Preparing for battle with

Bufo marinus

Scientists are leaving no stone unturned in their quest to combat the cane toad. **Bryony Bennett** outlines the multi-pronged approach.

As the cane toad makes its way north, south and west across Australia's roads and rivers, scientists are working on the problem of what, if anything, can be done about this notorious invader. The two main avenues of study involve assessing the toad's impact on native fauna and searching for a biological control.

With hardly an obstacle in its path, the cane toad (*Bufo marinus*) is spreading across northern Australia at an average rate of 30 kilometres a year. In 1995, the toad reached the tip of Cape York and it has also extended to the Roper River in the vicinity of Roper Bar in the Northern Territory. Scientists fear it may reach Katherine, the edge of Stage 3 of the Kakadu wetland system, in three to four years. In addition to this natural rate of spread, concerns have been raised over the accidental transport of toads through the territory via commercial, recreational and military vehicles.

On the southern front there is movement too. New South Wales Parks and Wildlife staff at Port Macquarie have confirmed that more than 40 cane toads have been collected in and around the town. The size range of their specimens indicates that the area supports breeding populations. Port Macquarie is well over 100 km south of the toad's previously known distribution in NSW, raising suspicions of deliberate or accidental human assistance, rather than natural spread. Surveys will be conducted later in the year to determine whether the Port Macquarie population is isolated from, or contiguous with, other coastal populations.

In late June this year a healthy adult toad was caught at Paradise, a north-eastern suburb of Adelaide. That same month, an adult toad was found near Victor Harbour

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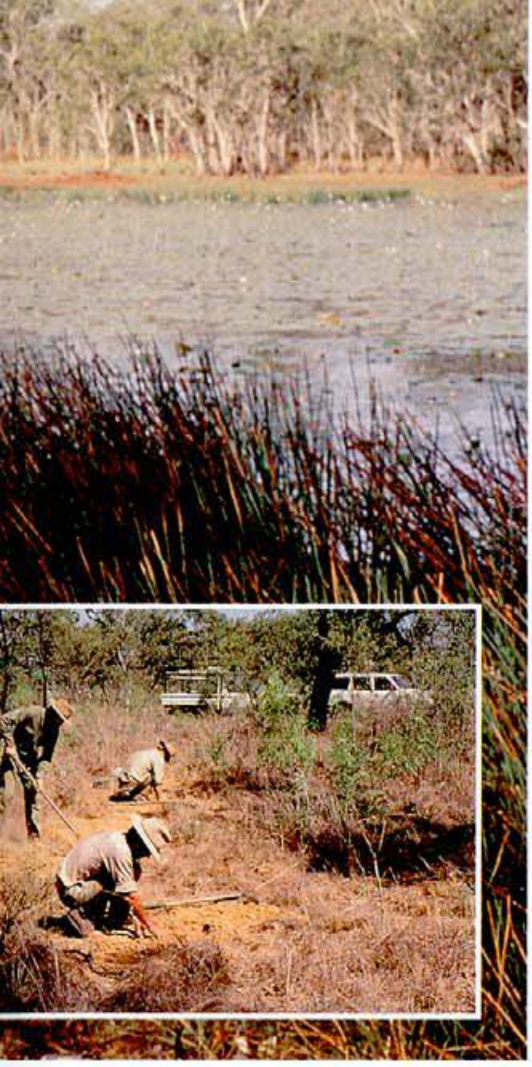


Main picture: Scientists use Elliott traps to sample small mammals beside a billabong at one of the three major cane toad study areas established last year in the Northern Territory.

Inset: Setting pitfall traps during the dry season to sample amphibians and reptiles.

in South Australia, close to an area claimed to have been deliberately infected with cane toads earlier this year. The Animal and Plant Control Commission of SA is continuing the search for other cane toads in these areas, trying to establish how they came to be there. The State Government has declared an amnesty to encourage the turning in of illegally-imported pet toads.

Cane toads can also be found at Geelong in Victoria but, fortunately for the local wildlife, they are safe behind locked doors. These toads are part of a project at CSIRO's Australian Animal Health Laboratory (AAHL) which is preparing to test seven viruses imported from Venezuela for their potential as biocontrol agents. The laboratory is Australia's national facility for exotic virus research.

A team led by Dr Alex Hyatt has spent the past 18 months characterising the viruses, comparing them with viruses known to exist in Australia, and devising tests for their detection. They have also developed special techniques and facilities for housing , holding, rearing, sampling and feeding the cane toads.

Hyatt says the research is time-consuming because it is the first time a virus has been sought to control an amphibian. 'Usually this kind of work is done for terrestrial organisms such as rabbits, for which the bio-control agent has already been identified,' he says. 'Our task is complicated because we have to identify a control agent and make sure that cane toads, and only cane toads, are susceptible to infection.'

A virus able to kill amphibians is known to exist in Australia, but its impact on wild populations is not substantial, Hyatt says. The Bohle iridovirus, which has been studied at CSIRO AAHL, and at Townsville's James Cook University, is known to affect fish species such as barramundi and a range of native frogs. 'Clearly, Bohle virus would not be suitable as a biological control agent,' Hyatt says.

This information is useful because it signals the need for a virus that is more potent, but which does not affect any animals other than cane toads. 'We have as much responsibility to reject unsuitable viruses as we have to identify potentially suitable ones,' Hyatt says.

Within the biocontainment facilities at AAHL, the team will test the seven viruses against adults, tadpoles and metamorph toads to see whether any have the potential either to kill large numbers of cane toads, or to render them more susceptible to environmental stresses. At the same time, they will assess whether the viruses remain virulent when grown in cell culture, or whether they must be maintained in the cane toads themselves.

Paradise abroad

Studies of the cane toad's ecology have revealed that, compared with the toad's home in South America, Australia really is a veritable paradise. Toad densities in a range of Australian habitats are 10 times greater, and mortality rates lower, than in their native environment.

These differences in adult mortality and population abundances are probably due to:

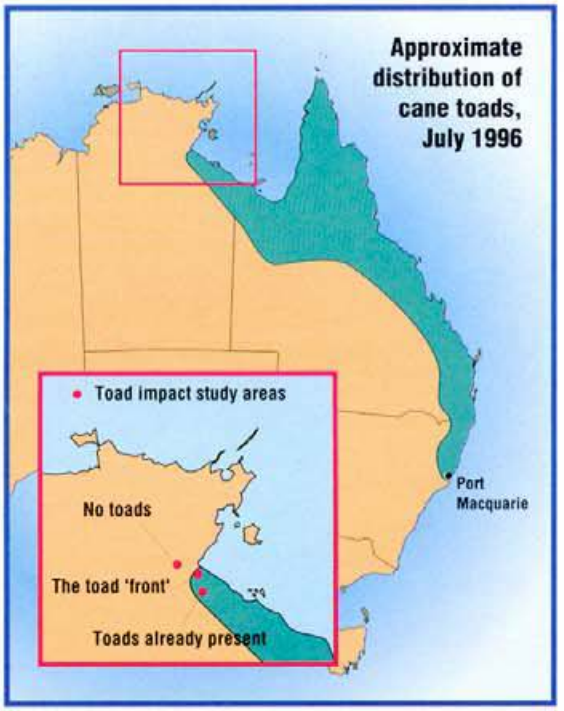
- the existence in South America of aquatic and terrestrial predators that have co-evolved and are immune to the toxins in cane toads;
- the heavier burdens of microparasites that occur in South American toads;
- shortfalls in the food available to toads (mainly ants and termites) that arise in some South American habitats may not arise in Australia; and
- the pathogenic influence of unidentified disease agents, and possibly ticks, which are not present in Australia.

To assess the potential cost, risks and benefits of a cane toad control program, a comprehensive picture of the toad's ecology and behaviour is needed. In Australia the toad is toxic to predators, probably competes with vertebrate insectivores for food, preys on native fauna, and could represent a potential vector for the transmission of disease to native fish and amphibians.

CSIRO's Division of Wildlife and Ecology has begun monitoring populations of native fauna at several sites in the Northern Territory that straddle the invasive front of toads. Follow-up surveys after the toad's arrival will reveal the major impacts of toads on native species.

In a project led by Peter Catling, three major study areas were established last July (1995) at 70 km intervals intersecting the cane toad 'front' which is moving westward along the Roper River. The field areas, located about a day's drive south of Darwin, were selected for their uniformity of habitat (eucalypt woodland, close to water and free from cattle grazing) and for their position in relation to the advancing cane toads.

The first and most eastern area has been inhabited by toads for six to eight years; the second area, when established, had not yet



been reached by the toads; and the third is not expected to be invaded for another two to three years. At each field area, five major survey sites, 1 km apart, have been established along a 5 km transect on the edge of billabongs.

Changes in the population of toads and native fauna at the sites are recorded twice a year by Catling's team: in the extreme heat of October-November, just before the onset of the wet season, and again in May, as the dry season begins. In addition, the toads are counted at night on a 100 m by 10 m plot along the edge of the billabongs. As many as 40 to 50 toads are recorded in each 100 m section of the most easterly study area.

A year into the project, Catling is able to confirm the toad's alarming rate of spread. By May of this year, they had 'swamped' the second field area, moving 30 km in one season, he says. The toads move furthest in the 'Wet', because this is when they breed.

'We are looking at changes in amphibian, reptile, bird, mammal and some insect populations,' Catling says. 'We have plenty of evidence that if snakes, goannas and some birds eat cane toads they will die, but in the long term it may be possible that some species will learn to leave the toads alone. We'll be doing comparisons of the population changes from each of the three areas to see whether this occurs.'

Another study, by CSIRO's Dr Brian Green, is assessing the extent to which toads compete for food with native frogs and lizards. At Shoalwater Bay in Queensland, a number of large enclosures have been constructed adjacent to permanent billabongs. All toads will be removed from half of these enclosures.

The body condition and food intake of native frogs, lizards and toads contained in all enclosures will then be compared to determine whether there is competition for food. The trial will also investigate what benefits might accrue to small native insectivores in the event that a successful biocontrol agent against toads is developed.

A novel approach to assessing the impact of cane toads on native frogs is being taken by Professor Gordon Grigg of the University of Queensland. He and his colleagues are planning to remotely identify the species and population density of frogs present at a number of field sites, before and after the arrival of toads, by computer analysis of the sound spectra of frog calls.

The remote recorders/analysers will be positioned in pairs along a transect across the expanding front of the toads over two to three years. Changes in the numbers of frog species calling and their densities will be monitored as the sites are invaded by toads.

In further research at the University of Queensland, Dr Craig Moritz is investigating genetic variation in Australian and South American cane toad populations. At least two distinct genetic strains of *Bufo marinus* have been isolated from South America. Australian toads are from an eastern strain and thus may be susceptible to apparently benign viruses carried by the other strain.

Other studies, at James Cook University, are assessing the toxicity of toad eggs and tadpoles to aquatic fauna.

Australian cane toad research has been funded for the past six years by the Federal Government and coordinated by CSIRO's Division of Wildlife and Ecology and the Cane Toad Research Advisory Committee. If further funding is provided, future work will include expanding the search for potential toad pathogens and broadscale screening of amphibians for viral antibodies, continued testing of pathogens against toads and native amphibians, and the extension of field studies of toad impact on native fauna.

Meanwhile, back at the lab, Alex Hyatt admits that the cane toad is not the easiest animal he's ever had to work with. 'The skins slough off and they urinate everywhere,' he says. 'I don't know whether you ever get fond of a cane toad.'

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Cane toads typically inhabit wet/dry savanna woodland.