LEGISLATIVE ASSEMBLY OF THE NORTHERN TERRITORY

Sessional Committee on Environment and Sustainable Development

Issues associated with the progressive entry into the Northern Territory of cane toads

Volume 1

REPORT NO. 1

October 2003

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Chair's Preface

In 1982/83 cane toads (*Bufo marinus*) moved into the Northern Territory from Queensland and have now conquered most of the Gulf country, Katherine, Pine Creek and are entering Darwin.

Their impact on native wildlife such as the northern quoll, snakes, goannas, water monitors and insects is significant, with impact on competitive species such as frogs largely still unknown.

What is known is that they are highly toxic, extremely hardy and now fast-moving in a north-west direction across the Northern Territory.

They are in many areas of Kakadu National Park, are killing freshwater crocodiles around Katherine and have reached Pine Creek, and greater Darwin.

Scientists, environmentalists, Indigenous Territorians and the public broadly have many unanswered questions and concerns.

The Northern Territory Government tasked the Environment and Sustainable Development Committee to undertake an Inquiry into cane toads.

Many experts who appeared before the Committee expressed their thanks that the focus on this pest was finally occurring. Noted scientists expressed that this work should have been done decades ago.

There is differing scientific opinion as to the degree of negative environmental impact with a US scientist, Dr Dan Holland, perhaps best summing it up as:

> *By analogy there was no question by the captain and officers of the Titanic on that fateful night in 1912 that the ship was sinking, the only question was how long would it stay afloat and how many of the passengers could they save.*

I thank my Parliamentary colleagues for working as a bi-partisan team and our hardworking, valuable secretarial staff for their support.

The Committee acknowledges and appreciates those organisations, researchers, scientists and individuals who have contributed submissions and appeared at public hearings that we held throughout the Territory.

May the findings go some way to combating a destructive invading species that will dramatically impact on the Territory environment, socially and culturally.

May the findings prevent incursion into the Cobourg Peninsula, islands and Kimberley region. We seek national co-operation to attract the focus, collaboration and resources required to combat the cane toad.

Ms DELIA LAWRIE, MLA
Chair

Members of the Committee

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The Committee acknowledges the assistance of the Northern Territory Parliamentary Library and Information Service.

Summary of recommendations

In relation to the risks and impacts, the Committee recommends:

1. That the Northern Territory's Power and Water Corporation continues to develop and implement monitoring and management regimes in regard to the risks that may be associated with the impact of cane toads on the management and control of water.

2. That ranger programs, such as those established by the Parks and Wildlife Commission of the Northern Territory (PWCNT) and the Northern Land Council's Caring for Country Unit, be supported and enhanced to pursue cane toad control methods.

In relation to managing the risks and impacts, the Committee recommends:

3. That the Northern Territory's Department of Infrastructure Planning and Environment develop and implement a plan of management for the control of cane toads.

4. That the Commonwealth and Northern Territory Governments continue with the development and management of quarantine regimes to protect offshore islands currently without cane toads.

5. That the Northern Territory Government take immediate steps to erect a cane toad proof fence across the neck of the Cobourg Peninsula.

6. That the Northern Territory Government lobby the Commonwealth Government to reclassify the cane toad from a "pest" to a "menace" under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act, 1999*.

7. That the Northern Territory Government nominate cane toads as a threatening process under the *Environmental Protection and Biodiversity Conservation Act, 1999*.

8. That the Northern Territory Government and relevant Commonwealth agencies continue to monitor the effects of translocating northern quolls to offshore islands.

In relation to public awareness and education, the Committee recommends:

9. That the Northern Territory Government develop a comprehensive multi-media public awareness campaign to educate the community on dealing with cane toads.

10. That a school-based education kit be developed on cane toads, addressing their environmental impact, risks and habits and what the community can do to mitigate their spread.

11. That Northern Territory community groups and volunteer organisations be encouraged to “Adopt a Waterway" as one of the ways in managing and controlling the impact of cane toads.

In relation to co-operation and collaboration, the Committee recommends:

12. That the Northern Territory Government make the management and control of cane toads a high priority in respect of monitoring the cane toad’s spread, and of co-ordinating research.

13. That the Northern Territory Government pursue with the Commonwealth and the states of Queensland, Western Australia, New South Wales and South Australia the establishment of a national task force to co-ordinate efforts to control and possibly eradicate cane toads.

14. That the membership of the national task force should include, but not necessarily be limited to, representatives of key stakeholder groups such as CSIRO, PWCNT, Co-operative Research Centre-Tropical Savannahs Management-Charles Darwin University, interstate academics, Environment Australia, Frogwatch NT, and peak Indigenous organisations.

15. That the role and function of the national task force include:

    (a) co-ordinate efforts to control and possibly eradicate cane toads in Australia;
    (b) identify and pursue funding;
    (c) ensure ongoing consultation and collaboration with the three tiers of Government, environment groups, tertiary institutions and other research bodies, relevant corporations and industry; and
    (d) any other roles and functions agreed to by the membership.

16. That the Northern Territory Government immediately approach the Western Australian Government, for the purpose of establishing an agreement on a co-ordinated program to research, control and possibly eradicate cane toads in Australia’s north west.

17. That the Northern Territory Government report to Parliament on the progress of implementing the Inquiry’s recommendations.

Summary of findings

The view of the Committee is that the findings of this Inquiry are of equal importance to the recommendations.

In relation to the background information submitted, the Committee found that:

1. It is expected that the urban areas of the Top End of the Northern Territory, including Darwin and Palmerston, will experience a high level of cane toad colonisation.

2. Cane toads have already colonised some Northern Territory offshore islands.

3. Cane toads have the potential to infest and affect all Australian States.

In relation to the risks and impacts of cane toads in the Northern Territory, the Committee found that:

4. The rate of spread of cane toads at approximately 30 kilometres per year is greater than expected.

5. Cane toads are spreading in a north westerly direction and will arrive in Darwin in the 2003/04 wet season.

6. Drawing from the evidence provided to the Committee by Parks Australia North (PAN) and the Environmental Research Institute of the Supervising Scientist (ERISS), the species likely to be affected by cane toads include the northern quoll, goannas, snakes (e.g. king brown and black), fish (barramundi, black bream, catfish), long and short-necked turtles (which eat toad tadpoles), freshwater crocodiles, salt-water crocodiles (found dead at Ngukurr on Roper River), some aquatic invertebrates, water scorpions, water bugs and beetles, dragonflies, freshwater prawns, shrimps, crabs, crayfish, centipedes, large spiders, some bird species and water rats. Pelicans, herons, jabiru, and semi-domestic pigs who have died as a result of ingesting cane toads may also be affected.

7. The northern quoll is a vulnerable species, threatened by the cane toad.

8. While the potential ecological effects are well documented, there is a need for ongoing, long term quantitative information on the actual ecological effects in areas where the cane toad is now well established.

9. There are limited studies quantifying the impacts on aquatic macro-invertebrates (aquatic insects, worms, clams, snails, and crustaceans).

10. There is a lack of information on the potential socio-economic impacts in the Northern Territory, including those on water, tourism, business, agriculture and Indigenous food sources.

11. The toxin secreted by the cane toad is potentially lethal to humans, domestic dogs and cats if ingested.

12. The potentially significant risk to humans and their domestic pets can be reduced with education and awareness.

13. The experience and knowledge of Indigenous communities already affected by cane toads should be used to enhance the work of existing ranger programs such as those established by PWCNT and the Northern Land Council's Caring for Country Unit.

14. The potential impacts on tourism include the:
    - reduced opportunity of tourists' likelihood of seeing native Australian species in the wild;
    - mistaken identification of native frog species for cane toads by unaware tourists who may then take management upon themselves;
    - reduced enjoyment of tourists in the Territory bush; and
    - possible reduction in interest from the more affluent tourists which are an important target group of the Northern Territory's tourism industry.

<u>In relation to the issues regarding managing the risks and impacts, the Committee found that</u>:

15. There has been extensive academic level research on cane toads.

16. There is no short-term solution in managing the impact of the cane toad.

17. No effective biological or chemical control method has yet been found for the cane toad.

18. The CSIRO is researching biological control of cane toads, but the project could take a further ten years and its final effect is unknown.

19. There is a need for further research into biological and chemical research.

20. There is limited base-line native fauna and flora data, before and after the arrival of cane toads in the Northern Territory, making it difficult to gauge their long-term impact on native species.

21. In managing the cane toad intrusion, a number of control methods and approaches ranging from continued monitoring and research programs, biological and chemical control including eradication and physical removal, quarantining, physical barriers and the relocation of threatened species to off-shore islands.

22. There are a number of physical or manual control methods and measures in managing the containment of the cane toad that may prove effective in localised areas, for example townships, caravan parks and specifically-targeted areas.

23. In regard to the funding for cane toad research and monitoring over the past twenty years from both the Commonwealth and Northern Territory Governments and what is predicted for the future, it was difficult to obtain clear and accurate figures.

24. Some formal arrangements between governments and research institutions could provide the opportunity for conducting joint research.

25. Commonwealth funding since 1991 in relation to cane toads has been tied primarily to research.

26. The Northern Territory, since the early 1980s, has been involved in some research programs on cane toads and has been aware of the potential impacts and spread.

27. There is no formal Northern Territory Plan of Management for cane toads.

28. There may have been missed opportunities in the past in attempting to control the spread of cane toads, however, evidence now points overwhelmingly towards further action.

29. Cane toads are currently not listed as a threatening process under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*.

30. The translocation of populations of the northern quoll to offshore islands requires ongoing research regarding the impacts of the quolls on the islands' ecology.

31. There are no comprehensive quarantine measures or facilities to guard against the transportation of cane toads.

32. There is an opportunity to protect important areas of the Northern Territory such as the Cobourg Peninsula with the erection of a cane toad proof fence across the neck of the Peninsula.

33. The traditional owners of Cobourg Peninsula want a cane toad proof fence built across a narrow neck of the peninsula.

<u>In relation to the issues regarding public education and awareness, the Committee found that</u>:

34. Top End residents are concerned about the threat of cane toad infestation, particularly via human assisted transportation.

35. Some people were worried about the arrival of the cane toad and its impact on lifestyle and the environment.

36. Indigenous communities are concerned about the impact of cane toads on wildlife and their cultural and social lives.

37. The real impact of cane toads is not going to be fully appreciated by the wider community until they arrive.

38. There is a lot of web-site based information, including the Frogwatch NT and the Australian Museum websites.

39. There is no comprehensive public awareness program in the Territory on the potential impacts of cane toads and possible management strategies.

40. There is a need for a series of education programs aimed at the general public to encourage people to actively participate in the management and control of cane toads.

41. A number of important factors would need to be considered when developing a comprehensive public awareness information campaign on the impact the cane toad will have on the Territory community. These factors include:
    - The information and content needs to be simple and easily understood by all levels of the community;
    - The information and content needs to be presented in all major languages spoken in the Territory, including Indigenous languages;
    - The Information needs to be disseminated through community forums, seminars, workshops and public information sessions;
    - A public awareness campaign promoted through all forms of multi-media is needed;
    - Education kits need to be developed and aimed at specific groups, such as schools and Indigenous communities; and
    - Active participation of community groups and volunteer organisations in disseminating information and promoting public awareness.

42. There exists a great potential for engaging community groups and school classes in such initiatives as “Adopt a Waterway”.

<u>In relation to the issues regarding co-operation and collaboration, the Committee found that</u>:

43. There is a need for a comprehensive management approach towards the control and possible eradication of cane toads in Australia.

44. There is a need to assess the limited funding arrangements between the affected jurisdictions and the Commonwealth that are tied to research and monitoring the environmental impact of the cane toad.

45. There is a need for consultative and collaborative arrangements between all tiers of government and other stake-holders in the Northern Territory community in the monitoring, research and control on the environmental impact of the cane toad.

46. There is merit in establishing collaborative arrangements through the establishment of a national task force to assess and manage the impact of the cane toad nationally.

47. Due to the potential of cane toads expanding their range into Western Australia, there is merit in establishing bilateral agreements between the Northern Territory and Western Australia to co-ordinate the research, control and possible eradication of cane toads in Australia's north-west.

List of abbreviations

CSIRO:	Commonwealth Scientific and Industrial Research Organisation
EPBC Act	*Environmental Protection and Biodiversity Conservation Act, 1999*
ERISS:	Environmental Research Institute of the Supervising Scientist
MLA:	Member of the Legislative Assembly
PAN	Parks Australia North
PWCNT:	Parks and Wildlife Commission of the Northern Territory
WWF:	World Wide Fund for Nature

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Chapter 1 Introduction

1.1. COMMITTEE'S ESTABLISHMENT AND TERMS OF REFERENCE

On 27 November 2002, the Legislative Assembly established the Sessional Committee on Environment and Sustainable Development to inquire into and from time to time report upon and make recommendations on matters referred to it by the relevant minister or resolution of the Legislative Assembly on any matter:

(a) concerned with the environment or how the quality of the environment might be protected or improved; and
(b) concerned with the sustainable development of the Northern Territory.

Appendix 1 shows the full text of the Committee's Terms of Reference passed by the Legislative Assembly on 27 November 2002.

On 27 November 2002, the Legislative Assembly referred the Committee to inquire into and report on issues associated with the progressive entry into the Northern Territory of cane toads.

1.2. THE NEED FOR THE INQUIRY

Since the introduction of the cane toad *(Bufo marinus),* a large South American toad, into northern Queensland in 1935 to control cane beetles, which were having a damaging impact on sugar cane harvests, there has been considerable dispute about the ecological impacts of cane toads. This has been fuelled partly by the lack of quantifiable evidence regarding impacts on wildlife populations.

Although cane toads have been present in Australia for almost 70 years and in the Northern Territory for some 20 years, there is still limited information about the impacts of cane toads on native fauna and ecosystems. Almost all authorities have recognised that there are substantial short-term impacts on the decline of many vertebrate predators, in particular goannas, most snakes and the northern quoll, but also of some crocodiles, turtles, fish and birds.

Although there are studies on the impact of the cane toad in the Northern Territory, progress in the Territory has been hampered in the past by a lack of support by governmental agencies, as well as loose funding arrangements to co-ordinate those impact studies and to implement possible control methods.

The Minister for Environment and Heritage, the Honourable Dr Chris Burns, MLA, in the Legislative Assembly debate on the motion referring the matter to the Committee raised the issue of community perceptions in regard to the progressive entry of the cane toad into the Northern Territory:

> *People do raise this issue. There is a perception in the community that government, and I guess the departments, have acquiesced all too easily to the spread of the cane toads. People are saying: 'What can I do when they come to my garden?' How do I protect my native species of frogs?' These are the questions that people ask about the issues associated with the progressive entry of cane toads into the Northern Territory. It is a very important reference.*

> *I think they will come to Darwin within a Wet season or so and people will be confronted by them. It is important that this committee look at issues to do with that.*[1]

Appendix 2 provides a selected extract of the Legislative Assembly's debate on the matters referred by the Legislative Assembly to the Committee's on 27 November 2002.

The Northern Territory Parliament has demonstrated concern about the intrusion of the cane toad into the Northern Territory by the commissioning of this report and is particularly concerned about the impact the cane toad will have on the community as the 'cane toad wave' pushes north-westward.

Issues of concern relate to:

- potential extent and effects cane toads have or will have in the Northern Territory;
- cultural, socio-economic and other factors;
- community concerns and expectations and the need for public education and awareness programs;
- managing and controlling the environmental impact of cane toads in the Northern Territory including funding arrangements; and
- future co-ordination and communication between the scientific community, relevant agencies, organisations, communities and the public.

1.3. COMMITTEE'S APPROACH TO THE MATTER REFERRED

In determining how to approach the matter referred to the Committee by the Legislative Assembly, the Committee began from the perspective that, in conducting this inquiry, it was essential to achieve maximum community representation and to consult widely with as many Territorians as possible.

The Committee adopted a series of focal points in addressing the issues associated with the progressive entry of cane toads into the Northern Territory. These focal points were:

- the identification of the problem and risks associated with cane toads in the Northern Territory;
- the potential extent and effects cane toads have or will have in the Northern Territory;
- the cultural, socio-economic and other factors associated with the encroachment of cane toads into the Northern Territory;
- identifying the current level of understanding concerning cane toads to date and assessing the need for public education and awareness programs;
- identifying ways to manage the environmental impact of cane toads in the Northern Territory; and
- community concerns and expectations in respect of the progressive entry into the Northern Territory of cane toads generally.

[1] Ninth Assembly First Session – 27 November 2002 - Parliamentary Record No: 9

1.4. INTERIM REPORT

On 21 August 2003 the Chair tabled an Interim Report in respect of this Inquiry together with some of the Committee's recommendations which, the Committee believed, required immediate Government attention, in particular:

(a) the construction of a cane toad fence across the neck of the Cobourg Peninsula;
(b) the development of a comprehensive public education and awareness program about cane toads;
(c) the development and implementation of quarantine regimes to off-shore islands to exclude the migration of cane toads to those islands; and
(d) the encouragement of the enhancement of existing ranger programs (such as the Northern Land Council's Caring for Country) and the establishment of new ranger programs in the management and control of cane toads.

Although the Committee's final report of this Inquiry was close to finalisation at the August Sittings, it was specifically concerned that cane toads were likely to reach greater Darwin and Palmerston during this coming Wet which warranted immediate action, hence the Interim Report – see Appendix 3.

Since the Tabling of the Interim Report, the Committee is aware that the Government is addressing the issues raised within that report.

In particular the Government has responded to the Committee's call for a public education and awareness program about cane toads with the production of information sheets and the holding of public displays in key areas such as shopping centres, markets throughout Darwin and Palmerston and the Smith Street Mall to inform the community about cane toads.

As part of the Government's public awareness program, the PWCNT have produced two information sheets.

- Cane Toads: The Facts; and
- Making your yard a toad free zone.

These information sheets are shown at Appendix 4.

The Committee notes that the Government's public awareness program needs to be expanded into communities in the western Top End prior to the arrival of cane toads in those areas.

1.5. CONDUCT OF THE INQUIRY

The Committee called for evidence in a series of advertisements in the Northern Territory's daily and regional newspapers. In addition, letters setting out the scope of the inquiry and inviting submissions addressing the Terms of Reference were sent to relevant organisations, companies and selected individuals. Subsequently, persons and organisations that had provided the Committee with written submissions were invited to appear before the Committee to address and respond to questions put by the Committee.

During the course of its deliberations a number of issues arose that required the further invitation of witnesses to appear before the Committee to address specific areas of concern and interest to the Committee.

The Committee resolved to follow precedent established by past investigations conducted by other Committees of the Legislative Assembly in that the hearing of evidence would be open to the public and the media.

1.6. FUNCTIONS OF THE COMMITEEE

The Committee derives its authority from the *Northern Territory (Self Government) Act, 1978* and the *Legislative Assembly (Powers and Privileges) Act.* Under its terms of reference, the Committee is empowered to appoint sub-committees and to refer to any such sub-committee any matter that it is empowered to examine. Three members of the Committee constituted a quorum of the Committee whilst two members of a sub-committee constituted a quorum of that sub-committee.

The Committee or any sub-committee also has the power:

(a) to send for persons, papers and records;

(b) to adjourn from place to place;

(c) to meet and transact business in public or private session;

(d) to sit during any adjournment of the Assembly; and

(e) to print from day to day such papers and evidence as may be ordered by it. Unless otherwise ordered by the Committee, a daily *Hansard* was required to be published of such Committee proceedings taking place in public.

1.7. PUBLIC HEARINGS AND MEETINGS

1.7.1. Public hearings

Hearings were open to the public, including the media. The media was able to report any public session of the Committee, unless otherwise ordered by the Committee.

The Committee held public hearings at the following locations:

Borroloola – 6 May 2003	Darwin – 12 May 2003
Katherine – 6 May 2003	Palmerston – 13 may 2003
Jabiru – 7 May 2003	Litchfield – 19 May 2003

The Committee, under its Terms of Reference, is able to authorise the televising of hearings under such rules as the Speaker of the Legislative Assembly determined. *Hansard* produced transcripts of the proceedings.

During the course of its inquiry, the Committee conducted 6 public hearings and meetings.

1.7.2. Deliberative meetings

This format is used for private meetings of the Committee where "confidential" matters and the proceedings of the Committee were discussed, together with general administrative business. Deliberative meetings were recorded in the Minutes of Committee Proceedings.

The Committee held eight deliberative meetings. Appendix 5 summarises the main items the Committee addressed at these meetings.

1.7.3. Briefings

Briefings to the Committee are used as a tool in gathering particular, pertinent and sometimes 'confidential' information required by the Committee. Briefings are not open to the public, unless ordered by the Committee. In regard to the referred matter, the Committee resolved that the transcripts of the briefings received by the Committee be made public.

The Committee received briefings from the following:

NAME	ORGANISATION	DATE PRESENTED TO COMMITTEE
Dr Grahame Webb	Wildlife Management International	26 February 2003
Dr Peter Whitehead	Key Centre Tropical Wildlife Management	15 April 2003
Dr David Lawson and Dr John Woinarski	Parks and Wildlife Commission of the Northern Territory	15 April 2003
Mr Graeme Sawyer and Mr Ian Morris	Frogwatch NT	15 April 2003
Ms Rhondda Dickson	Environment Australia – Canberra	19 May 2003
Dr Tony Robinson	CSIRO – Canberra	19 May 2003
Dr Bill Freeland		28 May 2003 and 10 June 2003

1.8. TAKING OF EVIDENCE

1.8.1. Evidence in general

Like all parliamentary committees, the Committee's effectiveness is largely reliant on the type and content of information developed, gathered or submitted during its deliberations. The source and content of information, in a number of the written and oral submissions received by the Committee, was generally of a high standard, professional and specialist in nature on specific subjects. Other submissions promoted or presented particular attitudes, trends and ideas.

Fifty-four people gave direct oral evidence to the Committee at its public hearings throughout the Northern Territory. Appendix 6 lists the individuals who appeared before the Committee.

The Committee also received 25 written submissions. Appendix 7 lists those submissions received. Environment Australia's written submissions to the Inquiry are provided in full in Appendices 8 and 9. For further reading of the written evidence submitted to the Committee, the reader is referred to Volume 2 - Written Submissions Received.

1.8.2. Evidence received in-camera

No *in-camera* evidence was received in this Inquiry.

1.9 COMMITTEE EXPENDITURE

The Committee's salaries and administration expenses for the conduct of the Inquiry are reflected in the following Table, which provides a cost break up attributed to the Committee's activities:

Table 1.1: Salary and Administration Expenses

ITEM	$
Salaries/Allowances	23,413
Motor Vehicle Expenses	417
Advertising/Communications	8,384
Information Technology Services	996
General Expenses/Consumables	2,173
Official Duty Fares	1,906
Air Charter	7,300
Travelling Allowance	1,134
Accommodation	785
Total	**46,508**

The following figure provides a percentage break up of item expenditure by category of cost.

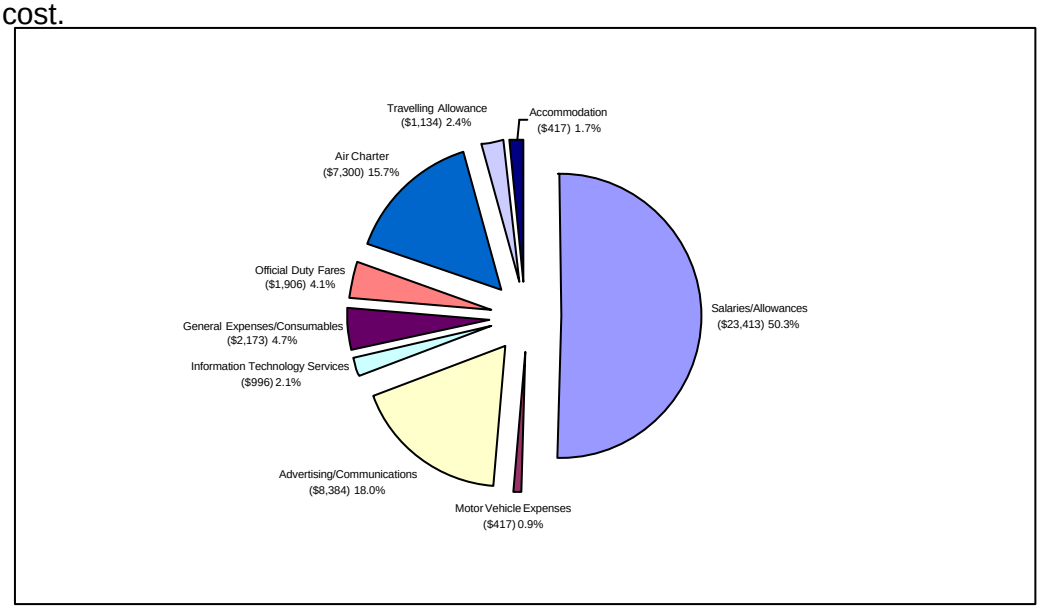

Figure 1.1: Item expenditure by category of cost

Chapter 2 Background

2.1. OVERVIEW

This chapter outlines a history of invasion of the cane toad (*Bufo marinus*) into Australia and the Northern Territory. The Chapter also outlines the problems associated and the potential effects and impact the cane toad will have on the Northern Territory community.

During the inquiry, it became evident to the Committee that the extent and distribution of the cane toad within the Northern Territory and its impact on native fauna and habitats was also very important and these areas are also discussed in this Chapter.

This Chapter also outlines the issues associated with the cultural, social and economic factors, in particular how these factors impact on the Indigenous communities in the Northern Territory.

2.2. HISTORY OF INVASION INTO AUSTRALIA AND THE NORTHERN TERRITORY

Native to South America, cane toads were introduced into Queensland in 1935 by the Bureau of Sugar Experiments Station at Gordonvale in northern Queensland to control beetles causing damage to Queensland's sugar cane industry. Cane toads failed to control the target organism they were introduced to control. The species has continued to increase its range into the north-east coast of New South Wales and the Northern Territory.

Cane toads entered the Northern Territory in 1982/83 via the Nicholson River drainage system, arriving in Borroloola in 1993/1994[2], Barunga in January 2000, Beswick in March 2000 and the southern end of Kakadu National Park in 2001 through the Katherine River drainage system. Their advance has been rapid in the wet seasons and slower in the dry seasons.[3]

Their direction of travel is north-west and downstream.[4] Their annual rate of travel is approximately 30km per year. Their rate of spread appears to have been more rapid over the last 3-4 years possibly due to their accessing the large river drainages of the Northern Territory.[5] The cane toad is now in most of Arnhem Land, Pine Creek, some of the Pellew Islands, the southern half of Kakadu National Park, Katherine and greater Darwin. The front of the invasion extends from Ramingining and greater Darwin in the north, Katherine Daly Catchment in the west and Dunmarra in the south. It is predicted that they will colonise Darwin this wet season and the Northern Territory's Top End by the end of 2004.[6]

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[2] Submission No. 3B, ERISS-PAN Risk Assessment in Katherine/ Mataranka and Borroloola

[3] Submission No. 15A, Environment Australia, 16 May 2003

[4] Submission No. 15A, Environment Australia, 16 May 2003

[5] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[6] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

2.3. WHAT IS KNOWN ABOUT THE CANE TOAD

As mentioned earlier, cane toads have been present in Australia for almost 70 years and in the Northern Territory for some 20 years and research has shown that there are substantial short-term impacts on the decline of many vertebrate predators, in particular goannas, most snakes and the northern quoll, but also some crocodiles, turtles, fish and birds.

The Committee throughout this Inquiry heard evidence that:

- adult cane toads are nocturnal, terrestrial and ground dwelling.[7]
- cane toad survival depends on constant access to water. In dry conditions, deprived of water, cane toads die of water loss in 3 days.[8]
- females lay between 7,000-50,000 eggs per clutch, depending on the size of the female. Females lay more than one clutch per year.
- during the Dry Season, they can remain inactive in shallow burrows under the ground, or in clusters under logs, rocks, sheets of iron, etc.
- in Australia, the cane toad has no known natural predators or parasites.
- cane toads compete effectively with other insect-eating animals for food.
- all life stages of cane toads have toxic compounds.
- cane toads may have a negative impact on native frog species, but this is still to be proven.
- cane toads can have the potential of being a human health hazard.
- under Northern Territory conditions, cane toad tadpoles are known to develop into toads in around 3 days.[9]
- cane toads move great distances in search of food and breeding sites.
- cane toad populations fluctuate greatly.
- cane toads do not have specific parasites, predators or diseases.
- cane toads live in and move through many habitats.
- cane toads discriminate food and mates by smell.
- cane toads don't drink. They absorb water through the skin on their belly. They extract water from dew, cattle dung, moist sand any other moist material. If forced to remain in flooded areas, they absorb excess water and will die.
- their skin is not waterproof. Water evaporates from cane toads at an equivalent rate as a dish of water with the same surface area.

2.4. DISTRIBUTION OF THE CANE TOAD

The potential distribution of the cane toad in Australia is still uncertain. The analysis by Sutherst *et al* indicated that the cane toad could permanently inhabit the wet

[7] van Beurden, E. K., 1978, 'Report on the results of stage 1 of an ecolgocial and physiological study of the Queensland cane toad, *Bufo marinus*' and Easteal, S., and Floyd, R. B., '1986, The cane toad- an amphibian weed', cited in Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[8] Corbett, L., 1998, 'Cane Toad Workshop, Report of Proceedings', Gagudju Crocodile Hotel, Jabiru

[9] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

coastal areas of Australia's north, as far south as Port Macquarie in New South Wales and Broome in Western Australia.[10]

Figure 2.1 shows the spread of cane toads across Queensland, extending into the northern rivers region of coastal NSW and the Northern Territory. They are being sighted in greater Darwin.

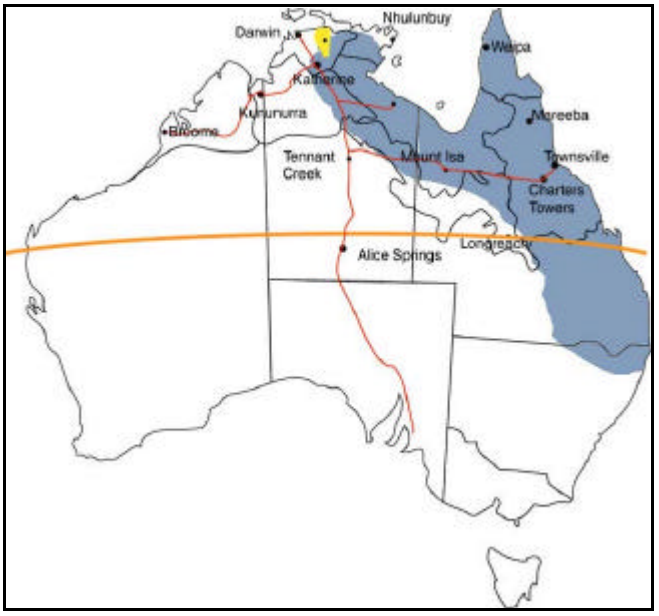

Figure 2.1: The current known distribution of cane toads within Australia[11]

Figure 2.2 below shows the potential distribution in Australia, based on suitability of climatic conditions.

Figure 2.2: The potential distribution of cane toads within Australia based on climatic conditions, 1996[12]

[10] Sutherst R W., Floyd, R. B. and Maywald G. F., 1996, 'The Potential Geographical Distribution of the Cane Toad, *Bufo marinus* L. in Australia', cited in Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[11] Frogwatch NT, Cane Toad Site, http://www.frogwatch.org.au/canetoads/default.cfm, Accessed 8 August 2003

The recent discovery of a well established cane toad population on Vanderlin Island, a remote island in the Gulf of Carpentaria, in the vicinity of Borroloola, approximately 1000km south east of Darwin, is of concern to the Committee. The island is also home to a population of northern quolls. It is still not yet understood how this population of cane toads came to exist on Vanderlin Island.[14]

As well as possibly invading Western Australia, the Committee heard the following from Dr Tyler:

> *I think I would add South Australia to that because the cane toad is about 100 km north of the Murray Darling headwaters. When it gets into the Murray river, the billabongs, the ground cover, the insect life, will be sufficient for it to flourish.*[15]

Figure 2.3 shows the known and potential distribution of cane toads based on bio-climatic factors; the utility of transport corridors such as roads and waterways; transport modes such as human assisted transportation and the extent of research available at that time.

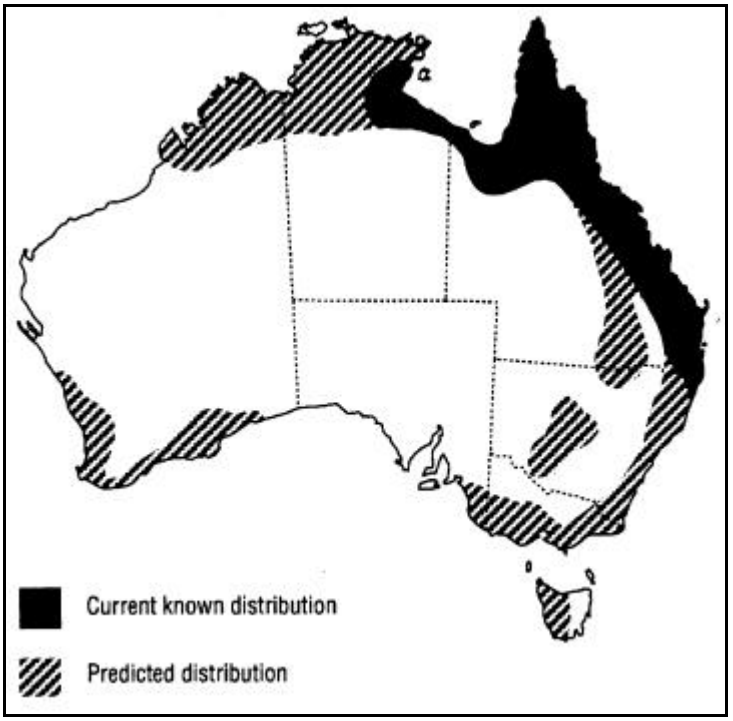

Figure 2.3: As at 2000, the known and potential distribution of cane toads in Australia based on bio-climatic conditions, and transportation modes[16]

[12] Sutherst R W., Floyd, R. B. and Maywald G. F., 1996, 'The Potential Geographical Distribution of the Cane Toad, *Bufo marinus* L. in Australia', cited in Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[13] Sutherst R W., Floyd, R. B. and Maywald G. F., 1996, 'The Potential Geographical Distribution of the Cane Toad, *Bufo marinus* L. in Australia', cited in Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[14] ABC On-line, Rural NT Country Hour, Reporter Ms Doust, Accessed 8 August 2003

[15] Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

[16] Vanderduys, E. and Wilson, S., 2000, Leaflet 0030, Cane Toads, http://www.qmuseum.qld.gov.au/inquiry/leaflets/leaflet0030.pdf, Accessed 29 September 2003

Again from Dr Tyler, the Committee heard:

> *In the case of Western Australia it will travel certainly as far as Derby but not probably as far as Broome. You get into these lateritic soils, lower levels of moisture, and then from there, there is a barrier, of course, down to La Grange, which is almost desert. But that is the limit I think that will be placed upon its ultimate dispersal and I hope that I am not around to see it happen.*

In regards to habitat preference, in Kakadu National Park, ERISS informed the Committee:

> *Cane toads are likely to colonise almost every habitat type within Kakadu National Park. The saline regions of the coastal plains and deltaic estuarine floodplains will most likely support some cane toads at various times, although they are not likely to use these habitats on a permanent basis. Other less suitable areas include deep open water and/or flowing channel habitats and tidal regions of larger rivers (excluding riparian zones) which extend 70 to 80 km inland during the Dry season. The steady range expansion over the last ten years indicates that most wetland habitats are probably suitable as breeding habitat and also as Dry season refuges.*[17]

Cane toads have a preference for disturbed areas in urban environments and they may occur in saline areas.[18] This preference has probably assisted their spread.[19] Their tolerance for a broad range of environmental and climatic conditions indicates that they can potentially occupy many different habitats.[20]

The Committee found that cane toads have the potential to infest and affect all Australian States/ Territories.

2.5. POPULATION

Dr Freeland informed the Committee that, from his previous studies of a single population of cane toads over 12 years, there is no consistent temporal pattern in population density or body condition. More rain in December resulted in more toads in the Dry season and fatter toads were found with more rain in May to June.[21] Cane toad populations randomly fluctuate.[22]

Regarding cane toad populations, the Committee heard from Dr Freeland:

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[17] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[18] Mr Walden, ERISS, Darwin Public Hearing, 12 May 2003

[19] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[20] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[21] Submission No. 22B, Dr Freeland, Written Submission, 2003

[22] Submission No. 22A, Dr Freeland, Oral Submission 1, Briefing, 28 May 2003

Cane toad populations fluctuate dramatically in a random fashion, there is no temporal trend. What dictates the population in the dry season, is how much rain fall there was in the previous wet, in particular the December rainfall. I think the December rainfall is important because that is when toads get their eggs, in late November or early December with the first rains, and that first batch that comes through, 2 things happen 1; if it keeps raining their probably the only batch that really succeeds because they eat each other for the rest of the season. And the other thing that happens is there is no rain and this batch comes out of the water, they simply de-hydrate and die.[23]

2.6. FINDINGS

1. It is expected that the urban areas of the Top End of the Northern Territory, including Darwin and Palmerston, will experience a high level of cane toad colonisation.

2. Cane toads have already colonised some Northern Territory offshore islands.

3. Cane toads have the potential to infest and affect all Australian States.

2.7. RECOMMENDATIONS

The Committee's recommendations from the discussions in this chapter have been incorporated into the recommendations of subsequent chapters.

[23] Submission No. 22A, Dr Freeland, Oral Submission, Part 1, 28 May 2003

Chapter 3 Risks and Impacts

3.1. OVERVIEW

The real extent and the severity of cane toad impacts formed the basis of many submissions. For example from Dr Freeland the Committee heard:

> *Okay, we don't know everything, can't know everything but we do know one thing and that is the majority of the Territory's terrestrial species are going to persist and that is experienced both in the Gulf and from Queensland.*[24]

From Environment Australia:

> *Based on the toxicity, fecundity, migratory behaviour and adaptability of cane toads, EA considers that it is highly likely that cane toads will adversely affect populations of many native species in the Northern Territory.*[25]

The Committee found a great deal of published information on the potential and immediate effects of cane toads. Whether the long-term effects on native species are deleterious, is inconclusive. Nevertheless, the seriousness of the incursion of cane toads into the Northern Territory is an issue of priority that must be addressed while there is still an opportunity to protect certain areas of the Northern Territory and properly inform the general community about how to deal with cane toads.

The Committee found that the toxin is also potentially lethal to humans, domestic dogs and cats if ingested. However, humans tend to avoid contact with the toads and are easily educated about the dangers. Some domestic pets are killed by contact with cane toads but many learn to avoid them.[26] The Committee found that the significant risk to humans and their domestic pets can be reduced with education and awareness.

Until recently there had been little research conducted on the indirect and long-term effects of cane toads on Australian native species and ecosystems. As a result, as yet there is little quantitative base-line data on the possible long-term effects of cane toads on native species and ecosystems.

The potential impacts of cane toads in the Northern Territory includes the ecological effects on native wildlife populations, the socio-economic effects on Indigenous communities and the wider community, effects on tourism and other businesses and the effects on power and water supply and generation.

3.2. ECOLOGICAL IMPACTS

The key characteristics of cane toad biology that enables their significant impact on Australian native species includes their toxicity to potential predators, their fecundity,

[24] Submission No. 22A, Dr Freeland, Oral Submission, Part 2, 10 June 2003

[25] Submission No. 15A, Environment Australia, 2003, Refer to Appendix 8, Copy of Submission

[26] Submission No. 15A, Environment Australia-16 May 2003

their dispersal ability over long distances and their adaptability to a wide range of habitats and prey species.[27]

Anecdotal evidence and research has provided much of the knowledge of cane toad impacts, through cane toad interactions with humans, domestic animals and many Australian native species. The toxin which cane toads produce is lethal to most Australian native species and animals that attempt to eat cane toads or their eggs or tadpoles. Cane toads also eat a wide variety of native species, mainly invertebrates and their large numbers favour their ability to compete with native species. However, little is known of these competition effects.[28]

For example the Committee heard from Dr Finlayson:

> *Will anything eat cane toads? Seemingly, at times, yes, but there is a large number of organisms, that cane toads at different stages of their lifecycle. You must remember, from the tadpole size through to the large adult there is a different organisms that - ..... organisms that do eat it. Some of these we are more worried about than others. People do not tend to worry about the centipedes and spiders as much as the birds, for example. The potential effects on prey is what does the cane toad eat itself? Again, they eat mainly ants, termites and beetles; that is, the smaller organisms. There are no studies that specifically investigate the impacts upon ground dwelling arthropods, the other smaller animals. They also eat small birds, mammals, reptiles and frogs, but generally in small numbers. But there is an effect there. So both issues are related to what eats the cane toad and what the cane toad eats.*[29]

The Committee also heard evidence from Dr Finalyson regarding competition between cane toads and native species:

> *The more interesting one perhaps is that the timing of arrival of tadpoles of native frogs or the toads in a certain habitat can affect the actual interrelation and whether there is an effect. So, who gets there first, who actually breeds there first and what stage of their lifecycle they are at, will have an effect upon what the impact is. So, really, we are saying here is, while there are animals that the cane toad eats, and we know that, there is competition between cane toads and some of the frogs. It is not as clear cut as saying there is total competition and there will be one outcome. It depends upon the actual lifecycle and the habitats that are involved.*[31]

The Committee heard much evidence regarding the physiological and behavioural characteristics of cane toads that advantages the species' opportunistic habits allowing it to be prolific in its feeding and breeding.

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[27] Submission No. 15A, Environment Australia-16 May 2003

[28] Submission No. 15A, Environment Australia-16 May 2003

[29] Dr Finlayson, ERISS, Darwin Public Hearing, 12 May 2003

[30] Submission No. 22A, Dr Freeland, Oral Submission, Part 1, 28 May 2003

[31] Dr Finlayson, ERISS, Darwin Public Hearing, 12 May 2003

For example from Dr Finlayson:

> *So the problem: the cane toad possesses highly toxic chemicals, animals that eat the cane toads die, it is a fairly well known fact. With the next three points: the actual breeding cycle of the cane toad enables it to spread fast and to establish quickly; the diet and habitat it can eat a large number of organisms and can survive in many different types of habitats but all use different habitats for at least part of the year; they can tolerate a broad range of environmental conditions, which is almost the same point; it can compete variably for resources from many native species. That point there is one where we feel there is not enough information as to how they can compete, how much they do compete and most importantly perhaps, there is no effective control method.*[32]

A great deal of evidence was provided regarding the species likely to be affected by the cane toad invasion.

For example the Committee heard from the Ms Kerin, the Katherine Regional Parks Manager of Parks and Wildlife Commission of the Northern Territory:

> *…Yes. I couldn't comment on Katherine itself but certainly in the Gulf country when the toads first moved through there, there were lots and lots of comments and feedback from the local people down there, particularly in relation to the impact on goannas and blue tongues. When we did some work down there with some of the traditional owners, you find out on those big black soil plains outside Borroloola a goanna or blue tongue for 20 minutes when you were searching with dogs. After the toads moved through that rocketed it up to about 3 - 31/2 hours so there's a huge impact and goannas and blue tongues are fairly stable part of those people's diet down there particularly along the black soil plains and also the sand plains along the McArthur River.*[33]

Dr Tyler:

> *…to remind you of the ecological effects that cane toads are going to have as competitors of the native fauna but also as predators they have voracious appetites and they live in high density. There's no doubt that they will knock back native populations of native frogs, possibly to extinction, and the Top End predators are going to be hit very hard as well. The quolls and the crocodilians, the goannas and the large snakes and so on.*[34]

From the evidence provided to the Committee, the species likely to be affected by cane toads include the northern quoll, goannas, snakes (e.g. king brown and black), fish (barramundi, black bream, catfish), long and short-necked turtles (which eat toad tadpoles), freshwater crocodiles, salt-water crocodiles (found dead at Ngukurr on Roper River), some aquatic invertebrates, water scorpions, water bugs and beetles, dragonflies, freshwater prawns, shrimps, crabs, crayfish, centipedes, large spiders,

[32] Dr Finlayson, ERISS, Darwin Public Hearing, 12 May 2003

[33] Ms Kerin, Acting Regional Parks Manager, NT Parks and Wildlife, Katherine Public Hearing, 6 May 2003

[34] Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

some bird species and water rats. Pelicans, herons, jabiru, and semi-domestic pigs who have died as a result of ingesting cane toads may also be affected.[35 and 36]

The Committee heard anecdotal evidence that, in Borroloola, goannas and certain types of snakes noticeably declined but have gradually begun to reappear.[37]

The Parks and Wildlife Commission of the Northern Territory provided an assessment of cane toad impacts on the conservation status of Northern Territory vertebrates in Table 2.1 below.

Table 2.1: Cane toad impacts on the conservation status of NT vertebrates[38]

Scientific name	**Common name**	**Status prior to consideration of cane toad impacts**	**Recommended new status**
Dasyurus hallucatus	northern quoll	Near Threatened	Vulnerable
Pseudantechinus bilarni	sandstone antechinus	Least Concern	Data Deficient
Sminthopsis bindi	kakadu dunnart	Least Concern	Data Deficient
Sminthopsis virginiae	red-cheeked dunnart	Least Concern	Data Deficient
Antechinus bellus	fawn antechinus	Near Threatened	Data Deficient
Planigale maculata	common planigale	Least Concern	Data Deficient
Planigale ingrami	long-tailed planigale	Least Concern	Data Deficient
Macroderma gigas	ghost bat	Near Threatened	Data Deficient
Cyclorana australis	giant frog	Least Concern	Data Deficient
Limnodynastes ornatus	ornate burrowing frog	Least Concern	Data Deficient
Varanus panoptes	yellow-spotted monitor	Least Concern	Near Threatened
V. mertensi	Merten's water monitor	Least Concern	Data Deficient
V. mitchelli	Mitchell's water monitor	Least Concern	Data Deficient
V. primordius	Northern blunt-spined monitor	Near Threatened	Data Deficient
V. scalaris	Spotted tree monitor	Least Concern	Data Deficient
V. tristis	Black-tailed monitor	Least Concern	Data Deficient
V. glebopalma	long-tailed rock monitor	Least Concern	Data Deficient
V. glauertii	Kimberley rock monitor	Data Deficient	Data Deficient
V. indicus	Mangrove monitor	Least Concern	Data Deficient
V. baritji	Black-spotted ridge-tailed monitor	Least Concern	Data Deficient
V. acanthurus	Ridge-tailed monitor	Least Concern	Data Deficient
Acanthophis praelongus	northern death adder	Least Concern	Near Threatened
Pseudechis australis	king brown snake	Least Concern	Data Deficient

35 Submission No. 3D, ERISS Power Point Presentation, Darwin Public Hearing, 12 May 2003

36 Submission No. 3B, ERISS/ PAN, Cane Toad Risk Assessment-Katherine/ Mataranka and Borroloola, 2002

37 Submission No. 3B, ERISS/ PAN, Cane Toad Risk Assessment-Katherine/ Mataranka and Borroloola, 2002

38 Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

Pseudonaja nuchalis	western brown snake	Least Concern	Data Deficient
Enhydris polylepis	Macleay's water snake	Least Concern	Data Deficient
Demansia olivacea	olive whip snake	Least Concern	Data Deficient
Demansia vestigiata	black whip snake	Least Concern	Data Deficient
Demansia papuensis	Greater Black Whip Snake	Least Concern	Data Deficient
Rhinoplocephalus pallidiceps	northern small-eyed snake	Least Concern	Data Deficient
Tiliqua scincoides	common blue-tongued lizard	Least Concern	Data Deficient
Ixobrychus flavicollis	black bittern	Least Concern	Data Deficient

Species changed to 'Data Deficient' resulted from the lack of knowledge of the long term impacts on many species.[39]

The full extent to which each of the identified species may be affected in still not fully understood. There is also limited information on the competition between cane toads and native animals for resources such as food, shelter and breeding sites. The heavy reliance of cane toads on ground dwelling arthropods generally excludes them from competition. Dr Freeland also questions the influence of other variables, naturally occurring or otherwise, such as fires and cattle.[40] Evidence suggests that there is a segregation of breeding sites between native frogs and cane toads. The timing of the arrival of tadpoles can affect their competitive ability.[41]

From Dr Freeland:

> *The research that we undertook was quite wide in it's scope. We couldn't find any impact of cane toads on frogs, communities in the Gulf during the dry season and that's is the time when the impacts should be greatest because that is when they are all congregated in the highest densities and food availability is likely to be least. The reason is simple, cane toads have an ecological niche', a place in life, if you like, which is simply not present in Australia before the toads arrival. They have no way of going about dealing with life and it is very different and their resource for uses are very minimally over-lapping with the native frogs, so they don't have any impacts.*[42]

In contrast, Dr Alford suggested that the competitive effects may be greater than previously reported.[43] Cane toads that aggregated around permanent water in the dry season were nutritionally stressed which may indicate food shortages. Other insectivorous species also dependent on the resources

[39] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[40] Submission No. 22A, Briefing, Dr Freeland, Oral Submission 2, 10 June 2003

[41] Submission No. 3D, ERISS Power Point Presentation, Darwin Public Hearing, 12 May 2003

[42] Submission No. 22A, Briefing, Dr Freeland, Oral Submission 1, 28 May 2003

[43] Cited in Submission No. 11B, Ecological Society of Australia 2, 2003

around enduring water sites may therefore be disadvantaged, including small reptiles and birds.[44]

Evidence was received that some species, including some snakes and fish, may have learnt to eat cane toads without ill effects, including dingo, king brown, crows and kites (sighted feeding on dead cane toads).[45]

Anecdotal evidence from Queensland weighted by the findings from the preliminary report of a study commissioned by Parks Australia in conjunction with Dr John Woinarski (PWCNT) and Ms Michelle Watson indicated that northern quoll populations would disappear abruptly. They were therefore deemed highly vulnerable to cane toad impacts by the PWCNT. This resulted in Environment Australia, the Parks and Wildlife Commission of the Northern Territory, the Northern Land Council and Aboriginal traditional owners collaborating to translocate approximately 60 quolls from the mainland of the Northern Territory to islands off Arnhem Land earlier this year. This initiative attempts to ensure the preservation of northern quoll populations until such time as an effective method of control or eradication is found.[46] The Committee notes that funding has been allocated for this financial year to continue monitoring of this translocation project.[47]

From a conservation perspective, the possibility of ecological benefits arising from cane toad colonisation was presented to the Committee:

From Mr Walden of ERISS:

> *The ecological benefits. This is an interesting one as well. If you have your feral cats and … pigs eating the toads and dying, … the pressure on other organisms which are currently under threat from those ferals will also be less. So there could be a balance there, not that we are advocating we should be feeding toads to the pigs, etc.*[48]

ERISS points out that feral pigs as well as impacting on smaller native fauna populations, are responsible for causing widespread damage on and around the edges of wetlands, assisting erosion and the establishment of weed species.[49]

ERISS reports that ground nesting birds may benefit from the reduced egg predation by goannas. In Kakadu National Park, these birds include three

[44] Submission No. 11B, Ecological Society of Australia 2, 2003

[45] Submission No. 3B, ERISS/ PAN, Cane Toad Risk Assessment-Katherine/ Mataranka and Borroloola, 2002

[46] Submission No. 3B, ERISS/ PAN, Cane Toad Risk Assessment-Katherine/ Mataranka and Borroloola, 2002

[47] Dr Lawson, Director, Parks and Wildlife Commission of the Northern Territory, Personal Communication, 18 August 2003

[48] Mr Walden, ERISS, Darwin Public Hearing, 12 May 2003

[49] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

species of quails (*Coturnix spp*), bush thick-knee (*Burhinus magniostris*), the great bowerbird (*Chlamydera nuchalis*) and the orange-footed scrubfowl (*Megapodius reinwardt*), the latter species being known for its mound-building, nesting habits.[50]

ERISS also suggests that a short-term decline of goanna numbers due to cane toads may also reduce the current level of predation on both fresh and salt water crocodile eggs.[51]

However, from Professor Grigg:

> *Data now accumulating suggests that some deleterious effects are certain and, because the native fauna of northern Australia is such a nationally significant asset, whatever can be done to protect it, should be done.*[52]

3.3. SOCIO-ECONOMIC IMPACTS

The Committee received substantial evidence regarding the potential socio-economic impacts. These include the effects on affected Indigenous communities, the wider community, power and water, business and tourism. While the socio-economic impacts are widely discussed in the evidence and research collected by the Committee, further research specific to these issues is required to accurately quantify the full extent of these impacts.

3.3.1. Impacts on Territory communities

The potential impacts on Territory communities relate to the:

- dangers posed to unaware adults;
- dangers posed to children;
- dangers posed to domestic pets unfamiliar with cane toads;
- blocking of drains;
- fouling of swimming pools;
- visual impacts (unattractive and in large numbers);
- lower prevalence of urban inhabited native species (eg. lizards and monitors);
- potential transmission of human disease as cane toads are known to consume human and other animal faeces; and
- potential dangers from the substance abuse of cane toad toxin.

The Committee was informed from the PWCNT that:

> *Toads will flourish in and around swimming pools and ornamental ponds, and the lawns and shady gardens that are such a feature of*

[50] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[51] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[52] Submission No. 12, Professor Grigg, 2003

> *Darwin are ideal toad habitat. Toads will prove a hazard for pets, and are likely to cause the death of at least some dogs.*[53]

From Mr Walden the Committee heard:

> *They eat human faeces, so you have got salmonella and parasites which can be spread through toad faeces as well, and you have also got rotting carcases lying around, especially if you have got vigilante gangs out with golf clubs and stuff, you can have them hanging off fences and that could be quite a problem. Anyone who has lived in Queensland will know how many you get on the roads. So there will be possibly - it is sort of an aesthetic thing, but it could be a human health thing as well. There will be smell and flies and that sort of gear, yes.*[54]

From Dr Finlayson:

> *…The contamination of water and water supplies. You just heard an example from Queensland. They do get into the bowls of water around a house; they do get into people's pools; and outside of urban areas they could cause a localised toxic effect or just have a large number of dead animals in a waterhole.*[55]

From Dr Tyler:

> *And one of the most significant things about the cane toad is the fact that its eggs are toxic, and this has probably been presented to you. There was a student at the University of Sydney undertaking medicine who was doing first year biology, and he had a female toad, and it looked remarkably like caviar. His friends bet him that he would not eat it, and he said he would not do it for nothing, but he would if everybody tossed in a dollar, which they did, and he ate the eggs. He had his first cardiac arrest after 20 minutes, was in intensive care for five weeks where he had two more cardiac arrests. A family in Peru died from eating a stew, where apparently frogspawn is made into stews, and there, a mother and two children died and one child recovered because they had picked the wrong species, they had got cane toad eggs.*[56]

Urban areas are likely to have a high density of cane toads. This would impact on the outdoor lifestyles, particularly the recreational activities, which urban Territorians currently enjoy. The likelihood of household pets being poisoned is also a potential impact.

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53 Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

54 Mr Walden, ERISS, Darwin Public Hearing, 12 May 2003

55 Dr Finlayson, ERISS, Darwin Public Hearing, 12 May 2003

56 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

For example the Committee heard from Mr Walden:

> *What we have found is, that there have been reports of feral cats dying in general. Dogs tend to get sick and if they are treated, if they are washed out, washed the mouths out or something like that, they tend to recover fairly quickly. Dingoes have been reported in the literature as being affected. So, yes, it is another grey area but, certainly, cats could be an issue. It comes into often the body mass size, which we will get on to a bit later. A smaller animal is going to get exposed to more toxin; a large dog has got a chance of recovery.*[57]

The dangers of cane toads to children was expressed to the Committee by several people. For example from Mr Murdoch of the Jabiru Town Council:

> *When you are three or four years old, and want to collect some, it does not matter that they may be poisonous. A worse still scenario is where a group of young children will capture a live toad and start to play with it. Scientists and herpetologists tell us that the toads are capable of spraying the poison from their glands over a short distance when they are stressed. There would be nothing more stressful than being annoyed by a group of young children who do not know when to stop. The poison will be spread throughout the group, and possible even sprayed into the children's eyes, causing immediate temporary blindness which will of course require emergency medical treatment. The other children will also have poison on their hands and other body parts. Again, those who know children will be aware, they do not wash their hands unless directed to do so, and the possibility of self transferal of toad poison to the mouth by the hand, is extremely real.*[58]

From Mr Lindner the Committee heard:

> *When they arrived the kids learnt within 24 hours to throw them with a power pole insulator and have a little mushroom cloud go up and it was great fun. Kids learn quick and they probably learn not to suck their fingers afterwards*.[59]

The Committee received evidence regarding the potential dangers of the substance abuse of cane toad toxin.

From ERISS the Committee heard:

> *It seems reasonable to suggest that substance abuse (as documented in the video, Cane Toads - An Unnatural History, ABC 1987) could also be practised in the NT. When cane toad toxin is extracted from the parotid glands and dried and smoked in a hand-rolled cigarette, the therapeutic/ hallucinogenic effects are said to be*

[57] Mr Walden, ERISS, Darwin Public Hearing, 12 May 2003

[58] Mr Murdoch, Public Relations Officer, Jabiru Town Council, Jabiru Public Hearing, 6 May 2003

[59] Mr Lindner, Jabiru Public Hearing, 6 May 2003

> *sufficiently rewarding, for the substance to become habit forming, as it has done in countries such as Fiji (S Choy, Qld DNR, pers comm). Furthermore, due to the long period of time that cane toads have been living in Queensland, there is anecdotal evidence to suggest that similar habits have been adopted by a number of people living in Cairns (S Choy, pers comm).*[60]

From Dr Holland:

> *… you kind of have to treat this one as a double-edged sword is that there a potential for basically substance abuse with cane toads. It's kind of self limiting because people who smoke dried cane toads usually end up dead, but people need to be aware of the potential for that problem. … there are incidences in Fiji and American Samoa of people drying toad skins and attempting to smoke them and winding up dead in a very short order.*[61]

The Committee was informed that in Queensland, cane toad toxin is listed as a dangerous drug under Schedule 2 of the *Drug and Misuse Act*.[62]

The Committee also received some evidence on the potential uses for cane toads. In countries such as China, the primary medicinal use of cane toad skin extract and toxin is for the management of cardiovascular disorders. However, there have been reported incidences of intoxication clinically similar to cardiac glycoside poisoning.[63] The potential to use cane toads for teaching and testing purposes also exists.

From the Power and Water Corporation's submission the Committee noted that there are no significant issues associated with cane toads on power generation or distribution, or sewage reticulation and treatment. There were however a number of concerns with the potential impacts of cane toads on water supply systems.

The report by the Power and Water Corporation highlights that cane toads pose:

1. *A low level of risk to well managed and adequately maintained drinking water supplies;*
2. *A potential risk to Aboriginal outstations or individual centres with a low level of borehole protection standards or maintenance; and*

60 Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

61 Dr Holland, Jabiru Public Hearing, 6 May 2003

62 Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

63 Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

3. *A certain risk to aquatic ecosystems and habitats within Darwin River Dam and other protected catchments.*[64]

3.3.2. *Impacts on Indigenous Communities*

The Committee received a great deal of evidence regarding the impacts of cane toads on Indigenous communities. The decline in numbers of bush tucker species such as goanna, water monitor, lizards, snakes and turtles would primarily affect the important and strong relationships Indigenous communities have with their country. Also affected would be levels of health with an increased reliance on bought store meat and reduced physical activity in the practice of hunting.

The Committee heard from Mr Cubillo, the Deputy Chairman of the Kakadu National Park Board of Management:

> *…the goannas and snakes and barramundi and all these things, they are quite significant to Aboriginal people's culture and indeed it means…and that is quite serious to think that a lot of Aboriginal people have…which is celebration of these particular animals. They are part of our culture because through our skin system, the moieties that make us part of the country and with the, if you like, endangering or disappearing of most of these animals, it is a quite big worry about you know, where does the culture go from here? And the serious one I am thinking about, if we have an eradication of animals that we have very strong stories about and we talk about that and Aboriginal people practice their culture. Aboriginal people not only eat these things for bush tucker but very serious parts of our culture, our tradition and it all. And all these things are embedded here… Do we dance about crocodiles when crocodiles die from you know, cane toads. King Browns, all these things have a significant view … the moiety system, which means you belong, you look after something. And if you are looking after something, you have interest in that to make sure that particular animal is around.*[65]

From the words of the Ngukurr Women Rangers:

> *People hardly go out hunting. They eat less bush meat and are depending on the shop for meat.*[66]

Also:

> *After the big rains this wet season (2003) there were millions of little cane toads around Ngukurr. The dogs keep away from them. We are*

64 Submission No. 16, Power and Water Corporation, 2003

65 Mr Russell Cubillo, Kakadu National Park Board of Management, Jabiru Public Hearing, 7 May 2003

66 Submission No. 8, Northern Land Council Caring for Country Unit, 2003

> *frightened of the toads and we teach our children not to humbug with the cane toads. So you got to be with the children all the time.*[67]

The Committee heard that the despoliation of waterholes and springs regarded as sacred sites would also affect Indigenous communities.[68]

In a paper provided to the Committee, Altman *et al* posed the following:

> *The survival of Aboriginal people as hunter-gatherers has also depended on treating toxic species with great circumspection. How should they react to new animals that exude poison or even squirt toxins when harassed? Should they stop eating fish or turtles that eat tadpoles or toads, even if these predators survive the experience? Should they stop harvesting animals that are badly affected by the toads so that the vulnerable aren't put at further risk? How will reduced availability of toad-affected species influence demand on other species?*[69]

3.3.3. *Impacts on business*

The Committee received a submission from the NT Chamber of Commerce discussing this issue.

> *There has been no detailed study on the impacts of cane toads on Northern Territory businesses. Anecdotal evidence suggests that the probable direct economic impacts of cane toads on business will be uncertain in the near future, but the indirect effects will become more evident in the next two to five years.*[70]

The Committee received a submission from the Northern Territory Horticultural Society regarding impacts on the agricultural industry.

From Mrs Clark:

> *We have identified a number of problems with Cane toads in our nursery. The toad will burrow into seed trays and we lose quite a few seedlings because of this. The only alternative is to put the trays on a higher stand. Ponds and water features are not recommended if they are on ground level as they will foul the water. They do seem to notice the difference between water that is chlorinated and plain water. We have never had a cane toad fall into or are near our chlorinated water. They can climb the height of a bath tub but cannot get out. They will also fall into a trench and not be able to climb out. The ecology has changed in the nursery. We have noticed more ants and in the last couple of weeks dead rats and an increase in the animals eg*

[67] Submission No. 8, Northern Land Council Caring for Country Unit, 2003

[68] Submission No. 3D, ERISS Power Point Presentation, Darwin Public Hearing, 12 May 2003

[69] Professor Altman, Dr Griffiths and Dr Whitehead, 'Invasion of the Rubbish Frogs', provided to the Committee by Dr Whitehead, Briefing, 15 April 2003

[70] Submission No. 13, Northern Territory Chamber of Commerce and Industry, 2003

> *bandicoots. Natural predators of some animals have decreased. No large goannas only smaller ones and less snakes. There are also less native frogs. Just a couple here and them, but not as many as there used to be.*
>
> *With or without the use of plastic mulch in the production of fruit and vegetables it has been found that the cane toad burrows into the soil where the drippers are killing the seedling plants.*
>
> *The effect of the toad on growers and nursery people is an extra cost in production. More problem insect gaining a foothold. Other animals that do not cat toads will inc-mase eg Bandicoots because the natural predators have taken a hammering since the toad appeared.*[71]

The Committee recognises that the potential impacts on business to be in need of further investigation and research.

3.3.4. *Impacts on tourism*

It is difficult to accurately state the impact that cane toads will have on tourism in the Northern Territory.

The Committee found the potential impacts on tourism to include:

- reduced opportunity of tourists' likelihood of seeing native Australian species in the wild;
- reduced enjoyment of tourists in the Territory bush;
- the possible reduction in interest from the more affluent tourists which are an important target group of the Northern Territory's tourism industry; and
- the mistaken identification of native frog species for cane toads by unaware tourists who may take management upon themselves.

The Committee heard evidence from the Northern Territory Tourism Commission:

> *The visual impact of cane toads will be high, in particular where activities are undertaken in the evening, around waterways or in urbanised areas. Campgrounds with watered lawns, shady trees and lighting will attract large numbers of toads and this will detract from the overall visitor experience. Waterways and wet areas will also attract large numbers and be visible during the day. However the majority of international visitors will not identify the cane toad as an introduced species that is doing untold environmental damage. Instead they will associate it with any other native frog. A concern would be that if visitors are told about the cane toad, they may take it into their own hands to cull as many as possible. This could lead to a number of problems including the wrongful culling of similar looking frogs including the marble, northern spade foot and ornate burrowing frogs.*

71 Submission No. 20, Northern Territory Horticultural Society, 2003

> *Each of these will already be in danger from the introduced species, without human interference depleting their numbers further.*[72]

Based on observations of Queensland's history with cane toads, the Northern Territory Tourist Commission submitted that:

> *Queensland has contended with the cane toad for many decades with no noticeable effect on tourism. The toads have not acted as a deterrent to visitors travelling to national parks and reserves in this State and while many species may have disappeared from the infested areas, the remaining wildlife still provides a high level of satisfaction to visitors.*[73]

From Dr Tyler:

> *Now what is needed, I believe, are steps to minimising impacts, and when I talk about sociological impact I'm talking about the residents of Darwin and particularly the tourists because I don't think there has been any study to look at what the impact will be on tourists. If I was a tourist and I wasn't that keen on cane toads, I might decide to move my holiday destination to Kununurra rather than come to Darwin.*[74]

The NT Chamber of Commerce and Industry's submission made the following point:

> *It has been suggested that cane toads have not affected tourism in places such as Queensland and Fiji where beaches are their main attraction. The effects of cane toads on tourism in the Northern Territory are uncertain due to its predominantly nature-based attractions. Of particular concern are the impacts on 'affluent adventurers', who are particularly attracted to pristine environments*.[75]

The Committee heard from the PWCNT:

> *Toads may also have some impact on Territory enterprises. Tourists may find the wildlife/wilderness experience somewhat diminished by the presence of large numbers of cane toads, although the limited information available suggests that this impact is likely to be minor.*[76]

From Mr Denigan of Mick's Whips and Leather Goods the Committee heard:

> *It might not be me, but some sort of hunter safari type tourism should possibly be looked at. It is humane, I mean, you are shooting and*

[72] Submission No. 14, Northern Territory Tourist Commission, 2003

[73] Submission No. 14, Northern Territory Tourist Commission, 2003

[74] Dr Tyler, Darwin Public Hearing, 12 May 2003

[75] Submission No. 13, Northern Territory Chamber of Commerce and Industry, 2003

[76] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

> *harpooning, it gives someone a job, it gives that new direction for Territory tourism, an elite market, and it has got a lot of potential.*[77]

The possibility of harvesting cane toad skins for the production of leather goods for the tourist market was also suggested.[78]

The Committee found that the impacts on Northern Territory's tourism industry needs further research, recognising that the real impacts may not be fully realised until cane toads are actually here.

3.4. FINDINGS

4. The rate of spread of cane toads at approximately 30 kilometres per year is greater than expected.

5. Cane toads are spreading in a north westerly direction and will probably arrive in Darwin in the 2003/04 wet season.

6. Drawing from the evidence provided to the Committee by Parks Australia North (PAN) and the Environmental Research Institute of the Supervising scientist (ERISS), the species likely to be affected by cane toads include the northern quoll, goannas, snakes (e.g. king brown and black), fish (barramundi, black bream, catfish), long and short-necked turtles (which eat toad tadpoles), freshwater crocodiles, salt-water crocodiles (found dead at Ngukurr on Roper River), some aquatic invertebrates, water scorpions, water bugs and beetles, dragonflies, freshwater prawns, shrimps, crabs, crayfish, centipedes, large spiders, some bird species and water rats. pelicans, herons, jabiru, and semi-domestic pigs who have died as a result of ingesting cane toads may also be affected.

7. The northern quoll is a vulnerable species, threatened by the cane toad.

8. That while potential ecological effects are well documented, there is a need for ongoing, long term quantitative information on the actual ecological effects in areas where the cane toad is now well established.

9. There are limited studies quantifying the impacts on aquatic macro-invertebrates (aquatic insects, worms, clams, snails, and crustaceans).

10. There is a lack of information on the potential socio-economic impacts in the Northern Territory, including those on water, tourism, business, agriculture and Indigenous food sources.

11. The toxin secreted by the cane toad is potentially lethal to humans, domestic dogs and cats if ingested.

12. The potentially significant risk to humans and their domestic pets can be reduced with education and awareness.

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[77] Mr Denigan, Mick's Whips and Leather Goods, Darwin Public Hearing, 12 May 2003

[78] Mr Denigan, Mick's Whips and Leather Goods, Darwin Public Hearing, 12 May 2003

13. The experience and knowledge of Indigenous communities already affected by cane toads should be used to enhance the work of existing ranger programs such as those established by PWCNT and the Northern Land Council's Caring for Country Unit.

14. The potential impacts on tourism include:
    - reduced opportunity of tourists' likelihood of seeing native Australian species in the wild;
    - mistaken identification of native frog species for cane toads by unaware tourists who may take management upon themselves;
    - reduced enjoyment of tourists in the Territory bush; and
    - the possible reduction in interest from the more affluent tourists which are an important target group of the Northern Territory's tourism industry.

3.5. RECOMMENDATIONS

The Committee recommends:

1. That the Northern Territory's Power and Water Corporation continues to develop and implement monitoring and management regimes in regard to the risks that may be associated with the impact of cane toads on the management and control of water.

2. That ranger programs, such as those established by the PWCNT and the Northern Land Council's Caring for Country Unit, be supported and enhanced to pursue cane toad control methods.

Chapter 4 Managing the risks and impacts

4.1. OVERVIEW

The Committee heard and received a considerable amount of evidence on the concerns and expectations of the community to the advancement of cane toads into the Northern Territory.

The Committee saw the need for a strong collaborative approach between Government and the affected Indigenous communities in managing the impact of the cane toad on their way of life.

The cane toad has proven to be a very robust and mobile species and does not respect State or Territory boundaries or for that matter property boundaries.

Effective cane toad management, control and eradication requires co-operative arrangement and programs between the stakeholders not only at the local level but also regional, Territory and State levels.

The Committee is of the view that without these co-operative arrangements and programs, the control and management of the advancement of the cane toad is likely to waste both time and resources.

This Chapter looks at:

- monitoring and research regimes that are or have been in place;
- the need for further research;
- what methods are available in controlling the cane toads;
- the merits or otherwise developing biological control;
- the issues and factors associated with quarantine and the need for cane toad free areas;
- the issues in respect of funding; and
- the establishment of a national task force and other collaborative arrangements.

4.2. FUNDING ISSUES

4.2.1. Commonwealth

The Committee received evidence in respect of the funding for cane toad research and monitoring over the past twenty years and what is predicted for the future. The Committee found it difficult to get clear and accurate figures. However, the Committee did receive a submission from Environment Australia in respect of Commonwealth funding issues.

In a video conference link up between the Committee and Environment Australia, held on 19 May 2003, a series of questions were put by the Committee to Environment Australia in regard to past funding offers and the comparison of the funding between feral animals and cane toads.

Environment Australia responded on 16 July 2003:[79]

Issue 1. Past funding offers from the Commonwealth to the Territory in terms of cane toad research that had not been taken up or accepted.

- *During 1999 Environment Australia informally sought the views of the Northern Territory Parks and Wildlife Commission. The Commission advised that further work on a biological control of cane toads was not considered warranted and did not intend funding such work. The Commission considered that from the range of vertebrate pests that required management for conservation reasons, a significant number would be accorded a higher priority than cane toads.*

- *In August 1999 the Northern Territory wrote to the Commonwealth concerning progress with the CSIRO cane toad biological control project and any other Commonwealth cane toad control proposals.*

- *In October 1999 the Commonwealth wrote to the Northern Territory seeking their involvement in a national approach to co-fund a renewed research and development effort to control cane toads. The Northern Territory responded providing qualified support to co-fund research and a development program for cane toad control, depending on the quality of the application received.*

- *In February 2000 the Commonwealth advertised nationally for expressions of interest to undertake a research program for biological control on cane toads. Based on the results of this process, the Commonwealth decided to proceed directly with CSIRO and funded an initial two year project. This research project was the subject of discussions with the NT inquiry on 19 May 2003, and which recently received additional funding under the Natural Heritage Trust.*

Issue 2. A comparison between research of other feral animals and cane toads.

Based on a preliminary evaluation of the information available to adequately address this request, it was decided that it may be useful to provide a snap shot of some of the funding provided for one nationally recognised pest species. The feral rabbit was selected to provide a useful comparison to the cane toad, as the rabbit calicivirus disease (RCD) research is one of the most recent vertebrate pest biological control project conducted in Australia.

The following figures provide conservative estimates of the total costs that would have been involved. Importantly, the information provides an indication of some of the major contributions made by the Commonwealth and State \Territory Governments.

[79] Submission No. 15B, Environment Australia, Follow up Submission 2003

Starting in July 1991, when the initial three-year laboratory project with CSIRO commenced, to the 1999/2000 financial year, a summary of known funding[80] is outlined in Table 4.1.

Table 4.1: Summary of known funding-CSIRO

Contributors	***1991-94***	***1994-95***	***1995-96***	***1996-97***	***1997-98***	***1998-99***	***1999-00***
Commonwealth	*$750,000*	*$1M*	*$1M*	*$950,000*	*$950,000*	*$375,000*	*$375,000*
				$650,000			
States & Territories	*unknown*			*$950,000*	*$950,000*		
Industry	*unknown*			*unknown*	*unknown*	*unknown*	*unknown*
Total	***$750,000***	***$1M***	***$1M***	***$4.5M***		***$375,000***	***$375,000***

In summary, over about a ten year period the total contracted funding provided by industry stakeholders, the Commonwealth and State/Territory Governments for RCD research was approximately $8 million. This amount does not include any in-kind contribution that may have been made, eg. CSIRO estimated that from 1991 - 1995 their in-kind contribution to the program was $2.3 million.

For cane toads, over about a ten year period the total contribution made mainly by the Commonwealth is approximately $4.7 million. Beginning in 1990 the Commonwealth provided $ 1.25 million over three years with some of the States contributing a further $90,000. In 1993 the Commonwealth provided an additional $2 million to the program that finished in December 1996. In 1996/1997, the first year of the Natural Heritage Trust, the Commonwealth provided $120,000 to fund the program to June 1997 to finalise some work not previously finished. Since 2000 the Commonwealth has provided approximately $1.5 million from the Natural Heritage Trust to support a new biological control program with CSIRO.

4.2.2. Northern Territory

In regard to the Northern Territory Government funding for cane toad research and monitoring programs, it has been difficult to get clear and accurate figures.

The Northern Territory has been actively involved in cane toad research and management for twenty years. In the words of Dr Freeland:

> *During that time it contributed more to the cane toad issue than any other State/Territory, and relative to its budgetary capacity, the effort compares favourably with that of the Commonwealth Government.[81]*

The following Table has been developed from excerpts from the debates of the Northern Territory Legislative Assembly from 1984 to 2003[82] that may give

80 *(All funding amounts are approximations.)*

81 Submission No. 22B, Dr Freeland, Written Submission, 2003

82 Northern Territory Legislative Assembly Parliamentary Records for the 4th, 5th, 6th, 7th, 8th and 9th Assemblies.

an approximate indication of what has been funded to the Northern Territory Parks and Wildlife Commission in regard to cane toad research and monitoring.

Table 4.2: Estimated Northern Territory Government monies appropriated for cane toad research and monitoring programs.

Year	Amount	Comment
1989/90	108,700	Major research program into the population dynamics and the possibility of control agents for the past 3 years. The program has been jointly funded by the Northern Territory, Western Australian, New South Wales, Queensland and Federal Governments, through the Council of Nature Conservation Ministers, to a total of $420 000. The Territory contribution has been $108 700.
	120,000	During the 3 years, the Government has also provided additional research funding of $40 000 per year to investigate the effect of toads on native wildlife. These funds have been provided from the commission's administrative and operational vote for wildlife research in the north.
1992-93	8,000	An amount of approximately $8000 was spent on cane toad research in 1992-93. The expenditure related to the continuation of a program that was initiated in 1989 to investigate the impact of cane toads on goanna populations. Expenditures in 1992-93 were reduced from the projected level of $25 000 because a study of the susceptibility of freshwater crocodiles to cane toad venom was cancelled. The study proposed force-feeding Queensland and Territory freshwater crocodiles with cane toads to determine whether Queensland crocodiles had developed immunity to the toxin. On reflection and review, the study was abandoned for ethical reasons. The funds are still within the commission's research and development trust account and are proposed to be used on broad-scale wildlife monitoring programs.
1993-94	8,000	There is no specific allocation for cane toad research in 1993-94, but it is anticipated that expenditure from general biological survey funding will be similar to that spent last year. The Northern Territory played a major role in achieving heightened awareness of the cane toad problem that led to the implementation of a $2m CSIRO program seeking methods of biological control. The prospects of slowing the advance of the cane toad and containing its numbers will be dependent on the conclusions of that research. There will be no point in the Territory making substantial expenditures until the results of that research are known.
1994-95	50 000	To monitor the impact of cane toads on native fauna in the Gulf region
1995-96	70,000	Cane toad research.
1996-97		Unknown
1997-98		Unknown
1999-00		Unknown
2000-01	14,000	Responding to the public in relation to potential cane toad sightings as well as producing and distributing educational and informative material so as to prevent the early establishment of cane toads in the Darwin area. Monitoring the cane toad front as they move across the Northern Territory; The commission has also been conducting educational talks in schools and to community groups and providing media information as required.
2001-02	50,000	Translocation of the northern quoll to offshore islands – drawn from operational funds 83.
2002-03	100,000	Translocation of the northern quoll to offshore islands – in response to cane toad threat
TOTAL:	**$478,700**	

The Committee also received evidence that funding for the relocation of the northern quoll had been funded for the next three years:

> *The government has provided funds for the next three years to further develop the role of islands as conservation arks for species that have*

83 Personal Communication, Dr Lawson, Parks and Wildlife Commission of the Northern Territory, 18 August 2003

> *suffered or are suffering from threatening processes on the mainland. This includes species that declined to extinction on the mainland of the Northern Territory prior to the arrival of cane toads.*[84]

4.3. MANAGEMENT AND RESEARCH

The Committee is of the view that there is no short-term solution in managing the impact of the cane toad. The Committee is aware that this reality should be recognised. It should not be an excuse for inaction.

The Committee noted that in the evidence received quite a number of the submissions addressed how the cane toad intrusion could be managed. A number of methods and approaches were highlighted in those submissions, which ranged from continued monitoring and research programs, biological control including eradication and physical removal, quarantining, physical barriers and the relocation of threatened species, the most recent example being the northern quoll.

The Committee received evidence from Environment Australia identifying the main ways to manage the environmental impact of cane toads, in order of priority:

- *identify one or more biological controls to reduce cane toad populations;*
- *institute strict quarantine measures in designated areas, e.g. islands or peninsulas, to keep them toad-free as long as possible;*
- *educate people to reduce the likelihood that they will transport cane toads to new areas;*
- *try to conserve breeding populations of species threatened with extinction by cane toads, through translocation or captive breeding if necessary and appropriate;*
- *conduct research to obtain more information about environmental, social, cultural and economic impacts in order to guide priorities for future impact mitigation measures; and*
- *increase co-ordination and momentum of research and control measures.*[85]

4.3.1. An overview of monitoring and research

The Parks and Wildlife Commission of the Northern Territory in its submission to the Committee succinctly describes the work that it has conducted in the Northern Territory since the early 1980's:

> *The Parks and Wildlife Commission has conducted research on cane toads since 1980. This work concentrated on how fast the cane toads were spreading, determining factors affecting population size, habitat requirements, food habits, interactions with native fauna, behaviour and activity patterns. Recently, there is some research effort directed*

84 Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

85 Submission No. 15A, Environment Australia, 2003

at investigating ecological responses to toad invasion in the Northern Territory. This work includes:

- *studies commissioned by Parks Australia on responses of quolls to toad invasion, and on monitoring of wildlife generally;*
- *a study by Wildlife International on the responses of freshwater crocodiles;*
- *a study commissioned by the Department of Defence on response of wildlife at Mt Bundey training area;*
- *studies on a range of goanna species by the Key Centre for Tropical Wildlife Management and researchers associated with Universities elsewhere in Australia and overseas;*
- *an examination by the University of Sydney of the initial impacts on snakes at Fog Dam and the subsequent mechanisms involved in population recovery, if this occurs; and*
- *studies on the response of native frogs by the University of Queensland.*[86]

In addition, Dr Woinarksi informed the Committee about important baseline data collected in the Top End by PWCNT:

We've, over the last decade or so we developed a very systematic way of counting terrestrial wildlife in the Territory and we've got probably five to ten thousand hectare quadrats spread across the Top End in which we've censused, over a three night period basically all the wildlife, the vertebrate wildlife that occurs in those and that's extraordinarily detailed and comprehensive baseline from which we can monitor any change that's occurred or that occurs henceforth. And we've used that system Kakadu in that report that's just gave where we, two years ago we sampled I think it was 110 odd quadrants in exactly that same way in the bottom of Kakadu and almost or a bit over half of those were invaded by cane toads in the six months after we'd sampled them and then we went back last year and re-sampled them all again both the ones that were impacted by toads and the ones that hadn't and that gave us a very clear picture of basically what the changes in the fauna had been. It's a very powerful way of doing it, from that basically it was evident that the quoll was by far the most affected of that group of animals that we could sample.

So that's a terrific amount of information that we've got for pretty well all the vertebrate fauna that lives on the land, however we haven't done similar stuff for the aquatic fauna so the fish, the aquatic goannas and we haven't got anywhere near the same, almost no information about the invertebrates. So that's basically the work that Parks and Wildlife's

86 Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

> *done which can be used to asses quite precisely the effect of toads…*[87]

Dr Woinarski also informed the Committee that studies on radio tracked quolls and goannas in Kakadu National Park are also currently being undertaken.[88]

Further to the Parks and Wildlife Commission of the Northern Territory list above, the Committee was made aware of other projects currently undertaken which are contributing to the understanding of cane toad impacts and can only aid the search for an effective control mechanism. All the projects made aware to the Committee during the Inquiry are:

- Dr Brown's work in Fogg Dam (refer below for summary).

- Dr Tyler was commissioned by Tiwi Land Council earlier this year to examine barge sites at both Melville and Bathurst Island with a view to preventing the invasion of cane toads on the islands.

- Professor Grigg *et al*'s work in Roper River Valley and Kakadu National Park (refer below for summary).

- Dr Whitehead – Key Centre for Tropical Wildlife Management-Northern Territory University

  Primarily looking at impacts, the Key Centre has been involved in a reasonable amount of work on cane toads. The Key Centre's focus has been on goannas and working closely with Indigenous people in this regard as Indigenous people have a particular interest in goannas as food. Goannas are a group of animals known to be severely affected by cane toads.

- ERISS – Dr Max Finlayson and Mr Walden are working on a risk assessment based approach to environmental management.

- CSIRO – research into developing an biological control method to interfere with cane toad metamorphosis (refer section on 'biological control' below for summary).

- Dr Webb – McKinlay River Crocodiles (refer below for summary).

- Frogwatch NT has enlisted the participation of the community to report sightings of cane toads in order to track their expanding distribution. As well as providing a comprehensive store of information on frogs of the Northern Territory, the Frogwatch NT website also provides a feed-back response service for any inquiries regarding both frogs and cane toads.

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87 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

88 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

- Dr Mahony's work based on the male sterilisation approach to biological control (refer section below on 'biological control').

Below is a summary of the research projects of note known to the Committee (refer *Volume 2 Written Submissions Received* for detailed information of others not summarised here).

4.3.1.1. Dr Brown - Fogg Dam

Professor Rick Shine has been awarded a five year grant for the Australian Research Council to study the effect of cane toads on reptile populations in the Top End. The aim of the research is to document the ecological effects on native populations.[89] For the last 5 to 10 years, Dr Brown in association with Professor Shine has been conducting long-term mark recapture studies on various reptile populations (water python, death adder, keelback snake, slatey-grey snake, Macleays water snake, file snake and snake-necked turtle) around Fogg Dam. The results of this study over such a long and significant period of time will allow the researchers to compare changes observed after the arrival of cane toads. The study has already provided valuable information on population sizes, age structures, reproductive rates and growth rates. This study will allow the detection and measurement of population declines of a wide range of species. As part of this study, cane toads in the area will also be studied when they arrive.[90]

4.3.1.2. Professor Grigg, Andrew Taylor, Hamish McCallum, Graeme Watson and Les Fletcher – Roper River Valley and Kakadu National Park

Professor Grigg *et al* have been monitoring the calling activity of native frogs in the Roper River Valley since 1996 (10 sites in known wetland habitats) and in Kakadu National Park since 1998 (6 sites in savannah woodland, rocky stram and floodplain). The researchers using automatic recording systems based on technology similar to voice recognition developed specially for the study. All the monitoring sites in Kakadu had not been reached by cane toads as at May 2003. All monitoring sites in the Roper Valley are now within the cane toad's expanded range. In Kakadu, the researchers now have four wet seasons of 'before toad' data for four sites and two wet seasons for the other 2 sites. Much "post toad" has been collected for the Roper River Valley sites. The Kakadu study data will provide an independent replicate study against a longer "before toad" base-line.[91]

The pattern of results suggests that toads may well have a detrimental effect on frogs, however due to gaps in the data, along with the short

[89] Dr Brown, Sydney University, School of Biological Sciences, Darwin Public Hearing, 12 May 2003

[90] Submission No. 21, Dr Brown, Sydney University, Written Submission, 2003

[91] Submission No. 12, Professor Grigg, Department of Entomology and Zoology, Queensland University, 2003

period before cane toad arrival into the Roper River Valley area, this suggestion is not conclusive. The weight of evidence from the five-year study shows that there has been a decrease in frog calling activity so it can not be ruled that there is no effect.[92]

4.3.1.3. Dr Webb - McKinlay River Crocodiles

This study began in 1979 with the then Conservation Commission. This mark-release-recapture of freshwater crocodiles in the McKinlay River, with an objective to recapture after 20 years began in 1979 with the then Conservation Commission. The aim of the study was to understand the population dynamics over an appropriate time-scale before natural survival rates were confused with survival rates due to cane toads. This closed population is perhaps the best studied and known crocodile population in the world.[93] It provides base-line data from which to make meaningful comparisons between pre- and post-cane toad results and quantify the effects of cane toads on this population of freshwater crocodiles. Over the past 2 years, 1600 animals in that population have been recaptured. Approximately 25% of animals that were previously marked back in 1978 were recaptured. The data from this study will be used to quantifying survival rates, not only of freshwater crocodiles but also of fish species that were also recorded during this study.[94]

4.3.2. Biological control

The Committee found that no effective biological or chemical control method has yet been found for the cane toad. In consideration of the merits of these approaches to cane toad control and management, the Committee heard from several scientific researchers and academics. For example:

From Dr Freeland:

> *The important thing about it is you only need a few things. You need lots of transmission so it gets around quick, and often and consistently. The impacts have to be specific to what you are trying to get rid of. Preferably it just persists everywhere, you don't ever have to worry about it again, because otherwise you have got people running around the place dropping little buckets of things here and there. And that is expensive and it takes time, and obviously it has to cause a very significant mortality or mutilation on the organism that you are trying to expose of. … The other thing is whatever it is that if it does work, they are going to have to check against the native species, irrespective of the vile carrier the thing itself, the chemical that causes*

92 Submission No. 12, Professor Grigg, Department of Entomology and Zoology, Queensland University, 2003

93 Briefing, Dr Webb, 26 February 2003

94 Briefing, Dr Webb, 26 Feburary 2003

disruption of the metamorphosis needs to be tested against natives before you go a step further.[95]

However, the Committee also found that there are a number of potential biological control research programs.

4.3.2.1. *CSIRO biological control research*

CSIRO has supervised research extending for more than a decade on possible control mechanisms for cane toads. This work initially looked at biological control agents such as viruses and diseases. Their present work is focussed on investigating ways to interfere with the metamorphosis process in tadpoles.

Historically, in the 1960s work in the United States was undertaken to demonstrate that interference with the metamorphosis of bullfrogs at the tadpole stage by injection of certain adult proteins (in this case haemoglobin) was possible. The findings of the United States' work were thought to be applicable to cane toad metamorphosis. CSIRO's work has been conducted for 2 years already. Commonwealth funding was secured for another 2 years. There is no guarantee of longer-term Commonwealth funding.

Although the preliminary results have demonstrated that interference with cane toad metamorphosis is possible, CSIRO's work is still exploratory. Due to the impracticality of catching cane toad tadpoles and injecting them with haemoglobin and the fact that haemoglobin may not be cane toad specific, CSIRO is searching for a gene expressed in adult cane toads but not tadpoles to target for this approach. This genetic research is looking for a mechanism of getting that protein or the gene for that protein to cane toads, thereby interfering with cane toad metamorphosis on a huge scale. CSIRO is looking for a virus which affects a number of amphibians, to act as a vehicle for the gene into cane toads. CSIRO has reached a stage where the virus can be attenuated so that it does not produce any disease but still affects the cane toad. CSIRO has shown that the virus can be engineered to contain genes.[96] In the words of CSIRO's Project Leader in the Division of Sustainable Ecosystems:

> *… so we have got the sort of building blocks, as it were, for the project in place, to really show in principle that you can interfere with metamorphisis in a cane toad using a virus as a taxi.*[97]

There is still much experimental work and investigation to be completed before the virus is found let alone before it is safe for

95 Submission No. 22A, Dr Freeland, Oral Submission-Part 2, 10 June 2003

96 Briefing, Dr Robinson, CSIRO, 19 May 2003

97 Briefing, Dr Robinson, CSIRO, 19 May 2003

release. CSIRO estimates that the whole process may take up 10 years.[98]

4.3.2.2. *The sterilised male approach*

The Committee received a unique submission from Dr Michael Mahony, a biologist at the University of Newcastle in NSW. The release of sterile males to control populations has proven to be successful in cases with insects (screw worm fly and mosquitoes). The basic idea is to release a population of sterile males so that the eggs of females will not be effectively fertilised. The aim of Dr Mahony's research is to:

> *…investigate genetic methods to produce sterile male cane toads that have libidos equal or greater that normal males. The first step in this project is to determine whether sterile males can be produced before this question should be considered.*[99]

The aims, objectives and methods of this research are outlined in *Volume 2 - Written Submissions Received* of this report.

As well as offering a contribution to a multi-pronged attack on toads, Dr Mahony points out the following advantages:

- *It does not involve introducing viral pathogens or the testing of specificities of any pathogens (i.e., it does not involve introducing a disease to kill toads or the need to test a large array of native animals to ascertain whether the disease is harmless to them).*
- *It does not require a vector (i.e., there is not need to have a means to spread an introduced disease).*
- *It does not involve genetically engineered pathogens.*
- *The method of producing triploids does not require any harmful reagents.*[100]

Dr Freeland argued that:

> *The biological control effort will require a massive amount of work and great expense, may have a high probability of failure due to epidemiology constraints and may pose profound dangers to native frog and fish communities unless the issues are dealt with effectively. … Even if the epidemiological constraints prove inconsequential, the modified virus proves permanently stable and toads die in large numbers there is no guarantee that the conservation outcomes (need to be clearly defined) we are seeking will be delivered. We can not afford fall*

98 Briefing, Dr Robinson, CSIRO, 19 May 2003

99 Submission No. 23, Dr Mahony, University of Newcastle, NSW, 2003

100 Submission No. 23, Dr Mahony, University of Newcastle, NSW, 2003

> *in the hole of simply assuming that somehow it will all get better.*[101]

Dr Tyler on the other hand:

> *Now the only positive research which is being undertaken at the present time is by CSIRO in Canberra… This is genetic work to try to introduce a disease into tadpoles which will prevent them from turning into adults.*[102]

From Environment Australia:

> *Since 2000 the Commonwealth Government has provided to CSIRO nearly $1.5 million from the Natural Heritage Trust to support that research program. The research being undertaken by CSIRO may take up to 10 years to complete and there is no guarantee that this research will result in a biological control method to control cane toads.*[103]

Also from Environment Australia:

> *Cane toad biology is well documented as a result of many years' research into biological control methods.*[104]

While biological control appears to be a distant and uncertain future, the Committee notes that research into biological control can only further enhance our knowledge and understanding of cane toads, while offering hope for an effective method of control.

4.3.3. Pheromone control

Pheromone research was suggested in several submissions as a possible method of chemical control for cane toads. Pheromones are chemical messages working at minute quantities. Sex pheromones are released by the female of the species to attract males. Synthetic pheromones can be spread around an area to confuse the males or lure them to a trap. Both techniques could interfere with the mating process and thereby reduce the overall pest population in an area.[105]

Dr Tyler of Adelaide University, renowned frog expert, indicated his interest in the potential of pheromone research. He informed the Committee that the first pheromone in any frog in the world was found in *Litoria splendida*, the Magnificent Tree Frog, which in the Northern Territory is found in Keep River National Park.[106]

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101 Submission No. 22B, Dr Freeland, Written Submission, 2003

102 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

103 Submission No. 15A, Environment Australia, 2003

104 Submission No. 15A, Environment Australia, 2003

105 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

106 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

Dr Freeland informed the Committee that during his time with the Northern Territory Parks and Wildlife Commission a proposal for pheromone research sought Northern Territory Government funding but was rejected because:

> *the proponent failed to provide a detailed research proposal (experimental protocols etc as is usual) or provide a clear indication of how such technology could be applied (again as would usually be expected in such a proposal).*[107]

From the evidence submitted to the Inquiry on chemical control methods, the Committee recognises that there is a need for further research.

The benefits of continued research, scientific or otherwise, is highlighted by this statement from Dr Tyler:

> *Then I wondered why, when I was standing up to my waist in water at two o'clock in the morning, you know, the way you do… And I noticed that although the water temperature was 35 and therefore close to my body temperature, I was covered with mosquitoes but the frogs were not. And this resulted in us demonstrating that frogs have got a mosquito repellent. They have also got a rodent repellent and a bird repellent. The bird repellent is known. It is a chemical which has been used in Paris and London to try and stop pigeons from pooping on parapets, I mean, it is a known chemical. So they have got this aura. And the more we look at these native species, the more we can demonstrate that there are benefits from conservation, and I think this is one of the aspects that I would urge you to take on board, and I say, this is pragmatic conservation.*[108]

4.3.4. Other control methods

The Committee received evidence identifying a number of physical or manual control methods and measures for managing the containment of the cane toad that may prove effective in localised areas, for example townships, caravan parks and specifically targeted areas.

The Environmental Research Institute Supervising Scientist in its written submission refer to its Report *Preliminary Risk Assessment of Cane Toads in Kakadu National Park – Report No. 164,* in regard to the construction of physical barriers:

> *Physical barriers can be constructed around facilities such as swimming pools by adding a 0.5 m high layer of fine mesh to the bottom of peripheral fencing. Similar precautions can also be taken around potential man-made cane toad breeding sites such as sewage treatment ponds. Thus, construction of physical barriers is successful for specific purposes (e.g. around swimming pools), but these may not necessarily be the direct responsibility of Park management.*

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107 Submission No. 22B, Dr Freeland, Written Submission, 2003

108 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

> *It appears as if the most appropriate way for Parks Australia North to manage the invasion of cane toads is to i) ensure that efforts are underway that will allow inferences to be made about the impacts of cane toads on the values of Kakadu, and ii) investigate measures by which cane toads can be managed on a localised basis, particularly around areas considered to be of high importance.*[109]

The Parks and Wildlife Commission of the Northern Territory comments on the importance of continuing research aspects on ground control:

> *It can be seen that the majority of research is on the ecological effects of cane toads on native fauna. While this work is important and should be continued it does not give any immediate insights into how on-ground control could be undertaken. There is also scope for enhancing the collaboration between Frogwatch and the Parks and Wildlife Commission.*[110]

Environment Australia raised in its submission the problems associated in attempting to conserve an entire ecosystem from the impact of the cane toad:

> *Until an effective biological control of cane toads is developed, the only method of conserving an entire ecosystem from the impact of cane toads would be to exclude cane toads from the area by natural or artificial barriers and quarantine measures. This would not be economically or practically feasible on a large scale but may be warranted in specific, small areas of northern Australia, particularly those that are suitable for conservation of species most at risk from cane toads*.[111]

Dr Kennett in his submission comments generally on some of the approaches that may be employed in containing the cane toad but emphasises that further research is needed:

> *Research is needed into the most effective methods for control, identification and destruction of toads that invade toad free areas or breach quarantine zones. This could include artificial refuges and water points, patrols and searches, fences and barriers etc. Toads are believed to possess olfactory capabilities hence there may have been some research (or at least speculation) into the use of chemical attractants or pheromones to locate toads. These may be useful when used in addition to physical barriers and should be explored.*[112]

The Ecological Society of Australia in its submission highlights the urgent need for developing a research program to evaluate the impact of the cane toad using exclosures:

> *As a matter of urgency, establish a research program to evaluate the impact of cane toads using exclosures.*

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[109] Submission No. 3C, ERISS, Preliminary Risk Assessment of Cane Toads in Kakadu National Park, 2002

[110] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[111] Submission No. 15A, Environment Australia

[112] Submission No. 18, Dr Kennett

> *A research program should include the establishment of a replicated series of fenced refuge areas ahead of the invasion front. Exclosures are essential to provide refuges for susceptible species and to experimentally determine impacts of cane toads. An experimental approach is essential to refine our knowledge of the impacts of cane toads as quickly as possible, and without the ambiguity inherent in uncontrolled monitoring.*
>
> *As a first step, ESA recommends that a scoping study be immediately undertaken to establish possible geographic areas that are suitable for fencing. A comprehensive examination of all areas within the expected geographic range of Cane Toads is required. This would provide a basis for weighing up costs against potential biodiversity benefits, and for designing a well-replicated experiment. The implemented design should include elements that examine the impact of creating habitat islands and active management may be needed to minimise the impacts of isolation on local populations.*
>
> *An assessment of the effectiveness of fence designs for excluding cane toads will also be needed. Fenced islands and toad-free offshore islands will form a complementary archipelago of refuges for toad-sensitive species. In addition, Coburg Peninsula should be immediately fenced off because this area unambiguously offers the best ratio of fence to protected-area in the Northern Territory, and is under imminent threat of Cane Toad invasion (within the next 1-2 years).*[113]

The Committee also noted from the evidence received the need to develop and enforce strict quarantine measures to protect toad-free islands. Earlier in this report the Committee recognised the work of Environment Australia, the Parks and Wildlife Commission of the Northern Territory, the Northern Land Council and Aboriginal traditional owners collaborating to translocate approximately 60 quolls from the mainland of the Northern Territory to islands off Arnhem Land earlier this year.

The Ecological Society of Australia in its submission, however, raises a cautionary note in regard to cane toad free areas:

> *Toad-free areas need to be carefully protected by preventing inadvertent or deliberate introduction. In addition, a toad-survey regime permitting the early recognition of quarantine breaches is essential for all toad-free refuges. Refuges without monitoring resources will be vulnerable to extensive, probably irreversible, invasion.*[114]

113 Submission No. 11B, The Ecological Society of Australia, 2003

114 Submission No. 11B, The Ecological Society of Australia, 2003

4.3.5. The fencing of Cobourg Peninsula

The Committee heard considerable evidence in the merits or otherwise of erecting a cane toad proof fence across the Cobourg Peninsula in order to quarantine the Peninsula's unique flora and fauna from cane toad infestation.

The Chairman of the Cobourg Peninsula Board of Management, Mr Christophersen in his evidence to the Committee was very concerned about impending infestation of the Peninsula:

> *I can't stress enough the way I feel about the Cobourg because that is going to be the last point, well Danger Point in the Cobourg Peninsula is the furthest point north of mainland Northern Territory, once they get there they can't get no further, except to the islands, now to protect that from the cane toads is like protecting the last frontier so to speak. Now to me and the families of Cobourg it is vitally important.*[115]

Mr Lindner, a former ranger, supported Mr Christophersen's concern:

> *Cobourg can be protected by barrier against overland toad invasion. The surveillance necessary for detection of transported toads them becomes similar to that necessary to protect insular land areas from toads.*
>
> *The relocation of predators known to succumb to toad availability, quolls, goannas, snakes (king browns) and so on, to islands is vandalistic and of questionable long term success prospect.*
>
> *Toad protection for Coburg will require a rare single-mindedness of intention and should not be dressed up with job opportunity for locals and other distractions. As with the mimosa program of Kakadu good worker performance in a wide variety of field work situations, in surveillance and in barrier maintenance work with the toad prevention, will be required and people on site with aptitude will be valued.*[116]

The Parks and Wildlife Commission of the Northern Territory suggests that fencing of the Peninsula is logistically the most effective way to stop the cane toad infestation, but raises some caution as an ongoing proposition:

> *It has been suggested that fencing may be effective in 'toad-proofing' part of the Territory mainland. Logistically, by far the most efficient place to do this is at Cobourg Peninsula, where exclosure fencing across the relatively narrow neck could protect an extensive area. Such action is under consideration by the Cobourg Board but there are reasonable concerns about the ability of any fence to exclude toads. If a location can be found that avoids watercourses (i.e. areas that would flood and negate any barrier) then such a fence may work. However its effectiveness would then depend on the likelihood that toads would not swim into the sea to get around such a fence (which would need to be made from a non- corrosive material where it entered the sea). Investigations on this would need to be undertaken. Also it would need to be assessed as to how diluted by freshwater the sea around the end of the fence would become in a high rainfall wet season (and thus*

115 Mr Christophersen, Jabiru Public Hearing, 6 May 2003

116 Submission No. 4, Mr Lindner, 2003

> *breakdown any seawater barrier). Another problem with this concept at Cobourg is the transport of cane toads into the area aboard cars or trailers. They are many examples where cane toads have been transported in such a manner. Thus constant vigilance would be needed and practical experience shows that this is unlikely to be achieved.*[117]

Dr Whitehead from the Key Centre for Tropical Wildlife Management-Northern Territory University comments:

> *Anything is possible if you are prepared to spend enough, and I guess that is something that is not being looked at very carefully, it is how you might go about designing barriers to toads. There was a suggestion in the past that a fence should be put across the neck of the Coburg Peninsula, I have some doubts about whether that would work, it is sort of trying to create a pseudo island. It seems to me more sensible to invest your money, if you are going to do that sort of thing, in real islands and helping with quarantine there and helping people who are on those islands to monitor the presence of toads and try to prevent toads being established, rather than trying to establish a pseudo island on the main land. You have got Melville and Bathurst and Groote Eylandt and those other islands, which it would be better looking after real islands than pseudo islands.*[118]

Dr Holland, consultant adviser to Parks North Australia comments on the use of exclusion barriers:

> *First, the use of exclusion barriers and other devices in combination with intensive long-term local surveys designed to detect and eradicate all life history stages of the toad may very well prove to be a very cost effective means of excluding the species from significant areas such as the Coburg Peninsula which you've just heard about from Mr Lindner, and some of the offshore islands which I'm sure Dr Kennett will discuss here in short order. These types of barriers and actions are known to work, they are known to be effective in excluding toads from areas, but will require proper design, installation and maintenance, as well as continuous survey and eradication efforts, to be effective. It is also critical to note that this is not going to be a one or two year effort, but that it will require long term commitment of resources and effort to maintain it's effectiveness. Are such barriers absolutely leakproof? No. No barrier is like that, but there is a world of difference in dealing from both a practical standpoint and an ecological standpoint, in dealing with ten toads in an area and dealing with 10 000 or 100 000 toads. I would point out that there is likely a very narrow window of time available to implement any of these measures with the hope of being effective.*[119]

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117 Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

118 Briefing, Dr Whitehead, 15 April 2003

119 Dr Holland, Jabiru Public Hearing, 6 May 2003

Dr Tyler comments on the difficulty presented by the varying sizes of the toad at the different stages of its life-cycle, to the development of effective cane toad barriers.

> *The problem is that we are dealing with organisms which may be as small as 3 mm long and we are dealing with an area which still has feral animals, that such a fence is going to have to be very strong and keep out individuals of small size as well as large size. But it is attractive because of the unique features of the Coburg Peninsular.*[120]

Dr Freeland's submission to the Committee comments on the feasibility of erecting such a fence:

> *Assessment of the feasibility of any such fence requires a detailed examination of possible alignments and the likely frequency of tree-fall across fences on those alignments, determination of the most suitable material for the fence (it would need to be a significant depth below ground as well as having a sun-exposed, above-ground component) and resolution of the difficult problem of what to do about the tidal parts of the fence. To minimize damage from pigs, banteng, water buffalo and possibly horses and macropods, the toad fence would need to be co-located with a fence meeting BTEC requirements (i.e. similar to the existing fence). It would also require resolution of the problem of location of the wash-down/toad search facility and the agreement of Traditional Owners to use the facility just like everyone else.*[121]

The Committee supports the view together with evidence received that a cane toad fence should be erected across the neck of the Cobourg Peninsula as matter of urgency.

4.3.6. Quarantining the islands

The Committee received considerable evidence in regard to the impending impact of the cane toad to the Northern Territory's off shore islands, such as Bathurst and Melville Islands. The following describes some of the issues surrounding the quarantining of offshore Islands:

Dr Kennett comments on the effectiveness of quarantining offshore islands:

> *I would recommend undertaking an immediate risk assessment of cane toad colonisation of all islands within the potential range of toads. This would include identifying what islands have been colonised, when and how and what factors facilitate or hamper cane toad colonisation of islands. (Having advocated a risk assessment process, there are several islands such as the Tiwi islands and Croker Island that are obvious places to immediately instigate cane toad quarantine measures. I would not delay implementing such measures while waiting for the risk assessment to be completed)*[122]

120 Dr Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

121 Submission No. 22B, Dr Freeland, Written Submission, 2003

122 Submission No. 18, Dr Kennett, 2003

Mr Frederick Mungatopi, Chairman of the Tiwi Land Council in his submission to the Inquiry was clearly concerned about the cane toad coming onto the Islands and damaging the fledgling aquaculture and forestry enterprises.

> *The Tiwi Islands have been free of many of the exotic pests and diseases that occur on the Northern Territory mainland. Unfortunately, however, we are now discovering new outbreaks of introduced weeds and feral animals. Increasing traffic between Darwin and the Islands, and the impending arrival of the cane toad in Darwin are placing the flora and fauna of the Tiwi Islands at great risk. Our fledgling aquaculture and forestry enterprises are vulnerable to attack from exotic pests and diseases that may already occur elsewhere on the mainland. Outbreaks are often found only after extensive damage has already occurred, and single incursions could destroy these emerging enterprises.*[123]

The Land Council's submission describes the type of facility that would need to be erected:

> *An effective quarantine holding area will require metal fencing, metal shelving and an undercover storage area. Access in and out of the area will be over specially designed grids that prevent cane toad access. It is anticipated that goods received at the Barge premises will progress through quarantine wash down and/or visual inspection before premises being placed in the quarantine holding area. They will then be loaded on the barge in one operation before transport to the Islands.*[124]

Dr Kennet further elaborates on the accidental carriage of toads to the islands:

> *Barges are likely to be a major source of accidental toad carriage to islands. Measures might include surrounding barge landings with a cleared area and a toad proof fences and artificial refuges and watering points, attractants such æ lights (toads attracted to insects as food sources) or chemical attractants (see above), as well as inspections and quarantine periods of unloaded materials to detect any hidden toads.*[125]

The Land Council, in its submission, comments on the funding issues involved in establishing such a facility and the likelihood that funding for the extra work that was not envisaged may not eventuate, thus putting the project under threat:

> *In 2002 we applied for and received funding from the Aboriginal Benefits Account and Indigenous Land Corporation for quarantine activities and facilities. Some of this money was earmarked for public awareness material and activities, which has been carried out. A further $150,000 (ABA) and $80,000 (ILC) was provided for wash-down facilities and associated infrastructure. Our advice at that time was that this would be sufficient for the required facilities. With further research carried out by Professor Mike Tyler and industry*

123 Submission No. 25, Tiwi Land Council, 2003

124 Submission No. 25, Tiwi Land Council, 2003

125 Submission No. 18, Dr Kennett, 2003

> *representatives, it has now come to light that a suitable wash-down facility that will provide consistent cleaning operations will cost in excess of $300,000. A fenced quarantine holding area with above ground storage and undercover storage is additional. In response to this information, we are currently seeking sponsorship from relevant organisations that may be able to provide materials for the additional infrastructure required, as well as engineering expertise and advice. To date we have had no success.*[126]

Dr Tyler, who has given evidence to this Committee and is also a consultant to the Tiwi Land Council comments on the issues associated with the proposed barge facility:

> *We're now at the stage of, I'm not a designer, I can say what you need is a barrier that must be x high, you've got to have grills with holes so big, and you've got to keep all your pallets off the ground so that creatures can't get into the pallets and become stowaways. Those are the sorts of things we hope to finalise…I hope they will put in a, and they have got funding to do this, but the barging points on the islands for the most part I don't think that anything could be done at all. One or two of them have concrete ramps, for the most part the high tides at times, simply would erode the super-structure. I don't think it could be done. I think what we've got to do is to have a program in Darwin which is much more conscious of the risks that are involved in accidental dispersal of these animals.*[127]

The Committee notes that this approach is the first attempt in Australia to provide a cane toad barrier of this type and supports the Tiwi Land Council's endeavours in mitigating the environmental impact of the cane toad on the Tiwi Islands.

4.4. ACTIONS FOR A COMPREHENSIVE RESPONSE

The Committee throughout the Inquiry has heard an enormous amount of evidence in respect of the impact the cane toad will have on the environment, communities and urban centres, research and monitoring, control methods biological or otherwise, public awareness and education. Throughout the Inquiry the Committee has asked the question that, given all the issues associated with the progressive entry of cane toads into the Northern Territory, what needs to be done to mitigate, control or eradicate the cane toad on the broader scale?

From Dr Lawson of PWCNT the Committee heard:

> *I don't think you can actually do anything about cane toads unless you did involve someone like the Caring For Country unit, after all we work very closely with them on all sorts of things like the quoll translocations we couldn't have done that without that co-ordination and I think the old idea that you know Parks and Wildlife somehow has to do the wildlife stuff on its own is gone. If it hasn't gone it certainly should have gone and I think there are a lot of people out there with very high skill levels in all sorts of different ways that could help*

126 Submission No. 25, Tiwi Land Council, 2003

127 Dr Tyler, Adelaide University, Darwin Public Hearing –12 May 2003

> *to get the message across to communities, particularly remote communities but you know, you can actually learn to live with cane toads for instance, you might not like it but they are coming, there is nothing you can do about that, so learn to live with it and I think we can help people to understand that they can live with it.*[128]

The Committee received evidence that cane toads are currently not classified as a threatening process to ecological values, despite the indications of the potential for negative impacts to occur due to cane toads. No legal requirement exists to control cane toads because it is not considered a 'menace' but only a 'pest'.

From Mr Baschiera, a former eco-tourism operator the Committee heard:

> *…the cane toad has been classified as essentially just a pest, not a menace, and this has allowed governments to primarily not see it as such a serious concern. That may well have been the case back in the 1930s, 1940s and 1950s in Queensland as the cane toad was expanding its way through that state. It is now a different kettle of fish, we're now in the 21st century, the wilderness areas, wildlife areas in the world are going to become very, very significant real estate in the years to come, particularly with future generations and we're here and now at risk with actually doing some significant damage to our wildlife environment in the Northern Territory. So, in that context I think we should really seriously examine whether we should continue classifying the cane toad as a pest or now start really talking about it as a menace.*[129]

From Mr Orchard co-ordinator of the WWF Frogs! Program:

> *And the other thing is that it is being listed in this country as a pest instead a menace and that has been a factor apparently … not being funded or applied research being funded into actually getting out there and finding out how to kill them and eradicate.*[130]

Environment Australia's written submission to the Inquiry stated that:

> *An introduced animal species, such as the cane toad, may be listed as a key threatening process under the Environmental Protection and Biodiversity Conservation Act (EPBC Act) if it "threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community". Foxes, rabbits, feral cats and feral goats are examples of currently listed key threatening processes.*
>
> *If cane toads are to be listed as a key threatening process under the EPBC Act, a nomination would need to be submitted and assessed by the Threatened Species Scientific Committee, which would then advise the Minister on whether the threatening processes meet the criteria for listing*

128 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

129 Mr Baschiera, Darwin Public Hearing, 12 May 2003

130 Mr Orchard, Darwin Public Hearing, 12 May 2003

> *under the Act. There is no nomination currently before the Committee to list cane toads as a threatening process.*
>
> *Once a key threatening process has been listed, the Minister may have a threat abatement plan prepared, if that is a feasible, effective and efficient way to abate the process.*[131]

Further to this, Dr Dickson of Environment Australia explained that:

> *Under the Act, anyone can nominate a threatening process. You know, the Northern Territory Government could, and an individual could, effectively nominate cane toad as a threatening process. And then that would have to be assessed by the Threatened Species Scientific Committee, which has to assess the significance of the threatening process and its implications on native species. And then they make recommendations to the Commonwealth minister, whether or not to list the cane toad as threatening process, under the Act. If the minister decides to list on the basis of the advice, there is another process whereby whether or not a Threat Abatement Plan, from his point of view, is a useful way of addressing this threatening process. These other feral animals listed, have gone through such a process or are in the process of completing the process. That can have a, what I was saying in the beginning, there is some value in having a Threat Abatement Plan that it can bring together the actions needed to address the threat, to have some strategy and coordination of those actions. That's the value. But it is important to note that these are national plans, not Commonwealth plans, and that they involve input and activities by all the states that have a threatening process on their land.*[132]

Dr Dickson explains further that:

> *The Commonwealth undertakes a whole range of activities to address biodiversity conservation or threatening processes which are not ever listed on a Commonwealth list or on a national list or on a state list. The funding of the cane toad research, is an example of Commonwealth support and work for addressing threatened processes that aren't listed.*
>
> *There isn't a requirement to do the listing either of a species or of a threatening process, before the Commonwealth can take any action. And the work that was done, the project that was done for the quolls, was you know, in the knowledge of the significant risks that were posed to quolls coming from the research, and the importance of taking this early action. There was no need for any of the other strategy processes that have been met to take that sort of action.*[133]

The Committee found that cane toads are currently not listed as a threatening process under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*.

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131 Submission No. 15A, Environment Australia, 2003

132 Briefing, Environment Australia and CSIRO, Video Conference, 19 May 2003

133 Briefing, Environment Australia and CSIRO, Video Conference, 19 May 2003

The Ecological Society of Australia raised a number of actions that need to be implemented for a comprehensive response to the cane toad threat.

- *As a matter of urgency, establish a research program to evaluate the impact of cane toads using exclosures.*
- *Develop, and enforce strict quarantine measures to protect toad-free islands and exclosures.*
- *Provide a co-ordinated approach to research and monitoring of cane- toad impacts.*
- *Using replicated experimental approaches, test methods for locally reducing cane toad abundance. One possible approach to locally reducing toad abundance could exploit the need that cane toads have for shelter near to permanent water to survive the dry season.*
- *Artificial shelters near dry-season water holes could act as traps, allowing many adults to be exterminated. This may be an effective method on leasehold and aboriginal lands.*
- *The efficacy of community involvement in reducing toad numbers could also be established experimentally (with replicated treatment and control neighbourhoods). If toad numbers can be suppressed in urban areas, then urban bushland and wetlands may become important wildlife refuges.*
- *Research into the chemical ecology of cane toads should be encouraged and supported. Cane toads appear to rely on olfaction to locate food and anecdotal evidence suggests that they may also use olfaction [the sense of smell] to identify potential mates. Baits or traps that emit toad- specific odours may attract toads, and so offer a useful way to locally reduce toad abundance. If effective manual removal methods can be developed it would offer a potential alternative to the use of fencing for creating refuges.*
- *Manual removal could also be used to create experimental toad-free areas for comparison with matched toad-infested areas.*
- *Distribution of a comprehensive toad and ground-frog identification brochure. Experience in Queensland shows that the community is prepared to be involved in toad extermination but lacks sufficient information, resulting in the culling of native frogs and tadpoles erroneously.*
- *Information provided to the community needs to detail all life history stages and provide enough detailed information so that the distinctions between toads and ground dwelling frogs are clear.*
- *Information about how to kill toads ethically, and eliminate cruelty, should also be provided.*
- *Provide support for long-term research into potential biological control mechanisms. Any such mechanisms must undergo comprehensive testing to ensure that the control is completely toad specific, with no risk of mutating to become virulent to native species. The long-term nature of this research should be recognised by funding bodies, to ensure there is no political pressure that may lead to a premature release of inadequately*

> *tested biocontrol agents. An extremely cautious approach to the timing of the release of biological control agents should be adopted.*[134]

Dr Lawson again:

> *I think one of the things they've done in Queensland too with constrained areas like Rapid Creek is that the local people have got together and they've actually got sort of cane toad task groups, they actually go out with buckets and collect the damn things you know. Now, you could argue well that's just a drop in the ocean, it's not going to really do anything in the big picture but I think you know, we shouldn't denigrate that sort of community effort and sort of encourage it, you know because there are certain places where if you did have a physical collection, you probably could keep them reasonably toad free and it might be places like Marrara Stadium where you say, do things for the footie, let's get in there and collect the cane toads and certainly I mean, it might actually act as a little bit of a magnet for cane toads if you've got a nice irrigated footie pitch you know.*[135]

The Committee is of the view that programs similar to those of municipal and local government councils encouraging residents to 'adopt a park' should be initiated to encourage residents to 'adopt a waterway'.

Mr Morris from Frogwatch NT:

> *Places like Cairns have big frog groups, big proportion of the population loves their green frogs and they have cane toads and they've had them for 70 years and I've done some sort of preliminary interviewing of people around Cairns and they've developed strategies for keeping toads out of their backyards and encouraging the native frogs to breed in their backyards and there's quite a few things going there.*[136]

Lorna Woods representing Keep Australia Beautiful in her submission to the Committee:

> *On the basis that there seemed to be an emphasis on education initiatives I have talked with my people today about incorporating some appropriate messages through the Territory Tidy Towns campaign. It is well known that Tidy Towns touches almost every community in the NT and has a regular participation base of a hundred and fifty with another hundred off-and-on participants. Homeland communities and associations are regular participants.*
>
> *We could incorporate "CANE TOAD ERADICATION/CONTROL INITIATIVES" as a section that would attract points. We could also include information about the problem and give suggestions for methods of control.*

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134 Submission No. 11B, The Ecological Society of Australia, 2003

135 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

136 Briefing, Frogwatch NT, 15 April 2003

> *We will also include a whole section on cane toads at our annual forum which takes place at the end of November. Indigenous communities are the main participants at this forum where participants are looking for good ideas and positive messages. A good presentation at this forum will have a valuable impact.*[137]

In his evidence at the Darwin public hearing Mr Orchard put forward advice on how to approach the cane toad problem:

> *My advice is approach the problem from a military perspective. That is sort of push aside people who want to study the problem and document the problem. They are wasting time. Take a comprehensive strategic approach to driving cane toads to complete extinction in the Northern Territory adapt, innovate, refine and kill toads relentlessly, that is how you do it. And what not to do, do not waste another minute, do not listen to defeatists, do not expect a quick fix and do not abandon demonstrated success, that is do not put money into something that starts to show promise and then have it peter out.*[138]

4.5. FINDINGS

The Committee found that:

15. There has been extensive academic level research on cane toads.

16. There is no short-term solution in managing the impact of the cane toad.

17. No effective biological or chemical control method has yet been found for the cane toad.

18. The CSIRO is researching biological control of cane toads, but the project could take a further ten years and its final effect is unknown.

19. There is a need for further research into biological and chemical research.

20. There is limited base-line native fauna and flora data, before and after the arrival of cane toads in the Northern Territory, making it difficult to gauge their long-term impact on native species.

21. In managing the cane toad intrusion, a number of control methods and approaches ranging from continued monitoring and research programs, biological and chemical control including eradication and physical removal, quarantining, physical barriers and the relocation of threatened species to off-shore islands.

22. There are a number of physical or manual control methods and measures in managing the containment of the cane toad that may prove effective in localised areas, for example townships, caravan parks and specifically targeted areas.

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137 Submisson No. 10, Keep Australia Beautiful Council, 2003

138 Mr Orchard, Darwin Public Hearing, 12 May 2003

23. In regard to the funding for cane toad research and monitoring over the past twenty years from both the Commonwealth and Northern Territory Governments and what is predicted for the future, it was difficult to obtain clear and accurate figures.

24. Some formal arrangements between governments and research institutions could provide the opportunity for conducting joint research.

25. Commonwealth funding since 1991 in relation to cane toads has been tied primarily to research.

26. The Northern Territory, since the early 1980s, has been involved in some research programs on cane toads and has been aware of the potential impacts and spread.

27. There is no formal Northern Territory Plan of Management for cane toads.

28. There may have been missed opportunities in the past in attempting to control the spread of cane toads, however, evidence now points overwhelmingly towards further action.

29. The Committee found that cane toads are currently not listed as a threatening process under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*.

30. The translocation of populations of the northern quoll to offshore islands requires ongoing research regarding the impacts of the quolls on the islands' ecology.

31. There are no comprehensive quarantine measures or facilities to guard against the transportation of cane toads.

32. There is an opportunity to protect important areas of the Northern Territory such as the Cobourg Peninsula with the erection of a cane toad proof fence across the neck of the Peninsula.

33. The traditional owners of Cobourg Peninsula want a cane toad proof fence built across a narrow neck of the peninsula.

4.6. RECOMMENDATIONS

The Committee recommends that:

3. That the Northern Territory's Department of Infrastructure Planning and Environment develop and implement a Plan of Management for the control of cane toads.

4. That the Commonwealth and Northern Territory Governments continue with the development and management of quarantine regimes to protect offshore islands currently without cane toads.

5. That the Northern Territory Government take immediate steps to erect a cane toad proof fence across the neck of the Cobourg Peninsula.

6. That the Northern Territory Government lobby the Commonwealth Government to reclassify the cane toad from a "pest" to a "menace" under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act, 1999*.

7. That the Northern Territory Government nominate cane toads as a threatening process under the *Environmental Protection and Biodiversity Conservation Act, 1999*.

8. That the Northern Territory Government and relevant Commonwealth agencies continue to monitor the effects of translocating northern quolls to offshore islands.

Chapter 5 Public education and awareness

5.1. OVERVIEW

It became evident to the Committee during the course of this Inquiry that there was a lack of knowledge within the Northern Territory community in respect of the cane toad advancement, particularly in Darwin, the rural areas and in national parks in close proximity to Darwin and Palmerston.

The Committee has noted that there have been a number of publications produced by various Commonwealth and Northern Territory government agencies. However, the Committee has also noted that there is no comprehensive public awareness program being promoted to educate the Territory community on the impact the cane toad will have in urban centres such as Darwin. The Committee notes that a public awareness program has commenced since its Interim Report.

The Committee is of the view that there is a need for a series of education programs aimed at Indigenous and non-Indigenous communities and organisations to encourage people to actively participate in the management and control of cane toads.

5.2. CONCERNS AND EXPECTATIONS

The Committee received varying evidence concerning the arrival of cane toads. Some people were worried about its arrival and what impact it would have on lifestyle and the environment. For example the Committee heard evidence from:

Mr Batten, the rural Landcare co-ordinator for Litchfield and Coomalie:

> *…within Litchfield and Coomalie we have 11 Landcare groups. Now, every one of those 11 groups is focussed on some sort of a watercourse, whether it be a lagoon, a creek, or whatever. That is their major concern. Of course, what is going to happen, like, what is the impact on these watercourses from these cane toads. So a couple of the groups are now looking at potential experiments that they can do, and also the associated funding for those potential experiments. Something like you know, if we can do a series of pit traps or something, that we can remove the other animals, if we can work it so that it is specific to the cane toad, so things like that are certainly what the groups are interested in.*[139]

The Committee heard evidence from Dr Finlayson, describing in general the understanding that the community has in regard to the impact of the cane toad:

> *…the actual impact on endemic species is not as clear as some people may have expected, we don't know a lot of the endemic species, there's a lot of species we have not even got to describe or know how much vulnerable they are to other impacts or pressures let alone enclosing the cane toad. That is very much a biodiversity argument. And what can we do in our area. This is just some practical issues at the top, swimming pools, spas, fish ponds, etc,*

[139] Mr Batten, Litchfield Public Hearing, 19 May 2003

> *you can limit the intrusion of cane toads into these areas, putting up low mesh screen etc, familiarise ourselves with the appearance and call of toads that people actually can identify the toad when it comes into an area and not to mistake with some of the native frogs that are around, which is the next point here. There have been cases as you may have heard of people going out and finding native frogs and killing them. Our awareness campaign about the occurrence and the likely impacts of the toad we do support strongly, not only that you have different communities want different information perhaps, but also we discourage any activity which is showing cruelty towards the toads, people walking around with golf clubs and cricket bats, we think is not a good outcome for our society.*[140]

Dr Tyler comments on the use of pit traps:

> *No, pit traps will not work when it is wet. The trap pops out of the ground as the groundwater level rises. I have seen efforts to direct toads in Europe and the United Kingdom into funnels so they can pass underneath roads through the so-called toad tunnels. People are trying to reduce the toad toll. At the present time people are actually picking up toads from one side of the road and carrying them to the other when they are going to their breeding grounds. But no, I do not think pitfall trapping will work.*[141]

Mr Murdoch – Jabiru Town Council:

> *Cane toads have already been located in Jabiru, the oxidisation of ponds on the roads into town and recently, on the roads on the fringes of the town. I am sure that at various stages during this hearing you will be advised by technical experts on all aspects of the cane toads, and as such, my submission is as we as a community have identified the position. While we in Jabiru understand and accept the view of the eminent scientists and environmentalists on the damage that toads do to the environment and fauna, we have looked at the issue of the cane toads invading from a different perspective. In all the public hysteria about the toads and their effects, it seems to us that one of the most important dangers associated with them has been disregarded or at least given minimal coverage. The danger is, one, of the effects of the toads on the young people who live in the bush. Anyone who has lived in a small, isolated Australian communities would soon realise that the cane toads can and will present a serious health hazard for our younger citizens. Although with our modern media, we can communicate and educate a broad band of Australians on the associated dangers of the toads, how can we communicate this to young people who either are not old enough to understand the English language, or to whom English is a second, third or even fourth language*[142]*.*

Mr Orchard, national co-ordinator of the WWF Frogs! Program:

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140 Dr Finlayson, Darwin Public Hearing, 12 May 2003

141 Dr Tyler, Darwin Public Hearing, 12 May 2003

142 Mr Murdoch, Jabiru Public Hearing, 7 May 2003

> *Obviously there is a lot of concern and often that concern is generated into people saying that there's an urgent need for more research and my experience in Australia is, in talking to researchers that they want to study the natural condition as it unfolds. It is very difficult to get people in to the applied frame of mind, taking what we do know, or finding out what we need to know to actually control populations and knock back their numbers.*[143]

Northern Land Council – Caring for Country Unit:

> *The impacts of cane toads throughout the Northern Territory reduces people's quality of life and the value of any investment in preserving our conservation areas. The consequence of cane toads in the Northern Territory warrants immediate action and continued research to find a long-term control. Aboriginal people and their lifestyle is severely and significantly affected by the consequences of cane toads on their lands. Trials to assess the success of cane toad free zones should be begun immediately and expanded if successful. Aboriginal people have a role to play in such measures as they are extremely concerned about the effects of cane toads. Keeping cane toads off islands is an important message for everyone living or visiting the Northern Territory. Continued reinforcement in order to maintaining these islands as quarantine areas free of cane toads is required…People feel frustrated that they cannot do anything to eradicate the cane toads and become quite depressed when told that it may be ten years or more before we may have a biological control to assist in eradicating this pest. If Aboriginal people could be involved in measures taken to reduce the cane toad's presence around living areas they would feel less disempowered.*[144]

The Committee also heard Mr Visentin's evidence professing perhaps cane toads are not a bad thing:

> *I guess the issue that I am trying to say is that it has been around for 70 years, maybe people are saying that the impact isn't really as bad as it is and therefore, is it only in the last few years that there is somebody is trying to make it a bigger issue than it probably has been or is and therefore now people are saying, oh let's give it some money. But if it has been around for 70 years and we don't sort of have enough evidence or we do not have sufficient evidence to say it's a huge impact. Maybe it is not a big issue? I do not know.*[145]*.*

Dr Lawson of the PWCNT raised the issue of the humane treatment and disposal of cane toads:

> *Yeah well I mean, the humane treatment of feral animals I think is sometimes overlooked and it shouldn't be, after all, if you look at it plainly, it's not the cane toad's fault it's a pest, is it? And it is actually a sentient animal, it can feel pain so I think that, I agree with you Tim, I think there's a very large responsibility*

[143] Mr Orchard, Darwin Public Hearing, 12 May 2003

[144] Submission No. 8, Northern Land Council-Caring for Country Unit, 2003

[145] Mr Visentin, Litchfield Public Hearing, 19 May 2003

> *on all of us to say, yes they are a pest, no we don't want them but don't be cruel to them. And certainly I think the most innocuous way to actually kill them is to use the freezer method. If you really want to be gentle, put them in the refrigerator first.*[146]"

Further the Committee heard evidence from Ms Kerin in regard to what the community might expect from the arrival of the cane toad and how the issue may be managed:

> *…realistically, in some respects with regard to toad invasion, it is like shutting the gate after the horse has bolted, in terms of controlling them…Unfortunately, unlike plants, cane toads don't sit still so they are a bit harder to try and manage.*[147]

The Darwin City Council in its submission raised a number of concerns in respect of the impact the cane toad will have on Darwin.[148] Of particular note was the inevitable resignation that nothing can be done about the cane toad:

> *It is difficult to appreciate the problems of the arrival of such a pest when in most cases the residents in affected areas appear to be resigned to the inevitability of the invasion and that nothing can be done about it.*[149]

Darwin City Council's Internal Report succinctly identify some of the basic concerns in how the Council may deal with the threat. The following are excerpts from that report:

> *There is surprisingly little information available on the practical management of the cane toad problem by Councils. The CSIRO is conducting research into the biological control of cane toads but has little to offer in terms of local management, The Queensland Museum appears to be an authority on the subject but mainly deals with distribution and differentiation from local species. Individual Councils in areas where the cane toad has been living for over 60 years such as Cairns City Council do not recognise cane toads as a problem, just a fact of life. More recently, invaded Councils on the east coast, such as Byron Bay, also do not actively seek to manage the issues as their residents appear to be resigned to the inevitability of the migration. The National Parks in NSW seek to control isolated breakouts of the toad rattier than trying to stop the natural front.*
>
> *In Katherine which was invaded about 12 months ago, they have not received any complaints or queries from residents and only one enquiry from a*

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146 Submission No. 1A, Parks and Wildlife Commission of the Northern Territory, Oral Submission, Briefing

147 Ms Kerin, Katherine Public Hearing, 6 May 2003

148 Submission No. 6, Darwin City Council. 2002, (The Council's submission was an internal report entitled 'Cane Toads' from the Director Technical Services dated 28 July 2002. Its recommendation was that Council liaise with the Parks and Wildlife Commission of the Northern Territory to produce appropriate Information sheets dealing with various problems associated with cane toads.)

149 Submission No. 6, Darwin City Council, 2002

sweeping contractor who had environmental concerns about washing his machine out.

The Problems

The most obvious problem is road kill. The toads initially smell, make a mess and attract flies. After a short time they just become hard, flat, black marks on the road not conducive to resealing.

They will take over short-grassed areas especially leading up to waterways but they do not like thick reeds and rushes.

They can kill native wildlife if eaten, will take over habitat and are a potential threat to pets such as cats and dogs.

They will eat pet food left out for animals and the cooler months they will shelter under timbers, sheets of iron etc.

Response to the Problem

Generally, Councils around the country are doing little about the issues. They generally refer all problems to the local Parks and Wildlife Department. In some areas, such as Lismore, the local Environment Centre run an annual Cane Toad Muster where people are encouraged to go out with buckets to collect toads and a nominal bounty is paid per skin. In one area of Brisbane, Greening Australia run an annual Cane Toad Busting Night. There is some doubt as to the benefit of these events however community involvement and awareness is seen as a positive for the environment.

Expected Arrival

The NT National Parks predict that the toads could reach Darwin this Wet Season. They are moving faster than everyone is predicting.

What Can We Expect?

The NT National Parks do not appear to have prepared themselves for a public response to the invasion. The types of questions and Issues that could be raised may include:

- *How should we handle them?*
- *How should we kill them?*
- *Will Council remove squashed animals from roads?*
- *Has Council done anything to prevent their spread through Council controlled parks and waterways?*
- *Who should queries be directed to?*
- *Will birds be affected at the dump If they eat dumped toads - what is the contractor doing about it?*

CONCLUSION:

It would appear that there is a fairly rapid invasion and then the numbers decline and stabilise over a number of years. Fluctuations will occur with seasons.

How Darwin residents will react is unknown. The NT National Parks does not appear to have any particular strategies in place but following our approach will investigate preparation of appropriate literature and responses.

> *Council has two options. They could refer all issues relating to this pest to the NT Government or they could take a more proactive approach in terms of providing information. It is not recommended that staff respond to complaints of road kill or other dead toads but rather advise residents on how to deal with the matter.*[150]

5.3. PUBLIC EDUCATION AND AWARENESS

The Committee noted during its Inquiry that currently, no comprehensive public awareness program was being promoted to educate the Territory community on the impact the cane toad would have in the Northern Territory in particular urban centres such as Darwin and Palmerston. However, the Committee has noted that a public awareness program is now being conducted by the Parks and Wildlife Commission of the Northern Territory –see earlier comments under *Chapter 1.4 Interim Report.*

The Committee also notes that in the Tiwi Land Council's submission, the Council has a 'Tiwi Island Cane Toad Action Plan' to promote public awareness to the Tiwi community on the possibility of cane toad infestation on the Islands – see below.[151]

The Committee identified a number of important factors that need to be considered in the development of a comprehensive public awareness campaign.

- The information needs to be simple and easily understood by all levels of the community.
- The information needs to be presented in all major languages spoken in the Territory, including Indigenous languages.
- The information needs to be promoted through all multi-media forms.
- Education kits aimed at specific groups, such as schools and Indigenous communities, need to be compiled.
- The active participation of community groups and volunteer organisations needs to encouraged.
- Information can be disseminated through community forums, seminars, workshops and public information sessions.

Many of the submissions and evidence received by the Committee brought to its attention the need for public education and awareness programs on cane toads. The following are some of the more interesting responses:

Ms Kerin:

> *I think as the toads progressed, a growing awareness through the Territory. Interestingly enough it is a lot of our visitors that ask us about toads, more so than locals. Locals tend to dispatch toads any, which way that comes easy. But I think certainly, if you compare say Katherine to Darwin, obviously you have got this awareness are not high in terms of what they do to dogs, chooks, pets, and all those sorts of things. So I think there is certainly some*

[150] Submission No. 6, Darwin City Council, 2002

[151] Submission No. 25B, Tiwi Land Council, 2003

> *potential, or enormous potential to do some advertising, some public awareness on this.*[152]

Parks and Wildlife Commission of the Northern Territory:

> *There will be considerable public disquiet about the arrival of toads in Darwin. It would be appropriate that there is a substantial communication effort to anticipate this interest. The Parks and Wildlife Commission, Parks Australia, the Tiwi and Northern Land Councils, and Frogwatch have provided some communication material about toads and their impacts. This should be updated and include details on:*
>
> - *the difficulty of control;*
> - *the long term nature of the development of possible control measures;*
> - *how to fence a swimming pool or a bush block to exclude cane toads;*
> - *how to minimise food resources for them e.g minimise area of green lawns,*
> - *do not use outside lights at night;*
> - *the most humane and efficacious procedures for killing toads; and*
> - *information about their impacts upon biodiversity.*[153]

Environment Australia suggests:

> *that it would be useful to conduct an initial education program, particularly in Aboriginal communities across the Top End, to minimise the risk of children or adults suffering harm from contact with cane toads. There will be a need for continuing education program to encourage people not to transport cane toads to areas which have not yet been reached by toads, and especially to areas that would otherwise remain free of cane toads, such as offshore islands and any other areas that can be isolated from the spread of toads…Public education methods that should be considered include picture booklets, posters, videos, television advertisements and documentaries.*[154]

From Dr Tyler:

> *We need an effective marketing program to make the public much more vigilant and participate in community eradication activities, as has been undertaken in Brisbane, where people go out in groups and now the numbers of can toads in Brisbane has dropped off quite considerably.*[155]

The Threatened Species Network-Arid Rangelands:

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[152] Ms Kerin, Katherine Public Hearing, 12 May 2003

[153] Submission No. 1B, Parks and Wildlife Commission of the Northern Territory, DIPE, Written Submission, 2003

[154] Submission No-15A-Environment Australia, 2003

[155] Dr Mike Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

> *Similarly there will need to be education campaigns targeting the onshore fishing industry and recreational boating groups to prevent inadvertent introduction of toads to islands.*[156]

Dr Tyler in regard to health issues:

> *There are going to be obvious cultural impacts on the Aboriginal communities, as you are quite aware. One of the things that isn't often discussed but actually was covered in some detail in Bill Freeland's problem analysis from 1984 is the human health factor of cane toads. That they eat mammalian faeces and that includes dogs, cats, humans and they can become primary hosts of human hookworm, dog and cat tapeworms, various intestinal parasites, and they pass that on of course when they're moving in and out of freshwater systems, so they have an extended pollution factor as well and human health issues should be of serious concern.*[157]

Dr Kennett:

> *If human health issues are significant then it may be necessary to initiate an education program about potential dangers to human health posed by handling and ingestion of toads…There will be a need for continuing education program aimed primarily, but not exclusively, at indigenous people to encourage people to make sure they do not accidentally or deliberately transport cane toads to areas which are currently toad free, and especially to areas that would otherwise remain free of cane toads, such as offshore islands and any other areas that can be isolated from the spread of toads.*[158]

The Committee noted that very few formal arrangements were in place to promote the issues associated with cane toad threat.

5.3.1. Use of multi-media to promote awareness on the cane toad

The Committee noted that two particular modes of media presentation were prominently used in the Northern Territory to promote public awareness on the cane toad, namely brochures and publications and the internet.

5.3.1.1. Brochures and publications

The Committee had heard evidence that there has been a number of publications on cane toads produced by various Commonwealth and Northern Territory Government agencies.

Two publications of note are:

- *Cane Toads…A few Facts*

This document is produced by the Parks and Wildlife Commission of the Northern Territory.

The content of this question and answer brochure covers in general the description of the cane toad and points out that it could easily be

156 Submission No. 17, Threatened Species Network-Arid Rangelands, 2003

157 Dr Mike Tyler, Adelaide University, Darwin Public Hearing, 12 May 2003

158 Submission No. 18, Dr Kennett, 2003

mistaken for some of the local species of frog, but also includes the following series of questions:

- What is the Cane Toad and why are they in Australia?
- Where are they in the Northern Territory and how far will they go?
- What has been?
- What do they eat?
- Why don't other animals eat the toad?
- Are they are hazard for my family or pets?
- Will they poison my pet's water bowl or my swimming pool?
- Will the wildlife suffer?
- Can I kill them?
- Will we ever be rid of them?
- What can I do to help?

- *Cane Toads in Kakadu National Park*

This simple English booklet interspersed with photographs is produced by the Environment Australia and is aimed primarily at school children and particularly relates to the environmental impact of the cane toad in Kakudu National Park.

5.3.1.2. The internet

The Committee also heard evidence that there has been a number of Internet web sites, which have information in respect of the cane toad, not only in Australia but internationally as well.

The following three internet websites of note have a particular emphasis on the Northern Territory:

Frogwatch NT

This particular website at http://www.frogwatch.org.au/canetoads/default.cfm is the most informative, not only about the cane toad, but also all of the known species within the Northern Territory.

The following Table lists the latest sightings of the cane toad downloaded from the Frogwatch NT's website:

Table 5.1: Cane Toad Sightings[159]

Date	Location
October 2003*	Humpty Doo, Nightcliff and Northlakes
September 2003*	Berry Springs
05-Mar-2003	- Oolloo Crossing Daly River
09-Feb-2003	- Jabiru
21-Jan-2003	- Pine Creek

[159] Source: http://www.frogwatch.org.au/canetoads/default.cfm, 18 August 2003.

* Committee's addition

07-Jan-2003	- kapalga street, tiwi
27-Nov-2002	- 19 Km South of Pine Creek
23-Aug-2002	- Warloch Ponds - 20km South of Mataranka
24-Jun-2002	- Koolpin Gorge camping ground, Kakadu National Park
10-Jun-2002	- Twin Falls
08-Apr-2002	- Mattheson Creek
14-Mar-2002	- Mary River Ranger Station
26-Feb-2002	- Carpentaria Highway
24-Feb-2002	- 11km South Dunmarra Roadhouse
10-Feb-2002	- Gapuwiyak
04-Feb-2002	2 sightings on Victoria Highway 'west' of Katherine
01-Dec-2001	- Edith Falls
28-Oct-2001	- NT WA Border Victoria Highway
17-Oct-2001	- Katherine
15-Oct-2001	- 3 sightings in the Katherine Region
31-Mar-2001	- Manyallaluk
15-Feb-2001	- Donydji (Arhnem land)
20-Jan-2001	- Dunmarra Roadhouse
04-Oct-2000	- Snowdrop Creek

Mr Graeme Sawyer who is one of the program's co-ordinators comments on the work of Frogwatch NT:

> *…one of the big issues with Frog Watch is our community education function that we're trying to fulfill…a lot of work aimed at supporting community groups and we've done a lot of work with people like Landcare groups and we do a lot of work with Junior Rangers and community education through Parks and Wildlife and other groups that are interested, schools and so forth…Frog Watch has been the model of community communication and collaboration that's supported through that web site and the way it actually takes the load off but our main aim there was to try and build a better environmental awareness based around the enthusiasm, interest in frogs and cane toads have really become an enormous part of that focus in the last couple of years in particular and the community interest in them is just staggering.*[160]

Parks and Wildlife Commission of the Northern Territory

This Government Departmental website has an information web page in respect of the cane toad — see Appendix 10 and at http://www.nt.gov.au/ipe/pwcnt/index.cfm?attributes.fuseaction=open_page&page_id=1572

The page is not as informative as the brochure and it is not easily found on the website.

160 Mr Sawyer, Darwin Public Hearing, 12 May 2003

The website also has a community education kit aimed primarily at students. The following is an excerpt from the web page describing the importance of community education and the role of the Community Education Unit:

> *The Community Education Unit provides a link from the Department to the public through its range of educational programs and services. The Unit aims to increase awareness of the Territory's natural and cultural environment to the public, engender support for the park system and provide opportunities for the public to play a role in protecting the Territory's environment.*
>
> *Community Education has an important role to play in assisting with the management of parks. The Unit provides educational programs to all sectors of the community, and in doing so promotes positive visitor behaviour to current and future park users.*[161]

However, the community education web page does not raise the issue of the cane toad and its impact on the Northern Territory environment.

Parks Australia North – Environment Australia

This body is responsible for management and protection of Kakadu National Park.

The park is proclaimed under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and is managed through a joint management arrangement between the Aboriginal traditional owners and the Director of National Parks. The Director manages Commonwealth national parks through Parks Australia, which is a part of Environment Australia.

PAN website is at http://www.ea.gov.au/parks/kakadu/index.html.

Like the Parks and Wildlife Commission of the Northern Territory's website, Parks Australia North has an information web page (a fact sheet which can be downloaded) discussing known pests within the Park. The fact sheet entitled *Keeping Kakadu Pest Free* reads in part:

> *Kakadu National Park, jointly managed by the Federal Government and Indigenous Traditional Owners, is at the cutting edge of pest control and research. While not immune to threat, Kakadu remains a wildlife haven largely untouched by feral pests and weeds. Recent achievements in the park include:*
>
> - *Groundbreaking, Commonwealth-funded research on cane toad impacts on vulnerable fauna. Projects include:*

161 http://www.ea.gov.au/parks/kakadu/pubs/kakadu-pest-control.pdf

- *pre and post toad surveys of small mammals, reptiles and terrestrial birds;*
- *population monitoring of quolls and goannas; and*
- *monitoring frog populations using automated frog call recording stations.*

Kakadu staff are also liaising with environmental experts across the Top End to combine knowledge and activities on the toad front.[162]

5.3.2. Information about protecting your household and yards from cane toads

The majority of the submissions and oral evidence given at the public hearings spoke in general about the dangers associated with children and domestic pets. Most of the evidence related generally to what one should do to mitigate the movement of cane toads in residential yards and areas.

Although the Committee notes that there is general information about cane toads, its toxicity, its danger to children in handling them and to domestic pets, there appears to be no definitive formal or official program to educate on what to do in protecting households, children and domestic pets from the dangers cane toads present. The Committee notes that a public awareness program has commenced post its Interim Report.

Environment Australia clearly outlines the problems associated with the lack of a comprehensive education program, when the cane toad arrived in Kakudu National Park:

> *In Kakadu, EA found that before cane toads arrived, many but not all residents had some awareness of the existence and likely arrival of cane toads, and that they contain toxin that is potentially harmful to humans, domestic pets and other animals. The level of awareness appeared to be lower amongst people with limited English literacy skills, and consequently EA prepared a picture booklet about cane toads and distributed it to Aboriginal residents in Kakadu.*
>
> *In 1998/99 The NSW Big Scrub Environment Centre Inc undertook a Cane Toad Control and Public Education Project that was funded through the Landcare program of the Natural Heritage Trust. The project focussed on educating the NSW North Coast community about cane toads.*
>
> *EA suggests that it would be useful to conduct an initial education program, particularly in Aboriginal communities across the Top End, to minimise the risk of children or adults suffering harm from contact with cane toads. There will be a need for continuing education program to encourage people not to transport cane toads to areas which have not yet been reached by toads, and especially to areas that would*

162 http://www.ea.gov.au/parks/kakadu/pubs/kakadu-pest-control.pdf

otherwise remain free of cane toads, such as offshore islands and any other areas that can be isolated from the spread of toads.[163]

FrogwatchNT on its website provides information on how to stop the cane toad:

What can I do to stop Cane Toad?

Stopping cane Toads will not be possible unless some form of biological control is found. However we recommend you do things that will minimise their impact in your area. This will minimise the impact on local frogs and other animals. This includes removing eggs from breeding areas and removing mature toads from your area. These toads should be disposed of humanely. We suggest putting them in a freezer and freezing them or placing them in a refrigerator and when they are cold euthanasing them with a sharp blow to the skull with a heavy blunt object.[164]

One international organisation, the Hawaiian Humane Society provides information about what to do when your domestic pet, in this case your dog is poisoned by a cane toad. The article describes what to do initially:

Depending on the size of the dog and how much toxin was ingested, symptoms can progress to tightly clamped jaws, heartbeat irregularities and even death. So the answer is to immediately start first aid and then seek veterinary treatment as soon as possible.

First aid includes washing out the dog's mouth with a steady stream of water, especially along the gums. Don't point the water down the dog's throat or allow him to swallow. Gently wipe toxic secretions off the gums and teeth with a cotton towel and rinse again with water. If the dog continues to salivate or shows other symptoms, take the dog to a veterinary clinic immediately.[165]

The article then describes what to do in keeping your back yard safe for the domestic dog:

If you have seen bufos [Cane Toads] in your yard, here's how to keep your canine pal safe:

- *Don't allow your dog outside unsupervised after sunset. Toads are nocturnal.*
- *When it is raining, stay with your dog in a lighted area and keep your eyes open. Toads come out more when it's wet.*
- *Check the yard thoroughly before you let your dog outside alone in the early morning.*
- *Lush plants and landscaping make ideal hiding spots for toads even during daylight hours.*[166]

163 Submission No. 15A, Environment Australia, 2003

164 http://www.frogwatch.org.au/canetoads/default.cfm.

165 Honolulu Advertiser, 12 January 2003

166 Honolulu Advertiser, 12 January 2003

5.3.3. Cane toad public awareness activities – Tiwi Islands

The Committee received a late submission from the Tiwi Land Council in regard to the activities in respect of the threat of the cane toad. Earlier within this Report the Committee raised the matter in regard to the issues surrounding the quarantining of the Tiwi Islands.

The Status report succinctly identifies the activities that have been or are to be undertaken. The report provides a very good example and a possible blueprint on what needs to done (with modification for the mainland) in promoting the awareness of the cane toad threat.

Status Report

The Tiwi Land Council is developing a training package consisting of a videotape by Professor Tyler, a CD and audio cassette titled "Frog Calls of the NT", various pamphlets and fact sheets on cane toads, and stuffed specimens. Tiwi land Council staff will deliver the package, and training will be ongoing through schools, men's centres, women's centres and environmental health workers. Training will also extend to mainland partners such as Tiwi Barge Services.

There is a high degree of literacy among the Tiwi people, and some knowledge of the toad problem on the mainland already existed through reading the NT News and watching TV. To augment this, and to develop awareness of the specific threat to the Islands, the Tiwi Land Council placed articles in the local media (Tiwi Times) during the first half of 2001. These articles were entitled "The Cane Toad Story", and were printed over a number of issues as a series.

Articles concentrated on what cane toads were, their history, why they are a problem, how to identify them and what could be done. They also highlighted the similarities and differences between cane toads and native frog species. These articles will be repeated once cane toads reach Darwin.

After publication of "The Cane Toad Story" the toad became a regular topic of conversation among the Tiwi, adults and children alike. Land Council staff and government visitors to the Island communities were frequently queried on where the cane toads were "now", and how they could help stop their arrival on the Islands.

A metal sign was also developed with the Parks and Wildlife Commission and donated to the Tiwi land Council. Signs showed a picture of a cane toad, and a message to keep them off Islands. Signs are prominently displayed at all barge landings, airstrips and approved fishing/camping spots on both islands.

A 'Tiwi" cane toad poster in traditional art style is being produced by local artists, and will be printed and widely distributed before October 2003.

The Parks and Wildlife Commission carried out a Junior Ranger camp on Melville Island which included cane toad activities, and Coastcare carried out cane toad activities with schools as part of their environmental education programmes. These activities will be ongoing.

Public awareness has also been a focus on the mainland, where much of the Islands' goods are sourced. Shipping companies, airlines, businesses, contractors, recreational organisations, basically anyone travelling or shipping goods and equipment to the Islands must know about the environmental dangers of cane toads and their responsibilities in stopping their migration.

The risk of cane toads reaching the Islands provided the catalyst for developing and distributing generic quarantine brochures and bookmarks. These have been distributed to tourist organisations, tackle shops, fishing associations, barge and airline charter companies and regular service providers who visit the Islands. They are also included in tender documents, in correspondence to contractors and other visitors, and handed out with access permits.

The metal cane toad signs have also been posted at mainland barge premises where goods are delivered for transport.

Tiwi Land Council issues permits for non-Tiwi to visit the Islands, and these permits are now watermarked with the message "keep cane toads out![167]"

167 Submission No. 25B, Tiwi Land Council, 2003

Tiwi Islands Cane Toad Action Plan

TIWI ISLANDS CANE TOAD ACTION PLAN
28 MARCH 2001

ACTION	RESPONSIBLE PARTY	BY WHEN	PROGRESS
1. Regulations			
Territory Parks and Wildlife Conservation Act	NT Govt	As required	N/A
Insert clauses in contractual agreements with companies, contractors etc.	Tiwi	As required	As required
2. Awareness			
Tiwi Islands			
Articles in Tiwi Times	Tiwi	from June/July 2001	Completed & ongoing
Tiwi Poster	Tiwi	by October 2003	In preparation
Signs at barge landings	Tiwi	by October 2003	Completed
Junior Ranger activities	Parks & Wildlife	from June/July 2001	1 completed; ongoing
Mainland			
Brochures for shipping companies, relevant businesses, contractors, relevant recreational organisations etc.	Tiwi	2003 dry season	Completed
Information sheets attached to permits	Tiwi	from 2003 dry season	Completed
Signs at barge landings, airline terminals etc.	Tiwi	by October 2003	Completed
3. Training			
Cane toad identification	Tiwi with advice & assistance from Parks & Wildlife Service	2003 dry season	In preparation
Identification of likely hiding places	"	"	"
Monitoring for cane toads	"	"	"
Eradication methods	"	"	"
4. Implementation			
Tiwi Islands			
Monitoring incoming freight	Tiwi/Business operators	from when cane toads reach Darwin	Ongoing
Monitoring freight premises and buildings	"	"	"
Identifying other areas where cane toads might enter Islands	Tiwi with advice & assistance	by 2003 dry season	Completed
Monitoring other likely areas (campsites etc.)	Tiwi	by 2003 dry season	Completed & ongoing
Reporting sightings	To Councils	from when cane toads reach Darwin	Ongoing
Eradication	Tiwi/Business operators	As required	As required
Mainland			
Construction of washdown bay and exclusion storage areas	Tiwi Barge	by end of 2003 dry season	In progress
Monitoring outgoing freight (add a box on consignment notes certifying that the goods have been inspected for cane toads?)	Shipper/Shipping company	from when cane toads reach Darwin	In progress
Monitoring mainland premises and buildings	Shipping company	"	"
Reporting sightings	To Parks & Wildlife	"	Ongoing
Eradication	Shipping company with advice & assistance from Parks & Wildlife	"	As required

5.4. FINDINGS

The Committee found:

34. Top End residents are concerned about the threat of cane toad infestation, particularly via human assisted transportation.

35. Some people were worried about the arrival of the cane toad and its impact on lifestyle and the environment.

36. Indigenous communities are concerned about the impact of cane toads on wildlife and their cultural and social lives.

37. The real impact of cane toads is not going to be fully appreciated by the wider community until they arrive.

38. There is a lot of web-site based information, including the Frogwatch NT and the Australian Museum websites.

39. There is no comprehensive public awareness program in the Territory on the potential impacts of cane toads and possible management strategies.

40. There is a need for a series of education programs aimed at the general public to encourage people to actively participate in the management and control of cane toads.

41. A number of important factors would need to be considered when developing a comprehensive public awareness information campaign on the impact the cane toad will have on the Territory community. These factors include:
    - The information and content needs to be simple and easily understood by all levels of the community;
    - The information and content needs to be presented in all major languages spoken in the Territory, including Indigenous languages;
    - The Information needs to be disseminated through community forums, seminars, workshops and public information sessions;
    - A public awareness campaign would need to be promoted through all forms of multi-media is needed;
    - Education kits need to be developed and aimed at specific groups, such as schools and Indigenous communities; and
    - Active participation of community groups and volunteer organisations in disseminating information and promoting public awareness.

42. There exists a great potential for engaging community groups and school classes in such initiatives as “Adopt a Waterway”.

5.5. RECOMMENDATIONS

The Committee recommends that:

9. That the Northern Territory Government develop a comprehensive multi-media public awareness campaign to educate the community on dealing with cane toads.

10. That a school-based education kit be developed on cane toads, addressing their environmental impact, risks and habits and what the community can do to mitigate their spread.

11. That Northern Territory community groups and volunteer organisations be encouraged to “Adopt a Waterway" as one of the ways in managing and controlling the impact of cane toads.

Chapter 6 Co-operation and collaboration

6.1. OVERVIEW

Given all the evidence received, the Committee is of the view that cane toads are a national issue. Throughout the Inquiry, the need for co-operative and collaborative arrangements between key stakeholders, at local and regional levels, in the Northern Territory, the States and the Commonwealth, was continually raised. Such co-ordinated arrangements would serve as a focal point for co-ordinating management and research strategies to address the issues regarding cane toads, offering a concerted approach towards effective control or possible eradication. In the more immediate term, the need for the Northern Territory to forge links with Western Australia to attempt to control cane toads spreading across the border was also identified. This chapter looks at the evidence received by the Committee in respect of these issues.

6.2. ESTABLISHMENT OF A NATIONAL TASK FORCE

During the course of the Inquiry the Committee raised the question as to the merits or otherwise of the possible formation of a national cane toad taskforce.

The Committee heard substantial evidence identifying the need to establish a national task force. Many of the submissions highlighted a number of factors:

(a) There is a need for a comprehensive management approach towards the control and possible eradication of cane toads in Australia.

(b) There is a need to assess and manage the limited funding arrangements within the affected jurisdictions and the Commonwealth that are tied to research and monitoring the environmental impact of the cane toad.

(c) There is a need for consultative and collaborative arrangements between all tiers of government and other stake-holders in the community in the monitoring, research and control on the environmental impact of the cane toad.

The Committee heard evidence from Dr Webb, Director of the Wildlife Management International Inc, who highlighted the need for a task force within the Northern Territory to assess and manage the impact of the cane toad in the Territory in the early 1980's:

> *…during the 1980's the NT monitored the exact rate at which cane toads took over the Northern Territory. We made no effort to get a task force together, to bring in the world's best people, to really bring in everything we could to absolutely assess in depth what was possible, or was not possible. We made no real attempt to be innovative, had we looked at those things we may have decided there is nothing we could do, but not to even look at them to me is something that I just can't wear as being professional nor appropriate to the level of the problem.*[168]

[168] Briefing, Dr Webb, Wildlife Management Internationals, 26 February 2003

Dr Lawson in his submission to Committee, highlighted the need to strategically approach the cane toad problem:

> *…I would like to see more co-ordination amongst researchers and people like ourselves in a more strategic approach to the cane toad problem and by that I don't mean necessarily looking for a magical cure, although that is very important but simply in terms of managing the situation that is inevitably going to happen, probably within the next one or two years in Darwin. I think there are ways we could more productively harness our energies to make sure the appropriate talent is used in the right way and I think there's also a need to reassure the public that the resources that we are expending, we're doing it in a strategic way to get the best bang for our buck.*[169]

Dr Kennett suggests a task force that is primarily focussed on northern Australia:

> *Given the urgency of the situation (i.e. cane toads have colonised >50% of the NT), the need for collaboration across sectors (government agencies, local government, land councils, universities etc), and the lack of NT government co-ordination of cane toad management and research in the past, the formation of a task force with appropriate powers and resources would be a useful step in dealing with the cane toad problem.*
>
> *I suggest the taskforce be kept small (perhaps a max of 5) otherwise it will be too cumbersome, meetings will never happen and little will be achieved. The team should be selected on the basis of scientific and technical expertise and communication abilities and work under the leadership of a suitable qualified scientist or manager. To expedite establishing the team they could be seconded to NT government positions for 18 months or 2 years with a review at the end of 2 years. NT government should be prepared to pay salaries unless the member's current employers can support their involvement, although this should not be a consideration in team selection.*
>
> *The role of the taskforce should be to undertake, commission and fast-track research, technical reports, feasibility studies, literature surveys etc, and to implement capital works where necessary. Positions on the taskforce should be full-time and the team should be adequately resourced to operate effectively in short time frames. The taskforce should report directly to the NT Environment Minister*[170]

Furthermore, as to representation and membership on a northern Australia task force, Dr Kennett suggests the following:

> *Representation on the taskforce might include individuals from Parks and Wildlife, research (possibly an NTU researcher), Commonwealth government, the Indigenous community, and the Northern Land Council. The taskforce should be provided with office space where the group can work together to*

169 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

170 Submission No. 18, Dr Kennett

> *ensure constant communication between team members and focus on the cane toad issues.*
>
> *The Commonwealth Government should be asked to nominate representatives from appropriate agencies, e.g. NAQS, EA, CSIRO who would be required to make responding to and communication with the task force a priority*[171]*.*

Dr Kennett makes further comment in regard to Western Australia's involvement in the task force:

> *The Western Australian Government will be extremely interested in the development and outcomes of the task force, toad control measures and impact studies. To ensure rapid transfer of knowledge to WA conservation authorities, WA Government representatives could be invited to the taskforce as observers. Similarly representatives from indigenous bodies in WA could be invited to participate as observers to the taskforce to ensure that indigenous people are kept informed.*[172]

Environment Australia is also supportive of a task force but raises a cautionary note:

> *EA is aware that some submissions to the inquiry have recommended the establishment of a cane toad task force. EA considers that there is scope for improved co-ordination and increasing the momentum of research into cane toad impacts and measures to minimise such impacts. It is important, however, that any such mechanism does facilitate and does not impede or delay progress in addressing cane toad impacts, and is cost effective.*[173]

The Committee supports the view that there is merit in establishing collaborative arrangements through the establishment on a national task force to assess and manage the impact of the cane toad nationally.

6.3. CO-OPERATION WITH WESTERN AUSTRALIA

The Committee heard evidence that as Western Australia is next in line for cane toad infestation, there is great merit in establishing bilateral agreements between the Northern Territory and Western Australia to co-ordinate the research, control and possible eradication of cane toads in Australia's north-west.

Dr Kennett comments on the possible collaborative arrangements:

> *Many of the species that are likely to suffer major declines following cane toad invasion are great cultural, spiritual and economic significance to Aboriginal people. Yet this aspect of the cane toad invasion has been largely overlooked or unacknowledged. I would consider that more attention be paid to this aspect of the invasion. Given that cane toads now cover much of the NT, this*

171 Submission No. 18, Dr Kennett

172 Submission No. 18, Dr Kennett

173 Submission No. 15A, Environment Australia, 2003

> *kind of study might be best done in collaboration with government and indigenous organisations in WA.*[174]

In its submission to the Inquiry, Environment Australia considered it would be beneficial for the Northern Territory, Western Australia and the Commonwealth to work together particularly when developing their long-term strategies in dealing the impact of the cane toad:

> *…there would be value in Northern Territory, Western Australian and Commonwealth research and management agencies assessing whether there are relatively undisturbed islands, peninsulas or other areas of high conservation value from which it would be economically and practically feasible to exclude cane toads. If it were feasible, it would be desirable from a conservation standpoint to maintain representative areas of the bioregion as toad-free. This would involve:*
> - *assessing the risk of toad colonization of islands within the potential biological range of toads, including identifying what islands have been colonised, when and how and what factors facilitate or hamper cane toad colonisation of islands;*
> - *examining whether any mainland areas could be kept toad free (for example, by patrolled fences across narrow peninsulas);*
> - *developing and instituting quarantine measures to prevent cane toads arriving on islands, including search and capture methods to locate any cane toads that enter toad-free areas;*
> - *raising public awareness of the need to prevent toads being transported to islands; and*
> - *involving Aboriginal people in patrolling quarantined areas for cane toads and in preventing their spread to quarantined areas.*[175]

The Committee is of the view that given the real threat of the cane toad to infest the Australia's northwest, there a very good reasons why Western Australia should be engaged.

6.4. A QUESTION OF PRIORITY

The Committee heard comments regarding which level of environmental priority the cane toad incursion should be given.

For example from the Co-ordinator of the NT Environment Centre:

> *…Well, I think, I mean it is tricky isn't it, it is very you know, which ecological value is more valuable? … No, within our work on exotics, it is not the highest priority, no. Like it is something that we and our membership has concern about but no, I think the spread of pastoral grasses unchecked is more significant environmentally.*[176]

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174 Submission No. 18, Dr Kennett

175 Submission No. 15A, Environment Australia, 2003

176 Ms Kirstin Blair, Co-ordinator, Environment Centre of the Northern Territory, Darwin Public Hearing, 12 May 2003

Dr Freeland's written submission listed twelve other equally important environmental priorities, including, the uncontrolled camel population in Central Australia causing damage to quondong abundance, the unchecked feral donkey populations in the Gulf Country and the spread of Gamba grass in the Top End and buffell grass across the semi-arid lands.[177]

Conversely, the Committee heard from the National Co-ordinator of the WWF Frogs Program,

> *So clearly there was a missed opportunity back in 1983 when they crossed from Queensland in to the Northern Territory where you might have been able to create a control zone there and effectively keep them out of the Northern Territory. But it's still a possibility to take advantage of this area along the Gulf of Carpentaria and prevent more cane toads from being recruited from outside the Territory.*

The Committee received much comment on the importance of learning from the experience now gained from the introduction of cane toads into Australia, so that the mistake will not be repeated.

For example from Mrs Douglas of Borroloola:

> *Well, how can you kill the cane toad when it's everywhere all over the place? Hundreds of 'em under the log, inside the hollow log. So how can you kill them all? Now they're spreading everywhere. So that is bad. And now we just give up, you know? We have just given up. If we could have think about this before when the cane toads start in Queensland way, or in Sydney, then we you know people should have stopped that. But now it's all over Australia.*[178]

From Dr Woinarski

> *It's slightly tangential to this and that's that it's easy to identify the toad problem retrospectively but we're making the same mistakes consistently now and our descendents are going to have to pay for them. Toads they're obvious, you know they look ugly, nobody likes them and they're conspicuous but at the moment much of the Top End, much of the Territory has been degraded by things which are far less obvious, things like Gamba grass, Para grass and in some cases Buffel grass and were still allowing these problems to be introduced to our environment and probably their effects on our bio-diversity are going to be far worse than cane toads. So it's fine, we've realised that cane toads are a problem, 60 years, 70 years after their introduction and we should be using the cane toad as an example of not to fall into that same trap again and now we're still, five years ago, ten years ago we were proselytizing about these pasture grasses and saying that you know they should be spread everywhere in the Territory almost and it's going to be our sons and daughters that are going to be, going to have to deal with the problem that will come from those in years to come and to me cane toad's just a classic example of the lesson we should be learning is that we shouldn't be so stupid again. That one*

177 Submission No. 22B, Dr Freeland, Written Submission, 2003

178 Mrs Douglas, Borroloola Public Hearing, 6 May 2003

> *vested interest shouldn't introduce something which is going to affect all our lives. Anyway, that's just a bit of a tangent but I think to me, I mean that's what we should be getting out of this cane toad thing. We're not going to solve the cane toad problem itself but we should be looking more broadly from it.*[179]

In addition, Dr Lawson addresses the issue of the environmental management of species introduction into the Northern Territory:

> *… we don't have a process for actually reviewing any species that people might want to bring into the Territory and I think that's to our detriment. I think we should have some process in place that if people want to bring new varieties or new species into the Territory that there is actually a very clinical look at not only the potential economic benefits that that might accrue but also the possible harmful effects and in the past, I think I'm right in saying that for instance in so called improved pasture species have been brought in by agronomists and certainly in the six years I've been here Parks and Wildlife has very little if any, been involved in actually being asked an opinion on that when it's happened. I think that that is an insidious environmental problem, as John said, and I totally agree with that but we just don't even have the most basic processes you talking about the introduction rather than for actually trying to stop that at the moment.*[180]

The Committee notes that there may have been missed opportunities to attempt to control the spread of cane toads. However, the evidence provided to the Committee in the submissions and briefings received, overwhelmingly supports further action.

While there exists no guaranteed method of biological control towards eradication, there exists an opportunity to actively manage the potential impacts and possibly prevent cane toads spreading across the Northern Territory's western borders. Pursuing strong collaborative arrangements between the Northern Territory and Western Australia, the establishment of a national peak task force, the translocation of threatened species like the northern quoll, the fencing of the neck of the Cobourg Peninsula and an extensive public awareness campaign utilising all multi-media forms are examples of positive actions towards a solution.

6.5. FINDINGS

43. There is a need for a comprehensive management approach towards the control and possible eradication of cane toads in Australia.

44. There is a need to assess the limited funding arrangements between the affected jurisdictions and the Commonwealth that are tied to research and monitoring the environmental impact of the cane toad.

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179 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

180 Submission No. 1A, Briefing, Parks and Wildlife Commission of the Northern Territory, DIPE, Oral Submission, 4 July 2003

45. There is a need for consultative and collaborative arrangements between all tiers of government and other stake-holders in the Northern Territory community in the monitoring, research and control on the environmental impact of the cane toad.

46. There is merit in establishing collaborative arrangements through the establishment of a national task force to assess and manage the impact of the cane toad nationally.

47. Due to the potential of cane toads expanding their range into Western Australia, there is merit in establishing bilateral agreements between the Northern Territory and Western Australia to co-ordinate the research, control and possible eradication of cane toads in Australia's North-west.

6.6. RECOMMENDATIONS

12. That the Northern Territory Government make the management and control of cane toads a high priority in respect of monitoring the cane toad's spread, and of co-ordinating research.

13. That the Northern Territory Government pursue with the Commonwealth and the states of Queensland, Western Australia, New South Wales and South Australia the establishment of a national task force to co-ordinate efforts to control and possibly eradicate cane toads.

14. That the membership of the national task force should include, but not necessarily be limited to, representatives of key stakeholder groups such as CSIRO, Parks and Wildlife Commission of the Northern Territory (PWCNT), Co-operative Research Centre-Tropical Savannahs Management-Charles Darwin University, interstate academics, Environment Australia, Frogwatch NT, and peak Indigenous organisations.

15. That the role and function of the national task force include:

    (a) co-ordinate efforts to control and possibly eradicate cane toads in Australia;
    (b) identify and pursue funding;
    (c) ensure ongoing consultation and collaboration with the three tiers of Government, environment groups, tertiary institutions and other research bodies, relevant corporations and industry; and
    (d) any other roles and functions agreed to by the membership.

16. That the Northern Territory Government immediately approach the Western Australian Government, for the purpose of establishing an agreement on a co-ordinated program to research, control and possible eradicate cane toads in Australia's north-west.

17. That the Northern Territory Government reports to parliament on the progress of implementing the Inquiry's recommendations.

APPENDIX 1: COMMITTEE TERMS OF REFERENCE

ENVIRONMENT AND SUSTAINABLE DEVELOPMENT COMMITTEE

TERMS OF REFERENCE

1. A Sessional Committee to be known as the Environment and Sustainable Development Committee be appointed.

2. Unless otherwise ordered, the membership of the Committee comprise three members to be nominated by the Chief Minister, two members to be nominated by the Leader of the Opposition and one independent member and that the Committee shall elect a government member as Chair.

3. The Committee shall be empowered, unless otherwise ordered, to inquire into and from time to time report upon and make recommendations on matters referred to it by the relevant minister or resolution of the Legislative Assembly:

(a) any matter concerned with the environment or how the quality of the environment might be protected or improved;

(b) any matter concerned with the sustainable development of the Northern Territory.

4. The Committee be empowered to send for persons, papers and records, to sit in public or in private session notwithstanding any adjournment of the assembly, to adjourn from place to place and have leave to report from time to time its proceedings and the evidence taken and make such interim recommendations as it may deem fit, and to publish information pertaining to its activities from time to time;

5. The Committee be empowered to consider, disclose and publish the minutes of proceedings, evidence taken and records of similar committees appointed in previous Assemblies;

6. The Committee be empowered to publish from day to day such papers and evidence as may be ordered by it and, unless otherwise ordered by the Committee, a daily *Hansard* be published of such proceedings as to take place in public; and

7. The Committee have power to appoint subcommittees consisting of 2 or more of its members and to refer to any such subcommittee any matter which the Committee is empowered to examine and that the quorum of a subcommittee shall be 2.

8. The foregoing provisions of this resolution, so far as they are inconsistent with the Standing Orders, have effect notwithstanding anything contained in the Standing Orders.

APPENDIX 2: 'SELECTED EXTRACT' OF THE ASSEMBLY DEBATE ON MATTERS REFERRED TO THE SESSIONAL COMMITTEE ON ENVIRONMENT AND SUSTAINABLE DEVELOPMENT COMMITTEE – 27 NOVEMBER 2002

Ninth Assembly First Session - 26/11/02 - Parliamentary Record No: 9

Topic : Sessional Committee on Environment and Sustainable Development

Subject : Matters Referred to the Committee

Date : 27/11/02

Member : Dr BURNS (Environment and Heritage)

Status : Minister for **Environment and Heritage**

MOTION

Environment and Sustainable Development Committee – References to Committee

Dr BURNS (Environment and Heritage): Madam Speaker, I move - That the Environment and Sustainable Development Committee inquire into and report on:

1. the efficacy of the establishment of an Environmental Protection Agency for the Northern Territory inclusive of but not restricted to -

   (a) arguments for and against the establishment of an Environmental Protection Agency for the Northern Territory;

   (b) options for the structure of an Environmental Protection Agency, taking account of the demographic, geographic and financial context of the Northern Territory; and

   (c) if a particular model is recommended, options for its staged introduction; and

2. issues associated with the progressive entry into the Northern Territory of cane toads.

Madam Speaker, this has been a fairly wide ranging debate today from this morning onwards. There have been many issues canvassed, including the establishment of the Environment and Sustainable Development Committee, examining the efficacy of an EPA, an environmental protection agency. It is my understanding that in other states an environmental protection agency provides a structure to examine and report on, and looks at addressing and remedying, environmental issues. As the member for Karama said earlier today, the Committee will be looking at a structure that can explore a whole range of environmental issues as they arise - I am talking about an EPA - rather than the Committee simply having a whole set of individual and discrete environmental issues that it is given. Considering the time available and the range of issues involved, it would make it very difficult for the Environment and Sustainable Development Committee to look at each one in depth.

This is a more strategic approach. Determining whether an Environmental Protection Agency would be efficacious, and I think that is the way to go. It shows how this government is interested in working strategically. It will also give community members, and different groups within the community - some of them obviously well known to the member for Goyder - to come along and give their points of view. Inherent in the establishment of an EPA there are quite considerable resource implications. This Committee is also charged with looking at the feasibility in that way, but also taking account of the unique nature of the Northern Territory; its demographic, geographic and financial context. I believe all those things are important. It is a strategic way for the Committee to go. I recommend the first term of reference for that very reason.

The second term of reference relates to the progressive entry of cane toads into the Northern Territory. I am a regular door-knocker in my electorate and I know other people from other places door-knock in other people's electorate, but I am a regular in my own electorate because I am interested to hear what my own electorate says. Actually, it has been a very clear question on a number of occasions from people: what can we do about the spread of the cane toad?

Mr Dunham: Then why didn't you tell them? You are the minister. Tell them what you say.

Dr BURNS: When I door-knocked, I was not the minister, member for Drysdale.

Mr Dunham: You did not have a clue!

Mr Kiely: We told them the CLP brought them in.

Mr Dunham: Yes, I bet you did!

Dr BURNS: May I continue, Madam Speaker? Very disruptive. I will look at you, Madam Speaker, and continue.

People do raise this issue. There is a perception in the community that government, and I guess the departments, have acquiesced all too easily to the spread of the cane toads. People are saying: 'What can I do when they come to my garden?' How do I protect my native species of frogs?' These are the questions that people ask about the issues associated with the progressive entry of cane toads into the Northern Territory. It is a very important reference. I think they will come to Darwin within a Wet season or so and people will be confronted by them. It is important that this Committee look at issues to do with that.

ENDS

APPENDIX 3: INTERIM REPORT

EXTRACT FROM THE PARLIAMENTARY RECORD – 21 AUGUST 2003

TABLED PAPER

Interim Report on Issues Associated with the Progressive Entry of Cane Toads into the Northern Territory

Ms LAWRIE (Karama): Mr Acting Deputy Speaker, pursuant to resolution of the assembly, dated 28 November 2002, I table the advance Sessional Committee on the Environment and Sustainable Developments interim report on issues associated with the progressive entry of cane toads into the Northern Territory. The Committee is close to finalisation of this inquiry into cane toads and anticipates tabling its full report in the Legislative Assembly's October sittings.

However, the Committee believes there are some matters that are time sensitive, which require being placed before parliament in these August sittings. Specifically, it is the finding of the Committee that cane toads are likely to reach greater Darwin and Palmerston during this coming Wet. In addition, we believe cane toads are likely to invade the historically and environmentally significant region of the Cobourg Peninsula during this coming Wet. Accordingly, we urge that the Northern Territory Government consider the following actions to ameliorate the significant impact that cane toads are likely to have during this coming Wet. The Environment and Sustainable Development Committee unanimously recommends:

- construction of a cane toad proof fence on Cobourg Peninsula

- increased use and enhancement of existing ranger and care for country programs to pursue cane toad control methods

- development and implementation of a multi-media public awareness campaign to educate the community about cane toads;

- development and management of quarantine regimes between the Commonwealth and Northern Territory Governments to protect offshore islands currently without cane toads.

In its recommendations, the Committee acknowledges that cane toads are an environmental issue of national significance which should attract Commonwealth, Territory and states funding. We acknowledge that a cane toad proof fence and quarantine measures are not failsafe measures to combat the incursion of cane toads. In the words of Dr Dan Holland, a consultant advisor for Parks North Australia, undertaking research in Kakadu National Park, we point out:

> *First, the use of exclusion barriers and other devices in combination with intensive, long term local surveys designed to detect and eradicate all life history stages of the toad, may very well prove to be a very cost effective means of excluding the species* [cane toads] *from significant areas such as the Coburg Peninsula and some of the offshore islands.*
>
> *Are such barriers absolutely leak-proof? No.*

In its submission to the inquiry, Environment Australia urged collaboration between the Commonwealth, Northern Territory and Western Australia, to develop long term strategies to deal with the impact of the cane toads that included:

Assessing whether there are relatively undisturbed islands, peninsulas, or other areas of high conservation value from which it would be economically and practically feasible to exclude cane toads. If it were feasible, it would be desirable from a conservation standpoint to maintain representative areas of the bio-region as toad free. This would involve: assessing the risk of toad colonisation of islands within the potential biological range of toads; examining whether any mainland areas could be kept toad-free, for example, by controlled fences across narrow peninsulas; developing and instituting quarantine measures to prevent cane toads arriving on islands including search and capture methods to locate any cane toads that enter toad-free areas; raising public awareness of the need to prevent toads being transported to islands; involving Aboriginal people in patrolling quarantine areas for cane toads and in preventing their spread to quarantine areas.

The Committee acknowledges that work is yet to be done on identifying any specific geographic placement of the proposed Coburg Peninsula fence, its design and construction feasibility. The fencing of Coburg Peninsula is a case of: be damned if you do and cane toad incursions occur, and be damned if you don't fence to protect a significant bio-diverse, historically, environmentally and culturally significant area. In weighing up submissions, the Committee found that on the whole, fencing of the Coburg Peninsula was desirable, with clear maintenance and monitoring control mechanisms in place to enhance its effectiveness. We commend this interim report to members of the Legislative Assembly and ask that you take it in the context that more broad findings and comprehensive recommendations will be provided in the final report due in October.

Mr Deputy Speaker, I move that the Assembly take note of the report and that I be given leave to continue my remarks at a later date.

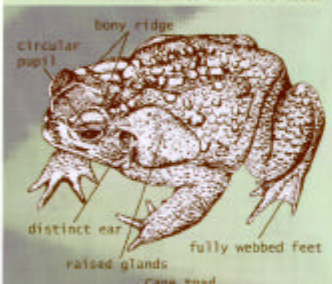
Leave granted.

APPENDIX 4: PARKS AND WILDLIFE COMMISSION OF THE NORTHERN TERRITORY, CANE TOAD INFORMATION SHEETS

mistaken identity

It is easy to mistake a cane toad for some of our native frogs. Cane toads can be up to 150mm long, but most of the frogs that look similar to cane toads are smaller.
Cane toads can also be identified by their distinct ears, raised poison glands and fully webbed feet.

For more information and identification advice call 8999 4536.



Giant frog - up to 100mm, distinct ear, horizontal pupils and feet not webbed.

Marble frog - up to 55mm, indistinct ear, horizontal pupils and feet partially webbed.

Northern spade foot frog - up to 55mm, indistinct ear, horizontal pupils and feet partially webbed.

Ornate burrowing frog - up to 45mm, indistinct ear, circular pupils and feet partially webbed.

Northern Territory Government

cane toads: the facts

Meet **Bufo marinus**, also known as the cane toad. People in Queensland and northern New South Wales have been living with these warty creatures for years - and now those of us in the Top End of the Northern Territory have to learn to live with them too.

when will cane toads be here?

Cane toads are already in Kakadu National Park, Katherine and Pine Creek. They will probably reach Darwin this wet season.

how can I recognise a cane toad?

The cane toad has warty skin, raised poison glands on its shoulders, a high bony ridge over its eyes, circular pupils and can be up to 150mm long. If it's smaller than 55mm and has no bony ridge, it could be an ornate burrowing frog, a marble frog or a northern spade foot frog. Cane toad eggs are in long strands of clear jelly, not clumps like frog eggs. If you are unsure, check with Parks and Wildlife.

what effect will they have?

Cane toads are prolific breeders and poison most animals that try to eat them. Many native animals will die and some species may become much rarer, possibly even extinct in their regions. We will see cane toads (dead and alive) on roads, in parks and gardens and in bodies of water like drains and swimming pools. Once their presence has peaked after a couple of years, we won't see quite so many of them.

what about my pet?

Cats are usually too cautious to attack cane toads, but dogs may try to eat them. If the dog is taken to a vet straight away, it will probably survive. Cane toads love eating pet food, but they won't poison it.

can I keep them out of my backyard?

Installing a 500mm high barrier of fine mesh or smooth sheeting around your perimeter (including the gate) could help to keep them out. Cane toads are poor climbers, but they can burrow a bit, so you will need to sink the barrier about 150mm into the ground. You will also need to watch out for toads that enter through your gate.

should I kill them if I see them?

You can reduce numbers of cane toads on your property by killing any that you see. The most humane way is to use a plastic shopping bag to pick the toad up, double bag it, tie it tightly and freeze it overnight. You can then bury it or put it in your wheelie bin. Make sure you really do have a cane toad first!

is there anything else I can do?

Avoid leaving containers of water around for toads to breed in. Keep your pet's food out of reach. If you have a pond, remove any cane toad eggs you see. Be careful you don't accidentally help cane toads travel: they are great hitchhikers and will find their way into pot plants, trailers and swags.

will our water supply be safe?

Cane toads don't poison water just by being in contact with it. Because they can't climb, they can't get to above-ground water tanks or most stock troughs.

what is the government doing about cane toads?

Unfortunately, at this time no one knows of a way to stop cane toads advancing.
The NT Government is:

- working with indigenous traditional owners to protect native species through the Island Ark program (vulnerable species like the northern quoll are moved to islands to keep them safe)
- taking steps to keep our offshore islands free of cane toads
- advising the community on living with cane toads
- researching the effects of cane toads on native animals.

The federal government is supporting CSIRO research into possible biological controls, but any solution to the cane toad issue is likely to be many years away.

making your yard a toad-free zone

Keeping cane toads out of your property may be possible ... but it will not be easy. The cane toad is one of the most determined, abundant and robust animals in the world: it is a worthy adversary. There are no entirely reliable proven ways to keep cane toads out. But the guidelines here are our best guesses based on what we know now. They could help minimise the chances of toads getting in.

fencing

Toads are not very good at climbing, hopping or burrowing. So a well-designed fence around your property may keep toads out.
The fence should be:

- A smooth solid material such as metal sheeting. Mesh fences - for example, flywire - may provide handholds for toads to climb over or may allow juvenile toads through.
- At least 50 cm high.
- Buried about 10 cm into the ground.

Remember to check the fence regularly for breaches caused by trees, water or other animals. You will also need to consider the weak points in your perimeter fencing: access roads and gates.

water

Toads prefer to drink or moisten themselves at least every two days.
You can make your property less attractive for toads by eliminating (or fencing) any standing water, and using sprinklers infrequently.

garden maintenance

Toads hunt most effectively in relatively open areas with little vegetation, such as closely cropped lawns and bare areas. Gardens with long grass or dense ground vegetation will be far less attractive to toads.

lighting

Toads like night-time lighting, because they can feast on the many moths and other insects that are also attracted to the lights.

reduce shelters

Toads seek shelter during the day in places that offer some shade and security, such as under rubbish and debris, in old car tyres, etc. You can make life far less tolerable for toads by eliminating such shelters.

patrols

Regular searches, for example by torchlight at night, may help you to find and destroy any toad intruders before they get a chance to breed and build up numbers. If you think one or a few toads have got into your place, it may be easiest to find them by putting out a bowl of water and using a tape of their display calls.

For more information phone the
Parks and Wildlife Service
on 8999 4536 / 0409 090 840

Northern Territory Government
Department of Infrastructure, Planning and Environment

Government Printer of the Northern Territory

APPENDIX 5: SUMMARY OF DELIBERATIVE MEETINGS

SUMMARY OF DELIBERATIVE MEETINGS

Date	Key Agenda Items
28 November2002	• Establishment of Committee, appointment of members and terms of reference • Election of Chair • Future deliberative meetings • Future Inquiry on Environment Protection Authority (EPA) • Future Inquiry on Cane Toads in the NT • Draft program and funding
26 February 2003	• Inquiry on Cane Toads in the NT – briefings to Committee - Public Hearings • Committee funding and staffing arrangements 2002-03 and 2003-04 • EPA Inquiry – Receipt of research material • Legislative Assembly sittings – Alice Springs
28 May and 10 June 2003	• Inquiry on Cane Toads in the NT – briefings to Committee – public hearings program - receipt of written submission
18 June 2003	• Draft framework of major report • Committee funding 2003/04
14 August 2003	• Draft Report on Cane Toads in the NT (for consideration)
20 August 2003	• Final Report on Cane Toads in the NT (for adoption)

APPENDIX 6: LIST OF PERSONS APPEARING BEFORE THE COMMITTEE

LIST OF PERSONS APPEARING BEFORE THE COMMITTEE

Date	Location	Name
6 May 2003	Borroloola	Mr Richard BAKER
		Mr Graeme DINGWALL
		Mr Ross BROWNING
		Ms Felicity CHAPMAN
		Ms Thelma DOUGLAS
		Ms Jemina MILLER
		Mr Bill BAIRD
		Mr Josh COATES
6 May 2003	Katherine	Mr Andrew PICKERING
		Ms Sarah KERIN
		Mr Werner ARNY
		Ms Kath RYAN)
7 May 2003	Jabiru	Ms Beryl SMITH
		Mr Johnny REID
		Mr Steve WILLIKA
		Ms Jane CHRISTOPHERSON
		Mr John CHRISTOPHERSON
		Mr Brian YAMBILBIK
		Dr Dan HOLLAND
		Ms Margaret RAWLINSON
		Ms Sajidah ABDULLAH
		Mr Brian COOPER
		Mr Dave LINDER
		Mr Russell CUBILLO
		Dr Rod KENNETT
		Mr Roger TEAGUE
		Mr Ian MURDOCH
		Mr Jonathon NADJI
		Ms Georgianna FIEN
12 May 2003	Darwin	Dr Greg BROWN
		Mr Jock SOMERVILLE
		Mr Richard SOMERVILLE
		Mr Ray SMITH
		Mr Mark NOONAN
		Mr Ray TAYLOR
		Ms Faith WOODFORD
		Ms Lorna WOODS
		Ms Anne BARKER
		Ms Donna MORONEY
		Mr Dan BASCHIERA
		Mr Thomas TYLER
		Mr Mathew SHILELDS
		Ms Holly DITHER
		Ms Angela ESTBERGS
		Ms Camilla MICHIE
		Mr Alan KERR
		Ms Kerralee CHAMBERS
		Mr Rohan WILKINSON
		Mr Terence BAYLY
		Mr Jeff FAREY
		Ms Lorraine DAVIES
		Ms Robyn KNOX
		Dr Mike Tyler
		Dr Max FINLAYSON
		Mr Dave WALDEN
		Ms Kirsten BLAIR
		Mr Mick DENIGAN
		Mr Graeme SAWYER
		Dr Stan ORCHARD
13 May 2003	Palmerston	NIL ATTENDANCE
19 May 2003	Litchfield	Ms Denise BATTEN
		Mr Herbert BACKERS
		Ms Barbara BACKERS
		Mr Peter VISENTIN
		Ms Mary WALSHE

APPENDIX 7: LIST OF WRITTEN SUBMISSIONS RECEIVED

LIST OF WRITTEN SUBMISSIONS RECEIVED

SUBMISSION NO.	FROM	ORGANISATION
1	Dr David Lawson and Dr John Woinarski and Ms Jailee Wilson	Northern Territory Parks and Wildlife Commission – Department of Infrastructure, Planning and Environment
2	Mr Michael Denigan	Mick's Whips
3	Dr C M Finlayson	Environmental Research Institute of the Supervising Scientist
4	Mr Dave Lindner	Private Citizen
5	Mr John Christophersen	Chairman of the Cobourg Peninsula Board of Management
6	Mr Dave Thiele and Mr Brendan Dowd	Darwin City Council
7	Mr Dan Baschiera	Private Citizen
8	Ms Robin Knox	Northern Land Council - Caring for Country Unit
9	Dr Stan Orchard'	World Wide Fund for Nature Australia Incorporated - National Co-ordinator FROGS! Programme
10	Ms Lorna Woods	Keep Australia Beautiful Council
11	Dr Craig James	Ecological Society of Australia
12	Professor Gordon Grigg	Dept of Zoology and Entomology, University of Queensland
13	Ms Carole Frost	Northern Territory Chamber of Commerce and Industry
14	Mr Richard Austin	Northern Territory Tourist Commission
15	Mr Peter Cochrane	Environment Australia/ Parks Australia North
16	Mr Kim Wood	Power and Water Authority
17	Ms Colleen O'Malley	World Wide Fund for Nature Arid Rangelands Threatened Species Network Alice Springs
18	Dr Rod Kennett	Scientific Researcher
19	S J Reynolds	Private Citizen
20	Ms Elizabeth Clark	The Bush Nursery / NT Horticultural Society – Katherine
21	Dr Greg Brown	Private Citizen
22	Dr Bill Freeland	Private Citizen
23	Dr Michael Mahony	Biologist - University of Newcastle
24	Ms Faith Woodford	Private Citizen
25	Mr Frederick Mungatopi and Ms Kate Hadden	Tiwi Land Council

APPENDIX 8: SUBMISSION NO. 15 A – ENVIRONMENT AUSTRALIA

SUBMISSION 15 A

Department of the Environment and Heritage

Submission

to the

Legislative Assembly of the Northern Territory

(Sessional Committee on Environment and Sustainable Development)

INQUIRY INTO ISSUES ASSOCIATED WITH THE PROGRESSIVE ENTRY INTO THE NORTHERN TERRITORY OF CANE TOADS

Introduction

Environment Australia (EA) is the Commonwealth portfolio that advises the Commonwealth Government on policies and programs for the protection and conservation of the environment. Of particular relevance to this inquiry, EA;

- manages Commonwealth reserves, including Kakadu National Park which is managed by the Director of National Parks and Aboriginal traditional owners;
- conducts research in the Alligator Rivers Region of the Northern Territory, through the Environmental Research Institute of the Supervising Scientist (ERISS);
- administers the *Environment Protection and Biodiversity Conservation Act, 1999*, which includes provisions relating to threatened species and threatening processes;
- manages the Natural Heritage Trust, jointly with Agriculture, Fisheries and Forestry – Australia. The four programs and ten areas of activity under the Natural Heritage Trust are listed at Attachment A.

Some information has been provided to the inquiry verbally by Kakadu National Park staff, members of the Kakadu Board of Management and by the Director of ERISS. This submission supplements the information provided at the hearings.

This submission addresses the six terms of reference for the inquiry, as listed in the call for submissions.

1. The identification of the problem and risks associated with cane toads in the Northern Territory; and
2. The potential extent and effects cane toads have or will have in the Northern Territory

Extent of cane toad invasion

Cane toads were introduced to coastal Queensland in the 1930s and arrived in the Northern Territory in the early 1980s. Parks Australia, the division of EA which jointly

manages Kakadu National Park with the Aboriginal traditional owners of the park, has kept records of reported sightings of cane toads since their arrival in Kakadu National Park. EA does not have centralised records of cane toads elsewhere in the Territory or in other States.

Cane toads arrived in the southern end of Kakadu National Park in 2001 through the Katherine River drainage system. They are now well-established in the upper reaches of the East Alligator, South Alligator and Mary Rivers. In Kakadu, cane toads are moving generally north-west and downstream. They have advanced very rapidly in the wet seasons and more slowly in the dry seasons.

Since early 2003, a few individual cane toads have been found around Jabiru. As at May 2003, cane toads have been sighted within Kakadu as far north as Mudginberi and as far west as Cooinda. They are now well established at least as far north as the Nourlangie Rock area in the Nourlangie Creek catchment.

Based on these records, within Kakadu cane toads are spreading north-west at a rate of about 60km per year. EA considers it likely that cane toads will continue to spread at a similar rate across Kakadu and the rest of the Top End of the Northern Territory, much of which affords suitable habitat and abundant food resources for cane toads.

Effects and risks of cane toads

Cane toad biology is well documented as a result of many years' research into biological control methods. The key features of cane toads that lead to significant effects on Australian native species are their toxicity to potential predators, their fecundity, their ability to disperse over long distances and their adaptability to a wide range of habitats and prey species.

The immediate effects of cane toad interactions with humans, domestic animals and many Australian native species are known from anecdotal evidence and research. Because cane toads produce a toxin that is lethal to most Australian native species, animals that attempt to eat cane toads, or their eggs or tadpoles often die. Cane toads also consume a wide variety native species, mainly invertebrates, as prey. Because of their large numbers and wide range of prey items, it is likely that cane toads compete with native species for food but little is known of these competition effects.

The toxin is also potentially lethal to humans, domestic dogs and cats if ingested, however humans tend to avoid contact with the toads and are easily educated about the dangers. Some domestic pets are killed by contact with cane toads but many learn to avoid them. As a result, cane toads do not pose a significant direct risk to human or domestic animal populations.

Based on the toxicity, fecundity, migratory behaviour and adaptability of cane toads, EA considers that it is highly likely that cane toads will adversely affect populations of many native species in the Northern Territory. However, until recently there had been little research conducted on the indirect and long-term effects of cane toads on Australian native species and ecosystems. As a result, there is as yet little

quantitative data on the likely long-term effects of cane toads on native species and ecosystems.

This lack of quantitative information was of increasing concern to EA and the Kakadu Board of Management as cane toads approached Kakadu and no biological control method had been found. Consequently, EA took the following steps to identify the likely effects of cane toads on native species in the Kakadu region.

ERISS prepared a preliminary risk assessment of the impact of cane toads (ERISS has submitted this report to the Inquiry). This risk assessment rated northern quolls, several goanna species and several snake species as most likely to be seriously affected by cane toads. Many other species are also likely to be adversely affected.

Parks Australia contributed funds to extend a frog monitoring program, being conducted by Dr Gordon Grigg, University of Queensland, into Kakadu (see synopsis of Roper River area work at Attachment B). None of the monitoring sites in Kakadu had been reach by cane toads as at May 2003.

Parks Australia engaged Dr John Woinarski, NT Parks and Wildlife Commission and Ms Michelle Watson to conduct a series of faun a surveys in Kakadu, at sites that had been surveyed up to 25 years ago, to examine faunal changes since the last surveys and again after the arrival of cane toads. In November 2002 a preliminary report on this study provided the first quantitative data available that quoll numbers drop rapidly with the arrival of cane toads. This lent considerable weight to anecdotal evidence from Queensland that quolls disappear abruptly with the arrival of cane toads. As a result, Environment Australia, the NT Parks and Wildlife Commission, the Northern Land Council and Aboriginal traditional owners collaborated to translocate about 60 quolls from the mainland of the NT to islands off Arnhem Land. This initiative is discussed further below.

The summary of a report recently received from Ms Watson and Dr Woinarski is at Attachment C. To date, surveys of 110 sites in the southern region of Kakadu have shown substantial declines in numbers of northern quolls where toads have invaded. Less substantial declines were found for a range of other species including the terrestrial gecko *Gehyra nana* and the pale field rat. Encouragingly, some species including the northern brown bandicoot, dingo, many bird species and most frogs showed no change or a relative increase.

Parks Australia also commissioned a more detailed study of northern quolls, which is being conducted by Dr Meri Oakwood. This study has also provided data indicating a dramatic decline in quoll numbers where cane toads have arrived (summary of progress report is at Attachment D)

Parks Australia supported a behavioural study of tree goannas, conducted by Dr Sam Sweet, which showed that these two species are unlikely to be seriously affected by cane toads. Parks Australia is supporting a pre- and post- cane toad study of sand goannas, conducted by Dr Dan Holland.

Dr Rod Kennett of EA compiled a reference list of studies conducted and in progress in the Northern Territory that have provided or may provide data on the effects of cane toads on native species. This has been updated for submission to this inquiry (Attachment E).

Since cane toads arrived in Kakadu, staff have been collecting specimens for examination of stomach contents, which have comprised a wide variety of invertebrates. Park staff have also recorded observations and/or collected specimens of native animals that have apparently died in attempting to eat cane toads, which have included death adders, goannas and freshwater crocodiles.

In summary, there is now scientific as well as anecdotal evidence that cane toads cause substantial declines in northern quoll populations. EA considers that there is a significant risk that quoll species across northern Australia may become locally extinct in areas that cane toads invade. It is likely that cane toads will cause substantial declines in other species including some goanna and snake species. Many other predator, prey, competitor and co-habiting species are also likely to be adversely affected. To date there is insufficient information to quantify the likely extent of declines of any affected species other than northern quolls, or to estimate the potential future recovery of any species.

3. The cultural, socio-economic and other factors associated with the encroachment of cane toads into the Northern Territory

Some of the species most likely to be adversely affected by cane toads are of considerable economic and cultural significance to Aboriginal people in the Northern Territory.

EA is of the view that a substantial decline in goanna or turtle populations would have a significant impact on the local economy of Aboriginal communities within Kakadu and elsewhere in the Northern Territory, as both are important traditional food sources.

Traditional owners in Kakadu National Park have expressed worries about the potential decline in goanna, snake, turtle, freshwater crocodile and barramundi populations, amongst other animals. These animals have a central role in Aboriginal culture and kinship systems, and many Aboriginal people feel strongly affiliated to these animals. Substantial declines in these species would cause grief, exacerbate Aboriginal people's worries about the health of their country and in time may lead to loss of knowledge about the species and their ecological and cultural significance.

Recent visitor surveys commissioned by EA in Kakadu National Park have indicated that one of the main reasons that tourists visit the park is to see wildlife, including crocodiles and goannas. A decline in visitors' perceptions of wildlife in Kakadu and elsewhere in the Top End could lead to decreased visitor satisfaction, although much of the wildlife is not readily visible to the casual visitor.

4. Identifying the current level of understanding concerning cane toads to date and assessing the need for public education and awareness programs

In Kakadu, EA found that before cane toads arrived, many but not all residents had some awareness of the existence and likely arrival of cane toads, and that they contain toxin that is potentially harmful to humans, domestic pets and other animals. The level of awareness appeared to be lower amongst people with limited English literacy skills, and consequently EA prepared a picture booklet about cane toads and

distributed it to Aboriginal residents in Kakadu. (A copy of this booklet has been provided to the Inquiry.)

In 1998/99 The NSW Big Scrub Environment Centre Inc undertook a *Cane Toad Control and Public Education Project* that was funded through the Landcare program of the Natural Heritage Trust. The project focussed on educating the NSW North Coast community about cane toads.

EA suggests that it would be useful to conduct an initial education program, particularly in Aboriginal communities across the Top End, to minimise the risk of children or adults suffering harm from contact with cane toads. There will be a need for continuing education program to encourage people not to transport cane toads to areas which have not yet been reached by toads, and especially to areas that would otherwise remain free of cane toads, such as offshore islands and any other areas that can be isolated from the spread of toads.

Public education methods that should be considered include picture booklets, posters, videos, television advertisements and documentaries.

5. Identifying ways to manage the environmental impact of cane toads in the Northern Territory

Broadly, EA considers that the main ways to manage the environmental impacts of cane toads are, in priority order, to:

1. identify one or more biological controls to reduce cane toad populations;
2. institute strict quarantine measures in designated areas, e.g. islands or peninsulas, to keep them toad-free as long as possible;
3. educate people to reduce the likelihood that they will transport cane toads to new areas;
4. try to conserve breeding populations of species threatened with extinction by cane toads, through translocation or captive breeding if necessary and appropriate;
5. conduct research to obtain more information about environmental, social, cultural and economic impacts in order to guide priorities for future impact mitigation measures; and
6. increase co-ordination and momentum of research and control measures.

5.1 Biological control of cane toads

CSIRO was commissioned by the Commonwealth in 1990 to undertake and manage a cane toad research program. The Commonwealth provided $1.25 million over three years with some of the States contributing a further $90,000. In 1993 the Commonwealth provided additional funding of $2 million, which finished in December 1996. In 1996/1997, the first year of the Natural Heritage Trust, the Commonwealth provided $120,000 to fund the program to June 1997, to finalise some work not previously finished.

Although much valuable research was undertaken in this period between 1990 and 1997, no methods were identified that would specifically target cane toads and enable

broad-scale control of them in Australia. In summary, while the research identified viruses from Venezuela that would control cane toads in Australia, laboratory trials showed that the same viruses also killed native Australian frogs.

In late 1998 the then Minister for the Environment, Senator the Hon Robert Hill, sought a reassessment and further national commitment to undertaking research into the biological control of cane toads. Based on this initiative a new CSIRO research project, also funded from the Natural Heritage Trust, began to investigate a mechanism to disrupt the development of tadpoles to sexual maturity.

Since 2000 the Commonwealth Government has provided to CSIRO nearly $1.5 million from the Natural Heritage Trust to support that research program. The research being undertaken by CSIRO may take up to 10 years to complete and there is no guarantee that this research will result in a biological control method to control cane toads.

The project is progressing well with CSIRO advising of success in isolating possible genes and viruses that could be considered for use in preventing cane toad tadpoles from developing. Further details about the project are at Attachment F.

5.2 Quarantine toad-free areas

Until an effective biological control of cane toads is developed, the only method of conserving an entire ecosystem from the impact of cane toads would be to exclude cane toads from the area by natural or artificial barriers and quarantine measures. This would not be economically or practically feasible on a large scale but may be warranted in specific, small areas of northern Australia, particularly those that are suitable for conservation of species most at risk from cane toads.

EA considers that there would be value in Northern Territory, Western Australian and Commonwealth research and management agencies assessing whether there are relatively undisturbed islands, peninsulas or other areas of high conservation value from which it would be economically and practically feasible to exclude cane toads. If it were feasible, it would be desirable from a conservation standpoint to maintain representative areas of the bioregion as toad-free. This would involve:

- assessing the risk of toad colonization of islands within the potential biological range of toads, including identifying what islands have been colonised, when and how and what factors facilitate or hamper cane toad colonisation of islands;
- examining whether any mainland areas could be kept toad free (for example, by patrolled fences across narrow peninsulas);
- developing and instituting quarantine measures to prevent cane toads arriving on islands, including search and capture methods to locate any cane toads that enter toad-free areas;
- raising public awareness of the need to prevent toads being transported to islands;
- involving Aboriginal people in patrolling quarantined areas for cane toads and in preventing their spread to quarantined areas.

5.3 Public education to minimise transport of cane toads

As noted previously, there is a need to carry out public education to encourage people to make sure they do not transport cane toads to quarantined areas or areas which

have not yet been reached by toads. It is important not to hasten the colonisation of new areas by cane toads, in the hope that biological control or other factors will reduce or halt the spread of cane toads before they reach all suitable habitat in Australia.

5.4 Conservation of species that may be threatened by cane toads

Translocation and captive breeding

As noted previously, data obtained from research in Kakadu in 2002-3 suggest that northern quoll numbers decline rapidly as cane toads arrive in an area. These findings prompted Parks Australia, the Parks and Wildlife Commission of the NT and the Northern Land Council to collaborate in relocating a small number of northern quolls to islands, offshore from Arnhem Land, where cane toads are not present. The quolls were translocated from a number of areas across the Top End, including Kakadu. The Commonwealth Government provided an NHT grant of $28,000 to support the involvement of Indigenous communities in this project.

Where studies indicate a substantial risk that the survival of a species may be threatened by cane toads, EA considers that it would be prudent to try to conserve breeding populations of species through translocation or captive breeding. These measures can play a role in safeguarding species from specific threats until that threat can be controlled.

Listing of threatened species

Listing of threatened species under State, Territory or Commonwealth legislation can potentially facilitate a strategic approach to conservation measures and an increased commitment by government agencies to implementing conservation measures.

Threatened species may be listed in the Northern Territory under the *Territory Parks and Wildlife Conservation Act, 2000* (TPWC Act) and/or nationally under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

The northern quoll is not currently listed and has not been nominated for listing as threatened under the EPBC Act. It has been nominated for listing as vulnerable in the Northern Territory under the TPWC Act.

To list a species under the EPBC Act, a nomination must be submitted for assessment by the Threatened Species Scientific Committee. This Committee provides advice to the Commonwealth Minister for the Environment on whether species meet the criteria for listing as a threatened species under the Act. The Minister is required to consider the advice of the Threatened Species Scientific Committee before making a decision on listing a species.

Once a species is listed under the EPBC Act, a recovery plan must be prepared for that species, either by the Commonwealth or jointly with State/Territory Governments. The Commonwealth must implement the plan in Commonwealth areas and seek State/Territory co-operation to implement it elsewhere.

Listing of cane toads as a key threatening process

An introduced animal species, such as the cane toad, may be listed as a key threatening process under the EPBC Act if it "threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community". Foxes, rabbits, feral cats and feral goats are examples of currently listed key threatening processes.

If cane toads are to be listed as a key threatening process under the EPBC Act, a nomination would need to be submitted and assessed by the Threatened Species Scientific Committee, which would then advise the Minister on whether the threatening processes meet the criteria for listing under the Act. There is no nomination currently before the Committee to list cane toads as a threatening process.

Once a key threatening process has been listed, the Minister may have a threat abatement plan prepared, if that is a feasible, effective and efficient way to abate the process.

5.5 Research into cane toad impacts

Although cane toads have been present in Australia for nearly 70 years, there is still very limited information about the impacts of cane toads on native species and ecosystems. Some biological surveys are in progress in Kakadu as described above, and elsewhere in the NT as outlined in Attachment E. Further information is needed to assist governments in setting priorities for conservation of species and ecosystems likely to be adversely affected by cane toads.

It would be beneficial to obtain more information about the long-term as well as short-term environmental, social, cultural and economic impacts of cane toads. The types of research that would be useful include biological surveys and interviews of Aboriginal people in areas in which cane toads have recently arrived.

Northern Territory, Western Australian and Commonwealth research and management agencies should consider the need for information about cane toad impacts when developing their long-term and annual research and survey work programs and budgets.

5.6 Co-ordination and facilitation of cane toad impact mitigation and research

EA is aware that some submissions to the inquiry have recommended the establishment of a cane toad task force. EA considers that there is scope for improved co-ordination and increasing the momentum of research into cane toad impacts and measures to minimise such impacts. It is important, however, that any such mechanism does facilitate and does not impede or delay progress in addressing cane toad impacts, and is cost effective.

Mechanisms that may delay progress include large co-ordinating committees with many stakeholders who are required to reach consensus before projects commence. Mechanisms that may facilitate action include a small scientific task force, an information exchange network and/or designated co-ordinators for cane toad-related activities in land and wildlife management agencies.

Northern Territory, Western Australian and Commonwealth research and management agencies, researchers, Indigenous groups and environmental groups should examine ways that they can contribute to exchanging information, minimising duplication of effort and increasing the momentum of work relating to cane toad impacts.

6. Community concerns and expectations in respect of the progressive entry into the Northern Territory of cane toads generally.

This submission has noted the concerns expressed by Aboriginal traditional owners in Kakadu National Park about the environmental and cultural impacts of cane toads. EA shares these concerns, and is taking action to gather information about cane toad impacts, contribute to initiatives such as the quoll translocation project, and disseminating information to Kakadu residents and visitors. EA is concerned at the potential impact of cane toads on ecosystems and communities across the Top End. EA will continue to work collaboratively with NT agencies, research institutions and Aboriginal people on identifying and addressing the environmental and social impacts of cane toads.

Attachments

A: Natural Heritage Trust programs and areas of activity
B: Grigg toad synopsis
C: Summary of Watson and Woinarski report May 2003
D: Meri Oakwood report February 2003
E: List of researchers
F: Summary of biological control project

Attachment A

Natural Heritage Trust programs and areas of activity

Natural Heritage Trust Programs

The **Landcare Program** will invest in activities that will contribute to reversing land degradation and promoting sustainable agriculture.

The **Bushcare Program** will invest in activities that will contribute to conserving and restoring habitat for our unique native flora and fauna which underpins the health of our landscapes.

The **Rivercare Program** will invest in activities that will contribute to improved water quality and environmental condition in our river systems and wetlands.

The **Coastcare Program** will invest in activities that will contribute to protecting our coastal catchments, ecosystems and the marine environment.

Together these programs will invest in the ten **Natural Heritage Trust areas of activity**, which are:

- protecting and restoring the habitat of threatened species, threatened ecological communities and migratory birds;
- reversing the long-term decline in the extent and quality of Australia's native vegetation;
- protecting and restoring significant freshwater, marine and estuarine ecosystems;
- preventing or controlling the introduction and spread of feral animals, aquatic pests, weeds and other biological threats to biodiversity;
- establishing and effectively managing a comprehensive, adequate and representative system of protected areas;
- improving the condition of natural resources that underpins the sustainability and productivity of resource based industries;
- securing access to natural resources for productive purposes;
- encouraging the development of sustainable and profitable management systems for application by land-holders and other natural resource managers and users;
- providing land-holders, community groups and other natural resource managers with understanding and skills to contribute to biodiversity conservation and sustainable natural resource management; and
- establishing institutional and organisational frameworks that promote conservation and ecologically sustainable use and management of natural resources.

Attachment B

IMPACT OF CANE TOADS ON NATIVE FROGS, ROPER RIVER VALLEY AND KAKADU NATIONAL PARK.

Brief synopsis of study and results to date, May 2003.

by

Gordon Grigg[1]
Andrew Taylor[2]
Hamish McCallum[1]

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Executive Summary

Since 1996 in the Roper River Valley and since 1998 in Kakadu National Park, we have been monitoring the calling acticity of native frogs at 16 sites using automatic recording systems based on technology similar to voice recognition which was developed specially for this study.

All our data for Kakadu is, until the 2002-03 wet season (not yet downloaded), base-line data, before the arrival of toads. In the RRV we have some pre-toad data and much post-toad data.

The results from the RRV are provocative. The number of frog species calling per station declined markedly between the beginning of the study in 1997-98 and 2001-2002. This pattern was consistent at each of the 10 stations and suggests that toads may well have a detrimental effect on frogs. However, because of confounding variables and gaps in the data, combined with the short period before toads arrived, we cannot be sure. We certainly cannot say that there is no effect. The weight of our evidence is that, during the five years of our study, there has been a decrease in frog calling activity at our sites (both in terms of species present and days each species calls). The data from the Kakadu study will be very important because they will provide an independent replicate study, against a longer pre-toad base-line.

ATTACHMENT C

Vertebrate monitoring and re-sampling in Kakadu National Park, 2002

Project RS10
Report to Parks Australia: March 2003.

Michelle Watson and John Woinarski

SUMMARY

This report provides information on a range of studies undertaken in 2002, that involve aspects of monitoring and re-sampling of the terrestrial vertebrate fauna of Kakadu National Park.

Assessment of short-term impacts of cane toads upon the terrestrial vertebrate fauna
The terrestrial vertebrate fauna was sampled in 110 quadrats in the Mary River district of KNP in the dry season of 2001. Cane toads were not present in any of these in the dry season of 2001, but colonised parts of the district including 77 of these quadrats in the wet season of 2001/02. We re-sampled all 110 quadrats in the dry season of 2002, and here compare changes in abundance from 2001 to 2002 in the set of toad-invaded quadrats and in the set of 33 quadrats that hadn't yet been reached by toads ("control" quadrats). This study design allows us to quarantine much of the variation between sampling periods that is unrelated to toad invasion.

The resulting data base included records of 122 frog, reptile, bird and mammal species that were recorded from at least 5 quadrats over the sampling period. Of these species, 112 were recorded in toad-invaded quadrats following that invasion.

The most marked change in the vertebrate fauna was the highly significant decline of northern quolls in the toad-invaded quadrats. None were caught in quadrats that toads had invaded, whereas 41 individuals had been caught at 17 of these quadrats in the previous year.

There were less substantial declines observed for a range of other species including pale field-rat and the terrestrial gecko *Gehyra nana*.

In contrast, some species showed a relative increase in toad-invaded quadrats. These included many bird species, most frogs and the feral pig.

There was little or no evidence of decline for some species for which some concerns had previously been raised. These included northern brown bandicoot, dingo, most frog species, blue-winged kookaburra, kingfishers, pheasant coucal, dollarbird, grey shrike-thrush, magpie-lark and butcherbirds.

Some caution is required in the interpretation of this study. We obtained insufficient data for some species that may be affected by toads, including some of the small dasyurid species, raptors, goannas and elapid snakes. We analyse results for very many species, so there are likely to be some Type I ("false-change") errors. Some

factors other than toad impacts may have contributed to the results (e.g. a higher proportion of control sites being burned). Our results consider only short-term impacts. The more important longer-term impacts may be very different, with possible recovery of species initially affected or, conversely, possible ongoing and compounded decline of some species initially showing only minor impact.

Re-sampling of a landmark sandstone fauna survey: Little Nourlangie Rock (Nawurlandja)

In 2002, we re-sampled the mammal fauna at the stone country site for which the most quantitative historic information was available. This baseline was a 3-year study (1977-80) by Begg and colleagues at Little Nourlangie Rock (Nawurlandja). We replicated their methodology and trapping area as tightly as possible, at two sampling periods (April and July). In comparison to the same sampling periods in the 1977-79 study, we observed a significant decline in overall mammal numbers and in three of the four individual mammal species recorded by Begg. Based on the results from the 1977-79 study, we should have trapped 28 northern quolls from our 2002 trapping effort (whereas we caught two), 139 sandstone antechinus (whereas we caught 41) and 30 Arnhem rock-rats (whereas we caught 0). In contrast, numbers of the smallest and least specialised mammal species, the common rock-rat, were significantly higher (63 captures in 2002) than the expected tally (33).

These results may be evidence of a long-term decline in the sandstone mammal fauna, or they may be evidence of a shorter-term response to fire history. The results offer some support for a short-term decline in at least the year following fire in this habitat. Longer-term trends can be deciphered only with further periods of monitoring.

Re-sampling CSIRO Kakadu Stage I & II fauna survey sites: mammals

In 2002, we re-sampled the vertebrate fauna at 16 sites (each with three quadrats) originally sampled between 1980 and 1983 as part of the Kakadu Fauna Survey. These 16 sites comprise most of the lowland eucalypt forest and woodland sites of that original study. All are in the northern half of the Park. None had been colonised by cane toads in either the baseline survey or at the time of our re-sampling.

In this report we describe results for the mammal fauna. These results show remarkably little change in the native mammal fauna across these 16 sites, with indication of change only for the northern brown bandicoot (relatively small decline). In contrast, there was major decline for a range of feral mammals from 1980-83 to 2002.

This set of results should be treated with some circumspection, because the amount of data (in the baseline and re-sampling) is relatively meagre. However, they do contrast substantially with previous results from Kapalga, and from the results at Nawurlandja reported elsewhere in this report, and offer some optimism for the KNP mammal fauna.

These results will be analysed in more detail subsequently. Vegetation at the 16 sites is currently being assessed, which will allow us to examine changes in the fauna at the site level, and whether this relates to vegetation change over this period.

Re-sampling of the Stage III (Mary River district) fauna plots: frogs, reptiles and birds

This study reports change in the frog, reptile and bird faunas at 263 quadrats in the Mary River District between a baseline sampling in 1988-90 and subsequent re-

sampling in 2001. It counterpoints results for the mammal fauna at these sites described in our previous report (Woinarski *et al*. 2002). The frog fauna showed some changes, including significant increases for the froglet *Crinia bilingua* and the introduced cane toad, but significant decreases for *Cyclorana australis* and *Limnodynastes ornatus*. Changes in the reptile fauna included a few cases of possible identification mismatches between the sampling periods, but less clearly explained significant increases for three species (*Gehyra australis, Cryptoblepharus plagiocephalus* and *Menetia greyii*) and significant decreases for eight species (*Diplodactylus stenodactylus, Delma borea, Lophognathus gilberti, Carlia triacantha, Ctenotus decaneurus, Ct. spaldingi, Ct. vertebralis* and *Glaphyromorphus isolepis*).

The major changes observed for reptile and frog species were largely unrelated to the invasion of cane toads to a small proportion of the quadrats sampled in 2001.

Changes in the bird fauna were clouded by significant inter-observer variability, which provides a timely caveat for protocol in monitoring programs. With the removal of this variability (through stripping of the large data set to only those cases that used the same observer in both time periods), results are substantially clearer. There were major declines from 1988-90 to 2001 for a group of irruptive species (banded honeyeater, bar-breasted honeyeater, varied lorikeet and red-backed button-quail) that were particularly abundant in the first time period. There were also less significant declines for a number of other species, most notably the two trunk-gleaning insectivorous birds (black-tailed treecreeper and varied sittella). In contrast, there were only two species that showed significant increase over this period.

These results reveal some of the pitfalls that may compromise a monitoring program. More importantly, they reveal that most fauna populations undergo population fluctuations of varying magnitude, and that it is almost impossible to interpret change from a baseline to a single subsequent re-sampling period. Longer-term trends can be discerned from "natural" fluctuations only by a series of monitoring periods.

Vertebrate sampling at fire monitoring plots

During 2002, we provided baseline fauna survey information for 36 of the established KNP Fire Monitoring Plots, increasing the tally of these 135 plots with fauna survey data from 21 (in 2001) to 57 now. The 2002 sampling substantially increased representation across the various districts of the Park, and more equitably across major habitats. Sandstone habitats are still relatively under-represented, and these are the main priority for sampling in 2003. A composite data base for all sampled plots has been prepared as a CD for all Park Districts.

Ongoing priorities

This work has considerably extending knowledge of the condition and trend of Kakadu's terrestrial vertebrate fauna. Additional activities are proposed under a continuation of this contract to 2003. Priorities for work beyond 2003 include:

- longer-term monitoring of the impacts of cane toads (and of the change in predator communities that they may engineer);
- targeted survey to obtain more information on species not well sampled by our conventional sampling protocol (notably including some small dasyurids, raptors, emu and snakes);
- targeted surveys to more precisely describe the condition and trend of threatened fauna; and
- continuing accumulation of fauna data from the established fire monitoring plots.

ATTACHMENT D

The effect of cane toads on a marsupial carnivore, the northern quoll, *Dasyurus hallucatus.*

Progress Report
February 2003

Meri Oakwood
Ecosystem Management
University of New England
Armidale NSW 2351

Summary

Northern quoll populations in Kakadu National Park are considered to be at risk of local extinction with the invasion of the introduced cane toad. In 2001, two study sites were chosen where monitoring of the effect of cane toads on northern quolls could occur: near East Alligator Ranger Station and near Mary River Ranger Station.

In December 2001, cane toads were reported approximately 15km from the Mary River Ranger Station site, consequently radio-tracking of northern quolls commenced there in January 2002. Cane toads arrived at this site in very low numbers in March 2002. Between January and June 2002**,** 40 female quolls were radio-tracked for varying periods of time. Of these, 14 were tracked to the site of their death. An additional two dead quolls were found opportunistically. Thirty one percent of these deaths appeared to have been caused by cane toad poisoning.

As the dry season progressed, the toads became cryptic and quoll mortality that appeared to be caused by cane toads ceased ("normal" mortality still occurred). In consideration of funds available, radio-tracking then ceased, the plan being to recommence in the next wet season.

Trapping indicated that the quoll population at Mary River was demonstrating the normal pattern (a slight decline) throughout the dry season up until early October, however the December and January trapping trips revealed that a sudden decline had then occurred. Normally, the wet season is a time of high quoll abundance as the juvenile quolls become independent and enter the trappable population. Examination of rainfall records showed that rain began in the area in the middle of October. It appears likely that with the rain, the cane toads emerged from their refuges and despite their low numbers at the site, were numerous enough to affect the quolls. In contrast, the non toad-affected East Alligator site still has very high quoll abundance, with large numbers of juveniles. These results support the anecdotal evidence from Cape York that quoll populations are severely affected by toads.

ATTACHMENT E

Summary of current studies on cane toad impacts on native fauna in the Northern Territory

This is an informal list of researchers who are undertaking studies that will provide data on the impact of cane toads on native fauna. It was derived from discussions between Parks Australia staff, NTU staff, PWCNT staff and other researchers. It should not be regarded as a definitive list as it is possible that other projects that will contribute information on the effects of cane toads may have been missed.

Taxa	Location	Agency/person responsible	Type of study	Status	Notes
Varanus spp.	Kakadu National Park	Dan Holland Jabiru 89792415, DCHPARS@aol.com (in conjunction with Key Centre Tropical Wildlife Mgt - NTU)	Radio telemetry study, pop. size estimates and road surveys of goanna sightings	In progress	Intensive radio tracking study of ca. 50 individuals of *V. panoptes*, plus captures and sightings data on *V. gouldii*, *V. mertensi* and *V. mitchelli*
Varanus spp.	Near Darwin and Maningrida	Tony Griffiths & Tim Schultz (NTU-KCTWM) tony.griffiths@ntu.edu.au	Radio telemetry study	In progress	
Dragon (*Lophognathus temporalis*)	Near Darwin	Tony Griffiths & Tim Schultz (NTU-KCTWM) tony.griffiths@ntu.edu.au	Mark-recapture	In progress	
Varanus tristis *and* Varanus scalaris	Kakadu National Park	Sam Sweet sweet@lifesci.ucsb.edu	Radio telemetry study	Complete	Behavioural ecology study indicated little likely temporal or spatial overlap between foraging goannas and juvenile (prey-sized) toads in woodlands distant from water. However both species are likely to be impacted where their home range overlaps wet habitats that can support toad breeding or toadlet activity. *V. tristis* at greater risk as home range is ca 12 ha cf to ca. 1 ha for *V. scalaris*.
Frogs	Roper River and Kakadu	Gordon Grigg, Uni Qld ggrigg@zoology.uq.edu.au	"Toadpoles" - automated	In progress	Ten sites (five pairs) between Mataranka and 120 km east on Roper valley Hwy. Six sites within KNP replicates in each of

Taxa	Location	Agency/person responsible	Type of study	Status	Notes
	National Park		frog call recording devices.		three habitats. Counts of relative abundances based on calling frequencies will allow detection of gross changes in frog populations before and after toads.
Frogs and reptiles	Mary River	Kerry Beggs & Peter Whitehead, NTU Peter.Whitehead@ntu.edu.au	Habitat and fauna surveys	In progress	Yield data on herp/toad interactions and toad capacity to exploit grasslands of different ground cover/stem densities and hence the species that will be at risk.
Frogs	Sites within and close to the Darwin region	Keith Christian, Jeanne Young & Lorrae McArthur, Faculty of Science NTU Keith.Christian@ntu.edu.au	Visual encounter and call surveys at specific field sites.	In progress	Visual encounter and call surveys at specific field sites. Data have been collected from September 2000 for pre cane toad estimates of the relative abundance of native species at several sites. Data will continue to be collected for this study until 2004 and will provide baseline data for a number of native species in the Darwin area.
Dusky rats (Rattus colletti)	Fogg Dam ,/ Adelaide River floodplain	Thomas Madsen & Beata Ujvari, University of Sydney Thomas.Madsen@zooekol.lu.se	Mark-recapture study	In progress	Cane toads are suspected to become one of the major predators on these native rodents. Dusky rats are a predominamt food item for many species of reptile including Water Pythons and a decline in rats may impact significantly on the floodplain fauna.
File snakes (Achrocurdus arafurae)	Djukbinj National Park / Adelaide River floodplain	Thomas Madsen & Beata Ujvari, University of Sydney Thomas.Madsen@zooekol.lu.se	Mark-recapture studies and genetic studies	In progress	File snakes do not feed on amphibians, however, this taxon may become indirectly affected if their main prey (catfish) will be affected by the arrival of the toads.
Water pythons (Liasis fuscus)	Fogg Dam	Thomas Madsen & Beata Ujvari , University of Sydney Thomas.Madsen@zooekol.lu.se	Mark-recapture study	In progress	Water pythons will most likely not feed on cane toads but this taxon may be strongly affected by a decline in dusky rats due to toad predation (see above).
Snakes and frogs	Fogg Dam	Rick Shine & Greg Brown, University of Sydney, 02 93512222 rics@bio.usyd.edu.au	Long term surveys and mark-recapture studies.	In progress	Long-term surveys and mark-recapture studies of water pythons (*Liasis fuscus*), keelbacks (*Tropidonophis mairii*) and slatey-grey snakes (*Stegonotus cucullatus*). Also have longterm data from nightly surveys on abundances of other snakes, and native frogs.

Taxa	Location	Agency/person responsible	Type of study	Status	Notes
Terrestrial fauna (skinks, frogs, small mammals, birds)	Kakadu National Park	John Woinarski & Michelle Watson, Parks and Wildlife NT John.Woinarski@nt.gov.au Rod Kennett Kakadu NP Rod.Kennett@ea.gov.au	Small mammal trapping, pitfall trapping, spotlight counts and bird counts	In progress	Reports being provided to Parks Australia under consultancy arrangements.
Terrestrial fauna (reptiles, frogs, mammals, birds, invertebrates)	Mt Bundey Training Area (1050 km^2, about 120 km southeast of Darwin; abuts KNP)	Department of Defence, CSIC – NT/K, Infrastructure, Robertson Barracks (Tony Law). Project conducted by Laurie Corbett, EWL Sciences. laurie.corbett@ewlsciences.com.au	Wet and post-wet season surveys (in 2002	Study completed. Report inquiries should be directed to Tony Law, Dpt of Defence, Robertson Barracks.	Methods included small mammal trapping, pitfall trapping, spotlight counts, diurnal searches, dingo tracking, bird counts; using standardised survey methodology at 24 sites in four major habitats. The study targeted the following indicator species/aggregrates: • Predators eating cane toads: dingo, quoll, predatory birds (eg. forest & red-backed kingfishers), snakes and large goannas; • Prey eaten by cane toads: beetles and other invertebrates; • Competing aggregates of species (for food and breeding resources): frogs; and • Indirectly impacted species aggregrates (food eaten by cane toads): small reptiles particularly skinks.
Terrestrial fauna (reptiles, frogs, mammals, bushbirds, invertebrates) and aquatic fauna (micro-invertebrates, macroinvertebrates, fishes, waterbirds)	Ranger and Jabiluka mining leases in the Magela Creek catchment; reference sites in the Nourlangie Creek	ERA Ltd - Ranger Mine. Project conducted by Laurie Corbett, EWL Sciences.	Wet and dry season surveys in 1994/95 and 2000/01.	Study completed. Report completed on 1994/95 data. Draft report for all data	Methods included small mammal trapping, pitfall trapping (vertebrates & invertebrates), spotlight counts, diurnal searches, bird counts; using standardised survey methodology. The data set comprises records from the same sites using similar methods, and thus provides information on changes in species richness and relative abundance over time (6 years). Any future planned monitoring surveys will provide information on cane toad impacts with allowance for natural temporal changes in richness & abundance.

Taxa	Location	Agency/person responsible	Type of study	Status	Notes
	catchment of KNP.			currently in preparation.	
Terrestrial fauna (reptiles, frogs, mammals, bushbirds, invertebrates) and aquatic fauna (fishes, waterbirds)	Bradshaw Field Training Area (8710 km^2 about 600km southwest of Darwin.	Department of Defence, CSIC – NT/K, Infrastructure, Robertson Barracks (Tony Law). Baseline surveys conducted by Laurie Corbett, EWL Sciences.	Wet and dry season surveys 1996-99.	Study with several reports completed. Inquiries about the reports should be directed to Tony Law, Dpt of Defence, Robertson Barracks.	Methods included small mammal trapping, pitfall trapping (vertebrates & invertebrates), spotlight counts, diurnal searches, bird counts; using standardised survey methodology. The data set comprises pre-impact baseline against which planned future monitoring surveys will provide information on cane toad impacts.
Terrestrial fauna (reptiles, frogs, mammals, bushbirds, and invertebrates.	Kapalga (about 650 km^2) in KNP	CSIRO TERC, Darwin. Surveys conducted by Laurie Corbett.	Fourteen wet and dry season surveys (1988 – 95)	Study completed. Several reports available from CSIRO, TERC Darwin.	Methods included involving small mammal trapping, pitfall trapping (vertebrates & invertebrates), spotlight counts, diurnal searches, bird counts; using standardised survey methodology. Extensive data set (20,000 records over 8 years) that may be useful as a pre-cane toad baseline incorporating natural temporal variation in richness and abundance. These data were collected as part of an investigation to understand fire impacts; but as few significant fire impacts were recorded, the data should be useful to understand natural temporal variation in richness and abundance. Any future monitoring surveys will provide information on cane toad impacts.
Small mammals	Darwin	Brooke Rankmore, Owen Price, Peter Whitehead (PWCNT and NTU) owen.price@nt.gov.au	Mark recapture studies	In progress	

Taxa	Location	Agency/person responsible	Type of study	Status	Notes
Quolls	Kakadu National Park	Meri Oakwood Uni of New England envirotek@hot.net.au Rod Kennett Kakadu NP Rod.Kennett@ea.gov.au	Density estimates and radio telemetry	In progress	Two sites (EAR and MRR) selected. Monitoring of toad invasion at MRR occurred over 2001/2002 wet season. Substantial declines in quolls reported at the MRR site following toad arrival.
Freshwater crocodiles and fish	McKinlay River	Grahame Webb Wildlife Management International gwebb@wmi.com.au	Mark recapture study	In progress	Original survey and estimates from 1980s compared to recent survey results pre and post toads will provide estimates of changes in densities and mortality rates. Will also be able to quantify changes in varanid predation rates on freshwater crocodile eggs as toads arrive. Also examining distribution of fish species in billabongs from 1978 onward so should be able to quantify losses.
Freshwater turtles (*Chelodina rugosa* and *Elseya dentata*)	Near Darwin	Tony Griffiths and Peter Whitehead KCTWM - NTU tony.griffiths@ntu.edu..au Rod Kennett Kakadu NP Rod.Kennett@ea.gov.au	Mark recapture	In progress and planning	Original survey and estimates from 1980s compared to recent survey results pre and post toads will provide estimates of changes in densities and mortality rates
Freshwater turtles (*Chelodina rugosa*)	Maningrida and surrounding floodplains	Uni Canberra/NTU Arthur Georges Damien Fordham georges@aerg.canberra.edu.au fordham@aerg.canberra.edu.au	Mark recapture and harvest rates by Aboriginal hunters	In progress	Provide data on population changes and impacts on Aboriginal hunting success.
Toad prey species	Kakadu National Park	Anne Ferguson Kakadu NP Anne.Ferguson@ea.gov.au	Mark recapture	In progress	Toads stomachs sampled monthly

Attachment F

Summary of the Current CSIRO Biological Control Research Program

The basic principle underlying the CSIRO research relate to differences in some of the key body systems between the adult cane toad and the tadpole. The immune system, digestive system and blood system are all very different between the adult and tadpole. This indicates that genes exist that are critical to triggering the metamorphosis from one stage to the next.

By selecting and expressing one such adult gene early in the tadpole stage, the tadpole's system should see it as a foreign entity and initiate an immune response against it. That response would then interfere with metamorphosis and prevent the tadpole from maturing and reproducing.

To deliver the gene to the tadpole, the researchers are looking for a natural virus, a ranavirus, specific to amphibians and fish that can act like a 'taxi' or 'courier'. The virus itself needs to be weakened (attenuated), so that its effects will not similarly influence amphibians and fish. The gene, rather than the virus, will affect the tadpole.

APPENDIX 9: SUBMISSION NO. 15 B – ENVIRONMENT AUSTRALIA

SUBMISSION 15 B

Department of the Environment and Heritage

Ms Delia Lawrie MLA
Chair
Sessional Committee on Environment and Sustainable Development
Legislative Assembly of the Northern Territory
GPO Box 3721
DARWIN NT 0801

Dear Ms Lawrie

I refer to the video conference held on 19 May 2003 concerning the *Inquiry into issues associated with the progressive entry into the Northern Territory of Cane Toads.* During the meeting I offered to provide additional information for members of the Committee.

Attached, please find the additional information. I trust that it will be of assistance to members of the Committee and the Inquiry overall. If you have any further questions concerning the information attached please contact Mr Robert Moore, Assistant Director, Threats & Threatened Section, by phone on (02) 6274 2272 or by email robert.moore@ea.gov.au

Yours sincerely

Rhondda Dickson
Acting First Assistant Secretary
Land, Water & Coasts Division

16 July 2003

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Follow-up Submission
to the
Legislative Assembly of the Northern Territory
(Sessional Committee on Environment and Sustainable Development)

INQUIRY INTO ISSUES ASSOCIATED WITH THE PROGRESSIVE ENTRY INTO THE NORTHERN TERRITORY OF CANE TOADS

Introduction

In a video conference held as part of this inquiry on 19 May 2003, Environment Australia agreed to provide some additional information to the Sessional Committee on the following issues (as noted on page 14 of the video conference transcript).

(1) Past funding offers from the Commonwealth to the Territory in terms of cane toad research that had not been taken up or accepted.

(2) A comparison between research of other feral animals and cane toads.

Each of these issues is addressed below.

Issue 1. Past funding offers from the Commonwealth to the Territory in terms of cane toad research that had not been taken up or accepted.

- Environment Australia provides the following information:
- During 1999 Environment Australia informally sought the views of the Northern Territory Parks & Wildlife Commission. The Commission advised that further work on a biological control of cane toads was not considered warranted and did not intend funding such work. The Commission considered that from the range of vertebrate pests that required management for conservation reasons, a significant number would be accorded a higher priority than cane toads.

- In August 1999 the Northern Territory wrote to the Commonwealth concerning progress with the CSIRO cane toad biological control project and any other Commonwealth cane toad control proposals.

- In October 1999 the Commonwealth wrote to the Northern Territory seeking their involvement in a national approach to co-fund a renewed research and development effort to control cane toads. The Northern Territory responded providing qualified support to co-fund research and a development program for cane toad control, depending on the quality of the application received.

- In February 2000 the Commonwealth advertised nationally for expressions of interest to undertake a research program for biological control on cane toads. Based on the results of this process, the Commonwealth decided to proceed directly with CSIRO and funded an initial two year project. This research project was the subject of discussions with the NT inquiry on 19 May 2003,

and which recently received additional funding under the Natural Heritage Trust.

Issue 2. A comparison between research of other feral animals and cane toads.

Based on a preliminary evaluation of the information available to adequately address this request, it was decided that it may be useful to provide a snap shot of some of the funding provided for one nationally recognised pest species. The feral rabbit was selected to provide a useful comparison to the cane toad, as the rabbit calicivirus disease (RCD) research is one of the most recent vertebrate pest biological control project conducted in Australia.

The following figures provide conservative estimates of the total costs that would have been involved. Importantly, the information provides an indication of some of the major contributions made by the Commonwealth and State \Territory Governments.

Starting in July 1991, when the initial three-year laboratory project with CSIRO commenced, to the 1999/2000 financial year, a summary of known funding is outlined in Table 1.

Table 1.

Contributors	1991-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Commonwealth	$750,000	$1M	$1M	$950,000	$950,000	$375,000	$375,000
				$650,000			
States & Territories	unknown			$950,000	$950,000		
Industry	unknown			unknown	unknown	unknown	unknown
Total	$750,000	$1M	$1M	$4.5M		$375,000	$375,000

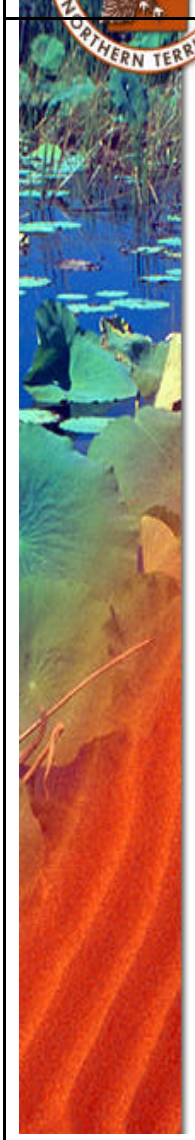
(All funding amounts are approximations.)

In summary, over about a ten year period the total contracted funding provided by industry stakeholders, the Commonwealth and State/Territory Governments for RCD research was approximately $8 million. This amount does not include any in-kind contribution that may have been made, eg. CSIRO estimated that from 1991 - 1995 their in-kind contribution to the program was $2.3 million.

For cane toads, over about a ten year period the total contribution made mainly by the Commonwealth is approximately $4.7 million. Beginning in 1990 the Commonwealth provided $ 1.25 million over three years with some of the States contributing a further $90,000. In 1993 the Commonwealth provided an additional $2 million to the program that finished in December 1996. In 1996/1997, the first year of the Natural Heritage Trust, the Commonwealth provided $120,000 to fund the program to June 1997 to finalise some work not previously finished. Since 2000 the Commonwealth has provided approximately $1.5 million from the Natural Heritage Trust to support a new biological control program with CSIRO.

APPENDIX 10: PARKS AND WILDLIFE COMMISSION OF THE NORTHERN TERRITORY WEB PAGE ON CANE TOADS

Science and Research



Cane Toads

Residents in other parts of Australia have been living with cane toads for many years. This information is for people in Darwin and rural communities to give an idea of what to expect when the toads arrive.

History

Cane toads were introduced to Australia in the 1930's from Central and South America to control the Cane Beetle.

Habitat

Cane toads can exist in many different habitats but must have water available to breed. During the Dry Season, toads remain inactive in shallow burrows under the ground, or in clusters under logs, rocks or sheets of iron, etc. They are mainly nocturnal.

Life Cycle

Toads are prolific breeders compared to native frogs. They can breed twice a year and lay 10-20,000 eggs each breeding. Their eggs can hatch in 2 days and look different to frogs eggs as they are laid in thin strands of clear jelly.

The Cane Toad tadpole is much smaller than native tadpoles. Eggs, tadpoles and toadlets are all toxic, but only some animals die when they eat them.

The Impact of Cane Toads

The main threat from Cane Toads is from poisoning predators that eat them. Even the tadpoles are poisonous so the range of possible victims includes fish, crocodiles, snakes, goannas, quolls and egrets. In parts of Queensland, populations of some of these animals were dramatically reduced when Cane Toads arrived, although it seems that most eventually recover. We are unsure whether Cane Toads also compete with, and so reduce the populations of native frogs.

Natives vs Toads

One of the main functions that Parks and Wildlife are involved in is in educating the public about toads. There are 3 important steps to follow if you think you have found a toad.

1. ***Identify the animal.*** In the last 5 years, our officers have been called on to identify many suspected Cane Toads sighted in Darwin. 95% of these animals were identified as Marbled Frogs or other native species. Some of these native frogs had been killed. People from interstate have never seen Marbled Frogs, a common Darwin native species and their warty appearance and large size fools many people. Please be sure that you really do have a Cane Toad before killing it.
2. ***Use a safe method to collect the toad.*** Cane Toads are toxic. The source of the toxins is a large gland on the back of the neck. It is only toxic if ingested or rubbed into eyes. The toxin exudes over the toad's skin, it does not spurt out. Use two plastic shopping bags, or something similar to pick up the toad. Turn the bags inside out, grab the toad, turn the bags the correct way round again, tie the bags tightly and you'll have safely bagged your toad.
3. ***Disposing of the toad.*** We have all heard stories of how people in other places kill Cane Toads. The most humane method of disposing of toads is to place your double-bagged toad in the freezer overnight.

Summary

Cane toads are coming. They are fat, ugly and poisonous. They don't belong in Australia and they will harm our pets and native wildlife, but please remember they are still living creatures and feel pain too.

So remember, identify the animal, safely collect the adult toads and dispose of them humanely. Any eggs found should be removed from pools of water and destroyed.

The Parks and Wildlife Service of the Northern Territory are always here to help. For information and identification advice, call 8999 4536.