STOP THE TOAD
KEEP WA CANE TOAD FREE

Stop the Toad Foundation
2008 Great Toad Muster
REPORT

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- ABN Foundation
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OTHER SUPPORTERS

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PHOTOGRAPHY

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An adult male cane toad.

1 EXECUTIVE SUMMARY

The 2008 Great Toad Muster (GTM) was Stop The Toad Foundation's (STTF) third annual muster on the Whirlwind plains of Auvergne Cattle Station. The Foundation has now collected three years of data and toad population statistics from this important feeder area in northern Australia.

A total of 68,418 cane toads were removed from Auvergne Station during a 4 week period from September 20th until October 18th 2008.

Muster operations during 2008 also included work on Bullo River Station, to account for the fact that some toads have moved further west. In one week, 798 toads were removed from areas on Bullo River Station.

The small number of toads caught on Bullo River Station, when compared to Auvergne Station, indicates the position of the main volume of cane toads in northern Australia and confirms the importance of the Whirlwind Plains on Auvergne Station as an important area for cane toad control. The smaller numbers to the west indicate that the combined efforts of groups working on eradicating cane toads is not stopping them but is dramatically reducing their numbers. This raises the question of what could be achieved with better coordination and more effective strategies such as fencing the permanent water holes.

The Foundation's exclusion barrier fencing strategy was used on a broad scale for the first time during the 2008 GTM. This method was found to be an extremely efficient method of collecting and removing cane toads from the northern landscape. The fencing strategy contributed to the high number of cane toads collected during this years GTM and was used on both man-made and natural water bodies with equal success.

The results of the Muster indicate that the movement of cane toads during the wet season is the critical issue in cane toad control and that the concept of a buffer zone is vital in preventing cane toads from moving further west.

Manual collection alone will not stop the spread of cane toads unless the available resources can be both increased in magnitude and better coordinated to minimise duplication and maximise their effectiveness.

The addition of the fencing procedure will be able to achieve better control because it allows for a more efficient collection effort in terms of less people required and a reduction in the time required to eradicate a local toad population. It also allows groups to implement control work on many more sites at the same time.

The fencing strategy has a significant potential to be used across northern Australia as a tool for cane toad control as the fences are cost effective, easy to erect, wildlife friendly and can guarantee to remove all toads in a specific area. They could be used to protect areas of high biodiversity and

in national parks in the event that cane toads enter Western Australia. The fences also have broader application to protect property within towns and to restrict the potential of 'hitch-hiker toads' to reach more sensitive environments from transport and trucking facilities.

Cane toads collecting on the Cedars Dam fence.

2 INTRODUCTION & BACKGROUND INFORMATION

Rationale - The STTF Strategy on the Whirlwind Plains

The Great Toad Muster is a field operation that has identified landscape corridors that cane toads move through in large numbers in their movement towards WA. The establishment of buffer zones to remove cane toads is the core element of the strategy. The strategy is based on the climatic conditions in the area and behavioural response of cane toads. Specific characteristics of toads, such as their vulnerability to evaporative water loss (EWL) have been carefully exploited by STTF in its approach to the timing and location of the Muster.

In 2006 the Foundation determined that cane toads were much closer to WA than previously thought. Toads were discovered in February 2006 near Gregory's Tree road and in June 2006 considerable numbers were found at Auvergne Lagoon on Auvergne Station. Later work showed toads had moved as far west as the western side of the west Baines river by the end of 2006.

At the time, Department of Environment and Conservation (DEC) and others were concentrating their efforts approximately 100km further east, at Brownies Creek. DEC decided the best approach would be to set a trap line between the Victoria River and the eastern side of the Newcastle Range (a distance at its narrowest point of only several hundred metres). Kimberley Toad Busters (KTB) took a numbers approach to catching toads and collected them from between Brownies Creek and Victoria River Roadhouse as well as from Victoria River Station, where toads had been present for several years.

The 2006 discovery of toads at Auvergne was derided at the time as a 'serendipitous incursion', but as three musters have demonstrated, chance had little to do with the reasons why this population of toads had established themselves at this location. Furthermore, the age and class structures of the Auvergne toad population indicated these toads had been established for at least 18 months on the eastern side of Auvergne station.

The STTF drew its 'line in the sand' at the Victoria River and based its approach on the premise that toads moved across the landscape by taking the most easily traversed route along watercourses and by taking a route that guarantees a refuge area.

Based on several years of examination, the Foundation believes that man-made water bodies (dams, stock toughs, ponded water trials and the like) have played a significant part in the success of the westward movement of toads. These areas have allowed toads permanent refuge after the natural waterholes in the landscape have dried up, late in the northern dry season, which can last up to 9 months in some years.

The Great Toad Muster of 2006 focused on the area bounded to the east by the Victoria River, on the northwest by the Pinkerton Ranges and to the south east by the Newcastle Ranges. Between these ranges lies the Whirlwind Plains, an area approaching 4000sqkm dominated by cracking black clay soils. These soils play a significant role in toad migration by providing refuge areas for toads around exposed wetlands and man-made water points.

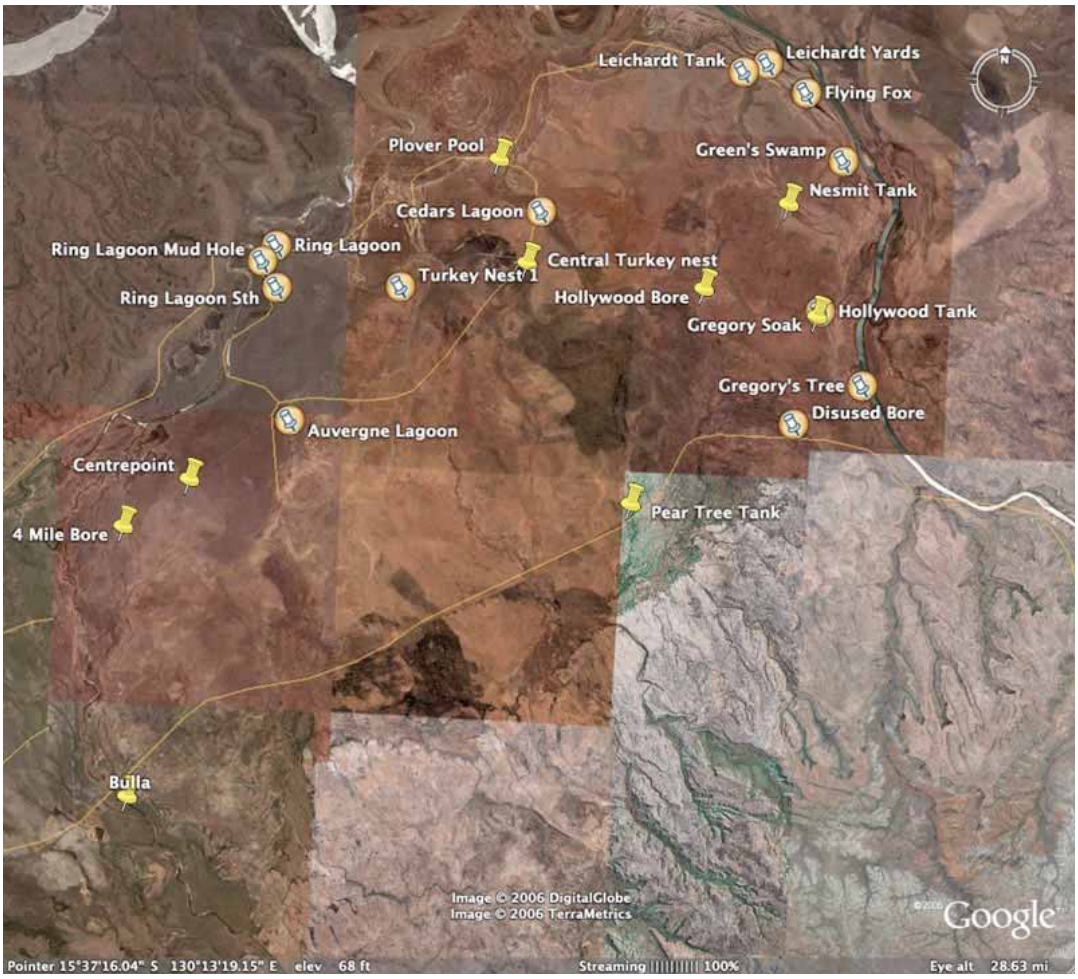
Cracking clay soil, or self-mulching black soil as it is known locally, absorbs water at a tremendous rate following rain. This absorption results in the soil swelling and becoming waterlogged during the wet season and the cracks in the soil close up. During wet season toads utilise grass tussocks and other refuges rather than soil cracks and rely on continued rainfall to get them to the next refuge. Without regular water, toads can be caught out in the open where they dehydrate and die rapidly.

In 2006, over a 6 week period, 126 volunteers at the GTM removed over 48, 000 toads, predominantly from Auvergne Lagoon, Ring Lagoon, and Cedars Dam, east of the Baines river (STTF Field Operations 2006 http://www.stopthetoad.org.au/publications/sttf_field_operations_report_v3l_2006.pdf). The numbers collected from these locations were the first indication of the importance of these systems in the westward movement of toads.

Cedars Dam lies on the drainage line of Sandy Creek from the Newcastle Ranges north to the Victoria River and is the centre of a major swamp which provides ideal toad habitat during the wet season. Toads are believed to move into the area from the Victoria River and contract back to the dam (Cedars) for refuge between seasons. In 2006 they numbered over 6000. After those toads were removed from the area it was surveyed by a DEC team using their sniffer dog and subsequently declared toad-free. In the same year a concerted effort was put in to clear Auvergne Lagoon and Ring Lagoon.

Auvergne Lagoon is a major, semi-permanent waterhole that lies in a central position on the Whirlwind Plains. The tidally-influenced northern part of this system allows toads to move upstream from the Victoria River and congregate at the freshwater lagoon before their next push west and south. This lagoon was subject to significant effort by STTF to hand-collect, or 'bust', every toad over 15 consecutive nights and again this lagoon was declared toad free by the DEC team in 2006.

Ring Lagoon sits near the junction of the East and West Baines Rivers (tributaries of the Victoria River) and provides a seasonal freshwater refuge close to the tidally influenced river junctions. It is likely that toads gather here as conditions are suitable for them to establish in large numbers towards the end of the dry season in preparation for the big push north and south following the start of the wet. This area was also cleared of toads in 2006.



Map of target areas including Ring Lagoon, Cedars and Auvergne Lagoon on Auvergne Cattle station.

The age and sex class structures identified in 2006 begins to identify the importance of these systems with almost 50% of all toads collected being sub-adult animals. *It is becoming apparent that these three systems were also important breeding sites for the toads. Removing large numbers of adults would likely result in a reduced sub-adult cohort in the following season as well as negatively impact on numbers moving west.*

In 2007 this appeared to have occurred. With these three main systems being targeted, as well as several man-made dams west of these systems, the Foundation removed 12,000 toads in a four week period and discovered that the sub-adult component had plummeted to less than three percent of the captured population.

This indicated that the impact of the 2006 effort was significant and had reduced the toads' ability to breed in this area.

In 2007 the Foundation trialled exclusion barrier fences at two man-made sites, Cedars Dam and Leichardt Dam. The results were impressive. The fence quickly revealed their ability to tip the balance in favour of efficient toad population control. Fences could be erected in a few hours and monitored by a few volunteers. The fences have little, if any, impact on wildlife and could, based on a recorded requirement for toads to rehydrate every four days (Cohen & Alford 1996, Seebacher & Alford 2002), guarantee the removal of 100% of toads in the area within seven days.

With more fencing materials and refinements to their structures (to minimize impacts on native wildlife) STTF returned in 2008 and removed over 69 000 toads. As in previous years, significant toad refuging had occurred at the 3 sites and significant numbers were again removed from these locations (Cedars 8K, Auvergne 19K and Ring 16k). Once again the sub-adult component was small, composed of approximately 18% of total numbers removed. The more western systems were also targeted using the fencing strategy and resulted in the complete removal of toads from these refuge areas.

2008 saw the fencing strategy being used on a much broader scale than 2007 with almost 5km of fencing becoming operational over the course of the 2008 GTM. There is no doubt that fencing contributed significantly to the total removal of toads from the areas on which it was used. It allowed the volunteer effort to become more efficient, cost effective and focused on preventing the westward movement of toads along this major feeder route towards WA.

The sum total of this effort has been a reduced westward invasion by toads. Without this effort the volume of toads closer to WA would already be in numbers impossible to manage.

As it now stands there have been small 'incursions' in to Bullo, Newry and Lejune Stations which, to a degree, have been addressed by DEC and KTB activities. Neither of these operations involves repetitive night busting for periods of up to 15 days. Neither incorporates a fencing nor barrier strategy to increase labour efficiency and improve the prospect of total local toad eradication.

The fencing strategy relies on the toads' need to get access to water to rehydrate. Denied access to water, the toads must find other sources of moisture. Those that strike out towards other water points die rapidly in the barren land. The point at which they are forced to go searching is usually when they are most critically in need of water and most vulnerable to dehydration. The majority remain at the fence and are easily collected at night. It is common for those that come to the fence after the nightly collection to be found dead or immobile the next morning.

The fencing strategy promises significant benefits for protection of areas of high biodiversity within WA. Fences are usually no more than 40cm in height and have access gates built into the lower portion allowing free movement by native frogs (which are smaller than cane toads), reptiles,

invertebrates and the like. Larger wildlife have little to no difficulty in going over the fences.

A more strategic approach to the use of fences may deflect toads into inhospitable areas and protect areas of high biodiversity. KTB board member Jeff Hayley has approached STTF with a view to joint fencing strategies. There has also been interest shown by DEC staff in Kununurra for the potential to protect such areas. This fencing approach should be adopted on all properties from Timber Creek west towards the WA border as a matter of course before toads invade WA. *This strategy could also commence earlier than the Muster period to increase the impact over a longer period of time*. There is a requirement for dam and wetland audits to be undertaken urgently to determine suitability for fencing. In situations such as found on Auvergne Station, where stock only have access to well maintained troughs external to the actual dam or water supply, the fencing strategy will be particularly effective.

Cane toads collecting on a barrier fence at the 2008 Great Toad Muster.

3 MUSTER OBECTIVES

Priorities for the Muster were to;

- Verify long-term impacts from the 2006 & 2007 Musters;
- To complete a three year data set from the Whirlwind Plains, the area known as the Primary Buffer Zone (PBZ), to determine the change in cane toad behaviour across the PBZ;
- To trial exclusion barrier fences on a broad scale and to determine whether this control method is an efficient model for cane toad control and whether it could be applied in other areas;
- To remove as many cane toads as possible from the region; and
- To engage members of the public to be involved with cane toad control and to raise the general awareness of the cane toad issue in Australia.

STTF's strategy is based on an adaptive management approach. It incorporates active trialling of ideas to provide useful insights into the practical in-field potential of such a strategy as a part of a management model for controlling cane toads that will stop cane toad movement rather than just reduce their numbers.

The verification of a model of cane toad control that will stop cane toads moving west is the priority. In doing so this will help develop the most effective toad removal model for the techniques and resources available.

Magpie Geese on Auvergne Lagoon.

4 MUSTER LOGISTICS

Base camp for the 2008 Muster was at Auvergne Lagoon on Auvergne Station. It was chosen because it was an easy access point to the Primary Buffer Zone (PBZ) on the Whirlwind Plains and also relatively close to sites further west on Bullo River Station.

The Foundation thanks the manager of Auvergne station Alan Andrews and his wife Ros Andrews for allowing us to set up our operations on their property for six weeks. Thanks also to Franz and Marlee Ranacher, owners of Bullo River Station, who were happy for us to work for a week on their property.

STTF relies on the support of volunteers to run a successful Muster. Heartfelt thanks must be made to all those who volunteered their time and efforts at this year's Muster. Seventy Volunteers from all over Australia and overseas attended this years Muster. The average number of volunteers per night was 21.

Special thanks must be made to Michael Lohf, Fiona Plaisted, Lucy Simnett and Jim Rasmussen who assisted with the set up and pack down of base camp – not an easy job in 45 degree heat!

STTF also relies on the generous donations from corporate and private donors. The Foundation is extremely grateful to the ABN Foundation, Skywest and Lotteries West for their support for the 2008 Muster.

Volunteers at Auvergne Lagoon base camp.

5 METHODS

STTF removed toads from a total of 16 sites on Auvergne Station and 8 sites on Bullo River Station. Different toad-busting methods, including the use of fencing, hand collection alone and sniping, were used depending on the size of the site, the surrounding environment and accessibility to the water body.

5.1 Fencing

STTF coordinator, Graeme Sawyer, developed the concept of the exclusion fence trials based on the success of other fencing trials, particularly the Gregory's Tree Road project, conducted by STTF. (http://www.stopthetoad.org.au/main/publications.php).

The erection of the fence is reasonably straight forward as it is almost self supporting and does not need major strainers. The fence should be placed about 2-5m away from the waters edge, or along the easiest route around the water body.

An example of a fence set up along the easiest route about 3m from the waters edge.

To begin construction, a star picket is driven into each corner around the water body. A fence dropper is then driven into the ground every 5-6 metres. Two rows of low-tensile wire are attached to one of the star pickets, one up to 60cm from the ground and one only 10cm off the ground.

The wire is then pulled tight to the next star picket and tied off until a circuit around the water body has been completed.

Shade-cloth is then attached to the star picket with wire and rolled out around the water body. The shade-cloth is then clipped to the wire, allowing for an outward facing 'skirt' of material up to 40cm in length. The fence then forms an "L' shape when viewed in profile. Droppers are then attached to the shade-cloth and fence using a crimping tool or wire ties. Lastly, 25mm square nylex mesh, pre-cut in 20cm high strips in between the shade cloth and the ground is attached by clipping the shade cloth to the top of the mesh.

Volunteers inserting 25mm square mesh along the bottom of the fence as wildlife friendly gates.

A final check needs to be made to ensure all gaps in the fence (at joins; at the wildlife gates) and depressions in the ground are back-filled and the fence skirt and wildlife gates are pegged or anchored to the ground.

During the GTM 2008, this technique allowed water bodies to be fenced quite quickly, depending on their size and whether an area needed to be cleared of grass or weeds, or if there were significant natural features to contend with.

It is possible to pre-make the fences, which in turn requires less people and time to erect the fence. About 40% of the fences for the GTM were pre-made by Kimberley TAFE and the Department of Corrections.

Once fences were erect, teams of volunteers were able to walk around the fences and collect toads off the fence. More volunteers were required if it was the first night toad busting in an area, but once the bulk of the numbers were removed, 2-4 people could easily bust a large area. Most of the toad-busting in fenced areas occurred after dusk, but toads were also able to be removed during early daylight hours as they would stay on the fence all night and not return to their refuge site.

5.2 Other methods of toad removal

Some sites, such as Auvergne Lagoon and Ring Lagoon were too large to fence given the resources of the Foundation and were surrounded by Freshwater Mangroves (*Barringtonia acutangula*) along the edge, making access to the water very difficult. For these sites, hand collection alone was used. Teams of 2-4 people would walk in a skirmish line from one end to another ensuring they were spaced out from the waters edge up to 20m away from the water body. Once they had a full bag of toads, they would leave the bag in an easily accessible location and mark the spot on a hand-held GPS unit. Once everyone had returned from the toad-busting, a volunteer would retrieve all the bags of toads on a quad bike and bring them back to base-camp.

In some cases, toads were too hard to remove by hand as they were sitting in the middle of the water body or under the roots of a Freshwater Mangrove (*Barringtonia acutangula).* They were usually the last remaining toads at a water body once all others had been removed. As a 'mop-up' tool, sniping was used to remove these hard to reach toads. Graeme Sawyer, STTF Regional Coordinator, holds an air-rifle licence, has approval to use the firearm from the property owner and is a qualified firearms range master and was our sniper during the 2008 Muster.

5.3 Recording data

Once back at base-camp, cane toads were euthanized with carbon dioxide (C02). This process is undertaken by placing up to 40 captured toads in an airtight heavy duty plastic survey bag and flooding the bag with concentrated CO2. The bag is then sealed and rolled to ensure that the CO2 reaches all toads. The bags are left overnight. It is generally acknowledged that an indicator of stress is the release of toxin by cane toads through the parotoid glands. This exhibits as a cream coloured slime and can totally coat the toad if stress is evident. Using this euthanasia method is effective, relatively stress free and results in 100% mortality overnight. The following morning toads are removed from the bag and data is then recorded on the total number collected, percentage of females, males and sub-adults. Some were dissected to determine what they had been eating and gain an indication of possible impacts on invertebrate fauna. Toads that were shot were recorded separately from those that were hand collected or removed from the fence.

6 RESULTS

6.1 Auvergne Station

A total of 68,418 cane toads were removed from Auvergne Station during a 4 week period from September 20th until October 18th 2008. (See Appendix 1 for full details).

Figure 1. shows the total number of toads found in an east-west distribution across the Whirlwind plains. It is interesting to note that Auvergne Lagoon, Ring Lagoon and Cedars were again the areas where the most toads were removed, confirming our prediction that they are the most significant refuge spots on the Whirlwind Plains in the late dry season.

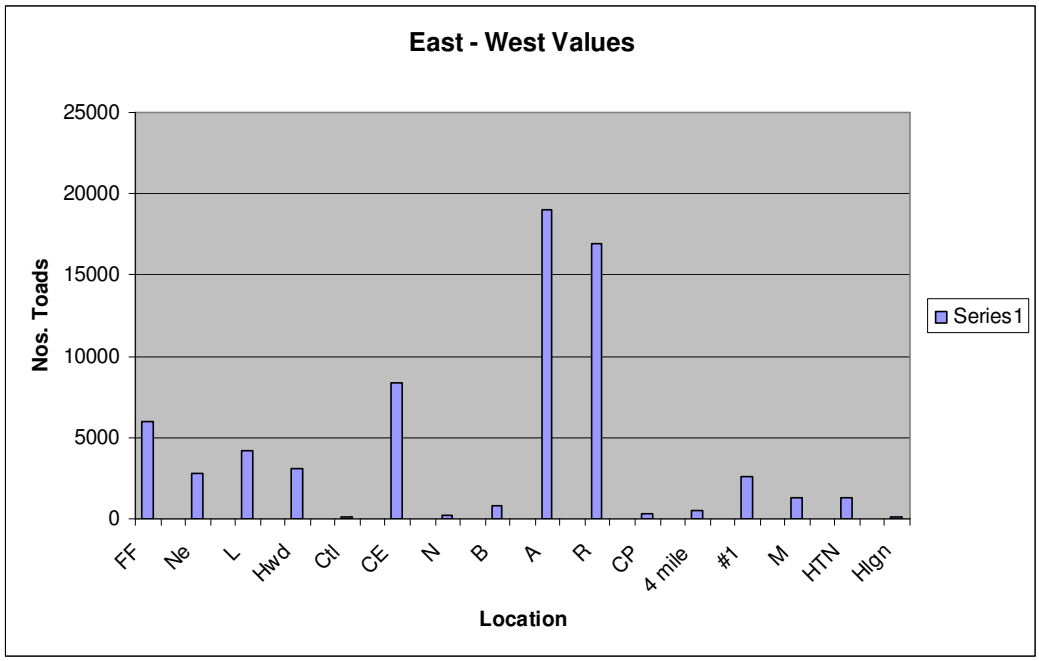


Figure 1.

Site description and strategy deployed

Flying Fox (FF) Figure 2.
Flying Fox is a natural wetland area approaching 2 km in length and up to 700 metres in width at its north-western end. The wetland is within 1.5 km of the Victoria River and at the north-eastern end of the Auvergne portion of the Whirlwind Plains. The system is seasonally wet and requires significant rainfall or the Victoria River to flood to become inundated. It is dominated by Freshwater Mangrove (*Barringtonia acutangula*) communities.

Over a period of two days a 750 metre long fence was erected around the remnant water contained in this system. Over 4000 cane toads were removed in eight days after which point no live toads were located at the site.

The focus on this system was determined owing to its location and association to the Bradshaw Military Base east across the Victoria River and the prediction that toads are recruited onto Auvergne Station from this area. In some years Flying Fox dries completely in a natural fashion and large numbers of toads perish due to these events. In years that do not allow this situation, following the first rains, toads migrate off the system and commence moving in all directions, most likely responding to the indicators of thunder, lightning, humidity and rainfall in deciding the movement direction. The 750 metres of fencing was rolled up and removed using 10 personnel in a three hour period.

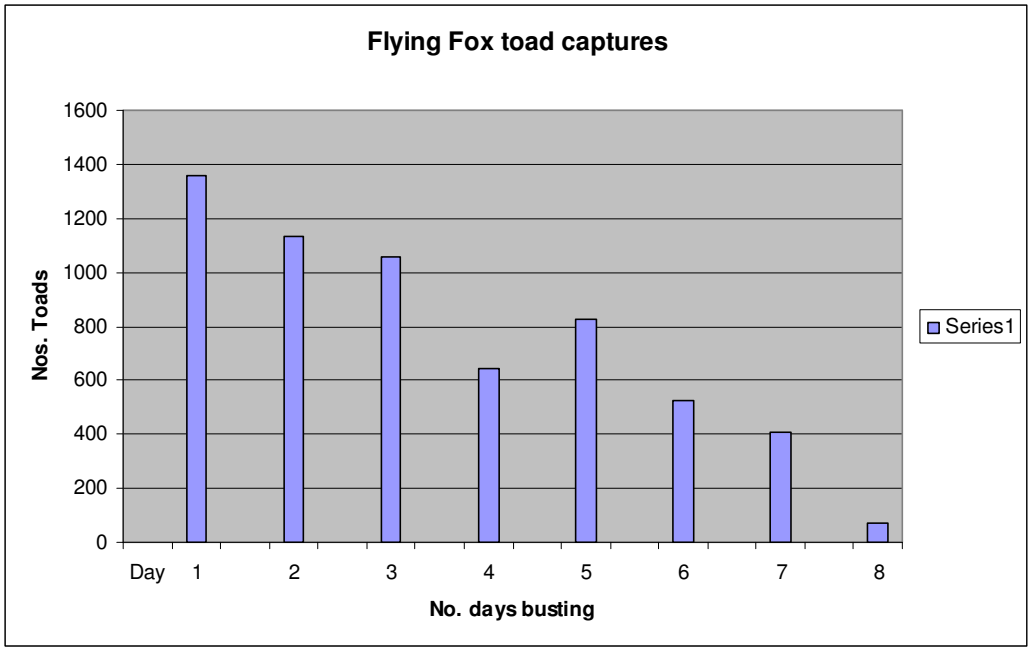


Figure 2.

Nesmit (Ne) Figure 3.

Nesmit is a man-made dam and overflow system west of Flying Fox. Only one collection night occurred at this location using manual hand collection and 20 personnel removed 2500 toads in a 1.5 hour period. This system was not fenced owing to a number of factors. Firstly, the system acts as an overflow area for Flying Fox as it is the nearest man made system to Flying Fox. Removing significant numbers from this system creates a space in the available refuge areas for toads moving across country from Flying Fox in response to climatic conditions allowing this movement. Also at the time of the muster, Nesmit had significant water and refuge sites and the next nearest refuge sites are man-made waterholes to the north and west but these are still a significant distance (over 4km) for toads to traverse even in the event of rainfall. By impacting in a small way on this

system it could be argued that the space created will allow toads to remain at this site without responding to competition which may force a move when conditions are suitable for this movement to occur.

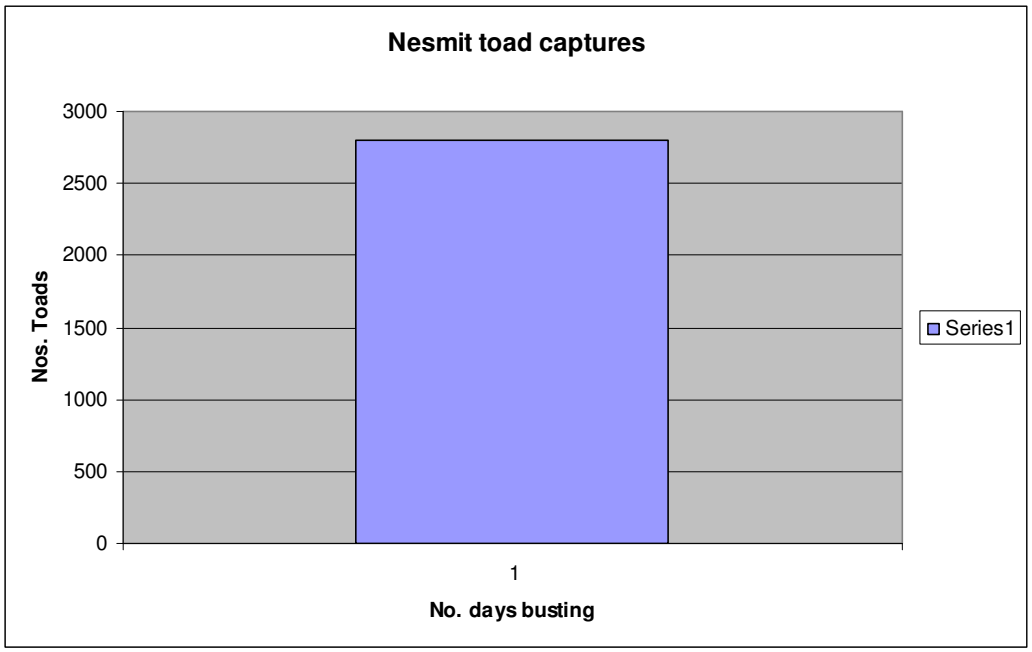


Figure 3.

Leichardt (L) Figure 4.

WNW of Nesmit, Leichardt is a man-made system comprising a turkey nest dam and 3 overflow areas – only the east overflow and the dam held water. This system was completely cleared of toads in 2007 using the fencing strategy. In 2008, just over 4000 toads were removed using a repetitive bust strategy of hand collection over a total of 5 nights. The numbers removed from the system reflect its proximity to other eastern systems on the Whirlwind Plains that are fed from the Victoria River and the undoubtedly extensive toad populations found within the Bradshaw Military area on the east side of the Victoria River. Many toads were collected from cracking clay refuge areas using a handheld hook design created by a volunteer that was extremely effective at pulling toads from the depths of the cracks.

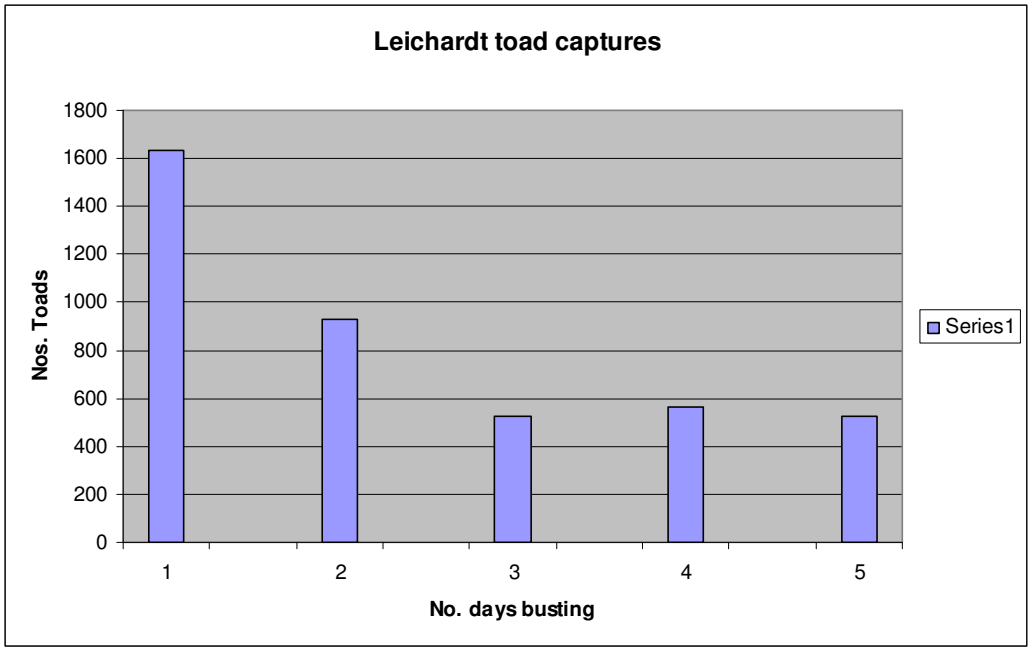


Figure 4.

Hollywood (Hwd) Figure 5.

Hollywood is almost directly in line with Leichardt, but 10kms further south, just NE of Sandy Creek. It is a man-made dam system with a turkey nest dam and one overflow, both of which were fenced during the GTM 2008. Both areas took a total of 3 hours to fence with 5 people. Hollywood was busted for 8 nights and just over 3000 toads were removed from the fences. The fences were taken down in 30 mins by six people.

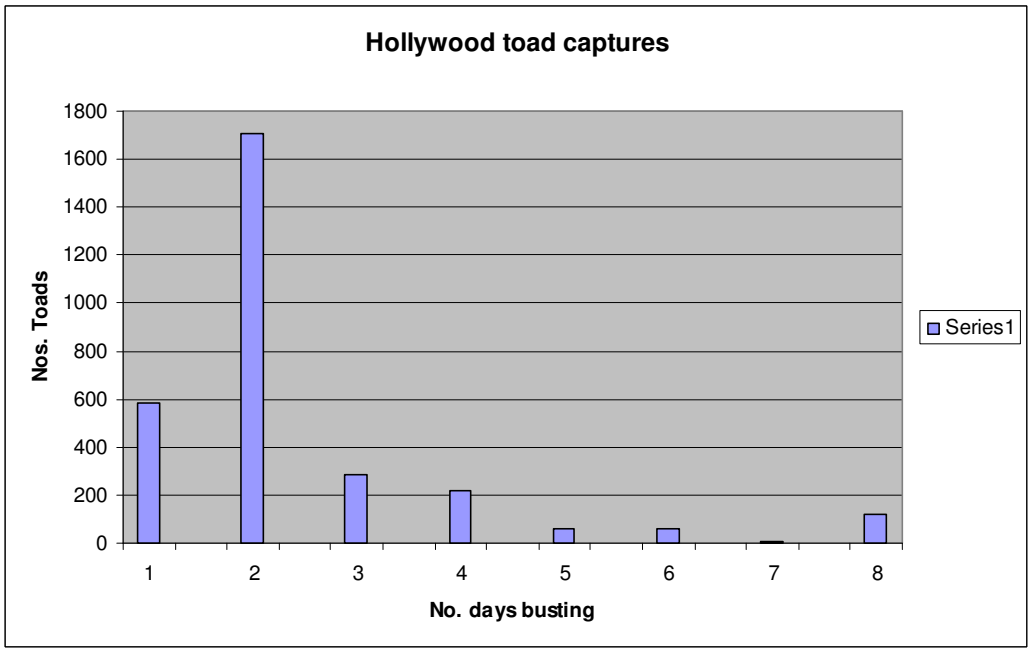


Figure 5.

Central (Ctl) Figure 6.
Central is a small turkey nest on the access road to Hollywood, sitting 5kms west of Hollywood, also north of Sandy creek. Central was not fenced during the GTM due to its smaller size and proximity to Hollywood. Only 30 minutes of busting was carried out during one night at Central. 133 toads were removed by 8 people.

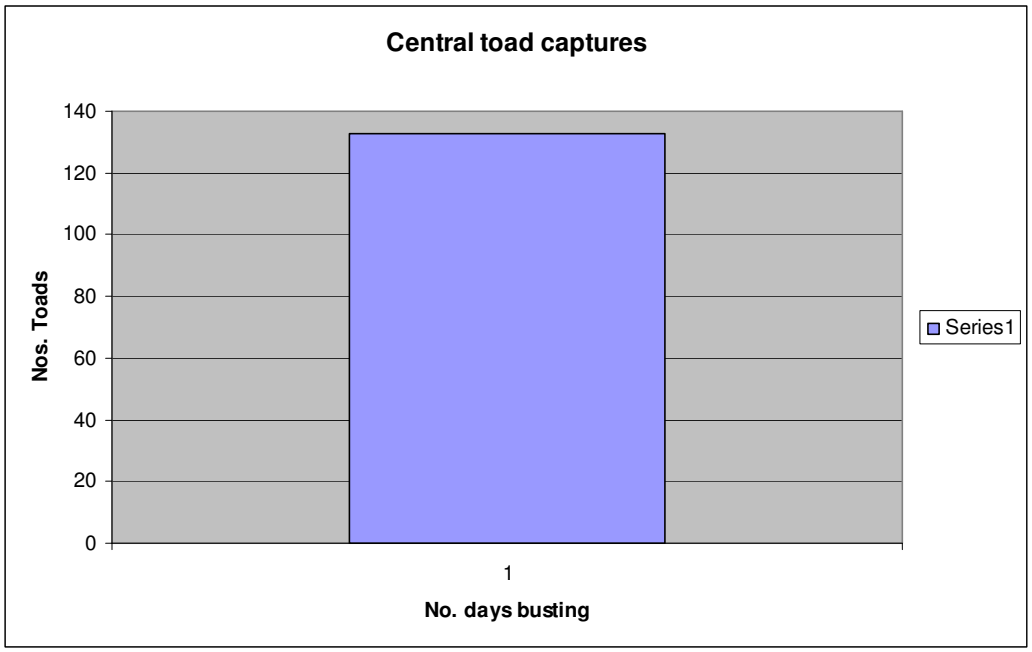


Figure 6.

Cedars Dam (CE) Figure 7.
Cedars is a large permanent turkey nest dam adjacent to a seasonal creek that flows north to the Victoria River during the wet season. There is a smaller dam immediately adjacent (on the north side) and there are two overflow areas on the east and west.

There are significant refuges for toads found around this system, provided by deep cracks in the black soil and surrounding vegetation. In 2006 large numbers of toads were removed during daylight hours as they refuged in the water and in vegetation (predominately *Sesbania sp*.) found around the edges of the main dam. There are extensive areas of vegetation within 100 metres of the system which also provide a refuge. Owing to its location on a seasonal creek, large numbers of toads can build up as they move westward from other systems and south from the Victoria River. In 2007 the main dam and the western overflow were fenced using the exclusion barrier (700m) and the area was cleared of toads. In 2008 the area was fenced and again significant numbers of toads were removed.

Cedars Dam required the most amount of fencing, with a total of 900m being erected in five hours by nine people. Almost 8500 toads were taken off of the three fences at Cedars over the course of 10 nights. The first night reaped just over 4500 toads, in comparison to the last two nights of

eight toads each, indicating that almost all toads were cleared from this important refuge site. The fences were taken down in 1.5 hrs by eight people.

There was a resident Saltwater crocodile (*Crocodylus porosus*) living in the turkey nest dam during this year's Muster which wasn't present during the 2007 GTM. STTF staff made sure there was a 'crocodile spotter' at all times during busting sessions, which included night spotlighting and day inspections for slide marks and scats.

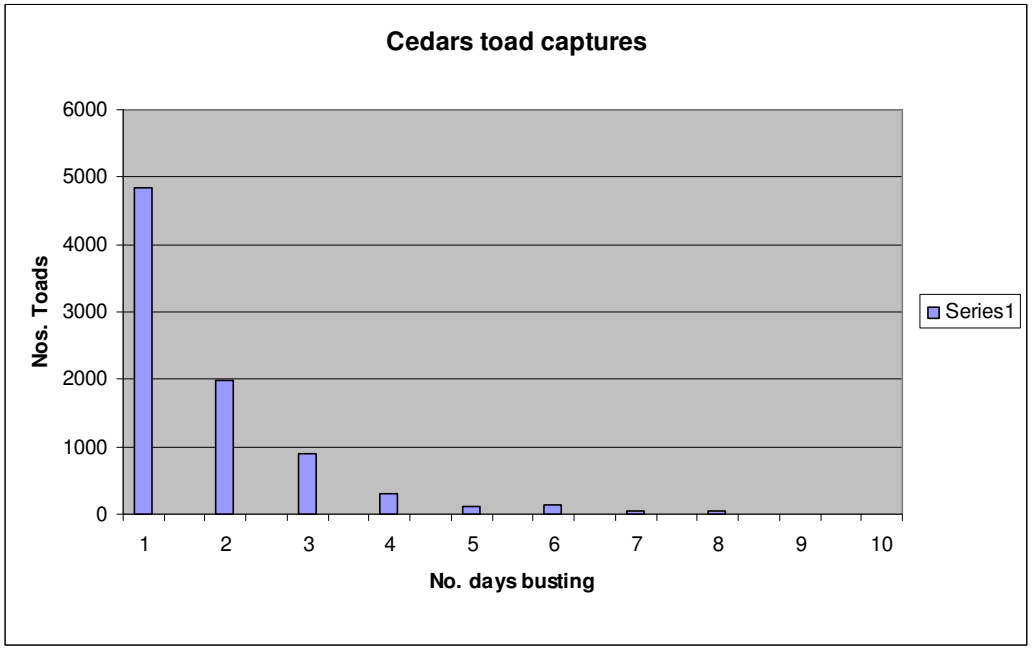


Figure 7.

Noahs (N) Figure 8.

Noahs is ENE of Auvergne Lagoon. It consists of a turkey nest dam and overflows on east and west. A trough is located on the north side within a stock route.

Noahs required 180m fencing that was erected by five people in 1.05 hrs. Just over 200 toads were removed from Noahs over eight nights. It is interesting to note that almost all of the 200 toads were collected during the first night of busting. After the first night's total of 172 toads, there were very small numbers collected during each of the following seven nights Noahs barrier fence was taken down in 30 minutes by six people.

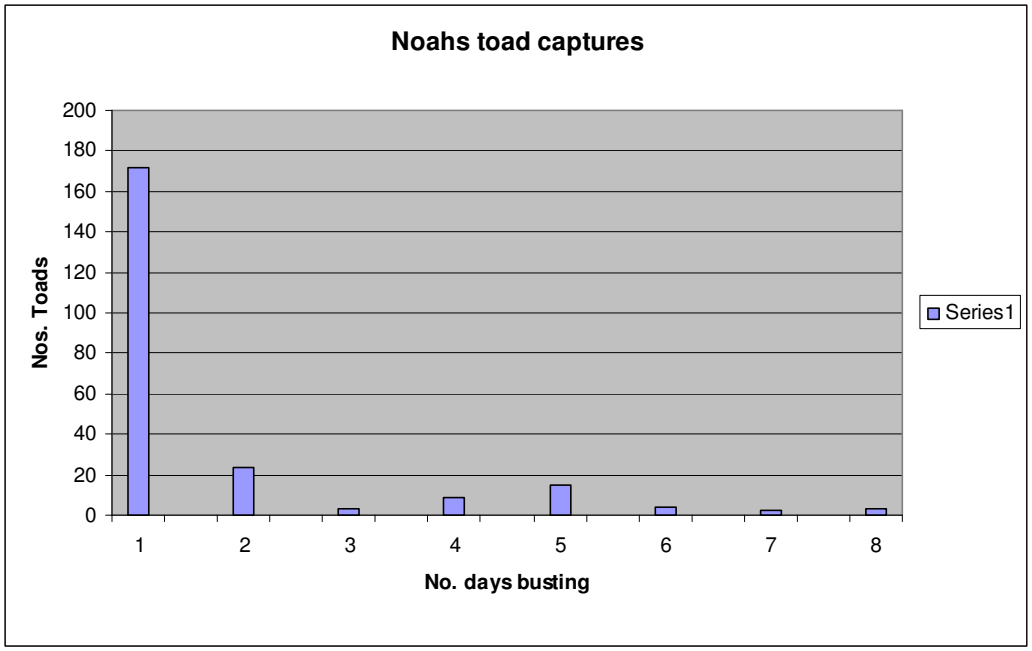


Figure 8.

Backwater (B) Figure 9.

Backwater is small turkey nest dam approximately 2.5km east of Auvergne lagoon. There are two overflow areas on the north and south sides respectively. There are significant refuge areas for toads around Backwater including cracking clay soils and remnant vegetation within several hundred metres of the dam. The dam is surrounded by a stock exclusion fence, as is the case with all other turkey nest dams on Auvergne.

Backwater was fenced by four people in 1.1hrs. It required 180m of fencing. Just over 800 cane toads were removed from this turkey nest in eight consecutive nights. Owing to its location (close to base camp), it was an easy site to bust and could usually be done by one person in under 10 minutes. The fences were taken down in 30 minutes by six people.

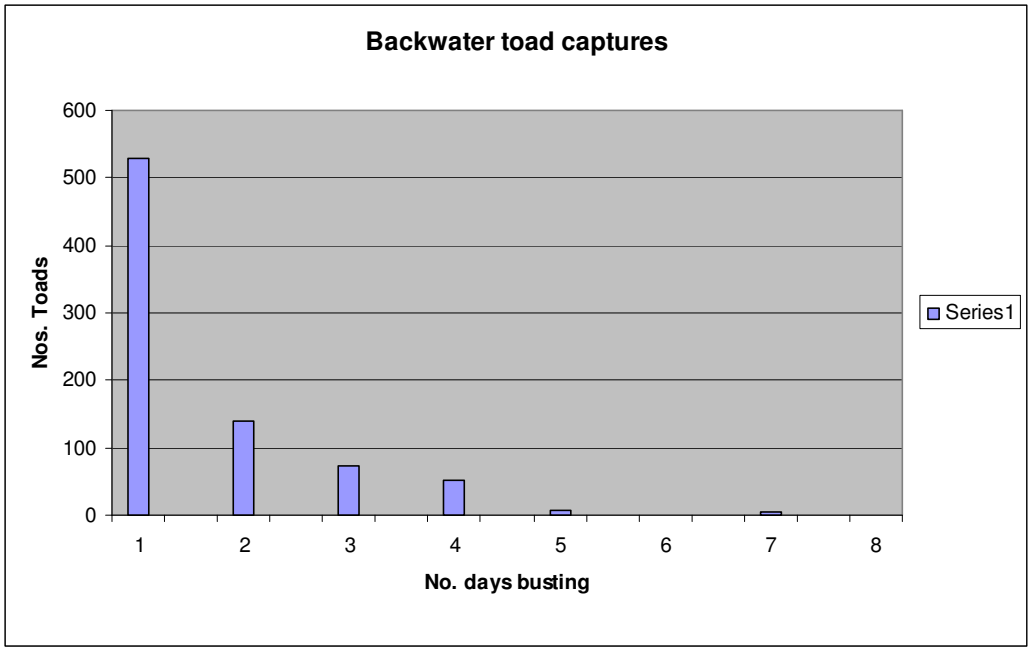


Figure 9.

Auvergne Lagoon (A) Figure 10.

Auvergne Lagoon is a major seasonal water body, with a north – south orientation, which is part of a major creek system crossing the Whirlwind Plains (Auvergne Lagoon Creek – a tributary of the Baines River). The system is semi-permanent, drying in some years but holding water following average to good wet seasons. The permanency of the pools in this system create perfect conditions for toads to establish and breed before moving in all directions following rainfall.

This system is tidal in its northern reaches and large spring tides force water from the Victoria River (often carrying toads) into the system. The remnant pools of freshwater found on this system have extensive riparian vegetation consisting of freshwater mangroves (*Barringtonia acutangula*) which provide significant refuges within tree hollows and logs. The system provides further refuge for toads with its adjacent cracking clay soils. The lagoon area also provides refuges for large numbers of waterfowl – magpie geese, Burdekin ducks, royal spoonbill, three species of egret, grass whistling duck, green pygmy geese, brolga and Black necked stork. Nail tail wallaby and agile wallaby also use the system. In 2008, there appeared to be large populations of native frogs dominated by *Litoria sp*. but no goannas (*Varanus sp*) and freshwater turtles were encountered (although a number of shells were found). A large water python was seen in a tree hollow and Childrens pythons (*Antaresia maculosus)* were often seen whilst busting.

In 2006 efficient removal of toads resulted in an almost complete eradication of toads from the major 'permanent' pool on this system (DEC confirmed this status following an inspection by their sniffer dog team). This effort required continual hand busting over 15 nights – a huge effort

to achieve this result. In 2007 numbers of toads on this system were very low in comparison to 2006 and their breeding appeared to have been significantly impacted upon with a very small sub-adult age class present overall (<3%). In 2008 hand busting removed large numbers of toads. The lagoon can reach up to 4kms in length (10+kms in circumference), making it difficult to fence, especially given STTF's limited resources. Fencing of this system should be a consideration for 2009.

During the GTM 2008, the Lagoon was divided into numerous water holes and all were covered by a repetitive hand-collection busting at night. The number of people at Auvergne Lagoon on any one night depended on those required for other sites. If there were more people able to bust Auvergne and cover a larger area, more toads were able to be removed (such as 30/9/08 and 16/10/08). Some nights, there were only a handful of people available and not as many toads were removed (7/10/08). This has influenced the shape of the graph below.

A total of 16 non consecutive nights were spent busting Auvergne with over 19,000 cane toads being removed from the natural water system. This took a total of just over 250 people-hours.

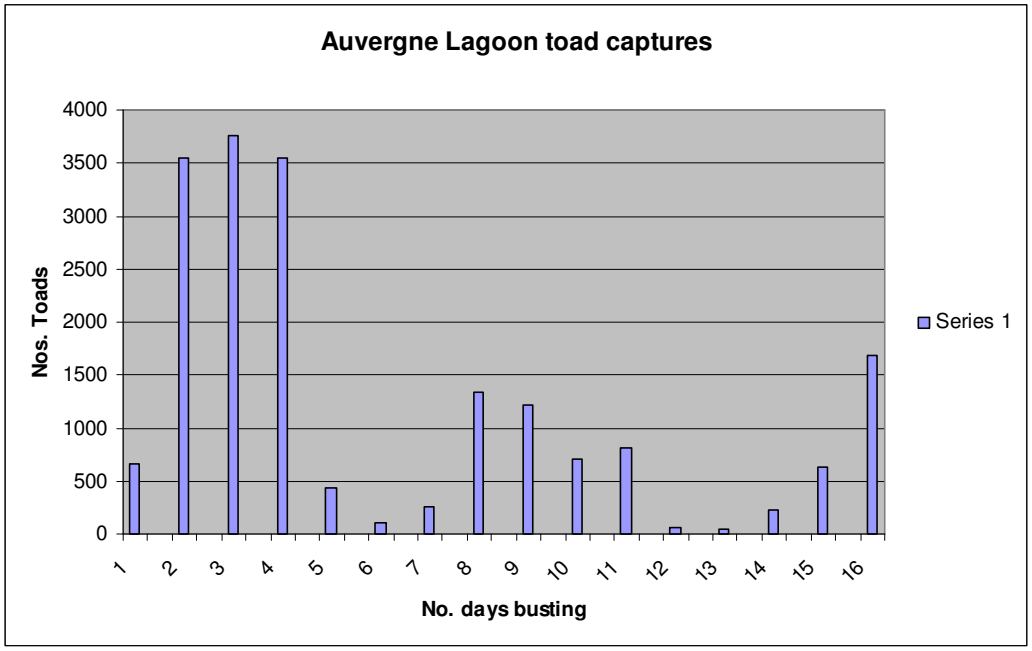


Figure 10.

Ring Lagoon (R) Figure 11.

Ring Lagoon sits near the junction of the East and West Baines Rivers (tributaries of the Victoria River). Depending on the climatic conditions, Ring Lagoon can dry up in some dry seasons. It was dry during the 2007 Muster, but ran for about 3kms during the GTM 2008. There were some areas where gaining access was difficult owing to the presence of Freshwater Mangrove (*Barringtonia acutangula*), but most of the area surrounding Ring Lagoon was clear and easily accessible.

A total of ten nights were spent hand busting Ring Lagoon. Over 16,000 toads were removed with a total of 160.5 people hours.

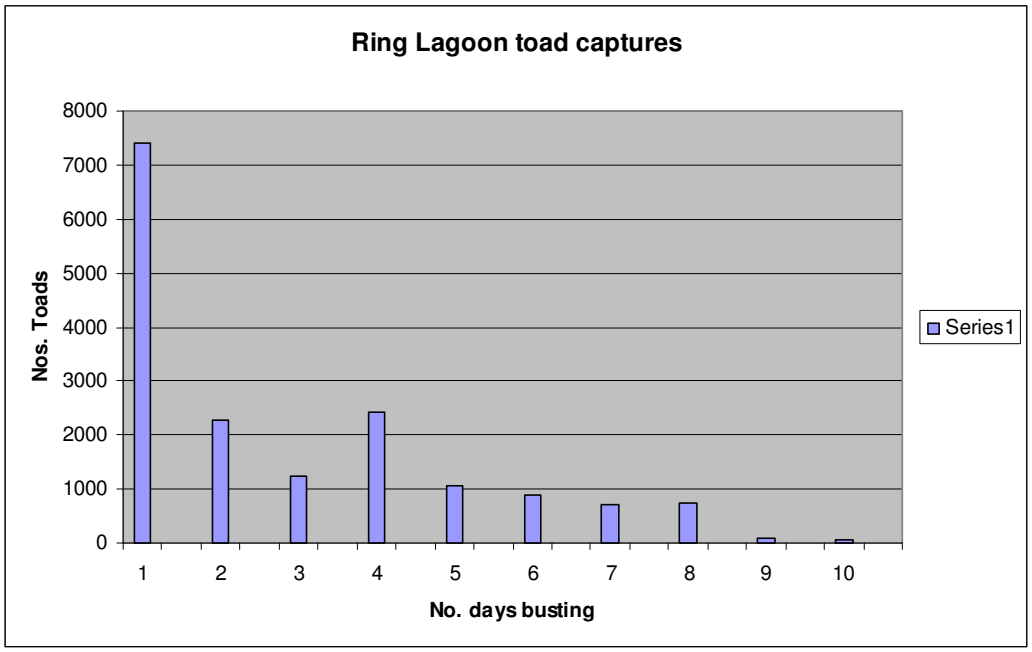


Figure 11.

Centre Point (CP) Figure12.

Centre Point is located on the Auvergne Lagoon access track about 3km SW of Auvergne Lagoon. It consists of a turkey nest dam and a large overflow. Both areas were full of water this year, so both required fencing. The fences were erected in 2.5 hrs with 1050m fencing material and nine people. There were only 275 toads removed from Centre Point fences over four nights. This low number of toads is probably due to the fact Auvergne Lagoon is relatively close by and most toads would seek refuge there. The fences were taken down in 30 mins by eight people.

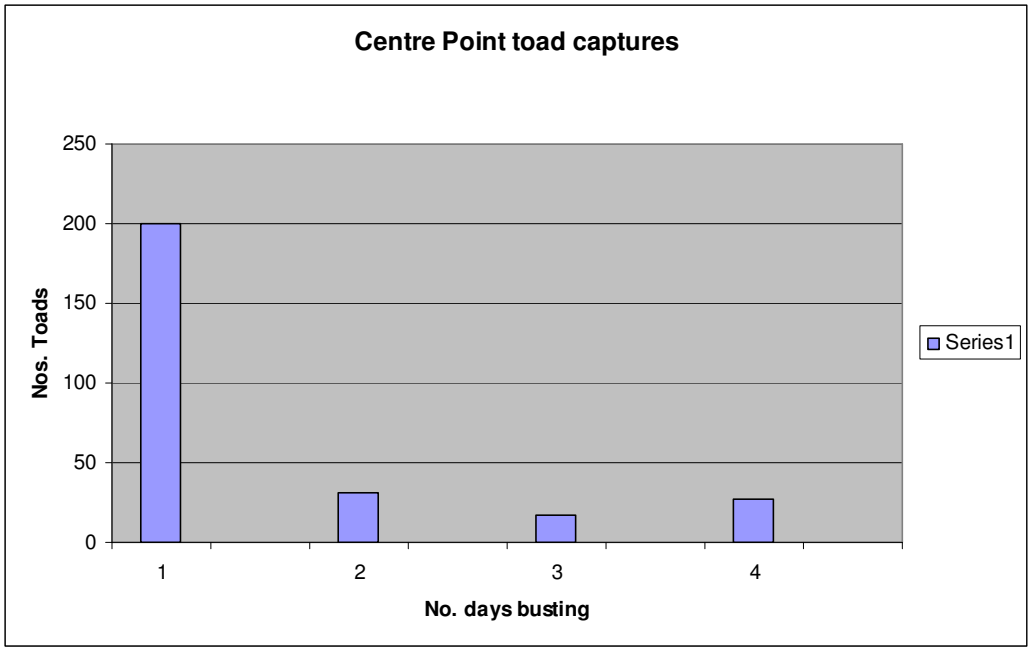


Figure 12.

Four Mile (4 Mile) Figure 13.
Lying on the main access road (4 miles) north-west of the Auvergne homestead, this system consists of a small turkey nest dam with a large overflow area adjacent to the south west.

The turkey nest dam had a few fallen tree branches along the edge and these were removed to allow access to all sides of the dam. It required about 100m fencing. The overflow was a lot larger and required about 300m fencing. Both fences were erected in three hours by nine people.

A total of 516 toads were removed from Four Mile over five nights. Again, this low number is probably due to the fact that Auvergne Lagoon is relatively close by and that it probably plays a role as a staging point for toads moving across the plains in response to rainfall which allows them to gain some refuge before the next move. There are extensive areas of vegetation and cracking clay soils to assist this refuging process.

The fences were taken down in 30 minutes by eight people.

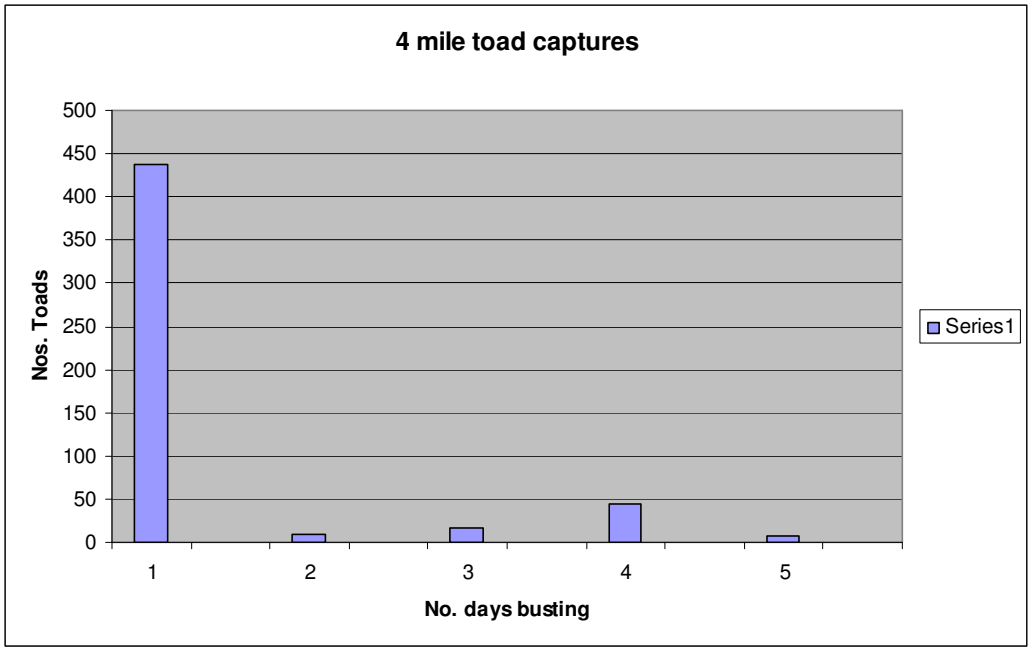


Figure 13.

Tank 1 (#1) Figure 14.

Tank 1 is located some 5 km west of Auvergne homestead. The site consists of a turkey nest dam with two overflow areas on the north and south-east respectively. Water was in the SE overflow and in the Turkey nest dam. The overflow is clear of vegetation until water levels rise a further four metres while the turkey nest dam is dominated by exotic plants including *Acacia farnesiana* and Caltropis.

Two exclusion fences were erected at this site on 11/10. On the 12/10/08 1147 live toads were removed from the site. On the 13/10/08, 392 dead toads were removed from the fence during a daylight maintenance inspection. All of these toads were extremely desiccated and many had been 'cleaned' by ants. A small number of toads were observed in both water bodies on this day and several hundred cane toad tadpoles were removed using nets. Ongoing collections occurred for a further four nights with a total of 2620 toads in total removed – This area was inspected by the DEC sniffer dog team and only two sub-adult toads were discovered *two weeks after the fence had been removed*.

A small number of *Cyclorana australis* were also observed at this site with one observed to jump the fence (R.Gueho pers.comm 16/10/08) – all at the turkey nest dam. Childrens pythons (*Antaresia maculosus)* were also observed to move freely through the wildlife gates and a number of *Litoria inermis* were found climbing the fence and using the wildlife gates. Other invertebrate fauna were also seen to use the gates including wolf spiders, centipedes and crickets.

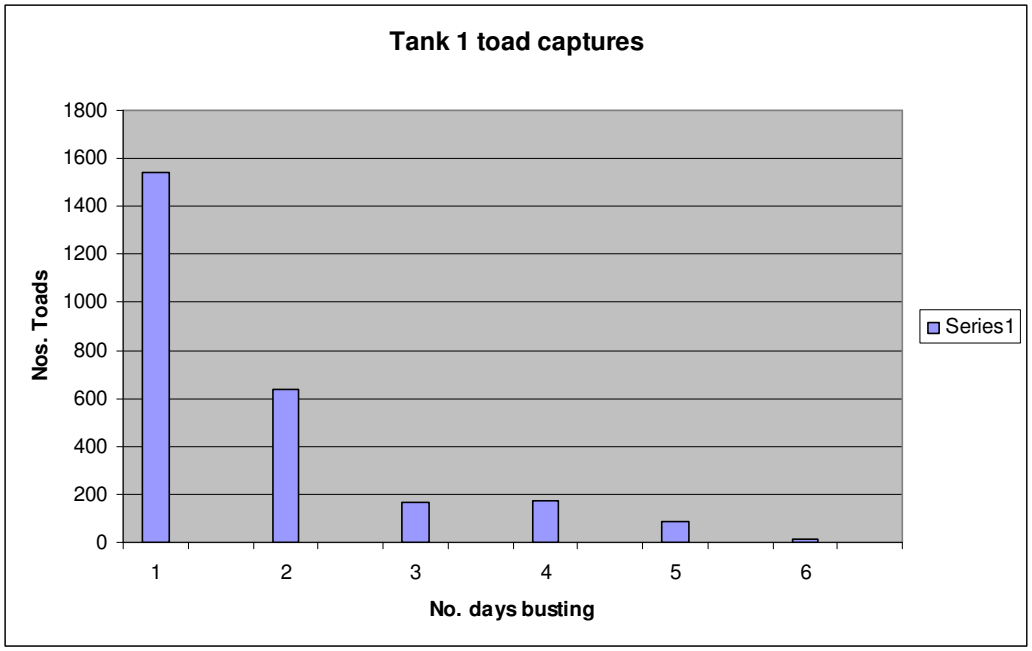


Figure 14.

Menzies (M) Figure 15.

Menzies dam is approximately 15km west of Auvergne homestead, in between the West Baines River and Dick Creek. It consists of a small turkey nest dam supplemented by groundwater pumped from a windmill. On the northwest side there is an overflow area of approximately 150sq metres. The area contained with the dam boundary fence provides significant refuge areas for toads with grasses, trees and cracking clay soils.

The turkey nest dam was surrounded by *Acacia farnesiana*, an exotic and *Bauhinia sp*, making it relatively time-consuming to erect a fence that wound its way through these prickly trees. This took three hours with 10 people. The overflow was clear of vegetation and quite easy to fence. It took two hours with seven people.

In 2007 this system held significant numbers of metamorphs and a small (<500) population of toads. In 2008, just over 1300 toads were removed from Menzies in six nights. The DEC sniffer dog team found *no toads at this site 2 weeks after the fences were taken down*.

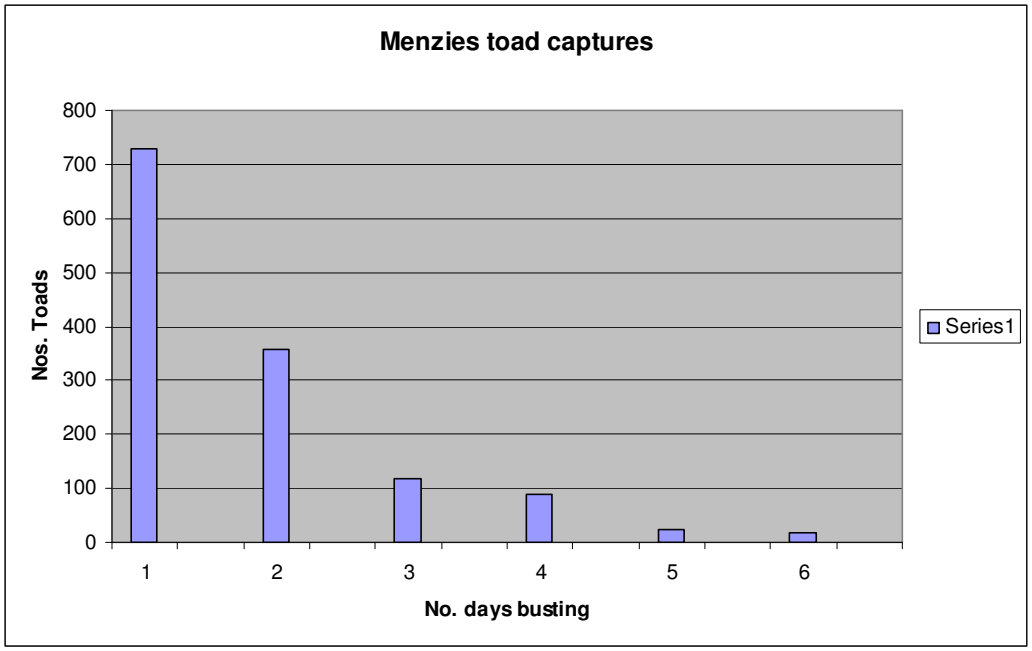


Figure 15.

Hayes Turkey Nest (HTN) Figure 16.
Hayes turkey nest dam is approximately 20kms west of Auvergne homestead and comprises a small dam of 120m in circumference with two overflow areas on the north and south respectively. The dam is fenced to block stock access and there is a well maintained trough supplied from the dam 120 metres north at some stock yards. The area outside the dam area is seriously denuded of vegetation and is dominated by cracking clay (black-soils) which provide significant refuge areas for cane toads which move to the dam to rehydrate overnight.

There were also a small concentration of invertebrates that were using the vegetation (predominately grasses) within the fenced dam area to feed and breed. Dragonfly life stages were observed within the dam water and larval stages were observed on the inside of the toad fence on the first night. There also appeared to be a healthy population of grasshoppers.

692 toads were removed by hand collection on the first night of operations (12/10/08) at Hayes Turkey nest. The following day a fence was erected at the system. A total of 1312 toads were removed from Hayes Turkey nest over four nights.

On 16/10/08 some light rainfall was received across an area of road to the dam and access was restricted – no actual rainfall was received in the vicinity of Hayes TN and consequently no collection took place on this night. Rainfall was again received at Auvergne Lagoon on 17/10/08 which precluded inspecting the dam on this night. On the 18th the fence was inspected and one live cane toad was removed before the fence was dismantled. The DEC sniffer dog team has subsequently inspected this

dam up to *two weeks following the fencing and only one cane toad was located at this site*.

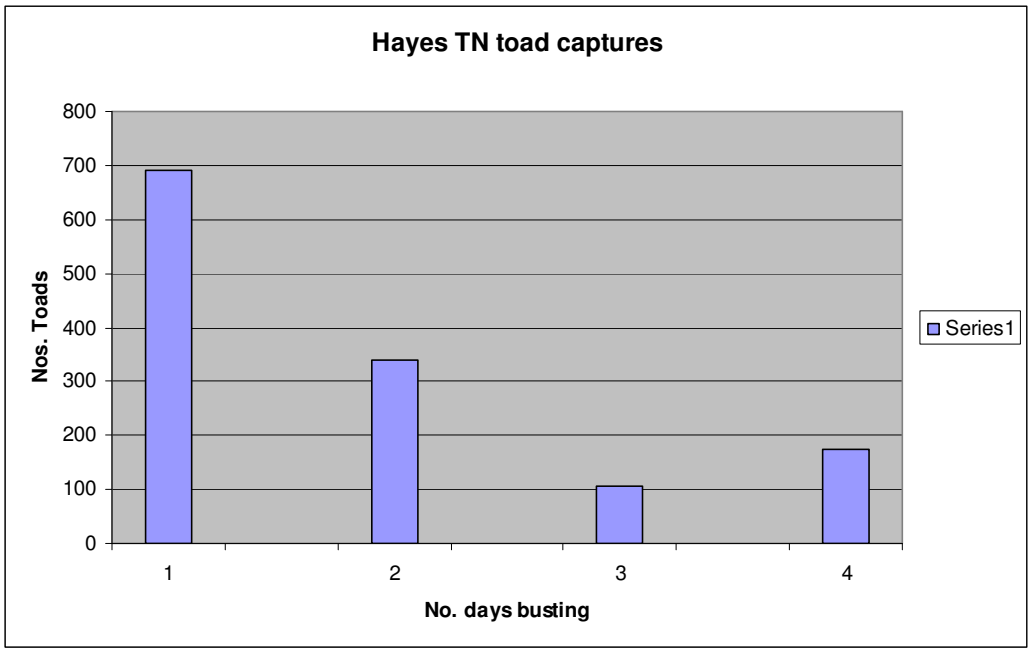


Figure 16.

Hayes Lagoon (Hlgn) Figure 17.
This system is a seasonal freshwater 'horseshoe' lagoon or billabong with a north – south orientation that fills as the West Baines River floods during the wet season. It is dominated by extensive riparian vegetation including grasslands, *Eucalyptus sp, Bauhinia sp, Barringtonia sp.*

Its overall length at the time of the Muster was approximately 400 metres. It had very steep banks either side, making some areas quite difficult to walk on.

Nine volunteers undertook a busting exercise on the system in one night (12/10) and only managed to remove 143 toads in one hour. This was a surprising result given its proximity to the West Baines River and the likelihood that it presents good habitat for toad populations to become established. There was further evidence that that toads had not significantly established on this system as several dragon species, in particular Gilbert's dragons (*Amphibolurus gilberti*) and skinks were seen during daylight and large numbers of insect fauna was observed (day flying grassland moths, dragonflies and beetle species). The system also appeared to have a healthy population of native fish. Large numbers of common archer fish (*Toxotes chatareus*) and a high density of large (>1.4 metres) freshwater crocodiles (*Crocodylus johnstonii*) were observed during daylight hours (8 animals counted – R.Gueho pers.comm).

The proximity of this system to Hayes Turkey Nest (where over 1000 toads were removed) raises some interesting questions about habitat preferences, impact of past musters, cross country movement by toads and so on. This system is only 500 metres north west of Hayes Turkey nest dam and is in a lower elevation than the dam system as the country drops away towards the West Baines River.

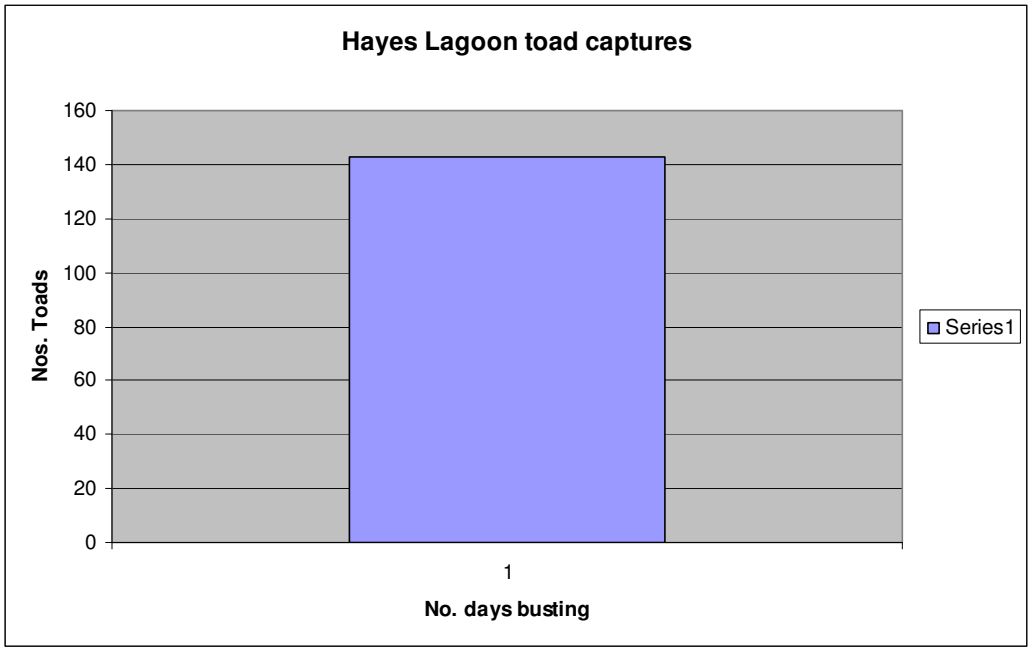


Figure 17.

6.2 Bullo River Station

Bullo River Station is directly west of Auvergne Station, on the western side of the Pinkerton Ranges. The country on Bullo River station is not as toad friendly as Auvergne as there are significant topographical difference with more sandstone escarpments and ranges, which appear to make it more difficult for toads to gain access. This has not, however, stopped toads from moving onto Bullo River station. They were first discovered there in March 2007.

STTF spent one week on Bullo River Station. No fences were erected on the areas busted by STTF as toads were still in small numbers and could easily be removed by hand only. A total of 798 toads were collected from eight different sites across the station by 13 people. This is significantly less than Auvergne station, indicating that the larger populations have not yet reached Bullo River station and that the work done by the STTF over past musters has significantly reduced the frontline pressure.

On the 13/10/08, the STTF Bullo team met up with a small KTB team; Malcom Day and his wife. Both parties coordinated their work that night to

ensure their work was complementary and the maximum sites were covered.

A summary of the results is as follows (see Appendix 1 for more details);
First Billabong – a total of 531 toads were collected over three nights.
Second Billabong – a total of 80 toads were collected over three nights.
Paperbark Lake – a total of 168 toads were collected over three nights.
Rock Hole - only two toads were found on one night.
Freshie Creek – eight toads were found on one night.
The Causeway – five toads were found on one night.
Big Knob Waterhole – three toads were found on one night.
Bullo station gate – one toad was found on one night.

6.3 Stomach contents

During the 2008 Muster, a number of cane toads were autopsied and their stomach contents recorded. Large centipedes, keel back snakes, native frogs and a wide range of beetles and bugs were found. Samples of stomach contents were collected, frozen and taken to Darwin for further studies.

10% of the captures were autopsied and their stomachs removed and the content of the stomachs placed in a container. The mass of the stomach contents showed Males averaged 2.6% of body weight, females 2.0 %, and sub adults 4.4%.

Many of the stomachs were close to empty indicating toads were probably finding food resources difficult to find. Food resources are limited due to dry season conditions and the large numbers of individuals competing for food resources at relatively small locations.

Estimates indicate the toads removed during the muster were collectively consuming 160kg of food each day or some 58.5 tonnes per year. This is likely to be an underestimate of total consumption as food consumption would increase significantly during the wet season.

These sorts of estimates indicate that cane toads are likely to have a significant impact on the biomass of invertebrates in and area and the volume of food available to native species.

6.4 Native wildlife impacts

Concerns have been raised over the impact of the fences on native fauna. Consistent observations during the 2008 GTM demonstrated that there were very few negative impacts on native fauna observed by STTF staff and volunteers. Those that were observed were usually based around a very short period of delay until the wildlife was able to locate the gates and then enter the fenced area.

The fences are specifically designed to allow access to water by all animals besides cane toads. They all had a 25mm square mesh inserted along the bottom of the fence that allows entry for native animals, such as frogs and snakes, but does not allow access to cane toads owing to their larger size. Wallabies were seen jumping over the fence, native frogs were seen jumping through the mesh or over the fence and a python was seen moving freely through the mesh.

Throughout the Muster, 53 *Litoria inermis* were found deceased along one of the fences. A complete list of fauna observations and their interactions with the fences can be found in Table one, Appendix 2. A complete list of fauna observed on Auvergne station and Bullo River station can be found in Table two, Appendix 2.

The exclusion fence presented no access problems to reptiles such as pythons.

7 CONCLUSIONS

Overall the results are encouraging in highlighting the feasibility of creating buffer zones. These are landscape spaces where cane toads move into the area during the wet season and can be removed in the dry season - with no toads actually managing to cross the zone due to the continued impact from fencing and hand busting. There is now practical evidence that these cleared and maintained buffer zones could become a reality.

This has implications for three key aspects of cane toad management. In the first instance, the muster trials have demonstrated that toads can be eradicated from an area. Second, toads may be able to be prevented from getting in to an area, and if not then their numbers can be dramatically reduced using a combination of strategies. Third, the cost and logistics of cane toad management strategies may well be affordable and practical when volunteers are used in an efficient and targeted fashion.

The use of exclusion fencing to increase the effectiveness of cane toad eradication was used more extensively during this muster and had an obvious and dramatic impact. The fences increased the efficiency of toad busting operations greatly and meant cane toads could be removed from a location with greater certainty, in a much shorter time and with fewer people needed to achieve eradication.

The example of Cedars Lagoon shows this benefit of fencing.

In 2006 there were over 6400 toads removed from Cedars by hand collection with no fence (the site was not completely cleared as 90 toads were collected on the last night).

- On the first night in 2006, six people spent 4.5 hrs at Cedars and collected 1615 toads at a rate of 60 toads per hour.
- In 2008, 8400 toads in total were collectd from the site with a fence being used. On the first night nine people spent 2.5 hrs at Cedars and collected 4581 toads at a rate of 216 toads per hour.
- On the second night in 2006, 2175 toads were collected, by 12 people, in 3.5 hrs at a rate of 52 toads per hour of effort.
- In 2008, 1986 toads were collected, by seven people, in two hours at a rate of 142 toads per hour of effort.

A preliminary analysis of the muster shows that when comparing the first night of busting at a site, if fences were used then the rate of collection was 293 toads per person per hour and if no fences were used it was 139 toads per person per hour. Combining data from the first two nights using fences led to a rate of 226 toads per person per hour and without fence 112 toads per person hour.

STTF are confident these figures can be improved upon as it was apparant during the muster we could send even fewer people to the fenced sites.

With fences, around 80-90% of the entire toad population at a site can be removed in two nights, without fences this figure drops to 40-50% of the population. Using fences decreased the total number of days needed to achieve eradication of the toad population at a site.

Further to this, the amount of fencing material available determines the number of sites that can be subjected to active control work during any period. Significant amounts of time were spent constructing new fence segments during the 2008 muster.

This construction element does not need to be repeated as these materials are rolled up ready for immediate re-use. The erection time for fences where the segments only need to be rolled out and stood up is much shorter than when the fence has to be built onsite.

Another key aspect of the fences is that more control sites can be active at any one time as the visit to a fenced site can be in daylight and fewer people are needed per site. Overall, the fences are a major advance in cane toad control and these results demonstrate that there is a clear need for them to be more widely used and incorporated into toad management strategies.

The exclusion barrier was also used in a natural wetland for the first time and was very successful. The fence was able to be placed through the freshwater mangrove forest and effectively blocked toads from gaining access to the water.

Exclusion fence at Flying fox Lagoon. The success of this trial indicates the strategy can be more widely used than previously thought.

An issue that needs to be considered is the ethics of allowing cane toads to die from dehydration if they were left on the fence for a few days and not removed every day. It should be acknowledged that this already occurs naturally when a waterhole dries up and there is no other water refuge close enough to allow the toads to rehydrate.

The numbers of people required to manage control sites are one of the limiting factors in a muster. If people do not need to visit sites every day the control options are greatly expanded.

The fences can be erected and left for several days at a time to block toads' access to water. They will however, die from dehydrations along the length of the barrier. The exact nature of the exemption from the animal welfare act that applies to the feral animal control act needs to be clarified. If it is ethically acceptable to allow cane toads to die from dehydration (as they do every other day in the field), barrier fences will become a powerful tool in stopping the westward movement of cane toads into Western Australia.

A cane toad is denied access to a water body. It cannot fit through the wildlife friendly gates inserted into the fences.

8 RECOMMENDATIONS

The obvious positive outcomes that have been highlighted by the use of exclusion and deflection barrier fencing presents real opportunities in the fight to keep Western Australia free of cane toads. The fences provide a number of benefits including:

- Cost effectiveness – the material cost and volunteer labour costs can be kept significantly lower to the point where the value of the resource being protected exceeds the cost of the effort.
- They increase the likelihood of maintenance of some native species which appear more adaptable to the presence of the fences and have learned that they are no impediment to getting access to water protected by fences – in particular invertebrate species probably are able to find refuge within the fenced area more effectively and thus avoid predation from toads.
- They increase the quality of water supplies available to cattle and native animals by removing the potential for pollution by dead toads.
- They are wildlife friendly – larger wildlife (wallabies) can move over the fences easily whilst smaller fauna including native frogs and snakes can move effectively through the mesh wildlife gates as they are smaller than cane toads.
- The impacts that they can have on populations of toads that are forced into refuge mode during the latter part of the dry season have been demonstrated.
- They engage volunteers who see the obvious impact the fences have on toad populations.
- They increase exponentially the likelihood that an area can be completely cleared of toads.
- They can be used to protect areas of high biodiversity and there is a volunteer cohort prepared to donate time and effort to undertake this work.

Based on the 2008 outcomes it is recommended that:

1. The area under fencing should be increased significantly in 2009 to include all properties west of Timber Creek. This should include Auvergne Station again as the data from past musters indicate the importance of this area for toad populations to establish, breed and move westward.

2. The fencing and mini muster model should be commenced as early as July 2009 to increase the effectiveness of the strategy and force toads to expend more energy searching for suitable rehydration points.

3. To support these outcomes, it is essential that DEC commit to undertaking complete wetland and man-made system audit prior to the commencement of the 2009 toad mustering season to determine the suitability of systems for fencing or hand collection.

4. Given the vast numbers of cane toads that expire naturally in areas such as the Whirlwind Plains and in other parts of northern Australia as rehydration sources (wetlands and annual water bodies) dry out, the ethics of deliberately allowing toads to die on exclusion fences should be considered. The STTF is of the opinion that removing this particular requirement to check fences everyday would exponentially increase the areas that could protected from cane toads and result in many more areas being cleared of toads. It is recommended that, to increase the efficiencies of toad control and consequently the areas under protection, fences should be inspected on the first two nights, when the majority of populations can be removed, and following these, removals should occur every 2nd day rather than every day.

5. Significant improvement in the impact of the muster model and the fencing strategy as a component of it can be achieved by immediate adoption of these methodologies by community groups and land management agencies across northern Australia. After three years of work the STTF has demonstrated the impacts that can be applied to populations of toads and the resultant reduction in age and class structures.

6. Adequate resourcing needs to be applied to the problem of cane toads infestation in Australia immediately. Given the current economic climate, work associated with extensive fencing and toad removal is a stimulus to local economies, provides employment opportunities and is an effective contribution to maintaining biodiversity in northern Australia.

7. Appropriate research be initiated immediately to assess impacts on essential ecosystem services from the imminent cane toad invasion into Western Australia. This research is imperative to assess the threats to loss of biodiversity, threats to critical aquatic systems (including RAMSAR Wetlands at Lake Argyle and in the Ord River Valley) and the potential decline in productive lands for conservation and other uses as a result of cane toad impacts.

9 REFERENCES

Cohen, M.P. & Alford, R.A. 1996. *Factors affecting diurnal shelter use by the cane toad, Bufo marinus*. Herpetologica 52:172–181.

Encyclopedia of Australian Wildlife, 1997, ed. J.Healey. Readers Digest (Australia), Surrey Hills.

Field Guide to Dragonflies of Australia. Theischinger. G, and Hawking. J, CSIRO Publishing. Collingwood, Australia 2006.

Field Guide to Insects in Australia, Zbroski. P and Storey. R. Reed Books Australia 1997.

Gregory's Tree Report
http://www.stopthetoad.org.au/main/publications.php.

Seebacher, F., and Alford, R. A. (2002) *Shelter microhabitats determine body temperature and dehydration rates of a terrestrial amphibian (Bufo marinus*).
Journal of Herpetology 36: 69-75.

STTF Field Operations 2006
http://www.stopthetoad.org.au/publications/sttf_field_operations_report_v3l_2006.pdf

10 APPENDIX 1 – Breakdown of results

DATE	LOCATION	NO. PEOPLE HOURS (no. people x no. hours spent busting)	TOTAL TOADS
20-Sep	Auvergne Lagoon	18.63	664
21-Sep	Auvergne Lagoon	41	3549
	Backwater	1.25	529
22-Sep	Auvergne Lagoon	33	3753
	Auvergne Shot	1	134
	Backwater	0.42	139
23-Sep	Auvergne Lagoon	27	3545
	Backwater	0.75	74
	Centre point	5	200
24-Sep	Ring Lagoon	42	7421
	Noahs	0.5	172
	Backwater	0.5	51
25-Sep	Ring Lagoon	42	2280
	Hollywood	2.5	582
	Backwater	0.17	8
26-Sep	Hollywood	12.5	1710
	Ring Lagoon	30	1239
	Backwater	0.08	0
	Auvergne Lagoon	5	270
	Auvergne Shot	3	254
27-Sep	Auvergne Lagoon	3	106
	Hollywood	2.5	251
	Hollywood Shot	1	32
	Noahs	1.25	24
28-Sep	Ring Lagoon	24	2417
	Cedars	23.5	4851
	Auvergne Lagoon	8	261
	Backwater	0.08	1
29-Sep	Ring Lagoon	12	1068
	Cedars	14.5	1986
	Hollywood	4	221
	Backwater	0.08	4
30-Sep	Auvergne Lagoon	22	1344
	Auvergne Shot	2	102
	Ring Lagoon	14	898
	Hollywood	1.5	58
	Noahs	0.17	3
1-Oct	Auvergne Lagoon	10	1179
	Auvergne Shot	5	243
	Ring Lagoon	10.5	712
	Cedars	7.5	889
	Backwater	0.17	1
2-Oct	Flying Fox	10.5	1359
	Cedars	5	314
	Auvergne Lagoon	9	703
	Auvergne Shot	0.5	22
	Noahs	0.83	9

DATE	LOCATION	NO. PEOPLE HOURS (no. people x no. hours spent busting)	TOTAL TOADS
3-Oct	Ring Lagoon	9	725
	Flying Fox	8	1135
	Auvergne Lagoon	14	817
	Cedars	1	119
	Noahs	0.5	15
	Hollywood	1	62
4-Oct	Leichardt	15	1636
	Flying Fox	15	1055
	Cedars	2	140
5-Oct	Flying Fox	20	645
	Leichardt	13.5	928
	Cedars	1	41
	Noahs	0.3	4
	Centre point	0.7	31
	Auvergne Lagoon	1	63
6-Oct	Hollywood	6	7
	Cedars	12	43
	Centre point	1.7	17
	4 mile	7.5	437
	Noahs	1.7	2
	Bullo - 1st Billabong	9	425
	Bullo - 2nd Billabong	2	75
7-Oct	Auvergne Lagoon	5	48
	Bullo - 1st Billabong	6.75	61
	Bullo - Paperbark Lake	6.66	21
8-Oct	Hollywood	2	121
	Cedars	2.66	8
	Cedars Shot	0.5	20
	4 mile	8.25	10
	Noahs	0.67	3
	Centre point	5.5	27
	Bullo - Rockhole	1.25	2
	Bullo - Freshie Creek	4.66	8
	Bullo - The Causeway	4.66	5
9-Oct	Leichardt	12	523
	Cedars	12	8
	Flying Fox	15	829
	Auvergne Lagoon	8	222
	Bullo - Big Knob	1.33	3
	Bullo - Front gate	0.08	1
	Bullo - 2nd Billabong	1	3
10-Oct	4 mile	2	17
	Ring Lagoon	9	90
	Leichardt	12	564
	Flying Fox	12	525
	Central	4	133
11-Oct	4 mile	0.67	45
	Auvergne Lagoon	15	637
	Leichardt	22	528
	Ring Lagoon	4	69

DATE	LOCATION	NO. PEOPLE HOURS (no. people x no. hours spent busting)	TOTAL TOADS
12-Oct	Tank 1	7.5	1539
	Menzies	9	730
	Hayes Turkey Nest	24	692
	Hayes Lagoon	9	143
	4 Mile	0.08	7
13-Oct	Hayes Turkey Nest	10	340
	Menzies	10	356
	Tank 1	12	639
	Flying Fox	5	405
	Bullo - Paperbark Lake	6	114
14-Oct	Tank 1	12	167
	Menzies	6	117
	Hayes Turkey Nest	6	105
	Flying Fox	5	70
	Bullo - 1st Billabong	6	45
	Bullo - 2nd Billabong	1	2
	Bullo - Paperbark Lake	6	33
15-Oct	Noahs	30	2803
	Tank 1	3.5	175
	Menzies	3.5	88
	Hayes Turkey Nest	3.5	175
16-Oct	Auvergne Lagoon	30	1685
	Auvergne Shot	3	59
	Menzies	1.5	24
	Tank 1	1.5	89
17-Oct	Tank 1	2.5	11
	Menzies	2.5	18
18-Oct	NO BUSTING DUE TO STORM		
	TOTAL TOADS	AUVERGNE	68,418
		BULLO	798
		MUSTER TOTAL	**69,216**

11 APPENDIX 2 – Fauna Observations and their interactions with the fences.

Table one.

DATE	SITE FENCED	FAUNA OBSERVATIONS
20-Sep		
21-Sep	Backwater	No dead *inermis* found on fence.
22-Sep		
23-Sep	Centre Point	No dead *inermis* found on fence. Wallabies moving freely over fence.
24-Sep	Noahs	11 dead *inermis* found in areas where there was more than 25m gap between mesh panels. Wallabies moving freely over and out of fence.
25-Sep	Hollywood	No dead *inermis* found on fence. Wallabies moving freely over fence.
26-Sep		
27-Sep		
28-Sep	Cedars	20 dead *inermis* found on main fence where gaps in mesh were bigger than 15m. Where there was continuous mesh there were no dead *inermis* and plenty were seen moving in and out of mesh. 2 small overflows found no dead *inermis*, but plenty of live ones. Wallabies moving freely over all three fences. Saltwater croc inside main fence. 8 Childrens pythons found in black soil cracks inside fence, 6 Childrens pythons found in black soil cracks outside fence.
29-Sep		
30-Sep		
1-Oct		
2-Oct	Flying Fox	No *inermis* found dead on fence, large olive python found inside fence.
3-Oct		
4-Oct		
5-Oct		
6-Oct	Four Mile	14 dead *inermis* found on fence where there was more than 25m gap in between mesh. Wallabies moving freely over fence.
7-Oct		
8-Oct		
9-Oct		
10-Oct		
11-Oct		
12-Oct	Tank 1, Menzies	Plenty of *inermis* at both locations moving in and out of fence, no evidence of dead ones.

DATE	SITE FENCED	FAUNA OBSERVATIONS
13-Oct	Hayes TN	Lots of *inermis* moving in and out of mesh, no dead ones.
14-Oct		
15-Oct		Dissection by RG found a dead *inermis* eaten by cane toad from Tank 1.
16-Oct	Tank 1, Menzies	Stimpsons pythons observed moving through fence (photos taken) at Tank 1. *Cyclorana australis* x 3 observed at Turkey nest outside of fence (1 observed to jump over fence), *Gehyra* sp (geckos) observed traversing fence and 'fencepost' skinks moving over fence and through gates.
17-Oct	Hayes TN	20+ nymphal stages of dragonfly found on inside of fence and large numbers of dragonflies observed over water at Turkey nest. Large numbers of grasshoppers, moths and other invertebrates observed at Menzies and Hayes in surrounding grasses. 8 dead *inermis* found on fence.
18-Oct		

APPENDIX 2 continued– Complete list of Fauna Observations on Auvergne Station and Bullo River station during the Muster 2008.

COMMON NAME	SCIENTIFIC NAME
REPTILES	
Gilberts Dragon	*Gemmatophora gilberti*
Snake eyed Skink	*Carlia sp.*
Mertens Water Monitor	*Varanus mertensi*
Estuarine Crocodile	*Crocodylus porosus*
Freshwater Crocodile	*Crocodylus johnstoni*
King Brown Snake	*Pseudechis australis*
Olive Python	*Liasis olivaceus*
Water Python	*Liasis fuscus*
Childrens Python	*Antaresia maculosus*
Keelback Snake	*Tropidonophis mairii*
AMPHIBIANS	
Green Tree Frog	*Litoria caerulea*
Floodplain Frog	*Litoria inermis*
Rockhole Frog	*Litoria meiriana*
Rocket Frog	*Litoria nasuta*
Roth's Tree Frog	*Litoria rothi*
Flat-headed Frog	*Limnodynastes depressus*
MAMMALS	
Agile wallaby	*Macropus agilis*
Antilopine Wallaroo	*Macropus antilopinus*
Northern Nail-Tail Wallaby	*Onychogalea unguifera*
Dingo	*Canis lupis dingo*
Black Flying Fox	*Pteropus alecto*
BIRDS	
Emu	*Dromaius novahollandiae*
Whiskered Tern	*Chlidonias hybridus*
Australian Pratincole	*Stiltia isabella*
Black winged Stilt	*Himantopus himantopus*
Common Sandpiper	*Actitia hypoleucos*
Crested pigeon	*Ocyphaps lophotes*
Diamond Dove	*Geopelia cuneata*
Bar-Shouldered Dove	*G. humeralis*
Red Winged parrot	*Aprosmictus erythropterus*
Little Corella	*Cacatua sanguinea*
Galah	*C. roseicapilla*
Red-Tailed Black Cockatoo	*Calyptorrhynchus sp.*
Red Collared Lorikeet	*Trichoglossus sp.*
Budgerigah	*Melopsittacus undulatus*
Black Kite	*Milvus migrans*

COMMON NAME	SCIENTIFIC NAME
BIRDS CONTINUED	
Black Shouldered Kite	*Elanus axillaris*
Whistling Kite	*Haliastur sphenurus*
Square tailed Kite	*Lophoictinia isura*
Peregrine Falcon	*Falco perigrinus*
Brown Falcon	*F. berigora*
Grey Falcon	*F.hypoleucos*
Wedge Tailed Eagle	*Aquila audax*
White Bellied Sea Eagle	*Haliaeetus leucogaster*
Black Breasted Buzzard	*Hamirostra malanosternon*
Darter	*Anhinga melanogaster*
Pacific Heron	*Ardea pacificus*
Little Pied Cormorant	*Phalacrocorax melanoleucos*
Pied Cormorant	*P. sulcirostris*
Australian Pelican	*Pelecanus conspicillatus*
Great Egret	*Ardea alba*
Intermediate Egret	*A.intermedia*
Little Egret	*Egretta garzetta*
Nankeen (Rufous) Heron	*Nycticorax caledonicus*
Australian White Ibis	*Threskiornis molucca*
Royal Spoonbill	*Platalea regia*
Black Necked Stork	*Ephippiorrhynchus asiaticus*
Brolga	*Grus rubicunda*
Magpie Goose	*Anseranas semipalmata*
Green Pygmy Goose	*Nettapus pulchellus*
Plumed Whistling Duck	*Dendrcyna eytoni*
Radjah Shelduck	*Tadorna radjah*
Pacific Black Duck	*Anas superciliosa*
Australian Bustard	*Ardeotis kori*
Pallid Cuckoo	*Cuculus paillidus*
Black Faced Cuckoo Shrike	*Coracina novaehollandiae*
Spotted Night-Jar	*Eurostopodus argus*
Blue-Winged Kookaburra	*Dacelo leachii*
Red-Backed Kingfisher	*Todiramphus pyrrhopygius*
Rainbow Bee-eater	*Merops ornatus*
Dollarbird	*Eurystomus orientalis*
Little Friarbird	*Philemon citeogularis*
White Gaped Honeyeater	*Lichenostomus unicolor*
Yellow Tinted Honeyeater	*Lichenostomus flavescens*
Red (Rufus) throated Honeyeater	*Conopohila rufogularis*
Lemon – bellied Flycatcher	*Myiagra sp.*
White Browed Robin	*Poecilodryas superciliosa*
Restless Flycatcher	*Myiagra inquieta*
White Winged Triller	*Lalage sueurii*
Olive Backed Oriole	*Oriolus sagittatus*
White Breasted Woodswallow	*Artamus leucorynchus*
Black faced Woodswallow	*A. cinereus*
Pied Butcherbird	*Craticus nigrogularis*
Torresian Crow	*Corvus orru*
Great Bowerbird	*Chlamydera nuchalis*
Mistletoe Bird	*Dicaeum hirundinaceum*
Fairy Martin	*Hirundo ariel*

COMMON NAME	SCIENTIFIC NAME
INSECTS	
Blue River Damsel (fly)	*Pseudagrion microcephalum*
Northern Riverdamsel	*Pseudagrion cingillum*
Northern Billabongfly	*Austroagrion exclamationis*
Emperor	*Anax sp.*
Northern Dragon	*Antipodogomphus neophytus*
L-Spot Basker	*Aethriamanta nymphaeae*
Bicoloured Skimmer	*Notolibellula bicolour*
Scarlet Percher	*Diplacodes haematodes*
Charcoal-winged Percher	*Dipklacodes nebulosa*
Graphic Flutterer	*Rhyothemis graphiptera*
Cockroaches	*Cosmozosteria sp.*
Black field cricket	*Teleogryllus sp.*
Mole Cricket	*Gryllotalpa sp.*
Grasshopper	*Heteropternis sp.*
Plague Locust	*Chortoicetes sp.*
Blue River Damsel Fly	*Pseudagrion microcephalum*
Northern Riverdamsel	*Pseudagrion cingillum*
Northern Billabongfly	*Austroagrion exclamationis*
Emperor	*Anax sp.*
Northern Dragon	*Antipodogomphus neophytus*
L-Spot Basker	*Aethriamanta nymphaeae*

12 APPENDIX 3 – A volunteer's memories

MEMORABLE MOMENTS
CANE TOAD MUSTER
AUVERGNE STATION N.T. OCTOBER 2008

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When you have to go
I decided that an early visit to the toot was in order. Just settled when I realised the reflective jacket was still on the entry. I leapt up! Unfortunately my shorts caught on the opening lever of the portaloo. I ended up on my hands and knees with my shorts around my ankles. Happily for me (and them) no one wandered in at that time.

The attack
It was a hot afternoon with people sleeping everywhere. I stretched out on the floor next to the pool and dozed off. Some nasty red ants coordinated an attack. A smaller creature would have been overcome immediately. I shot a foot above the ground, stifled a scream and jammed my right hand down my shorts. I grabbed a handful of those sods and ripped them off. Most other people were still asleep. I slunk back to my vehicle where I made a closer examination and removed some nippers. Rule 1 - Apply Bushman's Protection throughout the day as well as the night. Rule 2 - If sleeping on the ground wear undies.

Ouch!
We were chatting in a group when Dot gave a vicious slap to a fly on her forehead. Unfortunately she was holding a tin mug in her hand.

Plumbing problem
The 40 degree plus days and hot nights resulted in a high level of sweating. For four days I did not pass any water. It being acceptable to discuss at least some bodily functions at camp I questioned most people as to how much fluid they were drinking each day and whether their systems were working OK. A common salutation was "G'day John – have you had a pee yet". I was touched by the interest shown by my fellow volunteers. An increase to eight litres a day solved the problem.

'Whirlwind Plains'
The 'Whirlwind Plains' are well named. One afternoon a strong blow came through the camp. Some awnings came down. Everyone in camp had to hang onto the remainder for a couple of hours until the wind abated.

Hot
Two consecutive days the temperatures were 43.9 and 44.6.

Never underestimate older Australian ladies

Edna made no secret she was an eighty year old (or 79 with a birthday fast approaching). I was paired with her on my first toad busting night. Regardless that she had been toad busting since the beginning of the muster I assumed she would probably need my assistance. She politely declined my offer to carry her battery, water and bags. At the lagoon Edna took the lead and set a cracking pace. Toads were flying everywhere and I was pushed to keep up. After about an hour Edna turned to me and sweetly said "John, why don't you sit down here and have a rest. I will come back in a little while". I just managed to croak that would be fine with me.

Sad

Dave and I were on a water run to Timber Creek. At the troughs past the double gates we came across a newly born little bull calf (complete with umbilical cord) and obviously separated from his mother. We slowed down and he must have thought my white Toyota was his mum. Bawling loudly he rushed over for a feed. We tried to get him to drink some water but without success. The station had been advised. That night we saw that he was in the same spot but had not made it through another hot day.

Bogged

Frank was on a return trip towing the water trailer behind a Troopie. It took only minutes for a heavy shower to turn the ground surface and tracks to slippery clay mud. After crossing a river bed the departure bank was like glass. With the weight of the water trailer being towed the Troopie just could not make it up the slope. Both Troopie and trailer ended up well and truly bogged. Using a snatch strap we managed to pull both vehicles out. There was so much mud under the trailer the wheels jammed. It was towed back to base camp with the wheels aquaplaning along the slippery surface.

The 'Mystery Toilet'

There were three well constructed toilet areas equipped with portaloos. But there was a fourth screened area with no portaloo. The debated but unanswered question at base camp was whether this was exclusively for girls light relief or was it for boys as well? Note - no reflective jacket was used.

Travel in comfort

We were short on vehicles so five of us used to travel in my Toyota Landcruiser. It was more comfortable that being jammed in the back of a Troopie. I would have different volunteers on board as we went to various locations. It was fun but I would not drive to Flying Fox nor carry toads on board.

Pretty Face Wallabies

Inevitably some were struck at night by vehicles. I don't like having to put down injured animals but it was humane to do so.

Nice Surprise!!
Kim introduced Kate and Phil as newly arrived volunteers. They were friends and near neighbours in Perth and w were at their farewell party in March. They headed off on their outback adventure over the top enroute to Victoria. What were the odds of meeting at the cane toad muster in NT?

Those peeping frogs
A small group of us were on tadpole netting duties. We were sitting under a tree having a break. Megan was talking about the frogs that lived under the pallets in the shower at base camp. She was certain that when she was having a shower she would see them lining up for a wash as well. I said that I had seen them as well and identified them as native Australian 'Voyeur' frogs. Dot said in all sincerity "Really, native Australian 'Voyeur' frogs - how interesting". A split second later it dawned on her. Maybe it was the heat but I thought that was quite funny. Whatever was thrown at me missed!

At Flying Fox
I could do with losing a few kg. OK - more than a few! I was with Dot. We went towards the centre of the lagoon. As we passed under some mangrove trees I broke through the surface and sank almost to my knees. I simply could not extract either foot from the mud. I grasped an overhead branch and managed to pull both feet clear leaving my boots behind. My battery gave out and I was in the dark as well. On hands and knees I retrieved my boots. Being slippery with mud I could not pull them on. I limped along the fence line back to the vehicle. Using pliers for grip I got them back on. Although it sounded good and amused others I admit that I embellished my survival story. I was in no danger of being lost forever and I did not leave slivers of skin from my fingers on the overhead branch. And Dot would have come back for me ... wouldn't she ... eventually?

Going Home
I did the rounds and said my goodbyes. With my Abba CD on full I left the camp in high spirits. My euphoria lasted 400 metres till the double gates. No friends on board, no sparkling repartee, no one to open the gates. I was all alone. Nearing the highway I spotted one of our Troopies trundling down the track. It was Lisa returning from Kununurra. Had a chat, spirits lifted, Perth here I come.

Conclusion
Hard work but I have not enjoyed myself as much for years. I am looking forward to the wind up. Well done to Russell and Kim for your organisation. Congratulations to all the volunteers especially those that did the full time. Great effort! Would I come again ... in a heartbeat!