Cane Toad Control Research Forum Program

Sky City Casino - Darwin

FRIDAY 13 JUNE 2008

Welcome

08:10 Prof. Tony Peacock: What is the Cane Toad Advisory Group? Setting the Scene

Prospects for Control – Cane Toad Science; Facilitator Kate Andrews

09:55-10:20 MORNING TEA

Prospects for Control – Community Based Cane Toad Control Activities; Facilitator Kate Andrews

11:15 ***Where to From Here? Facilitated Discussion – Kate Andrews***

01:15 Wrap Up

01:30 LIGHT LUNCH ~ SKY CITY CASINO

Disclaimer:

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 The contents are not peer reviewed and apart from lay-out changes, have been printed as received from submitting authors.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

CANE TOAD FORUM ABSTRACTS

(IN ORDER OF PRESENTATION)

CANE TOAD TOXINS: FACT FROM FICTION

Robert Capon[1] and Andrew Hayes[1]

[1]University of Queensland, Institute for Molecular Bioscience, Brisbane, Qld

ABSTRACT:

Cane toads (*Bufo marinus*) deploy toxic secretions from their parotoid gland in a defensive response to deter predators. Ingestion of these can be lethal to Australian native predators, such as quolls, lizards and snakes. As the cane toad invasion front moves across northern Australia naïve predator species will be confronted by and many individuals will succumb to cane toads toxins. The toxicity of cane toads, and their impact on predatory species (arguably) represents the single most significant environmental impact of this invasive species.

That *Bufo* parotoid secretions are toxic has been known for many years. Indeed, the chemical composition of these secretions has been studied and a number of hallucinogenic alkaloids and cardioactive steroids (bufadienolides) have been isolated and identified from different *Bufo* species, including *Bufo marinus*. Dried preparations of selective *Bufo* secretions can be purchased as the Traditional Chinese Medicine Ch'an su. – as a topical anaesthetic and aphrodisiac – while certain toad alkaloids are proscribed by law as substances of abuse. Bufotenine, for example, is listed by the US FDA a Schedule 1 drug, along with GHB, cannabis, heroin, Ecstacy and LSD.

Despite a direct link between toxic secretions and ecological impact, the chemical composition, variability and relative/absolute toxicity of Australian cane toad toxins has not been described. For the most part Australian cane toad researchers (the public and the media) have uncritically accepted the dogma associated with cane toad toxins – attributing the toad almost legendary powers to kill all in their path, poison waterways and more...

We have reviewed the available literature, developed and implemented independent analytical protocols and methodologies, to carry out chemical analyses using state-of-the-art instrumentation, to challenge our central hypothesis that;

"Detailed knowledge of the molecular story behind cane toad toxins, embracing ecological relevance to the cane toad and impact on other species, is critical to understanding and potentially controlling cane toads in Australia."

This presentation provides a brief analysis of some of our observations made over the course of a two year study, concentrating on; cane toad toxin composition and ecological significance as well as cane toad toxin distribution and developmental significance.

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FUTURE OPTIONS FOR THE CONTROL OF CANE TOADS

Jackie Pallister[1], Damien Halliday[2], Tony Robinson[2], Thayalini Shanmuganathan[2], Chris. Hardy[2], Daryl Venables[2], Rhonda Voysey[1], Lyn Hinds[2], Andy Sheppard[2], Tanya Strive[2] and Alex Hyatt[1]

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[2] CSIRO Entomology, Black Mountain Laboratories, Clunies Ross Street, Black Mountain, Acton ACT 2601.

ABSTRACT:

Over the past six years we have explored a strategy for the trans-continental reduction of cane toads via the use of an infectious recombinant virus. In this immune approach to cane toad biocontrol, tadpoles are exposed to cane toad genes that are normally expressed later in development in an attempt to induce an autoimmune response that interferes with normal development. Assessment of this approach is currently being finalised with the delivery to tadpoles of two proteins involved in gut development – gastrokine and trefoil factor.

If the above strategy is successful then we intend to pursue it further. However we also recognise the importance of identifying and pursuing other biocontrol options, some of which will involve and build upon technologies developed in the current project. These strategies are aimed at either trans-continental and/or local control, are high risk and require long term investment with no guarantee of success. The options we have identified are (a) search for a species specific pathogen, (b) RNAi technology and (c) exploitation of the unique properties of toad Na^+ K^+ ATPase.

Search for a species specific pathogen(s). To date the only examples of species-specific pathogens used successfully as biocontrol agents for vertebrate pests are myxoma virus and rabbit haemorrhagic disease (RHD) virus. Both of these viruses were discovered serendipitously. There is currently no known pathogen specific for cane toads and the probability of discovering one must be low.

RNAi. A process that has only very recently been discovered in plant and animal cells is RNA interference (RNAi). RNAi involves a cellular pathway that is activated in response to double stranded RNA and leads to sequence specific degradation of messenger RNA. This in turn disrupts protein production. Some of the advantages of this technology are that it does not depend on an immune response and very small regions of a gene may be targeted so that the targeting may be highly specific. This technology has the potential for delivery on a local scale initially followed by development of transcontinental delivery by an infectious agent.

Exploiting Na^+ K^+ ATPase in toads. This enzyme is involved in ion transport across membranes and is a target for the *Bufo* toxin. However, cane toads are resistant to their own toxin and this seems to be due to some cane toad specific changes in the cane toad Na^+ K^+ ATPase. These cane toad specific regions of the Na^+ K^+ ATPase may be potential targets for chemical inhibition, or inhibition by RNAi. Identification of a successful biocontrol strategy for the trans-continental and local reduction of cane toads in Australia will require major funding of multiple research programs such as those listed above.

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FIRST, UNDERSTAND YOUR ENEMY: AN ECOLOGICALLY-BASED APPROACH TO TOAD CONTROL

Richard Shine

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ABSTRACT:

The rate at which cane toads are spreading through tropical Australia has not been slowed by any of the methods so far employed to control them, despite enormous financial expenditure and an extraordinary volunteer effort by community groups. No other current approaches are likely to succeed in toad control, especially within a realistic timeframe. Ideas about genetically manipulating viruses to attack toads cannot work; even if major technical obstacles could be overcome, the inadvertent spread of such a virus to other continents would be disastrous. In summary: the old ideas are not working, and we urgently need new approaches to reduce the ecological impact of cane toads in Australia.

Remarkably, previous attempts at toad control have been based on very scanty information about the biology of cane toads - especially, of cane toads at the invasion front. The reason was simple: we knew very little about these troublesome invaders. Extensive research over the last few years by the University of Sydney, in collaboration with researchers from a range of institutions in Australia and elsewhere, has changed that situation. We now have a firm empirical basis from which to develop novel approaches to toad control. Although Team Bufo's research effort has not been targeted specifically at toad control, we have discovered a wide range of biological attributes of toads that render them vulnerable to new forms of control; and just as importantly, we now understand the ecological and microevolutionary impact of cane toads well enough that we can sensibly plan how to mitigate those impacts.

In this talk I will bring together new information on a wide range of topics in toad biology (including microevolutionary and physiological consequences of the invasion process, toad endocrinology and immunocompetence, toad-specific pheromonal communication systems, life-history plasticity, spawning-site selection criteria, cannibalism, sexual conflict, host-parasite history and the effects of parasitism), and on the impacts of cane toads on a complex tropical fauna. Based on those data, I will propose a novel approach to toad control, and to reducing the ecological impact of cane toads in Australia. The methods I will suggest are simple, and confer much less risk to the native fauna than does the current toad invasion or alternative control methods based on genetic manipulation. Importantly, these new ecologically-based methods to reduce toad numbers and toad impact are ideally suited to implementation by community groups.

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ENHANCING TRAPPING WITH TOAD ATTRACTANTS

Lin Schwarzkopf, Jen Davis and Ross Alford

School of Marine and Tropical Biology, James Cook University, Townsville, QLD 4811

ABSTRACT:

At present there are no highly effective mechanisms for reducing cane toad densities. Trapping may be used as a medium-term mechanism to reduce densities, but trapping is only moderately effective, removing only a small proportion of available toads. We experimentally examined the effectiveness of lights and cane toad calls (normal and enhanced) as attractants for toads. Toads were repelled by all types of light used in an experimental Y-maze, indicating that toad attraction to traps with lights is likely to be to insects attracted by lights, rather than to the lights themselves. Toads were attracted to toad calls, and the attractiveness of manipulated calls varied. Adding unmanipulated calls to traps in the field tripled their effectiveness. Adding manipulated calls to traps in the field may significantly enhance to effectiveness of toad trapping programs

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LUNGWORM (*RHABDIAS CF HYLEA*) IN CANE TOADS AT THE FRONTLINE

Jordy Groffen

INHOLLAND University, PO Box 1188, Kununurra, WA, 6743

ABSTRACT:

Cane toads and native frogs in Queensland have been impacted by the lungworm *Rhabdias cf Hylea* but there has been insufficient research on whether this lungworm is present in cane toads (or native frogs) at the colonising cane toad front lines. My research indicates that little parasite research has been undertaken in colonising cane toad front lines and that there has been little or no DNA comparative research on parasites from South American cane toads, and those currently being found in cane toads breeding in Australia. This would indicate that current research cannot answer the question whether or not the lungworm *Rhabdias cf Hylea* is endemic in South America.

In my research I found that *Rhabdias cf Hylea* is in cane toads, which are only 80 km behind the frontlines. If we could confirm that the native frog species responsible for passing on this lungworm were also present at these frontline areas, there is the possibility we could deliver infected toads into these areas without adverse impacts on native frog species. This would significantly hasten the adverse impacts of *Rhabdias cf Hylea* on colonising cane toads and could result in reduction in numbers and resilience of toads at the colonising front lines, making *Rhabdias cf Hylea* one weapon in the fight against the cane toads' invasion of Australia.

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KIMBERLEY TOAD BUSTERS VOLUNTEERING

Sandra Boulter

Kimberley Toad Busters PO Box 1188 Kununurra, Western Australia, 6743; Sandra Boulter 88 Winthrop Avenue, Nedlands, sandraboulter@westnet.com.au

ABSTRACT:

Over 2,000 Kununurra based registered Kimberley Toad Buster volunteers are now enjoying their third year of weekly hunting and gathering of cane toads, over 200,000 sq kms, as a way of life. They are working hard to save our native Australian species from extinction by cane toads and our ecosystems from further disruption. The KTBs have caught, weighed, measured and recorded, and killed and buried over 245,000 adult cane toads; and countless millions of tadpoles and metamorphs. This equates to over 98,000 kgs of cane toad biomass out of our already threatened precious NT desert wetlands. This volunteer effort has been aided by private donations, Lotterywest and the federal (and more recently the WA State) government. As at April 2008, KTB toadbusting comprises around 455,970 of recorded volunteer field hours. If support and administration hours are included these volunteer hours are probably closer to 950,000 volunteer hours for the KTBs in the public interest. At a conservative value of $20 an hour, this equates to $19,000,000.

The Kimberley Toad Buster are unique in environmental campaign history in Australia, if not the world, simply because of their numbers, the scale of the campaign arena, the harshness of the terrain and weather conditions in which they toadbust, and the sustained endurability of their campaign. Why is this? What keeps them going and growing in number and stature? What motivates our volunteers to toadbust in the public interest? How exactly to they go about toadbusting? This presentation will describe the knowledge gained, the records kept and the outcomes of the KTB campaign and celebrate these most remarkable of volunteers through a presentation of graphic and telling photos, and video footage.

"IF EVERYONE WAS A TOAD BUSTER, THE TOADS WOULD BE BUSTED"

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CANE TOAD CONTROL IN WET - DRY TROPICAL SAVANNAHS

Graeme Sawyer[1], Ian Morris[2,] Adam Britton[3]

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ABSTRACT:

This project was designed as a follow up to previous cane toad control work, conducted by FrogWatch during 2005-06, which showed significant capture rates of cane toads using cane toads traps. Sawyer (2006) The project was an attempt to verify the outcomes of that previous work and an attempt to see if the results would transfer to other sites in different habitats.

The project included toe clipping and trapping in a number of sub habitat types across the savannah woodlands.

The talk will present the findings from the research and look at some of the implications for possible management and control strategies.

A toe clipping element was included in the project during which 1419 cane toads were toe clipped and released. An additional 13 recapture sessions were conducted and data recorded. Data was also recorded from the cane toad trapping activity that was continuous at the main site, Dam1.

Transect counts were conducted at 11 locations and trapping was conducted at 8 locations.

Results show that toads are much more sedentary than previously thought with recaptures as high as 80%, at the mark location, over the course of the 10 month toe clipping project. There is also evidence to support the idea cane toads have to refuge on water in the Dry season, which provides an opportunity to control their numbers.

References:

Sawyer (2006), Sawyer, G R, Morris, I.J, and Britton A, FrogWatch Trap Report in Molloy, K.L. and Henderson, W.R. (Eds) (2006). Science of Cane Toad Invasion and Control. Proceedings of the Invasive Animals CRC/CSIRO/Qld NRM&W Cane Toad Workshop, June 2006,

Brisbane. Invasive Animals Cooperative Research Centre, Canberra. ISBN 0-9775707-2-X\ August 2006 Invasive Animals CRC

Notes

BROADSCALE CANE TOAD CONTROL

Graeme Sawyer[1], **Russell Gueho**[2]

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ABSTRACT:

The Stop the Toad Foundation (STTF) has been involved in major projects trying to stop the westward movement of cane toads into WA. As a part of this work we have been involved in major on ground projects in the form of the Great ToadMuster in both 2006 and 2007. (Reports are on the website http://www.stopthetoad.org.au)

We have data from the two musters and some interesting comparisons relating to possible impacts of this type of work and the levels of input required to remove cane toads using volunteers to collect them.

We have also been working on trials of different types of fencing to assist in the cane toad control work. The report will cover our findings on the 3.6 km long Gregory's Tree Road cane toad deflection barrier and also on the exclusion fencing trials we ran as a part of the Muster in 2007.

The trials indicate we can completely eradicate toads from a location like the one in the muster in a week, with 93% of toads captured in 2 nights. This technique looks likely to dramatically improve our ability to remove cane toads from areas with big increases in the efficiency of toad removal when compared to hand collection and big decreases in the people resources required.

The talk will present the findings from the research and look at some of the implications for possible management and control strategy issues.

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TACTICS, TOOLS AND TECHNIQUES TO TACKLE THE TOAD

Susan Crocetti[1], Kerry Cooper[1] & Lisa Wellman[2]

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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.

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ADDITIONAL ABSTRACTS

TEMPORAL CHARACTERISTICS OF BENIGN ELECTRICAL STIMULATION OF CANE TOAD PARATOID GLANDS TO RELEASE DERMAL SECRETIONS

Michael J. Tyler

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ABSTRACT:

Development of a technique of electrical stimulation of the skins of Australian frogs has permitted the collection of dermal secretions from dozens of species (Tyler et al. 1992). In the case of the Cane Toad the dermal secretions are localised into macroglands (sensu Duellman and Trueb 1986). Sequential photography of the paratoid glands demonstrates that secretion commences 5 seconds after application of the stimulator electrodes and attains maximum discharge after 25 seconds.

References:

Duellman, W.E. and Trueb, L. (1986). Biology of Amphibians. New York, McGraw-Hill Book Co.

Tyler, M.J., Stone, D.J.M. and Bowie, J.H. (1992). A novel method for the release and collection of dermal, glandular secretions from the skin of frogs. J. Pharmacol. Toxicol. Methods. 28(4):199 – 200.

Notes

INVASION OF CANE TOADS ASSOCIATES WITH A SIGNIFICANT INCREASE IN MORTALITY IN A NAÏVE AUSTRALIAN VARANID LIZARD

Beata Ujvari[1] and **Thomas Madsen**[1,2]

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ABSTRACT:

Human introduction of numerous exotic animal and plant species into the Australian continent has often had catastrophic effects on the indigenous fauna and flora. A fairly recent introduction was the release of the South American cane toad (*Bufo marinus*) into the sugar cane fields of Queensland in 1935. The cane toad is one of the most toxic bufonids and when seized and swallowed by naïve Australian predators the toxin will usually result in the demise of the attacker. One group of Australian squamate reptiles that has been suggested to be very susceptible to cane toad toxin is varanid lizards. Prior to the invasion of cane toads into our study area, situated in the Top End of the Northern Territory of Australia, annual mortality of adult male radio-tracked yellow-spotted goannas (*Varanus panoptes*) was very low (two deaths recorded among 20 lizards over three years). By contrast after the arrival of the toads in October 2005, all of radio-tracked goannas were found dead in August 2006 (nine out of nine lizards). Our results suggest that the vast majority, most likely > 90%, of the naïve adult male goannas will succumb when encountering cane toads. Such a significant increase in mortality will result in a substantial reduction in population genetic diversity that may further impede the long-term survival of these large carnivorous lizards.

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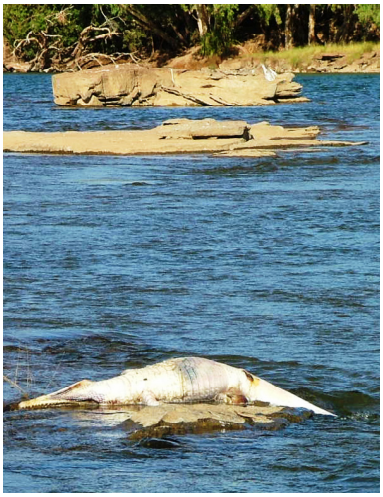
WILL THERE BE WILDLIFE AFTER CANE TOADS?

Sarah F Brett

Kimberley Toad Busters Inc., Kimberley Wildlife Rescue Inc. and Sarah Brett PO Box 1442 Kununurra, Western Australia, 6743, kimberleyvet4@westnet.com.au; Kimberley Toad Busters PO Box 1188 Kununurra, Western Australia, 6743

ABSTRACT:

There has been much publicity about the impending arrival of the cane toad in Western Australia. What does this really mean for the wildlife in our state? Many people are unaware of the huge impact the cane toad will have on our environment, or the reasons we are trying to prevent this declared pest from reaching our beautiful state. Cane toads pose a devastating threat to our wildlife, as EVERY stage of its lifecycle is toxic to anything that eats it. Cane toad eggs, tadpoles, metamorphs (baby toads) and adult toads are all poisonous when eaten, be it by a reptile, bird or a mammal.



The impact of the cane toad is a multilayered one, and there will be many indirect effects of their arrival. Cane toads consume a huge quantity of food from the biomass, and result in starvation of many native creatures. They compete for refuge, shelter and breeding sites in the environment, and displace wildlife from their natural habitat. Our wildlife is already in a perilous state due to the environmental destruction caused by frequent fires, habitat clearing and predation by feral cats. The arrival of the cane toad will have a profound and fatal effect on our wildlife unless we act now to educate everyone of their potential impact.

"IF EVERYONE WAS A TOAD BUSTER, THE TOADS WOULD BE BUSTED"

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THE IMPACT OF THE CANE TOAD (BUFO MARINUS) ON THE SMALL REPTILE FAUNA OF THE KIMBERLEY REGION

Lyall Grieve

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ABSTRACT:

This study is a Masters project conducted through Macquarie University Sydney, with the assistance of Kimberley Specialists in Research Inc and the Kimberley Toad Busters Inc volunteers. The project aims to determine the impacts, which Bufo marinus may have on the small reptile fauna of the Kimberley region, focusing on the Western Australian border region and the frontline toad migration. Using a presence/absence study design of trapping and sampling, a species composition and abundance investigation is underway in areas inhabited by toads, and similar habitats toads have not yet reached. Gut contents of Cane Toads are being analysed in order to infer what composition of prey items are consumed. This research may indicate a combination of competition and predation effects on the fauna of the same habitat and size range. The results of this study will help understand the interactions and impacts this invasive species will have on the Kimberley reptile communities. In conjunction with the research into the impacts of the Cane Toad, trapping and visual observations of various localities within the region are underway to further understand the seasonal variations, distributions and species inventories of remote Kimberley ecosystems .

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