University of Waikato, in Hamilton New Zealand. The information exchange between the two programs will lead to strong collaborations into the future.

Specific reports developed over the year include:

- *The role of fishing competitions in pest fish management*
- *How to organise and run carp angling competitions (Guidelines)*
- *Development of an Australian emergency response plan for freshwater fish incursions- A literature review 2009*
- *Decision support package to inform the selection and implementation of carp management options at wetland inlets: a test case for South Australia*
- *Development of management strategies for the control and eradication of feral tilapia populations in Australia*
- *A strategy for developing fish specific biocides and delivery mechanisms, and the*
- *Aliens in the Basin* revised brochure.

Specific program achievements follow.

A third year Independent Review of the Freshwater Products and Strategies Program was undertaken in May 2008 and helped set the direction of the Phase 2 research program. Two reports resulted:

Hoey P, Mitchell G and Krueger C (2008) An Independent Review of the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre, a report to IA CRC and MDBC

and

Hoey P, Mitchell G and Krueger C (2008) An Independent Review of the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre, Supplementary Report to the Murray-Darling Basin Commission



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.

Pheromones released by both mature male and ovulated (sexually-receptive) female carp have been isolated, tested and identified, enabling provision of a 'product' for field testing.

For further information, see page 34 of the IA CRC Research Portfolio Summary.

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



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

Daughterless fish technology (Project 4.F.3)

Development of 'daughterless' technology, that is, an inherited genetic construct that biases offspring sex ratios towards males, offers hope as the first long-term sustainable management tool for the control and possible eradication of alien fish species in the Murray-Darling Basin.

The daughterless carp project continues to make steady progress and an important collaboration has been established with Auburn University in Alabama, USA to make use of accredited GM fish culture facilities. This enables trials of various GM constructs on carp to be advanced further than could readily be done in Australia.

For further information, see page 31 of the IA CRC Research Portfolio Summary.



*A carp-specific construct was transfected into carp eggs in October 2008. The first possible carriers were examined in September 2009, and are just beginning to reach sexual maturity. They will be screened for the construct next (northern hemisphere) spring.
PC facility - Auburn Univ, USA*



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

Demonstration site: Lachlan, NSW (Project 10.U.9)

The lower Lachlan River, including its tributaries and floodplain wetlands is recognised as a Priority High Conservation Value Aquatic Ecosystem in New South Wales.

Benchmarking is complete in the Lower Lachlan catchment. Benchmarks have been established for the size of the carp population relative level of carp recruitment from each hotspot and the status of water quality parameters, riverbank stability, aquatic vegetation cover, native fish community composition and social attitudes towards carp. Carp made up 84.5 per cent of the total biomass. The Lachlan is undergoing continued implementation of integrated carp control.

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

Optimised wetland carp separation cages (Project 4.F.12)

This project focussed on identifying ways of exploiting carp spawning aggregations at wetland inlets. Investigations evaluated the migratory (and jumping) ecology of carp through wetland inlets, including the application of existing Carp Separation Cage (CSC) technology for trapping and removing carp at wetland inlets. Required modifications to the existing Carp Separation Cage design were investigated, and a carp 'pushing' trap component was subsequently developed and incorporated into the cages and field trialled.

A prototype wetland carp separation cage has been built based on designs resulting from research completed.

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.



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. Highlights for the year include producing the first comprehensive national pictures of:

- the distribution and densities of 10 invasive animals (see Project 12.D.1)
- the economic impacts of vertebrate pests, from agricultural losses and expenditure on research and control (Project 12.D.6)
- public perceptions on invasive animals and methods used to control them (Projects 10.D.12b and 12.D.8).

By improving our understanding of triple-bottom-line costs, distributions and public perceptions of animal pests, the D&P Program will help in setting priorities, leveraging funds, designing control programs and raising public awareness.

In addition to information building, the program has also been active on the biosecurity policy front; putting in a submission to the Beale Biosecurity and Quarantine Review highlighting the need to include wildlife health in national biosecurity strategy, attended workshops on the Australian Biosecurity Intelligence Network and being involved in organising the Global Biosecurity 2010 conference. The program has also undertaken two research projects identifying disease threats in feral animals in Australia from exotic and endemic pathogen.

Specific achievements from the program include the following.

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 now being used by Commonwealth and state agencies in decisions to import and keep exotic vertebrate species. This was followed up by a national workshop looking at risk assessment processes in Australia.

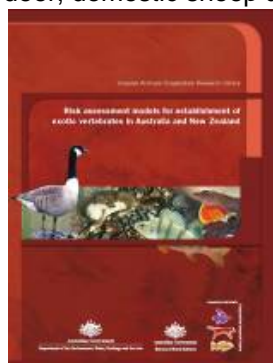
Reports from these projects have been used for public awareness campaigns and CRC submissions (e.g. on the ban on savannah cat imports, proposed changes to the NSW hunting legislation, the EPBC Act review), and to advise the VPC.

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 are already being used for prosecution cases regarding the import and keeping of high-risk species.

For further information, see page 72 of the IA CRC Research Portfolio Summary.



Pathogens in vertebrate pests of Australia (Project 8.D.3)

While the greatest potential threat of disease from vertebrate pests may be from future exotic outbreaks such as foot-and-mouth disease, it is clear many other pathogens of concern currently occur in feral populations. The occurrence of such a wide range of pathogens emphasises the need to effectively monitor and manage populations of vertebrate pests to avoid the spread of disease into livestock, native species or humans.

This project involved a literature review of published articles on pathogens or disease identified in the vertebrate pest species of interest to the CRC, namely, cane toads, carp, feral cats, feral goats, feral pigs, foxes, rabbits, rodents and wild dogs. Australian research published between 1990 and 2009 was reviewed. The final report is being prepared for publication as an IA CRC report and will also be used to submit a scientific journal article.

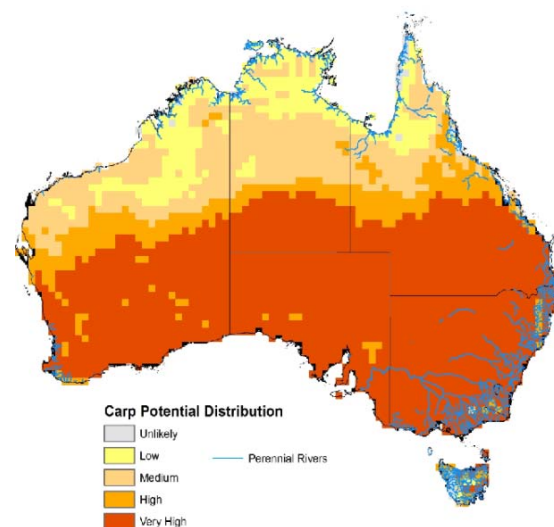
For further information, see page 78 of the IA CRC Research Portfolio Summary.

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

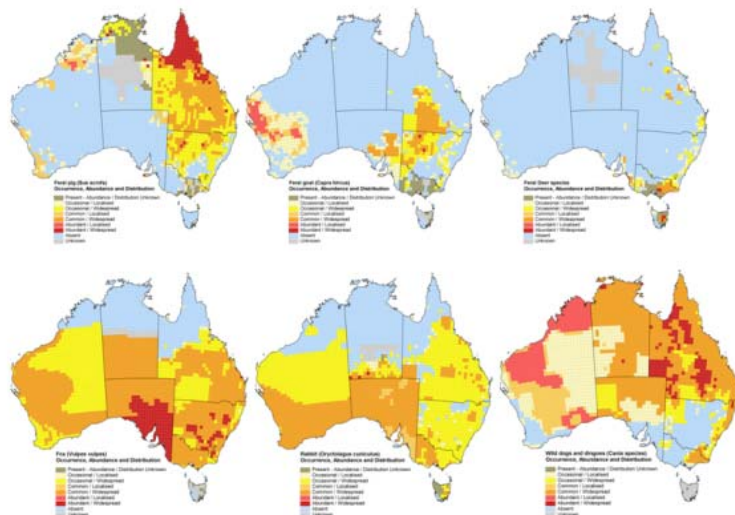
The major project outputs to date have been the production of national, state and NRM region maps that show the distribution and abundance of ten key pest animal species (feral pigs, feral goats, rabbits, foxes, feral cats, wild dogs and dingoes, common carp, starlings, cane toads and feral deer). These maps and case studies of pest animal impacts were published as a joint NLWRA/CRC report *Assessing invasive animals of Australia 2008*. The project has also resulted in the first set of nationally agreed, standardised protocols for monitoring and reporting on invasive animals.

With a nationally endorsed proven method for monitoring and reporting of invasive animals, this project will build on existing datasets to deliver more detailed information for a wider range of established species, new and emerging species and alien fish. This project will make improvements to tools, techniques, procedures, products, and information management, and deliver vital information to decision-makers at all levels. On completion, this project will provide the IA CRC with national maps for a large number of pest species, as a benchmark for prioritising research, and assessing programs, funding and investment, management actions, and national policy.

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



Maps showing invasive species distribution are available on the PESTMAPS website



Attitudes to invasive animal control methods (Fitzgerald 2009)

Farmers: If no commercial return or recreation factor, poisoning generally OK

Indigenous Australians: different world view - feral animals are a resource, not a pest

Wildlife managers: Cost, effectiveness, specificity & humaneness.

The public: Shooting & fertility control (Cost generally not a key consideration for the public)



Public attitudes to current and proposed forms of pest animal control

Public attitudes to invasive animals and control methods (Projects 10.D.12b and 12.D.8).

This project reviewed predominantly Australasian literature on people's attitudes to current and proposed forms of pest animal control. Animals covered in the review include: foxes, wild dogs and dingoes, rabbits, horses, pigs, cats, deer, goats, water buffalo, kangaroos, wallabies, possums, stoats and flying foxes. Coyotes, wolves and elk are also briefly discussed.

The review is being prepared for publication and should be useful as an information resource for those involved in researching and managing the impacts of animal pests in Australia and New Zealand.

For further information, see page 93 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 has been produced and is scheduled for launch by the Minister for Agriculture, Fisheries and Forestry, the Hon Tony Burke MP, early in the first quarter of 2009–10.

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 for almost two 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.

On average, 90 per cent of women and 80 per cent of men agree on the importance of developing effective, safe and humane controls for Australia's pest animals. Fertility control remains the public's number one choice as the preferred method for controlling feral animals (supported by 90 per cent); this method is especially favoured among women. Baiting with a new, humane poison has moved to the public's second most-preferred method of control (replacing biological controls).

"The community's top 5 pests are: cane toads, feral cats, rabbits, carp & foxes, followed by feral pigs & Indian mynahs"

Community Awareness Survey

The survey highlights contrasting attitudes towards pests between different groups in the Australian community. For example: older people are far more likely than young Australians to regard cats, camels, cane toads, carp, mynahs, starlings and feral pigs as serious pests. Young people are far more likely to regard introduced mice, rats, gambusia and pigeons as serious pests. These results suggest that young Australians should be provided with objective information about invasive animals and the damage they cause.

For the last quarter, the survey contained new questions specific to rabbits. Interestingly, carp had been ranked third but have now been overtaken by rabbits in recent findings. Overall awareness of the significance of rabbits as a major pest has continued a slight upward trend evident since May 2009 (a period coinciding with an increased communication focus on this pest by IA CRC and others).

At the CRC Association's national conference in Canberra this year, the survey methodology was described in a keynote presentation and a major professional development workshop. This workshop was identified as the highest-ranked workshop by delegates who answered a survey following the conference.

This project also contributes to Output 10.1: A registration, marketing, export and community uptake package for reducing the impacts of invasive pest animals.

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).

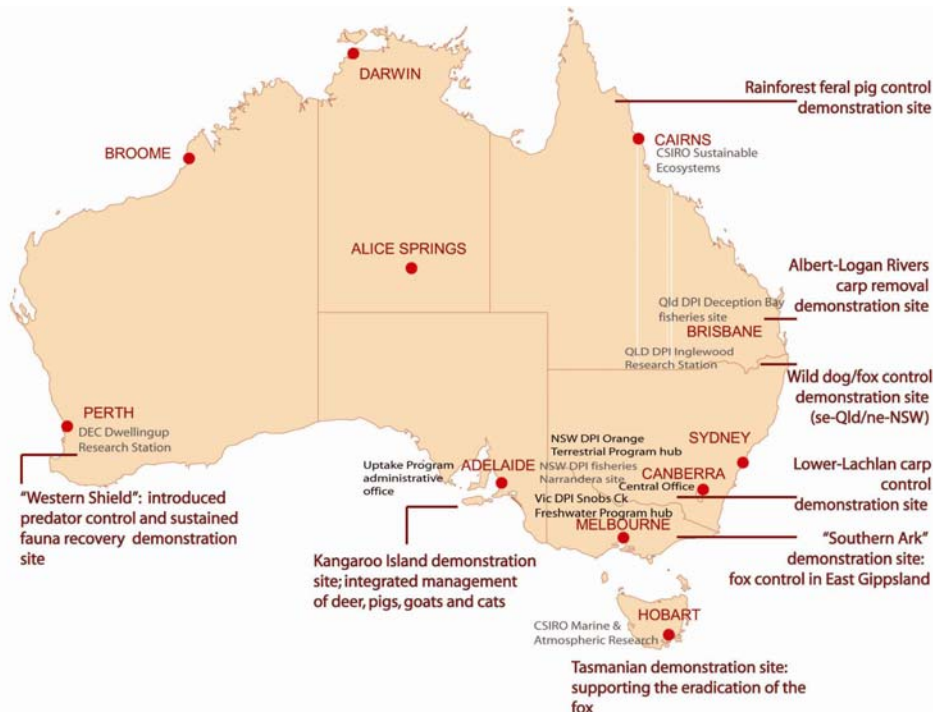


Figure 4: IA CRC demonstration sites

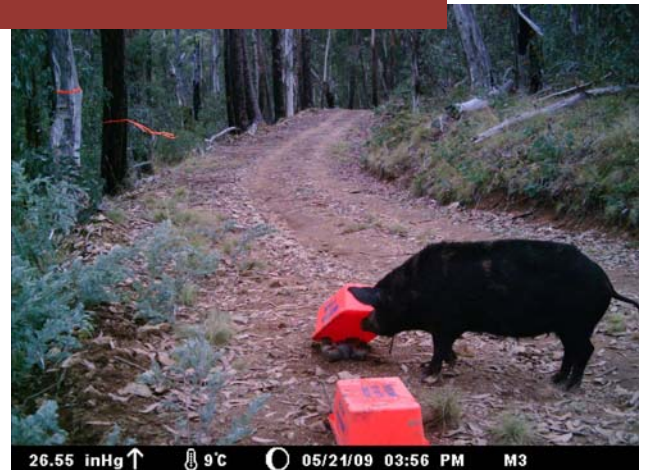
Demonstration sites are embedded within the appropriate goals. Key achievements from the broader program included the Hog-Gone® field trials (see below) and PAPP field trials (see Terrestrial program achievements).



*63% reduction in number of feral pigs
Namadgi NP, ACT,
HOG-GONE trial, May 2009*

Hog-Gone field trials

Pen trials of new nitrite / HOGGONE formulations conducted in Queensland, New Zealand and South Australia as well as field trials on Kangaroo Island, Glenrock Station (NSW, where an 89 per cent population knockdown was achieved) and in Namadgi National Park (ACT). Successful PAPP bait efficacy field trials undertaken at Hat Head National Park (NSW), Goonoo lands (NSW), Kumbarella state forest (Qld) covering over 150,000 ha and over 140 landholders.



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

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

The project has seen pen trials of new nitrite/HOG-GONE® formulations in Queensland, New Zealand and South Australia, field trials on Kangaroo Island, Glenrock Station (NSW, where a 89 per cent population knockdown was achieved) and in Namadgi National Park (ACT), non-target risk assessment research in New Zealand (with Connovation and Landcare Research), and an independent nitrite toxicosis welfare assessment in Adelaide.

Results from the project were presented in both Perth and New York State.

In addition the project has been conducting collaborative field trials of the BOAR BUFFET bait delivery hopper on KI, and in the Paroo-Darling, Daintree and Namadgi National Parks. This device will go on sale in late 2009.

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



*Extensive feral pig damage on
Kangaroo Island*

*Uptake program leader, Dr Steven
Lapidge, sets up a remote camera.*

Kangaroo Island (Project 10.U.2)

The Kangaroo Island demonstration site has accomplished eradication of feral goats from one of their seven management units (MU's). MU 2 and 3 are close behind, nearing the final stages of eradication, with no feral goats sighted in the past 5 months.

In total 631 goats have been destroyed over the past three years with the assistance of Judas goats.

Kangaroo Island is likely 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.

For further information, see page 20 of the IA CRC Research Portfolio Summary.

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

The four Western Australia subprojects' monitoring activities has enabled them to identify optimum population identification sampling and feral predator (fox) baiting regimes.

The co-ordinated and refined baiting programs have resulted in the successful reduction of fox numbers at various sites, including Dryandra Woodland, Northern Jarrah Forest and Lake Magenta, where, if this is sustained, it is planned to reintroduce the Quenda back to the site.

Additionally, the subprojects are successfully monitoring feral predator and native fauna populations (Woylies, Quenda) and investigating mesopredator release (Chuditch and Varanids) occurring from the reduction of feral predators (foxes and cats), through the use of DNA sampling tools in collaboration with Dr Oliver Berry's genetic analysis team.

For further information, see page 52 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 3,000 potential fox scats have been sent to Canberra Uni for species identification. Fox positive scats are then sent for genotyping in the Wildlife Forensics Laboratory at the University of Western Australia.

The entire south-eastern section of Tasmania is being surveyed for fox scats (Phase 2 survey; mid 2009) in a follow up to the success of the first north-eastern section (Phase 1; mid 2008).

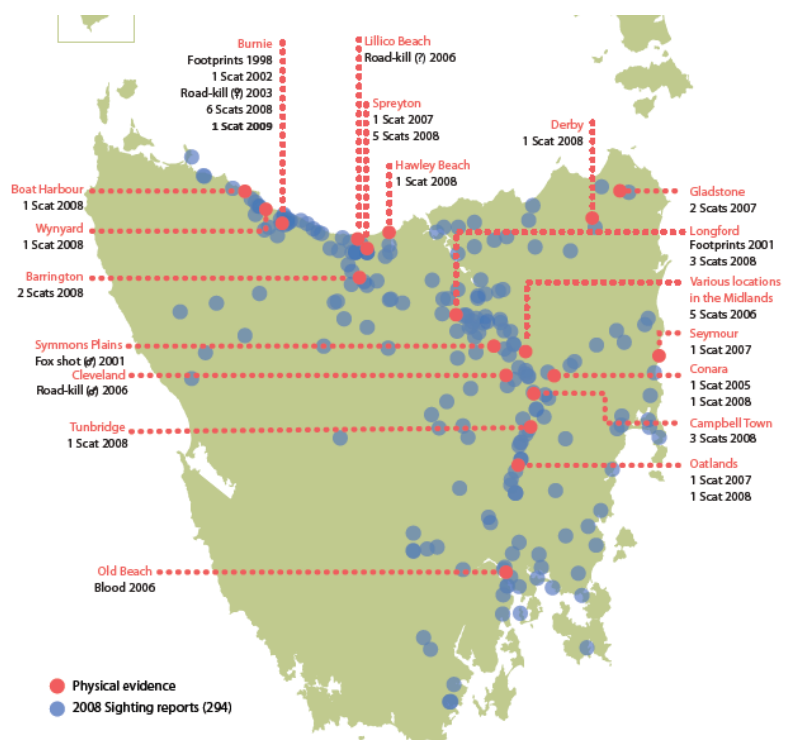
Findings give the FEP an indication of where to target its detection and eradication activities in the future to ensure the best chance of fox eradication in Tasmania. DNA analysis of thousands of scats has identified 39 as fox positive since 2005, and has resulted in identifying ten individual foxes.

For further information, see page 14 of 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





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.

Over the past year the project:

- developed an Intellectual Property (IP) management plan.
- developed an IP register and audit, which includes an international IP search.
- published a paper on international review of registration requirements.
- contributed to the development of nitrites as a new class of vertebrate omnivore pesticide.
- liaised with commercial partners to provide strategic input into fertility control research and development.
- achieved registration of PIGOUT® with the Australian Pesticides and Veterinary Medicines Authority (APVMA).
- commenced the APVMA registration application process for PAPP fox and wild dog bait products.
- planned and completed two extensive PAPP bait field trials (involving fox and wild dog management with more than 150 land managers and 150,000 hectares)



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

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. Note that progress on Education Program outcome relating to student progress are reported under section 2.6.c

Balanced Scientist

The Education Program currently supports 27 PhD candidates. 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 three annual training camps, including Wee Jasper (2007), Kangaroo Island (2008), and Kioloa (2009). Three of the students have so far submitted and one has graduated.

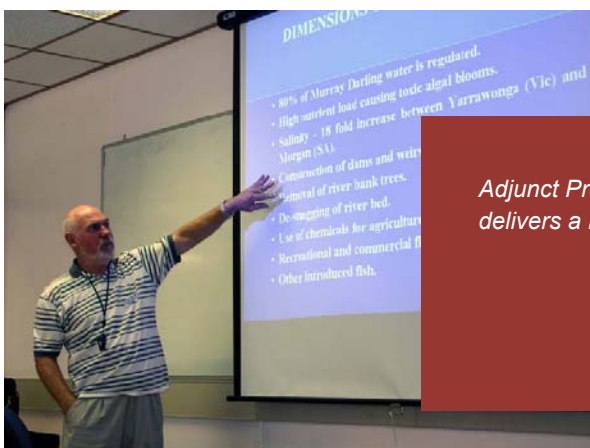


Karen Mow presenting at the 2009 professional development training camp



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 is being followed up with a fee-paying version of the course currently being trialled (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.



Adjunct Prof Mike Braysher delivers a PestPlan class.



Participants from the PestPlan pilot course.



FeralFocus
define understand manage

Featured Activity: Feral Pig:
Pest or Resource?

*Teachers examine the Feral Focus
secondary school resource.*



Online information and learning www.feral.org.au

We have continued to maintain and develop this site. Key achievements include: the addition of over 7400 records to the site (since 2005), including web links and grey literature documents, a large and increasing number of visitors to the site (around 9000 visits per month), the rebuilding of the site in Cold Fusion, the inclusion of a new 'verity' 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. This site now hosts the Feral.Focus teachers' resource pack discussed below.

Schools Education (feral focus)

The Education Program has developed an online school and community based education program (FERAL FOCUS). In its current form, this online teacher's resource is principally aimed at highschool years 8 to 10, but is in the process of being adapted for a broader spectrum of educational niches, such as primary school. Following a successful launch on 13 May 2009, Feral.Focus is now available on the aforementioned www.feral.org.au web site and is experiencing steady uptake by state and international users. The Program includes curriculum based online delivery of education resources conceived for use by Australian primary and secondary teachers and their students. Each resource can be accessed through the website and provides detailed, accurate and easy to understand pest animal management information and case studies in the form of downloadable student worksheets, online activities, suggested readings and educational games.

NRM Facilitator

In the last 12 months, NRM Facilitator Jessica Gibson has brokered individual contracts to assist NRM regions. These are in addition to more informal contact with a wide selection of NRM groups.

The NRM Liaison Officer is involved with the Pest Animal Reference Group (PARG), continuing support for the regional pest animal management strategy with the Lachlan Catchment Management Authority (CMA)

Two pest animal management planning workshops were held with the Northern Rivers CMA in February 2009 to help work towards a pest management strategy. The workshop held in Kyogle had more attendees than any of the previous workshops held in NSW. In April 2009, there was a follow-up workshop held in Kyogle that coincided with autumn baiting by the Livestock Health and Pest Authority (LHPA) officers. The workshop was followed by a LHPA and landholder baiting day where baits were strategically positioned based on landholder knowledge, baiting history and landholder interest. The outcomes from this process allowed the Northern Rivers CMA to identify pest animal issues and where the gaps in control and management existed.

The NRM liaison officer brokered a contract agreement with Border Rivers-Gwydir CMA to develop an Invasive Species Management Plan for their region was secured in May 2009. A steering group to help drive the planning process was formed and initial meetings were held to help guide the approach.

For further information, see page 86 of the IA CRC Research Portfolio Summary.

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.

The Detection and Prevention program was contracted by the Cooperative Research Centre for National Plant Biosecurity to provide expert advice for development of detection surveillance plans for non-indigenous species on Barrow Island, as part of the Greater Gorgon natural gas development. This contract was valued at \$40 000. A short-form services contract worth \$12,000 was also agreed between the IA CRC and the Department of Environment, Water, Heritage and Arts to develop a network and communications products. This project facilitates the conservation management of Australia's offshore islands by enhancing the sharing of knowledge amongst people involved in island conservation issues.

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 continued in 2008–09.

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

The islandNet network was recently 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.

A comprehensive information base of experience and expertise is being developed. It will document who is doing what, where, control or conservation programs that have been undertaken and the lessons learned from those programs. To date, about 190 people have subscribed from a wide range of countries, including Australia, New Zealand, United States, France, Japan, Canada, and various Pacific islands. 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 feral.org.au. The site hosts a resources database containing articles, reports, policy documents and images of island-related research and management.

Barrow Island quarantine processes (Project 9.D.8)

This project provided advisory services to a project being run by the CRC for National Plant Biosecurity (CRCNPB: 'Barrow Island Quarantine Management Strategy'), developing detection surveillance plans for non-indigenous species on Barrow Island, as part of the Chevron-operated Gorgon Project.

The IA CRC provided expertise (through Landcare Research) required in the project for detection surveillance plans for non-indigenous terrestrial vertebrates. Specifically, advice was provided for the vertebrate surveillance statistical design component. Project outcomes will be used to advise quarantine procedures on the island.



"Congratulations ... there is so much current information presented...really valuable!"

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.

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. The key national and international collaborators are outlined below.

Australian collaborations:

- CSIRO - sharing of expertise and facilities.
- Australian Wildlife Conservancy - trial sites.
- National Wild Dog Management Advisory Group - development of wild dog management plans.
- Rabbit Free Australia – RABBITSCAN / RABBITING ON / RHD BOOST
- Australian Hydatids Control & Epidemiology Program.
- Desert Knowledge CRC - camel consultancy.
- 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 IA CRC also played a key role in the Cooperative Research Centre Association annual conference held in May 2009. The CEO participated in the organising committee and support for specific events was provided by the Chair and Communications Manager. The event was held in conjunction with the Australian Science Festival.

Grant sources

The IA CRC applies for funding from competitive grant sources to support specific project outcomes. A total of \$490,000 was secured this financial year from Caring for our Country (CfoC) funds administered by both the Department of Environment, Water, Heritage and Arts and the Department of Agriculture, Fisheries and Forestry; and the CfoC 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	\$100,000	NRM Liaison Officer (project 11.T.3) Building capacity for management of invasive animal impacts on agriculture.
CfoC	Department of Environment, Water, Heritage and Arts	\$34,000	Codes of Practice and Standard Operating Procedures for the humane control of Cane Toads (project 5.T.5)
CfoC	Department of Environment, Water, Heritage and Arts	\$66,000	Preparation of a National Cane Toad Threat Abatement Plan (project 5.T.5)
CfoC	Department of Environment, Water, Heritage and Arts	\$12,000	Establishment of the offshore islands network (islandNet) (project 12.D.11)
APAMP	Department of Agriculture, Fisheries and Forestry	\$65,000	Best practice guidelines for the use of guardian dogs for the protection of livestock in Australia (project 1.T.5)
APAMP	Department of Agriculture, Fisheries and Forestry	\$95,000	Rabbit resurgence (project 7.T.8) Minimising future economic and biodiversity losses
APAMP	Department of Agriculture, Fisheries and Forestry	\$82,000	Blue Healer (project 10.U.14c) Registering an antidote to methaemoglobin inducers: para-aminopropiophenone and sodium nitrate
APAMP	Department of Agriculture, Fisheries and Forestry	\$36,000	Commercialisation of the Boar Buffet: a feral pig specific bait hopper

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.

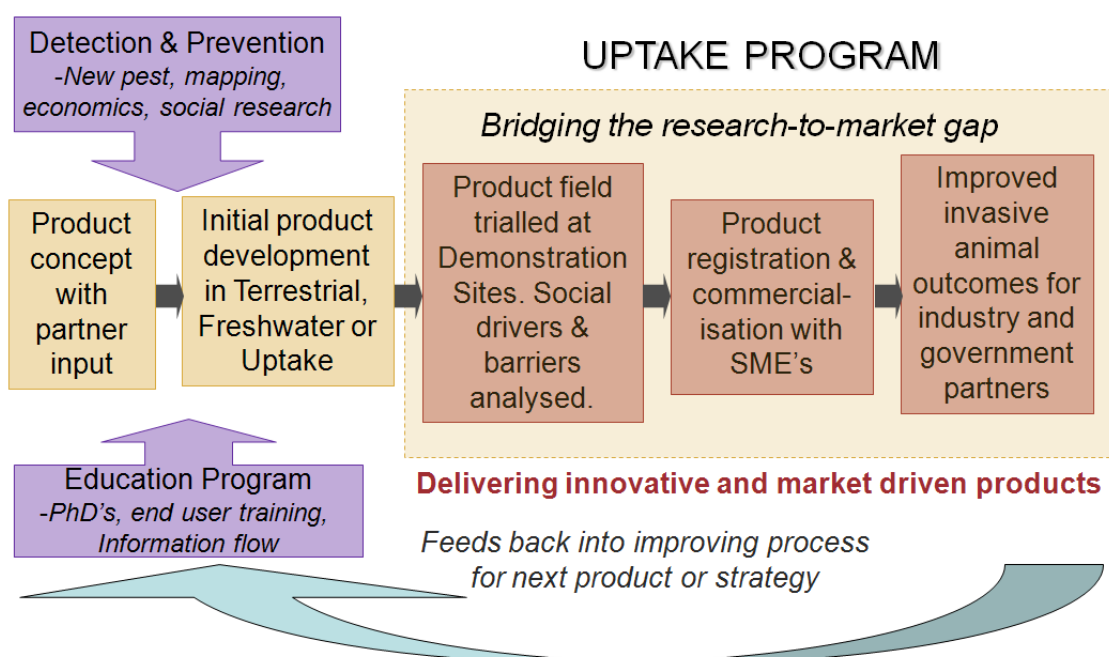


Figure 5: IA CRC product development strategy schema

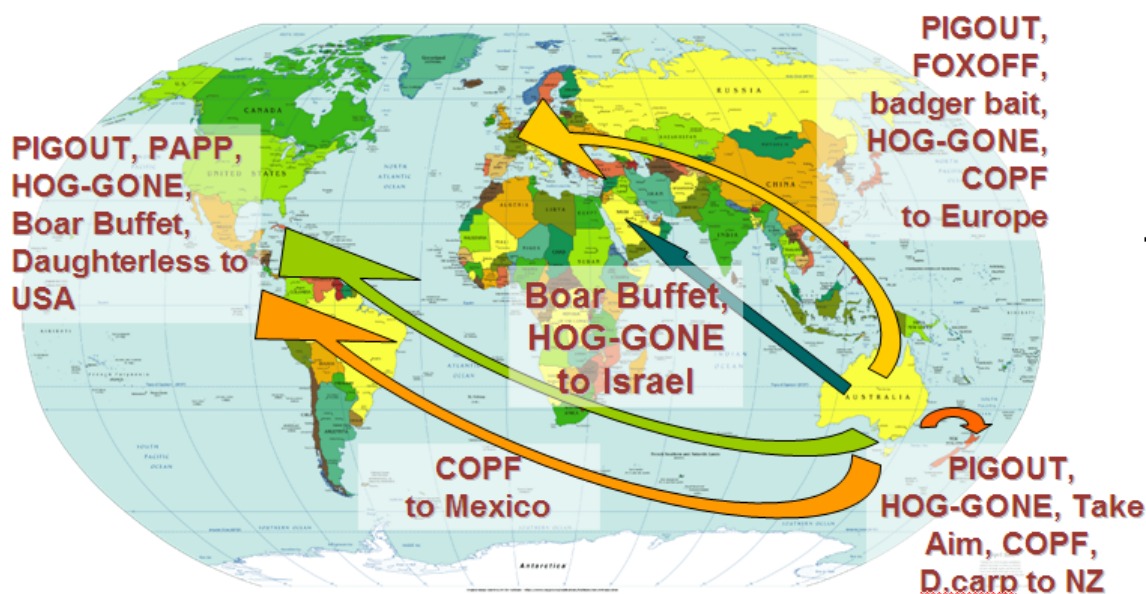
The IA CRC commercialisation strategy is built on two fundamental principles: each commercial project has at least one commercial participant involved in managing the research and a dedicated commercialisation resource within the CRC whose aim is to add and capture value from centre activities. The advantages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

IA Offshore activities



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

- Provision of access to the registration package for PAPP to the Department of Environment, Water, Heritage and Arts.
- Provision of access to the registration package for PAPP to IA CRC participant, Connovation, for input in potential New Zealand applications.

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 \$35.851 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)

One of our core participants at the 2008 Australian Vertebrate Pests Conference.



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.

Press coverage has increased over the past year, with the pest focus moving from Savannah cats to rabbits, coinciding with connected CRC media efforts.

Jul08	Aug08	Sept08	Jan09	Feb09	Mar09	Apr09	May09	Jun09
Cats	Cats	fox/dogs	Rabbits	Rabbits	Rabbits	Rabbits	Rabbits	Rabbits

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

Seven specific IA CRC media releases were issued: Savannah cat ban (4 August 08) RabbitScan (4 March 09), and Tasmanian fox scat genotyping results (11 March 09). RabbitScan & Easter (10 April 09), further Tasmanian fox scat genotyping results (17 April 09) and a response to the NSW Game and Feral Animal Control Amendment Bill 2009 (18 June 09). The IA CRC also supported media releases issued by NSW Department of Primary Industry and Meat and Livestock Australia. These releases led to national publicity in both broadcast and print media.

The 'hot issue' in the second half of 2008 continued to be the potential importation of Savannah Cats, following on from the IA CRC media release on 4 August 2008 and Tony's subsequent series of interviews. This campaign was instrumental in the government subsequently completing a review process and banning the importation of these hybrid animals. 22 print and three online stories appeared on this issue in the quarter, including an 840 word feature in The Australian. Media interest generated over this issue flowed on into a number of stories and interviews which highlighted invasive vertebrate impacts in general.

Media focus shifted in the first half of 2009 to rabbits, leveraging from several publicity opportunities (150th Anniversary of introduction of rabbits, the RabbitScan launch held at Parliament House 4 March, the ABC radio 'Rabbiting On' competition, the research discovery that rabbits are developing immunity to the Calicivirus, the Easter bilby issue, and reportage of escalated rabbit numbers).

Program and project publicity efforts continued to be undertaken by staff and participants and included:

- A series on pest control in Australian Farming Journal, instigated by Linton Staples.
- Release of the Lapidge/Dall/Spencer paper suggesting that wild dogs and hybrids are increasing in size. An initial interview with Tony for Country Hour led to further interviews with the ABC Rural Report and Bush Telegraph programs (10 interviews in total), and a number of print articles followed
- An interview with the Science Show and Steven Lapidge on PIGOUT® and feral pig impacts

- Working with Meat and Livestock Australia to leverage publicity from the HOG-GONE® trials.
 - Mulligan's Flat nature reserve promotion
 - Promotion of research relating to benign RHDV and RabbitScan (to support RHD Boost initiative)
 - A special feature on rabbits for ABC's Landline program
 - A segment on RabbitScan for the ABC children's program, Behind the News
 - A comprehensive article in the FRDC publication 'Fish' on the carp removal trial in the Lachlan catchment
 - An eight-part series on wild dog management initiatives in Rural Press's Australian Farm Journal
 - Proposed changes to the NSW Game and Feral Animal Control Act
 - Tony Peacock's regular blog, twitter publishing and appearance on local ABC radio.
- Media coverage continued to increase from the previous reporting period, even despite the high amount of coverage on the Savannah cat issue in the first quarter.

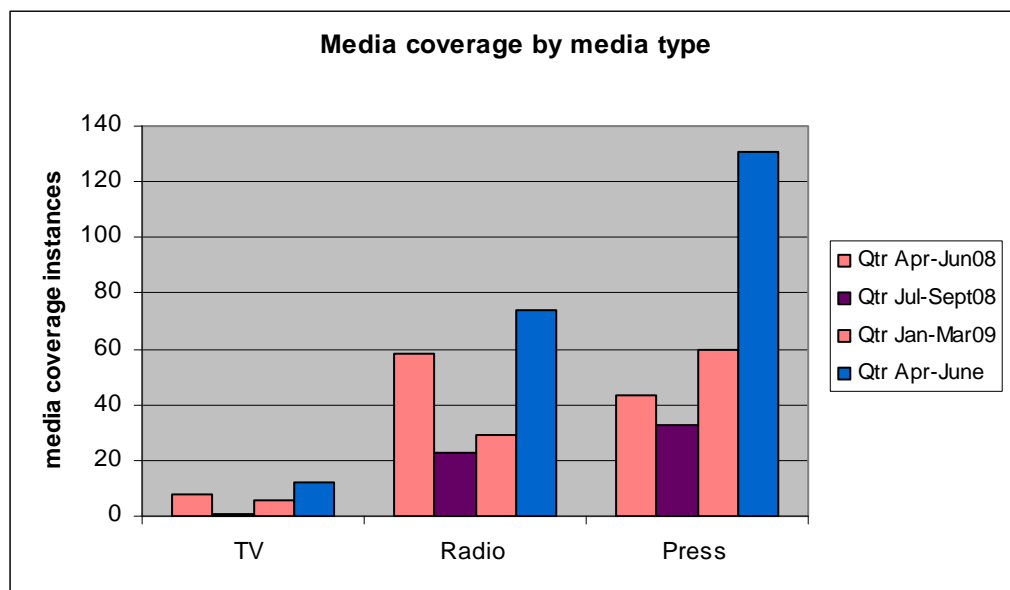


Figure 6: Media coverage by media type

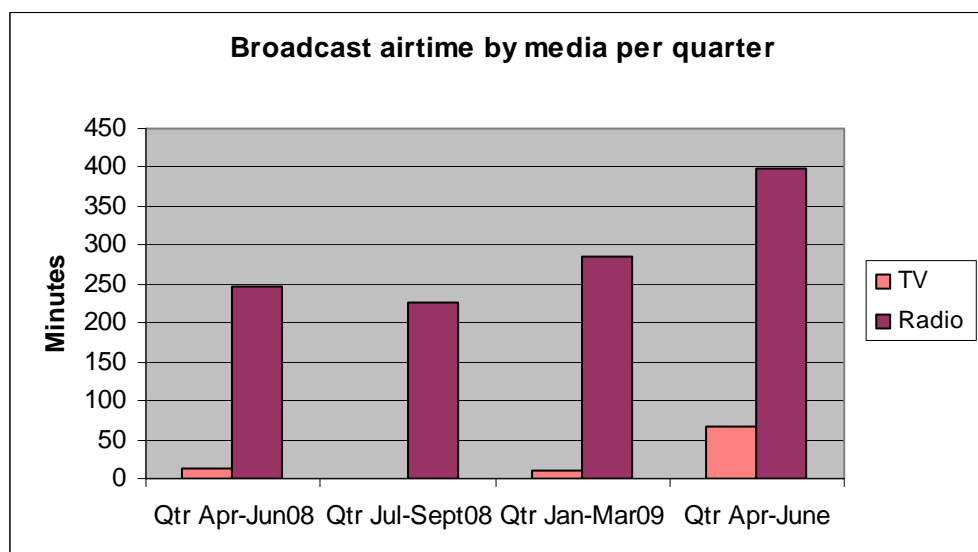


Figure 7: Broadcast airtime for TV and Radio

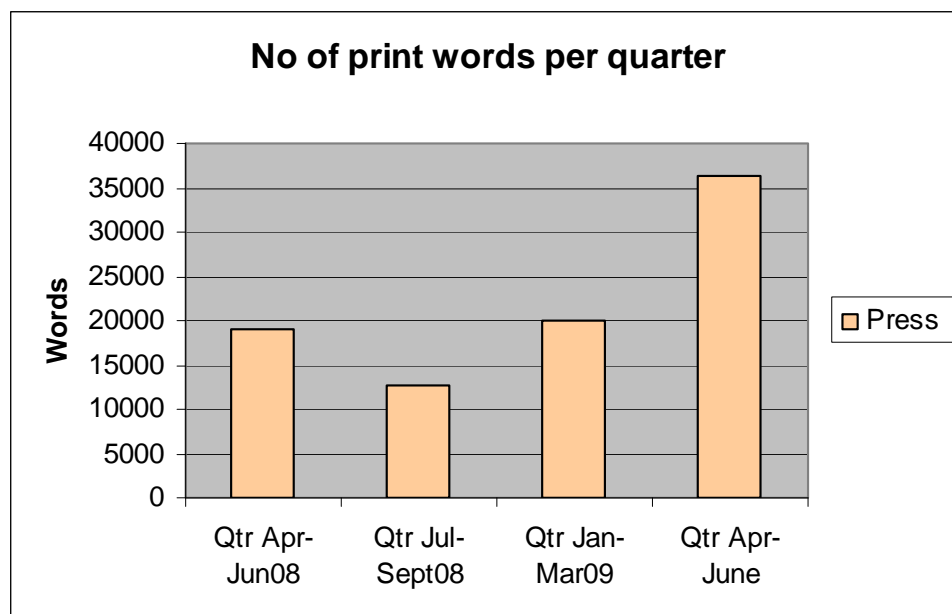


Figure 8: Number of print words monitored each quarter

Website Monitoring

IA CRC Website usage averaged at approximately 550 visitors per day. This rate increased from 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 Tony Peacock
CEO - Invasive Animals Cooperative Research Centre



an informative and entertaining blog from our Chief Executive, Prof Tony Peacock

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	Due Date	Outcome/Output	Key Responsibility	Progress
Recruit Cohort 1 students	July 05	Jan 06	11 PhD candidates and 1 Honours candidate enrolled at partner universities on CRC projects	Sarre	Completed
Recruit Cohort 2 students	July 06	Jan 07	11 PhD candidates and 2 Honours candidates enrolled at partner universities on CRC projects	Jenkins	Completed
Recruit Cohort 3 students	July 07	Jan 08	5 PhD candidates enrolled at partner universities on CRC projects	Jenkins/Heinsohn	Completed
Recruit Cohort 4	July 08	Jan 09	2 affiliated PhD candidates in support of CRC outcomes	Heinsohn	Completed

Table 10: Balanced Scientist Program cohort progress

Cohort 1

Students from the first Cohort are now into their fourth year of a four year program. Two submitted in mid 2008 and had their PhDs conferred this year. A third submitted in August this year, and is under examination. The remainder are in the final stages of their PhDs and virtually all are on track for submission in early to middle 2010. Most have attended their affiliated program reviews and have reported on their projects to the review panel. Table 1 provides summary data on each student and their project.

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 <i>Bufo marinus</i>	Peter Koopman David Booth	Terrestrial	In fourth year and progressing towards submission.
Andrew Bengsen	UQ	Controlling feral pigs in tropical rainforest	Ian Gordon Luke Leung Steven Lapidge	Uptake	In fourth year and progressing towards submission.
Tony Buckmaster	USYD	Responses of feral cats to broad scale fox control in East Gippsland, Victoria	Chris Dickman Gordon Friend	Uptake	Progressing towards submission.
Tarnya Cox	UQ	Carnivore odours as repellents: effects of diet and evolution	Peter Murray Graham Hall Xiuhua Li Andrew Tribe	Terrestrial	In fourth year and progressing towards submission.
Jennyffer	UQ	Effects of predation and	Luke Leung	Uptake	In fourth year and

Cruz-Bernal		resource availability on western brushtail possum populations	Paul de Tores Duncan Sutherland Nicky Marlow		progressing towards submission.
Alex Diment	USyd	Fox ecology in response to lethal control.	Chris Dickman Gordon Friend	Uptake	In fourth year and progressing towards submission.
Amanda Elledge	UQ	Environmental impacts of feral pigs (<i>Sus scrofa</i>) on lowland rainforests	Iain Gordon Clive McAlpine Peter Murray	Uptake	In fourth year and 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	In fourth year and progressing towards submission.
Eve McDonald-Madden	UQ	Modelling optimal monitoring	Hugh Possingham	Detection / Prevention	Submitted PhD thesis in July 2008 and PhD conferred in 2009.
Carla Meurk	UQ	Social aspects of feral pig management in the Wet Tropics of North Queensland	Iain Gordon Wolfram Dresler	Uptake	In fourth year and progressing towards submission.
CRC Linked PhD Student					
Megan Barney	UTas	Sex Determination and Differentiation in carp, <i>Cyprinus carpio</i>	Jawahar Patil Chris Carter	Freshwater	Submitted PhD in August 2009. Currently under examination.
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

The second Cohort of students are in the middle stages of their studies with some quite advanced in their project work. One candidate withdrew from her PhD program because of illness. See the below table for summary data on each student and their project.

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	Darryl McPhee Andrew Norris	Freshwater	Commenced February 2007. Currently in mid

		populations and the implications for management	Michael Hutchinson		stages of PhD.
Aaron Elkins	ANU	Environmental Attractants for Carp	Russell Barrow Simone Rochfort	Freshwater	Commenced February 2007. Currently in mid stages of PhD.
Peter Elsworth	UC	Development of genetic resistance to Rabbit Haemorrhagic Disease in wild rabbits <i>Oryctolagus cuniculus</i>	Brian Cooke Stephen Sarre Brett Lidbury	Terrestrial	Commenced February 2007. Currently in mid stages of PhD.
Jess King	USyd	Investigating the role of wildlife and wild canids in transmission of <i>Nesospora caninum</i>	Peter Windsor David Jenkins Peter Fleming Jan Slapeta John Ellis	Terrestrial	Commenced September 2007. Currently in final stages of PhD research and aiming for submission in 2010.
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 February 2007. Currently in mid stages of PhD.
Lindsey McFarlane	UQ	Characterisation of RNA silencing pathways in the common carp (<i>Cyprinus carpio</i> L.)	Jawahar Patil Peter Koopman	Freshwater	Commenced July 2007. Currently in mid stages of PhD.
Tom Newsome	USyd	Strategic management of wild dogs: how it affects ecosystems in north eastern NSW	Chris Dickman Peter Fleming	Terrestrial	Commenced March 2007. Currently in mid stages of PhD.
Hayley Pearson	USyd	Understanding and mitigating domestic pig and wildlife interactions	Jenny-Ann Toribio	Terrestrial	Commenced March 2007. Currently in mid stages of PhD.
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	Commenced January 2007. Discontinued at end of 2008 due to illness.
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 January 2007. Currently in mid stages of PhD.
Scott van Barneveld	USyd	What makes a species invasive? An assessment of invasive capability in a model genus <i>Lampropholis</i> (De Vis 1888)	Michael B. Thompson Elaine Murphy Dieter Hochuli	Prevention and Detection	Commenced March 2007. Currently in mid stages of PhD.
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

Table 12: Summary data for Cohort 2 PhD candidates

Cohort 3

The third cohort of students includes five PhD candidates selected to fill designated CRC-related projects. Three commenced in early 2008, and two in late 2008. See the below table for a summary of each of the students and their project.

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 January 2008. Entering mid stage of PhD.
Kate Garrock	ANU	Removal of the pest bird – Indian Myna (<i>Acridotheres tristis</i>) and its impacts and implications for native Australian birds	David Lindenmayer Chris Tidemann Jeff Wood	Terrestrial	Commenced in mid February 2008. Entering mid stage of PhD.
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 mid February 2008. Entering mid stage of PhD.
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. Entering mid stage of PhD.
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.

Table 13: Summary data for Cohort 3 PhD candidate

Cohort 4

Following on from the Education Program Third Year Review in late 2008, the review panel recommended that the Education Program create a new category of 'Affiliated PhD Candidate' to be selected from applicants whose PhD programs were in support of IA CRC outcomes. However, because all available scholarships had been allocated, they would not receive any top-up stipend, but would be eligible for participation in the Balanced Scientist Program group training events, such as annual PhD training camps. In response to this directive the Education program recruited two new affiliated PhD candidates at the start of this year. Their details are summarised in the table below.

Invasive Animals CRC PhD Program Cohort 4					
Student	Uni	Project	Supervisor	Affiliation	Progress
Cohort 4					
Jordan Hampton	Murdoch	Understanding the ecology of Australian feral camels to aid management	Peter Spencer Shane Maloney Andrew Woolnough Neil Burrows	Terrestrial	Commenced PhD Jan 2009
Ian McDonald	UQ	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 PhD mid 2008.

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 development.	Heinsohn	Completed

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	Due Date	Outcome/Output	Key Responsibility	Progress
Development of Diploma level training course in Invasive Animal Management	Jan 06	Mar 08	Diploma level course available online for land managers across Australia and roll	Sarre/Jenkins/Braysher/Dalla Costa/ Heinsohn	Pilot course with 11 industry-based students successfully completed in 2008; fee-paying version of the course is currently

			out overseas		in progress (2009) with 10 industry-based students, and is being used to test the market.
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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	Ongoing maintenance; 7,400 documents; rebuilding in Cold Fusion, additional 200+ plus photographs, 9,000 visitors/month; Feral.Focus teacher resource linked in 2009.
Development of School curriculum based Invasive animal education activities and resources	Mar 07	Dec 08	Resources and activity packs available and used by schools to address curriculum areas on invasive animals.	Sarre/Keogh/Braysher	FERAL FOCUS for years 8-10 was officially launched on 13 May 2009; Ongoing adaptation for broader educational niches including primary school.

Table 17: Community education program progress

Financial information

This information supplements the DIISR on-line reporting requirements. Full financial tables are included in Appendix F. Financial reports for both the IA CRC and for Invasive Animals Limited are at Appendices D and E respectively.

In-kind contributions

Salaries

The rate of staff inkind contributions are below

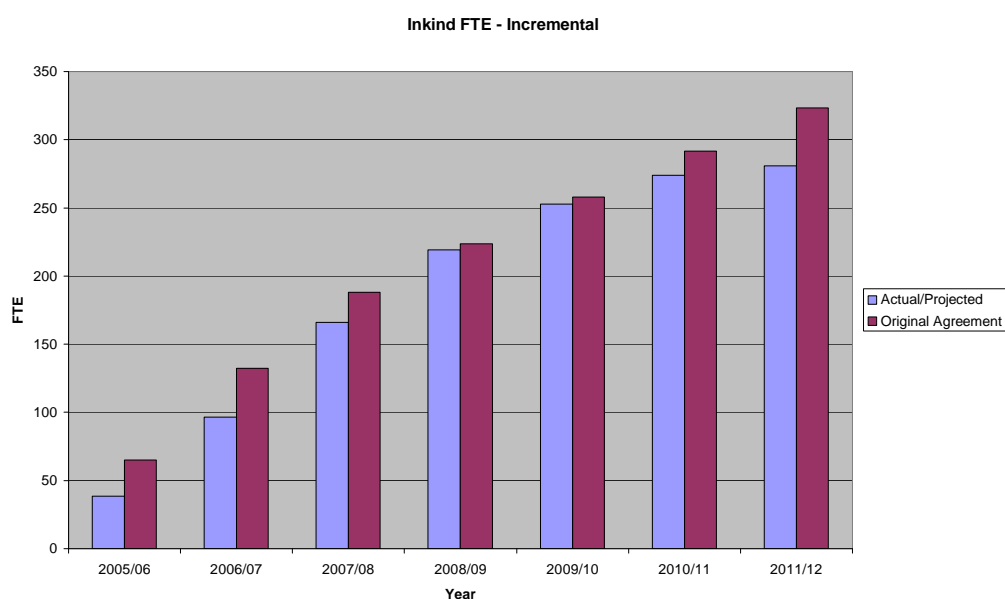


Figure 9: staff in-kind full-time equivalents (FTE) in 2008–09

Capital

Non personnel in-kind contributions are below.

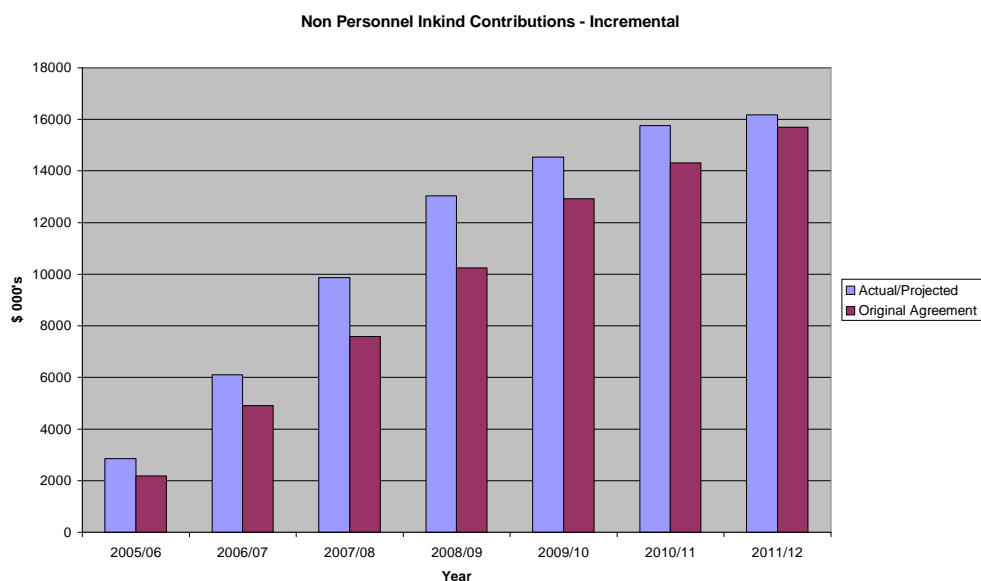


Figure 10: non-personnel in-kind contributions in 2008–09

Cash and resources

Resources available 2008–09

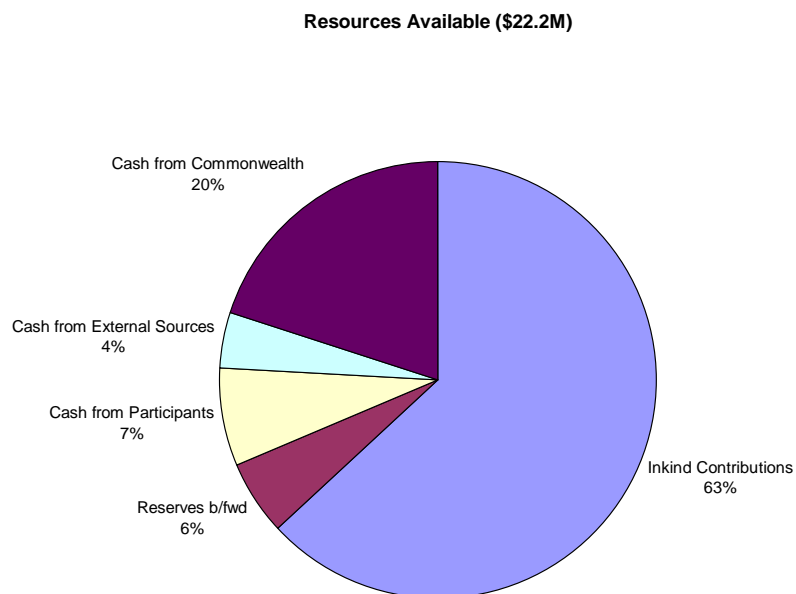


Figure 11: Resources available in 2008–09

The above chart represents the total cash and in-kind resources available for application.

Resources applied to activities and allocation of internal resources 2008–09

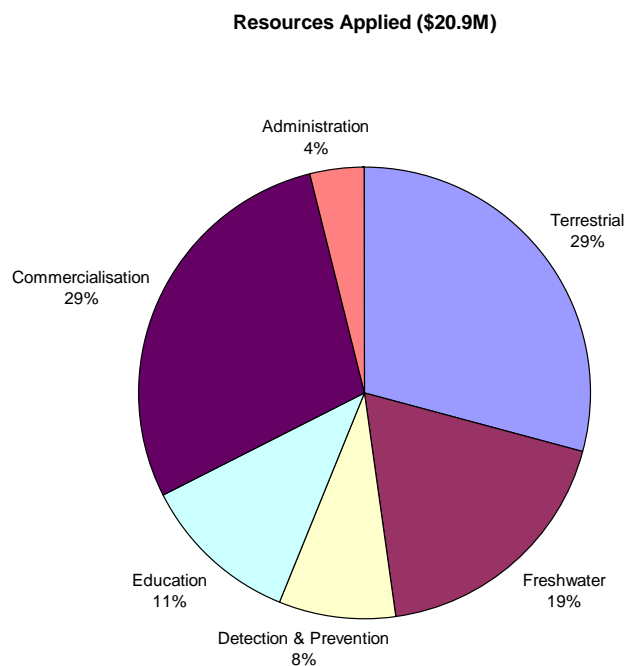


Figure 12: Resources applied to activities of the IA CRC in 2008–09

Cash contributions from participants 2005–2012

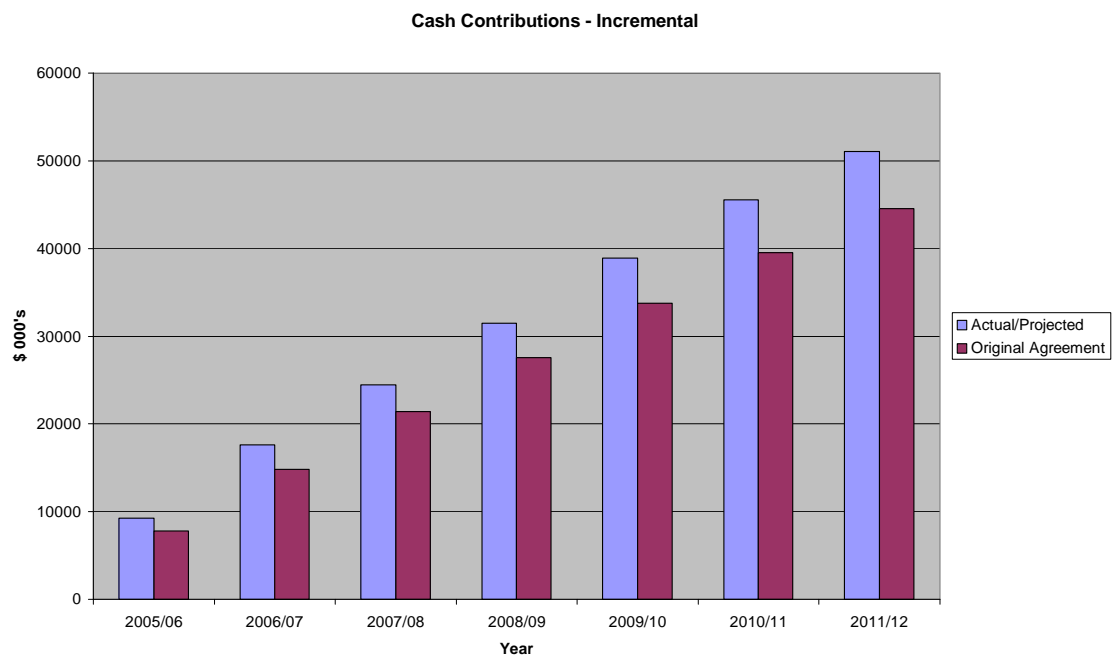


Figure 13: Cash contributions from participants from 2005 to 2012

Financial reports

Financial reports for both the IA CRC and for Invasive Animals Limited are at Appendices D and E respectively. This covers the DIISR requirement for financial information for 2004 and 2006 round CRCs.

The signed auditor report for the IA CRC financial statements follows.

Auditor report



1st Floor, 45-47 Constitution Avenue
Canberra ACT 2612

Phone +61 2 6245 3300
Fax +61 2 6230 6161

INDEPENDENT AUDIT 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 2009. 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 policies 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.

Variances against Commonwealth Agreement

Contributions in cash and in-kind were not received from the following Partners to at least the value of the budget as specified in Schedule 4 to the Commonwealth Agreement.

In-Kind Staff Contributions	Actual	Agreement
Animal Control Technologies Australia	4.1	4.5
Department of Primary Industries Victoria	0.5	1.8
NSW Department of Primary Industries	3.5	4.2
Parasitech	0.0	0.5
Pestat	0.0	0.3
Queensland Department of Natural Resources and Mines	0.0	1.5
The University of Queensland	0.5	1.0
University of Sydney	1.1	1.9
Australian National University	0.1	0.2
Australian Wildlife Conservancy	0.0	0.2
Australian Wool Innovations Ltd	0.0	0.1
Cattle Council of Australia	0.0	0.5
Department of Agriculture and Food (WA)	0.0	0.2
K & C Fisheries Global Pty Ltd	0.0	0.3
Landcare Research New Zealand Limited	0.0	1.0
WWF Australia	0.0	0.3

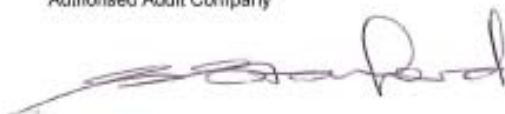
In-Kind Non-Staff Contributions	Actual	Agreement
	\$'000	\$'000
CSIRO	1,108	1,276
University of Queensland	82	100
Australian Wildlife Conservancy	0	57

Audit Opinion

In our opinion, for the year ended 30 June 2009;

- 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.

ASCENT AUDIT PTY LTD
Authorised Audit Company



Selina Stanford
Director

29 October 2009

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 single clone
myxomatosis	a virus specific to rabbits caused 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.

Publications listing

- Algar D and Richards J (2008) Presentation: Sustained integrated predator control in the Rangelands, *14th Australasian Vertebrate Pest Conference*
- Allinson G and Theodoropoulos T (unpublished 2008) *A strategy for developing fish specific biocides and delivery mechanisms*. Final Report (Summary). DPI Queenscliff.
- Aster D, Boot S and Gentle M (unpublished 2008) *Development of cyanide bait for rapid disease sampling and surveillance of wild animals*, Supplementary Report to Wildlife and Exotic Disease Preparedness Program in DAFF
- Aster D, Gentle M, MacMorran D, Aylett P and Eason C (2008) Presentation: Can we develop a cyanide bait for foxes? *2nd Queensland Pest Animal Symposium*, Cairns, 19–22 October 2008
- Ayres R and Clunie PE (2009) Developing a national rapid response plan for invasive freshwater fish in Australia. Pg 10 In Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program. *Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23–25 June 2009, Hamilton, New Zealand, pp 47
- Bajer P, Brown P and Sorensen PW (2009) Elucidating mechanisms that regulate the abundance of common carp populations in Minnesota lakes with implications for an integrated control of this species. Pg 45 In Abstracts of American Fisheries Society Tri-state (Minnesota, Ontario and Wisconsin). *American Fisheries Society Tri-state (Minnesota, Ontario and Wisconsin) Chapter conference*, 2–4 February 2009, Duluth, Minnesota, USA, pp 45
- Barney ML, Carter CG and Patil JG (2009) Molecular investigations of the mechanisms of sex determination and differentiation in the common carp, *Cyprinus carpio* (PhD) Pg 12 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meeting. *Combined annual science review meetings of the Lake Ecosystem Restoration New Zealand and the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre*, 23–25 June 2009, Hamilton, New Zealand, pp 12
- Barney ML, Patil JG, Gunasekera RM, Carter CG (2009) Distinct cytochrome P450 aromatase isoforms in the common carp (*Cyprinus carpio*): Sexual dimorphism and onset of ontogenic expression. *Gen Comp Endocrinology*, 156 (3) 499–508
- Bax NJ and Thresher RE (2009) Ecological, behavioral, and genetic factors influencing the recombinant control of invasive pests. *Ecological Applications*, 19 (4) 873–888
- Bengsen A, Leung LK, Lapidge SJ and Gordon IJ (2008) The Development of target-specific vertebrate pest management tools for complex faunal communities. *Ecological Management and Restoration*, 9 (3) 209–216
Online at: <http://www3.interscience.wiley.com/journal/121560936/abstract>
- Bomford M (2009) Risk assessment models for establishment of exotic vertebrates in Australia and New Zealand. Invasive Animals CRC, Canberra
- Bomford MM, Darbyshire RO and Randall L (2008) Determinants of establishment success for introduced mammals. *Wildlife Research* 36 (3) 192–202
- Bottrill M, LN Joseph J Carwardine, M Bode, C Cook, ET Game, H Grantham, S Kark, S Linke, E McDonald-Madden, RL Pressey, S Walker, KA Wilson and HP Possingham (2008) Is conservation triage just smart decision-making? *Trends in Ecology & Evolution* 23, 649–654.
- Brown P (2009) Integrated tagging for determination of carp movement and migration in the Murray-Darling Basin. Pg 15 In Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23–25 June 2009, Hamilton, New Zealand, pp 47
- Chadès I, McDonald-Madden E, McCarthy MA, Wintle B, Linkie M, and Possingham HP (2009) When to stop managing or surveying cryptic threatened species. *Proceeding of the National Academy of Sciences* 105, 13936–13940.
- Cowled BD, Elsworth P and Lapidge SJ (2008) Additional toxins for feral pig (*Sus scrofa*) control: identifying and testing Achilles' heels. *Wildlife Research*, vol 35 no 7 pp 651–662

- Online at: <http://www.publish.csiro.au/nid/144/paper/WR07072.htm>
- Cowled BD, Lapidge SJ, Smith M and Staples L (2008) Vaccination of feral pigs (*Sus scrofa*) using iophenoxic acid as a simulated vaccine. *Australian Veterinary Journal* 86: 50-55
- Cowled BD, Aldenhoven J, Odeh IO, Garrett T, Moran C and Lapidge SJ (2008) Feral pig population structuring in the rangelands of eastern Australia: applications for designing adaptive management units. *Conservation Genetics* 9: 211-224
- Cox T (2009) Presentation: Carnivore odours as repellants - evolutionary, taxonomical & dietary effects. *23rd International Congress for Conservation Biology*, Beijing, China
- Cruz J, Leung LK, Lisle A, Rivera DF, Staples L and Smith M (2008) Grain, pellet and wax block bait take by the house mouse (*Mus musculus*, Linnaeus 1758) and non-target species: implications for mouse eradications on coral cay islands in the Great Barrier Reef, Australia. *The Journal of Integrative Zoology*, vol 3 no 3 pp 227-234
- Online at: <http://www3.interscience.wiley.com/journal/121421227/abstract>
- Daniel AJ, Hicks BJ and Hall KG (2009) Collected abstracts of the combined annual science review meetings of the Lake Ecosystem Restoration New Zealand and the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre. *Combined annual science review meetings of the Lake Ecosystem Restoration New Zealand and the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- de Tores PJ and Asher J (2008) "Case study 9 - Monitoring introduced predator impacts on native fauna in the Jarrah Forest bioregion, southwest Western Australia", *Assessing invasive animals in Australia 2008*, first edn National Land & Water Resources Audit, Braddon, Australia, pp 71-72
- Online at: http://www.invasiveanimals.com/downloads/NLWRA_Invasive20Animals20WEB-READY.pdf
- Diment AN (2009) Counting cryptic carnivores: a comparison of novel techniques for monitoring predators. In: *Proceedings of the 29th Congress on Conservation Biology*, Beijing
- Dickman CR, Glen AS and Letnic M (2009) "Reintroducing the Dingo: Can Australia's Conservation Wastelands be Restored?" in Hayward MW and Somers MJ (eds) *Reintroduction of Top-Order Predators* 1st edn Blackwell Scientific Publishing, London, United Kingdom, pp 238-269
- Eason CT, Lapidge SJ, Hix S and MacMorran D (2009) *Confidential Report: The effectiveness of an encapsulated formulation of a new pig toxin in pen trials*
- Eason CT, Fagerstone K, Eiseman J, Humphrys S, O'Hare J and Lapidge SJ (2008) A review of terrestrial vertebrate pesticides with a rationale for linking use patterns to registration requirements *International Journal of Pest Management*
- Elkins A, Barrow R and Rochfort S (2009 in press) Carp Chemical Sensing and the Potential of Natural Environmental Attractants for Control of Carp: A Review. *Environmental chemistry*
- Elkins A, Barrow R and Rochfort S (2009) Screening and isolation of environmental attractants for carp (PhD) Pg 22 In Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- Elledge AE, Allen LR, Carlsson B-L, Wilton AN and Leung LK-P (2009) An evaluation of genetic analyses, skull morphology and visual appearance for assessing dingo purity: implications for dingo conservation, *Wildlife Research* 35: 812-820
- Elsworth PG and Marsh M (2009) It's getting hot in here: the temperature profile of rabbits during infection by RHDV In: *Proceedings of the 2nd Queensland Pest Animal Symposium*, Cairns
- Fitzgerald G and Wilkinson R (2009) *Assessing the social impact of invasive animals in Australia*, Invasive Animals CRC, Canberra
- Fleming PJS, Allen LR, Lapidge SJ, Robley A, Saunders GR and Thomson PC (2009) A strategic approach to mitigating the impacts of wild canids: proposed activities of the Invasive Animals Cooperative Research Centre, *Australian Journal of Experimental Agriculture* 46: 753-762
- Fleming PJ, Ballard G, Brown A, Jenkins DJ, King J and Stephens D (2008) Remotely capturing DNA samples from wild dogs: pilot pen and paddock studies. *4th NSW Pest Animal Control Conference*, 30 September-2 October 2008, pp 88-90
- Game ET, McDonald-Madden E, Puotinen ML, and Possingham HP (2009) Should we protect the weak or the strong? Risk, resilience and the selection of marine protected areas. *Conservation Biology* 22, 1619-1629
- Game E, Bode M, McDonald-Madden E, Grantham HS, Possingham HP (2009) Dynamic marine protected areas

- can improve the resilience of coral reefs. *Ecology Letters* 12, 1-11
- Gilligan D (2009) Identification of 'hot spots' of carp recruitment in the Murray-Darling Basin. Pg 24 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- Glen AS (2008) Population attributes of the spotted-tailed quoll (*Dasyurus maculatus*) in north-eastern New South Wales. *Australian Journal of Zoology*, vol 56 no 2 pp 137 - 142
Available Online at: <http://www.publish.csiro.au/nid/90/paper/ZO08025.htm>
- Glen AS, Berry O, Sutherland DR, Garretson S, Robinson T and de Tores PJ (2008) Crime scene investigation using DNA melt curve analysis. *AWMS Conference 2008*, 24-27 November 2008
- Glen AS, Berry O, Sutherland DR, Garretson S, Robinson T and de Tores PJ (2009) Forensic DNA confirms intraguild killing of a chuditch (*Dasyurus geoffroii*) by a feral cat (*Felis catus*). *Conservation Genetics*
- Glen AS, Cardoso MJ, Dickman CR and Firestone KB (2008) Who's your daddy? Paternity testing reveals promiscuity and multiple paternity in the carnivorous marsupial *Dasyurus maculatus* (Marsupialia: Dasyuridae). *Biological Journal of the Linnean Society*, vol 96 no 1 pp 1-7
Online at: <http://www3.interscience.wiley.com/journal/121575278/abstract>
- Glen AS, de Tores PJ, Sutherland DR and Morris KD (2008) The chuditch *Dasyurus geoffroii* and its interactions with introduced predators: a review. *Australian Journal of Zoology*
- Grantham HS, Bode M, McDonald-Madden E, Game E, Possingham HP (2009 in press) Effective conservation planning requires learning adaption. *Frontiers in Ecology and Evolution*
- Guay PJ, Tracey JP (2009) Feral Mallards – A risk for hybridisation with wild Pacific Black Ducks in Australia? *Victorian Naturalist* 126
- Guay PJ, Tracey JP (2009) Hybridisation between Mallards (*Anas platyrhynchos*) and Pacific Black Ducks (*Anas superciliosa*) on Lord Howe Island: What can genetics tell us? *Proceedings of the Waterbirds and Wetlands Conference*. Managing for Resilience, 9-13 November 2009, Fivebough and Tuckerbil Wetlands Trust Inc, Leeton, NSW
- Haynes G (2009) Population genetics of common carp in the Murray-Darling Basin (PhD) Pg 25 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- Haynes GD (2009) *Population genetics of common carp (Cyprinus carpio L.) in the Murray-Darling Basin*. PhD The University of Sydney (Supervisors: Prof Frank Nicholas, Dr Peter Grewe, Dr Dean Gilligan, Prof Chris Moran)
- Haynes GD, Gongora J, Nicholas FW and Zengar KR (2009) Rapid identification of maternal lineages in common carp (*Cyprinus carpio* L.) using real-time PCR and high resolution melt-curve analysis. *Aquaculture*, vol 287 no 1-2 pp 59-66
- Henderson WR (2009) *Workshop proceedings: Risk assessment processes for import and keeping of exotic vertebrates in Australia*. Invasive Animals CRC, Canberra
- Hoey P, Mitchell G and Krueger C (2008) *An Independent Review of the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre, Supplementary Report to the Murray-Darling Basin Commission*, unpublished report to MDBA and IA CRC
- Hinds, L.A., Labutut, L.J.A., Snape, M.A., and Miller, L.A. (2008) Presentation: Short term effects of GnRH vaccine (GonaCon) in tammar wallabies. *Vertebrate Pest Conference, Darwin*
- Humphrys S and Lapidge SJ (2008) Delivering and registering species-tailored oral antifertility products: a review. *Wildlife Research*, vol 35 no 6 pp 578-585
Online at: <http://www.publish.csiro.au/nid/144/paper/WR07145.htm>
- Hutchison M, Norris A, Chilcott K and McLennan M (2009) Validation of annual increment formation in carp from the northern Murray-Darling Basin. Pg 29 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 25-27 June 2009, Hamilton, New Zealand, pp 47
- Jacob J, Singleton GR and Hinds LA (2009) Fertility control of rodent pests. *Wildlife Research*, 35, 487-493
- Kelehear C, Webb JK and Shine R (2009) *Rhabdias pseudosphaerocephala* infection in *Bufo marinus*: lung nematodes reduce viability of metamorph cane toads. *Parasitology*, vol 136 no 8 pp 919-927
- King JS, Jenkins DJ, Ellis J, Windsor PA, Slapeta J (2009) Are dingoes definitive hosts of *Neospora caninum*? *Proceedings of the ASP and ARC/NHMRC Research Network of Parasitology Annual Conference*, Adelaide

- Lapidge SJ, Eason CT and Humphrys ST (2008) *A review of chemical, biological and fertility control options for the camel in Australia*. Desert Knowledge CRC, Alice Springs, Australia, 67p
- Lapidge SJ and Eason CT (2009) Pharmacokinetics and methemoglobin reductase activity as determinants of species susceptibility and non-target risks from sodium nitrite. *Wildlife Research*.
- Lapidge S, Wishart J, Smith M and Staples L (2008) Presentation: Is America ready for a humane feral pig 'toxin'? *Wildlife Damage Management Conference 13*
- Levesque H and Sorensen P (2008) A Juvenile Aggregation Pheromone in the Common Carp Pg 44 In Abstract Booklet from the 2008 Minnesota Invasive Species Conference. *Minnesota Invasive Species Conference*, 26-29 October 2008, Duluth, Minnesota, USA, pp 44
- Levesque H and Sorensen PW (2008) Function and Complexity of Species-Specific Aggregation Pheromones in Two Species of Related Fish, the Goldfish and Common Carp. Pg 141 In Proceedings of 24th International Society of Chemical Ecology conference. *24th International Society of Chemical Ecology conference*, 17-22 August 2008, Pennsylvania, USA, pp 141
- Lim H, Levesque H and Sorensen PW (2008) The complexity of male sex pheromone discerned by female goldfish and common carp is affected by their reproductive status. Pg 142 In Proceedings of 24th International Society of Chemical Ecology Conference. *24th International Society of Chemical Ecology conference*, 17-22 August 2008, Pennsylvania, USA, pp 142
- Lim H, Levesque H, Traveline MJ and Sorensen PW (2009) Trapping Schemes For Common Carp Control Using Pheromonal Attractants and Food. Pg 46 In Abstracts of American Fisheries Society Tri-state (Minnesota, Ontario and Wisconsin) Chapter conference. *American Fisheries Society Tri-state (Minnesota, Ontario and Wisconsin) Chapter conference*, 2-4 February 2009, Duluth, Minnesota, USA, pp 46
- Marks CA, Gigliotti F, McPhee S, Piggott MP, Taylor A and Glen AS (2008) DNA genotypes reveal red fox (*Vulpes vulpes*) abundance in a comparison of survey techniques. *Wildlife Research*
- Masters, P., Markopolous, N. and Florence, B (2008) Presentation: Deer eradication on Kangaroo Island, *14th Australasian Vertebrate Pest Conference*, Darwin
- McColl KA, Sunarto A, Williams LM and Crane MS (2009) Koi Herpesvirus (KHV): its potential as a biocontrol agent for carp in Australia. Pg 32 In Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- McDonald-Madden E, Baxter PWJ, Possingham HP (2008) Making robust decisions for conservation with restricted money and knowledge. *Journal of Applied Ecology* 45, 1360-1638
- McDonald-Madden E, Bode M, Game ET, Grantham H, Possingham HP (2009) The need for speed: informed land acquisitions for conservation in a dynamic property market. *Ecology Letters* 11, 1169-1177
- McDonald-Madden E, Gordon A, Wintle B, Grantham H, Walker S, Carvalho S, Bottrill M, Joseph M, Ponce R, Stewart R, Possingham HP (2008) 'True' conservation progress, *Science* 323, 43-44.
- McFarlane LJ, Thresher R, Koopman P and Wilhelm D (2009) Investigating mechanisms of RNA interference (RNAi) in fish (PhD) In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of the Lake Ecosystem Restoration New Zealand and the Freshwater Program. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 33
- McPhee SR, Butler KL, Kovaliski J, Mutze G, Capucci L and Cooke BD (2009) Antibody status and survival of Australian wild rabbits challenged with rabbit haemorrhagic disease virus. *Wildlife Research*, vol 36 no 5 pp 447-456
Online at: <http://www.publish.csiro.au/nid/144/paper/WR08137.htm>
- NLWRA and West P (2008) *Significant invasive species (vertebrate pests) — Status of information for reporting against indicators under the National Natural Resource Management Monitoring and Evaluation Framework*. National Land & Water Resources Audit, Canberra
- Patil JG and Gunasekera RM (2008) Tissue and sexually dimorphic expression of ovarian and brain aromatase mRNA in the Japanese medaka (*Oryzias latipes*): implications for their preferential roles in ovarian and neural differentiation and development. *General and Comparative Endocrinology*, vol 158 pp 131-137
- Patil JG and Hinze SJ (2008) Simplex PCR Assay for Positive Identification of Genetic Sex in the Japanese Medaka, *Oryzias latipes*. *Marine Biotechnology*, vol 10 no 6 pp 641-644
- Richards J and Algar D (2009) Controlling feral animals in the rangelands, *Landscape* 23, (3):52-58
- Russell DJ and Thuesen P (2008) Freshwater Recreational Fisheries in Tropical Australia: Emerging Sustainability

- Issues. Abstract 191 In: Proceedings of 5th WRFC *5th World Recreational Fishing Conference*, 10-13 November 2008 Dania Beach, Florida, USA
Online at: <http://www.igfa.org/wrfc07/schedule/abstracts.asp>
- Russell DJ, Thuesen PA and Thomson F (2009) Towards control of feral tilapia populations in north-east Queensland. Pg 37 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 25-27 June 2009, Hamilton, New Zealand, pp 47
- Russell J and Thuesen P (2009) Towards control of tilapia populations in north-eastern Queensland. Pg 76 In: Proceedings of the 14th Australasian Vertebrate Pest Conference. 10-12 June Darwin. G Saunders and C Lane eds *Australasian VPC 14th Australasian Vertebrate Pest Conference*, 10-13 June 2009, Darwin, Northern Territory, Australia, pp 178
- Sarre SD (2008) Application of genetics to island pest management, *14th Australasian Vertebrate Pest Conference*, Darwin
- Sarre SD (2008) Presentation: DNA detection of foxes to prevent establishment in Tasmania. Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá - IEPA, Brazil.
- Saunders G, Lapidge S, Fulton W, Murphy E, Sarre S, Buller C and Peacock T (2008) The Invasive Animals CRC: a new research initiative for managing some old problems. Pest or Guest: the zoology of overabundance Ed. D Lunney, P Eby, P Hutchings and S Burgin. pp 88 – 93
- Smith BB, Thwaites L, Conallin A and Fleer D (2009) Spawning migrations and attractant flows: Achilles' heel exploitation of innate carp behaviours. Pg 38 In Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-26 June 2009, Hamilton, New Zealand, pp 47
- Smith BB, Thwaites L, Conallin A and Hillyard K (2009) A draft decision support package to inform the selection of carp management options for use at wetland inlets. Pg 39 In Daniel AJ, Hicks BJ, Hall KG, compilers. 2009 Collected abstracts of the combined annual science review meeting of LERNZ *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- Sorensen P and Bajer PG (2008) Integrated Pest Management of the Common Carp. Pg 75 In Abstract booklet from Minnesota Invasive Species Conference. *Minnesota Invasive Species Conference*, 26-29 October 2008, Duluth, Minnesota, USA, pp 75
- Sorensen PW and Lim H (2009) Sex pheromonal attractants for the common carp, *Cyprinus carpio*. Pg 40 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of LERNZ and IA CRC Freshwater Program*, 23-25 June 2009, Hamilton, New Zealand, pp 40
- Strive T, Wright JD and Robinson AJ (2008) Identification and partial characterisation of a new lagovirus in Australian wild rabbits. *Virology*, vol 10
- Sutherland DS, Glen AS and Cruz J (2008) An alternative spool-and-line tracking device for medium-sized animals. *Australian Mammalogy*, vol 30 no 2 pp 89-90
Online at: <http://www.publish.csiro.au/nid/256/paper/AM08011.htm>
- Thresher R, Grewe P, Patil JG, Whyard S, Templeton CM, Chaimongol A, Hardy CM, Hinds LA and Dunham R (2009) Development of repressible sterility to prevent the establishment of feral populations of exotic and genetically modified animals. *Aquaculture*, vol 290 no 1-2 pp 104-109
Online at: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T4D-4VPV59W-5&_user=141304&_coverDate=05%2F04%2F2009&_alid=972656029&_rdoc=1&_fmt=high&_orig=search&_cdi=4972&_sort=r&_docanchor=&view=c&_ct=1&_acct=C000011678&_version=1&_urlVersion=0&_userid=141
- Thresher RE, Grewe PG, Van de Kamp J, Campbell G, Gurney R, Patil J and Canning M (2009) Development of daughterless technology for the control of pest fish. In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC. *Combined annual science review meetings of the Lake Ecosystem Restoration New Zealand and the Freshwater Products and Strategies Program of the Invasive Animals Cooperative Research Centre*, 23-25 June 2009, Waikato, New Zealand, pp 41
- Tracey JP (2008) Bird pests. In: Crawford C Ed, *Vertebrate Pest Management Course Handbook*
- Tracey J, Bomford M, Hart Q, Saunders G and Sinclair R (2007) Managing Bird Damage to Fruit and Other

- Horticultural Crops, Bureau of Rural Sciences, Canberra
- Vine SJ, Crowther MS, Lapidge SJ, Dickman CR, Mooney NJ, Piggott MP and English AW (2009) Comparison of methods to detect rare and cryptic species: a case study using the red fox (*Vulpes vulpes*). *Wildlife Research*, vol 36 no 5 pp 436-446
- Online at: <http://www.publish.csiro.au/nid/144/paper/WR08069.htm>
- Wells A (2009) Community understanding and attitudes to alien fish Pg 69-72 In: Ansell D and Jackson P (2007) Emerging Issues in Alien Fish Management in the Murray-Darling Basin Workshop Proceedings. *Emerging Issues in Alien Fish Management in the Murray-Darling Basin Workshop*, 30-31 May 2009, Brisbane, Queensland, Australia, pp 74
- Wells A (2009) Engaging communities of the M-D Basin in the IA CRC's Freshwater Products and Strategies Program. Pg 43 In: Daniel AJ, Hicks BJ, Hall KG, compilers 2009 Collected abstracts of the combined annual science review meetings of LERNZ and IA CRC. *Combined annual science review meetings of LERNZ and the Freshwater Program of IA CRC*, 23-25 June 2009, Hamilton, New Zealand, pp 47
- West P (2008) *Assessing invasive animals in Australia*, Invasive Animals CRC, Canberra
- West P (2008) Significant invasive species (vertebrate pests) - status of information for reporting against indicators under the National Natural Resource Management Monitoring and Evaluation Framework, NLWRA, Canberra.

APPENDICES

APPENDIX A: Online milestone reporting

APPENDIX B: Third-year review outcomes

APPENDIX C: Management Data Questionnaire

APPENDIX D: Invasive Animals Limited audited financial report

APPENDIX E: IA CRC audited financial report

APPENDIX F: Full financial tables

Appendices are available online here:

<http://www.invasiveanimals.com/publications/downloads/Annual-Report-Appendices.pdf>