

Battlelines drawn against the cane toad march

Cane toads have been in the spotlight again due to their alarming advance into Kakadu National Park, where they are expected to threaten native species including the dwindling northern quoll.

Sheila Lunter reports that experts recently met to up-the-ante on fight-back measures, including a potential genetic control being developed by CSIRO.

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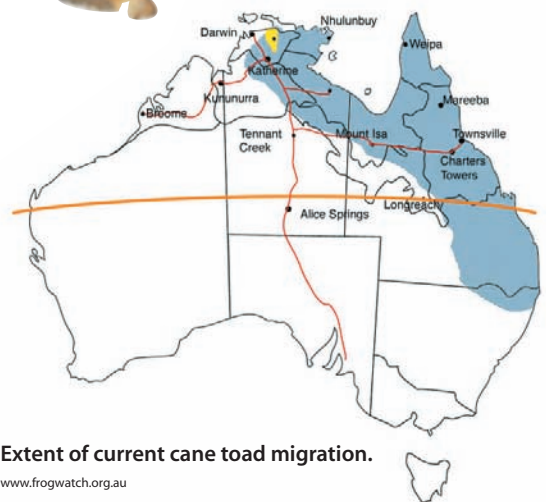
While the cane toad chorus rises in volume as the front advances on Darwin, Australia's foremost experts in cane toad research were meeting during March in Brisbane to discuss current research priorities in cane toad control. The workshop, funded by the Australian Government Department of the Environment and Heritage (DEH) through the Natural Heritage Trust, focused on progress made in a biological control project being undertaken by CSIRO. Ecologists, herpetologists, virologists and conservationists joined DEH policy-makers and state government representatives from New South Wales, Queensland and the Northern Territory.

Cane toads are seen as a major threat to biodiversity, not only because they voraciously out-compete some native species for food and consume others, but also because their skin toxins are thought to kill carnivorous predators which mistake them for local amphibians. Although the impact of cane toads on native Australian species is perceived to be detrimental, most reports so far are anecdotal, a fact recognised at the workshop by a number of ecologists. Gradually, however, more quantitative data on the impacts of native species are becoming available to greatly assist in confirming the toad's effects.

This native death adder was found dead after attempting to devour a cane toad.



Courtesy of Anne Ferguson



Extent of current cane toad migration.

www.frogwatch.org.au

Quantifying risks to native species

While, for example, native frog populations in Queensland appear to be reasonably stable at the moment, there is actually no means of assessing the true number of species lost since the spread of cane toads because there is no data on the diversity of Queensland's frog populations before their arrival. The situation with frogs is characteristic of other native animal populations.

Another species that appears to be badly affected by the arrival of the toads are quolls. According to anecdotal evidence from both Queensland and the Northern Territory, they have alarmingly declined to extinction levels within 12 months of the cane toads arriving. The Northern Territory Government is taking

action, under a project called Island Arks (see box), to protect quolls from cane toads by moving populations to islands off the coast.

Further species impact studies are now under way in the Northern Territory. Over the past three years, for example, ecologists have been gathering data on goanna and freshwater crocodile abundance in the Daly River.

The goannas studied include three monitor lizards; *Varanus mertensi*, *Varanus mitchelli* and *Varanus panoptes*, as well as *Crocodylus johnstoni*, a freshwater crocodile.

Sean Doody, a post-doctoral fellow with the University of Canberra says 'The latest reports indicate that the cane toads have now hit our monitoring sites, so I expect that when we do our next field trip later this year we will get a greater insight into how the toads impact the goannas and crocodiles in the area.'



CSIRO Sustainable Ecosystems

Other 'before and after' research includes a project on water pythons, for which data have been gathered over the last 20 years in the Northern Territory. Rick Shine, Professor in Evolutionary Biology at the University of Sydney, says that 'about 20 years ago we started an ecological project at Fogg Dam on water pythons that has since expanded to all of the other snakes in the area. We are looking at the ecological impacts of cane toads on what happens when the toads hit Fogg Dam'. An analysis on the distribution and preferred diet of Australian snakes suggests that it is likely that 49 species are at risk from the invasion of the cane toad.

Scientists from the University of Queensland are gathering data from 'toad poles' – listening devices for frog calls – in another project in the Northern Territory. Gordon Grigg, Professor of Zoology at the University of Queensland explains that six stations are based in Kakadu and ten, in pairs, between Mataranka and Roper Bar. 'When we started in 1996 there had been only anecdotal reports of the effects of cane toads on fauna, so we thought to try to gain some objective data. Over the last six years we have found that the number of frog species calling has declined with the arrival of toads, but we cannot yet be sure whether or not it is a direct consequence of the toads. We have good baseline data from our six sites in Kakadu, where the toads are

Where the problem began

Cane toads, originally from Venezuela, established in Australia in 1935 after an innocuous release of just over a hundred individuals at Gordonvale, north Queensland, by the Bureau of Sugar Experiment Stations to control the greyback cane beetle and French's cane beetle. The toads did little to control the insects, but became pests themselves, proliferating in the warm Australian environment, and with no natural predators, spreading south and

west across the continent, impacting local species and ecosystems with their voracious appetites and toxic skins.

Australia is not the only country working on cane toad controls; a number of countries in the Asia-Pacific region also introduced cane toads in an attempt to control insects. In Fiji, for example, a new project is about to begin in an attempt to eradicate the toads from a small island where they threaten the native Fijian ground frog.

just this past wet season engulfing our monitoring sites, so we'll get data from another invasion there.'

New control challenges

While it is expected that these studies will provide a much better picture of the impact of cane toads on native species in the short term, there are only limited options currently available for sustained cane toad control. Local volunteers, for example, unite under control program initiatives to collect cane toads, but can only target small areas, and such exercises need to be repeated on a regular basis. Similarly, the Northern Territory's Island Ark program is mainly focused on the removal of threatened species to safe havens, and on public education. A control method that can address the spread of cane toads on a national scale is urgently needed, and the search is narrowing on solutions through diseases and biotechnology.

Researchers from James Cook University investigated possible controls from 1987 to 1989, focusing on diseases in Australia that could affect cane toads, but they were unable to find anything that could be used as a control for cane toads. From 1989 to 1994 research focused on the original habitat of the cane toad, Venezuela, and looked at local diseases in South America that had a potential for use in Australia. But the viruses tested killed one species of Australian amphibian and were found to be unsuitable for cane toad control. In 2001 CSIRO commenced a project that is investigating the possibility of creating a biological control from a native amphibian virus which can interfere with metamorphosis of the cane toad.

The first goal of the research is to identify and manipulate a critical toad gene to disrupt development.

Cane toads established in Australia in 1935 after an innocuous release of just over a hundred individuals at Gordonvale.



David McLennaghan CSIRO

CSIRO researchers hope that they have found a way to stop cane tadpoles becoming toadlets.

There is the added question of whether the benefits of the control method in Australia would outweigh the risk of the demise of the cane toad in Venezuela.

It is expected that if the altered gene is expressed early in the tadpole stage, it will be seen as a foreign body, initiating an immune response, halting metamorphosis, and preventing the tadpole from maturing and then reproducing. The second goal is to develop a way of delivering the gene effectively to the toad's genetics, using a viral infection.

Researchers have chosen an existing native amphibian ranavirus that may be able to act as a genetic 'taxi'. This virus needs to be weakened (attenuated) in order to specifically infect the toads, without causing mortality in other native amphibian species and fish.

Work is progressing well, but although the chosen ranavirus occurs in Australia naturally, a lack of information about it needs to be remedied by targeted research before it can be considered a genuine control candidate.



David McClenaghan CSIRO

High fecundity and frequent reproduction mean the cane toad population has exploded in the tropical north.

About the Island Arks

The Island Arks program has been set up by the Northern Territory Government to assist the conservation of native fauna threatened by cane toads.

The program includes:

- captive breeding of selected species at the Territory Wildlife Park;
- translocation of populations of selected threatened species – particularly the northern quoll – to islands just off Arnhem Land.
- informing Indigenous owners of the ecological value of their islands and working with them to maintain these values long-term;
- assisting the development of Indigenous Ranger Programs to manage these areas for conservation;
- establishing agreements with traditional land owners for long-term conservation assisting with

procedures for guaranteeing biosecurity of islands; and

- a cane toad awareness campaign for the general and urban public.

In particular the translocation of 65 quolls in 2003 has been highlighted in the media. Follow-up trapping surveys show that the quolls are thriving in their new habitat and have proven to be good travellers. The quolls have maintained their weight and condition and have bred. The next step will be to assess if these young go on to survive and produce a self-sustaining population.

The project has stimulated much interest among Indigenous land owners by making their islands available to be used as refuges and contributing to on-ground work. It has led to further collaborative work between scientists and Indigenous land owners on other conservation projects.



Ian Morris

Keen for freedom and to investigate its new home, a northern quoll leaps out of the bag, released by Martin Armstrong. As quolls are nocturnal they were released at sunset to reduce stress.

Comprehensive research approaches

Dr Alex Hyatt, senior researcher for the CSIRO biocontrol project, acknowledges, 'There is a need for a lot more work to be done on the ranavirus by various experts, so that we gain a better understanding of it and we can better gauge how an attenuated version might function amongst cane toad populations.'

The weakened virus is currently being tested under laboratory conditions on some native frog species, but researchers still also need to know how successful the attenuation is, how well it disseminates and at what temperatures it is most effective, how species-specific the selected genes are, and what effect the modified virus might have on native amphibians and fish.

There is a risk, too, of the modified virus escaping to the native habitat of the cane toad in South America, which has the obvious potential of wiping out the 'useful' species in its original habitat. Currently, it is unknown whether or not this risk is a real probability, but if it is soon quantifiable, there is the added question of whether the benefits of the control method in Australia would outweigh the risk of the demise of the cane toad in Venezuela. These questions cannot be answered without further input from scientists and the community in South America.

In Brisbane, the recent workshop provided an important opportunity for experts to identify the research priorities. These included a risk assessment of cane toad impact; more research on ecological, economical and social impact of the toads on native fauna and communities – in particular Indigenous communities; and the need for implementing short- and long-term control projects (biological, mechanical and chemical). Most importantly, participants recommended that a national cane toad task force be formed to ensure that research is complementary, and that a national public awareness campaign be instigated.

In Kakadu, while yet another toad croaks its love song into one of the toad poles' receptors, experts hope the promise of a new genetic control means it may soon be a swan song.

More information:

Ranavirus control program: <http://www.deh.gov.au/biodiversity/invasive/ferals/canetoad/term-3.html>

<http://www.csiro.au/canetoads>

<http://www.austmus.gov.au/factsheets/canetoad.htm>

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