"Together, create and apply solutions"

Community on-ground cane toad control in the Kimberley

A review conducted for the Hon. David Templeman MP, Minister for the Environment, Climate Change and Peel

Professor Tony Peacock, Chief Executive
Invasive Animals Cooperative ResearchCentre
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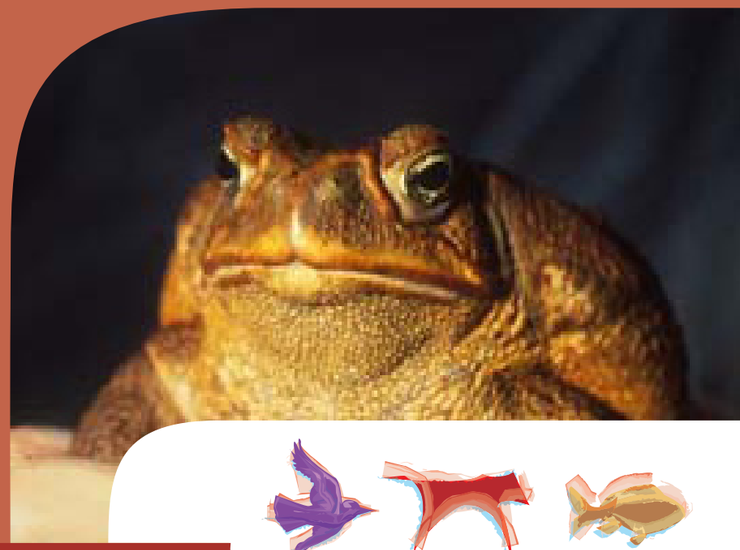
July 2007



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Department of Environment and Conservation

Invasive Animals CRC

A review conducted for the Hon. David Templeman MP
Minister for the Environment, Climate Change and Peel

By

Professor Tony Peacock

Chief Executive, Invasive Animals Cooperative Research Centre, University of Canberra

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Executive Summary and Key Recommendations

A large and passionate community movement in Western Australia commenced in 2005 to physically stop the cane toad from entering the State. This movement, principally carried out through the Perth-based Stop The Toad Foundation and the Kununurra-based Kimberley Toad Busters, has received funding from the governments of Western Australia and the Commonwealth and from donations. This review was commissioned to look at the success of these efforts and at the future of community on-ground control.

There is no evidence that physical removal of cane toads has slowed the invasion of toads towards WA. Toads have moved west at the same pace since community on-ground control began as before it, although the biomass of toads at the front has no doubt been diminished.

However, it may be too early to draw conclusions on aspects of physical removal and any cane toad 'solution' proposed by scientists is likely to require community effort. Therefore, it is recommended that the Minister should continue to support community effort on the basis that it can form part of an overall Australian Cane Toad Plan.

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The entry of cane toads into Western Australia and the consequent environmental impacts are issues of concern to all Australians. Indeed the unique environment of the Kimberley means that invasion of toads is of international conservation concern.

All Australian Governments have recently agreed upon an Australian Pest Animal Strategy (APAS) and are in the process of finalising a revised Australian Biosecurity System (AUSBIOSEC). The imminent entry of cane toads into Western Australia justifies a national, rather than simply a Western Australian, response.

The main finding of this report is that an overarching Australian Cane Toad Plan, under the auspices of the Australian Pest Animal Strategy is necessary and that on-ground community control in the Kimberley should contribute. Unfortunately, there are mismatches in timing, but it is suggested that the Western Australian Minister for the Environment could provide strong leadership to get an Australian Cane Toad Plan into place quickly.

Key recommendations

1) The Minister should seek agreement from his Federal and State counterparts to urgently develop an Australian Cane Toad Plan under the auspices of the Australian Pest Animal Strategy.

2) The Australian Cane Toad Plan should contain the following elements:
   a) Reducing the spread of the cane toad;
   b) Reducing the impact of the cane toad;
   c) Researching solutions; and
   d) Public education and awareness raising.

3) Support should be offered for KTB and STTF to participate in the overarching Australian Cane Toad Plan, on the basis that the community organisations are making a positive contribution to the plan. That support should comprise:
   a) Support for STTF's 2007 Great Cane Toad Muster, and if successful, the 2008 event; provided sufficient time is available for organisation;
   b) Support for KTB to continue to provide reconnaissance and intelligence on toad locations; providing samples for research studies and local removal at specific sites.

The community response to the cane toad invasion towards Western Australia is unprecedented. If community support for WA's biodiversity can be successfully harnessed to assist with an overall cane toad, there will be valuable lessons learnt that can be built upon.

Introduction

The cane toad (*Chaumus marinus*[1]) currently occupies about 1.2 million km^2 of the Australian continent and continues to increase its range westward and, possibly, southward. A recent study indicates that the possible future range of the toad in Australia could be 2.0 million km^2 (Urban et al, 2007).

In the northern part of their range, toads have steadily increased their rate of spread. Historically (1935-45), they invaded new areas at a rate of 10km per year but now they regularly achieve rates more than five times faster (around 55km per year).

The cane toad currently occupies about 1.2 million km^2 of the Australian continent…

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Toads now occupy a large proportion of the Victoria River District southwest of Darwin and are close to the Western Australian border. At the current rate of spread, the toad invasion is likely to spread into Western Australia in 2008, 2009 or 2010.

Since 2005 very significant public and private effort and expenditure has gone into holding the cane toad within its range in the Northern Territory and avoid its entrance into Western Australia. More than $15 million and tens of thousands of volunteer hours have been expended in this effort. On-ground control efforts have been organised by two community groups: the Kimberley Toad Busters (KTB) and the Stop The Toad Foundation (STTF) and by the Western Australian Department of Environment and Conservation. Funding has been provided by the governments of Western Australia and the Commonwealth, through public donations and by the volunteers themselves.

This report has been prepared for the Western Australian Minister for the Environment, Climate Change and Peel. Its purpose is to examine the success of community-led control programs, make recommendations on the future of such programs and suggest additional or alternative methods to reduce the impact of cane toads on Western Australia.

General comments and observations

The effort to halt the advance of the cane toad into Western Australia is unprecedented in history. Australia is one of the countries most affected by invasive species, so some of the

[1] Recently reclassified from *Bufo marinus*

most heroic attempts to reduce their spread have been in this country. Barrier fences have been put in place to limit the advance of larger invasive species such as dogs and rabbits, with mixed and limited success. Very small scale island eradications of cane toads have been attempted on Pacific Islands, again with mixed success.

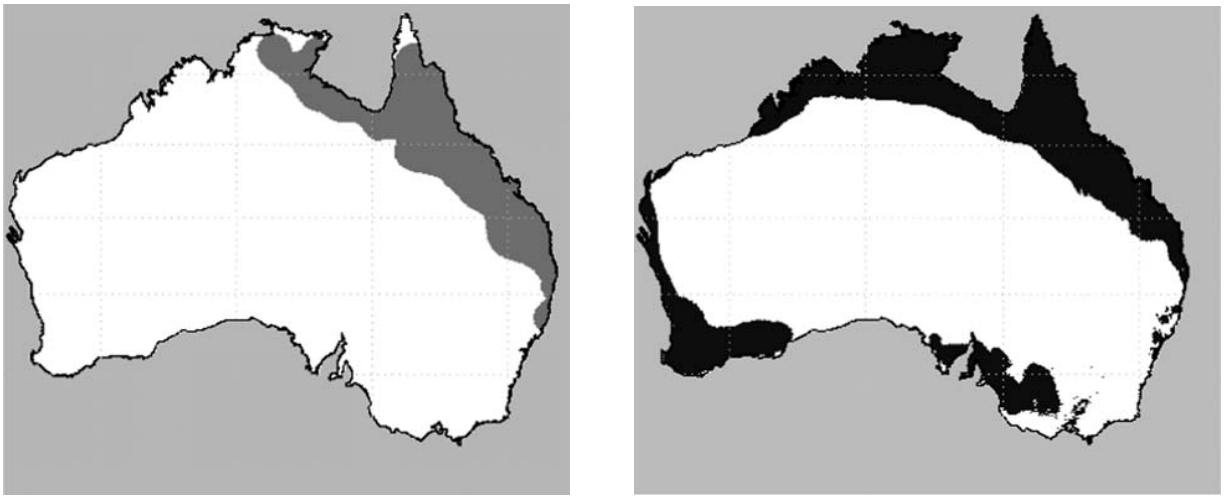

Figure 1. *Left*, The current (2007) distribution of cane toads in Australia, covering some 1.2 million km^2, and *right*, the potential distribution of 2.0 million km^2 (from Urban *et al* 2007).

…toads are likely to cross the Western Australian border during 2008 if the coming wet season is above average or 2010 if two "dry" wet seasons are experienced in the coming two years…

Before the current attempts to halt the toad's advance into Western Australia, there were simply no guides or examples available that could be used to predict the outcomes of such an effort. The most relevant example to provide hope that using community labour to physically remove toads to delay or halt the invasion came from the southern invasion front in Northern New South Wales. A decade of effort around Port Macquarie may have resulted in local eradication from that area (Crosetti, pers. comm., 2007). However, that example needs to have the major rider that the climate is to the advantage of control efforts as the toad is likely to be towards the southern limits of its "natural" range in Northern New South Wales and that they were satellite populations not contiguous with populations further to the north.

Therefore, the attempt to slow or halt the toad at its current front in the Northern Territory, commenced in 2005 is justified and its execution represents an extraordinary community movement. Those undertaking the effort are certainly not naïve in their efforts and understand fully the gigantic task they are attempting. Most express the opinion that they are slowing the invasion until science can provide better control options.

The evidence of the past two years indicate that physical removal of almost 200,000 adult toads and perhaps millions of tadpoles and metamorphs has not made any difference to speed and magnitude of the toad invasion. The facts are reasonably clear: toads spread about 50-80 km in 2005-2006, a year with a long wet season; toads spread about 20-40 km in 2006-2007, a year with a shorter, weak, wet season. The water flow across the regions the toads are covering is also relevant to the speed of spread.

The average spread of toads during the two years of community effort to physically remove toads is the same as it has been since toads entered the Northern Territory – about 50 km per year. The current rate of removal of toads is unlikely to affect the advance of cane toads into Western Australia. Under these circumstances, toads are likely to cross the Western Australian border during 2008 if the coming wet season is above average or 2010 if two "dry" wet seasons are experienced in the coming two years.

This prediction should not be used in any way to belittle the efforts of the community groups that have attempted to slow or halt the invasion. Nor should they be discouraged from continuing to fight for the biodiversity of the Kimberley region which they value so passionately. Any control effort for cane toads will almost certainly require community support and volunteers willing to undertake "toadbusting" should be strongly encouraged to continue to do so, but in different ways that utilise the ecological knowledge gained during the two years since they commenced their campaign.

It is recommended that elements of current activities remain, but that DEC takes a strong leadership role in development and implementation of an overarching Australian Cane Toad Plan through the newly established Australia Pest Animal Strategy.

Comments will be provided against specific terms of reference, followed by a general discussion on the elements an Australian Cane Toad Plan should include.

Addressing the Terms of Reference

Each of the Terms of Reference are now addressed specifically. The complete Terms of Reference are presented as Appendix 1.

1. ***The independent reviewers are to examine and comment on the likely outcomes of proposed State assisted cane toad work programs from the STTF and KTB in the Victoria River District in terms of reducing the severity of likely impacts of cane toads on Western Australia and in delaying the arrival of major cane toad populations into the State.***

   In particular the review is to investigate and report on, taking into account likely wet season scenarios, including 'average', 'poor' and 'wet', wet seasons for the next 3 to 5 years:

   a) the likely success of proposed operations by STTF to effectively eliminate or significantly reduce cane toad populations from key target areas and the prospects of continuing the protection of these key areas in the medium to longer term;

   b) evidence available to demonstrate that such actions are likely or unlikely to have an impact in reducing the rate of spread of cane toads towards Western Australia;

Figure 2. The barrier/deflection fence at Gregory's Tree. There is no evidence that the fence is providing any benefits.
Photo: A. Peacock

The principal on-ground operations of the Stop The Toad Foundation in the past two years have been (1) construction and trialling of a 4.6 km barrier or deflection fence at Gregory's Tree, and (2) a "Great Cane Toad Muster" on Auvergne Station in September-October 2006 in which about 120 volunteers collected and disposed of almost 50,000 adult toads.

STTF have proposed to the government of Western Australia that they wish to undertake a second "Great Cane Toad Muster" in September-October 2007 at the same place as last year's muster and continue to maintain the barrier/deflection fence. The cost to the government would be approximately $390,000.

There is no evidence that the barrier/deflection fence at Gregory's Tree has had any impact….

The current management of the fence is in fact a source of some concern

The barrier/deflection fence

There is no evidence that the barrier/deflection fence at Gregory's Tree has had any impact on the cane toad invasion towards Western Australia. Toads appear to be equally abundant on either side of the fence, so there is no reason to believe it has provided a barrier to toads. Traps set up on either side of the fence have not been regularly monitored to determine whether the fence has acted as a means of deflecting or guiding toads towards the traps. No evidence is available to suggest that these traps have a higher capture success rate than traps elsewhere.

The current management of the fence is in fact a source of some concern. It has not been adequately monitored to ensure that trapped toads are quickly removed and disposed of. If the fence continues to be managed in its current manner, it is likely to lead to animal welfare concerns for trapped toads. STTF believed that local Aboriginal rangers had been organised to undertake monitoring but this has not been the case. DEC also made a capital investment in the fence, with no prospect at present that useful information will be yielded.

A management plan for the fence is required that includes:

- An experimental protocol setting out the hypothesis to be tested by the fence;
- Arrangements for adequate monitoring of the fence and associated traps;
- Some means of determining whether the fence is effective (i.e. does it deflect toads into traps); and
- Animal Ethics Committee approval for experimentation should be put in place.

DEC should take over management of the barrier/deflection test. If the above requirements cannot be put in place cost effectively, trapping at the fence should cease.

The Great Cane Toad Muster

The Great Cane Toad Muster is based on a "dry season strategy" to use the toad's requirement for water as a means of halting their westward movement. The strategy has been partially implemented through the 2006 Muster and STTF require funding to carry out the second phase of the strategy to test its validity.

It is recommended that the "dry season strategy" be tested to its conclusion by undertaking the 2007 Great Cane Toad Muster. There is relatively little evidence to suggest that a major reduction of toads at the western front will halt the advance of toads. In fact, our current knowledge of toad ecology (some of which has come to light only since the Muster concept was developed) in fact leads to the conclusion that the Muster will **not** work. But our knowledge of toad ecology is not sufficiently complete to provide definitive statements. The success of the Muster relies on a number of factors:

The Great Cane Toad Muster is based on…the toad's requirement for water…

It is recommended that the "dry season strategy" be tested to its conclusion.

i) A capacity to remove all or nearly all toads from a large section of the western invasion front.
   - Department of Environment and Conservation staff report that toads are present at Auvernge Station at the site of the previous and the proposed Muster (Kruger, pers. comm.). Toads have moved further towards the Western Australian border from Auvernge, moving through parts of the Pinkerton Range that were thought may provide a natural barrier. Toads are evident in the West Baines River, west of Auvernge.
   - Work by Brown *et al* (2006) indicates that the very leading edge of the invasion front is in fact difficult to observe. The observation of mass numbers of toads is perhaps several months after the actual "invasion".
   - STTF applied significant removal pressure to the Muster area and have provided evidence that all toads were removed from the area in 2006, with observations (including using the trained detection dog) showing freedom for some months after.

ii) That all toads must seek access to water bodies every 3-5 days.
   - Work by Shine and colleagues indicate that toads do not necessarily seek water but can achieve rehydration from other sources such as cattle or buffalo pats. Toads can rehydrate from soil containing very low levels of moisture (Schwarzkopf and Alford, 1996).
   - STTF point out that the East Kimberly area is significantly drier during the dry season than Fogg Dam near Darwin where Shine's work has been largely conducted, making it much more likely that toads must access water directly on Whirlwind Plains.

iii) That an individual toad only moves relatively short distances.
   - The STTF strategy is based on observations by Schwarkopf and Alford (2002) who found that although individual toad movement varies widely (from 0 to 1,300 metres a night), toads average displacement an evening is only about 2 metres. They are more direction-oriented during the wet.
   - More recent work by Brown *et al* (2006) indicates that toads in the invasion front in fact move with a strong sense of direction and over considerable distances each night. Invading toads appear to move into an area, deposit eggs and quickly move on.

- The difference seen by scientists is most likely due to the fact that Alford was working on toads in the Townsville region, where they had likely been present for more than half a century whereas Brown et al (2005) were observing toads at the very edge of the invasion in the Northern Territory.

iv) That toads move little during the dry season.
- This seems to be a universal observation: toads don't tend to move much in the dry and thus the dry season is a potential "Achilles' Heel" and the heart of STTF's strategy.
- Unseasonable rain can cause dispersal and poses a potential problem for STTF. East Kimberley received 100 times its annual June rainfall in June 2007 and extensive rain was also experienced in June 2006.
- Some resource needs to be devoted to at least monitoring the dispersal of toads in the wet and during unseasonable dry season rain events. STTF must find effective means of achieving a year round on-ground presence, through their own resource or working with DEC or KTB.

To test the dry season Muster strategy thoroughly, all available resources should be applied to intensive removal of toads from the Auvernge/Whirlwind Plains site. DEC and KTB should play a part.

Why support the 2007 Muster?

In terms of the Muster, STTF developed a strategy, documented it very well but only executed half of it. The 2006 Great Toad Muster was conducted professionally and safely. Despite the reservations expressed above, support for the 2007 event is recommended. The attempt to stop invasion of toads into WA is unprecedented and clearly there is community will to try to do so, despite the obstacles. It is a unique opportunity and to fail to proceed with the 2007 Muster may leave a considerable public regret that not everything that could be done to prevent the incursion was done.

To test the dry season Muster strategy thoroughly, all available resources should be applied to intensive removal of toads from the Auvernge/Whirlwind Plains site. DEC and KTB should play a part. DEC has capacity for detecting toads at low density with a detection dog and KTB have local knowledge and resources that would be best applied at this time to giving the dry season strategy the best chance of success.

In developing a strategy later in this Review, the author suggests a further two years of support for the Great Cane Toad Muster/dry season strategy. Obviously, close review is required so that if the strategy proves effective it would be further supported from "implementation" funds or if it clearly fails this year, it would not take place in 2008.

With hindsight, STTF clearly took on too many activities for the funding available to them and as a consequence they have effectively gone broke before completing any of the activities to a point where reasonable conclusions can be drawn. The Board of the Foundation had a reasonable expectation that significant corporate sponsorship could be achieved to pay for planned activities. Nevertheless, the Board of the Foundation must wear responsibility for authorising expenditure on so many activities without having secured funding to complete them and should undertake more circumspect planning for future events.

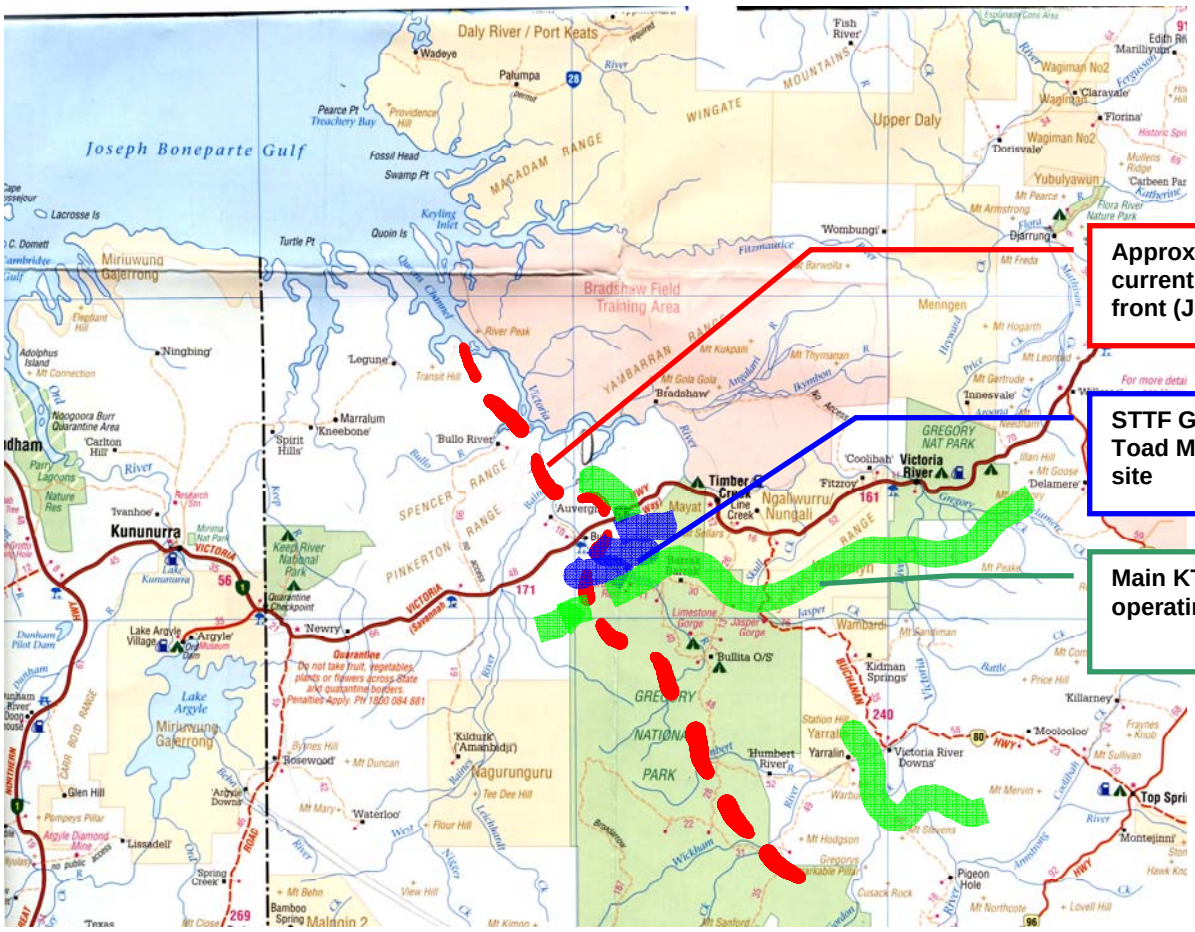

Figure 3: The operating areas for the Stop The Toad Foundation and Kimberley Toad Busters.

Addressing the Terms of Reference (continued)

c) the likely success of proposed targeted capture and removal operations of KTB on slowing the rate of spread of cane toads towards Western Australia;

d) evidence available to demonstrate that such actions are likely or unlikely to have an impact in reducing the rate of spread of cane toads towards Western Australia;

e) the adequacy of data available to make assessments of the likely success of the proposed operations, in particular in terms of records of movement of cane toads, expansion of cane toad range towards Western Australia and adequacy of surveys to determine the range of cane toads;

Kimberley Toad Busters (KTB) have removed approximately 120,000 adult toads and probably hundreds of thousands, perhaps millions of eggs, tadpoles and metamorphs in almost two years of active control. They have operated over a wide range of areas (see Figure 3). Besides volunteers "busting" expeditions mainly conducted over weekends, KTB have been active in conducting longer-term "busting" programs, raising public awareness, conducting reconnaissance missions to determine the extent of the toad invasion and other activities.

Unfortunately there is no evidence that KTB's targeted capture and removal operations are slowing the rate of spread of cane toads towards Western Australia. The main determinant of the spread appears to be the length and perhaps the intensity of the wet season.

KTB conduct their operations in a very professional manner and keep excellent records.

f) advice on the level of apparent social benefits to the Kununurra and broader communities of proposed work programs, including team building, impact on community spirit, indigenous engagement etc., and,

There are very clear social benefits from the operations of both KTB and STTF. Indeed, the community response to the coming cane toad invasion is nothing less than a social phenomenon. Both organisations have successfully raised public awareness of environmental issues in general and invasive species in particular. Both organisations have a 100% record of safety.

Many outsiders, including the author, have found the dedication of the cane toad community effort to be inspiring. There is enormous potential for the various programs to deliver even more benefits to the local and regional communities. For example, toad busting provides a sense of achievement, a source of meaningful activity and a range of skills for participants and there are very good news stories about engagement of the local community.

There are very clear social benefits from the operations of both KTB and STTF

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One word of caution seems to be that use of "CDEP top-up" schemes have provided mixed results. This system was proposed but not successfully applied for the Mulayee Aboriginal Women's Rangers to monitor and maintain STTF's barrier/deflection fence. Whether through miscommunication or misunderstanding, CDEP top ups were not received, the work was not done and expectations were raised amongst several other indigenous groups that volunteers may be paid.

The design of future schemes should ensure that a distinction is maintained between volunteer work and paid work. The size of the STTF and KTB operations justify full-time paid staff. Both are requesting that the WA government support full-time coordinators based in Kununurra. A common operation would allow some specialisation of staff, which would result in more social flow-on effects.

g) whether current or proposed operations are likely to impact on cane toads at a regional scale as opposed to localised control.

It has been concluded in previous sections that even localised control is unlikely to be achieved in the medium to long term (with the proviso that STTF's dry season strategy is yet to be fully tested). It follows that regional control is very unlikely to be achieved by the current and proposed operations.

During the almost two years of field operations, the cane toad front has advanced at the same rate as it did across the rest of the Northern Territory. Almost fifty tonnes of toads have been removed during that time but there is no evidence that it has halted or even

slowed the advance. The scientific understanding of toad invasive ecology, which has advanced a lot in two years, also indicates that physical removal of toads is unlikely to have an impact and therefore accords with on-ground evidence.

If we keep doing what we are doing, we should not expect a different result. However, KTB is not naïve of the likely impact (or lack of impact) of this work. Many individual toadbusters expressed the opinion that their felt they were "holding back the tide" until science could provide an answer. Thus, the opportunity exists to use KTB as a valuable on-ground resource to assist in advancing the current science.

2. **The independent reviewers should also provide advice, referring to data available, as well as expert opinions and judgement on options for alternative works that could give improved outcomes for the State, taking into account skill sets and resources available to STTF and KTB, and the proposed works program of DEC.**

Both STTF and KTB are currently employing all known physical methods for removing or deterring toads. Current methodologies could possibly be enhanced through several methods. Several methods that may be of benefit are listed below and might be considered under the "short-term control methods" section of the proposed Australian Cane Toad Plan:

- More extensive use of toad-detecting dogs in areas where toads are in low density or their presence is unknown. Dogs may be useful in shifting emphasis from collection of male toads calling near water bodies to finding female toads in surrounding woodlands;
- Point of detection lethal control. The Canberra-based company, Pestat Pty Ltd., has announced the development of a humane lethal spray, HopStop™, which may be a useful adjunct in collection (diluted sprays of the antiseptic Dettol® and other chemicals like caffeine have also been used). Killing toads at the point of detection may allow teams to cover significantly more area.
- Enhanced trapping through auditory attractants. Traps are viewed by all groups as the least efficient method of collection. Between DEC, KTB and STTF a reasonable capital outlay has been incurred through trap building. One preliminary investigation indicated an auditory cue (tape cane toad call) could enhance the success of a trap (Kruger, personal communication). DEC has world-leading expertise in auditory enhancement of traps and baits for feral cats. It would be well worth investigating with a relatively cheap modification of existing traps could be employed to improve the efficiency of trapping as a collection method. Bycatch is noted by all groups as a real issue and toad welfare cannot be ignored, so regular monitoring of any set traps is vital.

Figure 4. Record keeping by Kimberley Toad Busters is impressive. It would be useful if more scientist could readily access data.

The elephant in the room

In conducting this review, the author has been astonished at the animosity between the two cane toad "busting" organisations, the Stop The Toad Foundation and the Kimberley Toad Busters.

It would be wrong to skate over the rivalry because it is evident to the author the issue has caused very significant inefficiencies and the Boards of both organisations must make renewed efforts to cooperate.

It is not the role of this review to determine the rights and wrongs of either side. However, I point out the very obvious inefficiencies:

- An STTF vehicle stationed in DEC's compound in Kununurra unmoved for months. It was well known around the town that it had to be jump started when it was moved.
- Use of extremely inefficient methods of public fund raising, with less than a third of public funds collected, applied to on-ground work (compare this to Australian Wildlife Conservancy's application of more than 90% of funds raised to wildlife work);
- The killing off of any prospect of major corporate sponsorships because responsible corporations will simply not engage in a program where they might get slammed in the media for backing the wrong side;
- Rival operations happening in the field at the same time;
- Lack of data sharing;
- Immense pressure put on DEC managers and staff to tread the line between powerful lobby groups;
- Media distraction away from the "main game".

Not one person spoken to during the course of this review thought that the rivalry between KTB and STTF was healthy. Many expressed disgust that it is occurring. No one offered easy solutions, most believing the rivalry was set to continue. It is almost blindingly obvious that KTB offers a more effective way of conducting on-ground operations while STTF offers much better prospects for fund raising and recruitment of non-local volunteers. All parties, including DEC, should be working from a common strategy or "battle plan".

The Minister is not in a position to force cooperation between the two groups and the public will very soon tire of the animosity. The best the Minister can do is insist on and resource a means of sharing data for the good of all groups.

It is up to individuals to swallow their pride and work together or step aside.

An Australian Cane Toad Plan

An alternative (or perhaps more correctly an adjunct) to community cane toad control is to develop an overall Western Australian, or Australian Cane Toad Plan. The States and Commonwealth have recently adopted an Australian Pest Animal Strategy (APAS). This is the first time since Federation that Australian Governments have agreed to tackle pest animal issues together.

The Western Australian government is already investing very significant resources in cane toad management. Other Australian jurisdictions (NSW, Queensland, NT) are already affected by cane toads while South Australia could be affected within five-ten years. It therefore makes sense to jointly confront the problem of cane toads and the APAS may provide a suitable vehicle.

In addition to the APAS, there have been recent research results that warrant much greater attention by governments. For example, urgent follow up of findings by Shine and colleagues that the lungworm *Rhabdias spp*. is absent from toads at the western-most end of their current range is required. *Rhabdias* would not be a complete answer to the toad problem, but it could potentially be utilised as a biocontrol to reduce the impact of toads on Western Australia. It may possibly slow the front down while other methods of control are found. *Rhabdias* is a lungworm that debilitates toads fairly severely in laboratory situations. It is a native Australian lungworm of Australian frogs, but when it crosses to cane toads it appears to

live in greater numbers (perhaps 25 worms per toad compared with 1-5 in most Australian frogs). Western-most toads appear to have "outrun" the parasite.

The isolation of an alarm pheromone through a collaboration of researchers from the Universities of Sydney and Queensland gives us hope that other chemical control methods may be discovered. This finding has occurred within 18 months of a $1 million injection of research funding by the government of Queensland.

HopStop™ was developed by Pestat Pty Ltd within 12 months of the 2006 National Cane Toad workshop in Brisbane. It may be available on the market within the next 12 months.

These developments indicate that significant advances can be made in cane toad control through research. The number of people working in the field is extremely limited and therefore the need to collaborate is intensified over many other areas of research. It is recommended that the Western Australian government catalyse a national cane toad Plan under the APAS.

Table 1: Likely elements of an Australian Cane Toad Plan. A total national commitment on this scale would cost in the order of $13.5 million and a cost-sharing agreement would need to be reached under the Australian Pest Animal Plan. More detail is provided at Appendix 2.[2]

Program Element	Areas addressed	2006/7	2007/8	2008/9	2009/10	2010/11
Reducing the spread of the cane toad;	*Community education* *Reconnaissance* *Supporting KTB on-ground control* *Register and roll-out 1-3 of potential controls that show value Trialling* *STTF's Great Cane Toad Muster for a further two years*	500	450	900	1100	1050
Reducing the impact of the cane toad;	*Maintaining DEC program* *Understanding species at risk* *Implement several short-term local control mechanisms*	1000	1000	800	600	400
Researching solutions;	*Coordinating mapping under DEC program* *Develop 1-4 efficacious chemical control mechanisms* *Examine the efficacy of Rhabdias as a possible biocontrol* *Examine non-target impacts* *Develop release strategies*	925	925	925	925	900
Raising public Awareness and review	*Distribute literature* *Maintain website* *School material developed*	200	200	250	200	200
Total		**2625**	**2625**	**2875**	**2825**	**2550**

[2] It is important to note that these budgets do *not* include research investment by the Australian Research Council (ARC), which has been important and significant in advancing our knowledge of cane toads. The ARC funds projects principally based on the excellence of research proposals in highly contested rounds. It is not reasonable to *assume* support from ARC. The author has also not included biological survey work in the Kimberley by DEC, although this represents a major investment by that Department. It perhaps should be included as part of 'understanding the impact of the cane toad".

Under a scenario such as the above, there would be recognition that cane toads are more than a Western Australian problem and there would be a commitment to longer-term funding. This proposal goes beyond the scope of the Terms of Reference for this Review. However, community cane toad control would be best placed within a national control and research plan.

Western Australia will be the most affected jurisdiction in the coming five years, given that the impact in Queensland has occurred for almost three quarters of a century. If Western Australia proposed paying one-third of the cost of the total cost of the national Plan; the Commonwealth may be persuaded under APAS to meet one-third and the other affected jurisdictions the remaining third. It must be noted that cost-sharing agreements have not yet begun to be determined under APAS. Because of the urgency of the cane toad incursion into WA, it is suggested that Minister Templeman would have to prevail on his Ministerial colleagues to act ahead of an agreement (the $175 million Red Imported Fire Ant incursion control program in Queensland may be cited as a precedent). The Northern Territory effort is principally in Darwin and a national plan would assist in a more strategic approach.

Under the above proposal, WA would need to commit to a total of $4.5 million over five years ($900,000 per annum). .

Support in the region of $500,000 would be needed if the dry season strategy was tested over 2007 and 2008 whilst approximately $75,000 per annum would be sufficient to implement educational and reconnaissance activities. A very strong recommendation is made that a single on-ground coordinator be jointly employed in Kununurra to implement any programs. It would be most appropriate to allocate funding against the Plan once agreed by all jurisdictions, although a decision on the 2007 Muster must be made now.

Summary

Three quarters of a century after its misguided introduction to North Queensland, the cane toad, *Chaunus marinus*, is close to the Western Australian border. Despite an unprecedented effort to slow or stop the toad's advance, all evidence suggests the cane toad will enter Western Australia shortly. The principal determinant of the speed of advancement is the length of the northern Australian wet season. If the coming wet season is a long one, we can expect the cane toad to enter Western Australia in 2008. Shorter or less intense wet seasons may delay the toad's entry to the State until 2009 or 2010.

The entry of the cane toad to Western Australia should be viewed as a National or International conservation issue, not simply one for the State of Western Australia. Therefore, the most sensible course of action is to have a nationally-agreed Plan. The newly established Australian Pest Animal Plan provides the perfect opportunity for all affected Australian jurisdictions to develop an Australian Cane Toad Plan.

Community action to physically remove cane toads at the invasion front is unlikely to stop its advance into Western Australia. The Stop The Toad Foundation's dry season strategy (the "Great Cane Toad Muster") has not yet been fully tested and warrants continued support. Kimberley Toad Busters are obviously providing a positive social benefit and their activities, as well as those of STTF, are raising public awareness of the coming impact on the ecology of the Kimberley region.

These community groups should be supported as part of an Australian Cane Toad Plan. However, they should not be supported with the belief that their actions will halt the cane toad, or to the level where resources are taken away from promising research work.

To date, research has not assisted in slowing the spread or reducing the impact of cane toads. However, a number of recent research developments look promising and warrant support under a national Plan.

The impact of toads on the wildlife of the Kimberley should be avoided if possible. Our current technology and knowledge does not allow us to stop that impact at the moment, but a more cohesive national Plan that fast-tracks promising research and delivers it in the field with community support is the best scenario for the future.

People consulted

During the course of this review, the following people and organisations were consulted:

- Department of Environment and Conservation staff: Dr. Winston Kay; Dr. David Pearson; Mr. Errol Kruger and his team;
- Stop The Toad Foundation; Mr. Russell Guelho; Mr. Graeme Sawyer; Dr. Andrew Storey and others;
- Kimberley ToadBusters: Lee Scott-Virtue and many others.
- Research organisations: Professor Rick Shine; Dr.Ben Phillips (University of Sydney); Professor Rob Capon (University of Queensland); Dr. David Dall (Pestat Pty Ltd);
- Cane Toad Advisory Group (convened under the Vertebrate Pests Committee): Dr. Glen Saunders (NSW); Mr. Frank Keenan (Queensland); Dr. Glen Edwards and Dr. Robyn Delaney (NT); Dr. Winston Kay (WA) and Mr. Rod Atkins (Commonwealth); Mr. Jarrad Holmes (Community representative – WWF Australia).

The author would like to acknowledge the assistance of those noted above, as well as the many volunteers and team members that provided comments during the review. All opinions and any mistakes are solely attributable to the author.

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APPENDIX 1

TERMS OF REFERENCE

The terms of reference are to focus on what value the proposed operations are likely to provide to the State. They will include a requirement to consider the best value for public money, in terms of possible and likely impacts on toad populations and their spread, and also take into account the local and statewide community impacts from funding (including team building, local community spirit, indigenous engagement etc.)

1. The independent reviewers are to examine and comment on the likely outcomes of proposed State assisted cane toad work programs from the STTF and KTB in the Victoria River District in terms of reducing the severity of likely impacts of cane toads on Western Australia and in delaying the arrival of major cane toad populations into the State.

   In particular the review is to investigate and report on, taking into account likely wet season scenarios, including 'average', 'poor' and 'wet', wet seasons for the next 3 to 5 years:

   a) the likely success of proposed operations by STTF to effectively eliminate or significantly reduce cane toad populations from key target areas and the prospects of continuing the protection of these key areas in the medium to longer term;

   b) evidence available to demonstrate that such actions are likely or unlikely to have an impact in reducing the rate of spread of cane toads towards Western Australia;

   c) the likely success of proposed targeted capture and removal operations of KTB on slowing the rate of spread of cane toads towards Western Australia;

   d) evidence available to demonstrate that such actions are likely or unlikely to have an impact in reducing the rate of spread of cane toads towards Western Australia;

   e) the adequacy of data available to make assessments of the likely success of the proposed operations, in particular in terms of records of movement of cane toads, expansion of cane toad range towards Western Australia and adequacy of surveys to determine the range of cane toads;

   f) advice on the level of apparent social benefits to the Kununurra and broader communities of proposed work programs, including team building, impact on community spirit, indigenous engagement etc., and,

   g) whether current or proposed operations are likely to impact on cane toads at a regional scale as opposed to localised control.

2. The independent reviewers should also provide advice, referring to data available, as well as expert opinions and judgement on options for alternative works that could give improved outcomes for the State, taking into account skill sets and resources available to STTF and KTB, and the proposed works program of DEC.

APPENDIX 2

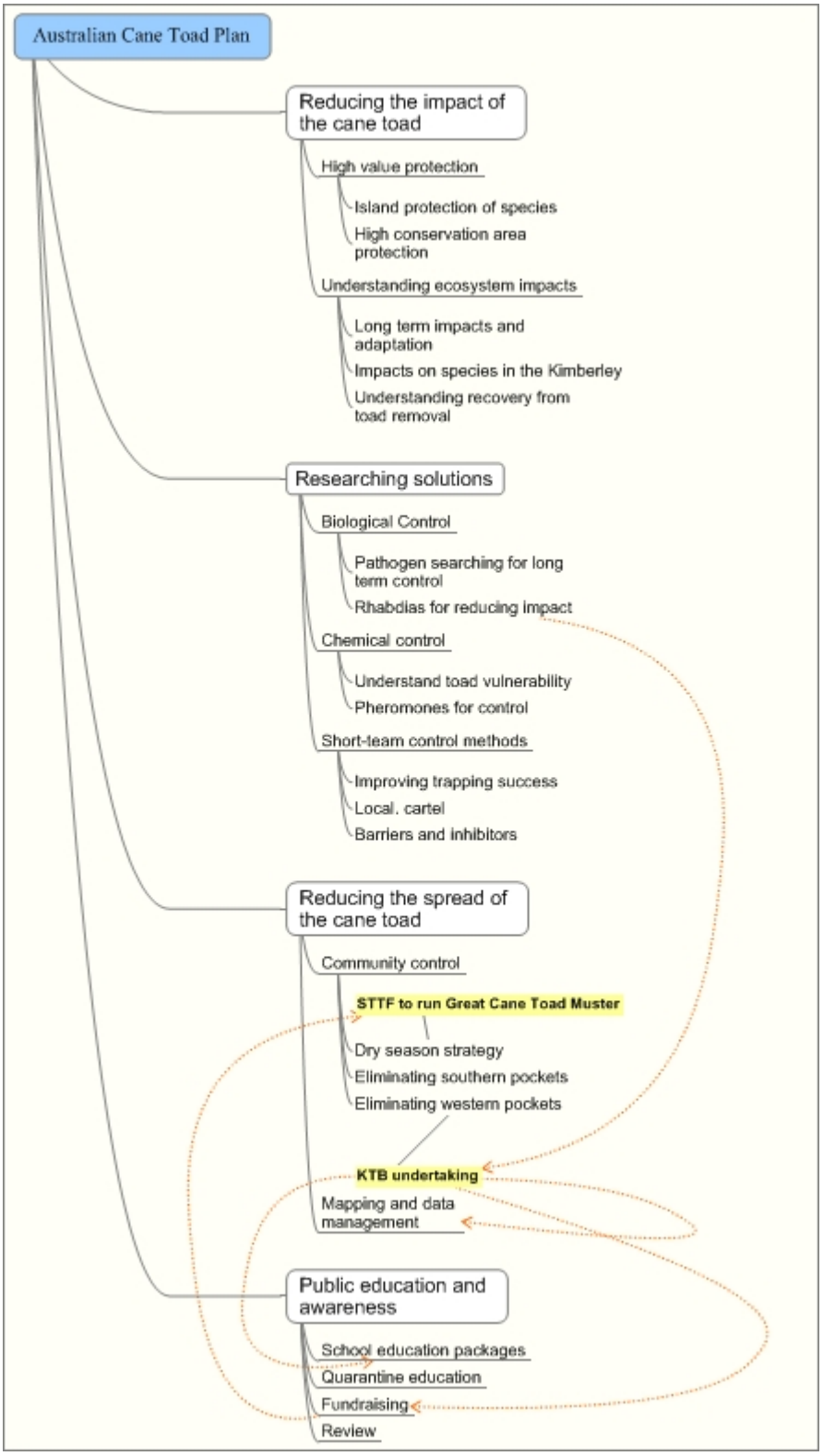

Figure 5. An outline of an Australian Cane Toad Plan and how the KTB and STTF might make positive contributions to the Plan. The Plan proposed is conceptual and would need wider consultation. However, the framework for such a Plan now exists with the adoption of an Australian Pest Animal Strategy by all Australian governments.