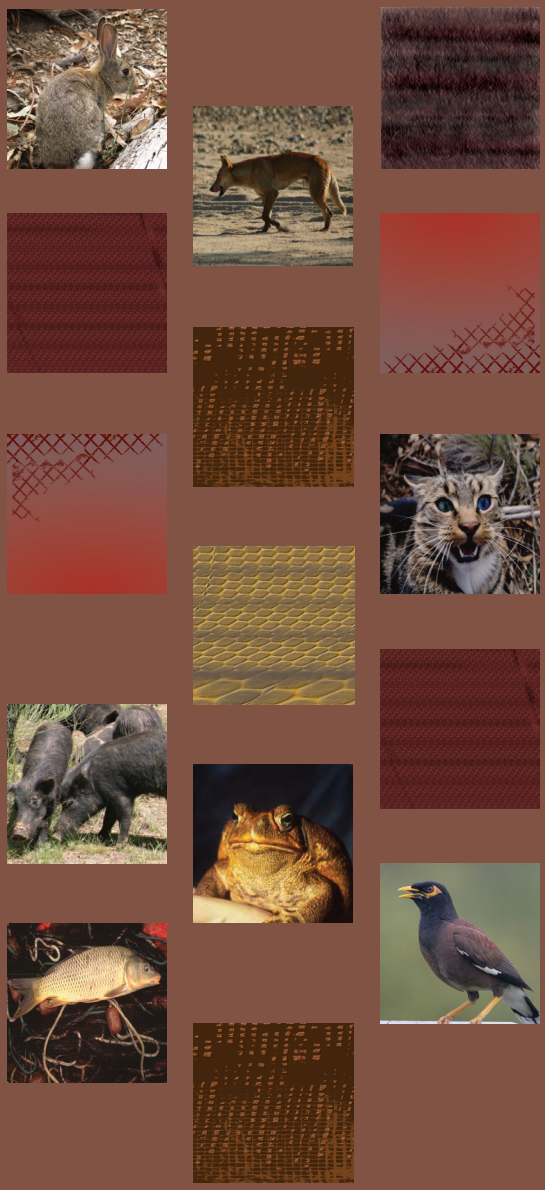
14th Australasian Vertebrate Pest Conference

Proceedings

Darwin, Australia

10-13 June 2008



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Invasive Animals CRC

Northern Territory Government

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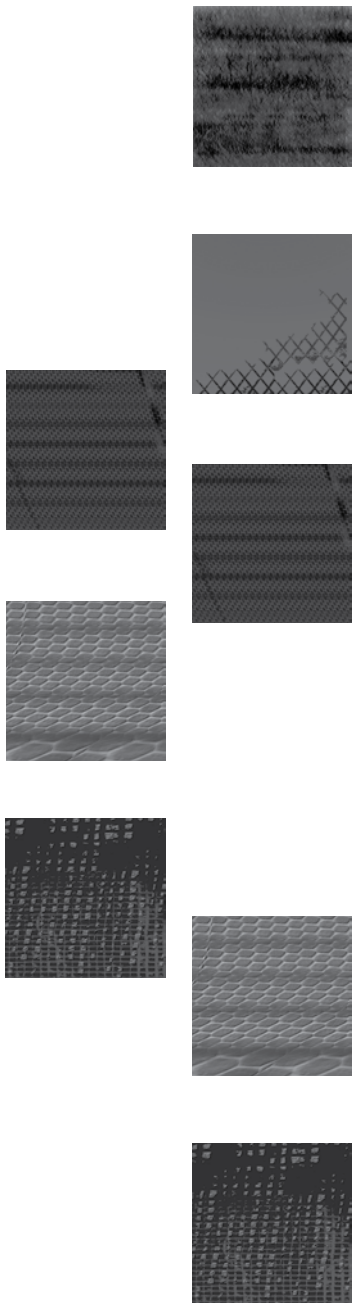

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14th Australasian Vertebrate Pest Conference

Disclaimer:

This volume is a pre-conference compilation of working papers. The contents are not peer reviewed and apart from layout changes, have been printed as received from submitting authors. In many cases, the contents contain preliminary results only. Please consult with authors before using any information contained in any of the abstracts.

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14th Australasian Vertebrate Pest Conference

Sky City, Darwin Australia

10 - 13 June 2008

Introduction:

The Australasian Vertebrate Pest Conference, held in Darwin 10-13 June 2008, is the 14th in a series recommended by the Vertebrate Pests Committee (VPC). The conference is held triennially, with the last conference convened in Wellington, New Zealand in May 2005. The 2008 AVPC was organised in conjunction with the Invasive Animals Cooperative Research Centre and the Northern Territory's Dept. of Natural Resources, Environment and the Arts.

The role of VPC is to provide coordination in policy, planning and overall strategies which address pest animal problems. This conference was timely given that VPC has just released its' Australian Pest Animal Strategy (APAS) which will provide a national framework for the management of pest animals for the next five years. Through these triennial conferences, VPC aims to increase the exchange of ideas, knowledge and innovations of all those involved in pest animal management in Australia and New Zealand as well as internationally.

Organising Committee:

Tony Peacock (Chair), Invasive Animals CRC
Glen Saunders, NSW Dept. Primary Industries
Chris Lane, NSW Dept. Primary Industries
Glenn Edwards, NT Dept. of Natural Resources, Environment and the Arts
Ben Reddiex, Ministry of Agriculture and Forestry, Biosecurity New Zealand
Darlene Lion, NT Dept. of Natural Resources, Environment and the Arts

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TUESDAY 10 JUNE 2008

OFFICIAL WELCOME 08:45-09:00

The Hon Len Kiely MLA

WELCOME TO COUNTRY 09:00-09:15

Larrakia Nation

PLENARY 1 09:15-10:30

PEST ANIMAL OUTLOOK
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CC-1A-2
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11:45 Fox surveillance in Tasmania: can we determine the success or failure of eradication efforts
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01:45 Macquarie Island Pest Eradication: planning a multiple species eradication project
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CONCURRENT SESSION 3B 03:30-05:35

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SKY CITY

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Chair: Dave Choquenot

Morning tea 10:30-11:00

CONCURRENT SESSION 4A 11:00-12:30

THE FUTURE OF CONSERVATION PEST MANAGEMENT (CONT'D)
Chair: Dave Choquenot

CONCURRENT SESSION 4B 11:00-12:30

PEST FISH CONTROL
Chair: Tony Peacock

Lunch 12:30-01:30

CONCURRENT SESSION 5A 01:30-03:00

PEST CONTROL IN PRODUCTION SETTINGS
Chair: John Burley

WEDNESDAY 11 JUNE 2008

CONCURRENT SESSION 5B 01:30-03:00

PEST FISH CONTROL (CONT'D)
Chair: Wayne Fulton

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CONCURRENT SESSION 6A 03:30-05:35

PEST CONTROL IN PRODUCTION SETTINGS (CONT'D)
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CONCURRENT SESSION 6B 03:30-05:30

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SKY CITY (ON THE LAWNS)

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CC-7B-5
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01:45 The immune approach to cane toad biocontrol
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02:30 A ten year study has revealed no long term impact of cane toads on native frogs in the Roper River district of the Northern Territory
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04:30 Long term survival of cooperative pest control programs
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05:15 The Board of the Society of Conservation Biology (Australasia Section) Student Award
05:25 Farewell by Tony Peacock

MINDI MARKETS 05:45

Gather in the SkyCity foyer to escorted down to Mindil Markets in time to catch the sunset.

POSTERS

14TH AVPC CONFERENCE ABSTRACTS

(IN ORDER OF PRESENTATION)

OVER THE HORIZON PEST ANIMAL MANAGEMENT

Anthony Peacock

Invasive Animals Cooperative Research Centre, University of Canberra ACT 2601

ABSTRACT:

A number of trends are evident or emerging in the management of invasive species and these give us some indication of the conditions under which we will combat feral animals in the future. If the past is any guide to the future, the major impacts on feral animal management will be social, regulatory and economic rather than technical.

To 2050, Australian society will continue to age; become more urbanised; and more animal welfare conscious. In the next decade, a large number of current research workers, teachers and practitioners will retire and not necessarily be replaced. The impacts on feral animal control are likely to be a restriction of freedom to operate, limited by availability of skilled workers and greater social barriers to conducting feral animal control.

Regulatory barriers are unlikely to be relaxed. However, harmonization of the regulatory system between Australia, New Zealand, the United States and Canada is achievable and would improve prospects of bringing new products to market.

Justification of the economic benefits of feral animal control programs will require major adjustments to current practices. It is likely that pest managers will need to provide projections of benefits and do more monitoring than has previously been the case.

All these trends will mean that pest animal control will require greater planning, consultation and reporting. Technical innovation will be important, but will not necessarily be critical. The skills of the people involved in pest animal management are more likely to be the critical factor in successful pest management. The future manager will require planning, consultative and communication skills equal to the new environment of justification, scrutiny and instant information flow.

To assist future managers to be successful, we must raise the profile of pest animals to a new level. The public must be knowledgeable of practices and the need for them. We must ensure politicians and environmentalists are willing to "champion" the issue of pest animal control as a significant economic and environmental issue, and not shy away from it as too difficult to advocate.

Notes

STRONGER INVASIVE ANIMAL MANAGEMENT KEY TO STRATEGIC CLIMATE CHANGE ADAPTATION

Andy Sheppard[1] and Andreas Glanznig[2]

[1]CSIRO Entomology GPO Box 1700 Canberra ACT 2601
[2]Invasive Animals CRC, University of Canberra ACT 2601
Email: Andy.Sheppard@csiro.au

ABSTRACT:

In the last 12 months there has been a dramatic shift in political will around the reality of human induced climate change in Australia. The new Federal government has taken office with mitigation of climate change impacts on the top of the political agenda, with a dedicated minister for the task.

The national climate change adaptation policy response is also well progressed with the release of the Council of Australian Government (COAG) *National Climate Change Adaptation Framework* in 2007. The subordinate biodiversity and agricultural action plans highlight the need to integrate the pest, weed and disease implications of climate change into strategies that minimise their impact on agricultural and natural systems. Actions include the need to assess and prioritise the implications of climate change on the distribution and abundance of pests, and identify potential impacts of climate change on managing pest risks.

This action agenda is yet to translate into a national collaborative research program that can provide practical guidance to focus management effort and resources on building resilience in important but vulnerable areas. To protect biodiversity assets, this includes reducing the threat of invasive animals to refugia and islands, while for agricultural assets this includes reducing the grazing pressure of rabbits and other invasive herbivores.

The talk suggests how climate change is able to drive bigger and more costly invasive animal impacts, and outlines a targeted research agenda that is needed to enable better mitigation of the impacts of invasive animals under climate change and also provide adaptive management solutions for impact management as conditions change.

Despite the strategic risk posed by invasive animals and existing policy commitments, the risk remains that invasive species will slip between the cracks in national climate change adaptation priorities. For example, a recent climate change adaptation report presented to the *Prime Minister's Science, Engineering and Innovation Council* (PMSEIC) was silent on the negative interaction between invasive pests and climate change.

Notes

AUSTRALIAN PEST ANIMAL STRATEGY – WHAT IS IT AND HOW WILL IT HELP?

Jim Thompson

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80 Ann Street Brisbane Qld 4000
Email: jim.thompson@dpi.qld.gov.au

ABSTRACT:

Over the last 200 years Australians have deliberately or accidentally imported many exotic animals into the country. At least 80 have established mainland populations and many have become significant pests. It is estimated that eleven of the major pests cost Australia over $720M per year through economic, environmental and social impacts (McLeod 2004). Impossible to cost are the environmental impacts of some pests, such as the contribution of predators to the extinction of Australia's native mammals.

Until the mid-1900's it could be argued that Australians demonstrated a naïve approach and poor understanding of the implications of the introduction of new species to Australia. However, it should also be acknowledged that Australian private and public landowners have increasingly recognised the problem and spend considerable time and money addressing the impacts of pest animals. There is an ongoing need to maintain and improve this effort through a nationally agreed approach.

The first Australian Pest Animal Strategy (APAS) was released in 2007. It is a national strategy to address the impacts caused by exotic vertebrate animals including mammals, birds, amphibians and fish. The vision for the strategy is that: *Australia's biodiversity, agricultural assets and social values are secure from the impacts of vertebrate pest animals.*

The Australian Pest Animal Strategy forms part of Australia's integrated approach to national biosecurity and compliments a range of existing and new national strategies for invasive species, such as those for weeds and marine pests. It is based on 12 key principles which recognise the need for shared responsibility, planning and prioritisation. Its three key goals relate to leadership and coordination, preventing new pests and managing established pests.

No strategy, by itself, will provide the panacea to pest animal problems in Australia. Its success rests with a demonstrated commitment to its principles and strategies by pest animal managers and their organisations across Australia. The challenge of pest animal management in Australia is long term. The challenge for the Australian Pest Animal Strategy is to ensure that the resources and efforts available for pest animal management in Australia are directed in a coordinated and strategic manner.

Notes

FOXES IN TASMANIA: AN UPDATE ON THE ERADICATION PROGRAM

Alan Johnston

Department of Primary Industries and Water, PO Box 46, Kings Meadows, Tasmania, 7250
Email: alan.johnston@dpiw.tas.gov.au

ABSTRACT:

Historically Tasmania has been considered free of foxes. However during the late 1990's evidence started to appear suggesting that there may be a small number of foxes present in Tasmania. A review of the evidence commissioned by the Invasive Animals Cooperative Research Centre (IACRC) in 2006 supported this view and also concluded that eradication was still possible. The IACRC Report also concluded that there is absolutely no doubt that foxes could successfully colonise Tasmania and that the impact would be catastrophic.

In response to the IACRC Report and mounting evidence the Tasmanian Government announced in late 2006 significant funding for a 10 year eradication program. The Australian Government is also contributing significant funds and the IACRC is providing funds for a specific scat monitoring project.

A formal Project Business Plan for two years has been developed with an appropriate governance structure, milestones, performance indicators and targets. The Project Plan is supported by a Communications Strategy, Research Plan and Operations Plan. Staff numbers have grown significantly with the Project Plan being delivered through a number of activities – strategic baiting, investigations, tactical response, monitoring, research, community engagement and biosecurity.

The focus of the eradication effort is built around broadscale baiting using 1080 baits, with a target of baiting 600 000 ha per year. Baiting is targeted at areas determined to be prime fox habitat, with a focus on hotspot areas as defined by evidence data. In the future information from a rigorous scientifically designed scat monitoring survey will inform baiting decisions.

The eradication of foxes in Tasmania is a high priority issue that will need the ongoing commitment of the government and community working in partnership if it is to be successful.

Notes

FOXES IN TASMANIA: WHAT'S ON THE MENU?

Shannon Troy[1], Dean Heinze[1], Rachel Musgrave[2], Shaun Thurstans[3], Nick Mooney[1]

[1]Fox Eradication Program, Department of Primary Industries and Water, GPO Box 44, Hobart, Tasmania, 7001
[2]School of Biological, Earth and Environmental Science, UNSW, Sydney, NSW 2052
[3]Bluewings Ecological Consultants PO Box 3065 West Hobart 7001
Email: nick.mooney@dpiw.tas.gov.au

ABSTRACT:

Predation by the introduced European red fox *Vulpes vulpes* has been implicated in the decline of various fauna on mainland Australia, and is recognised as a threatening process through the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. The recent introduction of the red fox into Tasmania presents a significant threat to wildlife in the state; Tasmania is a stronghold for many critical weight range (35-5500g) mammals and flightless and/or ground nesting birds absent or threatened on mainland Australia.

The target outcome from management operations against the fox in Tasmania is complete eradication. However, as eradication of foxes has never been achieved in an area comparable in size to Tasmania, it is important to plan for the possibility that eradication may fail. In addition to the direct risks to wildlife from fox predation, there are also potential risks to non-target species from the eradication agent, 1080. To quantify these risks, the Fox Eradication Program's research activities focus on three key areas: (1) assessing the ecological impacts of eradication activities; (2) assessing the risk to wildlife from direct fox predation/competition; and (3) ongoing at-risk species monitoring.

(1) Remote monitoring techniques will be used to determine the relationship between the species taking bait, and the spatial and temporal aspects of bait-take. These actions will lead to an increased understanding of bait-take and the potential ecological effects of baiting on non-target species. This information will be used to further refine guidelines for effective eradication activities that minimise risks to non-target species.

(2) In the worst case scenario of eradication failure and the establishment of foxes in Tasmania, resource limitations will necessitate prioritising management actions to focus on species and regions where impacts are likely to be greatest. In view of this, a risk assessment was carried out to identify at-risk species, which are defined as fauna that exhibit traits that leave them vulnerable to fox predation or competition. Using molecular techniques, the level and spatial distribution of genetic diversity and gene flow will be determined among populations of a sub-set of species ranked at extreme risk. Results from these genetic analyses will be used to identify management units for population monitoring, and define vulnerable local populations that may require extensive management. This paper presents results from genetic analyses of population structure in the Tasmanian bettong *Bettongia gaimardi*, and describes their application to population monitoring. (3) A long-term monitoring program will be developed to collect baseline data on selected at-risk species, allowing detection of spatial and temporal changes in population size and distribution due to fox predation.

Protecting the ecological function and genetic diversity of Tasmania's unique wildlife species is critical should foxes establish. The research activities described here will allow the threat that the red fox poses to at-risk species to be assessed and monitored.

Notes

FOXES IN TASMANIA: DEVELOPMENT OF A STRATEGIC SURVEY

Alison Foster[1], Dave Ramsey[2], Stephen Sarre[3] and Nick Mooney[4]

[1]Department of Primary Industries and Water, PO Box 46, Launceston, Tasmania 7249
[2]Arthur Rylah Institute, PO Box 137, Heidelberg, Victoria 3084
[3]Institute for Applied Ecology, University of Canberra,
[4]Department of Primary Industries and Water, GPO Box 44, Hobart, Tasmania, 7001

ABSTRACT:

The Tasmanian Fox Eradication Program, in partnership with the Invasive Animals CRC and the University of Canberra, has been developing a strategic carnivore scat collection survey that aims to define the spatial extent of fox presence in Tasmania. This information will be used to guide eradication activities.

Methodology has been established in consultation with a Technical Advisory Panel who provides ongoing guidance. The survey will proceed in three phases over three years and will include all of mainland Tasmania. Survey points will be spread systematically across habitat that is considered to be highly suitable for foxes, based on the assumption that foxes will colonise such areas before dispersing into more marginal habitat. Surveys will be carried out on foot by staff and volunteers of the FEP in autumn each year. These surveys will primarily target linear landscape features and data will be presented to show that scats are likely to be found in association with such features. Scats will be tested for the presence of fox DNA at the University of Canberra.

Positive fox identification will provide a trigger for further surveillance efforts in the neighbourhood of the location of the fox scat. Here an adaptive cluster sampling approach will be used in an attempt to define the extent of local fox populations.

Notes

FOX SURVEILLANCE IN TASMANIA: CAN WE DETERMINE THE SUCCESS OR FAILURE OF ERADICATION EFFORTS?

Dave Ramsey[1], Alison Foster[2], Stephen Sarre[3] and Nick Mooney[4]

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ABSTRACT:

The Fox Eradication Program (FEP), of the Tasmanian DPIW, is committed to the eradication of foxes from Tasmania. To this end, the FEP has been developing a strategic carnivore scat collection survey that aims to define the spatial extent of fox presence in Tasmania to direct eradication activities and, ultimately, quantify the success of fox eradication efforts.

Surveillance will proceed in three phases over three years and will include all of mainland Tasmania. Survey points will be spread systematically across habitat that is considered to be highly suitable for foxes, based on the assumption that foxes will colonise such areas before dispersing into more marginal habitat. Surveys will be carried out on foot by staff and volunteers of the FEP in autumn each year. These surveys will primarily target linear landscape features and data will be presented to show that scats are likely to be found in association with such features. Scats will be tested for the presence of fox DNA at the University of Canberra. Positive fox identification will provide a trigger for further surveillance efforts in the neighbourhood of the location of the fox scat. Here an adaptive cluster sampling approach will be used in an attempt to define the extent of local fox populations.

However, one of the biggest challenges facing the FEP is determining whether eradication attempts have been successful. If foxes are not detected by surveillance activities then eradication may have been successful or foxes may have survived undetected. Here we outline a Bayesian statistical framework that is designed to estimate the probability that one or more foxes remain undetected following surveillance activities. Central to the framework is the establishment of key relationships between searching effort and scat detection probability. These relationships are currently being estimated using field experiments. The Bayesian framework also admits the explicit use of prior information about the presence of foxes in each sampling unit using data from previous surveys or public sightings. A key prediction from these statistical models is the amount of surveillance effort required to detect foxes, if present, with a specified level of confidence. This information can then be used to determine the optimal amount of resources that should be directed at 'proving' eradication using bio-economic decision support methods.

Notes

MANAGING THE STARLING INCURSION IN WESTERN AUSTRALIA

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ABSTRACT:

The incursion of the Common Starling, *Sturnus vulgaris*, into Western Australia is analogous to the current invasions of cane toads across northern Australia or foxes in Tasmania. Indeed, it is one of the most serious pest animal invasions currently in progress. Establishment of this species represents a major threat to the agricultural economy, public amenity and biodiversity of Western Australia. This threat has long been recognised by the Government of Western Australia, evident by the ongoing commitment for thirty-eight years to the control programme. During this time there have been a number of impressive achievements, including the eradication of infestations at two separate localities. Currently, there are two infestations in Western Australia; one located in the vicinity of the Munglinup township and the other in the Condingup area of south-eastern Western Australia. The Munglinup infestation is the most extensive, with starlings spread at very low density across a control area of nearly 2000 km^2. Recognising that the Munglinup infestation represented the most extreme invasive animal risk in Western Australia since the arrival of the rabbit, the programme was given a major financial boost from the State Government. To control this invader, a number of proven techniques have been used (e.g. trapping and shooting) and some novel techniques developed and implemented (e.g. the Judas technique for starlings). The further spread of starlings in Western Australia has currently been halted through a combination of resources, strategic planning, research and development, commitment, and determination. The ultimate aim is to achieve local eradication and continual exclusion of this pest from Western Australia.

Notes

INVASIVE MONKEYS IN PUERTO RICO: THEIR HISTORY, THEIR DAMAGE AND CHALLENGES TO INITIATING MANAGEMENT ACTIONS

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ABSTRACT:

Monkeys were introduced to Puerto Rico beginning in late 1930's. Today, two species, rhesus macaques and patas, have growing populations and are threats to human health and safety, agriculture, and native wildlife. In particular, the monkeys cause severe damage to agricultural crops and have caused some farmers to switch from growing fruit and vegetables to pasture land for grazing. Moreover, there is a high prevalence of herpes B virus among the rhesus macaques, which while fairly benign in macaques, is about 70% fatal in humans. Between 1996 and 2004 the monkey populations were estimated to have quadrupled. Currently, the monkeys are found in rolling hill, savanna-like habitat with patches of forest. Should the monkeys disperse or be transported to the rugged karst mountains of northwest Puerto Rico or the higher Sierra de Luquillo Mountains in the northeast, both of which are blanketed with tropical rain forest, management or containment would be exponentially more difficult, if not impossible. The political and economic paths that successfully led to initiation of management actions were convoluted. We briefly describe that history here and the planning for an effort to manage monkey problems. We intend to develop a science-based effort by rapidly developing the information necessary to implement practical and effective management. We would look to define the range of each species and identify behavioral vulnerabilities to be exploited, while at the same time developing and testing monitoring and detection methods, population assessment methods, attractants, and other management technologies. The information would allow formulation of a comprehensive and optimally designed strategy for possible future management.

Notes

CAPACITY BUILDING FOR BEST PRACTICE PEST MANAGEMENT - A DIPLOMA COURSE IN STRATEGIC PEST MANAGEMENT

Mike Braysher, Stephen Sarre, Stephen Dalla Costa and Nina Jenkins

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ABSTRACT:

The Education Program of the IA CRC has developed a Diploma level (level V) training course in best practice pest management under the Australian Qualifications Framework. It aims to increase the capacity of those involved in planning and implementing strategic, cooperative invasive animal management. Development was jointly funded by the IA CRC and the NHT. The course is based on the core competencies for pest management that were developed under the auspices of VPC in the mid 1990s. These resulted in the Conservation and Land Management Training Package (pest animals). The course complements the pest animal training course being developed by NSW DPI for levels 1 – IV. It is consistent with and will help meet the adoption aims of VPC's *National Vertebrate Pest Management Strategy*.

The course draws on PESTPLAN and it's Toolkit – *A guide to setting priorities and developing a management plan for pest animals*, developed by Braysher and Saunders (2003). State and territory pest agencies as well as managers of pest programs were consulted to determine the key requirements for effective pest planners and managers. It aims to provide field officers with the skills needed to develop and implement strategic vertebrate pest management plans. Four successful pest management programs were assessed and packaged as case studies to illustrate desired approach and to support the problem based approach learning that is the basis of the course. The following key principles underpin the course:

- A pest is a human construct.
- All key stakeholders need to be consulted and actively engaged in the development and implementation of the plan.
- Rarely can pests be eradicated (that is every last individual eliminated).
- Pest management needs to focus on the outcome – what is desired from the management of pests.
- Managing the damage due to pests requires a whole of system approach.
- Our understanding of these complex and dynamic systems is imperfect – hence planning needs to incorporate the management of risk.
- It is essential to monitor the result of the intervention and evaluate the results against the stated outcomes (as objectives) and evaluate them and the program.

The course runs for 2 semesters and is delivered primarily online supported by 3 short residential components. Students are required to develop and present a practical pest management plan as part of the course assessment.

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Notes

NATIONAL WILD DOG MANAGEMENT: A UNIFORM APPROACH

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ABSTRACT:

A strategic approach to wild dog management is currently promoted across Australia by government agencies and enunciated in a number of publications and state strategies. It involves planning to prevent future stock losses and is proactive rather than reacting to immediate stock attacks. The planning process needs to ignore property boundaries so that management focuses on wild dog ecology, impacts and the environment (ie. nil tenure) within a local area. Successful application requires cooperation amongst groups of landholders and other stakeholders who often have varying objectives, capabilities and resources. While state and local government have brought many groups of stakeholders together, some are incomplete or fail to reach agreement on key issues, resulting in a breakdown of the planning process.

In response to a growing need for coordinated and strategic management of wild dog (including dingoes) the Invasive Animals CRC project entitled "Facilitating Strategic Management of Wild Dogs Throughout Australia" was developed. Integral to the project was the appointment of a National Wild Dog Facilitator to raise the profile of wild dog management, highlight priority areas for management and research, create communication networks amongst managers and researchers across states and to promote the development of strategic and coordinated wild dog management programs. The emphasis of the project is on the broad implementation of strategic management of wild dogs, rather than addressing particular research questions.

Operating in a similar fashion to coordinators of Weeds of National Significance (WONS), the National Wild Dog Facilitator operates between state and local government agencies, landholder groups and non-government organisations to broker agreement between these parties to implement wild dog management programs. At a local level the facilitator provides support and complements the skills of regional coordinators and local pest control authorities as management plans are developed and implemented. To this end the facilitator can also operate between local management groups, shires and the states to develop wild dog management programs consistent with guidelines which have been developed but have yet to be implemented nationally.

Information is provided on the development and progress of the project to date as well as the implications for future wild dog management within Australia.

Notes

TRACKING AUSTRALIA: DEVELOPMENT OF A PROGRAM TO ENGAGE INDIGENOUS PEOPLE IN INVASIVE AND THREATENED SPECIES MONITORING

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ABSTRACT:

A program to deliver reliable nationwide data on the distribution of invasive and threatened species and provide engagement and employment opportunities for Aboriginal people is described.

A quadrat-based data collection technique has been developed in which animal sign is recorded while searching a 200x100 m quadrat for 30 minutes. Medium to large animal species are identified from their track and gait characteristic imprinted on the sandy substrate providing a snapshot of the faunal assemblage. Quadrats are typically stratified in relation to mapped landscape features and located in the proximity of tracks or roadways. The quadrats can also be used to provide ground-truthing of mapped information (e.g. waterbodies, substrate and vegetation type, and fire scars).

Data collected in the Maralinga Tjarutja region of South Australia and the Tanami Desert are used illustrate the technique and compare the composition of the predator assemblages. Issues regarding occupancy estimation and detection are outlined.

A major aim of the program is to provide an opportunity for Aboriginal people to contribute information to the program for fair recompense. In the past Aboriginal people have been given little opportunity to provide information about the environment in which they live and contribute to the national understanding of the composition and processes operating within the natural environment. The skills of Aboriginal people can be easily integrated into the Tracking Australia program because animal tracking and plant identification is already a familiar activity for many. Success of the program will require a coordinating body to facilitate project development, assist in data collation, management and analysis, develop training and accreditation schemes for data providers and provide a brokering role between investors and data providers. Options to administer the program and engage and accredit Aboriginal people are outlined.

Notes

AUSBIOSEC: ENHANCING AUSTRALIA'S BIOSECURITY SYSTEM

Bob Biddle

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ABSTRACT:

The enhancement of Australia's biosecurity system for primary production and the environment (AusBIOSEC) is a whole-of-government project established in October 2005 jointly by the Natural Resource Management (NRM) and Primary Industries (PI) Ministerial Councils.

Biosecurity is vitally important to maintaining Australia's trading advantage, and to meeting our trading obligations and the terms of international treaties. Our biosecurity systems also protect our unique natural landscapes and native flora and fauna, including the ecosystem services they provide, and our quality of life.

The cost to Australia's primary industry and environmental sectors of managing invasive animals is high. It is estimated that direct economic losses caused by Australia's main exotic pest animals are at least $420 million per year, mainly in terms of lost agricultural production. Environmental costs are estimated at $720 million per year.

Biosecurity risks are increasing due to increasing trade, passenger movement and the threat of climate change.

These risks can be managed through better integration and operational delivery across biosecurity sectors, and building on existing biosecurity arrangements.

The AusBIOSEC project is developing an overarching framework of common principles and guidelines, allowing biosecurity arrangements to be implemented consistently and efficiently across sectors and jurisdictions.

It is anticipated that Primary Industries and Natural Resource Management Ministerial Councils will consider a draft Intergovernmental Agreement in 2008 to implement AusBIOSEC arrangements.

The key drivers behind the enhancement of AusBIOSEC and the outcomes to be achieved will be outlined.

Notes

UNDERSTANDING LANDHOLDER DECISION MAKING ABOUT THE CONTROL OF NATIVE BROWSING ANIMALS IN TASMANIA

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ABSTRACT:

The management of native browsing animals on agricultural land is a challenging issue for landholders and government in Tasmania. Control options include broadly shooting, poisoning with 1080 or exclusion with fencing. In 2004, the Tasmanian Premier (Hon. Paul Lennon) announced a total ban on 1080 use on public lands from December 2005. In May 2005, the Federal and Tasmanian Governments jointly announced the Tasmanian Community Forest Agreement (TCFA) which included several commitments to research and develop alternatives to 1080 in controlling browsing animals. The decision to discontinue the use of 1080 on public land and to reduce its use on private land arose in part from the consultations which took place for Tasmania *Together,* the long term social, environmental and economic plan for the next 20 years.

This project was funded by the Australian Government through the Tasmanian Community Forest Agreement Research into the Alternatives to the Use of 1080 program. The program is being administered by the Tasmanian Department of Primary Industry and Water (DPIW).

The purpose of this social research was to explore landholder decision making about the use and or non-use of 1080 to control native browsing animals. The specific aims of the project were to:

- Identify drivers and triggers that cause landholders to use 1080;
- Identify drivers and triggers that cause landholders to not use 1080; and
- Identify how different landholders monitor and react to high levels of browsing damage.

In mid 2007 a survey was sent to landholders who had had a permit to use 1080 sometime between mid 1996 and 2007. Thirty two percent of landholders responded to this survey. Respondents to the survey were invited to volunteer for a face to face interview. In November and December 2007, 90 landholders were interviewed about the nature and extent of their problem, how they measure and monitor it, their control strategies and how they made decisions about their approach to the management of browsing animals.

The results of this social research provide a unique picture of landholder understanding of the issues of native browsing animals and how they make decisions about management.

Notes

VERTEBRATE PEST MANAGEMENT CHALLENGES AND INNOVATION IN NEW ZEALAND

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ABSTRACT:

Some of the most significant environmental, social and economic impacts associated with biological invasion have resulted from the introduction of vertebrate pests into New Zealand. The range of vertebrate pest threats and associated management challenges for New Zealand are outlined in this presentation, along with a brief overview of how New Zealand organises itself to meet these challenges.

Three innovations in recent history and future challenges for vertebrate pest management in New Zealand are then illustrated. Innovations include the formation of successful government/industry partnerships, strong applied science and management partnerships, and further advances in island biosecurity. Future challenges include strengthening a socially acceptable toolkit, preventing the next generation of vertebrate pests, and ability to understand and measure benefits of vertebrate pest control.

Notes

THE ERADICATION OF INVASIVE MAMMALS FROM NEW ZEALAND ISLANDS: ADVANCES AND CHALLENGES

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ABSTRACT:

Invasive alien mammals have now been eradicated from many islands in the New Zealand archipelago, with a substantial increase over the past 30 years in the number and scale of successful eradications. Perhaps the most significant advance has been in the ability to eradicate invasive rodents from increasingly large islands, although managing the risk of reinvasion remains a challenge. Based on the New Zealand experience, there are good prospects for further eradications of invasive mammals from islands in Australasia and elsewhere, thereby facilitating ecological restoration and the recovery of threatened species. A programmatic approach to eradication planning is recommended to increase efficiency, to fill information gaps and to develop capacity.

Notes

MACQUARIE ISLAND PEST ERADICATION: PLANNING A MULTIPLE SPECIES ERADICATION PROJECT

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ABSTRACT:

Designing eradication plans for multiple target species requires an understanding of the ecological role of each of the target species in a given ecosystem, as well as an understanding of inter-specific relationships between target species and sympatric non-target species. On sub-Antarctic Macquarie Island; rabbits, rats and mice have different impacts on the environment and create differing consequential effects to native species and to each other.

Macquarie Island presents an ambitious eradication challenge because of the remoteness, large size, terrain, weather and the mix of target species. Aerial distribution is the only option for accurate and comprehensive bait coverage to attain the prescribed sowing rates, while logistics and resourcing are constrained by infrequent shipping opportunities. Brodifacoum in cereal-based pellets is the intended toxin for aerial distribution, targeting ship rats (*Rattus rattus*) and house mice (*Mus musculus*). Some European rabbits (*Oryctolagus cuniculus*) will also consume baits but not all rabbits will feed on pellets and an alternate methodology is required to eradicate this species.

In designing a combined eradication project for Macquarie Island, the characteristics of each target species need to be planned for to ensure the highest chance of successfully eradicating that species. Despite this, some unknown variables will challenge assumptions and planning decisions. Accordingly, eradication methodology needs the flexibility to respond to developments and counter any factors which may lead to individual survivorship.

Characteristics of target species and strategies to address these will be identified and discussed in the context of current planning, including addressing the implications of eradication techniques on non-target species.

Notes

A CASE FOR THE ERADICATION OF MALLARD (*ANAS PLATYRHYNCHOS*) X PACIFIC BLACK DUCK (*A. SUPERCILIOSA*) HYBRIDS FROM LORD HOWE ISLAND

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ABSTRACT:

Introduced Mallard occur on many islands of the South Pacific, but their ecology and impacts on islands have rarely been studied and few attempts have been made to manage these populations. In October 2007, systematic behavioural observations were conducted on Lord Howe Island to estimate the extent of hybridisation with Pacific Black Duck, to estimate their abundance and distribution and to provide basic ecological information. Mallard x Pacific Black Duck hybrids were commonly observed on the island in areas of high public use in fresh, estuarine and saline water. Observations of phenotypic characteristics suggests that introduced Mallard are dominant and suppressing the naturally occurring Pacific Black Duck, with 81% of birds classified as Mallard or Mallard-like hybrids, 17% as intermediate hybrids and only 2% as Pacific Black Duck-like hybrids. No pure Pacific Black Duck were observed. These hybrids pose obvious direct and indirect economic, social and environmental impacts to Lord Howe Island. Impacts include the suppression of native Pacific Black Duck and unquantified negative social and economic impacts to aesthetics, natural values and tourism. Mallard hybrids may also play an unquantified role in the maintenance of avian influenza and other viruses.

A pilot management program using trapping, shooting and opportunistic capture by hand reduced the initial population by 71.7% and provided information on the cost-efficiency of management techniques. The majority of Mallard x Pacific Black Duck hybrids were removed by shooting. Hand capture was most cost-efficient but was opportunistic and limited to juveniles and chicks. Trapping was the next most cost-efficient technique but had difficulties with disturbance by the public.

Bomford & O'Brien (1995) outline six criteria that must be met for successful eradication of a vertebrate pest to be achieved. We believe that five of these criteria can be satisfied for Mallard and Mallard hybrids on Lord Howe Island: all animals are likely to be at risk by at least one method of control, rate of removal can exceed the rate of increase at all densities, the population can be monitored at all densities, discounted benefit-cost analysis is likely to favour eradication, and there is a suitable socio-political environment conducive to eradication. The remaining criteria stipulating that immigration is zero, is unlikely to be met for Mallard or hybrids. However, on the basis of previous records of introductions, immigration is likely to be infrequent and preventing their re-establishment is considered manageable. Eradication of Mallard and associated hybrids from Lord Howe Island is therefore recommended and considered achievable with a program of education, monitoring, shooting and targeted poisoning using Alpha-chloralose.

Notes

LEARNING MORE FROM MOUSE ERADICATION ATTEMPTS – CAN WE INCREASE THE SUCCESS RATE?

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ABSTRACT:

The house mouse (*Mus musculus*) is an invasive species in many parts of the world and can cause considerable damage to native ecosystems. House mice have been recorded as damaging populations of invertebrates (Miller and Webb 2001; Rowe-Rowe *et al*. 1989), lizards (Newman 1994), birds (Jones *et al*. 2003; Wanless *et al*. 2007) and seed production in forests (Wilson *et al*. 2007). The significant negative impacts of house mice mean it is beneficial to eradicate them from islands and to date 30 islands worldwide have been cleared of introduced house mice (MacKay *et al*. in press). A recent review of mouse eradication attempts on islands worldwide found that 38% of attempts failed (MacKay *et al*. in press). This figure is far higher than the failure rate of 5% reported for attempts to eradicate Norway rats (Howald *et al*. 2007). The reasons behind the increased failure rate for mice compared to rats are unclear and the focus of a Ph.D. study at the University of Auckland funded by the Department of Conservation. In order to investigate possible reasons for this we are first going back to basics and looking at population densities, ranging behaviour and home range sizes of mice on New Zealand islands. Here we are presenting density estimates and descriptions of ranging behaviour for mouse populations on two islands in different areas of New Zealand. Surprisingly, absolute densities of mouse populations on islands are almost entirely absent from the literature (White and King 2006). Later work will include an eradication conducted under experimental conditions and an investigation into detecting mice at low population densities. This information will be used to improve current poisoning methodology to improve the success rate of mouse eradication attempts.

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PRIORITISING AND PROTECTING AUSTRALIA'S PRIORITY ISLANDS

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ABSTRACT:

Australia's islands are of immense biodiversity conservation importance, particularly as sanctuaries for threatened and migratory species. We argue that an Australian Islands Initiative is needed to assist in identifying nationally important islands affected by invasive species, undertake priority pest animal eradication and island restoration projects.

In 2007 the Australian Government announced a funding commitment of $12.3M to the *Plan to Eradicate Rabbits and Rodents from Sub-Antarctic Macquarie Island*, and efforts are well progressed to develop a plan to eradicate rodents from World Heritage Listed Lord Howe Island. We now have a unique opportunity to focus these efforts and build on existing databases to identify priority islands where native species are threatened and pest animal eradication will result in high conservation returns, or where threatened species can be given a safe haven, given this is feasible and cost effective.

WWF-Australia is utilizing the help of our supporters to contribute to the restoration of Australia's islands as safe havens for threatened species. WWF has identified a number of islands that could be included in a more comprehensive list of potential priorities for eradication and restoration. We welcome discussion with government and other organizations on the opportunities for supporting investment in these and other important islands.

Notes

ISLANDS AS SANCTUARIES FOR THE THREATENED MAMMALS OF NORTHERN AUSTRALIA

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ABSTRACT:

Many mammal species across northern Australia are in decline and islands are becoming increasingly significant for their conservation. Of the 69 mammal species identified as being predominately found in the savanna ecoregion, 17 are listed as threatened under Commonwealth, State or Territory legislation. There are 30 islands where at least one or more of the 17 threatened mammals have been recorded, and 19 of these islands also have records of one or more vertebrate pest species.

Using available databases, WWF has collated information that identifies priority activities in the areas of pest management, research and capacity building for mammal conservation on northern Australian islands. Past, current and planned projects will be outlined, all of which are in partnership with Traditional Owners and Indigenous representative bodies.

Notes

COMMERCIAL HARVESTING OF PEST ANIMALS: A REVIEW

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ABSTRACT:

In Australia, there are a number of both native and introduced pest species that currently comprise the commercial trade in harvested products. The commercial harvesting of pest species offers potential economic returns from animals which impinge on agricultural or conservation objectives. However, there are often ecological, economic and social barriers which make it problematic to effectively control the impacts of pest animals through commercial harvesting.

Effective control of pest species should be measured in terms of the degree of reduction in the impacts caused (Allen *et al*, 1995). However, in commercial harvesting this principle is seldom applied. Conflict can arise between the utilisation of pest animals as a resource by landholders and the need to reduce their impact. A landholder may tolerate moderate levels of pest infestation before taking action to reduce their numbers, with the actual threshold dependant upon the managers experience, attitude and personal interests. The point at which commercial harvesting is instigated, and the intensity at which it occurs, has no ecological justification. Furthermore, commercial industries exist for commercial purposes rather than mitigation of pest damage (O'Brien and Bomford, 1995). Markets for Australian wildlife products have traditionally not been lucrative, reflecting prevailing attitudes towards the resource and its products, and affecting the price consumers are prepared to pay (Choquenot *et al*, 1998). A pest management technique based on inadequate or volatile markets is unlikely to produce effective control.

In the case of introduced pest species, where the goal, particularly in relation to conservation objectives, is typically to reduce animal numbers to as low as possible or to achieve complete eradication where feasible, there is the additional complication that assigning a monetary value to a pest species is a threat to achieving these goals (Elliott and Woodford, 1995). Commercial harvesting is reliant upon the pest population not being driven to natural or commercial extinction, and hence there is concern that harvesting may sustain or intensify pest problems.

This paper will review the role that ecological, social and economic factors can play in determining the ability of commercial harvesting to produce effective pest animal control.

Notes

CONTROLLING FERAL GOAT AND CAMEL POPULATIONS THROUGH COMMERCIAL HARVESTING

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ABSTRACT:

While feral goats can be successfully controlled at a property scale, broad-scale control has not happened despite a long history of commercial use in Australia. Feral goat populations in the sheep rangelands have been monitored on aerial surveys for kangaroos since the 1970s providing an indication of population trend under harvesting. Despite substantial price rises in the mid-1990s, harvesting in South Australia and Queensland has not driven populations to relatively low densities. This is likely to be a result of a combination of high rates of increase in good seasons, refuges from harvesting and an inability to maintain a high rate of harvest over an extensive period. Feral goat numbers in Queensland appear to have increased from around 100,000 in the mid-1980s to over 1 million animals by 2001. Limited data on harvesting suggest the harvest rate was around 30% in the early 1990s but around 20% in 2005. If these rates were maintained they should achieve a reduction in average population size in the long term of 40-50%. There is no obvious spatial pattern in the trend in feral goat numbers in Queensland, with increases across their distribution. Harvest rate is uneven across this distribution, but cannot readily explain any variation in trend. In South Australia, feral goat numbers have increased since the late 1970s, although a population of perhaps 400,000 has been maintained since the early 1990s. In the early 1990s, the harvest rate appears to have been around 30%, but had declined to less than 10% by 2002.

In contrast, and as expected from their large body size, camels have a particularly slow maximum population rate of increase of 7-8% p.a. The actual rate is highly sensitive to the estimate of adult survival (e.g. 93% survival = 4% growth; 98% survival = 10% growth), highlighting the value of control methods targeting adult survival. A similar elasticity analysis for goats indicates recruitment is a greater influence on rate of increase than adult survival. Historical survey data support a population trajectory for camels in the Northern Territory at close to this maximum rate, although the actual rate is sensitive to the initial, rough estimate in the 1960s. Theory and some empirical evidence predicts that a large mammal population will increase almost exponentially from low density up until close to carrying capacity, following a density-dependent reduction in firstly juvenile survival, then reproductive output and eventually adult survival. An annual harvest of 6,000 camels would have kept the Northern Territory population stable in 2001. However, spatial variation in both camel density and any potential harvest will frustrate efforts to reduce the growth of camel populations.

Notes

THE POSSUM FUR INDUSTRY IN NEW ZEALAND: CAN IT CONTRIBUTE TO MANAGING THIS PEST?

Bruce Warburton and Wendy Ruscoe

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ABSTRACT:

Introduced brushtail possums (*Trichosurus vulpecula*) have been harvested for their fur in New Zealand since 1921. The industry peaked in 1981 when 3.4 millions skins were exported. Since then demand for fur-on-skin has been weak, but since 1992 there has been an increasing demand for plucked fur that is woven with merino wool to produce high quality yarn (e.g. Merino mink™, Perino™).

The use of plucked possum fur as a component in blended yarn is now well established in the New Zealand yarn industry with the total value of this industry estimated to be in the order of $50 to $70 million per annum. To service the current industry about 1,000,000 possums are harvested per annum. Because possums are controlled extensively in New Zealand for Bovine Tb management and conservation protection, the yarn-based industries are concerned about security of supply and the "waste" of product when possums are killed as part of control operations. Consequently, the question is posed: Can the fur industry and pest control agencies work together for mutual benefit? The extent to which the fur industry can contribute to possum control objectives depends on the target densities required (either to eliminate Tb or protect a particular conservation asset), and the price paid per possum.

To examine whether the fur industry can be integrated into official control, three scenarios were examined: (1) assisting with initial population knockdown, (2) sustained harvest at a desired threshold density, and (3) cyclical rather than steady-state harvesting.

For Tb management, the very low densities required to be maintained for disease elimination (ie. <0.5 possums/ha) cannot be achieved through commercial incentives, although commercial recovery of fur can contribute significantly to the financial return of those contractors involved in initial "knockdown" operations (ie. reducing populations from high densities). For conservation resources that are not highly susceptible to possum impacts (e.g. Kamahi forest canopy), commercial fur harvesting can apply sufficient pressure to result in measurable conservation benefits.

Notes

CAN FERAL PIG HARVESTING AND COORDINATED CONTROL REDUCE DAMAGE TO GRAIN CROPS?

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ABSTRACT:

Commercial and recreational harvesting of pigs is often encouraged by pest managers because it is essentially a 'free' reduction in pest density. However, the reduction in numbers may provide minimal damage mitigation and may be inappropriately allocated in space and time. Additionally, more effective control (e.g. baiting) may not occur because of the incorrect perception that harvesting is effective or because pigs are valued for recreational use.

This project aims to assess of the impact of commercial and recreational pig harvesting over strategic areas of the Queensland Murray Darling Basin. This is a critical component of an ongoing program by the Queensland Murray Darling Committee to coordinate the control of feral pigs, foxes and feral cats in the region. The broad outcomes of the project will provide an evaluation of the impacts of commercial and recreational pig harvesting compared to a coordinated control program, particularly in the reduction in crop damage. This will be achieved by investigating feral pig harvesting and damage to grain crops at a range of pig densities in six sites across southern Queensland. At three of these sites, control of pigs will be coordinated through new trapping and poisoning programs and potentially incorporating incentive schemes. At the remaining three sites pigs may be managed but such control will remain uncoordinated. A landholder and harvester survey will determine the intensity and distribution of feral pig control across the region, and investigate attitudes to pig control and damage. The project will help to quantify the impacts of feral pigs on crops, and will provide new knowledge, expertise and strategies on best practice to optimise the management of feral pigs and other pest animals. This will provide vital information on the feasibility, cost effectiveness and logistical requirements for the implementation of a broader control program for the region.

Notes

WHEN DOLLARS AND CENTS BECOME FERALS AND PESTS – MANAGING ANIMALS THAT WERE ONCE A COMMERCIAL VENTURE

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ABSTRACT:

Urban Expansion – Taking the City to the Pest

Using comparison satellite and LANDSAT images the expansion of Gold Coast City population into what was once it's rural fringe becomes obvious. The development of land that was once used for rural enterprises has seen the green acres become suburbs and the cow runs become streets.

It has been well documented that not all of the animals are removed from these areas prior to development. Some animals had escaped from the farms when they were operatring and 'took to the hills' while some were just not economically viable to collect when the land was being developed. Those that remain rapidly become 'feral' or pests causing havoc on the streets and damaging manicured gardens and Golf Courses. Where once farmers and land holders dealt with these animals in their own way, it is becoming increasingly common for residents of the new suburbs to request the Local Government Authority help with or take charge of the removal of these animals. What does remain to be answered is why these residents prefer to call for this assistance just before sunrise on a Sunday morning. Within Gold Coast City the responsibility for the front line management of these animals fall to the members of the Animal Management Unit.

Through the use of satellite images, colour and infra red images and first hand experience this presentation discusses the ex-commercial animals that have become a pest throughout the city. Considerations include how these animals came to be where they are, what seems to be the problem with the community, the difficulties faced and some of the tactics employed by those charged with their management.

The species covered will include Deer, Cattle, Horses, Pigs, some selected avian species and finally a select number of "Others".

Notes

UNDER WHAT CIRCUMSTANCES CAN COMMERCIAL USE EFFECTIVELY MANAGE PEST ANIMALS?

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ABSTRACT:

There are many vertebrate pests Australia and New Zealand that are widespread and abundant. Ongoing pest control programs, to manage their impacts, are expensive. It has been claimed that commercial use is an innovative and cost-effective way of managing introduced and native vertebrate pests. But this idea is largely untested.

The purpose of this paper is to derive generalisations regarding the suitability of vertebrate pests for commercial use, considering the constraints of profitable use and effective control of pest impacts. Based on these generalisations I make predictions regarding the success, or otherwise, of a range of vertebrate pests species in Australia and New Zealand to be effectively managed using commercial harvesting.

Notes

APPLICATION OF GENETICS TO ISLAND PEST MANAGEMENT

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ABSTRACT:

Genetic approaches to studying wildlife are evolving rapidly and have been been applied to a wide variety of management issues. The value that genetic approaches can offer to managers is through the ability of DNA markers to discriminate between species, populations, and even individuals often when only trace samples such as hair, skin or even scats of the organism in question remains and when conventional capture of the animals is technically or logistically difficult. Although genetic approaches are being used frequently in the study of wildlife, their mainstream application to management is still in its infancy. I will argue that genetic approaches have much to offer wildlife managers generally and eradication and control programs on islands specifically. In particular, the ability to detect species from trace samples offers the prospect of detecting difficult-to-capture species at low densities, and the ability to identify population units across the landscape could assist with determining eradication strategies. I will illustrate the possibilities with examples from our own work with Tasmanian foxes and other mainland and island examples. Barriers to the adoption of these approaches include (1) the expense involved in establishing an approach for each new species and in conducting the genotyping, (2) the small number of laboratories in Australia equipped to conduct genotyping studies, and (3) a lack of understanding of the capabilities of these techniques among wildlife managers. The eradication of widespread feral animals such as foxes and pigs may escape the first of these constraints because genetic markers are already in general use for those species and the Invasive Animals CRC is funding the development of a genotyping facility specifically for invasive animals at the University of Canberra which will assist with the second. Greater integration between management and universities is required to confront the third barrier.

Notes

THE PHILLIP ISLAND EXPERIENCE: 100 YEARS OF FOXES FROM CULLING TO THE POTENTIAL OF ERADICATION

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ABSTRACT:

Foxes (*Vulpes vulpes)* were released on Phillip Island (PI) in 1907 (Glidden 1968) 31 years after the Australia's first fox was shot at Bird Rock near Little River, Victoria. PI was a breeding station for the Acclimatisation Society of Victoria for hares, pheasant, and fallow deer (Rolls 1969). No reason has been put forward for the release of foxes on Philip Island. This could simply have been a mischievous act. PI a 10,000 ha island on the shores of Westernport Bay is a food rich environment abundant introduced species (rabbits, hares, black rats , house mice); and seabird populations ~60,000 little penguins (resident year-round) and >1 million short-tailed shearwaters (migratory, resident Sept-May). PI has 0.6-.08 fox per km^2 (McPhee & Bloomfield 2005). In comparison Western Treatment Plant 10,800 ha adjoining Port Phillip Bay, has abundant introduced species; and a Ramsar wetland with XX birds. It has +/- 14 foxes km^2 (Spear pers comms). Urban Melbourne has some suburbs that support 14-16 per fox km^2 (Marks & Bloomfield 1999b) and rural central Victoria 3.9 km^2 (Coman 1991). PI has fewer foxes than its carrying capacity and this is due to culling. Culling is killing a fox or foxes which may cause the fox populations to be less then the carrying capacity, (see Heydon & Reynolds 2000) have little or no effect as fox numbers are regulated by resources rather than human induced effects (Baker &Harris 1997) & (Riethmuller 2005). Detection of foxes at very low densities is an inexact science, thus current PI methods have only provided approximations. Increases in abundance of ground nesting birds (WESBOC & PINP 2007) among other species may indicate a change in levels of predation from reductions in fox numbers even given multiple killing behaviour.

The success of island fox eradication is where all or a significant number of individuals are stopped from successful breeding. PI fox culling has decreased populations using mostly time inefficient and resource hungry methods. Broadscale island-wide 1080 baiting started in 2007 has impacted on PI foxes giving hope to eradication. The vision of The Strategy to eradicate foxes from Phillip Island appears within our grasp but how easily will know if we have achieved that?

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WESBOC Westernport Bird Observers Phillip Island

Notes

ERADICATION OF FERAL PIGS (*SUS SCROFA*) FROM SANTA CRUZ ISLAND, CALIFORNIA

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ABSTRACT:

Feral pigs (*Sus scrofa*) were the last exotic mammal species present on Santa Cruz Island (25 138 ha). In 2002, The Nature Conservancy and the Channel Islands National Park determined to eradicate the pigs. This paper summarizes how this was achieved by mid-2006 using a contracted hunting team (ProHunt Ltd).

The island was fenced into five zones between late 2002 and mid-2004. This took 42.6 km of fencing at a cost of at least US$42 000/km. Few pigs breached the fences over the next two years judging by the movements of radio-collared Judas pigs. ProHunt's system applies the control techniques that cause least disturbance to the pigs first and those that induce most learned avoidance behaviour amongst survivors last. It also attempts to ensure no pigs escape each encounter with the control event. Thus, they used walk-in traps first, shot animals from a helicopter next, then hunted with dogs and ground-based hunters, and finally deployed radio-collared Judas pigs.

Trapping: Silo traps (n = 102) were set in areas where denser vegetation was predicted to make aerial shooting less effective. The traps were pre-baited with grain and then set for between 2 and 95 trap-nights. Beginning in March 2005, 814 pigs were caught. This represented 16.1% of the total pigs eventually killed, but between 40 and 45% of the pigs whose home ranges (based on separate data from pigs with GPS collars and eventual known kill site) might have overlapped the traps' 'catchment' area.

Aerial shooting: All areas were flown over many times by the Schweitzer 269C helicopter and 3875 pigs were killed (77% of the total). Depending on the vegetation in each fenced zone and thus the visibility of pigs from the air, between 67 and 94% of pigs known to be present in each zone were shot in one complete aerial sweep of the zones.

Ground hunting with dogs: ProHunt's method is to use team hunting with trained dogs all supported by the helicopter to positions the teams and act as a spotter for escaping pigs. The aim is to work across the landscape such that no pigs escape back through the hunting line. The dogs are trained not to all break and chase any pigs, but just those that first encounter animals bail the pigs – unless animals attempt to break back through the line. The hunters and helicopter pilot are all in radio contact to coordinate the 'wall-of-death'. In the first complete sweep of the island after the helicopter hunting, 211 pigs were killed, 46 in the second, and 4 in smaller hunting forays where pig sign was detected. Between 35 and 83% of pigs known to be present were killed by ground hunting.

Judas pigs: Judas pigs were not particularly successful. Of the last 63 pigs in each fenced zone, 21 were shot from the air, 39 were killed by ground hunting, one was trapped, and two were killed by chance events. Only 12% of these were located as a result of their association with a Judas pig.

Eradication: The last pig was killed in June 2006 and subsequent monitoring has failed to detect survivors.

Notes

CONTROL OF THE INVASIVE BROWN TREESNAKE ON GUAM USING AN ORAL TOXICANT

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ABSTRACT:

The invasive brown treesnake (*Boiga irregularis*; BTS) has caused unprecedented ecological and economic damage to the island of Guam, including the complete collapse of the island's native forest avifauna community. Control of the snake focuses upon the prevention of dispersal via Guam's cargo network and the protection of discrete biological and economic resources. The limited ability to control BTS has, in part, been dictated by the availability of control methods that are useable on a landscape level. An oral toxicant (acetaminophen) has been recently registered for use on BTS, for delivery via both bait stations and aerial delivery. This technique has proven effective for controlling a wide range of BTS size classes and may greatly enhance the operational ability of management programs to reduce BTS populations on a landscape scale. This paper will overview the development of BTS oral toxicants and highlight the results of several recent field trials that have helped refine the application of acetaminophen baits on Guam.

Notes

DOC "MAINLAND ISLANDS"

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ABSTRACT:

In 1995 and 1996 the New Zealand Department of Conservation (DOC) established six "mainland island" projects; Trounson Kauri Park, Northern Te Urewera, Boundary Stream, Paengaroa, Rotoiti and the Hurunui South Branch. All of these projects have ecosystem focussed (as opposed to single species focussed) restoration goals, which at the time of their creation were quite unique for conservation projects on the New Zealand mainland. Over the last twelve years pest mammal populations have (for the most part) been suppressed to very low levels at five of these sites producing many noteworthy conservation outcomes, especially for threatened native forest birds and plants. However, an important, and often unrecognised aspect of these sites, is that they are places where research and rigorous testing of conservation management techniques is encouraged, if not expected. The work done by staff working at these mainland islands was central to the creation of DOC "best practice" techniques for controlling feral cats, mustelids and rodents. Staff at these sites have also been pioneering techniques for translocating native birds into areas without natural or man made barriers to dispersal, and where pest mammals are still present in very low numbers.

Notes

ERADICATION VS CONTROL: OUTCOMES OF A MULTI-PREDATOR MANAGEMENT TRIAL FOR MANAGEMENT OF CRITICALLY ENDANGERED SPECIES

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ABSTRACT:

Critically endangered species management in New Zealand has often relied successfully on control and eradication of single or few pest species (e.g. ship rat for tuatara, stoat for brown kiwi). Such an approach of focusing on only one or few pest species has failed to achieve recovery in the critically endangered grand skink and Otago skink. These species exist in an ecologically degraded and dynamic multi-pest system. Population modelling predicts imminent likelihood of extinction. Therefore, it becomes essential to move into a management ethic accounting for all or as many potential agents of decline as can be adequately controlled or eradicated with the resources available.

Described here is a management trial where *all* potential mammalian predators were either controlled through a predator press or removed entirely using mammal proof fences over several seasons, and monitored for responses in resident populations of the critically endangered skinks. The predator press was achieved by implementing 12 trap/bait combinations in a random block design in an attempt to account for weasel, stoat, ferret, European hedgehog and feral cat, whilst general suppression of the European rabbit (primary prey) population was achieved by rabbit fencing pasture boundaries and periodic control by disease (RHD) and regional pest control initiatives. The other treatment, using mammal exclusion fencing, enabled the eradication or suppression to undetectable levels of mice, ship rat, Norway rat, European rabbit, hare, brush tailed possum, weasel, stoat, ferret and feral cat. This was intended to not only alleviate mammalian predator pressure but also enable ecological release for the skinks through vegetation recovery and reduced competition for resources. This set of management trials was intended to answer the questions: 1.) Are grand and/or Otago skinks recoverable under optimal pest control scenarios (eradication and/or removal to undetectable levels)? 2.) Can predators be suppressed sufficiently using conventional trapping technology to allow a recovery in skinks? 3.) What, if any, are the minimum spatial requirements of a predator press to enable recovery? 4.) What is the influence of trap, bait, season and habitat on the relative preference for entering traps for the predator species?

The results suggest that both total mammal exclusion and an intensive predator press are capable of enabling population recovery in the skinks. This is extremely significant because the past 10 years of controlling only 1 or 2 predator species has failed to show any positive response in the skink populations. Another significant finding was that trapping operations that were insufficiently buffered from the invasion of predators did not enable recovery of skinks. We also identified strong patterns in pest-specific preferences for certain trap and bait types and the role of habitat in trap efficacy. These results are critical in contributing to a prescriptive and adaptive management outcome to secure these species conservation *in situ*.

Notes

1080 ALTERNATIVES FOR TASMANIA

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ABSTRACT:

Feratox® pellets containing cyanide have proved to be an effective alternative to 1080 for possum control in New Zealand. In 2007 we started a project to ascertain whether cyanide could be registered, accepted and effective for use in Tasmania for control of overabundant browsing possums and wallabies. Cyanide offers advantages of relative humaneness and low environmental persistence. Our approach has involved regulatory authority and community engagement, and will increasingly now focus on pen and field trials. Through targeted interaction with RSPCA representatives, community groups and stakeholders, we have sought to establish "buy in" for cyanide as a humane form of euthanasia for browsing herbivores when used alongside other control strategies. We have developed registration dossiers for filing with APVMA utilising NZ databases and safety and efficacy data with Feratox® used for possum control. We are now conducting pen and field trials to establish efficacy in Bennett's wallabies and improve delivery systems so that non-target risk is reduced. In parallel we are testing more potent herbivore repellents which include secondary plant compounds, predator odours, synthetic fermented egg and egg acrylic in one formulation so that the use of a lethal control tool can be preceded or complemented by non-lethal means of protecting forestry plantations.

Notes

EFFICACY OF COMMERCIALLY-AVAILABLE RODENTICIDE BAITS FOR THE CONTROL OF NORWAY RATS AND HOUSE MICE

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ABSTRACT:

Introduced rats and house mice have spread to many oceanic islands during the last two centuries. Once rodents become established on islands, they often have severe and drastically negative impacts on the native wildlife and plant species. Currently, one of the most common methods of eradicating rats from islands in the United States (US) has been the use of anticoagulant baits maintained in bait stations, but aerial broadcast-baiting methods are being used more frequently. A national registration has been obtained from the US Environmental Protection Agency for aerial broadcast-baiting of conservation areas with diphacinone (0.005%) pellets. They are reviewing a similar registration for brodifacoum (0.0025%) pellets. We presented individually-caged wild Norway rats and wild house mice with 12 different rodenticides in a two-choice feeding trial with a 3-day rodenticide exposure period. The active ingredients included first generation anticoagulants (warfarin, chlorophacinone, and diphacinone), second generation anticoagulants (brodifacoum, bromadiolone, and brodifacoum), and acute toxicants (zinc phosphide, bromethalin, and cholecalciferol). The 3-day exposure period was chosen because this is considered the maximum time aerially broadcast bait on a tropical island would remain available to rodents before being degraded by weather or removed by non-target species such as crabs. All rodenticides tested resulted in at least 80% efficacy with rats, with the exception of zinc phosphide pellets, which failed to kill any rats. Zinc phosphide on oats, however, was very effective with the rats. With the house mice, we conducted two-choice feeding trials with 3-day and 7-day rodenticide exposure periods because relatively few rodenticides (only 5 of 12) were efficacious with only a 3-day exposure. The rodenticide baits that were at least 80% efficacious with house mice in the 3-day exposure trial were brodifacoum, difethialone, zinc phosphide on oats, and bromethalin. In the 7-day exposure trial, only 1 additional rodenticide (bromadiolone) achieved 80$ efficacy. While a large number of successful rat eradications have been conducted worldwide, house mice eradications have been much more problematic. Our study results suggest that the eradication of house mice with current rodenticides will require the careful selection of one or more rodenticides and considerable effort to assure success. Finally, we investigated the potential effects of vitamin K-rich plant foods on anticoagulant efficacy with wild Norway rats, roof rats, and house mice. Rodents introduced to tropical islands typically have access to green plant foods year-around. In the pen trial, rodents had access to vitamin K-rich Brussels sprouts or collards before, during, and after the rodenticide (both diphacinone and brodifacoum groups) 10-day exposure period. Mortality rates in the study were 75-100% in each group, suggesting that the vitamin K content of the vegetables was not enough to counteract the effects of the anticoagulants. Hence, the native vegetation on islands should not be a threat to successful eradication with anticoagulant rodenticides.

Notes

AN EVALUATION OF WAXTAGS® AS A MONITORING TECHNIQUE FOR LOW-DENSITY POSSUM (*TRICHOSURUS VULPECULA*) POPULATIONS IN NEW ZEALAND

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ABSTRACT:

In New Zealand, the brushtail possum (*Trichosurus vulpecula*) is a widespread economic and epidemiological pest species. Currently, assessments of abundance are based on the numbers of possums captured in leg-hold traps; referred to as the Residual Trap Catch Index (RTCI). Whilst research suggests that the RTCI is a relatively robust monitoring technique, setting out traps is labour-intensive and also places ground-dwelling native birds at risk. An alternative monitoring technique involves the use of WaxTags, where possums can be identified by bite marks. These devices are lightweight and many more can be placed out in the field than leg-hold traps. This is likely to increase the accuracy and precision of population estimates, particularly when the population density is low and/or the distribution is patchy following control. To evaluate the potential of WaxTags, field trials directly compared WaxTags with leg-hold traps in four low-density possum populations. At each site, 20 lines of leg-hold traps were overlaid with lines of WaxTags stations. The WaxTag lines were more effective at detecting possums with 37-47% of trap lines failing to detect possums where a WaxTag line had indicated possum presence. Two WaxTag indices of abundance (proportion of WaxTag stations showing any evidence of possum chewing and the mean total number of WaxTags chewed per station) were also highly correlated with the RTCI estimates. These results suggest that WaxTags have good potential for monitoring low-density possum populations. Additional research should be undertaken to further validate the relationship between WaxTags and RTCI at other possum densities, in conjunction with other measures of abundance such as total capture and/or mark-recapture techniques.

Notes

URBAN WILDLIFE CONTROL: CONCEPTS AND ETHICS

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ABSTRACT:

Urban wildlife control is a fast growing profession in the United States, which has only recently come to be identified as a special interest within the larger field of wildlife damage management. This may be due to the emphasis placed by wildlife damage managers on animals causing problems in agriculture and livestock production, as well as the historically predominant focus of U.S. state wildlife management agencies on commercially valuable "game" species as harvestable resources. The result has been that while the need for services in urban and suburban environments has grown, these have largely defaulted to commercial businesses that may be poorly regulated by state or federal authority. In turn, this can lead to politically charged conflicts when animal welfare, protection and conservation interests challenge this emerging wildlife control industry over the moral and ethical bases of many urban wildlife control practices. Animal interests are likely to argue that trapping and relocation or killing are unnecessary and typically cause unacceptable suffering. Trapping interests may argue that human interests, including those based on economic concerns, take precedence over any interests involving animal protection. A general dearth of research information and science-based findings unfortunately directs much of the dialogue onto subjective ground, rather than allowing it to grow from a sound, empirical foundation. We address some of this controversy by examining the conceptual basis of contemporary urban wildlife conflict with respect to concepts currently emanating from more traditional areas of wildlife damage management. We attempt to identify and outline some of the basic principles that can be better used to inform practitioners and elicit productive dialogue about this emerging field, and we speculate about the possible role urban wildlife conflict resolution will come to play within broader disciplinary concerns. With increasing global urbanization and the demographic dominance of urbanites, it is reasonable to assume that the attitudes, values and perceptions about wildlife they hold will have an impact on wildlife management everywhere.

Notes

OPERATING A "HUMANE" WILDLIFE CONTROL BUSINESS: CHALLENGES AND OPPORTUNITIES

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ABSTRACT:

In May, 2007 The Humane Society of the United States (HSUS) launched a for-fee business entitled Humane Wildlife Servicessm (HWS) to meet residential and commercial customer needs for wildlife conflict resolution in the Washington, DC metropolitan area as well as on Cape Cod, Massachusetts. The majority of customer services to date have dealt with the removal of wild animals from structures, typically where disrepair has created occupation opportunities. The need for this type of service is growing rapidly in the U.S. and to date most providers have come from traditional recreational or commercial trapping backgrounds. There, the typical approach to resolving wildlife "problems" involves trapping, with either relocation or, more frequently, drowning or some other killing practice to completely remove animals. Substantial fees may be charged for this, and further economic incentives for killing can exist where state regulatory agencies allow pelts to be sold as well. HWS advocates an alternative approach that focuses on eviction and exclusion of problem-causing animals, and the use of reunion strategies to keep females and their litters intact while causing them to relocate nests or dens. Exclusion-reunion is arguably the most humane approach to wildlife conflict resolution in U.S. urban environments. We argue as well that it is biologically and ecologically more sound than other practices. By leaving wild animals in their known home range or territorial areas and resolving any conflicts they might have with humans a number of desirable conditions may be satisfied, not the least of which could be stable, resident populations in which human concerns for problems such as the transmission of zoonotic diseases are minimized. Here, we describe the operational procedures employed by what we term "humane" wildlife control services, relating these to the actual functioning of a service business in a highly competitive business environment. We note the strengths and potential weaknesses of this approach with respect to the management of wildlife populations in urbanizing environments, as well as the need to provide for consumer protection and better public education.

Notes

A MODEL FOR ASSESSING THE HUMANENESS OF INVASIVE ANIMAL CONTROL METHODS

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ABSTRACT:

When determining the most appropriate method for managing the impact of an invasive animal, several factors need to be considered. These include efficacy, cost-effectiveness, practicality, target specificity, operator safety, and also humaneness. But how do we measure humaneness? One approach would be to assess and compare methods based on a set of 'humaneness criteria'. However, given that such a wide variety of techniques are used to mange such a diverse range of target species, it is unlikely that we could come up with a list of suitable criteria applicable to all methods. Another approach is to examine the *negative impacts* that a method has on an animal's welfare and, if a lethal method, *how the animal is killed*. A model has now been developed to allow such an assessment of humaneness.

The model has two parts: Part A examines the impact of a method on overall welfare and the duration of this impact; Part B examines the intensity of suffering and duration of suffering of the killing technique. In Part A, overall welfare impact is assessed by looking at the impact in each of five 'domains', originally described by Mellor and Reid (1994) to examine the impact of scientific procedures on experimental animals. Domain1 is water deprivation, food deprivation, malnutrition; Domain 2 is environmental challenge; Domain 3 is injury, disease, functional impairment; Domain 4 is behavioural, interactive restriction; and Domain 5 is anxiety, fear, pain and distress. The degree of impact in each domain is rated on a five-step scale – no impact, mild, moderate, severe or extreme impact. The overall impact is the rating given to Domain 5 since this represents the outcome of the impacts in the other four domains (and also includes external influences, such as the presence of humans). In Part B, the killing method is assessed by examining the level of suffering and the duration of suffering based on the time to insensibility. Matrices are used to determine the score for each part and then the two scores are combined to obtain the overall humaneness score.

The main advantage of this model for assessing humaneness is that it provides a systematic, comprehensive and transparent process that helps to generate consensus among diverse stakeholders regarding the humaneness of control methods. Also, the *relative* humaneness of different techniques can be compared based on the score obtained. Although it cannot achieve a purely objective and precise assessment, this model allows us to *grade* humaneness using the available scientific information and informed judgement.

References:

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Notes

WELFARE ASPECTS OF POISONING FOR FERAL PIG CONTROL – PRELIMINARY EVALUATION OF CYANIDE

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ABSTRACT:

Feral pigs (*Sus scrofa*) are controlled as pests in both Australia and New Zealand. In New Zealand, no poisons are registered for feral pig control and pig populations in accessible areas are generally kept to acceptable levels by recreational hunters with dogs. Pig hunting is reduced in areas where 1080 (sodium monofluoroacetate) is aerially applied for brushtail possum (*Trichosurus vulpecula*) control, because of the potential for residual 1080 occurring in wild pork and the high risk to hunting dogs of secondary poisoning. Few pigs are killed by these 1080 applications, so without hunting pressure their populations can increase and cause significant localised damage to agricultural or conservation values. Limited use of poison baiting could provide cost-effective pig control in such instances. In Australia 1080 and yellow phosphorus are registered for feral pig control, with warfarin also being trialled under experimental permit. None of these poisons was considered acceptable for use against pigs in New Zealand because of humaneness concerns, and secondary poisoning / residue risks in the case of 1080 and warfarin. Cyanide poisoning in species such as brushtail possums and dogs is considered relatively humane because it produces unconsciousness within approximately ten minutes. Similarly rapid 'knockdown' and death in pigs would represent a welfare improvement over currently-used poisons and in New Zealand would also facilitate field collection of feral pig carcasses for Tb surveillance.

In a preliminary pen evaluation of efficacy and humaneness, a modified mechanical ejector was used to deliver c.1 g of powdered potassium cyanide orally to domestic pigs. Six pigs were acclimatised to activating ejectors loaded with non-toxic (icing sugar) capsules before being presented with ejectors loaded with cyanide capsules. Two pigs (mean weight 36 kg) were killed after their first activation of a toxic ejector. Signs of poisoning were staggering and unco-ordinated gait within 2-5 min, and salivation / vomiting within 5-8 min. Laboured, rapid breathing and 'blushing' then became evident in both pigs and continued until just before death. The first pig was prone by 8 min 30 s, lost consciousness by 28 min 40 s, and died at 31 min 48 s, and the second pig was prone by 22 min, unconscious at 70 min 21 s, and dead at 71 min 31 s. Three other pigs activated a toxic ejector once, twice or thrice and all survived. In some instances these pigs displayed early signs poisoning (staggering, salivation, vomiting and dyspnoea) but did not progress to the prone stage, and appeared to have recovered fully within 3 h. One further pig did not activate a toxic ejector, despite having activated non-toxic sets repeatedly.

Times to unconsciousness and death in cyanide-poisoned pigs in the trial were long in comparison to those reported in other species. While cyanide appears unlikely to be useful for rapid 'knockdown' of feral pigs, a comparison of welfare compromise against existing and alternative poisons in pigs would indicate whether it offers improved humaneness. Pigs survived estimated oral exposures of 14-25 mg/kg, indicating lower susceptibility to cyanide poisoning than other mammal species. Hence, bait concentrations of cyanide likely to be effective for feral pigs will also require consideration in terms of non-target and operator hazard.

Notes

RABBIT CONTROL IN THE URBAN ENVIRONMENT: DEMONSTRATED SAFE USE OF SHOOTING AS A PRIMARY CONTROL TECHNIQUE

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ABSTRACT:

The European wild rabbit (*Oryctolagus cuniculus*) is a well known agricultural and conservation issue, as such rabbits are a declared pest across NSW under the Rural Lands Protection Act 1998. In the urban environment rabbit control is equally important in the context of conservation (endangered fauna and flora), landscape management (sports fields, retaining wall/building integrity) and is legislatively required under the fore mentioned Act.

Centennial Park is 186 hectares of iconic urban parkland in Sydney's eastern suburbs, only 2.3km from the Sydney GPO. In the mid 1990's the European wild rabbit was identified as a significant issue as damage to formal gardens and sports fields incurred increasing maintenance costs and safety concerns (sports injuries due to diggings in the playing surface). At that time the Rural Lands Protection Board (RLPB) assessed the rabbit problem and determined that a medium density population was present. The RLPB recommended that Pindone baiting be undertaken. The Parklands management planned to use Pindone but was stopped by community complaints and a legal challenge on the basis of the risk to non-target species. Following this failed attempt, static fumigation was the primary form of rabbit control. Habitat modification, in the form of weed control and debris removal was the only secondary control option. In addition, myxomatosis occurred naturally in the Parklands (1995) and was observed in the population annually. Rabbit Haemhorragic Disease (RHD) was unsuccessfully introduced into the Parklands (1997).

In 2002 a threatened species community, Eastern Suburbs Banksia Scrub (ESBS), was recognised by the NSW Scientific Committee. Remnants of this community were identified within the Parklands, as such bush regeneration commenced and rabbits were identified as a primary threat to the regeneration effort. The conservation issue posed by the rabbits within the ESBS remnant provided the catalyst to implement a new control technique, shooting, which had previously been dismissed as unsuitable in the park environment.

Over a two-year period (April 2005 to 2007) sixteen culls successfully targeted 344 rabbits. During 2005 five culls removed 219 rabbits (5, 51, 70, 53, 40, respectively). Importantly with each cull the target area was increased to incorporate additional areas with rabbit activity as shooting was proven as a safe and effective primary control technique. During 2006 seven culls removed 119 rabbits, with the entire Parklands being targeted each time (33, 34, 17, 17, 8, 4, 6). Lastly, during 2007 four culls removed six rabbits (2, 3, 1, 0) subsequent monitoring for warrens, diggings, scats and spotlight surveys has failed to conclusively demonstrate that rabbits are still present within the Parklands.

This case study demonstrates that shooting can be used as a primary form of control where rabbit densities are not cost prohibitive. Further, the use of shooting in the urban environment is demonstrated as a safe and effective technique. Importantly, a conservation aim (preservation of the ESBS remnant) was the critical component that drove this project. Following the successful removal of rabbits from the ESBS remnants the focus turned to population control with a view of reducing the threat of re-invasion and to reduce the impact of rabbits across the Parklands amenity; including user safety, and non-listed native flora.

Notes

EXAMPLES OF COMMUNITY DRIVEN ANIMAL PEST CONTROL PROJECTS IN THE WAIKATO REGION, NORTH ISLAND, NEW ZEALAND

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ABSTRACT:

Environment Waikato, Waikato Regional Council, supports a number of community driven animal pest control projects within the Waikato Region. Different projects are controlling a different suite of vertebrate pests depending on the outcome desired by the community.

These projects span predator control for the purpose of kiwi protection, possum control across large tracts of farmland to protect production values and maintain Tb freedom, and intensive rodent control to protect iconic native birds and general biodiversity.

Environment Waikato provides different levels of support to community groups from technical support of community led pest control, cost sharing arrangements for rabbit control, through to carrying out larger scale pest control operations using contractors where the community has the desire but cannot undertake the job themselves.

Environment Waikato attempts to empower landowners to act as ambassadors or advocates for vertebrate pest control within their own communities. This community led approach breaks down many of the barriers associated with local government projects and leads to greater community-wide 'buy in' to the project, greater cooperation from all involved and ultimately better results on the ground.

Harnessing the community to undertake vertebrate pest control provides benefits to the wider community and is helping to protect and enhance native biodiversity and production within the Waikato Region.

Notes

INVESTIGATING THE ROLE OF WILDLIFE AND WILD CANIDS IN TRANSMISSION OF *NEOSPORA CANINUM*

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ABSTRACT:

Neosporosis is a bovine reproductive disease that has been estimated to cost the Australian dairy and beef industries an average of $30 million per annum. However, knowledge of the life cycle of the pathogenic apicomplexan parasite *Neospora caninum* is incomplete. It is believed that transmission can occur from oocysts passed in the faeces of dogs that were probably infected through eating N. caninum tissue cysts in aborted material from cattle infected with the disease. This life-cycle may explain why the majority of reported outbreaks of the disease in NSW and Qld cattle are in association with proximity to bushland, where wild canids (dingoes, dogs and foxes) are common. To provide objective data to support this hypothesis, studies to determine whether Australian wild canids are definitive hosts of *N. caninum* were attempted.

Firstly, prevalence surveys of N. caninum in cattle herds where *Neospora*-related reproductive problems occur and in co-occurring wildlife have commenced. A serosurvey of *N. caninum* by a whole herd bleed on a Kempsey dairy farm in proximity to a National Park where wild dogs and foxes occur has demonstrated that both vertical (transplacental) and horizontal (post-natal) transmission may have occurred within this herd.

Further, a transmission study has been undertaken where dairy bull calves were intravenously infected with an Australian isolate of *N. caninum* and selected tissues from these calves were fed to dingo and domestic dog pups. The presence of *Neospora*-like oocysts in faeces shed by one dingo pup, were confirmed to be *N. caninum* via PCR.

The occurrence of sporulated oocyst in the intestinal tract of a dingo demonstrates the potential for horizontal transmission of *N. caninum* from dingoes to farm animals and wildlife in Australia. Collection of fresh fox and wild dog faeces, blood and tissue, particularly from areas adjacent to farms experiencing bovine abortions will continue in 2008. This information is of importance if claims that control of wild canid populations in areas adjacent to farms are a necessary management procedure to control bovine neosporosis and limit the risk of bovine abortion, are to be supported by scientific data.

Acknowledgment: IA CRC - Post Graduate scholarship (Jessica King[1])
Dr William Richards Award in Veterinary Pathology, USyd

Notes

POST-CAPTURE NECROSIS OF THE FEET CAUSED BY SOFT-CATCH TRAPS - INCIDENTS, CAUSE AND PREVENTION

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ABSTRACT:

When recapturing satellite collared wild dogs that had been trapped one month previous in padded foothold traps, we noticed varying degrees of pitting on the pads of their trapped paw Veterinary advice, based on images taken of the injuries, suggests that the necrosis was caused by vascular compromise. Five of six dingoes we recaptured had varying degrees of necrosis restricted only to the trapped foot and ranging from single 5 mm holes to 25% sections of the toe pads missing or deformed, including loss of nails. The traps used were rubber-padded, two–coiled, Victor Soft Catch #3 traps. The springs are not standard Victor springs but were Beefer springs; these modifications slightly increase trap speed and the jaw pressure on the trapped foot. Despite this modification the spring pressure is still relatively mild in comparison to conventional long spring or four-coiled wild dog traps.

The five wild dogs developing necrosis were trapped in November 2006 at 5-6 months of age. Traps were checked each morning so the dogs were unlikely to have been restrained in the trap for more than 12 hours. All dogs exhibited a small degree of paw damage at capture which presented itself as a swollen paw and compression at the capture point.

In contrast, eight wild dogs, 7-8 month-old, were captured two months later in February. Upon their release, on advice from a veterinarian, we massaged the trapped foot to get blood flow back in to the foot and applied a bruise treatment (Heparinoid 8.33 mg/ml) to assist restoring blood flow. These animals were subsequently recaptured several months later and showed no signs of necrosis.

While post-capture foot injuries are unlikely to be an issue in conventional control programs where the animal is immediately destroyed, caution needs to be used when releasing accidentally captured domestic dogs or research animals captured in rubber-padded traps. We have demonstrated that 7-8 month old dogs can be trapped and released without any evidence of subsequent necrosis following minimal veterinary treatment. We suspect that the rubber padding on traps may increase the tourniquet effect by wrapping around the paw and recommend the evaluation of offset laminated steel jaw traps as an alternative. Offset laminated steel jaw traps have been shown to be relatively humane producing as few foot injuries as rubber-jawed traps.

Notes

SURVEY OF DOMESTIC PIG AND WILDLIFE INTERACTIONS ON COMMERCIAL PIGGERIES IN AUSTRALIA

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ABSTRACT:

Baseline information is needed to direct further investigation of wildlife interactions within commercial piggeries in Australia. We conducted a postal survey of commercial pig producers in late 2007 to identify key wildlife species and the diseases carried by them that were of concern.

A one-page questionnaire was distributed by post to all 444 commercial piggery owners and managers who were members of Australia Pork Limited (APL) with the APL 'Pork It Up' newsletter in September 2007. Non-responders were re-sent the questionnaire at 6 and 9 weeks following the original mail-out.

A total of 169 producers returned a completed questionnaire (response rate of 38%) and 85% of respondents reported some level of wildlife incursion either into piggery buildings or within five metres of the farm perimeter. Feral cats (*Felis catus*) were most commonly observed (reported on 60% of piggeries experiencing wildlife incursions), followed by rodents (45%), wild canids (31%) and unspecified wild birds (21%). The most commonly observed bird species included the House sparrow (*Passer domesticus*, 19%) and the European starling (*Sturnus vulgaris*, 16%).

Common methods of control included shooting, baiting and trapping. Of those farmers that used a control for feral cats 77% (51/66) found them effective. Baiting was the most common control technique used for rodents 93% (55/59), with a farmer reported effectiveness of 88% (52/59). Only 10% (1/10) of farmers found the control techniques for starlings effective.

The highest ranked topic for future research was the European starling (listed by 20% of producers) followed by the Indian mynah (*Acridotheres tristis*) and House sparrow (15% each), and disease issues related to wildlife (14%). Salmonellosis, toxoplasmosis, and leptospirosis were the three diseases most commonly of concern to farmers. Concern about salmonellosis was not restricted to a particular species, whilst leptospirosis was most commonly a concern in rodents and toxoplasmosis in cats.

The results of this producer survey indicate that wildlife species do enter buildings and visit close to farm perimeters on commercial piggeries in Australia. Control techniques have been implemented on some farms to control wildlife populations however producer opinion about the efficacy of control techniques varies. Bird control, in particular for the European starling, had low effectiveness and this may have attributed to the European starling and other bird species being stated as key areas for future research.

Notes

AN EXPERIMENT TO EVALUATE TO CONSEQUENCES OF PEST CONTROL IN A NEW ZEALAND COMMUNITY CONTEXT

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ABSTRACT:

Predator management in New Zealand forests is aimed at reducing the direct threat to native biota; in most cases threatened birds. The most commonly targeted predators are the introduced stoat (*Mustela erminea*) and increasingly the ship rat (*Rattus rattu*s). The reduction in rats is thought to both reduce direct predation, but also reduce food availability for stoats and consequently slow stoat population increases.

Recently, anecdotal reports have documented increases in ship rat abundances following possum control operations. In smaller conservation areas, community-lead removals of stoats and rats have left behind another pest, the house mouse (*Mus musculus*) that appears to thrive. An understanding of how pest species affect not only native biota but also each other is required before the outcome of pest control operations can be predicted for the community as a whole.

In this talk I will present early results of a pest removal experiment in New Zealand indigenous forest. In 2006/7, four treatment areas of 900ha (2 reps) were established in the central North Island mixed podocarp forests. The experimental pest removals were (1) a one-off aerial 1080 operation targeting possums and rats, (2) the 1080 operation initially with ongoing ground based control of rats to prevent re-establishment, (3) stoat removal, and (4) a non-treatment control. The most dramatic results to date show the numerical increase in house mouse population abundances following the aerial 1080 control for possums and rats. The immediate consequence of this shift in pest guild is an increase in the number of smaller invertebrates and seeds that are taken by mice, potentially changing the composition of insects and recruitment-available seeds left in the forest. Secondly, if stoat population reductions are expected as a result of rat control, it is contingent on stoats not simply swapping to a mouse-dominant diet. This study aims to quantify the effects common pest control operations have on the vertebrate pest community in NZ forests.

Notes

WHEN IS A FERRET LIKE A FALCON? MANAGING VERTEBRATE PESTS TO RESTORE INDIGENOUS ECOLOGICAL PROCESSES

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ABSTRACT:

By definition, ecosystems are comprised of a number of biotic and abiotic components, with the interactions among those components, operating at multiple scales, termed processes. In the broadest sense, ecosystem processes include a variety of different factors such as hydrology, biogeochemical cycles, energy flow, pollution buffering and resilience to disturbance (Sinclair & Byrom 2006). However, many ecologists are interested in processes that operate to affect species and populations. These might include some or all of the following: predation and herbivory, competition, pollination, obligatory associations and mutualisms, forest/shrubland regeneration, disease dynamics, plant recruitment, succession, and dispersal.

While ecologists might have a vague notion that maintaining some of these processes in a fully-functioning natural ecosystem is 'good' (e.g. we know intuitively that if there is little or no recruitment of seedlings on the forest floor eventually there will be no forest) and that some processes are 'bad' for natural ecosystem function (e.g. the hunting efficiency of introduced predators can eliminate native fauna), rarely in Australia or New Zealand do we articulate exactly how vertebrate pests might affect ecosystem processes, and how we might take advantage of understanding how those effects operate in order to manage an ecosystem in perpetuity. In terms of the future of pest management, one desirable goal may be to have self-sustaining 'natural' ecosystems. For this to happen, we need to restore, maintain, or 'mimic' original ecosystem processes and have those processes operating with their natural characteristics and intensity. This will not be easy. Is it even achievable?

We use a series of experiments in a New Zealand dryland ecosystem, set in a modelling framework, to illustrate that a better understanding of how pests operate in the system might result in different (and potentially sustainable) styles of management. For example, if exotic consumers have similar functional responses to native consumers, then we might only need to manage the intensity of consumption for the purposes of protecting a resource. In other words, we might want to maintain *the equivalent of* natural predation on lizards by raptors, natural predation on invertebrates by lizards and native birds, and natural herbivory that would have been imposed by moas. If the functional response is a different type, then we need to find ways to change the type, for example by adding refuge to shift from type II to type III in order to protect natural processes. If dispersal between rock tors is important for lizards, then we need to re-create safe corridors to facilitate dispersal. If succession to native woody shrubs is a desirable process compared with succession to exotic woody weeds, we need to reduce the potential for possums to disperse briar seeds. These examples highlight some possible futures for conservation pest management.

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Notes

MULTIPLE INTERACTING SPECIES IN DRYLAND ECOSYSTEMS: PREDICTING BIODIVERSITY OUTCOMES OF PEST CONTROL

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ABSTRACT:

Managing pests does not always protect the resources we value. Even when it does, there can sometimes be unintended consequences for other parts of the ecosystem, especially in complex food webs. Pest species rarely occur in isolation from other pest species, and they often have direct and indirect impacts on more than one native species. The future of conservation pest management will require managing ecosystems as a whole.

We illustrate this with an example from a dryland ecosystem in New Zealand's South Island. Here, pest herbivores (rabbits, hares, possums), top-order predators (cats, ferrets, stoats, weasels), mesopredators (mice), and insectivores (hedgehogs) interact to varying degrees. Native lizards are keystone species that are threatened directly and indirectly by this suite of pests. The conventional approach in New Zealand is to remove the immediate threat – the top-order predators that consume lizards. But that can potentially give rise to an increase in mesopredators, which may lead to even greater damage given their small size and greater accessibility to cryptic lizards. Removing top-order predators may also give rise to more pest herbivores resulting in habitat modification that inhibits lizard dispersal and threatens the viability of lizard metapopulations. Is controlling pest herbivores a better approach in this situation? Not only does reducing herbivores reduce the top-order predators that rely on them as prey, but it also enhances vegetation in a way that might benefit lizards.

In making decisions like this, managers generally have to rely on qualitative information collected in a piecemeal fashion. We are developing qualitative and quantitative ecosystem models to assist decision making and to generate hypotheses about potential consequences of single-species and multi-species pest control. Our first prototype qualitative model (using fuzzy cognitive maps), for example, predicts that remnant, but still relatively common, native lizards will continue to decline even with top-order predator control. This decline might be explained by the fact that mice were predicted to increase with predator control. We are testing these predictions with a large-scale experiment using predator removal and non-removal treatments. Preliminary results confirm the lack of recovery of lizard populations, but increases in mice have not been observed so far. This suggests that processes other than predation might also need to be managed to protect native lizards.

This experiment suggests this ecosystem is not currently being driven by 'top-down' processes, although the reverse may have been the case 10 years ago before rabbit haemorrhagic disease arrived. Rabbits were more abundant then, they severely reduced vegetation cover, exposing lizards to greater risk of predation, and they supported high-density populations of top-order predators. RHD may have therefore reversed the overall dynamics of the system, with the result that manipulating habitat attributes such as shrub cover might now be a management strategy that will boost lizard populations. Future experiments could involve replacing predator removal with some form of habitat manipulation to determine its role in restoring natural ecosystem processes.

Notes

EXPLOITING PREDATION PROCESSES TO PROTECT NATIVE FAUNA AND CONTROL VERTEBRATE PESTS

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ABSTRACT:

Predation by introduced mammals is one of the processes threatening native fauna in Australia and New Zealand. Predation has two components: the number of predators and their efficiency in killing prey. The traditional approach is to tackle the former by removing predators, in some cases very effectively (for example, foxes in south-west Western Australia and possums in New Zealand) and in other cases with little or no effect (for example, feral cats almost everywhere). Results from recent and current research suggest that understanding the second component of predation – predator efficiency, or its converse the ability of potential prey to evade predators – might lead to new management opportunities for protecting native fauna, controlling pests and reinforcing processes that sustain natural ecosystems.

The theoretical basis for manipulating predator efficiency has already been encapsulated in standard predator-prey models. For example, the presence or absence of factors such physical refuges that reduce predator efficiency can be represented by type III compared to type II functional responses. For the former, prey persist in the presence of predators but in the latter case predation can result in extinction of the prey population. The management objective should be to take advantage of habitat attributes that provide protection for native fauna threatened by predation and to remove, or focus control effort on, refugia for pest species. This theoretical framework has been used to predict whether enhancement of refuge habitat might benefit small-to-medium native mammals (Sinclair *et al*. 1998), and tested experimentally using model systems (Arthur *et al*. 2004; Stokes *et al*. 2004). Other possible non-standard options for manipulating predators' functional responses include conditioned aversion and diversionary feeding (Norbury & Arthur 2003).

The 'Giving up Density' technique (GUDs record depletion of artificial food patches) has been used to measure the relative safety of microhabitats for small dasyurids in woodlands, bush rats in forests and house mice in farmland. Currently GUDs are being used in New Zealand podocarp-broadleaved forests to determine which microhabitats allow ship rats to persist in the presence of stoats. The immediate aim is to understand how habitat attributes mediate predator efficiency. The long-term aim is to exploit this knowledge to protect valued prey or eliminate undesirable ones.

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Stokes, V.L., Pech, R.P., Banks, P.B. & Arthur, A.D. (2004) *Biological Conservation* 117: 331-342.

Notes

EFFECTS OF INTRODUCED RATS ON ECOSYSTEM PROCESSES ON SEABIRD-DOMINATED ISLANDS IN NEW ZEALAND

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ABSTRACT:

With 84 species of breeding seabirds – 23% of the world's total seabird fauna – New Zealand is the world's seabird capital. Most of these species are currently confined to New Zealand's offshore islands. Predatory mammals, especially ship and Norway rats, have eliminated most seabirds from many islands. In northern New Zealand, several islands have never been invaded by rats and are home to breeding populations of shearwaters and petrels that nest in burrows (average 36 burrows per 100m^2). Ship or Norway rats have invaded other islands of equivalent size in the same region and either extirpated seabirds or reduced populations to very low levels.

Comparing rat-free and rat-invaded islands, we found that rats substantially reduced forest soil fertility through disrupting sea-to-land nutrient transport by seabirds. This in turn led to cascading effects through multiple trophic levels of the soil food web, and ecosystem processes driven by the soil biota such as soil respiration and litter decomposition. We also found important aboveground effects of rats; generally rats reduced plant nutrient concentrations through reducing soil fertility. Even though most ship and Norway rat invasions have occurred $<$150 years ago, there is evidence that disruption of sea-to-land nutrient transport results in more conservative cycling of N but not P through foliage and litter across a range of plant growth forms, and, as a result, limitation of ecological processes by N but not P. When seabirds are present on islands, their trampling and burrowing activities create a chronic disturbance regime. By preying upon seabirds, rats reduced disturbance and hence indirectly enhanced C sequestration in live plant biomass on these islands by 104%, reduced C sequestration in non-living pools by 26%, and increased total ecosystem C storage by 37%.

Technology to eradicate rats from islands was pioneered in New Zealand and has now been achieved on large remote islands of over100 km^2. We compared ecosystem processes and plant communities on islands from which rats have been eradicated in northern New Zealand with rat-free and rat-invaded islands in the same region. The principal driver of ecosystem processes was not whether or not rats were present or had been eradicated but the density of seabird burrows on the islands. Therefore island restoration may depend upon reintroduction of seabirds after rat eradication. This contrasts with restoration goals over previous decades for New Zealand islands, which have focused on introducing land birds and reptiles.

Notes

SEABIRDS, PREDATORS, AND ISLAND RESTORATION: IS THE CAT OUT OF THE BAG?

Matt Rayner

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ABSTRACT:

Detrimental impacts of top predator removal on the complexity and productivity of continental food webs have been widely reported from, yet the potential for such trophic cascades to harm island fauna, particularly seabird communities, remains to be tested empirically. Oceanic Islands are particularly threatened by exotic predators which can drive native species to extinction. However, ecological theory predicts that the elimination of top introduced predators from islands could lead to the counterintuitive decline of native prey populations through the ecological release of smaller introduced species in a process termed mesopredator release. In accordance with theory, and counter to conservation goals for a New Zealand island reserve, cat eradication on Little Barrier Island led to reduced breeding success of Cook's petrels, also vulnerable to predation by a mesopredator, the Pacific rat. Rat eradication in turn was followed by an immediate rise in petrel productivity. While some have taken to argue that such results present the cat as an unlikely champion of procellariiform conservation, ongoing research on Cook's petrel suggests these introduced predators are not quite "out of the bag". It appears that habitat and life-history parameters may play an important role in mediating spatially explicit responses by seabirds to predator eradications on islands.

Notes

MESOPREDATOR RELEASE IN THE JARRAH FOREST OF SOUTH-WEST WESTERN AUSTRALIA

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ABSTRACT:

In Western Australia, use of the toxin sodium monofluoroacetate, or 1080, is considered relatively safe in terms of non-target effects and, when delivered in a dry meat bait or sausage bait, there have been repeated examples of increases in abundance of predation sensitive native fauna - well, at least we think so, as monitoring has relied on indices of abundance only. Indices (this time of predator activity) have also been used to infer reductions in fox density at 1080 baited sites. But we call this science anyway.

As a result of the findings from fox control in WA, introduced predator baiting has been advocated as essential for recovery of predation sensitive native fauna and when undertaking threatened species translocation programs. Unfortunately, 1080 baiting appears to be seen, until recently at least, either consciously or subconsciously, as a panacea for many wildlife management problems. There are now data to show its use needs to be more carefully considered and strategic – despite the presence of fox control, populations of keystone species have declined and translocation programs have revealed disturbing trends.

At a localised scale, baiting for fox control to protect translocated populations of the "threatened" arboreal marsupial, the western ringtail possum, *Pseudocheirus occidentalis*, has been shown to result in an increase in the level of predation by another introduced predator, the feral cat, *Felis catus*, and a native predator, the south-west carpet python, *Morelia spilota imbricata* - clear evidence of mesopredator release. At a landscape scale in the northern jarrah forest of Western Australia (Operation Foxglove), there are also data to suggest a similar response by cats.

Is mesopredator release the sole factor responsible for these trends? So goes the argument for re-introduction of the dingo. To some of us this is a *non sequitur*. The current IA CRC supported research in the northern jarrah forest and coastal translocation sites is testing the mesopredator release hypothesis, but are we doing enough to determine if such a response is scale and/or biome and/or resource dependent? The methodologies adopted will be described.

Notes

DEVELOPING AN EFFECTIVE FOX CONTROL PROGRAM FOR LARGE NATURE RESERVES IN THE WA WHEATBELT

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ABSTRACT:

Lake Magenta nature reserve (104 000 ha) is one of the largest conservation areas in the wheatbelt of WA, and is one of the fauna recovery sites for the Western Shield program. Fox baiting commenced in 1996 and populations of chuditch (*Dasyurus geoffroii*), brushtail possum (*Trichosurus vulpecula*) woylie (*Bettongia penicillata*) and quenda (*Isoodon obesulus*) increased. However since 2001 these medium-sized mammals have declined. This study was commenced in 2006 to examine the reasons for this and is part of a larger study examining the issue of mesopredator release in WA. Using the nearby Dunn Rock nature reserve (70 000 ha) as an unbaited control, this study has examined the activity of foxes and cats in relation to fox baiting, fox baiting effectiveness and the diversity and abundance of vertebrate fauna at both sites.

Activity of foxes at Lake Magenta is lower than that at the unbaited Dunn Rock site, however feral cat activity is higher at Lake Magenta. Fox activity also extends throughout the reserve and is not confined to the perimeter. Fox activity at Lake Magenta appears to remain at a constant level irrespective of the time since aerial baiting. The relationship between fox and cat activity and abundance still needs to be developed through DNA assessment of hair systematically collected at both reserves.

The effectiveness of fox baiting has been assessed through examination of baiting records and bait uptake trials. The aerial fox baiting prescription is for baiting to occur every 90 days however actual baiting intervals have varied from 54 - 138 days. There is similar variation in ground baiting and no synchronization between aerial and ground baiting operations. Bait uptake trials indicate that some foxes at Lake Magenta will pass by baits, and there is little uptake of baits laid off track. A trial to compare fox and cat activity with simultaneous aerially and ground baiting is proposed.

Despite a continued presence of foxes at Lake Magenta the abundance of medium- sized fauna is higher at Lake Magenta than the unbaited Dunn Rock nature reserve. A study into the prevalence of parasites and general health of wildlife at Lake Magenta is also underway.

The completion of this study and the development of an effective feral cat bait will result in more effective control of introduced predators at Lake Magenta and permit the reintroduction of native mammals that once occurred there.

Notes

MODELLING LANDSCAPE LEVEL FOX CONTROL AND CREATING ECOLOGICAL TRAPS THROUGH BAITING

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ABSTRACT:

Ecological traps are habitat sinks that can attract dispersing animals but have higher mortality or reduced fecundity compared to source habitat. The red fox is controlled through much of its range for economic and environmental reasons. Red foxes rapidly occupy any territory left vacant by the death of a resident fox. Therefore, on going control will create an ecological trap by continuously removing foxes from territories thereby encouraging foxes in neighbouring uncontrolled territories to occupy vacant territories and in turn be removed themselves. We modelled an ecological trap for foxes using a simple population model in which a fox population is divided into a controlled and an uncontrolled habitat with a density dependent immigration rate so that foxes moved from high density uncontrolled habitat to low density controlled habitat. Control rates and the proportion of controlled to uncontrolled habitat were systematically varied to determine the equilibrium abundance of both controlled and uncontrolled population. The main result of this model was that below a threshold control rate or proportion of the habitat controlled the uncontrolled habitat was rapidly filled with immigrants from the uncontrolled habitat but that above a threshold control rate the abundance of foxes in the uncontrolled habitat decreased markedly.

Notes

WILD DOGS AND BIODIVERSITY

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ABSTRACT:

Introduced to Australia around 4000 years ago, the dingo *Canis lupus dingo* now occupies large areas of the mainland. Wild dogs (dingoes and domestic dog-dingo hybrids) are the continent's top predators. Owing to their destructive attacks on livestock, especially sheep, wild dogs are maintained at zero or very low densities in semi-arid rangeland habitats where sheep grazing is the dominant land use. These vast areas have been greatly degraded, and suffer from eroded soils, impoverished native vegetation communities and unprecedented levels of extinction of native mammals and other vertebrates. Using the 325 000 km^2 rangeland environment in the Western Division of New South Wales as a case study, I evaluate whether wild dogs could have positive effects on the diversity of remaining small and medium-sized native vertebrates by suppressing populations of their major predators, the introduced red fox *Vulpes vulpe*s and feral cat *Felis catus*. Using a rank-scoring scheme to determine their susceptibility to fox and cat predation, I estimate that 70 of 80 species of vertebrates listed as threatened at the state level should benefit from the mesopredator suppression effect if wild dogs were reintroduced. Other benefits potentially include reduced populations of introduced pest species, maintenance of native vegetation, and the restoration of ecological interactions and ecosystem services performed by native species. Four steps would be needed to make dingo reintroduction practicable – quantifying the biodiversity benefits of reintroduction, exploring novel methods of protecting sheep flocks and farm incomes, engaging the community, and changing legislation – and I will discuss each in turn.

Notes

MODELLING ECOSYSTEM CONSQEQUENCES OF PEST MANAGEMENT

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ABSTRACT:

Attempts to understand and quantify the benefits of vertebrate pest management have shifted from a focus on measuring the pest itself to understanding the relationship between pest abundance and measures of damage or impact. Increasingly there is a need to move beyond simple abundance-impact relationships to understanding how change in pest abundance can affect entire ecosystems and/or key ecosystem processes. Achieving this will require:

1. Cross-disciplinary collaboration between wildlife ecologists and scientists with expertise in other ecosystem processes.
2. A focus on modelling complex systems and using short-term data to forecast longer-term outcomes.
3. Properly accounting for variability and multiple sources of uncertainty in model outcomes.

I illustrate this shift in focus using an example in which we model the likely long-term benefits of sika deer control for canopy tree regeneration in mountain beech forests of the central North Island, New Zealand.

Notes

A REVIEW OF INVASIVE FRESHWATER FISH CONTROL IN AUSTRALIA

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ABSTRACT:

The present status of invasive freshwater fish species in Australia is summarised. There are at least 43 exotic or alien species present in inland waters in Australia (Arthington *et al*., 1999). Wild populations have become established by at least 23 exotic fish species (Bomford, 2003). As a generalisation, most of the early introductions were made ostensibly to provide recreational and/or food resources for the new colonies whilst many of the later introductions (since the early 1960s) have resulted from the release, both accidental and intentional, of aquarium species.

Exotic fish impact on natural ecosystems in various ways with not all established species becoming invasive. Impacts on native fishes have for example been recorded due to common carp, tilapia, mosquitofish or gambusia, swordtails, redfin perch, brown trout, rainbow trout, goldfish and oriental weatherloach. These impacts are not always via the same pathway and the observed modes of action are summarised.

Attempts to control exotic fish species in Australia have in general been ad hoc and localised. Realistically there has not been a coordinated and widespread effort to control any exotic fish species in Australia with the exception of the Tasmanian efforts on common carp. A summary is given of the various control exercises that have been undertaken around Australia.

Efforts are now underway to take a more coordinated approach to management and research on invasive fish species with work in the areas of detection and prevention, rapid response and education underway. The Invasive Animals Cooperative Research Centre, with major support from the Murray-Darling Basin Commission, has established an extensive program to collect critical information on some invasive species and develop control mechanisms. The present status of invasive species research and management projects in Australia is summarised.

Notes

PEST FISH IMPACTS AND MANAGEMENT IN THE MURRAY-DARLING BASIN

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ABSTRACT:

The Murray-Darling Basin (MDB) covers over 1 million square kilometres or approximately 14% of Australia's total land area. Native fish in the catchment have suffered both in terms of their abundance and distribution, as the impacts of human use continue and the health of river systems decline. The *Native Fish Strategy for the Murray-Darling Basin* 2003-2013 aims to restore native fish populations to at least 60% of pre-European levels within 50 years by dealing with all threats to native fish in the Basin in a sustained and integrated manner. Alien fish are a key threat to native fish and the MDB has a high proportion of alien fish species with 12 of the 57 fish in the Basin being either alien or translocated (Lintermans 2007) and alien fish accounting for up to 70% of the numbers and 80-90% of the fish biomass in some river systems. Carp are the most widely recognised alien fish in the MDB, however various trout, Atlantic salmon, Redfin perch, Oriental weatherloach, Tench, Roach, Goldfish and Gambusia are all established in the Basin and tilapia are present in systems perilously close to the MDB. The abundance and attributes of some alien fish continue to cause damage to habitats and populations of native species, however it is a challenge to manage alien fish where perceptions of different species range from pests to valuable recreational fishery species. However, there is an urgent need for coordinated alien fish management across the MDB and the Murray-Darling Basin Commission (MDBC) is proceeding with the development of a Basin-wide plan to manage alien fish with the principle objectives of:

- preventing introduction of new alien fish species into the Basin;
- limiting the further spread of alien fish species currently established in the Basin;
- applying integrated management techniques to control alien species at key focal points in the Basin, with the goal of reducing the impact of alien species rather than their density; and
- reducing the potential of the Basin as a source for alien fish species establishment outside the Basin.

The plan fits within the framework of the Native Fish Strategy and will be supported by a number of projects currently being undertaken by the Invasive Animals Cooperative Research Centre, as well as projects independently commissioned by the MDBC.

References:

Lintermans, M. (2007). *Fishes of the Murray-Darling Basin: An Introductory Guide*. Murray-Darling Basin Commission, Canberra.

Notes

IDENTIFICATION OF 'HOT-SPOTS' OF CARP REPRODUCTION IN THE MURRAY-DARLING BASIN

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ABSTRACT:

Common carp (Cyprinus carpio) have a short larval period where they are susceptible to being flushed from spawning habitats by high flow events. Targeting these downstream drifting larvae using ichthyoplankton nets set during high flow events is a cost-effective means of assessing the point-sources of carp larvae within river systems. Targeted larval sampling was undertaken in catchments within the Murray-Darling Basin for a period of three carp breeding seasons. These data indicate that carp reproduction does not occur uniformly throughout river systems, and that a majority of carp larvae originate from a relatively small number of locations within catchments. Of around 150 sites sampled across 15 catchments, carp larvae were only collected at 18 sites, with large numbers of carp collected from only 7. Each of these locations was immediately downstream of a large low-lying floodplain wetland which had been inundated by recent high flows. However, repeat sampling in a sub-set of these catchments suggest that there is a high probability of false-negative results (not finding carp larvae at a site that could act as a major carp nursery). To validate the larval sampling technique, to minimise the risk of false-negative results and to provide data from the remaining catchments that had not been sampled, electrofishing data collected from a large number of sites within NSW 1994, and from the a large number of sites throughout the entire Murray-Darling Basin since 2004 was used to map the distribution of very young carp (< 75 mm), carp less than one year old (<150 mm) and adult carp throughout the basin. Based on these data, only 18 large scale recruitment sites were located in the Murray-Darling Basin, with nine other locations having potential to act as carp recruitment hotspots. Further, data suggest that seven of these are of much greater importance than the remainder, including the Macquarie Marshes, Namoi wetlands, Gwydir wetlands and Barmah-Millewa Forest. The identification of these 'hotspots' of carp reproduction is a major step forward in implementing an Integrated Pest Management strategy for carp, as a relatively finite number of carp source areas can targeted, as opposed to distributing carp control activities over tens of thousands of kilometres of rivers within the Murray-Darling Basin.

Notes

DEVELOPMENT AND TESTING OF A NOVEL PUSHING TRAP: IS IT TIME WE GAVE COMMON CARP THE FINGER?

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ABSTRACT:

Common carp (*Cyprinus carpio*) make annually predictable migrations between habitats for over wintering (main river channel) and summer spawning (shallow wetlands). Their movements result in localised accumulations at migration barriers (ie. weirs, carp screens), which may persist for several months. Accumulated carp are aggressive in their attempts to push underneath barriers to their migration. Thus, we developed a novel 'pushing trap', with design specifications that are tailored to the pushing abilities and morphology of a targeted size range of carp (>250 mm TL). The final 'finger style' push trap design was selected over four others and can be constructed from readily available materials. Additionally, it can be retrofitted to existing carp separation cages and carp exclusion screens, or adapted into mobile 'rapid response' cages. Initial proof of concept trials in the laboratory have been successful, with >90% of carp entering the trap. This new technology promises a unique opportunity for targeted removal programs, and may be applicable to other vertebrate pests that experience population bottlenecks at times when migratory pathways become spatially constrained.

Notes

POPULATION MODELLING FOR PEST FISH MANAGEMENT: RELATIVE EFFECTS OF SPATIAL STRUCTURING AND MOVEMENT PATTERNS

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ABSTRACT:

Carp (*Cyprinus carpio*) and two tilapia species (*Oreochromis mossambicus* and *Tilapia mariae*) are significant aquatic pests in Australia. High densities of carp occur throughout most of the Murray-Darling Basin (MDB) and in many south-eastern Australian coastal catchments. Tilapia are actively spreading throughout east-coast Queensland catchments and have recently been reported in a north-flowing, Gulf of Carpentaria stream. To assist development of an integrated pest management (IPM) strategy, population models have been developed simulating the likely effects of a range of pest-control methods on idealised, closed populations of carp (Brown and Walker 2004; Davis *et al*. 1999) and tilapia (Russell 2008). The population of carp across the Murray-Darling basin is likely to be spatially structured into several stocks based on recently observed patterns in genetics (Haynes, unpublished data), reproduction and recruitment (Gilligan, unpublished data), with movements of some individuals among stocks. Australian tilapia are also distributed in multiple adjacent catchments with varying levels of physical connectivity that suggests that simulation using a form of metapopulation structure may be appropriate.

We used CarpSim2.0 software to explore the potential for a range of spatial structuring and movement patterns to influence the outcomes of an IPM strategy. Simulations of pest fish populations with a metapopulation structure akin to our current understanding of carp in the MDB were built. The modelled populations had spatial arrangements of increasing complexity and up to 10 stocks of varying sizes were run with high or low movement rates among stocks. Links between stocks were a mix of downstream-only, upstream-only, or bi-directional movements. Simulated management outcomes examined and compared included population viability, and biomass reduction.

References:

Brown P, Walker TI (2004) CARPSIM: stochastic simulation modelling of wild carp (*Cyprinus carpio L*.) population dynamics, with applications to pest control. *Ecological Modelling* 176, 83-97.

Davis SA, Catchpole EA, Pech RP (1999) Models for the introgression of a transgene into a wild population within a stochastic environment, with applications to pest control. *Ecological Modelling* 119, 167-275.

Russell J (2008) Development of management strategies for the control and eradication of feral tilapia populations in Australia In 'Invasive Animals Cooperative Research Centre Review of the Freshwater Products and Strategies Program'. Hobart. March 2008

Notes

TOWARDS CONTROL OF TILAPIA POPULATIONS IN NORTH-EASTERN QUEENSLAND

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ABSTRACT:

Two species of tilapia, *Tilapia mariae* and *Oreochromis mossambicus*, have been progressively colonising watercourses in Queensland and Western Australia since the early 1970s. In Queensland feral populations of both species, which are declared noxious pests, are now present in many of the rivers and impoundments in the north-eastern Wet Tropics and *O. mossambicus* has colonised watercourses around Townsville and in the southeast corner of the State. Until recently only eastern flowing catchments in Queensland were impacted but *T. mariae* are now known to be present in the western flowing Gulf of Carpentaria drainage. If left unchecked, feral tilapia populations can potentially have severe impacts on coastal and inland fisheries and on the environment. They have the capacity to rapidly increase their populations and dominate fish fauna in rivers, impoundments and lagoons.

Current control measures are mostly restricted to public education (Mackenzie & Bryant 2001; Mackenzie *et al*. 2001), limited spot eradications using chemicals, fishing and the installation of expensive screens. Consequently, the Invasive Animals Cooperative Research Centre has jointly funded a program to assist in the development of new control techniques. The program involved a detailed study of the biology of both species to identify any vulnerabilities in their life cycle that could be potentially exploited to manage infestations and to provide baseline information to populate a model (Brown & Walker 2004) to determine the efficacy of various control methodologies. Biological characteristics, including reproductive seasonality, fecundity, age structure and stunting strategies from over 5,500 fish sampled from feral tilapia populations in north-eastern Queensland are detailed. In addition, encouraging results from an innovative trial in a small freshwater reservoir involving both mechanical removal and predator introduction are discussed.

References:

Brown P, Walker TI 2004. CARPSIM: stochastic simulation modelling of wild carp (*Cyprinus carpio* L.) population dynamics, with applications to pest control. Ecological Modelling 176(1-2): 83-97.

Mackenzie R, Bryant M 2001. Controlling exotic pest fishes in Queensland: a strategic approach. Proceedings of 12th Australasian Vertebrate Pest Conference, 21-25 May 2001. Pp. 131-135.

Notes

WHAT'S STOPPING EFFECTIVE WILD DOG MANAGEMENT IN NORTH EAST NSW?

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ABSTRACT:

In north east New South Wales the Department of Primary Industries is actively promoting the benefits of a strategic approach to wild dog management, via an Invasive Animals CRC Demonstration Site. The project's core activities involve research, monitoring and developing cooperative management plans that address problems with wild dogs at both local and regional scales.

Interactions with key stakeholders in wild dog management have revealed a range of significant barriers to wild dog control. This paper highlights these barriers, identifies associated challenges facing stakeholders, as observed within the demonstration site, and suggests ways to improve management in the future.

Notes

NON-INVASIVE RECOVERY OF BRUSHTAIL POSSUM (*TRICHOSURUS VULPECULA*) DNA FROM BAIT INTERFERENCE DEVICES

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ABSTRACT:

In New Zealand the Brushtail Possum is managed as a significant pest of conservation and primary production concern. In situ DNA recovery from this species has many potential management and research applications, such as determination of species presence, identification of individuals, mark-recapture studies, or monitoring re-invasion in low-density populations. A novel non-invasive DNA sampling tool, the WaxTag®, a bait interference device, was presented to captive and wild possums. DNA was recovered from bitten tags using the Qiagen DNeasy, tissue and blood extraction protocols. Using Polymerase Chain Reaction amplification of a 407bp fragment of the Cytochrome Oxidase 1 region, we were able to achieve 94% DNA recovery from captive possums, and 68% recovery from wild possums. We also had strong indication that these recovery rates could be significantly improved through minor changes to the amplification recipe. Sequencing from 23 captive possums confirmed the species with a 99% match on GenBank. Mouse DNA was also recovered from bitten tags and the species was genetically confirmed with a 96% match on Genbank. In this study we established that bait interference devices can be used to non-invasively sample possum DNA in the field, and that WaxTags® are a useful tool for collecting this DNA, both for possums and for other species. This method could have applicability for management of other species, such as endangered marsupials in Australia.

Notes

MODELLING WILD DOG MOVEMENT USING STATE-SPACE MODELS TO EXAMINE OPTIMAL BAIT PLACEMENT

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ABSTRACT:

Wild dogs (Dingoes, feral domestic dogs and their hybrids) impact on agricultural enterprises and potential have a bearing on biodiversity, and are listed in Victoria under the CALP Act as pests that are actively controlled by various State Government Departments.

The Victorian Government currently spends 3 million dollars annually on integrated control programs including trapping, shooting, fencing, and buried baiting. Currently aerial baiting is not permitted in Victoria. The two most commonly used techniques (trapping and buried ground based baiting) place the control measure along roads. These landscape features represent a very small proportion of the space used by wild dogs.

Wild dogs interact with their environment in complex ways and these interactions can produce complex movement patterns. Understanding how these patterns arise and what their implications are for the placement of control tools is an important issue for pest managers.

Movement pathways, which are time series of location observations (e.g. GPS locations), can be analysed using state-space models (SSMs; Jonsen *et al*. 2003). SSMs are time-series models that allow unobservable, true states to be inferred from observed data by accounting for errors arising from imprecise observations and from stochasticity in the process being studied.

The aim of this paper is to demonstrate how individual wild dog pathways may be combined using meta-analytic techniques so that inferences about population-level behaviour can be made allowing investigation of the optimal placement and density of lethal control techniques.

Reference:

Jonsen, I., Myers, R., and Flemming, J. (2003). Meta-analysis of animal movement using state-space models. *Ecology* 84, 3055-3063.

Notes

THE POTENTIAL ROLE OF SEED-EATING BIRDS IN THE DISPERSAL OF 'WEEDS'

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[3]Western Australian Museum, Locked Bag 49, Welshpool DC WA, 6986

ABSTRACT:

Frugivorous birds are well recognised as important seed dispersal agents in tropical and non-tropical environments. However, the ability of truly seed-eating birds to spread viable seed is less understood. Similarly, the role of seed-eating birds in the persistence of feral populations of cultivated crops has been rarely documented (Twigg *et al*. 2008). Improved understanding of these factors is important because: 1) seed-eating birds may help to maintain weed and undesirable plant populations, 2) such seed dispersal may result in new weed populations ultimately impacting on biodiversity and agricultural production, 3) understanding this potential will enable more informed decisions regarding containment zones during exotic plant incursions, and 4) given that some genetically modified agricultural cultivars produce fertile seed (e.g. Canola - Belcher *et al*. 2005), seed-eating birds may spread GM-crops beyond containment boundaries enhancing the potential for transgenic flow to wild flora, or to non-genetically modified crops (Belcher *et al*. 2005; Twigg *et al*. 2008). The potential for seed-eating birds to spread viable seed was therefore investigated using captive feeding trials to determine seed preference, passage time through the gut, and the viability of passed seeds. Test birds comprised pigeons, doves and finches with 'omnivorous' Black and Wood ducks included for comparison. Test seeds were Bladder (hard seeded) and Crimson (soft seeded) clovers, Gorse and Canola. Their consumption was compared to that of appropriate standard rations.

Although the test seeds were acceptable food items, with the exception of Canola, their consumption usually decreased in the presence of other food. Except for Bladder clover, few whole seeds were recovered from the faecal pellets of the true seed-eaters, and apart from the Bladder clover seeds, few were viable. In contrast, viable seeds of Canola and Gorse were recovered from the duck faeces, although the germinability of these seeds was reduced when compared to that of untreated controls ($P<0.05$). Passage time was relatively quick (means $<$ 5h) for all test seeds and standard rations suggesting that seed dispersal distances by these birds will generally be short. Viable seeds were also recovered from regurgitated soft-pellets of some urban, omnivorous wild birds. Despite the low probability of individual birds spreading viable seed, the sheer number of seed-eating birds feeding in the wild suggests that the potential for true seed-eating and other birds to disperse viable seeds cannot be discounted, particularly if exozoochorous dispersal is also considered.

References:

Twigg, L.E., Taylor, C.M., Tim J. Lowe, T.J., and Calver, M.C. (2008). Can seed-eating birds spread viable canola seed? *Pacific Conservation Biology* 14: 000-000.

Belcher, K., Nolana, J and Phillips, P.W. (2005). Genetically modified crops and agricultural landscapes: spatial patterns of contamination. *Ecological Economics* 53: 387– 401.

Notes

HOME RANGE, ACTIVITY PATTERNS, AND HABITAT USE OF URBAN DINGOES

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ABSTRACT:

Dingoes (*Canis lupus dingo* and *hybrids*) have traditionally been viewed as a livestock predation problem of rural areas, but in recent years dingoes have emerged as a human health and safety risk in urban areas. Populations of urban dingoes exist in most cities and towns within their extended range. They often attack people and pets, are known to be reservoirs of zoonotic diseases and parasites, and can cause significant economic losses to many people and industries along the urban-agricultural interface. Despite this, very little is known about their general ecology in urban areas, including their home range sizes, activity patterns, habitat use, and their disease and parasite epidemiology. Consequently, the agencies responsible for pest animal management in urban areas continue to respond to requests for control and damage mitigation without sufficient information in the literature to guide and support their efforts.

In this study, GPS collars were fitted to several urban dingoes to record their home range sizes, activity patterns, and habitat use. Each GPS collar was programmed to record a GPS point at five minute intervals from 5:00pm to 9:00am and hourly intervals from 9:00am to 5:00pm. Monitoring fine-scale movement patterns at this detail provided new and novel opportunities to analyse home range, activity patterns, and habitat use using techniques with more biological merit than has been achievable in the past. This included: the development of Traversed Area Polygons (TAPs) as a new method of calculating home range size, able to objectively incorporate concave angles into a polygon comprised of large amounts of fine-scale and autocorrelated data; the ability to accurately use 'speed of travel' as a indicator of activity levels; and the ability to describe habitat use in terms of actual time (minutes or hours) spent in a given habitat rather than the proportion of points in a given habitat.

Results show urban dingoes to have comparably small home range sizes (mean 2.17km^2 TAP or 4.14km^2 MCP) and exhibit crepuscular activity patterns and flexible habitat use. The only exceptions to this were one adult female monitored during breeding season and one juvenile female monitored during a dispersal event that had obvious anomalies in home range size. However, at all times, all urban dingoes were within 700m of residential homes, were often within 200m of homes, and were regularly in extremely close proximity to homes. One 27kg urban dingo even had a core area in a small patch of bushland at the bottom of popular primary school in the heart of a large town. Urban dingoes were confident around roads and residential suburbs, and while wary, did not appear perturbed by human presence. The results of this study indicate that the spatial ecology of urban dingoes is dissimilar to that of rural dingoes, and is more similar to that of urban foxes and urban coyotes.

In order to effectively manage dingoes in *urban* environments, the ecology and impacts of dingoes in urban areas need to be investigated in more detail. This can be achieved, in part, through investigations of seasonal home range size, activity patterns and habitat use, and further epidemiological studies of zoonoses. Genetic purity related research, diet and food availability, and accurate density estimates of populations should supplement these studies.

Notes

ECONOMICS OF FERAL ANIMAL CONTROL IN THE NT

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ABSTRACT:

Exotic pest animals have major economic, environmental and social impacts across Australia (Commonwealth of Australia 2007). In a major review of the most significant threats to biodiversity in the NT (covering fire, feral animals, pastoralism, weeds and land clearing), the highest ranked threat across all regions was related to the presence of large feral herbivores (Price *et al*., 2007).

There are 19 species of exotic vertebrate pests in the Northern Territory. Donkey, horse, cane toad, Arabian camel, pig, water buffalo, fox and cat are considered major pests because they have a high level of overall impact at current densities and distributions.

A cost-benefit analysis was carried out with regard to feral animal control activities for the above species plus rabbits and wild dogs. Based on expert opinion obtained through a series of workshops, and with a view to achieving the NT Integrated Natural Resource Management (INRM) Plan goal by 2020, specific control strategies for all the main feral species in the NT were identified.

Two different aerial control strategies were modelled for large feral herbivores and pigs. Trapping/baiting, eradication and exclusion strategies were modelled for the remaining species. The direct economic benefit to the pastoral industry of large feral herbivore control was also modelled.

Considering only the large feral herbivores (camels, horses donkeys, buffalos) for which the most reliable data was available, the total present costs of a control programme was calculated to be approximately $28.1m over a 20 year time horizon (given a 5% discount rate). This is equivalent to an annualised present cost of $2.26m. However, costs are front-loaded, with 50-75% of total funds over the 20 years having to be spent in the first 5 years.

While such control costs are large, they are far outweighed by the direct economic benefit to the pastoral industry from reduced competition between livestock and large feral herbivores. The net present benefits of a control programme are thus estimated to be in the region of $180.7m over 20 years, equivalent to an annualised present benefit of $14.5m p.a. This may well be a lower-bound estimate of the benefits of control, as currently unquantified environmental and cultural benefits are also likely to be important.

Based on a sensitivity analysis, the robustness of the results suggests a strong argument for implementing a comprehensive feral animal control programme sooner rather than later. Further work to provide an additional level of detail upon which implementation of such a control programme could be carried out is likely to be highly justified. A more in-depth study is also urgently needed with regard to rabbit and pig control costs.

References:

Commonwealth of Australia. 2007. Australian Pest Animal Strategy – A national strategy for the management of vertebrate pest animals in Australia.

Price, O., Drucker, A., Edwards, G., Fisher, A., Woinarski, J. and Saalfeld, K. 2007. Review of threats to biodiversity in the Northern Territory. Draft Final Report for NHT Project 2005/043, NRETA.

RECOMBINANT APPROACHES FOR MANAGING INVASIVE FISH

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ABSTRACT:

The efficacy of an inherited gender-distorting gene construct (a "daughterless" gene) at controlling pest populations has been investigated using a series of models of intermediate complexity, on several pest animals. The models consistently indicate that a daughterless type construct (including sex-specific lethal or sterile options) can markedly reduce pest numbers, but often at the cost of a substantial stocking program. The stocking effort required, however, depends on the nature of sex ratio investment by the wild-type animals, and under some circumstances, virtual pest eradication can be achieved with minimal stocking effort, a point we demonstrate using a fully parameterised model of introducing daughterless carriers into the North American Great Lakes lamprey population. This effect has two consequences. First, it indicates that accurately predicting the cost and benefits of a daughterless type program requires good data on sex ratio variability in target populations, which are often lacking. And second, it re-emphasizes the essential trade-offs between risk and the cost of a control program when using genetic technology, a point that will be explored in detail in the presentation.

Notes

LABORATORY DEVELOPMENT OF A PROTOTYPE DAUGHTERLESS CONSTRUCT IN THE MEDAKA, *ORYZIAS LATIPES*

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ABSTRACT:

CSIRO, with the support of the Murray-Darling Basin Commission and the Invasives Animal CRC, has been working to develop a functional prototype daughterless construct, in the model species O. latipes (a distant relative of carp). The technology is based on the targeted disruption of a gene that produces an enzyme critical for production of the female hormone, estrogen, in fish. The project has gone through three stages. First, direct injection of the blocking sequence alone into eggs was shown to produce genetic females that were fully functional males, showing that the gene disruption was feasible. Second, the blocker was joined to a promoter element, to produce a full gene sequence, which in turn was injected into eggs and shown to be effective in creating "neo-males". In the project's current stage, we are attempting to get this gene sequence integrated into the genome of the test species, so that it inheritably distorts sex ratios. This talk will review the status of the integration trials, and outline the next stages of daughterless development.

Notes

KOI HERPESVIRUS: A POTENTIAL BIOLOGICAL CONTROL AGENT FOR THE COMMON CARP

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ABSTRACT:

Disease associated with koi herpesvirus (KHV) was first described in common carp (*Cyprinus carpio carpio)* in Israel in 1998. Since then, the virus has spread throughout much of the world, and it represents a serious threat to important carp industries. By contrast, common carp in Australia are an introduced pest, and KHV represents a potential weapon for controlling them. Carp were first introduced to Australia in the 1850s, but they had little impact until the 1960s when the Boolara strain gained access to the Murray River. This strain adapted very well to Australian conditions, and the population of carp expanded dramatically. They are now found throughout all of south-eastern Australia, and are considered to have a seriously deleterious effect on Australian freshwater ecosystems.

In Australia, KHV, a disease exotic to this country, has been considered as a potential biological control agent for carp. In summary, it is the specificity of KHV for carp, the sensitivity of carp to infection with the virus, the subsequent high mortality in the host species even in wild populations, and the capacity to affect carp of many ages that make KHV such an attractive option as a potential biological control agent. The Invasive Animals Cooperative Research Centre has funded the Fish Diseases Laboratory at the high-security CSIRO-AAHL to examine the potential of KHV in this role. Preliminary studies have demonstrated that Australian larval carp are indeed susceptible to a lethal infection with KHV, but that mortality is less in older, mature fish. Testing the susceptibility of non-target fish species is currently underway. All current studies will be strictly confined to the laboratory, and, even if the results continue to be encouraging, it is likely to be many years, and after much public consultation, before the virus would be considered for use in a multi-pronged attempt to control carp in Australia.

Notes

USING LOW pH TO REPEL SALMONIDS: FROM THE LAB TO THE FIELD

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ABSTRACT:

Many of New Zealand's endemic non migratory freshwater fish species are currently threatened as a result of competitive exclusion and/or direct predation by salmonids. Tools to eradicate and manage exotic fish species in running waters in New Zealand are presently limited. Interestingly, salmonids exhibit high sensitivity to low pH water relative to many native New Zealand species. This vulnerable aspect of their physiology was used to explore the possibility of using low pH to 'repel' brown trout.

Choice chamber laboratory trials conducted previously indicated that pH 5.5 or less would elicit a clear avoidance response by brown trout. This information was used to test the ability to repel trout from a real flowing stream in Karori Sanctuary, Wellington. During the field trial pH's were dropped from near neutral and kept consistently in a range between 5.5-4.8 over a 100m reach for a 9 hour period. In contrast to laboratory responses, brown trout did not respond strongly to the treatment in a field situation. It is likely that the motivation for trout to leave in a real stream is probably influenced by other factors such as the reluctance to leave established territories. Under natural conditions brown trout are able to cope with significant stressors over short periods (e.g high temperatures, low flows) but their ability to persist is reduced in the long term if conditions remain suboptimal. The use of pH to repel brown trout is unlikely to be a useful non-lethal tool for removal of brown trout over short time frames. Its use over longer timeframes is likely to be logistically unfeasible and as a result we suggest further effort should focus on refining the use of powdered rotenone for removal of trout in flowing situations and minimising the effects of aquatic mortality that will result from this method.

Notes

NONNATIVE FISH MANAGEMENT IN GRAND CANYON, ARIZONA, USA TO PROTECT AN ENDANGERED INDIGENOUS FISH SPECIES, THE HUMPBACK CHUB (*GILA CYPHA*)

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ABSTRACT:

Construction of Glen Canyon Dam on the Colorado River, Arizona, USA was completed in 1963. Due to the environmental impacts of the dam on natural resources, the Glen Canyon Dam Adaptive Management Program (GCDAMP) was formed to address the issues. Under the GCDAMP, Grand Canyon Monitoring and Research Center (GCMRC) is tasked with conducting scientific experiments to measure the effects of the dam and make recommendations for natural resource management. One of the resources mandated for protection under the program includes the endangered humpback chub (*Gila cypha*) indigenous to the Colorado River Basin. Two main threats to humpback chub are 1) introductions of predatory and competitory nonnative fish and 2) habitat alteration associated with changes in the natural hydrograph and water quality conditions. GCMRC has been charged with developing a nonnative fish management plan for Grand Canyon. This plan includes reviewing historic nonnative fish captures in Grand Canyon and its tributaries, developing and implementing effective nonnative fish capture techniques for abundance estimation and removal programs, developing a bioenergetics model to identify the nonnative fish species posing greatest risk to humpback chub, identifying sources of and areas important to nonnative fish recruitment. The goal of this plan is to provide information to managers for effective and efficient control of nonnative fish and their negative impacts on native fish throughout 300 miles of a remote river in Grand Canyon.

The presentation will provide information on the long term management approach and a mechanical removal experiment aimed at nonnative fishes in a small reach of the Grand Canyon.

Nonnative fishes were removed from 12 miles of humpback chub habitat near the confluence of the Little Colorado River. During 23 trips conducted in 2003-06, a total of 25,455 non-native fishes were removed using hoop nets and electrofishing. The majority of the removed fish were rainbow trout (81%, 20,636 fish). Over the course of this study there was a reduction in the catch proportion of nonnative fishes from ~96% to ~40%. Estimated rainbow trout abundance has been reduced to less than 10% of the original abundance and remained at this level through 2006. Electrofishing catch rates of native fish increased markedly in the summer of 2005 likely due to an increase in catch rates of age 1-2 fish. Decreases in nonnative trout may be a result of mechanical removal or may be due to other confounding factors which may have disadvantaged nonnative trout such as warm water temperatures, low oxygen levels, and food base changes.

Notes

AN INTEGRATED APPROACH TO ERADICATING CARP IN TASMANIA

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ABSTRACT:

Over 11 years IFS Tasmania has made concerted effort towards controlling and eradicating common carp, *Cyprinus carpio*, from Lakes Crescent and Sorell. Remarkably carp have been contained to these lakes. Extensive effort and design has gone into the configuration and construction of containment screens. It is estimated that carp numbers of <10 and <50 remain in lakes Crescent and Sorell respectively. Several mark recapture population estimates have been undertaken over the past 10 years in Lake Crescent using both a Peterson and Schnabel methods of calculation to estimate the remaining numbers of carp. CPUE based population estimates extrapolated from the Lake Crescent study onto the neighbouring Lake Sorell have precluded the need for releasing any marked fish into this much larger lake. In 1997, the implementation of transmitters and radio tracking equipment was incorporated into the program. Subsequently, with the help of grid reference charts, the CMP have recorded all tracking events and location data for each individual fish hosting a transmitter over the past 11 years. Tracking information is stored within a Microsoft Access database. To visualise historical tracking data in a spatial sense, a datalink has been constructed to upload specific tracking information with the output displayed in Microsoft Mapinfo. The datalink enables the user to view individual tracker fish behaviour for any given time period within either water body. Thematic distribution maps can also be displayed for specific intervals of time, illustrating favourable areas of inhabitancy. By incorporating water temperature and lake level data into the database, the areas where tracker fish are likely to be during particular environmental conditions can be determined. Ultimately this information is used to target the carp using electrofishing, netting and trapping at different time of the year and under varying environmental conditions. The removal of last few carp has been a challenge necessitating incorporation of additional integrated management strategies. The deployment of extensive barrier netting to prevent carp from accessing key spawning sites and field trials where reproductively primed odour donor female fish are used to attract and trap wild free ranging carp have been introduced. This work demonstrates the ability to limit spawning opportunities and the feasibility of deploying odour donor carp to assist in trapping and their removal in field conditions. However the molecules (pheromones), mechanisms of chemoreception and the influence/interaction of environmental factors remain less understood.

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Key Words : Eradication, containment, physical removal, integrated approach.

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THE COMMUNITY INVOLVEMENT PROCESS IN THE WILD DOG PROGRAM IN VICTORIA

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ABSTRACT:

In Victoria, wild dogs mainly occur on public land in the eastern highlands. The majority of the damage is caused by wild dogs moving from nearby public land onto adjoining private land where they attack livestock, predominantly sheep and lambs, but also goats, calves and cattle. Wild dogs have both an economic and social impact on the communities where ongoing attacks occur.

The current approaches to wild dog management in Victoria are consistent with the aims and outcomes of the *Victorian Pest Management – A Framework for Action 2002* (VPMF). Beneath this framework is the *Wild Dog Management Strategy* which describes the strategic directions for wild dog control programs in Victoria.

The goal of this strategy is to:

"Minimise the impact of wild dogs on economic and community values through the implementation of a community supported strategic approach to wild dog management that contributes to the protection of livestock and meeting the social outcomes of regional and statewide strategies".

The Victorian Government is committed to effective wild dog control in Victoria and is working in partnership with the community to meet this goal through the adoption of integrated pest management and community engagement principles. In Victoria all wild dog control staff are employed by one government agency. A total of 27 full time staff are involved in delivery of the Department of Primary Industries (DPI) wild dog program.

In 2002 the Victorian government established by Ministerial appointment Wild Dog Management Groups (WDMG) in Gippsland and North East Victoria. Each group has ten members, consisting of six landholders and four government staff some of which represent public land management agencies. The government agency members include the DPI Wild dog project manager, regional representatives for the Department of Sustainability and Environment, Forest Management and Flora and Fauna sections, and Parks Victoria. The chairperson is a landholder nominated by the Minister. Executive support to the group is provided by the DPI wild dog program community engagement officer, who is also responsible for coordinating wild dog control in that area.

The WDMGs are appointed for a three year period. Each group develops and implements a wild dog action plan for the duration of their term. The scope and responsibilities of the WDMGs are established through the development of their "terms of reference". Foremost, each WDMG provides recommendations to the DPI Secretary on the strategic management of wild dogs. Specifically, through the development and implementation of their action plans the WDMGs are also responsible for;

- the engagement of all key stakeholders and the building of partnerships where applicable
- engaging the wider community in the development of local area control plans
- initiating community awareness activities,
- developing submissions for additional funding,
- participating in the review of existing policies and guidelines
- recommending priorities for future research.

The achievements of the two WDMG's have been wide ranging and include;

- greater community input into program planning and delivery
- improvements to the wild dog request for assistance process
- enhancing wild dog exclusion fencing designs and the development of a fencing handbook
- review of grant rates for exclusion fencing
- securing additional resources for wild dog control
- providing advice to government on the merits of aerial baiting and future research priorities.

THE EFFICACY OF RATTOFF® ZINC PHOSPHIDE BAIT SACHETS IN CONTROLLING RATS IN BANANA AND TEAK PLANTATIONS

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ABSTRACT:

Several rodent species inhabit banana and teak plantations within Queensland, and effective control is required to address crop damage, and to minimise the risks of leptospirosis infection transfer.

Rodents such as the introduced *Rattus rattus* (Black Rat) and *Mus domesticus* (House Mouse), and the native *Melomys burtoni* (Grassland Melomys) are known to build nests in the top of banana bunches. Damage occurs from claw scratching (which can pierce or mark the skin of the banana) or consumption of the fruit. Further damage occurs from the burrowing habits of species such as the native *R. sordidus* (Canefield Rat), which weaken the root structures of both banana and teak trees, rendering them more susceptible to collapse. In addition to the damage caused by rodents, contact with contaminated rodent urine and faeces can produce human infections of leptospirosis, a potentially fatal bacterial disease.

There is currently no registered rodenticide for control of rodents in banana or teak plantations, therefore these trials aimed to determine if RATTOFF® Zinc Phosphide Bait Sachets (previously developed for rodent control in sugarcane crops) could reduce populations of rodents in banana plantations in the Tully district and in teak trees at the Mount Ray Plantation north of Cooktown in Qld, Australia.

In two banana plantations, capture-recapture trapping was conducted in July and August 2007 in paired treated-control sites for up to seven consecutive days pre-treatment. RATTOFF® was applied in plastic bait stations at 1 kg/ha (100x 10g sachets/ha) to the two treated sites and left undisturbed for seven days. This was followed by up to five consecutive days of post-treatment trapping at all sites. In the 4,200 trap nights at the four sites, 328 *R. sordidus*, 116 *M. domesticus*, 35 *R. rattus* and 3 *R. fuscipes* were captured. Based on survivorship of tagged individuals (corrected for control sites), RATTOFF® caused a 93% reduction in rodent population numbers in Plantation 1 and a 49% reduction in Plantation 2, a mean decline of 71%. The pre- and post-bait population sizes of *R. sordidus* on each trap grid were estimated using Huggins closed-capture population analysis (model averaging) in program MARK. Based on these population estimates, the population in the treated site in Plantation 1 dropped from 130 to 17 as a result of RATTOFF® application compared to a reduction from 127 to 99 in the control site. In Plantation 2, the application of RATTOFF® did not have the same effect on model estimated population sizes, with numbers increasing from 26 to 30 in the treated site. This estimated population increase was not as substantial as calculated for the paired control site, where estimated numbers of *R. sordidus* more than doubled from 20 to 45. Therefore, although estimated numbers rose slightly, RATTOFF® treatment reduced the extent of the population increase in the treated site.

In the teak trial, trapping on standardised grids was conducted in October 2005 in paired treatment and control sites on two blocks. Trapping was conducted at all sites for four consecutive days pre-treatment, then RATTOFF® was applied at 1 kg/ha (100 sachets/ha) to the two treatment sites and left undisturbed for seven days. This was followed by three consecutive days of post-treatment trapping at all sites. A total of 137 *R. sordidus* were captured over 1,015 trap nights. The pre- and post-treatment population size on each trap grid was also estimated using program MARK. After baiting there was a significant reduction in the population size at the two treatment sites (Z test, both $p<0.01$) and a significant increase at the two control sites (Z test, both $p<0.01$). There was also a significant reduction in the survivorship of rats at the two treatment sites (Z test, both $p<0.01$) but there was no change at the two control sites (Z test, both $p>0.01$). RATTOFF® application reduced the two estimated populations by 82 and 85%.

The results extend the range of crops for which RATTOFF® provides effective rodent management without the risks of environmental toxin accumulation that arise from anticoagulant use in these situations.

EFFICACY OF MOUSEOFF® TO CONTROL MICE IN A SIMULATED CROP HABITAT

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ABSTRACT:

MOUSEOFF® Zinc Phosphide Bait has demonstrated high levels of efficacy against mice (*Mus domesticus*) in broad-acre cereal crops in Australia, and a natural extension of the technology is to test the formulation in other crops that sporadically suffer economic damage from mice. Two root vegetable crops (radish and turnip) and two brassica crops (broccoli and cauliflower) were grown within enclosed mouse-proof enclosures at the UQ Gatton facility to test the efficacy of MOUSEOFF® in intensive vegetable crops. Each crop was grown within four enclosures (15 x 15m); two control and two treated. Various mouse densities (representative of natural populations) were acclimatised within the crops around the time of maturation. Baits (MOUSEOFF® in treated and placebo grains in control enclosures) were introduced within bait stations, and after 10 days (root vegetables) and 5 days (brassicas) the surviving mice were recaptured. Bait uptake and mouse activity was monitored daily by directly assessing bait consumption and via tracking boards adjacent to bait station entrances. Mouse survivorship (efficacy) was calculated based on the number of mice "known to be alive" (KTBA) at the time of baiting, and the number of these mice recaptured post-bait. Survivorship was compared between control and treated enclosures. Not all mice survived the acclimatisation process, with mortalities occurring from exposure (experiments carried out over winter with winter crops) and predation by rats invading from adjacent enclosures. The number of KTBA mice was calculated for each enclosure after the acclimatisation period (before bait application), and although lower than anticipated (densities ranging from 133/ha to 667/ha), all MOUSEOFF® treated enclosures achieved 100% mouse efficacy compared to minimal change in population numbers in control enclosures. Population reduction in treated brassica crops was particularly fast, with all mouse activity ceasing within 24 hours of MOUSEOFF® application (confirmed by the lack of track board and bait activity). Track board activity and bait consumption also supported the KTBA survivorship results and strengthened the conclusion that mice in treated pens died as a result of consuming MOUSEOFF®. These results demonstrate that MOUSEOFF® is capable of achieving rapid control of mouse populations within intensive vegetable crop situations.

Notes

ADVANCES IN TRAPPING FOR CONTROL OF PEST POSSUMS AND WALLABIES IN TASMANIA, AS AN ECONOMIC ALTERNATIVE TO 1080 POISON

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ABSTRACT:

Brushtail possums (*Trichosuus vulpecula*), rufous wallabies or Tasmanian pademelons (*Thylogale billardierii*) and Bennett's wallabies (*Macropus rufogriseus*) are significant native animal pest species in Tasmania. They compete with livestock for pasture on farms, and consume tree seedlings on forest regeneration and plantation sites. 1080 poison has been the main control measure adopted to control pest browser numbers until recently. From January, 2006 though, 1080 poison has been banned from all Tasmanian Government and associated forestry operations, and it's use on private holdings is steadily declining.

Alternatives to poison for browser control are practically limited to fencing, shooting, and trapping. Trapping has only been a legal option in Tasmania since early 2006 when a trap design by the author, and a trap design by Forestry Tasmania, were formally accepted as humane traps for wallabies. Use of conventional wire mesh cage traps for wallabies is not allowed because of the natural tendency for wallabies to jump in the confinement of a trap and to suffer severe abrasions, especially to the face, as they abrade it against the wire mesh. The author's trap designs comprise variations on a nylon fabric containment with a minimal steel collapsible frame whereby the contained animal avoids injury because it can only jump against a soft fabric. The Forestry Tasmania "Mersey Trap" design is essentially a conventional wire mesh trap with the contained animal kept in the dark by virtue of a sheet metal hood which covers the sprung trap and keeps the trapped animal in the dark.

Various issues associated with trapping and humanely killing trapped browsers are discussed in this report. Topics include alternative feed attractants, manual and automatic feeders, and feeder compounds with one way animal entry and exit doors. The need for repeat trapping to remove browsers moving in to replace those previously trapped, and the costs of trapping compared with poisoning and shooting are reviewed. An important component of the trapping research is long range night vision filming of marked and unmarked animals for objective quantitative determination of animal presence. Practical night vision filming issues are detailed and photographic and video data presented.

Notes

FERAL GOATS, RAINFALL AND WATER: POTENTIALS FOR MANAGEMENT IN DIFFERENT ECOSYSTEMS

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ABSTRACT:

The home range of feral goats in Australasia is related to mean annual rainfall (MAR) by an inverse power function. Smaller home ranges are apparent at MARs above about 500mm. Below 400 mm MAR home ranges become very large and at about 250mm MAR, feral goats become nomadic, searching for water.

Studies at field sites in the temperate and semi-arid rangelands, indicated that the dependence of feral goats on freestanding water varied. In temperate rangelands in central, eastern NSW with > 700mm MAR, feral goats were not dependent on water sources and their distribution throughout the landscape was related to vegetation and topography. Conversely, our studies in the semi-arid rangelands of north western NSW showed the dispersion of feral goats was strongly related to water courses and water sources.

This varying dependence on water provides opportunities for different harvesting and control practices of feral goats in different environments, some of which are already utilised. For example, trapping on water is a recognised practice in semi-arid landscapes, but is unsuitable to temperate rangelands. In this paper, we discuss alternative feral goat management options for different situations, compare the application and costings of these, and indicate some research directions to better strategically manage feral goats.

Notes

VICTORIA'S GOOD NEIGHBOUR PROGRAM

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ABSTRACT:

Weed and pests on public land, particularly along interface areas with private land are often seen as a problem by individual neighbours and communities. Resources to deal with the problem are finite and investment that is delivered in a manner that recognises the local problems are important. Successful partnerships lead to government been seen as an active member of these communities. Locally based government staff plays an important role in implementing effective systems such as the Victorian Good Neighbour Program (GNP) to achieve this aim.

The programs objectives include, building positive relations with neighbours, promoting government as a good neighbour regarding weed and pest management, taking into account community priorities and actions, supporting community based programs occurring on private land and integration with other natural resource management objectives and consistency with government and public land policy.

GNP was developed to address weed and pest impacts along public/private boundaries, the level of consultation with neighbours and community, and limited integration between public land managers in on ground works. Promotion of the work being undertaken was not a strong feature. Funding available for weed and pest control did not often take place along the boundary or due to discretionary nature may have been used in other areas of activity.

The GNP commenced in 1992 and has an annual budget of $2.7 million, allocated across 10 Catchment Management Areas. The program is supported by the Department of Sustainability and Environment, Department of Primary Industries, Parks Victoria and Catchment Management Authorities.

Key features of the program include; annual project submissions of one to three year projects and regional assessment panels comprising representatives from government and community. Local agency staff develops and manage projects with close community consultation. Promotion is an essential component of the program.

Approximately 500 projects are funded each year and deal with a range of species including rabbit, fox, goat, pig, wild dog and a range of weed species. Success of the program is measured by a range of methods including effective engagement, works outcomes, and promotion. The GNP provides successful formulae for addressing the previous problems.

Notes

ARE WE FOCUSSING WILD DOG CONTROL THE WRONG TIME OF THE YEAR AND GOING ABOUT IT THE WRONG WAY?

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ABSTRACT:

Our evaluation of the predation of calves by wild dogs in the 1990s found that the number of calves killed and frequency of years that calf losses occurred, is higher in baited areas compared to adjoining, non-baited areas of similar size. Calf losses were highest with poor seasonal conditions, low prey numbers and where baited areas were re-colonised by wild dogs soon after baiting.

We monitored wild dog "activity" before and after 35 baiting programs in southwest, central west and far north Queensland between 1994 and 2006 and found change in activity depends on the timing of the baiting. Baiting programs conducted between October and April show an increase in dog activity post-baiting (average increase of 219.1%, SEM 100.9, n=9, for programs conducted in October and November; an increase of 82.5%, SEM 54.5, n=7 for programs conducted in March and April; and a decrease in activity of 46.5%, SEM 10.2, n=19 for programs conducted between May and September).

We monitored the seasonal activity and dispersal of wild dogs fitted with satellite transmitters 2006 to present. We have found that:

- Activity of breeding males and females, whilst rearing and nurturing pups, is focussed around the den between July to September and away from areas of human activity. Activity of breeding groups appears to avoid locations of human activity until juveniles become independent (around late November).
- While independent and solitary yearlings often have unstable, elliptically-shaped territories in less favourable areas, members of breeding groups have territories that appear seasonally stable and circular located in more favourable habitats.
- Extra-territorial forays of solitary yearlings can be huge, in excess of 200 km. The largest forays we have monitored have occurred when the activity of pack members is focussed around rearing pups and juveniles (August to November).
- Where wild dogs have dispersed or had significant territorial expansion, it has occurred within days of baiting programs and onto recently baited properties.
- The wild dogs we have tracked have followed netting barrier fences for hundreds of kilometres and lived adjacent to or bypassed numerous grids in the barrier.

Based on these studies, we conclude that a proportion of the perceived decline in dog activity between May and September, post baiting, is due to a decline in dog activity in areas associated with human activity. The increase in dog activity post-baiting between October and May (and increased calf predation on baited properties) is likely caused by wild dogs dispersing (juveniles and yearlings) or expanding (adults) their territory into baited, now 'vacant', areas. We hypothesise that baiting programs should be focussed in summer and autumn commencing late November as soon as juveniles become independent of adults. We also hypothesise that instead of large, annual or semi-annual baiting programs, laying the same number of baits over 4-6 weeks may be more effective. These hypotheses need to be tested through an adaptive management project.

CARNIVORE ODOURS AS REPELLENTS: AN EFFECTIVE PEST MANAGEMENT TOOL?

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ABSTRACT:

Research into the use of carnivore faecal-odour based repellents as a pest management tool has increased over the last 30 years; however there are many unanswered questions regarding their efficacy, particularly in an Australian context. We evaluated carnivore faecal odours as a repellent for Australian rangeland pest species on 20 goats to determine their effectiveness as feeding deterrents. Faecal odours from tigers and Tasmanian devils fed on two different diets were evaluated. Tiger faecal odour was more effective than Tasmanian devil faecal odour ($P<0.05$) however the odours, from the tigers and Tasmanian devils fed the different diets were not significantly different ($P>0.05$) in their repellence of goats from feed. Animals exhibited signs of habituation to the faecal odours over the experimental period (36 Days) and a gradual change in their behaviour as they approached feed troughs was observed. The results indicate that the use of carnivore faecal odours as feeding deterrents for goats has the potential to be an effective management tool however the quantification and impact of habituation warrants further investigation.

Notes

ACTIVITY OF WILD DOGS, CO-OCCURING CARNIVORES AND KEY PREY SPECIES BEFORE AND AFTER STRATEGIC CONTROL IN NORTHERN NSW

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ABSTRACT:

In northern NSW, land managers control wild dogs (*Canis familiaris familiaris*, *Canis familiaris dingo* and *hybrids*) and foxes (*Vulpes vulpes*) to reduce impacts on livestock production, to conserve native fauna and to alleviate social impacts on associated communities. Control is implemented through integrated strategic and reactive management programs where the former is principally dependent upon annual aerial 1080-baiting campaigns. Monitoring the activity of target species, as well as their prey, is important to provide information about management efficacy and broader impacts on affected systems. This paper reports preliminary findings from an ongoing project that aims to monitor activity levels of wild dogs, co-occurring carnivores and key prey species before and after annual control. Our observations, taken across four stratified sites (two treated and two untreated), suggest that, in the short term, strategic control appeared to be successful in its ability to reduce wild dog activity. Co-occurring foxes and cats, however, did not respond similarly, suggesting that local land managers should be cautious in regarding aerial-baiting as an effective, broad-spectrum predator control technique.

Notes

CO-EVOLUTION OF WILD RABBITS (ORYCTOLAGUS CUNICULUS) AND RHDV: RESISTANCE AND VIRULENCE

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ABSTRACT:

Rabbit Haemorrhagic Disease Virus (RHDV) was introduced to Australia in 1995 for the control of wild rabbits. Initial outbreaks greatly reduced rabbit numbers and the virus has continued to control rabbits to varying degrees in different parts of Australia. However, recent field evidence suggests that the virus may be becoming less effective in those areas that have previously experienced repeated epizootics causing high mortality. There are also reports of rabbits returning to pre-1995 density levels.

Virus and host can be expected to co-evolve. The host will develop resistance to the virus with the virus subsequently changing to overcome that resistance. It has been 12 years since the release of RHDV and it is an opportune time to examine where the dynamic currently stands between RHDV and rabbits.

Laboratory challenge tests have indicated that resistance to RHDV has developed to different degrees in populations throughout Australia. In one population a low dose (1:25 dilution) of Czech strain RHDV failed to infect a single susceptible rabbit, yet infected a low to high (up to 73%) percentage across other populations tested. Different selection pressures are present in these populations and will be driving the level of resistance being seen. The mechanisms and genetics behind the development of resistance are also important as the on-going use of RHDV as a control tool in the management of rabbits relies on our understanding of factors influencing the efficacy of the virus. Understanding how resistance has developed may provide clues on how best to use the virus to circumvent these mechanisms. Similarly, it will help in managing populations that have yet to develop high levels of resistance.

Notes

ARE RABBITS AT TURRETFIELD RESEARCH CENTRE SOUTH AUSTRALIA BECOMING RESISTANT TO RHD?

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ABSTRACT:

It is almost 13 years since rabbit haemorrhagic disease (RHD) was introduced into Australia in 1995. Landholders in southern Australia are beginning to report a resurgence in rabbit numbers even in areas where RHD had successfully reduced numbers to low levels. Possible reasons for the resurgence in numbers, either singly or in combination, include a lack of application of conventional rabbit control techniques, effective fox baiting programs, a change in the timing and frequency of myxomatosis epizootics, and the development of resistance to RHD and/or a reduction in the virulence of rabbit haemorrhagic disease virus (RHDV).

Since 1996, we have been conducting a longitudinal study of the epidemiology of RHD in a relatively isolated population of rabbits on Turretfield Research Centre, just north of Adelaide, South Australia. During that time, we have live-trapped and tagged over 2300 rabbits and taken 4500 blood samples for RHD and myxomatosis serology.

In July 2006, sero-negative rabbits collected from Turretfield were challenged with the original imported Czech strain of RHDV under laboratory conditions. They neither died nor sero-converted suggesting they may have developed a degree of resistance to the virus. An outbreak of RHD occurred four months after the sample had been collected from the site but a significant proportion of survivors were found not to have detectable antibodies to the disease. This serological status was in marked contrast to that of survivors of previous outbreaks. At the time it was thought that these field data supported the suggestion from the laboratory trials that the rabbits were developing resistance to RHD. The disease broke out again 11 months later in spring 2007, and the sero-negative "resistant" survivors of the 2006 outbreak still present in the population all died or disappeared, presumably succumbing to the disease. Possible reasons for their demise are discussed including age-related resistance, exposure to different amounts of virus, different strains of RHDV, and environmental/vector differences.

Notes

DISCOVERY OF A NEW BENIGN CALICIVIRUS IN AUSTRALIAN WILD RABBITS

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ABSTRACT:

When Rabbit Haemorrhagic Disease Virus (RHDV) escaped from the research station on Wardang Island and reached mainland Australia in 1995, it appeared to cause lower mortality in the cooler and more humid south-east regions of the continent. Furthermore, archival serum samples collected from rabbits before 1995 appeared to contain cross reactive antibodies when tested in RHDV specific immunoassays. These findings lead to the hypothesis that a similar virus, related but not identical to RHDV, is circulating in wild Australian rabbit populations and providing a level of immunoprotection from lethal RHDV challenge [1].

In May 2007 twenty eight rabbits were caught from Michelago, NSW (35.44' S, 149.09'E). Predominantly young animals (200-900 grams) were targeted, as previous studies suggest that the primary infection most likely occurs early in life [2]. Trapped rabbits were killed and different organ samples were obtained from each individual. A Reverse Transcription Polymerase Chain Reaction (RT-PCR) assay was designed using degenerate universal primers that allow detection of any infectious agent within the lagomorph calicivirus family.

When analysed, three kittens (440-600 gms) tested positive in the universal lagomorph calicivirus RT-PCR, with the highest virus concentration in the small intestine. Sequencing and subsequent phylogenetic analysis of the virus genome revealed that the newly discovered agent is a previously undescribed member of the lagomorph calicivirus family.

In a pilot infection study, eight domestic rabbits were inoculated with the new virus. None of the animals showed any signs of disease throughout a 28 day period. Two animals each were sacrificed after four and seven days post infection in order to produce more virus material for future experiments and to study tissue tropism. All four remaining animals had antibodies cross reacting to RHDV after 28 days, with responses varying greatly between individuals. When challenged with RHDV, two of the four animals died while the other two remained healthy and survived the challenge infection.

Despite the small number of animals used in this study, the preliminary results indicate that this new benign calicivirus from wild Australian rabbits may have the potential to interfere with lethal RHDV challenge.

References:

[1] Cooke, B.D., McPhee, S., Robinson A.J. and Capucci, L. (2002). Rabbit haemorrhagic disease: does a pre-existing RHDV-like virus reduce the effectiveness of RHDV as a biological control in Australia? *Wildlife Research*, 29 (6), 673-683.

[2] Richardson, B.J., Phillips, S., A, Hayes, R.A., Sindhe, A. and Cooke, B.D. (2007). Aspects of the biology of the European rabbit (*Oryctolagus cuniculus*) and rabbit haemorrhagic disease virus (RHDV) in coastal eastern Australia. *Wildlife Research*, 34, 398–407.

Notes

EFFECTIVENESS OF RHDV RELEASES FOR RABBIT CONTROL

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ABSTRACT:

Experimental releases of rabbit haemorrhagic disease virus (RHDV) on bait were tested as a means of initiating disease outbreaks in field populations of rabbits, Oryctolagus cuniculus. Four releases were conducted in agricultural regions of southern Australia where natural spread of RHDV had not greatly reduced their numbers. Specific attention was given to examining serological evidence of antibodies to non-pathogenic or benign caliciviruses (bCV), whether they might be reducing mortality rates and/or spread of the released virus, and how that might influence the effectiveness of RHDV releases for improving rabbit management. Release of RHDV on bait produced disease outbreaks that challenged almost all animals within the general release area and spread up to 3 km beyond release sites. Survival rates were high in individually marked rabbits that had clearly been previously exposed to RHDV and extremely low amongst rabbits that lacked any detectable antibodies. Rabbits carrying antibodies classified as being due to previous infection with bCV had survival rates that were dependent on circulating antibody titre and approximately 50% of survival rates in rabbits with clear antibodies to RHDV. This is the first quantified evidence that antibodies raised against bCVs provide significant protection against RHD outbreaks in field populations of rabbits. The experimental data indicated that bCVs can greatly reduce the efficacy of RHDV for biological control of rabbits in Australia and that further releases of RHDV are likely to be of minor or inconsistent benefit for controlling rabbit numbers where bCVs are prevalent. Further releases conducted by NRM Board officers have subsequently produced variable results and these will be discussed with reference to the experimental data.

Notes

THE VALUE OF HAVING NO WILD RABBITS IN SOUTH EAST QUEENSLAND

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ABSTRACT:

Rabbits released in Australia in 1859 spread to most areas of suitable habitat by 1910 causing great damage to the environment and primary industries. Measurement of damage is essential to justify spending money and utilising resources to remove rabbits. Damage to pasture and biodiversity may be irreversible and therefore difficult to measure without comparison with an area that has never suffered such damage. A rabbit proof fence completed in 1906 protected a large part of south east Queensland from rabbits. The Darling Downs Moreton Rabbit Board (DDMRB) continues to maintain the fence and keep the area relatively free of rabbits. This area is unique because it is highly suitable for rabbits and yet it has never 'experienced' the damage caused by plagues of uncontrolled rabbits.

A study site was established where the DDMRB fence separates an area heavily used by rabbits ('dirty side') from an area that has never been infested by rabbits ('clean side'). The number and location of all rabbit warrens and log piles were recorded. The absence of warrens from the 'clean side' shows clearly that the rabbit proof fence has prevented rabbits from establishing warren systems. The 'dirty side' is characterised by a high number of warrens, a high density of rabbits, fewer pasture species and low macropod activity.

Future work will determine whether the rabbit populations are viable in the absence of rabbit warrens. We plan to radio collar rabbits on both sides of the fence to measure their survival rate. In selected warrens and log piles of varying degrees of complexity and size, rabbits will be trapped and information on reproduction and age structure will be collected. This will allow better targeting of the source of rabbits during control operations.

Once the initial comparative analysis of the site has been completed, all rabbit warrens will be destroyed on the dirty side of the fence. After rabbits are removed from this area, monitoring will continue to determine if pasture and biodiversity on opposite sides of the fence begin to mirror each other.

Notes

A METHOD FOR MAPPING THE DISTRIBUTION AND DENSITY OF RABBITS AND OTHER VERTEBRATE PESTS IN AUSTRALIA

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ABSTRACT:

The European wild rabbit has been considered Australia's worst vertebrate pest and yet little effort appears to have gone into producing maps of rabbit distribution and density. Mapping the distribution and density of pests is an important step in effective management. A map is essential for estimating the extent of damage caused and for efficiently planning and monitoring the success of pest control operations. This paper describes the use of soil type and point data to prepare a map showing the distribution and density of rabbits in Australia. The potential for the method to be used for mapping other vertebrate pests is explored.

The approach used to prepare the map is based on that used for rabbits in Queensland (Berman et al. 1998). An index of rabbit density was determined using the number of Spanish rabbit fleas released per square kilometre for each Soil Map Unit (Atlas of Australian Soils). Spanish rabbit fleas were released into active rabbit warrens at 1606 sites in the early 1990s as an additional vector for myxoma virus and the locations of the releases were recorded using a Global Positioning System (GPS). Releases were predominantly in arid areas but some fleas were released in south east Queensland and the New England Tablelands of New South Wales. The map produced appears to reflect well the distribution and density of rabbits, at least in the areas where Spanish fleas were released. Rabbit pellet counts conducted in 2007 at 54 sites across an area of south east South Australia, south eastern Queensland, and parts of New South Wales (New England Tablelands and south west) in soil Map Units where Spanish fleas were released, provided a preliminary means to ground truth the map. There was a good relationship between mean pellet count score and the index of abundance for soil Map Units. Rabbit pellet counts may allow extension of the map into other parts of Australia where there were no Spanish rabbit fleas released and where there may be no other consistent information on rabbit location and density.

The recent Equine Influenza outbreak provided a further test of the value of this mapping method. The distribution and density of domestic horses were mapped to provide estimates of the number of horses in various regions. These estimates were close to the actual numbers of horses subsequently determined from vaccination records and registrations. The soil Map Units are not simply soil types they contain information on landuse and vegetation and the soil classification is relatively localised. These properties make this mapping method useful, not only for rabbits, but also for other species that are not so dependent on soil type for survival.

Reference:

Berman, D., J. Robertshaw & W. Gould, (1998) Rabbits in Queensland: where have they been, what have we done and where are they now? In: 11th Australasian Vertebrate Pest Conference: 395. Promaco Conventions, Bunbury.

Notes

REVIEW OF THE RABBIT CONTROL PROGRAM AT ULURU-KATA TJUTA NATIONAL PARK, FEBRUARY 1989 TO 2007

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[5] Department of Lands, Planning and Environment, Alice Springs, NT, 0870
[6] PhD Candidate, RSBS, ANU, Canberra ACT 2601
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ABSTRACT:

Rabbits (*Oryctolagus cuniculus*) invaded Uluru-Kata Tjuta National Park shortly after 1900 and occupied warrens initially established by the native burrowing bettong (*Bettongia lesueur*). A major rabbit control program at UKTNP began in 1989 after two years of discussions with Traditional Owners which resulted in agreement to remove rabbits so locally extinct Tjukurpa species could be reintroduced. Initial mapping of warrens in 1988 from air photos showed rabbit warrens were concentrated in rings around the Uluru monolith and Kata Tjuta in the more calcareous run-on land units. Ripping of 337 active warrens of 530 total warrens examined took place over 5 months during an abnormal wet season early in 1989. Follow-up monitoring of warrens and fumigation of all open holes occurred in a 5 day period in early summer in 1989. Subsequently, annual monitoring and fumigation of active holes was done over a 5 day period during the next 11 years until 2000 and then triennially to 2007. The control area gradually expanded to include areas of warrens discovered by Rangers during the year between monitoring periods. Comparison of success between years was based on the initial surveyed area.

Active holes were reduced to below 2% of initial activity levels within the first 2 years and were maintained at or below 1 to 1.5% through the remainder of the 18 year period. Active holes were reduced to 0 around Uluru monolith area in 1990 and 1996 but a few holes are re-opened by surface dwelling rabbits and invaders from adjacent dunefields. At the more variable and extensively populated areas around Kata Tjuta the number of active holes has been maintained between 4 to 2% of the original population. Triennial monitoring and treatment from 2000 to 2007 shows that numbers remain relatively low despite above average rains in 1999 to 2001. In general, on going dry conditions, predators, myxomatosis and likely calici virus have greatly assisted in the maintenance of low numbers of rabbit, but the need for periodic monitoring and control appears to be useful to prevent increases in rabbit populations under favourable conditions and to hasten decline in populations during dry conditions.

History shows that rabbits do re-invade and at the northern limits of distribution, a continuing low level of control will prevent high numbers by taking off some of the annual increase. Predators and disease may also keep rabbits in the predator pit except in good times. Additional consideration with successful reintroduction of Tjukurpa species requires careful fumigation, trapping or physical digging out of rabbits to ensure re-introduced Tjukurpa species are not accidentally killed.

Notes

WHERE SHOULD RABBITS BE CONTROLLED? USING A RANGE OF TOOLS TO ENSURE A SUCCESSFUL OUTCOME

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ABSTRACT:

In Victoria, substantial amounts of public and private resources were invested in large, coordinated control programs in the mid to late 1990's to complement the impacts that Rabbit Haemorrhagic Disease (RHD) had on rabbit populations across the state. The effects of RHD and these programs have reduced rabbit populations and their impacts to relatively low levels for much of the intervening period.

As a consequence of a presumed long-term solution being achieved, the focus and energy directed at rabbit management programs shifted to other issues. A reduction in energy and commitment by stakeholders to ongoing rabbit control at a landscape scale is a challenge that has required the use of an array of approaches by landholders, catchments management authorities and government agencies. An example of where a range of approaches have been used to good effect, is the Glenelg-Hopkins catchment in south west Victoria. Detailed planning has been used to identify the catchment assets at greatest risk from rabbit impact, to then direct priorities for on-ground action. Coordination of action has occurred at local levels through Landcare groups with support from government through incentives, extension and enforcement programs.

Rabbit management programs have been conducted in a staged approach to provide land managers with sufficient time to voluntarily achieve an agreed level of control. Regulatory enforcement is being used to ensure a consistent level of compliance with defined rabbit control standards across all land tenures within discrete target areas. Through the implementation of this integrated approach over successive years, rabbit impacts on key assets has been minimised across large areas of the catchment. A further outcome of this approach has been the development of broad scale community expectation and support for the use of active compliance programs as a component in a successful approach to sustaining low rabbit densities.

Notes

INVASIVE SPECIES ISSUES AND MANAGEMENT IN A GLOBAL WILDLIFE MELTING POT: FLORIDA

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ABSTRACT:

The state of Florida has among the two worst invasive species problems in the USA. Besides the sheer numbers of established exotic species in Florida, many species are novel as potential targets of control, or have other characteristics making effective control extremely challenging. Moreover, initiation of management action requires more than recognition by experts that a potentially harmful species has become established. It also requires the political will along with concomitant resources and appropriate personnel to develop effective methods and carry out control. We illustrate various aspects of the situation in Florida with examples of invasive vertebrates, the problems they pose(d), and management approaches to the problems. The problems described include long-established species requiring intensive localized control (feral swine); recently established species with potentially severe repercussions, but no operational removal programs in place (Nile monitor lizards, Burmese pythons, Tegu lizards, green iguanas); highly prolific mammals that could rapidly invade wide areas without containment/eradication (Gambian giant pouched rats, black-tailed jackrabbits, black-tailed prairie dogs); charismatic, but destructive birds (monk parakeets); localized species where sufficient public outcry has resulted in control programs (black spiny-tailed iguanas); and rapidly expanding aggressive species for which no practical management actions likely are available (northern curlytail lizard). A five species subset is used to exemplify in more detail the array of invasive species situations in Florida.

Notes

NEW PRODUCTS FOR VERTEBRATE CONTROL IN THE US

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ABSTRACT:

Recent product development efforts at the Wildlife Services, National Wildlife Research Center resulted in numerous new and potential product registrations in the fields of predator and bird control. During the past 5 years, Wildlife Services has worked towards obtaining U.S. Environmental Protection Agency (U.S. EPA) approval of three anticoagulant based rodenticide products for eradicating rodents from islands, developing a new predacide formulation based on theobromine and caffeine, and developing a wetting agent for controlling pest birds in roosts. Registration activities around each of these products are varied and unique to the product composition and intended user groups. Wildlife Services has worked closely with the U.S. Fish and Wildlife Service and many other groups in an effort to register three anticoagulant products r containing the active ingredients diphacinone and brodifacoum for island conservation purposes. Work is also beginning on a chlorophacinone-based product for island conservation work. Data supporting this pesticide registration has come from many non-traditional sources including government and non-profit conservation agencies, indicating a wide range of support for this effort. Work on a theobromine/caffeine-based predacide for carnivores was a result of outside-the-box thinking stemming from potential 'natural' chocolate products. With the support of Wildlife Services, state agencies and research boards, and industry associations, a formulation of theobromine/caffeine is being developed for administration in the Coyote Lure Operative Device (CLOD). Since neither theobromine nor caffeine are currently registered active ingredients in pesticides in the U.S., extensive data development will be required to support registration. Wildlife Services Operations and NWRC also developed methodology for using sodium lauryl sulphate as a wetting agent to eliminate blackbird and starling roosts. In 1996, the U.S. EPA formally determined that 31 materials, including sodium lauryl sulphate, were of so little risk that pesticide product employing them as the active ingredient would not require federal registration. This product became available for use in the U.S. in early 2008.

Notes

RECENT DEVELOPMENTS IN WILDLIFE CONTRACEPTION

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ABSTRACT:

For the past 15 years, scientists with the U.S. Department of Agriculture's (USDA) Wildlife Services's National Wildlife Research Center (NWRC) have been developing and testing wildlife contraceptives. This talk will provide an overview of accomplishments, and discuss the current state of research. The regulatory authority for contraceptives for wildlife and feral animals has recently been moved from the U. S. Food and Drug Administration (FDA) to the U. S. Environmental Protection Agency (EPA). Two fertility control agents containing the active ingredient nicarbazin have received regulatory approval with the Environmental Protection Agency and are commercially available in the U.S as OvoControl™ for managing Canada Geese and pigeons. The registration package for an injectable immunocontraceptive vaccine (GonaCon™ Immunocontraceptive Vaccine) will be submitted to the EPA in early 2008 and is anticipated to be registered for use in female white-tailed deer in 2009. The single-shot, multiyear vaccine stimulates the production of antibodies that bind to the GnRH hormone in an animal's body, reducing GnRH's ability to stimulate the release of the sex hormones that are needed for normal reproductive activity. All sexual activity is decreased, and animals remain in a non-reproductive state as long as a sufficient level of antibody activity is present. An oral contraceptive, DiazaCon, is being studied for use in avian and mammalian species with short breeding seasons. This compound inhibits the conversion of cholesterol to the reproductive steroids and causes infertility for several months.

Future research at the NWRC will be directed toward development of an aerosol or oral vaccine delivery system for a recombinant GnRH vaccine. Scientists at NWRC have developed a collaborative research agreement with Dr. G. P. Talwar in New Delhi, India to develop his GnRH plasmid for use in an aerosol or an oral contraceptive. The plasmid can be inserted into bacterial vectors that will express a recombinant GnRH protein (16 KD) which is small enough to be taken up by an animal in an aerosol or oral form. Production can be scaled up to large quantities at an economical price so it would be practical for large scale operations. NWRC has begun collaborative research agreements to test Dr. Talwar's plasmid in: 1) a feral pig specific GnRH *salmonella* developed by Dr. Carlson at Iowa State University; 2) a *Brucella suis* vector from Dr. Stephen Boyle at Virginia Tech University that could be used to develop a dual *Brucella*/GnRH contraceptive vaccine for feral pigs; and 3) a recombinant GnRH protein vaccine from the NWRC. One or all of the techniques may provide us with an aerosol or oral contraceptive.

Notes

TECHNIQUES FOR ESTIMATING THE ECONOMIC IMPACT OF VERTEBRATE PESTS: A CASE STUDY

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ABSTRACT:

Estimating the economic impact of vertebrate pests can be difficult and involve several different economic techniques. In many cases, vertebrate pest damage to biological systems is relatively well defined however measuring how that impact affects the economy is complex. A case study examining the economic impact of bird and rodent damage to California crops highlights the complexity of quantifying vertebrate pest damage. California is the largest producer of agricultural crops and commodities in the U.S.A. The State ranks first in U.S. for production of 81 crops and commodities and in 2004 the total value of agricultural production was $31.8 billion. Vertebrate pest damage to these crops by numerous rodent and bird species can be significant and have substantial economic consequences. Sound estimates of these pest impacts are an important management tool when allotting funds for mitigation. Estimation of county-level economic impacts from rodent- and bird-caused damage requires current empirical inputs of specific magnitudes of crop or commodity loss. This requires a step-wise approach involving: (1) acquisition of recent empirical estimates of rodent- and bird-caused damage to the State's major crops and commodities, (2) developing scenario-based assessments of projected losses for these crops and commodities, and (3) projecting the impacts of these scenario estimates to the regional economy to estimate the total magnitude of impacts to 10 counties that lead the State in production of crops and commodities. Quantitative economic assessment of the regional economy is possible through the use of sophisticated input-output models that provide a range of state-of-the-art estimates of the total economic impact of crop damage caused by rodent and bird pests.

Notes

USING INPUT-OUTPUT MODELS TO MEASURE THE ECONOMIC IMPACT OF VERTEBRATE PESTS

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ABSTRACT:

Vertebrate pests can have disastrous impacts on the regional biological systems which can, in turn, negatively impact economies. To date, quantification of vertebrate pest impacts has generally focused on biological rather than economic factors. One way to quantify economic factors is through the use of input-output (IO) models. These models have long been used by economists to quantify the economic impact that results from "shocks" to a regional economy. Input-output creates a mathematical representation of the regional economy which then can be used to "model" how vertebrate pest damage (shock) can affect jobs and revenue, for example. IO models allow the analyst to consider three rounds of impact: direct, indirect and induced. Direct effects are the initial shock from the damage caused by the vertebrate pest. Indirect effects represent the second round of impact as the local economy responds to the initial shock caused by damage done by the vertebrate pest. Lastly induced effects are the third and final round of the direct shock as it diffused through the wider regional economy. The total impact to the regional economy is the sum of all of these effects. The model used in this presentation is the IMPLAN® software model (Minnesota IMPLAN® Group, Stillwater MN), a state of the art IO modeling system. Using the IMPLAN modeling software allows for the quantification of the economic impacts of vertebrate and provides the most accurate measurement of their total impacts.

Notes

GENETIC BACKGROUND AND WORLDWIDE EVIDENCE OF RESISTANCE TO ANTICOAGULANT RODENTICIDES IN RATS AND MICE

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ABSTRACT:

Resistance to anticoagulant rodenticides, the common and indispensable means for the control of commensal rodents (*Rattus norvegicus*, *Mus musculus*), has developed under high selection pressure in restricted areas of several countries. Due to the natural spread of the species or translocation of individuals, resistance is extending from areas where it previously has developed. Within resistance areas, specific compounds lose efficacy and may even become totally ineffective.

Anticoagulants inhibit blood coagulation by repression of the vitamin K reductase reaction (VKOR). Recent studies by Darrel Stafford's and by our group identified VKORC1, a key component of the vitamin K redox cycle, as the target protein of the anticoagulants. Essential functions of the vitamin-K-metabolism, including the vitamin K dependent synthesis of several blood clotting factors, are affected by the gene encoding for this protein.

Investigations into resistant brown rats and mice originating from various localities in several countries worldwide identified a number of different missense mutations in the *VKORC1* gene, each conferring a certain degree of resistance to anticoagulant rodenticides. This suggests several independent and mostly region-specific mutation events in brown rats and in mice.

The identification of the basic anticoagulant resistance gene also provided new opportunities for the amendment of resistance testing methodology by molecular-biological techniques. A PCR based genetic test for mutations in the VKORC1 gene can successfully identify resistant rats from tissue and faeces samples, thus providing a simpler, non-invasive and more efficient methodology for monitoring the distribution of resistance in rats and mice than previous methods, supporting both registration authorities and users of rodenticides in their efforts to develop resistance management strategies, and to avoid animal experiments and burdening the environment with ineffective pesticides.

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Notes

NEW TOOLS FOR FERAL PIG CONTROL UNDER DEVELOPMENT AT THE INVASIVE ANIMALS C.R.C.

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ABSTRACT:

Despite the species worldwide impact, the development of improved feral pig management options has lagged behind that of other pest species. In view of the potential for agricultural and environmental damage, and disease preparedness, there is a need for simple broad-scale feral pig control tools. The Invasive Animals CRC is addressing this with its *Roll-out of feral pig control solutions* project. The overall project combines ecology, behaviour, toxicology, genetics and GIS in an *Achilles Heel*-style approach to identify unique characteristics of feral pigs in the Australian landscape that can be exploited with novel and innovative control techniques. PIGOUT®, a manufactured omnivore bait containing fluroacetate that is highly target specific to feral pigs in Australia, is the first product to be delivered. Following four years of development, field testing and registration PIGOUT® commenced sales earlier this year. However, as with any new control tool its ultimate contribution will be a product of its effective use at the proper scale. As such, we have also focussed on ascertaining appropriate feral pig management units, and environmental correlates thereof, based on the *genetic fences* (ascertaining barriers to gene flow) concept. The development of the Boar Buffet™, a permanent pig-specific sentinel bait station approach to keeping feral pig populations low and avoiding the annual boom-control cycle will be a useful addition for management purposes. Finally, and perhaps most importantly, we are now in year one of a five year program to develop and register a new quick-acting and reversible active for selective removal of feral pigs. HOG-GONE®, the new manufactured bait based on the successful PIGOUT® carrier, and potentially a concentrate version suitable for grain and meat applications, will be the key deliverables from this new project. In summary, the development of products that focus on the collective and unique weaknesses of feral pigs, including species-targeted actives, baits and delivery devices used at the appropriate scale, may offer great advantages to feral pig control both in Australia and internationally.

Notes

EFFECT OF A GnRH VACCINE (GonaConTM) ON THE FERTILITY OF MALE AND FEMALE WALLABIES

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ABSTRACT:

The management of introduced and overabundant native vertebrates in Australia currently relies mainly on lethal methods (trapping, shooting or poisoning). These require regular application and may or may not be species specific. Alternative approaches, such as fertility control, have been under development for more than two decades, but none have reached the stage of field testing in Australia.

Targets for fertility control include disruption of either the reproductive endocrine axis, the function of the gonads, fertilisation, and/or implantation. Later stages of pregnancy and lactation could also be targeted although these approaches raise animal welfare issues.

In Australia, laboratory research on the development of virally vectored fertility control agents has ceased due to major technical difficulties with respect to duration of induced infertility and/or transmission of the engineered virus between individuals. Other research is continuing on the use of hormone implants (steroids or agonists of gonadotrophin releasing hormone, GnRH) delivered subcutaneously, as well as immunocontraceptive vaccines delivered by the intramuscular route. Infertility achieved with these techniques varies depending on the dose contained in the implant or the level of immune response in the host. The longer term goal is remote delivery of these agents via darts or oral delivery via food baits.

A GnRH vaccine, GonaConTM, has been shown to effect fertility in a range of eutherian species – for example in female white-tailed deer GonaConTM induces infertility for periods of 2-5 years. We have commenced studies to assess the effects of GonaConTM in adult female and pre-pubertal male tammar wallabies (*Macropus eugenii*). In March 2007, groups of twelve tammars were vaccinated intramuscularly with (a) vehicle control; (b) a single vaccination of 500 μg GonaConTM; or (c) two vaccinations of 500 μg GonaConTM one month apart.

Seven weeks after the first vaccination, the testes of vaccinated males were reduced in size and the volume has remained unchanged from 11-52 weeks post vaccination. In contrast, the testis volume of the control animals increased to adult size. The fertility of control and vaccinated females was assessed 4 months after treatment by removal of pouch young: birth or mating occurred 26-28 days later in 8 of 10 control females, 2 of 10 females which received a single vaccination and 0 of 10 females which received 2 vaccinations. At 12 months post-vaccination, control females (6/10) have commenced breeding, but no vaccinated females (0/24) have given birth or mated as of the end of February, 2008.

We can conclude that the short term effects of this vaccine are promising. If the vaccine proves efficacious in the longer term (>2years) it could be suitable for the management of captive or semi-captive populations of macropodids.

Notes

FIELD TRIAL OF A NEW BAIT AND TOXICANT FOR FERAL CAT MANAGEMENT ON FRENCH ISLAND, VICTORIA

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ABSTRACT:

The management of feral cat populations over large areas is limited when utilising existing techniques in terms of cost-efficacy and target-specificity. This paper will report on the first field trial of a new bait and toxicant developed to assist with management of feral cat populations. This is a collaborative program between the Victorian, Western Australian and Commonwealth conservation agencies.

An encapsulated para-aminopropiophenone (PAPP) pellet was presented in a chipolata style meat bait ("Eradicat" type) and distributed across a 50 km^2 study area within French Island National Park. Baits were distributed both aerially (50 baits/km^2) and at 100 m intervals along the track network within the study area on the same day in April 2008.

Ten feral cats were trapped within the study area during January 2008 and fitted with GPS data-logger / VHF transmitter collars. A network of active monitoring plots was installed at 500 m intervals inside and outside the study area. These monitoring plots were assessed for the presence of cat activity prior to, and following, the application of baits. The survival of collared cats and the activity at the monitoring plots was used to assess baiting efficacy. In addition, a hair sampling device was installed at each monitoring plot for collection of DNA samples which were also used to provide an index of baiting efficacy.

Along with the results of this trial, we will provide an outline of the next stages in the development of this new tool for managers of conservation estate.

Notes

DEVELOPING A NEW TOXIN FOR THE CONTROL OF FERAL CATS AND STOATS IN NEW ZEALAND

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ABSTRACT:

The endemic fauna of New Zealand evolved in the absence of mammalian predators and their introduction has been responsible for many extinctions and declines. Currently, predator control relies largely on labour-intensive trapping, so the development of a humane predator-specific toxin would be a valuable additional control method. Para-aminopropiophenone (PAPP) is being investigated as a toxin for feral cats and stoats in New Zealand. The toxic effects of PAPP appear to be related to the rapid formation of methaemoglobin in some species, which leads to a rapid and lethal deficit of oxygen in cardiac muscle and the brain. Carnivores appear to be much more susceptible than birds, so it potentially has a high target specificity, at least in the New Zealand context.

Pen trials with 20 feral cats and 15 stoats have been undertaken using meat baits containing a proprietary formulation of PAPP at various doses. A PAPP dose of 80 mg was lethal for feral cats (weight range 2.4-3.9 kg; dose 20-34 mg/kg). Onset of first symptoms was 22-55 minutes after consuming a bait and death between 54 to 125 minutes. For stoats (weight range 135-345 g; dose 37-95 mg/kg), 12.8 mg of PAPP was lethal, with first symptoms 6-40 minutes after ingestion and death between 15-85 minutes.

The toxicity of the PAPP paste formulation has also been tested on Australian magpies, blackbirds and mallard ducks and is planned for weka (a large endemic flightless rail). Chemistry and manufacturing data, including accelerated stability testing at 54ºC on the PAPP active ingredient and paste, have been collected.

Our results confirm that PAPP is potentially a humane and effective toxin for feral cat and stoat control. We are collating toxicology data and undertaking further studies towards product registration. Field trials with the PAPP paste are planned for both feral cats and stoats in 2008.

Notes

A SPRAY FORMULATION FOR HUMANE LETHAL CONTROL OF CANE TOADS

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ABSTRACT:

The cane toad (*Chaunus [Bufo] marinus*) is a toxic invasive pest in many areas outside its natural range. Commencing from a small deliberate introduction in the 1930s the cane toad has colonized a large area of Australia, and continues to extend its geographic range and environmental impact. There are now an estimated 1.3 million households in cane toad-infested areas of Australia, and this number is expected to increase in the future. Instances of poisoning of pet dogs and cats are widely reported in toad-infested areas, and the toads also present a potential safety hazard for small children.

We report the development of a chemical formulation that can be used to safely, effectively and humanely kill cane toads. The formulation is active when applied to toads as a topical spray. We have demonstrated the activity of the formulation when dispensed from an aerosol spraycan, as commonly used for pest control in domestic settings.

The formulation contains materials that rapidly anaesthetize the toad and subsequently kill it. The formulation has been shown to be 100% effective in killing cane toads in field trial settings in Australia, across a sample of animals differing in size by more than an order of magnitude (25-320 grams) and sourced from widely separated geographic locations. In our trials toads treated with the spray ceased to move in an average time of less than one minute, and died in as little as 10 minutes, but on average about 45-50 minutes after treatment. In the period between their cessation of movement and death, toads remained motionless and silent, and exhibited no sign of distress. We have also successfully tested the formulation on cane toads and the toxic invasive Cuban Tree Frog (*Osteopilus septentrionalis*) in laboratory trials in Florida.

We are now working to register the formulation as a vertebrate pesticide in Australia, and believe that its potential utility extends to other areas of the world that are infested with cane toads and/or other invasive amphibian species.

Notes

FOR WHOM THE BELL TOLLS: OVER-ABUNDANT BELL MINERS, LERPS AND THE FATE OF EAST COAST EUCALYPT FORESTS

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ABSTRACT:

Bell Miner Associated Dieback (BMAD) is listed as a Key Threatening Process in New South Wales under the description "*Forest eucalypt dieback associated with over-abundant Bell Miners and psyllids*". This form of dieback is a well known cause of eucalypt decline in coastal forest types from Victoria, through NSW and southern Queensland. It has been estimated that 2.5 million hectares of suitable forests types are vulnerable to decline due to BMAD in NSW. There is no current information on the extent of the threat zone across the three eastern States although the issue is of national concern. The factors driving this phenomena are complex and are difficult to decipher, although the theorems and processes have been well documented (White and Jurskis 2004; Wardell-Johnson *et al*. 2006). BMAD commonly occurs in forests and remnants where Lantana or an equivalent dense understorey monoculture has become established. The abundance and behaviour of Bell Miners (*Manorina melanophrys*) and psyllids ie. *Glycaspis* are integral to this form of dieback. Bell miners are renown for their mobbing behaviour and ability to chase most other birds out of their defendable range. Bell miners also influence the invertebrate predator-prey system by intensively hunting psyllid predators such as spiders and cockroaches etc. The absence of invertebrate predators allows the psyllid populations to exceed carrying capacity and cause the exhaustion of the trees food reserves. Ultimately the tree cannot recover and dieback occurs. The initiatives, research, adaptive management trials and future directions of BMAD will be outlined in this presentation.

References:

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Notes

EVALUATING TECHNIQUES FOR DETERMINING FERAL CAT AND FOX POPULATION DENSITIES, IN SOUTH EASTERN QUEENSLAND

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ABSTRACT:

The ability to census and monitor a pest animal species is vital for its successful management. Without reliable information on the abundance and distribution of a species it is difficult to evaluate the magnitude of the problem, the impacts of the pest species and the effectiveness of control programs.

Recently there has been a push to standardise monitoring techniques for cats in Australia (Draft Threat Abatement Plan for feral cats). The density of the species and the characteristics of the habitat being monitored can greatly influence the logistics of different monitoring techniques as well as the reliability of the results. This project aims to investigate the viability of different techniques for their success in southern Queensland.

Spotlight counting, passive and active track plots, and the mark-recapture technique will be assessed for their usefulness for monitoring feral cats and foxes. GPS collars will also be fitted to a number of animals to look for trends in animal behaviour (nocturnal/diurnal; seasonal) and movements through different habitat types to assist in determining the most suitable time and location to detect and monitor populations. Results from this work will be used to provide information to assist in developing more reliable techniques and strategies for monitoring feral cat and fox abundance.

Notes

HOME RANGE AND MOVEMENT OF FERAL CATS IN TALL FORESTS IN FAR EAST GIPPSLAND, VICTORIA

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ABSTRACT:

Most information on the ecology of feral cats in Australia arises from research in the arid and semi-arid zones. There is very little known about feral cats in tall forests in Australia. The Southern Ark project in Far East Gippsland, Victoria, provides an opportunity to examine both the ecology of feral cats in tall forest habitats and assess intraguild interactions among invasive predator before, during and following a broad-scale fox baiting program. Using a combination of VHF and 'store on board' GPS collars, feral cats are being tracked pre and post fox control to determine if there is variation in home range size and usage or a change in movement patterns following the fox control program.

VHF and GPS data gathered to date (pre fox control) indicate that male feral cats in Far East Gippsland have a MCP 100 home range of 752 ± 353 (s.e.) hectares while females have a home range of 184 ± 19 (s.e.) hectares. Male feral cat home ranges are larger than those found in temperate woodlands, open forests and the semi arid zone. Female home ranges are smaller than those found in temperate woodland and comparable with those found in the semi arid zone. Tracked feral cats are undertaking long range but short term forays outside their home ranges. The purpose of these forays is currently unknown. Feral cats move greater distances during the early evening and night compared with late morning and afternoon.

GPS tracking has identified large apparently suitable areas within home ranges that are not used by cats while similar surrounding areas are utilised heavily. Determining why these areas are not utilised should be informative, and may help to guide management options to limit reinvasion of feral cats following control efforts.

Notes

COMPARISON OF DNA-BASED TECHNIQUES FOR POPULATION ESTIMATION OF WILD DOGS

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ABSTRACT:

Newly developed DNA-based techniques provide opportunities for improving monitoring of cryptic animals such as wild dogs. Non-invasive DNA sampling allows simultaneous monitoring of both population demographics and the interbreeding of feral dogs with dingoes. It can also improve the efficiency and scope of data collection relative to sighting or trapping-based techniques. Despite initial optimism about the applications of individual identification using non-invasive sampling, the high potential for obtaining incorrect genotypes from trace DNA sources has become a concern, and the extent of this impact needs to be evaluated for each population of interest. This study compares the quantity and quality of DNA obtained from three sources (hair, saliva and scats) and five sampling methods, in the context of choosing an optimal sampling technique for obtaining mark-recapture population estimates. Frequency of DNA 'trap' visits, real-time PCR quantification and the level of genotyping error from each DNA source are used to compare their efficiency and utility for individual identification of wild dogs. As the optimal DNA-collection method will vary according to local environmental and biological conditions, relative merits and pitfalls of each technique are presented.

Notes

DETECTION OF CRYPTIC ANIMALS AT LOW DENSITIES: FINDING FOXES USING REMOTE CAMERAS AND FORENSIC DNA

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ABSTRACT:

Rare species present particular problems for wildlife research, particularly if they are wary or cryptic. The low chance of detecting these animals with traditional survey methods has encouraged a range of novel approaches, enhanced by new technologies and techniques for analysis of the resulting data. This paper will present a case study of detection of foxes using a range of these techniques, in the Southern Ark program, far east Gippsland, Victoria.

Low-density monitoring is especially important for pest control programs, as densities of the target species become very low. For attempted eradication, it is useful to estimate tiny remnant populations, and critical to be sure when the density has genuinely reached 0.

Conventional survey techniques, such as counts or trapping grids, are not well suited to very low-density and cryptic species. Data with mostly zeros is also not well served by the typical statistical analysis. In order to collect adequate data, enormous survey effort is required; this still can not provide good estimates for very rare species and thus sparse data.

Techniques that have a continued detection presence are more suitable, with detection of footprints being the most common. Such measures, when used as counts, only provide an index value of activity; the data can also be used more analytically to model patch occupancy.

Identification of individuals through non-invasive genetic sampling is becoming a more common method to provide data where animals are rare or cryptic. Such data can provide estimates of population parameters, and information on ranges, relationships and sex of animals. Use of scat DNA is highly suited to animals which mark territories or prominent features with scat, such as canids. It is also possible to streamline and standardise surveying by eliciting scatting behaviour at specific locations (using scat-attractors).

Remote cameras are increasingly used in wildlife research. They provide ongoing positive confirmation of the presence of animals in an area, and can monitor multiple species concurrently. The data can be used as an index value, and some statistical analysis is also possible: for species that can be individually identified, the data can provide population parameters through capture-resight techniques. For animals where this is not possible, statistical analysis is being developed which estimates density based on correlations between timing and location of camera triggers.

Recent technological advances are enhancing the cost effectiveness of this technique; digital cameras with fully infra-red detection (ie. no visible flash) can be purchased for under $300. There are practical issues; the technology is still limited, cameras can malfunction, or give inconclusive results. They are also tempting assets for tampering and/or theft.

Notes

NATIONAL ASSESSMENT OF INVASIVE ANIMALS – PROJECT OUTCOMES

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ABSTRACT:

Management authorities require accurate information on the extent, numbers and impacts of pests to develop management and biosecurity strategies, implement appropriate policies and programs, and measure the effectiveness of management actions and funding initiatives.

The Invasive Animals CRC, National Land and Water Resources Audit, Vertebrate Pest Committee and all states and territories collaborated during 2006/07 to produce a national assessment of 10 of Australia's significant pest animal species. A series of national-scale datasets were developed using a consistent approach and agreed data standards for reporting against indicators for the extent, abundance and impacts of vertebrate pests under the National NRM Monitoring and Evaluation Framework.

Information products include extent and abundance maps at national, state and territory, and regional levels – including natural resource management (NRM) regions. Impacts information was summarised through a series of case studies providing a snap-shot of information from existing management and monitoring programs.

The assessment showcases the National Monitoring and Evaluation Framework as a mechanism for monitoring and reporting of invasive species in Australia. It identifies where pest problems are most pronounced, and the scale of the problems in Australia to guide management activities. It lays the foundations for ongoing monitoring and reporting, however, the findings should be used as one of many mechanisms to evaluate management programs, and identify priorities for control, planning and research.

Improvements are needed to current monitoring protocols, procedures for information collation and reporting, products for stakeholders, and information management. Future assessments should address gaps in knowledge, and need to incorporate new and emerging species, impacts information, management actions and investment. The next formal assessment is recommended in 2-4 years time to complement the 2011 State of the Environment Report.

This paper presents key outcomes from the assessment, and highlights directions for future research.

Notes

FERAL DEER DISTRIBUTION, ABUNDANCE AND IMPACT, AND ASSOCIATED LANDHOLDER ATTITUDES: RESULTS OF AN EXTREMELY SUCCESSFUL POSTAL SURVEY OF RURAL LANDHOLDERS IN SOUTHEAST SOUTH AUSTRALIA

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ABSTRACT:

Rural landholders in the southeast of South Australia had reported an increased social and economic impact by feral deer. Utilising the Total Design Method for questionnaire-based surveys (Dillman 1978), in November 2005 and March 2006 a survey was distributed to a total of 785 southeast South Australia rural landholders with property in the region between Meningie and Penola. Survey questions asked for details of feral deer species, including their numbers and impacts, as well as landholder deer control efforts, issues and attitudes.

An extremely high return rate of 65% (507 returns) was achieved. However, surprisingly almost half of the respondents (235) stated they had no feral deer on their property. It is believed that two of the primary reasons for this high return rate from all landholders is reflected in two survey results: 'Traffic hazard' then 'Disease risk' were ranked the most serious risks that feral deer pose to human safety; a risk for all landholders. In addition, almost 2/3 of responses (355 properties) perceive deer to be a 'Pest' or 'Potential pest', highlighting the general landholder concern that stimulated the survey. Of the 265 respondents with feral deer, fallow deer (*Dama dama*) and red deer (*Cervus elaphus*) were reported present on the largest number of properties (238 Fallow; 152 Red). Only a small number of properties reported populations of the new and emerging feral deer species, being, in declining abundance, rusa deer (*C. timorensis*), sambar (*C. unicolor*), chital deer (*Axis axis*) and hog deer (*A. porcinus*). 'Eating fodder' was ranked the most serious property impact, closely followed by 'disease risk' and a range of other property impacts. Feral deer trampling of malleefowl mounds was stated by a few landholders. Subsequently, evidence of deer visitation to mounds was detected at 10 of the 93 malleefowl mounds (~ 11%) monitored across the region early in the summer of 2006/07 (Threatened Species Network, unpublished data). For all deer species the most commonly reported maximum group size was '1-5 Individuals' (53% of the total number of responses). 48% of landholders indicated 1-7 barriers to feral deer control with 'lack of time' and feral deer not being perceived a problem the greatest barriers. 48% of landholders who indicated their desired level of control consider feral deer numbers should be reduced by '76-100 %'.

Landholder attitude towards feral deer in the principal deer area in southeast South Australia appears to be somewhat contrary, and more negative, to that found in the Queensland survey of Finch and Baxter (2007). To achieve improved deer control, one management outcome has been a successful trial helicopter shoot in March 2007 with 182 deer (23 rusa and approximately 80 red and 80 fallow deer) shot in four hours at and around Gum Lagoon Conservation Park (T. Fraser and B. Robins, DEH pers. comm. 2007).

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Finch N. A. & Baxter G. S. (2007) Oh deer, what can the matter be? Landholder attitudes to deer management in Queensland. *Wild. Res*. 34, 211–7.

Notes

MACHINE VISION CLASSIFICATION OF ANIMALS

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ABSTRACT:

Invasive vertebrate pests together with overabundant native species cause significant economic and environmental damage in the Australian rangelands. Access to artificial watering points, created for the pastoral industry, has been a major factor in the spread and survival of these pests. Existing methods of controlling watering points are mechanical and cannot discriminate between target species. Machine Vision Technology (MVT) provides the ability to discriminate between species. By exploiting the need for large vertebrates (> 5kg) to drink regularly, combined with novel enclosure designs, automated gates and MVT the opportunity exists to manage all large vertebrates in the Australian rangelands on a landscape scale.

This presentation outlines how MVT can be used to monitor, trap, exclude or draft large vertebrates. The focus of this research and planned demonstration sites are in the Australian rangelands. However the system will have application in any habitat throughout the world where a resource is limited and can be enclosed for the management of livestock or wildlife.

Notes

DNA EVIDENCE FOR THE ORIGINS OF FOXES IN TASMANIA

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ABSTRACT:

Six fox carcases have been discovered in Tasmania since 2001, and a number of fox scats have been identified by DNA analysis. How did these foxes enter Tasmania, and from where? Do they represent multiple independent entries, or a single introduction followed by local breeding? These questions have been the subject of much investigation and speculation, but have proven difficult to resolve. In this presentation I will demonstrate how DNA analysis can help resolve these important questions. I obtained microsatellite DNA genotypes from three of the carcases (Longford fox, 2001; Burnie fox, 2003; Cleveland fox, 2006), and used an extensive database of fox DNA genotypes from mainland Australia together with computer simulations to test hypotheses concerning their origins. This analysis had three parts - Initially, I used model-based clustering analysis to identify regions in Victoria where foxes show the greatest genetic similarity to the carcases. Second, I used genetic exclusion approaches to test whether specific mainland ports were the source of the carcases. Finally, I modelled population genetic processes in a small fox population founded by a pair of unrelated parents from Victoria, and compared the relatedness of the three carcases to that predicted by simulations. I will present the results of these analyses, and discuss their implications for future biosecurity monitoring in Tasmania.

Notes

BOTHER IN THE BUSH – SEEDS OF DOUBT

Clarey, Ray[1]; Falconer, Glen[2]; Crisp, Philippa[3]

Greater Wellington Regional Council. [1]Masterton Office; [2]Upper Hutt Office; [3]Head Office, Wellington

ABSTRACT:

Part of the forest of the Wainuiomata Water Catchment is managed as a Mainland Island by Greater Wellington Regional Council (Greater Wellington). With mature native forest and a wide range of flora and fauna, the catchment is an important site of regional biodiversity. It is also a principal water collection area used to supply water to the cities in the Wellington region of New Zealand (NZ).

Ongoing integrated pest management is undertaken for pest animals, including trapping for possums and mustelids and poison baiting for rodents. For rodent control, bait stations are filled with rodenticide baits, manufactured in the USA. Baits are placed in Pelifeed bait stations spaced on a 100 x 150 metre grid pattern. The bait stations are serviced at two-monthly intervals and replenished with new bait. Old bait is removed from the operational site.

In October 2006, staff noted that seeds in the rodenticide baits had sprouted in some of the bait stations. Given the pristine environment, Greater Wellington staff were concerned that they may be introducing pests or pathogens into the area. These concerns were logged with MAF Biosecurity New Zealand (BNZ), and a sample of the seeds and sprouts was sent for identification to the National Centre for Disease Investigation. The seeds were identified as millet and canary grass, recognised as invasive species in NZ but also potentially carrying unwanted pathogens. Good germination was demonstrated supporting the fact that the manufacturing process for the baits had not devitalised the whole seeds contained in the baits.

A stop was placed by BNZ on the importation of the rodenticide bait and a warning was issued by Greater Wellington to all Regional Councils. No other Regional Councils using the product reported any sprouting from baits or any other irregularities.

BNZ issued Greater Wellington a 'Notice of Direction' under s122 of the Biosecurity Act 1993 in November 2006 to collect and destroy the bait from the particular batch that Greater Wellington had distributed. It also directed that the bait be destroyed in accordance with the provisions of the Hazardous Substances and New Organisms Act 1996 in such a manner that no viable seeds in the bait may sprout or continue to grow.

The bait collection was undertaken by a contractor at considerable expense to Greater Wellington. All 1,083 stations were cleared and the bait removed, followed by an audit of the work. After an application process, BNZ issued compensation for the expense of mitigating this biosecurity threat.

The manufacturing process of the bait was promptly modified. The bait was soon being imported into New Zealand once again and is currently being used with confidence within the Mainland Island and at other rodent control sites under the aegis of Greater Wellington.

This event highlighted the management associated with the risk of an unwanted organism and the difficulties and expense of removing a potential threat to a very special native ecosystem.

Notes

"VECTORNET" - TECHNOLOGY FOR MANAGING A LARGE PEST CONTROL PROGRAMME

Alison Barrett

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Animal Health Board Inc.
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ABSTRACT:

Activities scattered over a large area, budgets to juggle, tons of details linking theory to practice, inaccuracy of data to deal with, losing details in translation between people. Familiar thoughts for managers of the NZ Bovine Tuberculosis vector control programme. The challenge we had: to plan more effectively, reduce administration and duplication, gather and store data so it can be used to make better decisions and reduce the risks from making changes in how things are done.

The result: an information system that underpins all aspect of the Tb vector control programme from the planning ahead for 3 years, detailed design of field work, the specification and management of contracts to the collection of results. We call it VectorNet and it is now the central tool for our $50 million annual vector control programme covering 9 million hectares. Vector control is a vital component of a strategy to reduce the number of cattle and deer herds with Bovine Tuberculosis.

VectorNet allows dynamic management of the vector control programme and captures key intellectual knowledge for future use. Regulatory monitoring and compliance information for toxins is also gathered for reporting. The system has provided direct benefits from reducing administration and streamlining processes. There are also indirect benefits from improved programme design and management.

The basic building blocks of VectorNet can be applied to other pest control programmes where the same issues we identified for the Bovine Tb vector control programme often arise. In terrestrial pest control, things happen on the ground so in VectorNet the same approach is adopted and all data is linked geospatially to a location. By identifying the common elements of pest control programme management as well as the detail of the actual control work, VectorNet can be set up to run one or several pest programmes and ensure the data is consistent, accurate and can be managed. This is a great advantage for managers, researchers, analysts and pest control experts utilising VectorNet's web-based platform.

Notes

A NEW 1080 BAIT SUPPLY MODEL FOR VICTORIA: MAKING IT HAPPEN

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ABSTRACT:

Pest animal bait containing sodium fluoroacetate (commonly known as 1080) is used throughout Victoria for the management of a range of vertebrate pest animals including rabbits, foxes, feral pigs and wild dogs.

In 2005 the Victorian Government made resources available through its '*Moving Forward: Making Provincial Victoria the Best Place to Live, Work and Invest*' statement to develop a regulatory framework that enabled the safe manufacture, supply and use of 1080 pest animal bait products in a commercial environment in Victoria.

The Victorian Government, who has historically been responsible for the manufacture of five registered 1080 pest animal bait products and the supply of all 1080 bait products to suitably accredited bait users in Victoria, does not consider the manufacture and supply of 1080 pest animal bait to be core business. Being a registrant for 1080 bait products and provider of 1080 bait imposes significant risk and potential liability for Government and places it in direct competition with the private sector. For landholders and key stakeholders in provincial Victoria, perceptions of 'red tape' and inconvenient user access to 1080 bait products have long been a source of significant dissatisfaction.

Following extensive consultation with a range of stakeholders including; commercial bait manufacturers, chemical resellers, pest management contractors, 1080 pest animal bait users, the Victorian Farmers Federation (VFF), Agsafe, training providers and the Australian Pesticides and Veterinary Medicines Authority (APVMA), a range of policy, legislative and operational changes were made to enable the commercial supply of 1080 pest animal bait products to authorised bait users.

Victoria's new 1080 regulatory framework is made up of two components:

a system that describes the process by which APVMA registered 1080 pest animal bait (eg. dried meat bait and oats) will be made available to authorised bait users; and

a system that describes the process by which perishable ('fresh') 1080 pest animal bait prepared using 1080 aqueous solution (but limited to the substrates of liver, boneless red meat and carrot) will be prepared and made available to authorised bait users.

The framework introduces a number of new safeguards around 1080 pest animal bait and brings about a strengthened and more comprehensive system of controls in Victoria. The commercialised environment enables more convenient user access to products (with less paperwork), ensures that risks reside with those who are best placed to manage them, removes Government as a competitor with the private sector and allows market forces to dictate product choice, development and price.

Following public announcement of the commercialised system in June 2007:

- over 4500 Victorian bait users have registered for training that is compulsory to enable their continued safe use of 1080 pest animal bait products;
- 23 licensed commercial operators have been trained in the manufacture and supply of perishable 1080 pest animal bait using 1080 aqueous solution; and
- 51 retailers across the State have been accredited to supply 1080 pest animal bait products (with a further 22 retailers scheduled to be accredited by June 2008).

The Victorian Government's regulatory framework for the commercial manufacture, supply and use of 1080 pest animal bait products took effect on 1 January 2008.

A NATIONAL APPROACH TO THE MANAGEMENT OF FERAL CAMELS

Glenn Edwards[1], Murray McGregor[2], Benxiang Zeng[1] and Petronella Vaarzon-Morel[3]

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ABSTRACT:

The management of feral camels in Australia presents many challenges. Camels are widely distributed across the rangelands of Western Australia, South Australia, the Northern Territory and Queensland and currently occupy a total area of about 3 million square kilometres. Many of the areas inhabited by camels are remote and hard to access by vehicle. The current population is estimated to be more than one million and the number of camels is doubling every eight years (Edwards et al. 2004). Camels are very mobile animals and can move hundreds of kilometres over just a few days. At current densities camels have demonstrable impacts on production, environmental and cultural values in many parts of their range. Current management approaches are largely small scale and ad *hoc* and do little to reduce populations or mitigate impacts.

The Desert Knowledge Cooperative Research Centre through the Natural Heritage Trust is developing a cross-jurisdictional approach to the management of feral camels. The project is examining stakeholder attitudes to feral camels, collating information on the impacts of feral camels, examining the legislative framework governing the ownership, use and management of feral camels and exploring options for cross-border management of feral camels, including existing and potential methods of population control. In this paper we outline the structure of the research project and some of the approaches being taken in developing the national approach.

Reference:

Edwards GP, Saalfeld K, Clifford B. (2004). Population trend of feral camels in the Northern Territory, Australia. *Wildl. Res*. 31, 509-17.

Notes

BIOLOGICAL CONTROL OF CANE TOADS: OVERVIEW

[1]**Alex Hyatt**, [1]Jackie Pallister, [1]Rhonda Voysey, [1]Donna Boyle, [2]Damien Halliday, [2]Thayalini Shanmuganathan, [2]Daryl Venables, [2]Tony Robinson

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ABSTRACT:

Cane toads *Chaunus (Bufo) marinus* were introduced into Australia (1935) to control two species of beetle, the greyback beetle (*Lepidoderma albohirtum*) and the French beetle (*Leptidiota frenchi*) which were recognised pests of sugar cane. A total of 101 toads were successfully transported to Queensland where they were bred and the toadlets released. With the ability to adapt to a broad range of temperatures and habitats, diversity of diet, fecundity and freedom from major predators the toads have spread from Queensland to New South Wales, to the Northern Territory and are expected to enter Western Australia in the near future. Modelling studies predict that with climatic change the distribution of toads will spread southerly along the eastern coast into Victoria, westerly throughout the Kimberley region of Western Australia and have the potential to establish in the south-western region of Western Australia.

The introduction of toads has raised concerns about predation on Australian fauna, toxicity of all life stages to potential predators and competition for shelter, breeding sites and food with native vertebrates. Based on recent studies showing that the northern quoll (*Dasyurus hallucatus*), monitor lizards (*Varanus spp*), freshwater crocodile (*Crocodylus johnstoni*) and some snake species have been severely impacted, *Chaunus (Bufo) marinus* has been listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*. Consistent with this, and the prolonged scientific and public identification of cane toads as a problem, there has been a national expectation/demand for the biological control of cane toads.

The search for possible infectious pathogens has been conducted in a sporadic way over the past three decades without success. More recently, strategies have been developed to use known infectious agents to impact on the long-term fecundity of the toads. What are the chances of success of such initiatives, what other approaches should be trialed, what are the social and environmental implications, should we be investigating a range of options including disseminating and non-disseminating agents and what resources are required to effectively progress such initiatives?

Notes

THE IMMUNE APPROACH TO CANE TOAD BIOCONTROL

[1]**Jackie Pallister**, [1]Rhonda Voysey, [1]Donna Boyle, [2]Damien Halliday, [2] Thayalini Shanmuganathan, [2]Daryl Venables, [1]Alex Hyatt, [2]Tony Robinson

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ABSTRACT:

The current CSIRO approach to cane toad biocontrol is based on the premise that cane toad proteins normally expressed at metamorphosis or in adulthood can be delivered to tadpoles and stimulate an immune response. Based on the studies of Maniatis et al (1969) on adult globin in bullfrog tadpoles, it appears that an immune response in tadpoles to protein expressed later in development can affect the subsequent expression of that protein.

Using two different delivery approaches (injection or viral) we sought to determine whether we could stimulate an immune based alteration in adult globin expression in cane toads. In the first approach recombinant adult globin was produced in E. Coli and injected into tadpoles. The levels of adult and tadpole globin in metamorphs were then analysed by measuring mRNA levels for each of the globins and analysing the protein profile of the adult globin in metamorphs. A careful analysis of the results obtained in injected animals revealed that there was no effect of adult globin administration on adult and tadpole globin mRNA levels or on the protein profile of adult globin.

Viral delivery of adult globin to tadpoles was assessed using a recombinant BIV expressing Chaunus (Bufo) marinus adult globin. Tadpoles were bathed in three different doses of the recombinant virus, and in the corresponding doses of a negative control virus that did not express adult globin. Blood samples taken from metamorphs were analysed by PAGE for any alteration in their protein profile, but no difference between treated and untreated animals was detected.

It therefore appears that the response to adult globin injection observed in the bullfrog, Rana catesbeiana, can not be replicated in Chaunus marinus in our hands. As a final test of this concept we are constructing two further viruses, one carrying the gene for trefoil factor, and the other carrying the gene for gastrokine – two factors involved in gut rearrangement at metamorphosis. The impact of either injection or viral delivery of one or both of these proteins on gut development will be monitored.

Notes

INVASIVE CANE TOADS CAUSE MASS MORTALITY OF FRESHWATER CROCODILES IN THE VICTORIA RIVER, NORTHERN TERRITORY

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ABSTRACT:

Invasive species are frequently blamed for faunal declines, but there is little direct evidence on the pathways, magnitude and size-selectivity of mortality induced by invaders. Top predators are of particular interest in this context, because their removal can generate substantial cascades of secondary effects on community composition. Cane toads (*Bufo marinus*) are large South American anurans currently spreading rapidly through tropical Australia. Native predators that attempt to consume these highly toxic toads may die as a result. During surveys of the Victoria River in the semi-arid tropical region of the Northern Territory, we documented massive mortality of freshwater crocodiles (*Crocodylus johnstoni*) at the toad invasion front. Toad-killed crocodiles spanned a wide size range (0.6 to 2.1 m long) but with significant biases; intermediate-sized animals (0.6–1.5 m long) were more likely to be found dead. Population densities of crocodiles plummeted by as much as 77% following toad invasion, and population size structures changed. The negative impacts of toads on crocodiles appear to be greater in these semi-arid landscapes than in higher rainfall areas where crocodile densities are lower, the predators have access to a wider prey base, and the toads can rehydrate in small, scattered water bodies rather than in the main river. Hence, cane toad invasion may disrupt populations of this top predator in the river headwaters, but not in the coastal floodplains.

Notes

TACTICS, TOOLS AND TECHNIQUES TO TACKLE THE TOAD

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ABSTRACT:

The cane toad (*Bufo [Chaunus] marinus*) was introduced into cane fields in the north east corner of New South Wales during the 1960's. Quickly colonising their surrounds and spreading across the landscape, the front is presently moving at a rate of 4 kilometres per year. Toad populations in NSW are currently found in an area bounded by the Queensland border to100 kilometres south of Byron Bay near Yamba and around 100 kilometres west near Kyogle. Disjunct populations are further south in Brooms Head, Angourie and Port Macquarie. Lone 'hitchhikers' are often reported in the summer months along transport routes and at tourist destinations. Despite efforts by the NSW Department of Environment and Climate Change (DECC), the toads have continued to use urban areas as gateways into ecologically sensitive areas.

In response to this, DECC released the *Cane Toad Management Policy* and the *Cane Toad Pest Management Strategy* in 2007, highlighting the urgency of abating this key threatening process and applying a holistic approach to tackle this pest. Recognising the need to harness human resources, incorporating community and stakeholder involvement as an underlying principle is essential to the success of the strategy.

A range of tools have been developed based on a decade of on-ground work, with each having a specific target audience and set of goals. One key component of the community engagement program is *Trap That Toad* which has been produced with the assistance of the Northern Rivers Catchment Management Authority and the Foundation for National Parks. It provides factual information, develops skills and promotes responsible action using a range of approaches that appeal to different learning styles. It can be used in part or whole or modified to suit an educators needs. It is currently being delivered by National Parks and Wildlife Service *Discovery* Rangers, local government officers and school teachers. It has been delivered to an enthusiastic 'army' of over 1000 students in northern NSW in the first 6 months of implementation. South East Queensland Catchments have also adopted this education resource and have commenced delivery in key cane toad control areas.

Trap That Toad, is an innovative approach to pest management. It provides an impetus for community members to take ownership of protecting our natural heritage. Increased community awareness has seen a marked increase in participation in cane toad control programs. Many isolated populations of toads have now greatly reduced or disappeared and round-ups have had record attendance. DECC has received unprecedented requests for additional information and resources from organisations, corporations, community groups and schools, demonstrating the effectiveness and desire from communities to be involved in local biodiversity conservation programs.

Notes

A TEN YEAR STUDY HAS REVEALED NO LONG TERM IMPACT OF CANE TOADS ON NATIVE FROGS IN THE ROPER RIVER DISTRICT OF THE NORTHERN TERRITORY

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ABSTRACT:

Using novel technology which permits automated identification and logging of frog calls for more than a year, we have monitored advertisement calls nightly from up to 20 species throughout ten wet seasons since 1997-1998 at ten wetland sites along the Roper Valley Highway. All species present at the beginning of the study are still present and there has been no overall decline in the frequency of detection. The number of species detected did fall shortly after the arrival of toads, followed by a return to original numbers. However, whether this was a transitory effect of the toads is unclear. Toads invaded the study area more rapidly than anticipated, which hampered distinguishing toad impact from overall year-to-year variation. A similar study is under way in Kakadu National Park, at six sites and with a longer baseline. It will be interesting to see whether or not any similar, short term effect occurs. It seems unlikely that the addition of cane toads will have a long term impact on the native amphibian fauna in the Northern Territory. The Queensland frog fauna had not been documented thoroughly prior to the release and spread of toads. By extrapolation, it seems likely that the current Queensland fauna is representative of the pre-toad frog fauna.

Notes

CANE TOAD CHEMICAL ECOLOGY: WHAT WE THOUGHT WE KNEW, WHAT WE NOW KNOW, AND WHAT WE SHOULD KNOW

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ABSTRACT:

Many animals use chemicals to enhance survival and improve reproductive outcomes, orchestrating behavioural responses within and between species, to attract mates, and avoid and/or deter would be predators. Invasive species with potent "*chemical ecology*" risk destabilizing and damaging fragile ecosystems – as has occurred with the misguided dispersal of cane toad from its native South American habitat to numerous countries around the world. The most obvious and arguably most pressing negative impact of the cane toad in Australia has been the poisoning of important predator species (snakes, lizards, quolls…), a process that has disturbed delicate ecological balances with flow on consequences. With the cane toad invasion front advancing relentlessly across northern Australia the need to prevent, or at least minimize further damage, comes with a sense of urgency.

Historic approaches to controlling cane toads in Australia have focused on *physical* (traps, barriers) and *biological* (viruses) solutions. The merits of these strategies notwithstanding, all possible avenues need to be explored. To this end, over the last two years we have pioneered a new *chemical ecology* approach.

Our hypothesis was "*A better knowledge of cane toad chemical ecology would reveal how the cane toad uses chemistry to survive and prosper.*"

A corollary to this hypothesis was "*A better knowledge of cane toad chemical ecology will reveal weaknesses that could be exploited for control purposes*."

This presentation summarizes key elements of our findings, including some unexpected results. *Yes*, Australian cane toads do produce cardiotoxic steroids (bufadienolides), *but* at quantitatively and qualitatively different levels from those reported overseas! *Yes*, bufadienolides feature prominently in the chemistry of most life stages, *however*, cane toad egg chemistry is remarkably complex and different to that of all other life stages, and at least one phase in tadpole development is completely lacking in bufadienolides! *Yes*, bufadienolides kill predators, *but*, their defensive role almost certainly varies across life stages and is likely augmented in adults by rapid acting neurotransmitter alkaloids. While cane toads *do not* appear to use sex pheromones, they *do* deploy an alarm pheromone that accelerates metamorphosis leading to smaller, less viable, but more *toxic* metamorphs.

While very much a work-in-progress, it is clear that newfound knowledge of cane toad chemical ecology can only improve our prospects for developing effective national control/management practices.

Notes

STUDYING THE BENEFITS OF POSSUM CONTROL IN NEW ZEALAND – A DECADE OF PROGRESS

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ABSTRACT:

Brushtail possum control was conducted on c. 95,000 km^2 (or 35%) of New Zealand during 2000–2007. The objective of control was either the control of bovine tuberculosis (primarily Animal Health Board funded) and/or protection of conservation resources (primarily Department of Conservation funded). Major reviews of the benefits of possum control for achieving those objectives were published in 2000. We reviewed both published and unpublished studies completed since 2000 with the aim of improving our knowledge of the changes in the populations or ecological and disease processes resulting from control of possums.

Study designs were predominantly correlational but knowledge is accumulating to show bovine tuberculosis transmission rates are reduced when possum densities are suppressed. We evaluate the evidence that native wildlife populations increase in response to possum control, but the confounding effect of ship rat reduction cannot always be ruled out. Long-lived tree populations have also proved difficult to study and may be subject to strong site effects. There will always be tension between asserting national level benefits and proving local-level responses to possum control.

Notes

MANAGING FOXES FOR BIODIVERSITY BENEFITS IN VICTORIA – THE 'ARK' PROJECTS

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[1] Department of Sustainability and Environment, East Melbourne, Vic
[2] Department of Sustainability and Environment, Orbost, Vic
[3] Department of Sustainability and Environment, Portland, Vic
[4] Department of Sustainability and Environment, Arthur Rylah Institute, Heidelberg, Vic

ABSTRACT:

The introduced Red Fox *Vulpes vulpes* is one of the major threats to biodiversity in Australia and is listed as a threatening process at the Commonwealth level through the Environment Protection and Biodiversity Conservation Act 1999 and at the state level in Victoria under the Flora and Fauna Guarantee Act 1988. Despite this, programs to control foxes for biodiversity outcomes are generally poorly focussed and co-ordinated, and are carried out at too small a scale and short a time frame to achieve meaningful and sustained results.

To help address these shortcomings, public land management agencies in Victoria have implemented two large-scale, ongoing fox control programs known as Southern Ark (in far East Gippsland) and Glenelg Ark (in the lower south-west) – the 'Ark' programs. These programs, which aim to facilitate the recovery of a suite of native mammals, birds and reptiles in these two regions, have the following features:

- large scale and cross-tenure, being 1 million hectares and 100,000 hectares respectively;
- ongoing, with continuous ground-based baiting using Foxoff;
- an outcome focussed research and monitoring component, based on measuring faunal responses to fox control;
- established investment platforms with the regional infrastructures required to manage complex projects and on which to build additional projects;
- strong stakeholder support among the relevant public land managers, research organisations and community.

These Ark programs have made significant advances in governance, policy, implementation, evaluation, communication and community engagement that allow the necessary spatial and temporal issues to be addressed effectively and so facilitate major improvements in biodiversity conservation. The quality of the science being applied in the Ark projects is at the forefront of conservation biology, applying true outcome-based monitoring and evaluation components (examining site occupancy) at a landscape scale to detect change.

A Communication and Community Engagement Plan for the Ark projects has been used to ensure key messages are effectively promoted and stakeholders engaged appropriately. Tools employed include regular newsletters (The Ark), presentations to community groups and at conferences, publication of annual achievements reports and case studies, regular media releases, highway signs and signs at works, website information, and involvement of volunteers (e.g. field naturalists) in monitoring and implementation.

Southern Ark is recognised as a national Demonstration Site of the Invasive Animals Cooperative Research Centre and has attracted significant other research funding for PhD studies on cat ecology and management and fox reinvasion ecology. It is also one of a small number of case studies selected for measuring impacts of pest animal control under the national indicators project conducted by the National Land and Water Resources Audit.

Notes

THE SOUTHERN ARK PROJECT – BROADSCALE FOX CONTROL IN COASTAL AND FORESTED LANDSCAPES IN FAR EAST GIPPSLAND, VICTORIA

Andrew Murray

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ABSTRACT:

Since its introduction to Australia in the 1860's, the Red Fox *Vulpes vulpes* has been implicated in the decline of a wide range of ground-dwelling mammals, birds and reptiles. While the impact of the fox has been most keenly felt in arid and open woodland ecosystems, the mesic forests of south-eastern Australia have not been immune.

The East Gippsland Forest Management Area (EGFMA) occupies over one million hectares of land, and includes some the least impacted ecosystems in Victoria. The EGFMA supports a diverse fauna including eight species of mammal, four species of ground-nesting birds and one species of large reptile that are all rare or endangered, at least in part as a result of fox predation. There is also a large number of other species (predators and prey) that, while not at direct risk of extinction, are likely to benefit from the decline of the Red Fox.

The Southern Ark Project operates across the majority of the EGFMA. The aim of the project is to significantly reduce the resident population of foxes living on public land, and to ensure that any foxes that disperse into the EGFMA are at constant risk. Fox control is achieved by a year-round buried baiting program, using baits containing 1080. Over 3,500 bait stations have been established on public land in the EGFMA, using the extensive network of vehicle tracks running through the forest. To date 500,000 hectares of forest are under ongoing fox control, with another 400,000 hectares to be added in early to mid 2008.

Species "recovery" is an obvious and theoretically measurable goal of the Southern Ark project, as it is with most programs where foxes are being controlled in natural ecosystems. A more esoteric aim of the project is to intensify, reinvigorate or re-establish the wide range of ecological processes that ground-dwelling mammals are involved in. Most of these processes are not well understood, although we do know, for example, that potoroos and bandicoots are vitally important in the dispersal of the spores of hypogeal fungi, which themselves have a vital role in nutrient uptake for a wide range of plant species. The idea that fox control is being undertaken to improve ecosystem function is one that is being embraced in Victoria. While it is a more difficult concept to communicate when compared to discussing the recovery of endangered species, it is important that we continue to attempt to do so, as it is a fundamental part of the project.

The indications are that effective fox control is being achieved, and that following a prolonged free-feeding campaign using unpoisoned baits across large tracts of forest, a substantial proportion of the fox population is killed within days once poison baiting commences.

Monitoring the population response by native mammals to the reduction in fox numbers remains a significant challenge with the range of techniques currently available. It is apparent that the localised recovery of a number of species of terrestrial mammals such as potoroos and bandicoots may take the better part of a decade to achieve, and that considerably longer may be required before increasing populations reoccupy habitat that is currently vacant.

Notes

DELIVERING COLLABORATIVE FOX CONTROL PROGRAMS UNDER THE NSW FOX THREAT ABATEMENT PLAN (FOX TAP)

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ABSTRACT:

Foxes (*Vulpes vulpes*) are widespread across New South Wales (NSW) and continue to have a serious negative impact on native fauna. Eradicating foxes from NSW is not considered feasible in the immediate future. Instead fox control operations, prioritised under the NSW Fox Threat Abatement Plan (Fox TAP), focus on areas where the impacts of foxes on threatened species are likely to be greatest. However the long-term effectiveness of control operations at Fox TAP sites is often limited by the rapid immigration of foxes from adjacent privately owned lands. In this paper, we describe the initial development of a project aiming to establish collaborative fox control programmes on private properties adjacent to Fox TAP sites along coastal NSW. We highlight the many challenges faced when undertaking pest animal control on private lands and some solutions to these problems. Preliminary results suggest that establishing collaborative fox control programs across all tenure at Fox TAP shorebird nest sites can assist with improving the fledging success of threatened shorebird species, however the results for threatened terrestrial species are unclear.

Notes

GENETIC CHARACTERISATION OF DINGOES IN THE BLUE MOUNTAINS WORLD HERITAGE AREA

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ABSTRACT:

The Australian dingo Canis lupus dingo is considered threatened due to hybridisation with the domestic dog Canis lupus familiaris. Paradoxically, the dingo is also persecuted as a threat to domestic livestock production. This presentation details research on genetic characterisation of wild dingoes from the Blue Mountains World Heritage Area (BMWHA), 65km west of Sydney, Australia.

A review of the literature reveals conflicting views on how to define a dingo. Most authors used a generic description to define dingoes inhabiting all landscapes in Australia. However, the range of biological parameters measured in previous studies, combined with recent advances in technology can be used to more accurately characterise dingo populations. Some shortcomings from historical and contemporary research include:

1. Geographical variations of dingo skull allometry were not accounted for when dingoes from central Australia were used as a standard for dingo "purity";
2. Genetic variations of dingoes isolated in captivity from wild dingo populations were not accounted for when selecting genetic markers for "purity";
3. Sampling methods to define dingoes using genetics were subject to ascertainment bias (sampling error);
4. Microsatellites were used to infer "purity" when reviews of microsatellite data suggest they should only be used to infer relatedness; and
5. New research shows chemicals can affect gene expression (epigenetics) and the development of the neural crest (in part, the skull) in early stages of embryo growth.

In this study, microsatellite markers, morphological measurements of trapped animals, and canonical scores from skulls found in the study area, were used to characterise the population of dingoes in the BMWHA. It is anticipated that managers of the BMWHA will use these data for the conservation and future management of this iconic Australian mammal.

From these data we conclude that genotypic and phenotypic characteristics of dingoes representing geographically isolated populations across Australia will vary, and that different populations may not conform to a precise generic description for all dingoes. We recommend that future research should describe dingo characteristics according to their geographic location and ecological role.

Notes

INTEGRATED MANAGEMENT FOR PEST ANIMALS IN AUSTRALIA'S ARID LANDS

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ABSTRACT:

Arid Recovery is a conservation initiative aimed at restoring Australia's arid lands. The Arid Recovery Reserve is a cat, fox and rabbit free reserve located in the South Australian arid zone. The design of the exclusion fence has allowed re-introductions of several threatened and endangered species.

A buffer zone surrounding the reserve is managed intensively for feral cats and foxes in an attempt to establish a population of the Greater Bilby (*Macrotis lagotis*) outside the fenced reserve. In 2007 Arid Recovery began a trial to test the cost-effectiveness of integrated control as an alternative to costly aerial baiting. The integrated management includes 20 permanent leg-hold traps, fortnightly shooting, bi-monthly 1080 hand-baiting and targeted monthly control in a 200km^2 control zone.

Interim hand-baiting results show a higher combined species uptake of baits in the warmer months with nearly 80% of baits taken in the first three weeks following baiting. In the cooler months more than 40% of baits were taken over the same period. Feral animal uptake was highest from May to July with another slight peak in September. In comparison the number of baits taken by lizards increased in the warmer months as did the number of stations where baits were taken by unknown species.

Results show cats and foxes were more likely to take baits from dunes than other microhabitats including vehicle tracks. Microhabitat preference did not change significantly with season when considering combined bait uptake. There was no significant difference in the amount of baits taken by feral animals between sites in the core and periphery of the baited area. Feral animals were, however, much more likely to take baits from bait stations along major fence-lines. A total of only 55 baits were known to be taken by cats and foxes between May 2007 and December 2008 compared with 28 cats and 11 foxes captured in permanent leg-hold traps or shot over the same period.

The combination of control techniques has allowed the Greater Bilby to survive and breed outside the reserve ten months into the trial. This paper discusses the cost-effectiveness and efficacy of integrated management in comparison to aerial baiting including recommendations for successful re-establishment of threatened species in unfenced areas.

Notes

WEKA-EXCLUDING BAIT STATIONS FOR POSSUM CONTROL IN WEKA HABITAT

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ABSTRACT:

Interference with toxic baits by weka (an indigenous NZ rail) has resulted in accidental deaths of this species and as a consequence there has been significant constraints placed on how some control tools can be used in areas where this species is present. Additionally, weka and rodents can compromise the effectiveness of ground-baiting operations for controlling possums by reducing the availability of bait to possums. In response to this problem, 'excluder' bait stations have been developed with the following demonstrating significant exclusion of weka from bait (Wekoff, Starline Baitsafe, Modified Sentry, and the Possum Only). These four bait stations were tested in pen trials that assessed possum control efficacy and the amount of Feratox® spillage occurring from each bait station through possum activity.

Possums (40 for each station type) were randomly allocated to a bait station type and prefed for two nights before being presented with toxic Feratox® (cyanide) capsules encased in a peanut butter-based prefeed paste (Ferafeed®). Possums that cracked a Feratox® pellet and survived were presented with more Feratox® capsules in the same bait station for another two nights to see if these individuals would drop whole Feratox® pellets after an initial sub-lethal exposure.

The kills achieved using the four bait stations were not significantly different, but significantly more intact Feratox® were spilt by possums feeding on bait in Possum Only stations compared with the other station designs. Significantly more individually penned possums accessed bait from the Wekoff station compared with the other bait station designs. The behaviour of surviving possums that had repeated exposure to Feratox® was variable. Five possums rejected the Feratox® capsules but ate the Ferafeed® encasing them. Six possums may have swallowed intact Feratox® capsules, as multiple pellets were removed from the stations but were not recovered by searching the pens. One intact Feratox® capsule was found in the stomach of a possum that was necropsied at the end of the trial. Five possums seemed to have an adverse response, after initially cracking and spitting out fragments of a capsule, and didn't touch the bait for the following two nights. One possum did not exhibit avoidance behaviour and cracked and rejected fragments of Feratox® capsules for the three consecutive nights it was exposed. Overall, the Wekoff and Modified Sentry showed the best results in terms of maximised efficacy and minimised spillage, and have been selected for further testing in field trials.

Notes

SUSTAINED INTEGRATED PREDATOR CONTROL IN THE RANGELANDS

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ABSTRACT:

The Department of Environment and Conservation (DEC), Australian Wildlife Conservancy (AWC) and Invasive Animals Co-operative Research Centre, commenced a project in early 2006 to control introduced predators (feral cats, foxes, wild dogs) in the semi-arid Rangelands of Western Australia with a single baiting strategy. Within close proximity and similar habitats lie AWC's Mt Gibson Wildlife Sanctuary (135,000 ha) and DEC's Karara and Lochada acquired pastoral leases (each approximately 100,000 ha), both with a key role in conserving remnant wheatbelt biodiversity. At Karara-Lochada, the control site, introduced predators were not baited. At Mt Gibson introduced predators were controlled with an annual aerial baiting using 70,000 'Eradicat' sausage baits in early winter.

Permanent track survey transects were established at both sites. Permanently marked sand plots with lures were located along the transects and used to survey introduced predator abundance. Surveys were conducted pre- and post-baiting in July and August and at 3-monthly intervals in October, December and April to assess plot occupancy.

Results to date suggest that cat abundance can be significantly reduced following a winter baiting. Cat abundance indices remained low for a number of months post-baiting. Similarly, fox abundance can be significantly reduced for a number of months after the winter baiting. However, abundance gradually increases over the summer and autumn. The success of the first baiting program was demonstrated again in 2007/2008.

Surveys will continue for four years, including monitoring of prey abundance (rabbits, small mammals, reptiles, invertebrates). An adaptive management framework provides the opportunity to conduct additional baiting in autumn 2009 using meat baits to address fox reinvasion after the two years of baseline data collection.

Notes

THE IMPACT OF GAME-BIRD MANAGEMENT ON FARMLAND BIODIVERSITY IN THE UK

Catherine Davey

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ABSTRACT:

Non-native species are the second most important factor leading to species' extinctions after habitat loss and the control of alien species is one of the biggest challenges facing conservation biologists worldwide. Most research and legislation aims to minimise the impact and spread of exotic species. However, game-bird enthusiasts actively promote the release and dispersal of alien game species.

An estimated 20-35 million ring-necked pheasants (*Phasianus colchicus*), are released into British woodlands every year to supplement wild stocks on shooting estates. This biomass greatly exceeds that of all other bird species in the UK. In addition to pheasant release, 2 million hectares of UK farmland, including 30% of all woodland, are specifically managed to enhance game-bird survival. Techniques utilised include habitat management, the provision of supplementary food and intensive predator control. These practices have the potential to affect wider species diversity and abundance in farmland landscapes and the ecological implications have not been fully investigated, although conservation benefits are often claimed.

While not considered a pest in the UK, due to economic importance and historical precedence, the repeated reintroduction of the pheasant may be considered a proxy for invasion. I completed a study examining the effect of game management and pheasant release on the abundance and biodiversity of native vertebrates in UK woodlands. The results suggest that pheasant release and associated management has the potential to significantly affect the population dynamics and distribution of coexisting species.

In Australia, despite a VPC threat rating of 'extreme', the ring-necked pheasant is still released under license in Tasmania, while in New Zealand pheasants can be reared and released in large numbers without control. The repercussions of managing the countryside for an exotic species will be discussed along with the potential implications of pheasant release in Australasia.

Notes

DEER ISSUES AND MANAGEMENT IN NEW ZEALAND

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ABSTRACT:

Seven species of deer are found in the wild in New Zealand. Species introduced in the mid to late 19th century include red, fallow, sika, and sambar. In the early 20th century wapiti (elk), rusa, and white tailed deer were also successfully introduced. Deer are now widespread on all three main islands. Some offshore islands remain deer free. The upper northern and north western parts of the North Island are mostly free of wild deer.

Deer were introduced for the purpose of sport and food and were first managed by the acclimatization societies as a hunting resource. Deer numbers multiplied and by the late 1920's deer had largely lost their protected status and were increasingly managed as agricultural and plantation forest pests and for causing damage to native forests. Government control through ground culling was carried out from the 1930s to the 1950s. In the late 1950s a commercial market for feral venison was found and with the advent of an aerial recovery industry, based around fixed wing aircraft and later helicopters, the deer population was reduced in many places by about 90%. Today wild deer populations are controlled by a combination of recreational hunting, commercial recovery, landowner control, and government funded control. Deer farming is now a well established industry. There is a safari park industry that caters for tourist hunters.

Government funded control of deer is focused around preventing deer becoming established in wild deer-free areas, removal of deer from offshore islands, and protection of sites where biodiversity values are threatened by deer impacts.

Control of wild deer populations has recently been suggested as a way of enhancing forest carbon sinks.

Notes

KANGAROO ISLAND PEST ERADICATION PROGRAM WITH A FOCUS ON FALLOW DEER

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ABSTRACT:

Feral pigs, deer, goats and cats are a substantial problem on Kangaroo Island. The KI Natural Resources Management Board is implementing a management program in association with the Invasive Animals Cooperative Research Centre, Department for Environment and Heritage, South Australia, and landholders.

Eradication trials are underway for goats and deer but effective long-term management strategies are still being developed for cats and pigs. The hope is that new baits will prove more effective than current control techniques.

This presentation will focus on the progress of the deer eradication program which is targeting all aspects of deer management to:

- minimise biosecurity risks by strengthening policy on deer importation, fencing standards, and domestic stock identification
- raise public support and participation with effective information exchange and awareness programs through the local media, public meetings and one-on-one contact, particularly with local landholders and hunters
- improve understanding of the ecology of feral deer on Kangaroo Island by collecting and analysing information on physiology, habitat use, diet and reproductive success, and thus making more informed decisions on control activities
- assess the ability to determine population size using genetic markers
- improve destruction techniques by trialing the use of lures and technology, and networking with people in other deer eradication programs
- refine monitoring programs and determine non-detectability of individuals within the occupied area
- assess the cost and feasibility of the eradication program in the long term.

Notes

LONG TERM SURVIVAL OF COOPERATIVE PEST ANIMAL PROGRAMS

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ABSTRACT:

The success of cooperative pest animal programs which operate under a cross tenure or local landscape scale agreement between managers of public and private lands has been well documented over the last decade (English and Chapple 2002, Hunt *et al*. 2002, Hunt *et al*. 2005). Many of these programs owe their success to a 'ground up' approach which successfully fosters local ownership and support culminating in an agreed plan of action which can be used as a powerful tool to access a level of resources or issue awareness not otherwise available. The initial stages of these cooperative programs rely on a high level of interest and commitment from land managers within a defined operational area. A number of guiding documents are available which outline the process of establishing a cooperative pest animal program (Braysher 1993, Fleming *et al*. 2001). In order for such programs to survive over successive planning cycles there is a need to maintain and build on early momentum and goodwill. However, the pattern of many programs, regardless of their success and at times possibly due to their level of success, is to falter due to a declining level of interest in the issue for which the program was initially established. This period should be seen as the most critical time in the life of a cooperative pest animal program as at this time the input of resources may be viewed as disproportionate to the current level of impact by the target species. Such observations are often made by those with little understanding of the pest animal impact history for the area due to their lack of involvement during the initial stages of the program. Cooperative pest animal programs that identify the need to evolve and adapt their operations in direct response to their fluctuating target animal profile are likely to retain an adequate level of resource commitment and support into the future. Programs that are able to not only determine but successfully justify the minimum level of resource commitment required to maintain decreased levels of pest animal impact may ultimately break the boom or bust resource cycle which plagues many cooperative pest animal programs. Part of the solution lies in adjusting performance objectives over successive planning cycles as existing measures of success are clearly met or become redundant.

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Notes

COMMUNITY INVOLVEMENT IN PEST MANAGEMENT IN SOUTHERN NEW ZEALAND

Richard Bowman and Sherman Smith

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ABSTRACT:

This paper examines the benefits that community-based pest control groups can provide for environmental protection and identifies factors that contribute to their success. It has been estimated that there are now as many as 3000 community-based biodiversity projects operating in New Zealand. This phenomenon has largely resulted from rising awareness of the measurable decline in indigenous habitat and species - particularly in the more densely populated and intensively developed areas.

Aparima Pestbusters is used as a case study. This community group is based in the picturesque coastal township of Riverton (pop. 1900) in Southland, New Zealand. It began by chance in 2002 when several senior community members decided to deal with a growing population of magpies which were attacking school children and upsetting golfers. This initiative led the group to contact the regional pest management agency – Environment Southland. Following this Aparima Pestbusters decided to take on other pest management activities as well which would provide wider benefits to the area. In particular it wanted to 'bring back the native birds' to the native forest remnants on the prominent Riverton Peninsula which overlooks the township immediately to the west.

In 2003 Aparima Pestbusters started to control possums, rats and mustelids in More's Reserve above the town in an enthusiastic but relatively piecemeal fashion. In 2004 the group consolidated its position and sought and received a grant of $17,000 from the Pacific Development Trust. This funding along with substantial voluntary labour resulted in the installation of a network of bait stations for possums and rodents along 25 km of cut lines covering an area of 200 ha. The group has also undertaken weed control and restoration planting at key sites in the reserve. In addition several private landowners have voluntarily agreed to fence off forested land adjacent to Mores Reserve and to allow pest control to be carried out. Environment Southland supports the project by monitoring native bird populations and densities of pests, ie. possums, rodents and mustelids. Measurements gathered over the last two years are showing encouraging improvements the native bird numbers and habitat condition.

The success of Aparima Pestbusters as an environmental restoration group is largely due to the drive and enthusiasm of a hard core of six retirees from a small community. They have harnessed the efforts of a large number of local volunteers and attracted external funding. Local agencies have provided technical advice and pest management tools but have not attempted to drive the programme. As a result Aparima Pestbusters has, through hard physical work and advocacy, created a strong sense of community ownership and pride in the special place they have taken stewardship of.

Public agencies with responsibilities for the sustainable management of natural resources need to learn how to nurture and foster this powerful community-based ethic as a driver for biodiversity protection and enhancement.

Notes

BRINGING OUT THE MONGREL IN AUSTRALIAN DINGOES: THE EVOLUTION OF WILD DOG BODY SIZE

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ABSTRACT:

The Australian dingo is an iconic symbol of the 'Outback', and also a much despised predator of domestic livestock. There are, however, fewer than 25% pure dingoes are left in most populations in eastern Australia. Since European settlement the wild dog gene pool has accumulated an increasing proportion of alleles from up to 170 breeds of domestic dog. Here we show that hybrids account for over 80% of wild dogs in some areas of Australia and that in parallel with this introgression of alleles, the genetic 'enrichment' of the gene pool has provided a catalyst for selection and the micro-evolution of larger wild dogs. There has been a 20% increase in average body weight over the last 40 years, with 40% of adult dogs in south-eastern Australia weighing more than 17kg, and the average mass of male dogs now approaching a point where 'hypercarnivory' is recorded in other carnivorous species. Larger dog size has led to an increase in the efficiency with which wild dogs kill major prey and our models indicate that a pack of wild dogs today requires almost a quarter more daily energy intake than an average pack of wild dogs prior to 1980. Any increase in the size of wild dogs has significant implications for management of endemic and domestic animals and for other aspects of human behaviour and well-being in the Australian landscape. Potential management options for controlling hybrids will also be discussed.

Notes

14th AVPC CONFERENCE POSTER ABSTRACTS

IS NIGHT-TIME WIND DIRECTION IMPORTANT TO BEST PRACTICE WILD DOG TRAPPING AND BAITING?

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ABSTRACT:

We discovered a significant bias for wild dog scent station spoor (scats and scratches) to be positioned on the north-easterly side of roads and intersections. Counts of this spoor, 50 metres in each direction of north-south and east-west intersections were made in state forests near Roma in southwest Queensland, Cecil Plains on the Darling Downs and Maryborough on the coast during mating season in April/May 2007. While 51% of 190 and 83% of 120 scent station spoor were located on the north-eastern sector of the intersections at Cecil Plains and Roma respectively, spoor were more evenly distributed across all four sectors at Maryborough (n=47).

Percentage of wild dog scats and scratches located in each sector of north-south and east-west road intersections in three state forests during April/May in Queensland.

Location	NE	NW	SE	SW
Cecil Plains	51	38	9	2
Roma	83	12	5	0
Maryborough	28	31	22	19

Wind direction, specifically night-time wind direction, gives the best correlation to the location of the scent stations. For example, 53% of the wind recorded at Norwin, a few kilometres east of Cecil Plains, between 1800 hrs and 0600 hrs, taken at hourly intervals from 2004 to 2006, is north-easterly (NE 53%, NW 6%, SE 23%, SW 8%, still 10%). A predominantly north-easterly wind direction occurs west of the Dividing Range in southern Queensland but coastal areas experience alternating southerly and north-easterly winds. We investigated whether wind direction, or the side of the road baits were laid, affected bait take but in February found no evidence of a directional bias. We discovered that wild dogs approached attractants directly from the forest, presumably locating the baits from downwind, and were not encountering them while travelling roads. This may explain why we found no directional bias in February but it may yet be relevant during mating and breeding seasons between April and July when activity along roads is highest. While wind direction may temporarily change from its prevailing direction during baiting or trapping programs, giving consideration to wind direction when placing baits and traps should increase the efficiency of both methods.

Frequency of visits by wild dogs to attractants placed on alternating sides of the road.

	Cecil Plains		Roma	
	# stations	Frequency of visits	# stations	Frequency of visits
North	62	24	63	9
South	62	22	63	8
East	62	9	21	3
West	65	17	35	2

CONTROL OF RABBITS IN ARID AUSTRALIA: DESTROYING THE DROUGHT REFUGE

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ABSTRACT:

Rabbits continued to infest Bulloo Downs in southwest Queensland even after rabbit haemorrhagic disease virus (RHDV) had effectively reduced rabbit populations to very low levels in most other arid parts of Australia. Control efforts for over 100 years have all appeared unable to stop rabbits causing damage to cattle production and native plants and animals in the area. In 2001 an experiment established to measure the benefit of rabbit control to biodiversity and cattle production showed warren ripping to cause an immediate reduction in rabbit activity. Three months after ripping there were still 98% fewer rabbits in ripped plots despite these plots being exposed to invasion from surrounding populations. The cost of ripping was high because of the high density of warrens and is prohibitive for a full-scale programme. Nevertheless, ripping warrens just in the rabbit's drought refuge (2002 -2004) appears to have effectively controlled rabbits over the entire property. Following one good season rabbits still have not recovered where the drought refuge was effectively ripped.

Destroying warrens in the areas where rabbits survived droughts achieved a reduction in rabbits of over 99% compared to a similar area near Coongie Lakes in South Australia. Low rabbit numbers allowed cattle to continue to be run on the property even though the area experienced seven consecutive years with below average rainfall. It still remains to be seen whether rabbits can recover from this low population-base during a run of good seasons. If rabbit numbers remain suppressed after a run of good seasons then rabbit control by destruction of drought refuge could be repeated at Coongie Lakes and other drought refuge areas in the arid zone. Identification and treatment of areas similar to Bulloo Downs where rabbits survive drought may relieve a very large area of arid Australia from the damage caused by rabbits.

Notes

YOUR ASS IS GRASS! INVESTIGATING SUSTAINABLE MANAGEMENT OF NATIVE HERBIVORES ON KING ISLAND, BASS STRAIT

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ABSTRACT:

King Island is the second largest of Tasmania's Bass Strait Islands covering approx. 110,000ha and supports a significant agricultural industry. Due to value-added product branding and market pressures, the use of 1080 is no longer a viable control option for crop protection management on King Island. The King Island Natural Resource Management Group has partnered with the Tasmanian Farmers and Graziers Association, the Tasmanian Institute of Agricultural Research, and the Department of Primary Industries and Water to investigate the viability of commercial harvesting, targeted culling and wallaby-proof fencing as integrated pest management strategies. Three species of concern are Bennett's Wallaby (*Macropus rufogriseus*), Tasmanian Pademelon (*Thylogale billardierii*), and the Brushtail Possum (*Trichosurus vulpecula*).

Under existing crop protection permits and commercial harvesting quotas, property managers are implementing targeted culling approaches to herbivore management. The two main objectives of the investigation are:

1) How does selected harvesting of native herbivores impact on browsing damage to pasture?
2) Is commercial harvesting a viable herbivore management approach for King Island?

Currently it is unclear how multi-species management will affect the pasture loss observed by landholders and land managers. Species-specific exclusion controls are being used to determine the significance of pasture loss and how browsing damage can be mitigated by the use of targeted culling approaches. The information produced will facilitate the implementation of an island-wide herbivore management plan and potentially assist in the development of a commercial harvesting industry for King Island.

Notes

THE EFFECT OF AN EXOTIC GAME-BIRD ON NATIVE BIRD POPULATIONS IN THE UK

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ABSTRACT:

An estimated 20-35 million pheasants are released into British woodlands every year to supplement wild stocks on shooting estates. This biomass greatly exceeds that of all other bird species in the UK.

Pheasants have a generalist diet and their impact on woodland food webs when released at high densities is currently unquantified. Management techniques, carried out to sustain the released birds, such as predator control and supplementary feeding, may also have unknown implications for heterospecifics.

As part of a study examining the effect of pheasant release and game management we examined the consequences for native birds. Breeding bird surveys were carried out in 20 woodlands in Southwest England using distance sampling techniques to obtain density estimates. The effects on bird abundance and diversity are presented here.

Notes

RADIO-TRACKING STUDIES SHOW THAT FOX CONTROL NEEDS TO BE CO-ORDINATED ACROSS LAND TENURES

Alison Towerton[1],[2], Trent Penman[1], Rod Kavanagh[1] and **Chris Dickman**[2]

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University of Sydney, 2006

ABSTRACT:

Foxes cause damage to native fauna and livestock throughout much of Australia. It has been estimated that fox control operations for 2003 in Australia cost $5.3M covering an area of almost 11 million hectares (Reddiex et.al 2006). The home range and distances moved by foxes vary depending on habitat and resources available to them. To effectively manage this species, conservation land managers need to have an understanding of the distances travelled by foxes in relation to the spatial and temporal spread of baiting programs. We used GPS collars to estimate home ranges, fox activity and bait encounters for foxes in the Goonoo Lands north east of Dubbo, NSW.

Home ranges calculated from GPS collars were significantly larger ($p < 0.01$) than those from previous studies and from VHF data from this site. Mean 100% MCP home-range size for VHF tracked animals was 850.8ha (range 172.8 - 1818.0 ha, n=9) while the GPS collared animals mean home-range was 9075.7 ha (range 7699.7 – 10310.0 ha, n=3). Encounter rates with baits within the public forest land were low with only one GPS collared fox traversing within 100m of a bait station during the control program, while after the baiting period the fox traversed within 20m and visited bait stations on 13 occasions. Eight out of thirteen foxes tracked are believed to have been poisoned, half on public forest land and half on private property. These results highlight the value of a coordinated approach to fox control across the landscape. Further investigation is required into the spatial and temporal distribution of baiting to ensure that control programs are effective.

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Notes

THE BIOLOGY OF THE GRASSLAND MELOMYS (*MELOMYS BURTONI*) (RODENTIA: MURIDAE) IN FAR NORTH QUEENSLAND SUGARCANE CROPS

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ABSTRACT:

Melomys burtoni and *M. cervinipes* occur naturally in habitats adjacent to sugarcane crops in north Queensland, have been trapped within sugarcane crops, and are potentially damaging to sugarcane crops. However, little is known about their biology and pest status in sugarcane crops and this information is needed by the industry for the development of a sustainable pest management programme for these rodents.

Field studies were undertaken between Tully and Innisfail in far north Queensland to determine the extent to which either or both *Melomys* species inhabit sugarcane crops and to examine the biology of *Melomys* within the crop. Field diagnostic approaches were developed which, when blind tested using molecular techniques, proved 100% accurate in-field discrimination of the two *Melomys* species.

Based on field trapping, *M. cervinipes* proved to be rare in sugarcane and should not be regarded as a pest by the industry. In contrast, *M. burtoni* were recorded in significant numbers within cane, were found to feed on cane and, in crop stage 5 (canopy closure to harvest), were responsible for damage to ~5% of stalks. *M. burtoni* were found to colonise sugarcane at the later stages of crop development than the other major sugarcane rodent, *Rattus sordidus*. The highest proportion of *M. burtoni* reproduction and juvenile recruitment also occurs in the later stages of crop development. The late colonisation of the crop by *M. burtoni* means that the Integrated Pest Management (IPM) strategy already in place for *R. sordidus* is not directly transferable to *M. burtoni.* If an effective IPM strategy is to be developed, further research is required to examine the population dynamics and dispersal of *M. burtoni* populations between the crop and the adjacent habitats within the sugarcane production system of far north Queensland.

Notes

NEW APPROACHES TO DEVELOPING HUMANE TOXINS: OUR RATIONALE, QUESTIONS AND ANSWERS

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ABSTRACT:

1080 use is under pressure and the use of alternatives such as brodifacoum has resulted in extensive wildlife contamination and non-target deaths. Culling of vertebrate pests still relies on the use of unpopular poisons, or poisons that are linked with secondary poisoning or are inhumane. Hence our focus on safer humane poisons. For example, in 1997 Feratox® was approved for possum control in NZ. It is a cyanide pellet which combines improved safety for handlers, with low secondary poisoning risk and proven humaneness (Gregory et al 1997).

Table 1: Welfare ranking, time to onset, duration and severity in possums.

	Onset	Onset-death	Death	Signs	Rating
Cyanide (Feratox®) *Gregory et al 1996*	3 mins	12 mins	15 min	Unconscious after 6 mins	High
1080 *Littin et al 2008*	1.5 - 2.5 hrs	9.5 hrs	11.5 hr	Tremors, spasms, vomiting	Mod-low
Brodifacoum *Littin et al 2002*	14 days	7 days	21 day	External bleeding, lame, crouching	Low

As Feratox® has proven humaneness for possum control (Gregory et al 1997), we are now increasing the intensity of our efforts to complete the development of cyanide pellets for new species. We are focusing on the development of Feratox® for wallabies and ferrets – exploring the potential of cyanide for humane culling of species other than possums. Para aminopropiophenone (PAPP) is a new substance undergoing trials for humane control of stoats and feral cats in NZ and cats and foxes in Australia. PAPP's mode of action, whilst different from cyanide makes it a particularly humane toxin for vertebrate pests. By reducing oxygen supply to the brain stoats and feral cats become lethargic, sleepy and unconscious prior to death in 1 to 2 hours. PAPP could potentially be the most significant advance in this field since the 1970's and PAPP will be the only vertebrate toxic agent other than the new cyanide pellets (Feratox) which clearly outstrips 1080, anticoagulants and other conventional poisons from a welfare perspective. It is noteworthy that both cyanide and PAPP cause central nervous system anoxia, lethargy and death albeit through different mechanisms of toxicity. Our poster provides further answers to commonly asked questions regarding the humaneness, effectiveness, safety and humaneness of cyanide and PAPP.

References:

Gregory, NG. Milne, LM., Rhodes, AT., Litten, KE., Wickstrom, M., Eason, CT. (1998). Effect of potassium cyanide on behaviour and time to death in possums. *New Zealand Veterinary Journal* 46: 60-64.

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PIG ROOTING IN LOWLAND RAINFORESTS: WHERE, WHEN AND WHAT DOES IT DO?

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ABSTRACT:

Feral pigs (*Sus scrofa*) are a significant invasive species in Australia as the disturbance caused by their rooting (underground foraging) activities alter ecological and biological processes which are important for ecosystem functioning. There are numerous studies that have investigated ecosystem relationships or the response of individual environmental variables to pig rooting, but there is a paucity of information providing a link between these two fields of literature. This study is investigating microhabitat variables that may explain spatiotemporal variations in the selection of patches for rooting by feral pigs and is assessing how specific habitat variables interact in response to pig rooting.

Six sites (N=120, 1x1 m plots) were surveyed for pig rooting and selected habitat variables, including soil compaction, soil micro-contours, soil moisture, rock cover, earthworm frequency, seedling recruitment, and the frequency of plant types. The initial data set was collected in the early-wet season, and seasonal sampling will continue bimonthly for one year, excluding the mid-wet season.

Initial observations suggest soil compaction, soil moisture, soil texture, and rock cover will be useful variables for predicting pig rooting. Preliminary findings indicate that pig rooting significantly increases soil compaction which leads to changes in the frequency of plant types, that is, an increase in vines and shrubs and a decrease in sedges and grass. This information will be used to develop a predictive model on the occurrence of feral pig rooting in lowland rainforests to provide a better understanding of spatiotemporal variations in pig rooting. This will allow pig control programs in the Wet Tropics World Heritage Area to focus their efforts and reduce the impact of feral pigs in rainforests.

Notes

ARID RECOVERY- CELEBRATING THE REWARDS OF 10 YEARS OF PEST MANAGEMENT

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ABSTRACT:

Arid Recovery is a conservation initiative aimed at restoring Australia's arid lands. The organisation is a partnership between BHP Billiton, Department of Environment and Heritage, The University of Adelaide and the Friends of Arid Recovery.

In 2008 Arid Recovery is celebrating its 10 year anniversary including all the rewards of long term pest management.

This poster will give an overview of the environmental benefits of a long term fenced reserve combined with controlling feral animals. It will show how feral cats, foxes and rabbits were eradicated in the reserve and the unique design of the fence. The poster will summarise the improvement in vegetation density since the exclusion of feral grazers, the increase in numbers of local fauna and the re-introductions of the Greater Bilby, Burrowing Bettong, Western Barred Bandicoot and Greater Stick-Nest Rat inside the reserve. In conclusion it will hopefully highlight future possibilities for land restoration when pest management is implemented.

Notes

GREY-HEADED FLYING-FOXES (*Pteropus poliocephalus*) IN ORCHARDS OF THE SYDNEY BASIN

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ABSTRACT:

Grey-headed Flying-foxes (GHFFs) occur along the east coast of Australia from Bundaberg to Geelong. Feeding on fruit and nectar in the tree canopy, GHFFs are often in conflict with commercial fruit growers, but are also providers of ecosystem services through pollination and seed dispersal of native trees. A project in the Sydney Basin is investigating the damage caused by GHFFs, relative indices of GHFFs visiting orchards, grower-friendly damage assessment techniques and their effectiveness, and the economics and effectiveness of non-lethal control measures. This project is a collaboration between NSW government agencies (Department of Primary Industries and Department of Environment and Climate Change), the Hawkesbury Nepean Catchment Management Authority, the NSW Farmers' Association, local orchardists and the NSW Flying-Fox Consultative Committee.

Stonefruit and apple orchards are affected by GHFFs and three assessment methods are being trialled in these commercial orchards in the Sydney Basin to measure flying-fox damage. The cost-effectiveness and application of total exclusion netting is being assessed. In the 2006-2007 and 2007-2008 fruit seasons, total crop yields and damage to fruit caused by GHFFs, birds and diseases were quantified in orchards that were partially netted and in others where small exclusion nets were constructed. Throughout the fruit seasons, indices of GHFF abundance entering these orchards (GHFFs entering an orchard/ person/hour of evening observation)were also obtained.

Preliminary analyses indicate that incursion of GHFFs into orchards was variable between the different fruit growing regions in the Sydney Basin, both within and between fruit seasons. Indices of GHFF abundance were greater in the 2006-2007 fruit season than in 2007-2008 season this was reflected in damage levels in both stonefruit and apple crops. Full exclusion netting of orchards gave average yield advantages of approximately 18% for apples and 15% for stonefruit. The rapid assessment method was highly correlated with whole tree counts of damaged fruit 20 days before harvest ($r = 0.97$, $P<0.01$ for apples and $r = 0.90$, $P<0.01$ for stonefruit) and took about 1/3 of the time to complete. This rapid assessment method has great potential for growers to use.

Notes

THE USE OF VIDEO CAMERAS TO DETERMINE NON-TARGET 'BAIT TAKE' OF 1080 FOX BAITS IN TASMANIA

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ABSTRACT:

Evidence indicates that foxes occur at very low levels either throughout much of the Tasmanian landscape or at specific regional localities. Expert opinion and review considers that the most effective method for eradicating foxes from Tasmania is based around the use of a broadscale 1080 baiting program.

The current fox baiting strategy includes landscape scale baiting throughout areas where foxes are likely to occur, and where evidence indicates fox presence. Baits contain 1080 at a dosage 3mg/bait are buried at a depth of 10 centimetres and at a landscape density of 10 baits/km2. The exact location of baits is recorded and baits are then retrieved approximately 4 weeks after being laid giving an indication of 'bait take'. Up until 2008 the bait of choice was dried kangaroo meat (DKM). This bait type is no longer available and the baiting operation has converted to the use of Foxoff.

Prior to the development of the baiting strategy, research was carried out in Tasmania and Victoria during 2001/2002 using DKM and Foxoff baits to describe and document bait take by target and non-target species. Results from this research indicated that bait take of both types by foxes is initially high and decreases with time, whereas bait take by non-target species in Tasmania of natural meat baits is initially low and then increases as baits decompose. Take of Foxoff by non-target wildlife in Tasmania did not accelerate over time. This research, however, was conducted prior to the rapid spread of Devil Facial Tumour Disease that has decimated Tasmanian devil populations throughout eastern Tasmania and the Tasmanian Midlands, areas where fox baiting predominantly occurs.

The aim of this project is to further define the degree of non-target 'bait take' during baiting with the aim to determine 1) the proportion of baits taken during operational baiting; 2) which species take and eat baits; 3) which species visit bait stations; and 4) the proportion of baits taken and eaten by various species.

Results to date indicate that between July 2006 and December 2007 a total of 31,982 baits, predominantly DKM, were laid in Tasmania. Where retrieval data was available 25,505 baits were laid and 3,559 baits were recorded as 'taken', representing 14% (range 6-40% bait take per site) of total baits.

Infra-red motion sensor video cameras will be used to identify both the species visiting bait stations, and those taking bait, and determine the timing of bait take. The outcomes will result in a more informed risk assessment for baiting both in terms of impact on wildlife and foxes by baiting and impact on baiting by wildlife.

Notes

NOVEL APPLIED TECHNIQUES IN PEST MANAGEMENT

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ABSTRACT:

Zealand's many 'pest' free offshore and mainland island refuges are the foundation of conservation management of our unique biodiversity. The success of these refuges is the long term maintenance of this pest free status. Rodents (Norway and Ship rats, and mice) are major pests and predators of indigenous fauna. Incursions by these rodents into conservation refuges can occur and early detection of these rodents is crucial for appropriate control responses and eradication.
The longer the rodents go unnoticed the more difficult they will be to control and the more damage they will do to the indigenous species within the refuge. Currently, the most commonly used detection device is baited tracking tunnels that record rodent footprints. However, tracking tunnels need to be serviced regularly, making them labour- and hence cost intense. We aim to test and quantify two detection methods:

1. The efficiency of certified rodent dogs in spotting a low density number of rodents in essential pest free forest, and
2. Can the scent of lab Norway rats attract wild Norway rats?

The main benefits of quantifying the efficacy of these methods will be to conservation managers and community restoration projects. If one or both of the new methods prove to be efficient at detecting rodents then we hope they can be incorporated into current conservation practises.

Notes

THE ROAD TO A NEW FOX CONTROL PRODUCT

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ABSTRACT:

The Invasive Animals Cooperative Research Centre, sponsored by Australian Wool Innovation, is developing a new active for the effective and humane management of foxes. The active is para-aminopropiophenone (PAPP). Using controlled pen studies and wild-captured foxes in Queensland and Victoria we have been able to maximize the relative efficacy and cost-effectiveness of PAPP formulation and dose presentation in FOXOFF® baits. This new product has also proven highly effective in the field (Werribee, Victoria), amongst what are arguably Australia's largest foxes. These very positive results, overlay the encouraging data on the relative toxicology of PAPP to non-target species compared to foxes, its toxicology profile, and its environmental toxicology and fate. The project will use this data to support two submissions to the APVMA during 2008 for the registration of a new fox management product that will 1. exhibit selectively greater toxicity to foxes compared to non-targets, including farm dogs, 2. has an effective and demonstrated antidote, 3. is rapidly degraded in the environment, and 4. will enhance the perception of fox baiting humaneness. This poster will outline the development of the product to date and the studies/timelines that are required prior to submission of a new registration application.

Notes

CONTROLLING FOXES ON PHILLIP ISLAND: WHAT IS THE MOST EFFICIENT METHOD?

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ABSTRACT:

The current program utilises staff from the Phillip Island Nature Park (PINP), and has over past years also included staff from Parks Victoria, Department of Primary Industries and a local contractor. The control programs has relied on a combination of techniques; hunting with hounds, treadle snaring, spotlighting, ground baiting with 1080 baits at selected sites, M-44 ejector baiting and den fumigation. The program considers weaknesses in fox biology or life cycles and attempts to time control operations to maximise fox mortalities. Timing of control methods is regulated to a certain extent by the tourist seasons and the behaviour of migratory sea birds. The program also recognises the problems of woody weeds providing surface harbour for foxes and acknowledges the importance of controlling rabbits for the management of foxes.

An evaluation of methods based on control efforts in hours invested for different control techniques and the number of foxes killed for each technique has been recorded since the early 1980s. An evaluation, information on the control effort and resultant fox harvest for a 29-month period from April 2000 to August 2002 (McPhee & Bloomfield 2004) and June 2005-Nov 07 looked at the efficiency of different control techniques to determine whether the control techniques were effectively reducing fox populations.

For all control methods combined the control efforts (hours per month) over the first 29 month period was relatively consistent with peaks of activity occurring in winter and spring. The control effort did not appear to decline. The catch per unit effort (foxes killed per hour) also showed seasonal fluctuations with more foxes being killed during the spring and summer periods when the population peaks and new cohorts of naive juveniles are more readily killed. The foxes killed per hour of effort show a slight declining trend, but this is probably due to the high number of spotlight kills. The remaining control methods were not causing major declines in fox numbers from the already low population base.

This indicates that the fox population over the first period may have reached equilibrium with the control effort. Thus, although foxes are being maintained at low levels, the combined control efforts over the first period had not caused further population declines over that period. The second period shows that the introduction of broadscale island wide baiting has had more dramatic impact on the fox population and is a more time efficient method to control foxes with the aim of eradication.

References

McPhee, S.R. & Bloomfield, T.E. (2004) *Strategy for the eradication of foxes from Phillip Island*. Report to Phillip Island Nature Park Board. Summerlands Phillip Island Victoria.

Notes

KANGAROO ISLAND GOAT ERADICATION PROGRAM

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ABSTRACT:

Feral goats are listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* and a declared species under the *South Australian Natural Resources Management Act 2004* because of their negative impact on biodiversity and pastoral production. Kangaroo Island has had a feral goat population for nearly 200 years. It is concentrated on the north and west coasts, and in a small population near Parndana in the centre of the Island.

The high conservation value of Kangaroo Island has prompted the Kangaroo Island Natural Resources Management Board, in association with the Invasive Animals Cooperative Research Centre and SA Department for Environment and Heritage, to implement a trial eradication program which is now in its second year of operation.

The goat eradication program is targeting all aspects of goat management to:

- develop and implement effective destruction techniques through planning and trialing control operations such as trapping, and ground and aerial shooting using Judas goats
- raise public support and involvement with effective information exchange and awareness programs through the local media, public meetings and one-on-one contact
- minimise biosecurity risks relating to importing and farming goats by strengthening policy on goat fencing standards, domestic goat identification and importation
- determine if goats impact on drooping sheoak, the food source for the endangered glossy black-cockatoo, by establishing a monitoring program in areas of sheoak, with and without goats
- improve understanding of the ecology of feral goats on Kangaroo Island through the collection and analysis of physiological, habitat, diet and movement data, so that more informed decisions can be made on control activities
- identify variables that influence distribution and abundance of goats to inform a predictive model of distribution and relative density
- develop methods of estimating the likelihood of eradication or probability of non-detection rates.

Notes

WRESTLING WITH THE SNAKE[A] – WHERE TO FOR EXOTIC REPTILE IMPORT APPROVALS?

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ABSTRACT:

The Vertebrate Pests Committee's (VPC) role is to provide coordinated policy and planning solutions to pest animal issues. Relevant state and territory agencies, the Australian Government, New Zealand, CSIRO, and the Invasive Animals CRC have membership.

The VPC-approved 'Guidelines for the Import, Movement and Keeping of Exotic Vertebrates in Australia' (2005) provides an agreed model for the management of emerging introduced terrestrial vertebrates according to a series of threat categories. The VPC's 'List of Exotic Vertebrate Animals in Australia' is a definitive, categorised record of these species, held in Australia under state and territory legislation.

VPC member agencies and other stakeholders provide comments on applications to the Australian Government Department of the Environment, Water, Heritage and the Arts to amend the list of specimens suitable for live import under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). All known reptile applications have been approved, so far only for commercial and non-commercial purposes (ie. scientific or educational uses), and have included species from Elapidae and Viperidae (venomous snakes) and Pythonidae (pythons).

The entire list of rejected terrestrial vertebrates currently comprises the Ferret and the Collared Dove. This is in spite of the fact that some other species have been assessed by agencies as presenting an Extreme Threat, as defined by the VPC Guidelines. ie. these species should not be imported into nor kept in Australia.

Agencies recently commented on an application to allow the import and private keeping of Hermann's Tortoise (*Testudo hermanni*), a species previously allowed import only for 'eligible non-commercial purposes, excluding household pets'. The species was assessed by West Australian agencies and assigned to the Serious Threat Category. The VPC Guidelines indicate that animals so assigned should be kept only for public display/education purposes or research and such is the practice around Australia for all introduced reptile species.

If approved, this precedent could apply pressure to state and territory agencies to allow this and potentially other significant-threat species to be kept as pets, with further requirements for risk management, a greater risk of escape or release and the potential establishment of wild populations that could have adverse effects.

One solution is to strive for a co-ordinated, high-level, triple-bottom-line approach, in spite of the aims of the various pieces of state, territory and federal legislation, and because of the diversity of ecosystems, economic developments and public amenity issues across the country. The VPC Guidelines and List provide a starting point.

[A] "If I seem to take part in politics, it is only because politics encircles us today like the coil of a snake from which one cannot get out, no matter how much one tries. I wish therefore to wrestle with the snake." Mahatma Gandhi 1869-1948, Indian Political and Spiritual Leader.

MINIMISING THE IMPACTS OF VERTEBRATE PESTICIDES ON NON-TARGET SPECIES

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ABSTRACT:

The numerous vertebrate pests introduced to New Zealand have put our native fauna, flora and meat export industry at risk. Great investments are made to control and eradicate introduced pests, and to ensure control methods are the most economic and efficient available. Often this means the use of toxic pesticides in the environment, sometimes resulting in negative impacts on non-target species. Much effort goes into researching ways to reduce these negative impacts; however the results of these works are wide-spread, making the task of reducing non-target species impacts difficult for resource managers, conservationists and land owners. Here we review methods for reducing these impacts in the New Zealand context. Based on the research reviewed, we make recommendations for decreasing impacts on non-target species when using pesticides.

Notes

IMPACT OF FERAL PIGS ON TROPICAL FRESHWATER HABITATS

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ABSTRACT:

The aim of this study is to quantify feral pig impacts on tropical freshwater habitats. The first objective is to use a number of ecological indicators found in freshwater habitats as a guide to quantifying feral pig impacts on elements of biodiversity. This will be achieved by excluding pig impact from six ephemeral freshwater lagoons and comparing the measured ecological indicators with six unprotected lagoons for three years. The sequential measurements of these ecological indicators as the lagoons draw down will give a guide to the consequences of feral pig impacts on biodiversity and a guide to the timing of recovery from these impacts if the level of impact is reduced. A range of water quality indicators, macrophytes and insect diversity and abundance indicators will be measured.

The second objective of this study is to conduct large scale learning by doing manipulative experiments to describe the feral pig abundance / impact system so that management of the problem can be developed. Large scale manipulation of feral pig densities surrounding large freshwater lakes will enable the changes in impact levels to be related to changes in feral pig abundances.

Notes

MANAGING DINGOES IN THE TANAMI DESERT

Newsome, T [1,2], Ballard, G [3], Fleming, P [3], Dickman, C [2] and Stephens, D [1,4]

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[4] University of Western Australia

ABSTRACT:

Newmont Asia Pacific is keen to ensure that dingoes are managed appropriately at the Granites Gold Mine, situated in the Tanami Desert, N.T. Managing dingoes can be problematic, not only because their presence may be a human welfare risk but because access to supplementary food and water resources could significantly impact upon the ecology and behaviour of dingoes.

In order to improve management, Newmont is sponsoring research aimed at better understanding the genetics of the population, movement behaviour and resource use of dingoes both at, and away from the mine site. This poster outlines current research activities, presents preliminary data and describes management options designed to minimise artificial increases in population size and associated negative interactions between local dingoes, mining operations and staff.

Notes

MONITORING OF SELECTED "AT-RISK" SPECIES DUE TO THE EMERGING FOX THREAT IN TASMANIA

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ABSTRACT:

The recent introduction of the Red fox Vulpes vulpes into Tasmania poses a significant threat to wildlife in the state. Currently, Tasmania supports a diversity of small to medium sized mammals and numerous ground nesting and flightless avifauna species ("at-risk" species) that are either absent, extinct or have suffered significant population declines on mainland Australia. Evidence suggests that fox predation is one of the primary agents responsible for the collapse of at-risk species populations throughout much of mainland Australia. Considering these outcomes and the recent decline in Tasmania's apex predator the Tasmanian devil Sarcophilus harrisi, it is likely that the establishment of foxes would lead to a significant increase in the risk of decline and extinction of various at-risk species. Tasmania's current situation is unique, in that we have the chance to gather baseline information and monitor populations of selected at-risk species prior to the potential establishment and expansion foxes in the State.

The proposed monitoring program aims to provide rigorous population information of at-risk species from which possible changes in population size and distribution resulting from fox predation can be measured and differentiated from both demographic and stochastic processes. In doing so the monitoring program should provide a means to measure the effectiveness of fox control activities while providing a basis for an adaptive management framework that could guide future conservation and management actions.

Species selected for longitudinal monitoring were defined using a quantitative risk assessment process, with those species ranked at extreme risk from fox predation short-listed for further assessment. A subset of three mammal species including the Tasmanian bettong *Bettongia gaimard*i, Eastern-barred bandicoot *Perameles gunnii* and Eastern quoll *Dasyurus viverrinus* and two avifauna species, the Tasmanian native hen *Gallinula mortierii* and Masked lapwing *Vanellus miles* were selected for ongoing monitoring due to their conservation significance or potential as indicator species of increasing or expanding fox predation in the state.

Monitoring of these species will be undertaken intra- and inter-annually at a range of sites selected on specific biodiversity and landscape values. Non-invasive and economically viable monitoring techniques such as line transect and camera-trapping surveys will be investigated as the primary means of monitoring with more conventional capture-mark-recapture surveys undertaken at a subset of sites. Concurrent monitoring of predator activity, particularly the fox will be undertaken using a series of sand pads at each survey site. Changes in predator activity patterns will be assessed in association with at-risk species populations to provide a measure of predator-prey interactions and impacts.

Longitudinal monitoring of these species is essential given the current status of foxes in Tasmania. Monitoring will provide both management and conservation outcomes that will guide current and future fox eradication and control activities, provide a basis for at-risk species conservation and set a broad framework for integrated wildlife monitoring and management throughout Tasmania.

Notes

EVALUATING THE SUCCESS OF THE GLENELG ARK LARGE SCALE FOX CONTROL PROGRAM – CHANGE IN SITE OCCUPANCY BY NATIVE SPECIES

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ABSTRACT:

The Glenelg Ark project aims to facilitate the recovery of native animal populations by undertaking large scale, continuous fox baiting using buried Foxoff baits across 100,000ha of State Forest and National Park in far south-west Victoria.

A significant component of Glenelg Ark is the monitoring and evaluation of the program. This is aimed at measuring the response of foxes to control actions and a range on native species that are currently at risk from fox predation. The outcomes of the monitoring and evaluation program will enable policy makers, and the community to assess the success and future direction of Glenelg Ark.

To ensure ongoing government commitment and community support for Glenelg Ark, its benefits to Victoria's biodiversity must be demonstrated in an unequivocal manner. To this end, we contrast fox activity and changes in site occupancy of key prey species between selected areas. Here we focus on the response of native species.

While a range of native species are likely to benefit from the intensive suppression of fox activity associated with Glenelg Ark, the long-nosed potoroo (*Potorous tridactylus*), southern brown bandicoot *(Isoodon obesulus*), and common brush-tail possum (*Trichosuros vulpecula*) have been selected for monitoring. The change in site occupancy of these mammals will be monitored annually at 40 monitoring stations established within each of three paired fox baited and unbaited areas. At each monitoring station, 9 hair-tubes will be set and checked daily for four consecutive days. This monitoring occurred once a year.

The phrase 'occupancy' is used here to mean the proportion of monitoring stations (both baited and unbaited) that contain the target species at a given point in time. The fundamental reason for this proposal involves the identified information requirements, efficiency and expense.

Each of the monitoring areas could exhibit a different trend in occupancy over time. A response to fox control should result in the average trend in occupancy at baited areas being greater than the average trend at unbaited areas. The difference in the average trend (DAT) between baited and unbaited areas will be used to quantify the response of medium-sized mammals to the fox control program.

Unless monitoring and evaluation are recurrent components of management, management will have no capacity to a) justify reinvestment of scarce public conservation funds, b) improve management actions based on reliable information about the effectiveness of previous management actions, and c) maintain community support. Thus, monitoring and evaluation is a part of management not an imposition or adjunct to it.

Notes

1080 ALTERNATIVES IN TASMANIA - BAITING STRATEGIES

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ABSTRACT:

In Tasmania, ground laid 1080 poison is used in carrot for the control of the native species Bennett's wallaby, Tasmanian pademelon and brushtail possum in both forestry and agricultural areas. Public opposition to use of this material on native animals and the perceived effects on non target species lead the then Federal Government to promise funding to assist in development of alternatives to 1080 in the 2004 election campaign.

This project was designed to develop more species specific baiting strategies with the aim of utilizing either Feratox® (encapsulated cyanide) or fertility control agents.

A number of commercially available and experimental New Zealand bait feeders, filled with commercial wallaby pellets were trialed in a compound containing breeding colonies of both Bennett's wallaby and Tasmanian pademelons. The behaviour of animals at the feeders was monitored with infra red activated still and video cameras. On the basis of capacity and minimal spillage in the compound the 'Kilmore' feeder was selected for field trials. This feeder can contain up to 1.5 kg of feed and a number of either Feratox®, fertility control or other toxic compounds in pellet form could be included.

Initial field trials were conducted in areas where populations of bettongs and potoroos were known to occur. Potoroos and bandicoots were excluded from feeding with a feeder height of 450 mm. Bettongs were able to jump, hold the feeder lip and feed at up to 600 mm, close to the limit at which pademelons can access the feed. Addition of a spring loaded door didn't reduce pademelon or Bennett's wallaby feeding but should prevent bettong access (still to be tested). Analysis of over 20,000 photos or video clips containing animal images have shown no birds feeding. Wombats have attempted to feed but are not able to access the feed. Tasmanian devils and quolls have been photographed in the vicinity of the feeders but none have attempted to feed.

In a wildlife park both forester kangaroos and fallow deer quickly located the feeders and were able to feed from them, but in field trials with wild populations neither species showed any interest in the feeders despite abundant numbers being present.

Using this bait feeder with set height restrictions should minimise the chance of non target species accessing toxins.

Notes

CANE TOAD HUSBANDRY

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ABSTRACT:

Our group has been studying the Cane toad (*Bufo marinus*) since 2001 with the goal of developing a biological form of control for this invasive species. An integral part of this has been the establishment and development of a captive cane toad colony and the breeding of cane toads in captivity. Cane toads were sourced from wild populations in Northern Queensland and relocated to our laboratories in Canberra ACT.

Toads in our colony have never been observed to amplex or lay eggs without hormonal stimulation. Selected toads are stimulated to breed by the injection of a gonadatrophin analogue with amplexus occurring about 18-20 hours post injection of the female. A successful breed is dependent on several conditions including not disturbing the toads post induction, provision of a suitable environment for them to deposit eggs and the timing of induction of the male and female.

Even under favorable conditions females toads do not deposit all the eggs they have produced with up to 50 % being retained after a successful breed. Egg numbers and the viability of the eggs also vary widely. Females lay on average 19, 500 eggs of which about 50 % hatch within 72-96 hours. The females undergo an average 22% decrease in body weight during amplexus. Density of the eggs is a key determinant of the eggs viability and hatching rates.

Tadpoles take between 55 and 65 days to metamorphose into toadlets but metamorphosis rates are dependent on a range of factors including tadpole density, water temperature and frequency of water changes.

Data from our captive breeding suggests that toads have a low survival rate in the wild and that only a small number of tadpoles survive through to metamorphs.

These observations may provide an explanation as to why toads lay large numbers of eggs but suggests the greatest risk is from toads producing smaller clutches of eggs as these have higher fertility and survival rates and may result in higher recruitment rate

Notes

PREFEEDING POSSUMS: AVERSION AND SEARCH IMAGE EFFECTS

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ABSTRACT:

In New Zealand prefeeding (free-feeding) is routinely used to increase the effectiveness of possum control operations, however the specific mechanisms of how prefeeding works is not well understood. Prefeeding can potentially increase kill by (1) increasing the amount of toxic bait eaten by reducing any aversion to a novel bait, and (2) by changing the search image of the target animal so they more easily find a toxic bait. It is likely that both mechanisms are important. Additionally, if prefeeding has these effects, how long do they persist before any benefits are lost? We used pen trials to test if prefeeding increased bait consumption on subsequent exposure, and how long such an effect might last, and field trials to assess if possums changed their search image in response to localised application of prefeed bait. Pen trial results indicated that possums responded positively to a prefeed effect for at least 4 weeks (the maximum time tested), and even 3 weeks after all prefeed was eaten in the field, possums still spent significantly more time searching where the prefeed had been than they did prior to the application of prefeed bait. These results indicate that prefeeding has a positive effect, both in terms of bait consumption and search image, and that there is no urgency for toxic bait to be applied soon after the prefeed has been consumed.

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