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Scientific Expedition Group with
National Parks and Wildlife and
Department for Environment and Heritage

EXPEDITION WITJIRA

INTERIM REPORT

12TH – 26TH July 2003

A biodiversity survey of the mound springs
and surrounding area.

Photo D Noack

Pogona viticeps enjoying the view

Scientific Expedition Group (SEG) with
National Parks and Wildlife (NPWS) and
Department of Environment and Heritage (DEH)

EXPEDITION WITJIRA

Interim Report

12TH – 26TH July 2003

Editors – Janet Furler and Richard Willing

The Scientific Expedition Group organises expeditions to places of scientific interest in South Australia. Expeditions offer training and experience in scientific field work under the supervision of scientists and experienced fieldworkers. In addition to training, expeditions aim to produce results of scientific interest. For further information, visit our website at: www.communitywebs.org/ScientificExpeditionGroup/

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For copies of this report contact

SEG Secretary,
PO Box 501, Unley 5061,
Email segcomms@telstra.com

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Summary

Expedition Witjira 2003 was a major collaboration between the Scientific Expedition Group (SEG), Department for Environment and Heritage (DEH) and National Parks and Wildlife Service (NPWS). The main objective was to conduct a biodiversity survey of the area, particularly the mound springs, to observe any differences between springs with original vegetation and those where feral date palms are invading the springs. Other objectives were to search for rare rodents, Kowari and Marsupial Moles and survey for feral animals. Base camp was near the Ranger's quarters close to the Dalhousie main spring in Witjira National Park in the Far North of South Australia.

Vegetation monitoring - involved mapping of five springs affected by date palms (*Phoenix dactylifera)* in the Kingfisher mound spring complex. Vegetation in the B1 and B2 springs was also measured. Mapping of *Eleocarus geniculata*, a spike-rush, near the main pool was undertaken to see if this would be suitable to monitor visitor impact.

Vertebrate monitoring at mound springs - 135 Elliot traps were set along the Kingfisher complex, B1 and B2, and Dalhousie main springs for four nights. Many house mice (*Mus musculus*) were caught and despatched, significant numbers of natives such as Plague Rat (*Rattus villosissimus*), Paucident Planigale (*Planigale gilesi*) and an attractive skink (*Ctenotis saxitilis*) were also trapped.

Rare rodent monitoring – A previously set up Rare Rodent site near Mt Crispe was reviewed. 200 Elliot traps set in a grid pattern caught Stripe-faced Dunnart (*Sminthopsis macroura*), Fat-tailed Dunnart (*Sminthopsis crassicaudata*), Forrest Mouse (*Leggadina forrestii*), and a Plains Rat (*Pseudomys australis*). 10km long lines of Elliott traps were set up on gibber pavement country east and west of the camp searching for evidence of Kowari (*Dasycercus byrnie).*

Other animals - A few tracks of Ampurta (*Dasycercus hillieri*) were seen. Twenty four pits dug at four sites in the sand of the western Simpson Desert revealed tracks of the Marsupial Mole *(Notoryctes typhlops)*. A mist net caught one Cave Bat *(Vespadelus finlaysoni)*.

Bird surveys - Surveys of the regular trapping sites for 20 minutes at the Kingfisher and other springs took place as well as opportunistic sightings in the area.

Invertebrate monitoring of the Kingfisher complex involved searching for invertebrates in the spring and tail, including cutting transects through the phragmites, sampling of the water and the benthic layer, setting pitfall traps, malaise traps and pan traps for invertebrates, as well as counting fish numbers near and away from date palm roots.

Physical properties of mound springs - at different times of the day, turbidity, dissolved oxygen content, pH, temperature, conductivity and shading both in springs and down the tails were measured.

Total grazing pressure management - rabbit population in the area had decreased to such an extent that there was a great regeneration of native vegetation even outside the exclosures. There was still considerable grazing pressure from feral camels, donkeys and horses, particularly for 25 km around Purni Bore in the western Simpson Desert.

Monitoring of feral animals - An ongoing aerial monitoring of feral animals was timed to coincide with the expedition. Plenty of feral camels and donkeys were sighted giving an indication that there is still considerable grazing pressure in the park despite reduction in rabbit numbers.

Visitor impact - The usual physical properties were estimated as well as a bathymetric survey to assess the shape and depth of the pool. Grab samples of the benthic layer had many sieving mud on the shore. An increase in spike-rush was mapped.

Bushwalking - A bushwalk near the end of the survey, heading south west of the camp, kept four energetic members occupied for three days.

Acknowledgements

Expedition Witjira 2003 was a major collaboration between the Scientific Expedition Group (SEG), Department for Environment and Heritage (DEH) and National Parks and Wildlife Service (NPWS). This was a happy symbiosis that was obviously of benefit to all involved.

We record our sincere gratitude to our sponsors, WMC Resources Ltd and Arid Areas Catchment Water Management Board, for financial support, and the Department of Environment and Heritage, for substantial departmental resources in materials and staff time. This support has made it possible to run this expedition at a cost that would otherwise have been prohibitive for most of the participants. These organizations have practical interests in the work that was done and we think that the results of the expedition will justify their investment in it and their expectations.

Thanks are due also to George Lucey, Ashford Constructions for the use of the Mile End depot, Belair Fruit and Veg, Belair Butcher, Belair Bread Supplies, Collinswood Foodland and Blackwood Hire for the trailer obtained at short notice.

Thanks are due to Mr. Bob Lewis for additional material and comments about his father's stay at Dalhousie as a young man.

The contents of the Handbook were painstakingly accumulated and produced by John Love prior to the survey.

Geoff Axford and Richard Willing worked on this project for two years before it came to fruition. Thanks are due to the participants, particularly the leaders and scientists who devoted much time and energy in setting up the various projects, and used their skills to educate people to perform worthwhile scientific tasks. Trent Porter won everybody's vote for a high-class catering and logistic act, and Trent and Graeme Oats are thanked for a determined effort in Adelaide to squeeze the load into a much smaller volume than appeared possible.

Rangers of NPWS were always helpful and cheerful, and Dean Ah Chee kindly agreed to have tents close to his house for a fortnight so that campers could easily use existing facilities.

Thanks are also due to the members of SEG who were the 'foot-soldiers' of the expedition. The work-load was much larger than expected, everybody rose to the occasion splendidly and all had a great sense of achievement at the end of it.

The Lions Club of Coober Pedy provided welcome meals and accommodation on the journeys to and from Witjira, and arranged entertainment for the travellers.

Thank you to the busy professionals who had to balance writing up results for this report with the work for which they are employed.

Finally, many thanks are due to Janet Furler who took over as editor of this report, a decision that has kept her busy for some time.

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Dalhousie ruins and view of surrounding country Photo R. Willing

What a difference water makes. Photo G. Oats

1. INTRODUCTION

1.1 KWATYE

Indigenous people's connection with kwatye (water) in the Great Artesian Basin.

By Dean Ah Chee, Senior Ranger, Witjira National Park

Witjira National Park is located on the western edge of the Simpson Desert in the far north of South Australia, covering some 7770 square kilometres. The area contains some 70 mound springs, including Dalhousie Springs; one of the largest mound springs complexes in Australia. The discharge from the Dalhousie mound springs complex accounts for as much as 80-90 percent of spring discharges in the South Australian portion of this Basin.

The responsibility to care for this country belongs to my people, the indigenous Southern Aranda people and the Irrwanyere Aboriginal Corporation. We have cared for this country for a very long, long time, much longer than the first Europeans to this area and much longer than 1985 when the area was declared a National Park.

Located within this area are many mound springs, which are universal to our Tjukurpa. The only European interpretation of 'Tjukurpa' I can provide is to say that it may be considered our 'Dreaming'. It is important to accept that Tjukurpa is not just a story, nor a myth, for Tjukurpa is more than just 'Dreaming', it contains our spiritual connection, our law, our culture, our heritage and the stories associated with the land. It contains the reasons for how and why things such as water, fire and the landscape exist. The Tjukurpa of this area is not restricted to Witjira for it flows through the country of many other indigenous groups throughout Australia who are associated with the mound springs within the Great Artesian Basin (GAB).

Before I go on, it is important to understand that my ability to write and speak on these issues has been granted to me by my elders. It is only with their permission and authority that I provide the information on my spiritual connection with 'kwatye' - an Aranda word for water within the GAB.

This unique watercourse is now called the Great Artesian Basin but in my language, the main springs, Dalhousie Springs, is known collectively as Irrwanyere or 'the healing spring'. Well before my elders' time, it provided more than just a source of water for indigenous people. For it was and remains a travel path, which connects many indigenous groups within the trail of the GAB and is our Tjukurpa.

We have a holistic approach to water. For this water is a source of healing when we are sick, and it provides us with many spiritual and cultural interests. It is our lifeblood, which we need to survive. It allows us to continue our ceremonies, which incorporate our rich and unique culture that is still strong today. It is these sources of water that provide an adequate and valuable food source rich in fish and other foods for my people. As one of the traditional elders of this country Mr Bingy Lowe says:

'We are in the middle of kwatye (water), it is all around us, we have to look after this place'.

Through my elders, I and privileged others have been given the responsibility to care for this country and this is a task that has proven difficult since the settlement of non-indigenous people to this land.

Expeditions by Stuart between 1858-1862 saw the first Europeans to the area. The first visits to the mound springs by non-indigenous people occurred in 1870 whilst surveying the overland telegraph route linking Adelaide to Darwin[1]. You can understand why Europeans

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[1] Cohen, B. European History. In W. Zeidler and W. F. Ponder, eds. Natural History of Dalhousie Springs (Adelaide, South Australian Museum, 1989).

were surprised to see such a large pool of water with reeds of up to 18 feet high in this dry arid area. The first large pool seen by Europeans was originally named by them 'Edith Springs', after the wife of the then Governor of South Australia. The name was soon changed at her request to be named 'Dalhousie' in respect of her father the Marquis of Dalhousie who lived some 20,000 kilometres from the Springs. But with such delight came the thought by many Europeans of a viable economic base for pastoralism and other ventures. Such thoughts were soon to become reality and with this came a dramatic change of the fragile environment that existed within the area. This change was soon to destroy beyond repair much of the land and our relationship to it that was of vital importance to the survival of my people.

For it was only a few years later around 1872 that a pastoral lease was taken up over the Dalhousie area. It remained as such until some 100 years later when it was gazetted as a national park. Within these 100 years the damage to the land extended well beyond the mound springs to produce changes to the land that would ultimately change our once self-reliant and healthy lifestyle.

Because of the fencing to keep cattle and sheep in and the impact of such stock and introduced species to many water sources, Aboriginal people were not able to travel and access sites that were of high cultural significance. Many sites including their extensive archaeological remains were destroyed often by stock or by infrastructure such as stockyards built near water sources. With this came the inability to tell the stories and perform the ceremonies associated with the Tjukurpa of these sites. Inability to perform such duties brought sickness to my people who were responsible to care for these sites. As the springs were damaged we could not seek the once powerful healing qualities as we were used to from 'kwatye'.

With the pastoral industry came the destruction and lack of many bush tucker plants and animals. Lack of bush food forced my people to travel further away to get food that was once abundant around the mound springs and waterholes became stock watering sites. The once high levels of water within the mound springs were slowly dropping. No wonder, as the pastoralists pumped large amounts of water from the springs to grow lucerne for their stock and allowed bores to flow freely from this valuable water source which accounted for huge losses of water from evaporation.

The Europeans brought with them government ration stations. With these ration stations came a change to my people's once healthy diet of fish, fruit, nuts and seeds. Rations included flour, sugar and tea. My people who once were able to access abundant sources of food within the area were now reliant on government rations. Their ability to travel and have reliable water sources also diminished because introduced stock and animals had now destroyed many of our once permanent water sources. Valuable water sources that my people had always relied on to continue their stories and ceremonies were all too often now destroyed or dried up.

My people could see that our country had changed in such a short time and these changes impacted on their lifestyle so dramatically. They could see the damage that the non-indigenous people were doing. But the people causing the damage would not listen to us, they could not and did not see the changes that they had made to the land, the plants and animals. They did not have the expertise or knowledge of the land like my people had and continue to have for thousands of years. Their priorities were different than ours, for they did not respect the land; they thought the water would last forever.

Ironically it was a drought in the late 1920s that ultimately saw many pastoralists leave such 'inhospitable country' and move west and south of the mound springs to seek favourable water sources for their stock. But in that short period of time, the Europeans had caused so much damage not only to the land but to our culture.

With the drought and the leaving of the Europeans came the opportunity for my people to come back and help restore the land that was very 'sick'. Although many Aboriginal people came back to the mound spring and surrounding areas, many who were now reliant on ration stations instead of 'bush tucker' had moved to Communities north and south of the mound springs at Finniss Springs, Charlotte Waters, Bloods Creek and Finke.

However, those Aboriginal people who stayed at the springs and surrounding areas were now able to return to their traditional land management practices. They were able to control burn on their country and perform the Tjukurpa. Burning the country returned many species of bush tucker, although many of the wildlife that were once abundant were now gone. Where there was once plenty of emus, kangaroos, bush turkeys, ducks, mussels, stick nest rats, bandicoots and fish, now there are many new animals like the donkey, horse, camel, fox and rabbit. Now there are many more animals that are competing for the same food that is no longer plentiful.

Even the springs that once provided fish and mussels could not provide for my people. The edge of the springs that once had many bush foods was replaced with foreign grasses and weeds. The once clear springs that were a source of healing for my people were now dirty from stock and feral animals drinking from the springs.

Despite all these inherited problems, we were glad to once again be the caretakers of the land - the springs and the surrounding areas. Although many of the Tjukurpa sites had been destroyed, we wanted to protect what was left and protect the 'kwatye' not only for us but for all the animals and plants.

But the country was so damaged and the fragile environment around the mound springs destroyed. We looked at how we could repair our country. We recognised that there were now many problems that we indigenous people had not previously encountered.

We saw there were significant changes in the vegetation from the impact of the pastoralists. There was an increase in salinity both in and around the springs. Certain animals that were once in abundance in and around the springs are now gone. Many bush tucker plants that once provided food for my people are gone. The once substantial water flow of the springs is now slower and a lot lower.

We acknowledged that it is only by combining our traditional land management skills and western scientific methods that together we can provide the most effective method of management of our country. So we negotiated the cooperative management structure with National Parks where we have a Board of Management with a majority of Irrwanyere people on it. A 99 year lease over the park has been granted to Irrwanyere. The park remains the property of the South Australian Government but the lease allows Irrwanyere members to live on, use and manage the park in accordance with the plan of management and subject to other leases. They also have me as the ranger at Witjira. Through the process of cooperative management my people believe it is the only way that we can help restore some of the sites, plants and animals that are so important to my people. We need to restore the country to its healthy state and protect the land from further damage.

But as we try to restore our country, even today non-indigenous people continue to destroy the site.

We have asked tourists to respect the springs as we as indigenous people continue to do so. We realise that some non-indigenous people want to swim in these waters and therefore to protect the other springs we have only allowed access by tourists to the main springs.

Despite the damage that has been done previously by non-indigenous people, tourists continue to use shampoos and washing powder in the springs and continue to destroy this fragile ecosystem. We ask them to appreciate our holistic approach to the country and try to see how we as Aboriginal people see the land - as part of us which is to be respected, for future generations and not as just a big hot waterhole in the desert. It is imperative that non-indigenous people learn the meaning of the word 'protection'. Together we must care for the land and not only protect what you think is important as the pastoralists once thought, but to think how important the land is to everything in it - to the many plants and animals that have the right to live as we do here and protect our Tjukurpa. Once you think about these things as an indigenous person does, then you will learn to respect the land and the water and the Tjukurpa.

[Reproduced from *Environment South Australia*, Vol. 9 No.1, by courtesy of Dean Ah Chee.]

Further notes

The first pastoral lease of the Dalhousie area was obtained by E. M. Bagot in 1872, after completing his contract for building the southern section of the overland telegraph line. Subsequent lease holders included his son Charles, John Lewis, who also had a part in establishing the telegraph service, and the Lowe family, from whom the State Government bought the lease in 1984.
During that period of about 112 years the property had, at various times, been stocked with sheep, cattle, horses and angora goats, and had been invaded by brumbies, feral camels, foxes and rabbits. To protect the sheep from dingos, shepherds yarded them at night and took them out to feed and water each day. Cattle ranged freely around the springs and bores and were mustered for branding, gelding and marketing. Fencing of cattle stations became general in the 1970s as a disease control measure required by the Commonwealth Government.

The overland telegraph to Darwin, and later the railway to Alice Springs, passed about 20-30km west of Dalhousie. Both have been abandoned but both, in their time, made communication with the rest of the world easier. Radio transmitters or telephones and an air strip at each homestead, and the Royal Flying Doctor Service base at Alice Springs, continue to provide the 'mantle of safety' that the Rev John Flynn succeeded in spreading over the outback.

Another episode in the European occupation of the springs area was an attempt at irrigated lucerne growing in the early twentieth century. Irrigation with mineralised water is self-defeating because the minerals become concentrated at the surface of the soil.

On 3 March 1899, John Lewis, in a letter to his son Essington, who was working at Dalhousie at the time, wrote '<u>Dates</u> I sent up a box some time ago. I want them planted about they should grow well at the Mission Springs'. Then on 14 April he wrote '<u>Dates</u> I am glad you have some young ones growing. It will be well to sow them in all suitable places and protect them.'[2] Government experimental plantations had been established earlier at Lake Harry (successfully) and Marree (where they did not do so well) and Lewis obviously hoped to produce dates commercially. It would seem that the Dalhousie dates were well able to look after themselves. The feral palms and their impact on the local ecology will be the focus of expedition Witjira 2003.

[2] These extracts are reproduced by courtesy of Mr R. G. Lewis, son of Essington.

1.2 GREAT ARTESIAN BASIN

Travis Gotch

Water in all its forms is the single most valuable resource on the planet. It is also one of the most undervalued and under appreciated resources. In desert environments the presence of permanent water results in highly specialised and unique ecosystems that often underpin the surrounding environment. In Australia the largest fresh water resource is the Great Artesian Basin (GAB), a confined aquifer underlying 1/5th of the continent of Australia (fig 1). The natural discharge of water from the basin comes from springs (GAB Springs) associated with faults and fractures mainly along the margins of the basin. Some of these springs have been discharging water into the region for at least one to two million years (Krieg 1989, Boyd 1990). Due to the relatively permanent nature of the water source and the isolation of the springs due to the desertification of the surrounding environment, the springs of the GAB have become hot spots of speciation and endemism. The springs are home to a wide suite of endemic, relict and spatially disjunct flora and fauna.

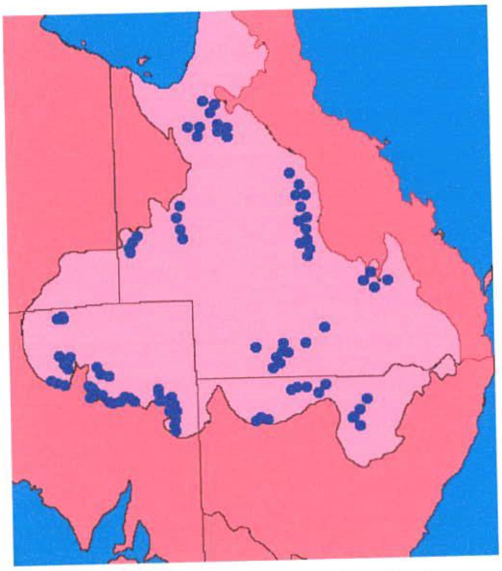

Figure 1: The Great Artesian Basin and the locations of major spring groups

There are 145 spring vents in the Dalhousie complex that flow at an estimated 54 ML/Day, this accounts for 10% of the entire water budget of the South Australian component of the GAB (calculated from data presented in Sibenaler 1996). Of all of the South Australian GAB Springs the Dalhousie Complex is the most important in terms of its conservation value and its heritage values. There are 30 species of significance (endemic, relict or rare) listed within the Dalhousie Complex (Gotch 2005). The springs also represent important places for Aboriginal and European culture and history.

At present there are a number of processes that are threatening the spring's ecology and heritage values. These include the reduction and potential loss of water flow due to decreases in aquifer pressure (aquifer drawdown), invasions of feral species impacting on the springs (date palms, donkeys and camels) and the impact of tourism and visitor numbers on the springs.

There is a lack of good scientific data available on which management decisions can be made within the Dalhousie region. The SEG expedition of 2003 played an important role in establishing baseline data for future control work and as a vehicle by which several methods of data collection could be trialled and refined for future surveying, monitoring and management.

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Gotch, T. B. (2005). *Checklist of significant species associated with GAB Springs in South Australia*. prepared for Dr Rod Fensham and the National GAB Spring Recovery Program, Adelaide.

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Sibenaler, Z. (1996). The Great Artesian Basin; a 25 year water use scenario. *MESA Journal*. **2**: pp 18-19.

2 THE EXPEDITION

2.1 SEG Leader's Report

Richard Willing

Expedition Witjira, a major co-operation between **DEH**, **NPWS** and **SEG** was two years in the planning. This involved countless letters, telephone calls, emails and meetings, initially between Geoff Axford and me, later with the scientists and leaders of the various departments and SEG. I admire the dedication of those who put the programs into place. One or two recce trips took place, thankfully using aircraft rather than car, enabling quick trips. After considering various sites, a camp near the Ranger Station at Dalhousie looked to be the best, with electricity, protected cooking area, and space for tents, while being able to use the camp ground toilet and shower facilities. There was also the attraction of a daily swim in the main spring. Away from the scientific work were the ruins of the old Dalhousie homestead, fenced off and partly restored, giving some historical perspective to the expedition.

July was selected to fit in with other commitments and avoid the summer heat, while hoping for no interruption due to rains that can quickly isolate the area. The weather was typical winter outback with warm sunny days and cool nights. A full moon early in the camp was a bonus. Heavy cloud that appeared suddenly in the south on Tuesday 23rd preceded a dust storm and strong winds that damaged some tents. It was short-lived and calm weather resumed.

Transport. A convoy of 6 private 4wd vehicles with one trailer, plus one NPWS heavy truck and station wagon with trailer left the Adelaide Oval gates in steady rain at 7am on Saturday 12th July, meeting with another NPWS station wagon and trailer at Port Augusta, by which time the rain was far behind. Another private vehicle travelled independently from Clare to meet us at Coober Pedy. Another station wagon travelled from Adelaide on Saturday afternoon, and another from Roxby Downs to meet us at Dalhousie on Sunday. After being catered for by the Coober Pedy Lions Club and spending the night at their hall the convoy travelled to Dalhousie via Oodnadatta arriving late afternoon due to problems of flat tyres and broken windows. A similar convoy left Dalhousie on Friday 25th July at 9am, spent the night at Coober Pedy again, left at 8am. Parts of the convoy split off at Pt Augusta. The rest had an uneventful trip home and arrived at the Adelaide Oval gates at 6.30pm.

Groups. The scientific crews established their projects, assisted by six groups of four SEG participants. These groups rotated through most of the activities including cooking. Around the campfire each group gave a short presentation about their day's activities followed by discussions, yarns and occasional songs.

Catering. Trent Porter, quartermaster extraordinaire, once again excelled at providing not only large amounts of delicious food, but waterproof instructions for anyone cooking it. Some who denied any prior knowledge of cooking were pleasantly surprised at what they could achieve. Also some remarkable cooking talents became obvious. Gina cooked quantities of bread in camp ovens, to everybody's delight. Breakfast time was strictly on time so that field parties could depart on time. At the same time everybody cut their own lunch and took it with them. Drinking water had to be transported every few days from Three O'clock Creek, a few miles west. Firewood was collected well away from the camp area.

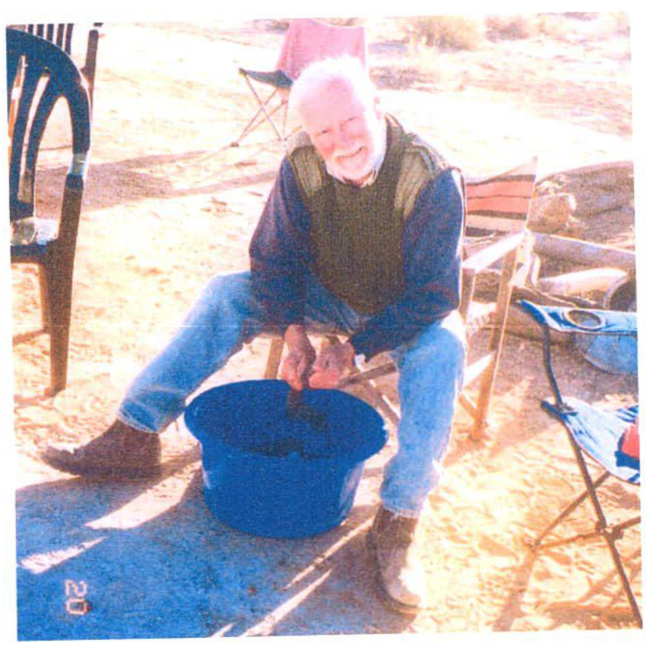
Daily program. Tribute is due to all the SEG volunteers and scientists, who were sometimes pushed to their limit because of the extensive scientific program. It often involved consecutive long days. Even the proposed day off in the middle saw many continuing to work away at jobs that needed doing. Fortunately interest in the scientific work mostly overcame objections about its quantity, fatigue and inability to do the washing.

Much of the first week was devoted to operations away from the camp, so groups were involved in the Kowari search, rare rodent trapping and setting up monitoring sites at Kingfisher and Banana springs. An evening slide show presented by Bruce and Travis highlighted how much the palms had advanced in thirty years. Alby's successful removal of a mother date palm and sucklings from the other side of the main spring was a cause for celebration and hopefully the start of more to come.

Much of the activity during the second week focussed on the main Dalhousie spring, sometimes intriguing people from the camping ground with groups knocking in droppers to form a grid, boatloads taking grid samples from the spring, and others on the bank sieving mud. During this week a couple of groups went beyond Purni Bore into the Simpson Desert to search for Marsupial Moles and previous exclosures. Four walkers took off on Tuesday heading south then west before being picked up on Thursday. During the week the plane arrived to do low level flights counting large feral animals. This included one or two SEG people who won a ballot for a seat.

Reunion. Witjira people with friends and family came from far and wide for a barbeque at the Fullarton Centre one Sunday three months later. Friendships were renewed, photographs inspected and hilarious moments relived.

Congratulations to everybody - SEG members, scientific and NPWS staff - for being so resilient, accommodating and hard working. It ensured the success of a combined operation whose importance will become even more obvious with time.



Richard at the Witjira laundromat

2.2 The Participants

The scientists and NPWS staff (19 people)

Geoff Axford	Scientific Leader, Regional ecologist, DEH
Dean Ah Chee	Senior Ranger, NPWS
Michaela Birrell	Senior wetlands officer, DEH
Jenny Bourne	Scientific officer
Rob Brandle	DEH
Travis Gotch	University of Adelaide
Scott Jenning	DEH
Dylan Koerner	Ranger
Kelli-Jo Kovac	WMC, Roxby Downs
Brendan Lay	Rangelands, DWLBC
Tom McIntosh	Ranger
John Maconochie	Rangelands, DWLBC
Denise Noack	University of Adelaide
Stuart Pilman	DEH
John Pitt	DEH
Lynette Queale	DEH
Bill Ryan	District Ranger
Robin Young	Ranger, pilot DEH
Alby Zepf	Ranger

The SEG team (27 members):

Richard Willing, SEG leader
Trent Porter, Catering and Logistics
Peter Bailey, Entomology
Eve Ayliffe
Corinne Border
Tony Border
Gina Breen
Heather Bryant
Kevin Burrett
Kate Burton
Anne Crawford
Margaret Evans
Rob Faulkner
Tim Greenhill
Bruce Gotch
Christopher Hall
Robyn Hann
Neville Hudson
Trevor Jones
John Love
Judy Mack
Jelena Nikolic
Graeme Oats
Andrew O'Connor
Andrea Roberts
Beth Schlotfeldt
Lorraine Woodcock.

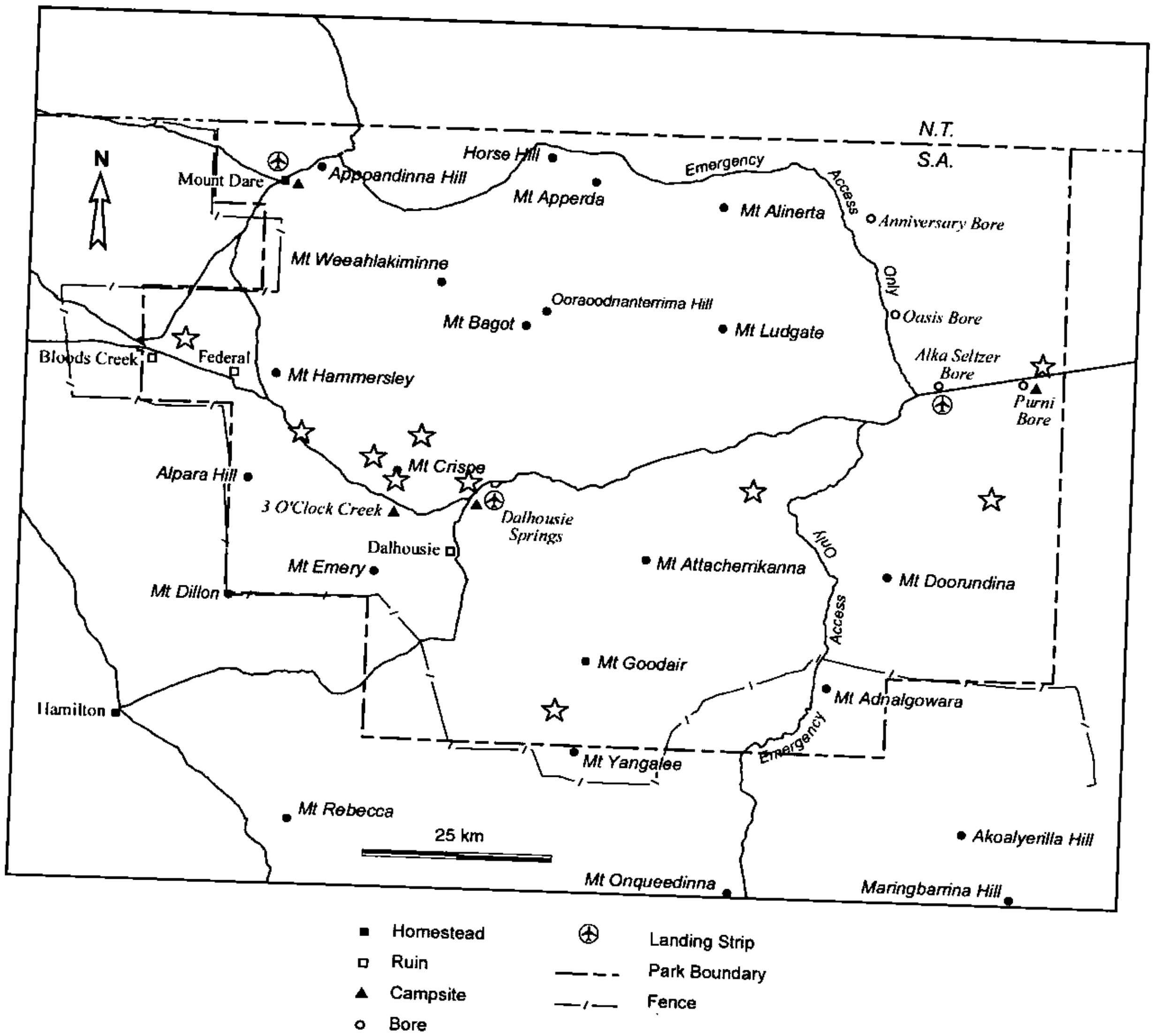
All the group

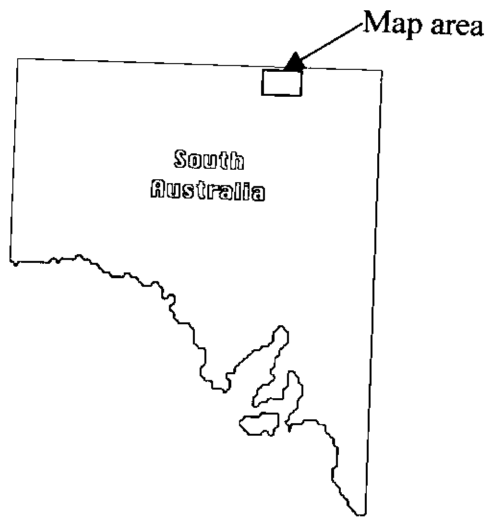
Photo by T Porter

2.3 The Study Sites

Witjira National Park, showing tracks, boundary, fence lines and other features.

Sites are marked with ☆





The Sites

Kingfisher Springs (group code DAA) is a group of 12 springs located in the north-east corner of the Dalhousie Complex. It consists of three large flowing springs, two low flowing springs, five seeping springs and two dry springs. The springs are ecologically diverse and contain a high proportion of the Dalhousie Complex's endemic species. They are also one of the complex's most significant springs in relation to Aboriginal culture. Kingfisher is thought to be one of the locations of the original date palm plantings by Essington Lewis and is now one of the most invaded and degraded spring groups to be affected by date palms.

One of the aims of the expedition was to compare a date palm (*Phoenix dactylifera*) infested environment with one free, or almost free of date palms. The Kingfisher complex (KF) was heavily infested, the Bananas complex (B1, B2) was almost free of palms. A range of types of vegetation was monitored – closed and open forest of date palms, Melaleuca forest (*M. glomerata*), and open shrubland of Acacia (*A. salicina*). These sites were used to compare vegetation, invertebrates, both aquatic and non-aquatic, vertebrates and physical properties of the water and environment. Mammals were trapped in the outflow regions of KF and B1 and B2, with 3 sites in each spring group. Bird surveys were conducted in the outflow regions of springs within the KF and B1, 2 spring groups. Bathymetry was also measured in 2 KF pools.

The main pool (Dalhousie Main Spring) was monitored for distribution of *Eleocharis geniculata*, vertebrates, both planned and opportunistic, birds, physical qualities of the water and the pool surrounds, baseline chemistry and bathymetry, and visitor impact on the local environment. Some opportunistic mammal trapping happened around the main pool.

There were sites at varying distances from the base camp.
Site DCC009 is a few kilometres west of Dalhousie Springs. It is an old vegetation survey site and exclosure which was re-fenced and re-surveyed.
Kowari searches were undertaken at sites 40k east, 60k east and 50k northwest of Dalhousie.
Track transects monitoring herbivore activity and Marsupial Moles were established at sites east of Purni Bore. Site PAT01 was the dune directly east of Purni Bore, PAT02 a further 100m, PAT03 a further 500m and PAT04 over 20km from Purni Bore. Vegetation was also monitored at these sites.
An established rare rodent site (CR03), west of Mt Crispe was monitored.
Buffel Grass infestations were monitored at 3 O'clock Creek at the foot of Mt Crispe, as well as Red Mulga Creek, west of the springs.
A photo-site was established west of Opossum waterhole on the Bloods Creek Bore road, due west of the base camp.
An old Biological Survey site was re-established near Memory Bore near the southern boundary of the Park with Macumba and Mt Sarah Pastoral runs.

Robin Young, Scott Jennings and John Pitt undertook an aerial survey of feral animals in sections of Witjira National Park. This was part of an ongoing program, so no results are available for this report.

Table of site names

Different expeditions over many years have labelled sites with a variety of names and numbers. This table explains the different names for sites to enable recognition and replication of work in the future.

SEGcode		GAB Spring ID	Colloquial	Zeidler,Ponder	Aboriginal
DCA001		DCA001	Main Pool	CA1	Irwanjira
DKF			Kingfisher Group		
DKF001		DAA002	Old Woman, Mother	AA02	Idnjundura
DKF001a		DAA001	Two boys1	AA01	
DKF002		DAA003	Two Boys 2	AA03	Urarra
DKF003		DAA005	Old Man	AA05	Ultjinga
DKF004		DAA006			
DKF005					
DBA			Witcherie Spring Group or Banannas		
DBA001	forest		B1		
DBA001	pool		B1		
DBA002			B2, Witcherie mound		
campsite					
DCC09		DCC009	Exclosure Spring	CC09	Kaputa Urpulja
spring photopoints					

CR03	Mt Crispe
ALI001	40k E of Dalhousie
ALI002	40k E of Dalhousie
ALI003	40k E of Dalhousie
ALI004	60k E of Dalhousie
FED001	NW Federal Yards
FED002	NW Federal Yards
PAT001	Purni Bore
PAT002	Purni Bore
PAT003	Purni Bore
PAT004	20k E of Purni Bore
Purnie Bore	1k E of Purni Bore
	9k E on French Line
	24k E of Purni Bore
Opossum Creek	
Memory Bore	
Red Mulga Creek	
3 O'clock Creek	
Bloods Creek Bore Rd	

Instructing the troops

Sorting out the day's findings

3 RESULTS

3.1 VEGETATION

3.1.1 MAPPING DATE PALMS AT KINGFISHER SPRINGS

Denise Noack

1. ECOLOGY

The Date Palm (*Phoenix dactylifera*) is a large dioecious palm (separate male and female plants) which reaches 30 m in height. The palm has a thick trunk covered with persistent leaf bases. Suckers occur at the base of the trees. The leaves are pinnate, averaging 3 to 6 m in length and can form a crown of more than 100 leaves. A new leaf is produced approximately each month. After reaching sexual maturity from three to five years the female plant blossoms once a year. An average of a dozen inflorescences is borne on a single tree. The date fruit is cylindrical in shape, measures about 5 cm in length and 2 cm in width and contains a single hard seed. The fruits require some six months to ripen. Annual fruit yield per adult tree can vary from as little as 5 kg to more than 100 kg. Dates palms can live for over 100 years.

Date Palms produce a prolific amount of fruit and seeds and at Dalhousie Springs the Dingo appears to be an important dispersal agent for the seeds. The Dingo is probably responsible for the spread of dates between springs. The seeds may also be transported within springs in the flowing outflow channels. The role of birds in the dispersal of date seeds is unclear. Establishment of the Date Palms from seed is dependent on suitable conditions to enable germination of the seeds and to sustain subsequent establishment and growth. Observations of seedling Date Palms emerging from Dingo scats at the Springs indicates that the dates require only minimal moisture for germination. Date Palms also reproduce vegetatively and an increase of the clumps from the growth of the offshoots or basal suckers is observed in many of the palms at Dalhousie Springs.

2. DISTRIBUTION AND STATUS AT DALHOUSIE SPRINGS

Date Palms were planted at the Springs in 1899. In the 100 years since the original plantings Date Palms have become established at 23 springs in the Spring complex. Date Palms have been recorded in all of the spring components; mound vents and pool, mounds and mound slopes, outflow channels and outflow tails. The greatest density of Date Palms at Dalhousie Springs has been recorded at the Kingfisher Spring group where they are present at all springs in the group.

3. IMPACTS

Date infestations represent a considerable threat to biodiversity conservation at Dalhousie Springs. Over time Date Palms form dense monotypic stands impacting upon both the flora and fauna of the springs.

Date Palms:

- have a dense canopy that reduces primary productivity in the springs that may lead to a reduction in populations of endemic aquatic fauna species;
- suppress the growth of native plant species and may lead to the decline in the distribution of some species; and
- have high water requirements that could result in a reduction in flow of some springs.

4. MAPPING RATIONALE

Information on the distribution, abundance, size, sex and habitat preferences of Date Palms is necessary to inform future management and control of Date Palms at Dalhousie Springs.

5. METHODS

For each Date Palm or clump of Date Palms mapping involved the recording of:
a GPS location; number of adults/juveniles/offshoots; height class; sex; water regime.

6. RESULTS

Date Palms Recorded at Kingfisher Springs.

SPRING	TOTAL ADULT PLANTS	TOTAL JUVENILE PLANTS	TOTAL PLANTS	ADULT OFF SHOOTS	JUVENILE OFF SHOOTS	TOTAL OFF SHOOTS	TOTAL PLANTS AND OFF SHOOTS
DKF001	44	29	73	199	23	222	295
DKF002	37	18	55	141	29	170	225
DKF003	34	24	58	182	1	183	241
DKF004	23	1	24	81	0	81	105
DKF005	3	1	4	36	7	43	47
TOTAL	***141***	***73***	***214***	***639***	***60***	***699***	***913***

The distribution of Date Palms at Kingfisher Springs will be mapped using high resolution digital imagery.

7. DISCUSSION

During the SEG expedition the distribution, abundance and characteristics of the Date Palms were recorded at Kingfisher Springs. This information is critical for future management of the Date Palms.

The effort required to remove even small palms is considerable. Future management of the Date Palms at Dalhousie Springs requires detailed knowledge of the distribution, abundance and life-stage of Date Palms in the spring complex. This information can be used to determine the resources required to control the Date Palms at Dalhousie Springs.

Eucalyptus coolabah ssp. _arida_ (Coolabah) now only occurs at one spring in the entire Dalhousie Springs complex (Spring DKF003). On the northern side of the outflow channel of DKF003 it is evident that the Date Palms are crowding out the Coolabahs and there is no evidence of recruitment of Coolabahs at this location.

Date Palms now dominate the outflow channel of Spring DKF002. There is evidence here of the Date Palms suppressing the recruitment of _Melaleuca glomerata_ (Desert Paper-Bark) and also resulting in the death of some adult trees along this outflow channel.

3.1.2 MONITORING OF *ELEOCHARIS GENICULATA* AT DALHOUSIE SPRINGS

Denise Noack

1. ECOLOGY

Eleocharis geniculata is a small spike-rush that grows to 40 cm high. The species is not stoloniferous and appears to be a perennial at the Springs, although it has been reported to be annual, biennial or perennial. It is thought that the species probably flowers in most months.

2. DISTRIBUTION AND STATUS

Eleocharis geniculata is found in warm parts of the world, and in Australia it is predominantly found north of 20° latitude in Western Australia, Northern Territory and Queensland. As well as being the only population in South Australia, the population of *E. geniculata* at Dalhousie Springs is the only recently observed occurrence of the species in central Australia. The nearest recently recorded population is 850 km northeast of Dalhousie Springs in western Queensland. The population of *E. geniculata* at Dalhousie Springs is likely to be a relict from previous wetter times in central Australia and therefore is of biogeographical interest.

Eleocharis geniculata is listed under Schedule 9 of the *National Park and Wildlife Act 1978* (SA) as rare in South Australia. In South Australia it only occurs at Dalhousie Springs where it has been recorded at four springs. The largest population of *E. geniculata* recorded at Dalhousie Springs is around the edge of the main spring, primarily at the western end of the pool on both southern and northern sides.

3. TOURIST IMPACTS

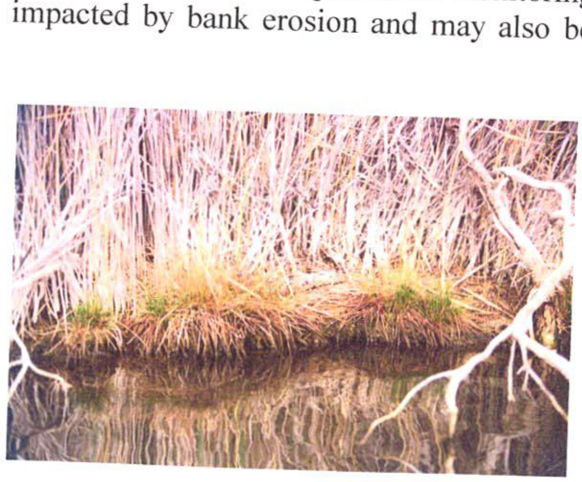
Prior to the redesign of the Dalhousie campground, which moved camping back from the edge of the main spring pool, recruitment of *E. geniculata* appeared to be being impacted by tourist activities. In particular, the southern edge of the pool was accessed by campers to obtain water and for entry to the pool. The vegetation of the southern side of the spring was being trampled and degraded by tourists taking advantage of unrestricted access to the pool. The adjacent compacted campground probably also contributed to increased runoff to the spring. Only five clumps of *E. geniculata* were recorded on the southern edge of the pool in July 1995.

4. MONITORING RATIONALE

Although the redesign of the campground effectively stopped uncontrolled access to the pool and ameliorated problems of increased, and potentially contaminated, runoff to the spring, the main spring pool is still the focus for visitor swimming at Dalhousie Springs. An estimated 15,000 tourists visit Dalhousie Springs annually and the majority of visitors would swim in the pool during their stay. Wave action from visitors diving into the pool at the two pool access points still results in bank erosion along the southern edge of the pool. As *E. geniculata* grows immediately along the bank of the pool it was considered to be a useful species for monitoring tourist impacts at the springs. It is likely to be impacted by bank erosion and may also be sensitive to changes in water quality.

5. MONITORING METHODS

Detailed baseline mapping of *E. geniculata* along the southern and eastern banks of the main spring pool was undertaken in July 2003 during the Witjira SEG Expedition. Basic information was also collected on morphology, phenology and condition of individual plants and clumps of *E. geniculata* along the pool bank.



Eleocharis geniculata **growing along the southern side of the main pool adjacent to *Phragmites* sp.**

6. RESULTS

Southern Bank of Pool

Along the southern bank of the pool, *E. geniculata* was found growing adjacent to the pool predominantly under a *Melaleuca glomerata* very low open forest primarily with an understorey of dense *Phragmites* sp. Between the two access ladders to the pool *E. geniculata* was also growing adjacent to a sedgeland of *Cyperus gymnocaulos* with *Sporobolus virginicus*. A total of 27 plants or clumps of *E. geniculata* were recorded along the southern bank of the main pool, including 155 seedling plants. Many of the plants had flowering heads and mature seeds were present. It was also evident that seeds had also been recently shed.

Eastern Bank of Pool

A further two clumps of *E. geniculata* were located at the eastern end of the pool. These clumps were also located under a *Melaleuca glomerata* very low open forest with an understorey of dense *Phragmites* sp. These plants had flowering heads with mature seeds.

Northern Bank of Pool

Only one clump of *E. geniculata* was surveyed on the northern side of the pool, at the eastern end near the beginning of the outflow channel. This clump was growing under a *Melaleuca glomerata* very low open forest with an understorey of dense *Sporobolus virginicus*. These plants had flowering heads with mature seeds. Apart from this clump, no *E. geniculata* was recorded at the eastern end on the northern side of the pool. At the western end of the pool along the northern bank *E. geniculata* extends from the central shallow part of the pool to within 5 m of the inflow at the northwestern end of the pool. Plants of *E. geniculata* along this portion of the pool were not individually surveyed but were observed with flowering heads and mature seeds. A *Melaleuca glomerata* very low open forest extends along the edge of this part of the pool.

Western Bank of the Pool

No *E. geniculata* was recorded along this side of the pool. At this end of the pool there is no defined edge to the spring, instead there is a mud bank that extends for several metres. The physical characteristics of this edge of the pool may influence the species ability to colonise. The distribution of *E. geniculata* at the spring is still to be mapped.

Distribution of *Eleocharis geniculata* at Main Pool.

	Clumps Recorded	Juveniles Recorded	Comments
Southern Bank	27	155	Increased from 5 clumps in July 1995.
Eastern Bank	2	0	Not present in July 1995.
Northern Bank	1*	0*	Abundant at western end of pool on northern side of pool.
Western Bank	0	0	No defined bank at western end of pool.
	30	155	

* Population at western end of pool not surveyed in July 2003.

7. DISCUSSION

Surveying during the SEG expedition has recorded the distribution, abundance and characteristics of *E. geniculata* at the main spring. This information will provide the basis for future monitoring of the recruitment and regeneration of the species, which is the only population of *E. geniculata* in South Australia and central Australia. It is evident that tourist management at Dalhousie Springs by NPWSA, in particular the redesign of the campground, has resulted in an increase in abundance of *E. geniculata* at the main spring.

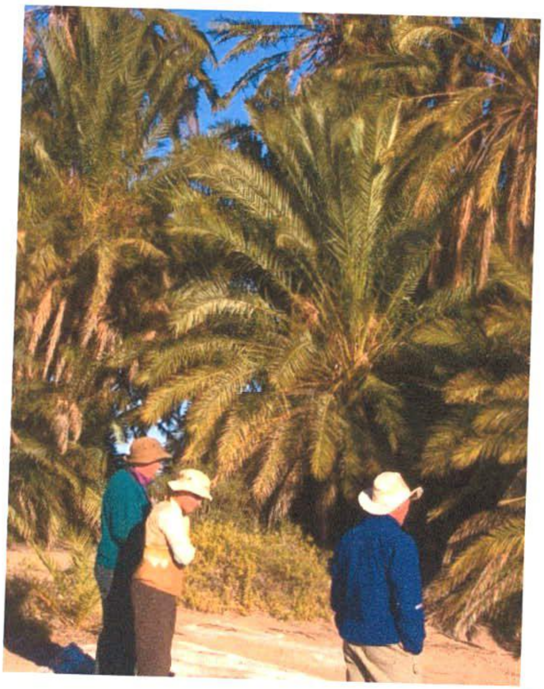
3.1.3 VEGETATION AT VERTEBRATE MONITORING SITES

The vertebrate monitoring sites around Kingfisher and Banana Springs were surveyed for vegetation types. They covered date palm infested sites, *Melaleuca glomerulata* forest and *Acacia salicina* shrubland. A summary is included (appendix 5.1).

Vegetation surveys were also done at the remote sites involved with mammal surveys.

A list of the vegetation species identifications has been confirmed and lodged with the Adelaide Herbarium (appendix 5.2). These were from surveys of the fauna sites and opportunistic collections during the survey.

Baumea juncea is a new record for Dalhousie Springs.



An indication of the height and density of the feral palms.

Photo G. Oats

A more natural mix of native vegetation

Photo G. Oats

Some of the local colour

Photos G. Oats

Further down the overflow, as the vegetation reverts back to desert form.

Phragmites makes great shelter.

3.2 INVERTEBRATES AND WATER QUALITY

3.2.1 INVERTEBRATE SURVEY

Travis Gotch

Background

Invertebrates occupy nearly every habitat niche on the planet. Because of this any survey of invertebrate biodiversity requires a variety of collection methodologies to be used to ensure a reasonable cross section of specimens is collected. In July 2003 we undertook an extensive invertebrate survey of springs in the Kingfisher Group at Dalhousie Springs. The survey consisted of a number of transects located across the outflow channels and several transects located across the vent pools. Methods included cutting transects through the phragmites, sampling of the water and the benthic layer. The distribution of transects was designed to maximise the diversity of habitats within the spring and their associated tails.

Figure 2: Transect and sample point locations at Kingfisher Springs, Dalhousie, South Australia. A Old Man (Ultjinga), B Two Boys 1 (Idnjundura 1), C Two Boys 2, D Old Woman

Aims

The aims of the invertebrate survey were to provide some baseline data on the faunal component of the Kingfisher Spring Group at Dalhousie, to trial several methods of data collection and to enable optimisation of future sampling effort. The data collected during the expedition also represents the most detailed study undertaken of the non-aquatic fauna ever collected at Dalhousie.

Site Selection

Each quadrat had its spatial location determined using hand held GPS equipment. During the survey the springs were assigned a code to differentiate them from each other, the relationship between the survey codes and other naming conventions are shown in table 1. Each transect was then assigned a letter from A to E (transect code) and each quadrat within the transect was assigned a number (quadrat code) 1 to 5. Thus the code DKF2B3 can be identified as **D** (Dalhousie Complex) – **KF** (Kingfisher group) – **2** (two boys spring) – **B** (transect B) – **3** (quadrat 3). This naming method ensured each sample could be spatially tied to a location on the spring. At each quadrat fauna samples were collected (see below) along with specific physical data (refer to Birrell, this volume).

Methods

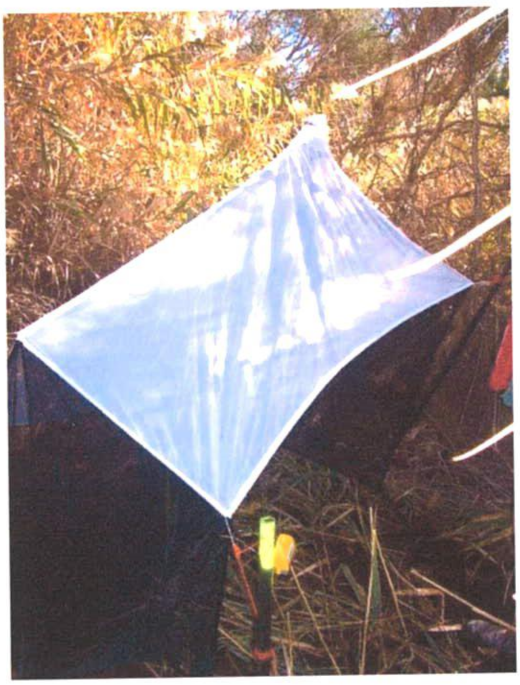
Four main methods were employed to look at the biodiversity of invertebrate fauna within the springs. They are,

- pitfall traps
- pan traps
- malaise traps
- dredge/sediment scoop

Pitfall Traps
To capture terrestrial and surface dwelling aquatics we used 75mm diameter plastic pitfall traps. Each trap contained a collecting medium of 70% ethanol and was inserted into the ground so that there was no protruding lip around the edge. One trap was placed at each quadrat and was left open for four days.

Pan Traps
Many flying insects, particularly hymenoptera are attracted to bright yellow colours. A standard methodology for capturing these insects is to use either yellow sticky traps or a yellow pan trap. The pan trap was half filled with water and a drop of detergent added to break the surface tension. The pan traps were left open for four days.

Malaise trap Photo G. Oats



Malaise Traps
Malaise traps are a form of flight intercept trap. Insects fly into the barriers of the tent and then move up into a collection bottle where they are preserved in a 70% ethanol solution. The malaise traps were placed near the centre of each transect and were left active for four days.

Sediment Sampling
Sediment samples were collected using one of two techniques depending on the depth of the water. If the water was sufficiently shallow then sediment was sampled using a constant volume scoop (stainless steel trowel) and placed in a sample jar. If the water depth was too great then an Ekmann-Burge dredge trap was used. This is a mechanical jawed grab trap that is lowered to the bottom by a rope and then triggered to grab a sample of the sediment. The samples were then deposited into sample jars to await processing or were processed on site.

Fish Numbers
As a measure of invertebrate density fish numbers were counted near and away from date palm roots.

Results
To date the identification of all samples is yet to be completed and correspondingly much of the analysis is yet to take place. Only the malaise trap data has been fully identified and of that data set only a comparison between the old man and old woman sites has been analysed. Old Man spring was selected as an example of a spring that has been badly degraded by the invasion from date palms. Old Woman by comparison has only been lightly impacted by date palms. The available raw data can be found in appendix 5.3.

Old Man – Old Woman Malaise Trap Data
The specimens were identified down to the finest taxonomic resolution available. Typically the samples were identified to order level except for the Diptera (true flies) which were identified to family level. The relative abundance of each taxonomic unit was determined by direct counting from the samples (figure 3). A total of 33 taxonomic units are present at Old Woman (the undisturbed site) while only 15 taxonomic units were present at the disturbed Old Man site.

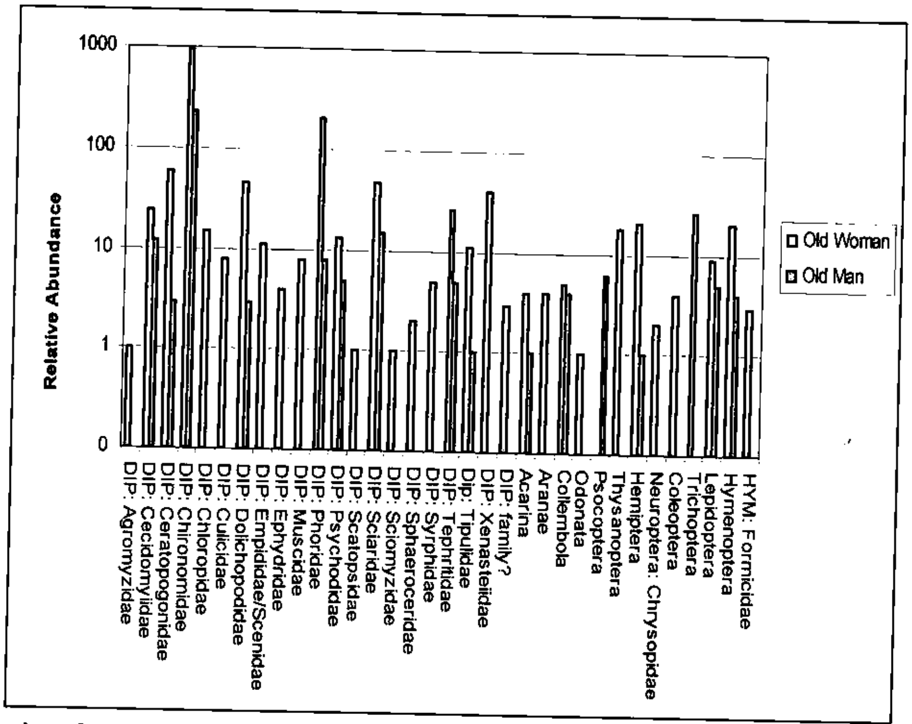


Figure 3: Relative abundance of invertebrates from malaise traps in two different spring habitats on a logarithmic scale. Old Woman spring has minimal disturbance from date palms while Old Man spring is heavily impacted by date palms.

A quick overview of figure 2 shows clearly the dominance of Diptera and in particular Chironomids in the sample. It should be noted that this is not a true reflection of the total invertebrate diversity but is an artefact of the methodology used. What the data accurately show is the variation in species diversity and abundance between undisturbed sites and disturbed sites. Shannon-Weiner estimates of species heterogeneity show significantly higher species heterogeneity in Old Woman springs compared to Old Man springs (Old Woman H` 1.743 ± 0.032; Old Man H` 1.119 ± 0.04). The Shannon-Weiner Index was chosen over Simpson's Index as it weights rare species more than common species. This is appropriate in this data set due to the high abundances of Chironomids relative to other taxonomic units.

The traps showed a greater diversity of invertebrates in Melaleucas than in date palm areas which may explain why more fish fed near Melaleuca roots than date palm roots.

Discussion
Data from Malaise traps contrasting the invertebrate diversity in date palm impacted springs over non date palm impacted springs show clearly the inhibiting effect of date palms on species diversity. The data show that even in taxonomic groups that are present in both habitats date palms are having a serious effect on relative abundances. Only one group show a positive benefit from date palms, the Psocoptera or book lice. This group typically feed on fungi and mould and can be found living in under bark or leaf litter associated with trees. Why this group has higher abundances in the date palm affected sites is as yet unknown, it may be a result of suppression of predators/parasites of the psocopids or just simply sampling error. Analysis of the remaining samples may yield clearer results.

3.2.2 MAIN POOL BATHYMETRY
Travis Gotch

Background
The main pool at Dalhousie (DCA001) is the largest single discharging spring in the Dalhousie Complex, discharging in excess of 11 mega-litres per day (ML/day) (Boucaut *et al.* 1986). It also contains the highest endemic diversity of any spring in South Australia (Zeidler & Ponder 1989). The pool itself is approximately 140m in length and 50m wide at its widest point. It consists of two vents within the pool itself and is fed by four other vents. The majority of vent pools at Dalhousie exhibit deep silt beds that support a number of species. The main pool at Dalhousie has lost most of its finer sediments due to disturbance by swimmers. This is because the main pool is the principal focus of all tourists visiting the park. Swimming is permitted in the main pool and has been a common occurrence since Europeans first discovered the springs. Pre 1990 the two internal vents were separated by a shallow silt bar and island that restricted the mixing of the two pools. After a second entry point to the pool was constructed into the western pool this silt bar has been progressively eroded until it is now non-existent. This erosion is a direct result of visitor impact and it is desperately in need of monitoring and management to ensure further degradation does not occur.

Aims
The main aim of this survey was to map the bathymetry of the main pool so that future impacts of visitors on the benthic environment can be monitored. In addition to this data was collected to enable the changes in distribution and abundance of benthic invertebrates as a result of substrate loss to be assessed and to examine the changes in turbidity during periods of peak visitor (winter and spring) activity to periods of low visitor activity (summer and autumn).

Methods
Main Pool Bathymetry and Turbidity

The bathymetry of the main pool was mapped by creating a grid using a baseline and graduated ropes. At every five metre interval a rope was strung across the main pool and a boat was pulled along it. Depth and turbidity readings were taken every metre using a secchi plate attached to a tape measure. Depth readings were taken when the plate touched the bottom and turbidity was recorded as the depth of the secchi plate disappearing from site. Due to time constraints a number of deviations from this methodology were implemented. As the sampling progressed the interval between transects was extended from five metres to ten metres and for the last five transects data was collected every two metres. A total of 700 points were sampled within the main pool.

Main Pool Fauna Survey

On every third transect three Ekmann-Burge grab trap samples were collected from the substrate. The methodology is the same as that described in the invertebrate survey section above. The samples were wet sieved on site and the samples were then fixed in 70% ethanol for storage.

Results
Main Pool Bathymetry and Turbidity

The main pool bathymetry data was entered into a spreadsheet and exported into Manifold v5.50 (CDA International Ltd.) GIS and mapping software. The file was then plotted and maps of the bathymetry and turbidity profile created (fig 4 & 5).

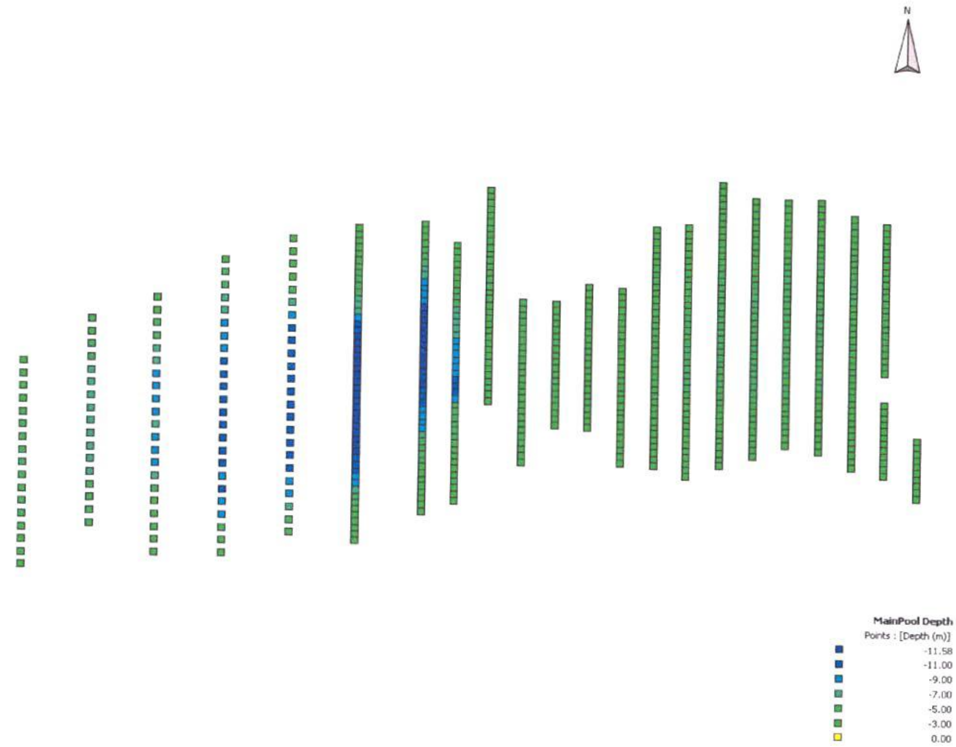


Figure 4: Bathymetry of the Dalhousie Main Pool (DCA001)

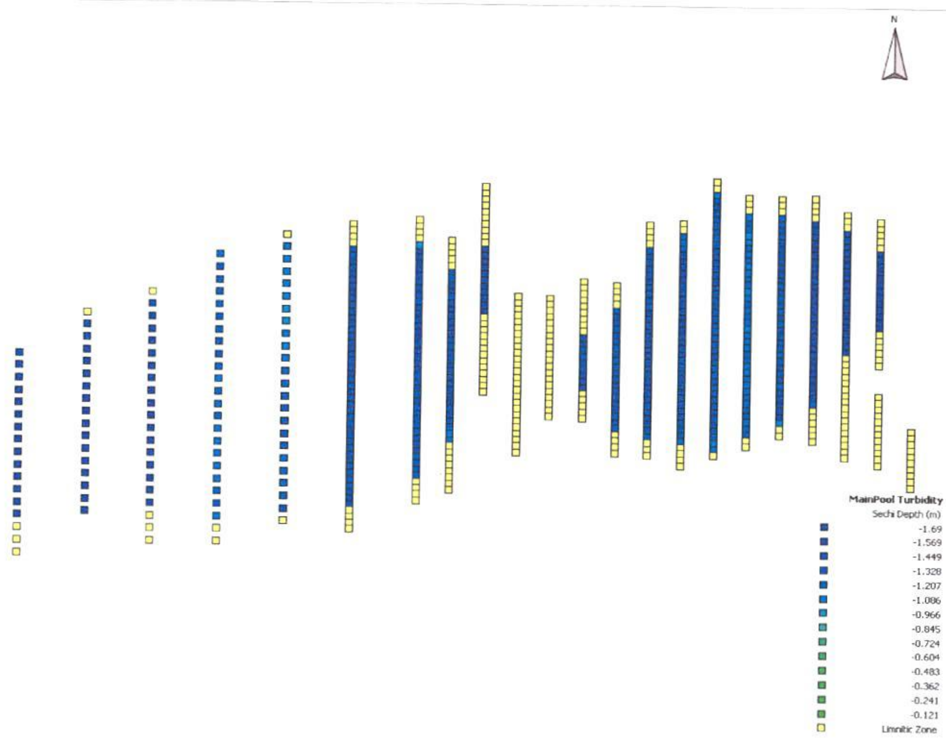


Figure 5: Secchi depth readings of the Dalhousie Main Pool (DCA001)

The two vents on the map can be seen clearly seen in figure 4, the westernmost vent is the deepest with a maximum depth of 13.8m while the eastern vent was measured at 10.9m. The shallow necked area in between the two vents is all that remains of the silt bar and island.

Main Pool secchi depth measurements (fig. 5) show a mean secchi depth of -1.346m (± 0.018m, N=479) below the water surface. Examination of the data also shows a trend for higher turbidity levels around the shallower regions and for an increase in turbidity in the down stream end (east) of the pool.

Main Pool Fauna Survey

The data collected from the grab traps has yet to be fully sorted, however one obvious trend is the lack of living hydrobiid snails in the deeper sections of the pool (> 1m). All living hydrobiids were found only on the margins of the pool. In the deeper zones only shells were found.

Discussion

The turbidity readings of the main pool show an increase in levels as you move to the east. This can be explained by the high visitor loads experienced in this part of the spring and due to the water flow characteristics of the pool. Water enters from the two local vents and from the outflow channels of other springs on the western end of the main pool. The clearest water is located at the western end, this area is characterised by higher temperatures and lower visitor numbers compared to the eastern end. It is proposed that the main pool turbidity is to be sampled in the summer of 2005/2006. The data collected in this survey should give an indication of the impact of visitors on the turbidity of the pool and the potential for sediment loss. The bathymetric map that we have generated lacks detail and a more precise contour map is to be developed. This map will provide the basis for ongoing monitoring of the sediment loss from the main pool.

Conclusions

Detailed above is the status of the work to date arising from the SEG Witjira 2003 expedition. It is hoped that the outstanding data will be sorted and analysed in the not to distant future. Further work at Dalhousie has already commenced to better understand the complexity of the ecosystems present and the data collected during the survey is underpinning a number of important management decisions recently undertaken within the spring complex.

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3.2.3 PHYSICAL PROPERTIES

Michaela Birrell

Major Objective

To measure changes in the physical characteristics of springs in the Kingfisher complex, targeting those attributes that may change as a result of Date Palm removal.

Methods

Three springs were selected for the monitoring program and field data was collected at these sites from 14 to 21 July 2003. At the 'Mother' and 'Old Man' springs, data was collected from both the spring pools and the outflow channels and at the 'Two Boys' spring data was collected from the pool only. Table 1 summarises the labelling system and locations of monitoring sites at each of the springs.

Table 1. Labelling system and location of sampling sites at the Old Man, Mother and Two Boys springs

Spring code	Labels for sampling locations (P = pool & OC = outflow channel)		Easting	Northing
DKF 001*	Mother	Northern edge (P)	551853	7079190
		Southern edge (P)	551826	7079149
		Eastern edge (P)	551865	7079152
		Western edge (P)	551800	7079179
		Centre (P)		
		Weir (OC)	551937	7079252
		Downstream of weir (OC)	551887	7079542
DKF 003	Old Man	Northern edge (P)	551867	7078789
		Southern edge (P)	551857	7078789
		Malaise trap (OC)		
DKF 001*	Two Boys	Northern edge (P)	551856	7078950
		Southern edge (P)	551862	7078930
		Eastern edge (P)	551867	7078939
		Western edge (P)	551847	7078943
		Centre (P)	551860	7078943

* *the tail of the Two Boys spring flows into the pool of the Mother spring and due to this connectivity they have the same spring code.*

Conductivity and water temperature were measured using a Hanna 9635 Multi-Range Conductivity/Total Dissolved Solids meter. Dissolved oxygen was measured using a Hanna 9142 Dissolved Oxygen meter. pH was measured using a Hanna 9025 pH meter. Turbidity was measured using a Hanna 93703 Turbidity meter. Water chemistry variables were measured at 9.00, 12.00 and 16.00 hours for a minimum of two days. All measurements at the Mother, Old Man and Two Boys springs were taken within 30 centimetres of the surface of the water.

Preliminary Results

Data analysis for the monitoring of physical properties is still in progress. Comparison of water chemistry data using averages for the three springs pools has revealed that dissolved oxygen in the water was 69.7% at the Mother pool, 53.7% at the Two Boys pool and 9.6% at the Old Man pool (Table 2). Average measurements for turbidity, pH, conductivity and water temperature in the three spring pools are also presented in Table 2.

Table 2 Water chemistry for the Mother, Old Man and Two Boys pools (using averages and indicating the number of samples for each attribute)

Pool	Mean water temperature (°C)		Dissolved Oxygen (%)		Conductivity (μs)		pH		Turbidity (NTU)	
Mother DKF001	33.3	*n*=29	69.7	*n*=28	1305.5	*n*=29	7.6	*n*=29	0.9	*n*=22
Old Man DKF003	32.7	*n*=8	9.6	*n*=7	1312.6	*n*=8	7.1	*n*=8	1.6	*n*=8
Two Boys DKF002	34.2	*n*=30	53.7	*n*=30	1302.0	*n*=30	7.4	*n*=30	2.0	*n*=30

Preliminary Discussion

Dissolved oxygen was significantly depleted at the Old Man pool, which is smaller than the other two spring pools, and the shading effect from date palms is much greater.

Turbidity was similar in the Old Man and Two Boys pools, but significantly lower in the Mother pool.

Conductivity and mean water temperature were similar in all of the spring pools despite differences in size and surrounding vegetation.

Observations from data that is yet to be fully analysed

At the Two Boys spring, shading over the pool was greatest on the northern side, with stands of date palms, phragmites and melaleucas creating darker microclimates. However, the shading appeared to have no effect on water temperature, dissolved oxygen, pH, turbidity and conductivity. Similarly, there appears to be no significant difference in water chemistry under date palms and phragmites in the Old Man pool.

Eve setting pan traps

Desert water sports!

Michaela testing the waters

Is this work or play?

Photos G. Oats

3.3 VERTEBRATES

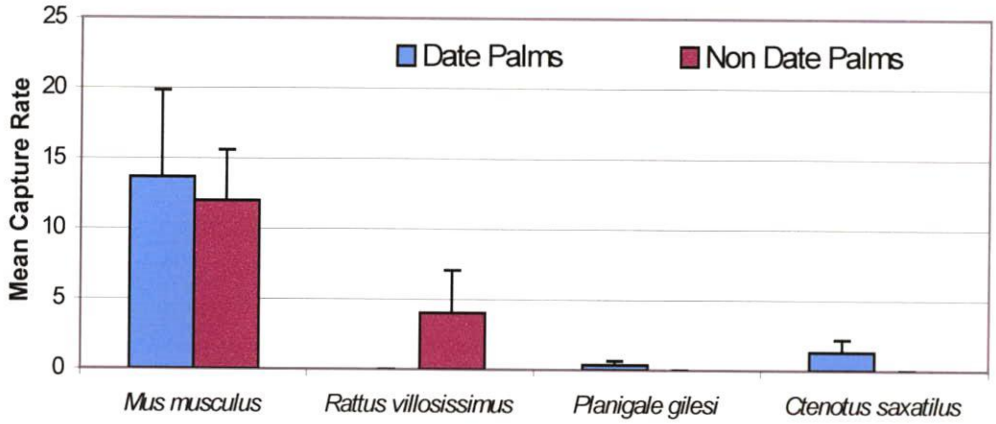
3.3.1 COMPARATIVE VERTEBRATE STUDY

Kelli-Jo Kovac

Mammal trapping was conducted in the outflow regions of springs within the Kingfisher and Banana spring groups. The aim of the trapping was to compare occurrence of mammals between springs which contained a high degree of date palm infestation (Kingfisher) and springs that were free, or almost, of date palms (Bananas). Some opportunistic trapping was also conducted around the main pool.

Trapping was conducted at three sites in both spring groups. Trapping consisted of trap lines of 15 or 30 Elliott traps that were operated for four nights. Four species of animals were recorded during the session including 3 mammals and 1 reptile. Initial results suggest that the long-haired rat, (*Rattus villosisimus*), preferred springs with date palms, which is likely to be related to the increase in available food.

Table 1: Mean capture rates of mammals and reptiles in springs with date palms and springs without date palms.



Mammal trapping was conducted in the outflow regions of springs within the Kingfisher and Banana spring groups and also at the main pond. The aim of the trapping was to compare mammals between springs which contained a high degree of date palm infestation (Kingfisher) and springs that were free, or almost, of date palms (Bananas and the lower part of the main pond).

Trapping was conducted at three sites in the spring groups and two at the main pond. Trapping consisted of trap lines of 15 or 30 Elliott traps that were operated for four nights. Four species of animals were captured during trapping including 3 mammals and 1 reptile. More native mammals were found at Kingfisher and the main pond, and only one at Banana. The lizard, *Ctenotus saxatilis,* was found at the main pool and at Banana.

	DCA 001	DKF 001	DKF 002	DKA 003	DKF 004	DBA001 pool	DBA001 forest	DBA002
M. musculus	9		14	18	5	23	2	16
R.villosissimus	3		10	2				
P.gilesi	1					1		
C.saxatilis	7					3		1

3.3.2 BIRD SURVEYS AT DALHOUSIE SPRINGS
Kelli-Jo Kovac

Bird surveys were conducted in the outflow regions of springs within the Kingfisher and Banana spring groups. The aim of the surveys was to compare birds between springs with a high degree of date palm infestation (Kingfisher) with springs that were free, or almost, of date palms (Bananas).

Surveys for 20 minutes were conducted at three sites in both spring groups. Time constraints during the survey resulted in low replication, making results hard to interpret. A total of 17 bird species were observed during the surveys. Of particular note was the presence of a number of Rufous Night Herons (*Nycticorax caledonicus*) that were observed opportunistically roosting in date palms in the Kingfisher spring group.

Among those sighted were: Little Crow (*Corvus bennetti*), Australian Raven (*Corvus coronoides*), Welcome Swallow (*Hirundo neoxena*), Bustard (*Ardiotis australis*), Black Kite (*Milvus migrans*), Wedge-tailed Eagle (*Aquila audax*), Rufous Night Heron (*Nycticorax caledonicus*), Singing Honeyeater (*Lichenostomus virescens*), Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*), Zebra Finch (*Poephila guttata*), Variegated Wren (*Malurus lamberti*), Crested Pigeon (*Ocyphaps lophotes*), Galah (*Cacatua roseicapilla*), Black Duck (*Anas superciliosa*), Pink-eared Duck (*Malacorhynchus membranaceus*), Australian Grebe (*Podiceps ruficollis*).

Opportunistic surveys were also made around the main pool. Mist nets were operated over several nights adjacent to the Rangers Hut. Captures included a Tawny Frogmouth (*Podargus strigoides*).

Photo D Noack

**A Tawny Frogmouth (*Podargus strigoides*) caught in a mist net.
Once released, it kept an eye on the camp for the rest of the evening**

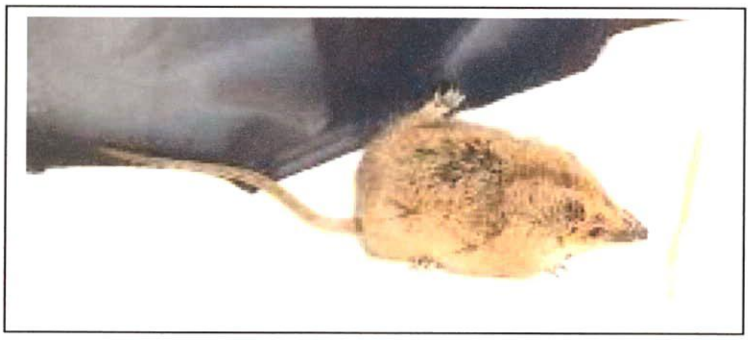
3.3.3 MOUNT CRISPE RARE RODENT SURVEY
Kelli-Jo Kovac

The Mt Crispe rare rodent site, CR03, was trapped during July 2003 as part of the work plan. The site is located approximately 25km from the Ranger Station at Dalhousie Springs. Trapping consisted of 19 pitfall traps and 200 Elliot traps that were operated for four nights. Photopoints and vegetation surveys were also conducted at the site.

Four mammal and one reptile species were recorded during the trapping session. On the second night an adult female Plains Rat (*Pseudomys australis*) weighing 45g was captured. This animal was fur clipped and released on site. This is the third record of *P. australis* at the site in seven trapping sessions. The first individual was recorded in August 1992, followed by a second individual in August 1997.

Table 2: Trap results for mammals and reptiles at the rare rodent site CR03, July 2003. Number of same session recaptures shown in parentheses.

Common Name	Scientific Name	Total
Plains rat	*Pseudomys australis*	1
Stripe-faced dunnart	*Sminthopsis macroura*	12 (3)
Forrest's mouse	*Leggadina forresti*	5
Giles' planigale	*Planigale gilesi*	2
Grey's skink	*Menetia greyii*	1



Giles' planigale (*Planigale gilesi*)

Photos G. Oats

Fat-tailed Dunnart (*Sminthopsis crassicaudata*) caught during Kowari search.

3.3.4 KOWARI SEARCH
Rob Brandle and Stuart Pilman

The Kowari (*Dasycercus byrnei*) was once known as Byrne's Crest-tailed Marsupial Rat after P.M. Byrne who was the first European to collect this species whilst he was at the telegraph station at Charlotte Waters (about 80km NW of Dalhousie Springs) in 1895. Several animals were collected and passed on to members of the Horne Scientific Expedition that passed through the area at the time. The species was next recorded from the eastern side of Lake Eyre near Cooper Creek in 1906 and then not until 1957 in south-western Queensland. This species now appears to be extinct from its two earliest collection sites, though it can still be reliably found in north-eastern South Australia and south western Queensland where it is rated as being vulnerable to extinction.

This current attempt to find this species in Witjira National Park, with the assistance of SEG, follows an aerial reconnaissance that identified the most suitable habitat for the species on the western side of Lake Eyre.

Five Elliot trap transects, using 100 traps per 10km transect, were set to attempt to detect Kowari on the most likely habitat types on the western side of Lake Eyre. Three lines were set 40km east of Dalhousie Springs in a basin between breakaway ranges that supported gibber pavement flats surrounding a substantial swamp. The gibber pavement supported small islands or mounds of consolidated sand that are typical of the country inhabited by Kowaris in NE South Australia. These areas appear to be important shelter sites as they support the majority of Kowari burrows. One line was set further east in similar though less extensive gibber pavement swales 60km east of Dalhousie Springs into the beginning of the Simpson Desert. Two lines of two hundred traps (10km per transect) were set in an area north and west of Federal Yards 50 km NW of Dalhousie Springs. This area had the smallest area of 'typical' Kowari habitat, having generally more sand cover and a well established cover of low shrubs (saltbush).

No Kowaris were captured and no signs of Kowari were noted (burrows, tracks, droppings). Three species of native small mammal were captured (see table for trapping efforts and capture rates). These were: the solitary Forrest Mouse (*Leggadina forresti*), the Fat-tailed Dunnart (*Sminthopsis crassicaudata*) and the Stripe-faced Dunnart (*S. macroura*). The first two species are commonly found on very sparsely vegetated flats whilst the Stripe-faced Dunnart is more commonly found in the vicinity of low shrubs and denser ground cover. The Kultarr (*Antechinomys laniger*) is a species that is commonly captured at known Kowari locations, but is more widespread and has in recent times been captured south of Witjira National Park. Its apparent absence was surprising given the apparent suitability of the habitat and proximity of healthy populations 100km to the south. The lack of Kowaris was less surprising given that the species has not been recorded in the region since 1895.

Trap Transect	Trapping Effort (trap nights)	Forrest Mouse *L. forresti*	Fat-tailed Dunnart *S. crassicaudata*	Stripe-faced Dunnart *S. macroura*
ALI001	3 x 100 traps = 300	-	-	-
ALI002	3 x 100 traps = 300	-	-	-
ALI003	3 x 100 traps = 300	1	1	-
ALI004	3 x 100 traps = 300	1	-	1
FED001	2 x 200 traps = 400	1	-	-
FED002	2 x 200 traps = 400	-	-	1

A possible explanation for both species being absent from the areas trapped may relate to historic heavy utilisation of the areas in question by stock. Dean Ah Chee indicated that the largest area of suitable Kowari habitat had been heavily used for cattle grazing in the past and that it was often completely bare of vegetation. Under such a scenario the sand mounds would have been heavily trampled and may have been unsuitable for the survival of small burrowing mammals. This, combined with the isolation of this particular area of suitable habitat, is likely to have contributed to the local extinction of both of these species. The sand mounds and other vegetated habitat types in the area appear to have significantly recovered, with stable soils supporting diverse vegetation associations.

The rates of capture of animals was exceptionally low at transects given the vegetative response to rainfall since March 2003. This may reflect the fact that most species have breeding peaks in spring, particularly the carnivorous marsupials such as Dunnarts. Colder temperatures such as those experienced in winter also result in decreased activity for small mammals. Minimum temperatures were between 7^0 C and 4^0 C during the survey.

View from Alinga camp

Typical Kowari like habitat west of Alinga camp

Dune crest along which Transect PAT01 was sampled

Dingo feeding on camel carcass

3.3.5 TRACK TRANSECTS
Rob Brandle and Stuart Pilman

Transects were established at increasing distances from Purni Bore to assess relative herbivore activity to distance from a permanent water supply as well as presence and relative activity of smaller mammals and reptiles. This information can also be linked to vegetation sampling taken at these locations. One of the questions concerning park management is whether maintaining permanent water in the Simpson Desert is impacting on potentially threatened species such as the Ampurta (*Dasycercus hilleri*), a rat sized carnivorous marsupial weighing between 100-200g.

Transects were done over 200m running along the crest of dunes. A tape measure was used to define the transect and all tracks and burrows within 1m either side of the tape were recorded when present for successive 10m sections of the transect.

Site PAT01 was the dune directly east of Purni Bore, PAT02 a further 100m, PAT03 a further 500m and PAT04 over 20km from Purni Bore. The table below indicates that large animals dependent on water were most active in the vicinity of the bore (eg dingoes, foxes, cats horses, camels and humans). Small mammal activity was highest further away from the bore though the Ampurta was present on the closest dune to the bore. The number of transects taken was small (particularly with only one distant from the water point). The above trends may therefore not accurately describe reality, at least five transects in each location may be needed before accurate trends become apparent. A much larger sample would be needed for statistical analysis – this needs to be established through further testing of the method.

Summary table of results

The table summarises the percentage of 10m segments of a 200m transect that contained tracks, scats or burrows of the animals listed. Each transect had 20 10m segments – therefore 1 segment is summarised as 5% of the transect.

Animal Type	**PAT01**			**PAT02**			**PAT03**			**PAT04**		
	track	scat	burrow	track	scat	burrow	track	scat	burrow	track	scat	burrow
Dingo	90			80			30			15		
Fox	5											
Cat	5											
Rabbit	80	10		80	25		10	5	5	50	5	
Horse/ Donkey	2						15	75				
Camel	40	95		55	90		10	40			50	
Cattle					5			5			10	
Hopping-mouse										60		
Ampurta	20									5		
Small Mammal /Reptile	75			45		30	60		60	85	20	20
Human	35	5		40								

3.3.6 MARSUPIAL MOLE SURVEY

Rob Brandle and Stuart Pilman

Marsupial Moles (*Notoryctes* spp.) are currently rated as endangered both nationally and in SA. This is partly because they rarely come to the surface where they can be observed or collected. Recent advances in Marsupial Mole survey techniques developed by Joe Benshemesh have made broad scale survey of these animals possible. The techniques involve digging several 1m deep trenches across the profile of a sand dune and smoothing one side so that their tracks in the form of cylindrical tunnels can be detected. This involves letting the sand dry to aid detection and so is best done by orienting the smooth side of the trench to the north and checked over a 3 to 5 day period.

Four sets of six trenches were dug on four separate dunes near the boundary of Witjira NP with the Simpson Desert Regional Reserve. In total five holes were detected in two of the dunes. Several of the trenches were filled in by strong winds on the day before they were checked. The mole tunnels were between 36cm and 60cm below the surface of the dune. These results confirm that moles have recently been active in this part of the Simpson Desert.

The "Mole Patrol" checking a trench

Photo provided by KJ Kovac

A Marsupial Mole tunnel

Photo provided by KJ Kovac

3.3.7 OPPORTUNISTIC CAPTURES AND SIGHTINGS

One Cave Bat (*Vespadelus finlaysoni*) was caught at the campsite in a mist net. It was of interest, as it may be utilising the "sink holes" in the area.

A Tawny Frogmouth (*Podargus strigoides*) was also captured one evening in the mist net.

Two yabbies were collected during the invertebrate study.

Grey's Skink (*Menetia greyii*) was caught at Mt Crispe during the Rare Rodent survey.

Several lizards (*Ctenotus saxatilis, Pogona viticeps*) were found at the main pool and at the DBA group.

A Gidgee Skink (*Egernia stokesii*) was found in a woodheap.

Ford's Dragon (*Ctenphorus fordi*) was spotted on the edge of the Simpson Desert.

Pygmy Mulga Monitor (*Varanus gilleni*) was caught and photographed.

Pygmy Mulga Monitor

Photos G. Oats

Other wildlife, like this Dingo, wandered around the work sites, keeping an eye on progress

3.4 TOTAL GRAZING PRESSURES
Brendan Lay

3.4.1 DALHOUSIE EXCLOSURES (DCC009)

These historic exclosures were first erected by Bill Matheson and Brendan Lay during September 1981, when the springs were part of Mt Dare Pastoral Lease. At the time it was evident that significant damage was being sustained to the Springs vegetation by uncontrolled numbers of feral donkeys and camels, as well as by cattle which were also watering directly from the springs or spring tail swamps. Also at that time rabbits in plague numbers were aggravating the already chronically degraded drylands and residual landforms in the vicinity of the spring complexes.

Consequently the exclosures erected comprised three experimental areas of 0.25 ha (50x50m each); one excluding rabbits and larger animals, one excluding larger herbivores and one with no fence as a control.

In two years the cross-fence difference was so dramatic that the visuals were used in a submission to Cabinet, which led to the acquisition of the lease (in 1984) and subsequent dedication as Witjira National Park.

Since then, the exclosures have been read intermittently, and foot-netting replaced during an ANZSES expedition in 1991. Denise Noack has been recording changes in the exclosures since then, but in recent years the fence has again rusted out, including the metal posts.

During this SEG expedition, the following was achieved:

- All the fencelines were cleared of the rampant growth of *Acacia victoriae* and *A ligulata* bushes, which had in places nearly flattened the fence
- The whole rabbit-proof plot was "renovated", by removing old rusted wire and replacing the foot-netting. This involved clearing nitrebush and other growth from the wires.
- The whole exclosure (both rabbit and cattleproof plots, and unfenced control plot) was shortened by 15 m to exclude the area adjacent to the spring where vegetation was atypical and corrosion was most evident. This job involved building new fencing using some of the old fence materials if still in good condition.
- The new smaller plots were then re-measured and re-pegged where needed.
- Photos from designated photopoint sites (fence corners) were also retaken.

What was most evident was the changes *outside* the plots, due to the effectiveness of the calicivirus in this area, and effect of a number of favourable seasons in recent years. The photos at the end of this report show this, the repair work and changes over 20 years. Note that the main problem was the growth of Acacias blocking the photo-scene and crushing the fence. Continued improvement and biodiversity enhancement was evident in all plots, but particularly the fenced rabbitproof plot. (Photos 1,2,3&4)

3.4.2 RELOCATION AND RE-MEASURING OF OLD PHOTOPOINTS

One of the key objectives of this expedition was to further enhance the completeness of a land monitoring program covering the whole of the Witjira NP. Geoff Axford has made an excellent first cut on the production of a monitoring manual that included all the old monitoring sites set up by earlier workers such as Dr Sue Barker in the mid 1980's and myself in the late 1970's. Also available were locations of some Biological Survey sites set up in the mid 1990's.

A number of these old sites had still to be re-located and photos retaken, so some time was spent during the SEG expedition driving to the localities where these old sites were recorded to be, and when found, to be re-pegged as necessary and updated locality information recorded, including AMG co-ordinates by GPS.

In the time available, we were only able to take two teams on traverses to relocate these sites, but some of the changes that were evident once the sites were found and new photos taken were profound. The photos attached (photos 5&6) show one such site near Opossum waterhole, showing the recovery from cattle grazing adjacent to the waterhole over 17 years.

Some old photopoints on and around the springs complexes were also relocated during this time.

3.4.3 ESTABLISHMENT OF NEW MONITORING SITES

Much of the remaining time was spent travelling to several separate areas, away from the springs, where new sites were to be set up to monitor existing or anticipated impacts on native vegetation communities. On three separate trips, with different expedition members, the following was achieved:

1. Purni Bore and Simpson Desert.

A two day trip to investigate progressive grazing impacts around Purni Bore was undertaken, with Brendan Lay, John Maconochie and Graeme Oats. To investigate the "piosphere" or zone of grazing influence around the Purni water point, we found that we had to go more than twenty kilometres east before the full complement of palatable species characteristic of the region was evident.

New paired sites were established within one kilometre of the Bore, at about 9km from it east along the French Line, and a further 15 km to the east just inside the Simpson Desert Regional Reserve. At each locality sites in the swale and on the dune crest were established according to the methods required for a pastoral "OB" site, which includes a plant species list and in this case a cover estimate of all species and soil surface using the "wheelpoint" apparatus.

These sites were used to locate soil pits and trenches for the search for fauna including the Marsupial Mole. (see other segments of this report).

Photo 7 refers (p 42)

2. Memory Bore area

A separate trip was made one day to the site of Memory Bore, near the southern boundary of the Park with Macumba and Mt Sarah Pastoral runs. An old Biological Survey site was found and a new site selected in an area of past soil scalding about 8km west of the Bore site. This latter site also exhibited quite marked evidence of recent cattle grazing, these being subsequently identified as belonging to Macumba station. A detailed species list was also collected at this site. Photos were taken on the scalded flat as well as across a vegetated dune, which provided some protection from an icy southerly wind that prevailed on the day in question.

3. Impacts of the introduced plants *Acacia farnesiana* (Thorny Acacia), its mechanical removal, and *Cenchrus ciliaris* (Buffel Grass)

On one day, a team travelled to tributaries of Red Mulga Creek, as well as the 3 O'clock Creek at the foot of Mt Crispe. In these locations, a hydraulic "plucker" and tractor had been used to mechanically remove mature and some young plants of this introduced thorny tree, which had become naturalised in these creek systems just north of the Springs Complex.

Two new photopoints were established there– one to record changes in a broad floodplain with Gidgee and Mineritchie in 3 O'clock Creek, and the other of an extensive clearing of the Acacia from a small eroded watercourse without other woody vegetation (photo 8).

Even on superficial examination, it was evident that much follow-up work would be needed over many years before we could be sure that the infestation was eliminated. The plucked plants have not been burnt as yet and large amounts of fat viable-looking hard seeds were evident. In 3 O'clock Creek there were numbers of young plants evident in the dense grassy understorey, and some regeneration from broken roots was also occurring.

A final photo-site was established west of Opossum waterhole on the Bloods Creek Bore road, where an infestation of buffel grass was spreading over a sandy flat and watercourse. This will be used to monitor effectiveness of any future control programmes.

Photo 1: Gina and Trevor replacing rabbit proof foot-netting

Photo 2: Growth of "Neverfail" *Eragrostis setifolia*, on both sides of netting following reduction of rabbit populations due to calicivirus

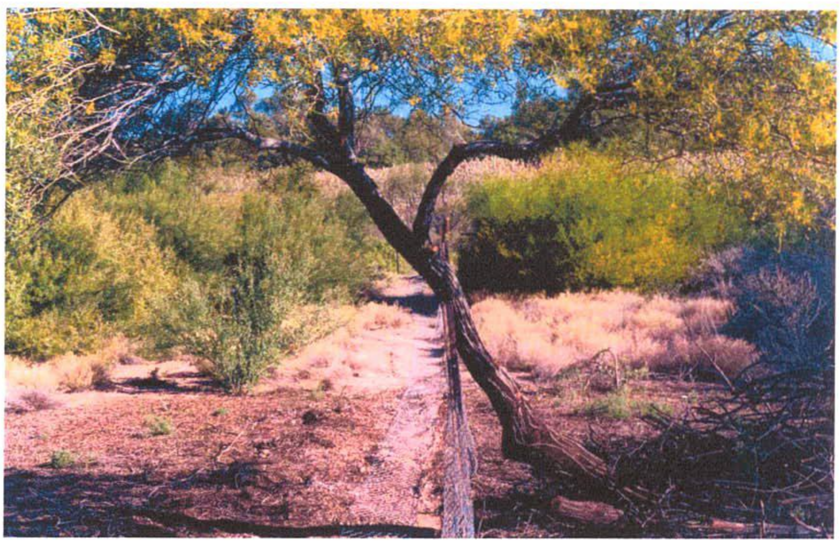


Photo 3: Original photo (in 1981) taken along new rabbitproof/ cattleproof fence towards spring

Photo 4: Same fenceline in 2003 after extensive clearing of acacia in foreground. Note *Phragmites* growth on spring mound

Photo 5: Old photo-site at Opossum waterhole showing how cattle have bared off the country and grazed the fringing coolabahs

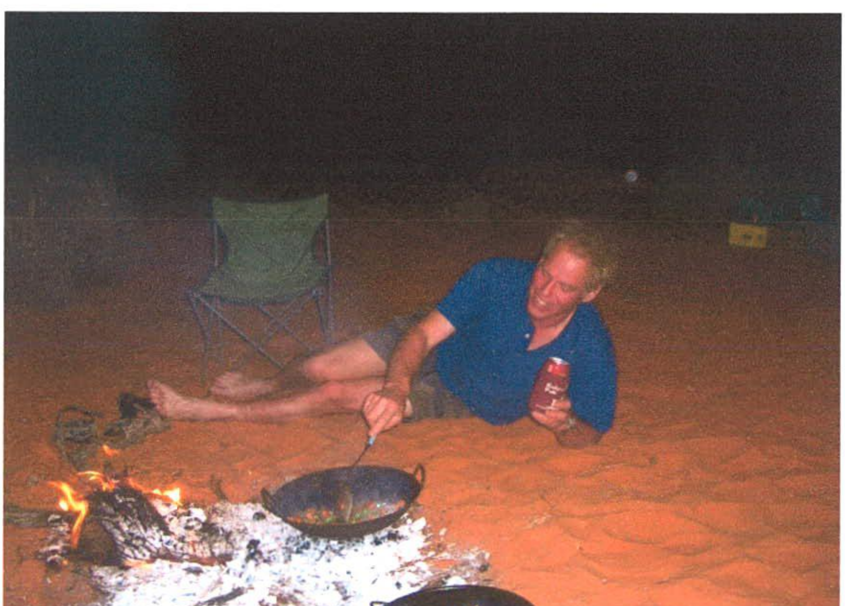
Photo taken in 1986

Photo 6: Same site, marked as PP 8378; site of original photo relocated July 2003, showing marked growth and soil cover – note naturally unproductive soils in foreground

Photo 7: New photopoint installation in the Simpson Desert; Graeme and Max score vegetation abundance using a wheelpoint to determine cover percentages East of Purni Bore

Photo 8: Old photosite taken in 1986, showing breakaway country on Bloods Creek track near Mt Crispe

Photo 9: Mt Crispe breakaways site 8380, taken 17 years later ...regrowth of Mitchell grasses is dramatic



Brendan on dinner duty Purni style

Photo G. Oats

4. ADDITIONAL CONTRIBUTIONS

4.1 REMOVAL OF DATE PALMS

Alby Zepf

(Varied and vigorous attempts were tried to develop a method of removing Date Palms. Alby Zepf has written this report on subsequent success in removing Date Palms. Ed)

Following the success of the trials to determine an effective and realistic method for Date Palm removal at the Dalhousie Springs complex during the SEG trip in July 2003, the Friends of the Simpson Desert Parks (FOS), agreed to have a go as well. Alan Hancox, a man of many talents, investigated further equipment in order to snap off the palms with the truck and chain method while keeping well off the mounds themselves. He came up with some new technology.

Dynamica Rope was said to be as strong if not stronger than steel cable of a similar size. So FOS, with funds they have raised themselves, purchased 100m of this expensive rope, so that we did not have to drive the truck onto the spring itself, thus minimising damage to the spring.

On the annual FOS working bee at Dalhousie we went to work. The rope was a great success, and the spring known as Witcherrie Mound, or B2, was attacked with numerous volunteers and myself in the Parks truck. Fifty seven palms, including suckers in seven clumps, were removed from the spring in two days work. Enthusiasm for the project grew as we saw the size of the Inland Paperbark (*Melaleuca glomerulata*) trees that we had saved from being smothered by the palms. We estimated that the trees would be several hundred years old, and someone said it was like saving an old man rainforest tree. The group all found it very satisfying to save such old trees as well as the other life in the spring and agreed to spend at least a few days every year on the project.

Months later it was found that the palms removed with this method, and which were in a wet/boggy part of the spring, died completely and did not reshoot, (which has been the case with many other trials in other areas). Some that were in high and dry areas did reshoot and will need further treatment. This indicated that the wet area ones probably contracted an infection and died. During the working bee in 2005 we will trial swabbing the exposed bases with the mud from one of the nearby springs, hoping to infect and kill the palms without the use of chemicals. During the last two weeks in May this year we will be tackling the Mother spring and others in the Kingfisher group, with some two dozen volunteers from FOS.

This is an excellent outcome that began with the dedicated volunteers and leaders of the Scientific Expedition Group. Thanks to all involved in the project.

The effort required to remove even small palms is considerable

(Photo D Noack)

4.2 Bushwalking - Witjira Style.
Graeme Oats

SEG has wherever possible provided an "adventure phase" in its expeditions. An extended walk in the desert of Witjira National Park looked a bit daunting from the seclusion of my Belair home, never having been near the place much less knowing what to expect weatherwise and the topography.

But, I like a challenge. Finding a map of less than 1:100,000 scale was the first problem, so I had to satisfy myself with the Dalhousie 1:100,000 sheet. Leader Travis Gotch had given us a general location by putting his bulky forefinger on a spot on the map just south of the Dalhousie Spring. I gave up after that and thought well we'll go on the basis that as we would be in the location travelling around for a week or so before the walk was due (usually it's the last 3 -5 days of an expedition) I would get some idea of the topography and the highlights that might we worth including.

Photo T Porter

The benefit of having a week to recce the area was useful and I was advised that I had to be back on the morning of 24th July for an important meeting of all expeditioners and leaders. In the end the meeting didn't happen as planned. Plan A always seemed to finish up Plan E, F or X.

Around 8.45am on 22nd July Kevin Burrett, Tony Border and I with packs laden, set off south with the aim of camping in a creek near the ruins of the old Dalhousie homestead. According the 1:100,000 map the ruin was about 10kms south which is a fairly comfortable day walk. Our first objective was a small tabletop hill some 1km or so away; this was reached without much fuss. The weather was fine and cool as it had been for most of the expedition up till then.

From our first advantage point we could "see forever" in all directions except for the west where a low range dominated the landscape. Our course seemed to be fairly open, but all is not as it seems. We descended onto open flat areas where the lower depressions formed run offs to the main creek (Spring Creek). I guess we wandered for about one hour before we came to the first of the phragmites.

We scouted about east and west to locate what we hoped would be an "easy" way through. We soon learned that there is no EASY way through phragmites.

There was no ground water beneath the phragmites, but they were several metres high and very dusty. After much grunting and sweating we forced our way through. We pushed on south wandering about a bit to pick the best route but also to take note of the varying vegetation and land forms.

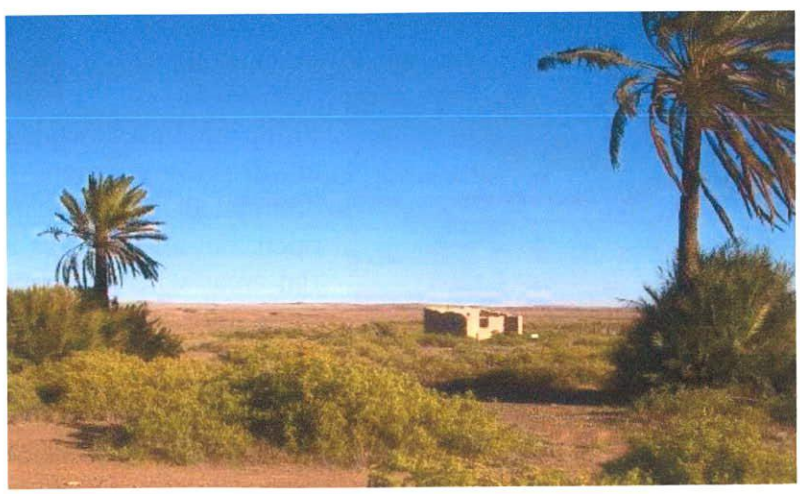
We came across a solitary date palm which must have been the centre of attention at sometime in the past. As we approached the palm a star dropper marker was nearby.

After a stop for lunch we continued in a southerly direction until around mid-afternoon after climbing a small stony rise we saw the ruins of "Old Dalhousie" about a kilometre to the southwest. We spent sometime wandering around them before looking for a campsite.

It had been arranged with Richard Willing that he would bring down a supply of water for the evening and next day. We located a campsite under large gums in a creek a few hundred metres south of the ruins. Later in the afternoon Richard arrived with the water and to our surprise Eve Ayliffe had decided to join us for the rest of the walk.

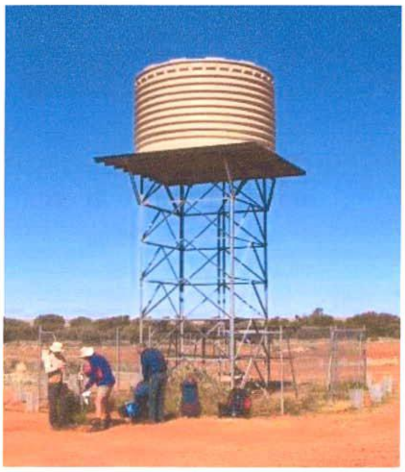
The campsite was prepared and a leisurely evening by a small camp fire was enjoyed by all. The weather during the day had been quite mild and the evening was cool but fine.

We all slept well and next morning after breakfast we retraced our steps back to the ruins, spending a bit more time reading the various information boards and trying to get an impression on the conditions the early settlers and inhabitants endured week in week out. After disturbing a dingo basking in the morning sun we started out west across undulating gibber towards Irrapowadna Creek.



A strong sou' westerly had sprung up in the early hours overnight which made conditions quite cool. I recall walking in a fibre pile jacket to keep warm.

The day's objective was Three O'clock Creek some 10 km to the west. The route was to take us pass a couple of smaller springs, Missionary Spring and Mount Jessie Spring.



Although the wider landscape seems uninteresting, being a broad expanse of undulating semi-arid land the micro landscape under your feet varies tremendously from small saltbush and native grasses, stony outcrops of gibber, to alluvial sandy plains some with small pockets of green vegetation.

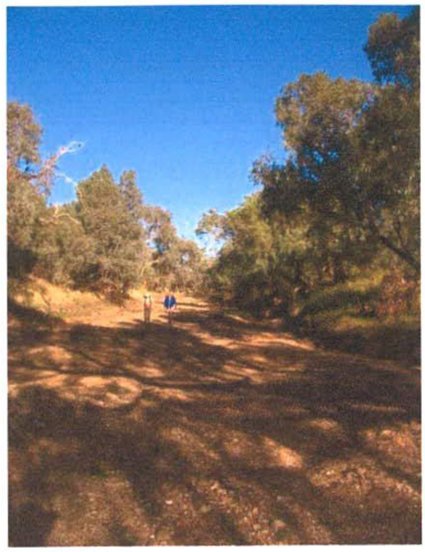
As time passed we could see on the far horizon a row of trees and a tall structure. We had been navigating on a compass bearing and using the sightings of a couple of higher "peaks" on the SW horizon, so we were pleased that we were on course, as it was Three O'clock Creek and the water bore shown on the map.

We spent some time wandering around the bore near which was a new "carport" like structure under which visitors could shelter if necessary. We restocked with water and eventually we made our way to the creek where we spent most of the afternoon out of the wind.

The vegetation in the creek and nearby was quite lush although no water was nearby. From time to time one or other of us decided to venture away from the campsite to investigate the creek bed and to fill in time.

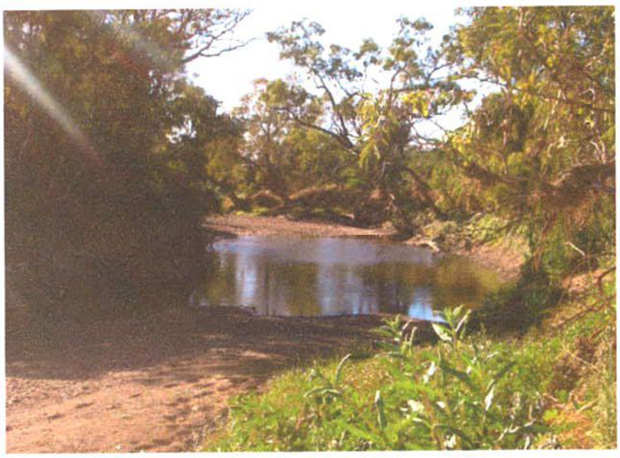
The wind died down during late afternoon and we enjoyed a comfortable meal and an evening with again a small campfire over which we solved problems ranging from how best to eradicate the date palms from the springs, invented a cure for the common cold and what time we should get under way next morning.

We didn't actually decide on the latter – it just happened. Our arrangement with Richard was that we would meet him at a predetermined road junction late morning to get us back in time for the all important, not to be missed meeting of all expeditioners.



We followed the creek downstream crossing the Bloods Creek Road. About 2 km downstream from the road we came upon 2 quite large billabongs. We meandered around them taking various photographs and sampling the water before taking another compass bearing from an assumed position on the map to the aforementioned road junction.

The weather had again returned to its glorious best and we made good time across the gibber and undulating plains meeting up with Richard as planned. His news of course was that the planned meeting had been delayed and as I recall it didn't happen until either that night or next morning, which was a bit of a disappointment. We were enjoying the walk and with another night out we could have walked back into camp the next morning.



Oh well, next time maybe?

The author, Graeme, working hard!

4.3 Coober Pedy News clippings

No. 37 **Coober Pedy News** 8 August 2003

Lions food eaten by expeditioners

Coober Pedy Lions, Frank Pennisi, Geoff Sykes and Roma Gosse are in the background at left. The venue was the Lions Club building on Seventeen Mile Road

The 'Lions food' actually was a barbecue cooked by the Coober Pedy Lions Club for the Adelaide based Scientific Expedition Group. The SEG were returning from their trip to Dalhousie Mound Springs, in the Witjera National Park.

The trek was led by Richard Willing, a retired physician, who is also the chair of the SEG.

Its purpose was to survey the date palms around Dalhousie. The date palms are so suited to the area that they are taking over, to the detriment of local flora and fauna.

Local flora and fauna were also surveyed. Evidence of the presence of the Marsupial Mole (see pg 3), and the Kowari, a marsupial rodent, was found.

Anyone can join the Scientific Expedition Group - see www.communitywebs.org/ScientificExpeditionGroup

SEG's 2003 Trek - Dalhousie Mound Springs, Witjera National Park

(Cont. from p1)

Have you seen a **Marsupial Mole?** They are known to inhabit sand dune and sandy plain country throughout SA, NT, WA and possibly south west QLD. The "Mole Patrol" project, funded by Anangu Pitjantjatjara Land Management through the Natural Heritage Trust, is trying to gain a better understanding of these elusive marsupials.

It will rely on volunteers across Australia to record and report mole sightings. The valuable information collected will help in conserving the species. If you would like to help or gain a better understanding of marsupial moles, an information package containing photos and descriptions of mole signs can be obtained by contacting:

Threatened Species Network
Alice Springs,
at either
coolabaheco@aol.com
or
(08) 8952 1541

Photo Courtesy Dr J. Benshemesh

Above: Article and photo reproduced from Coober Pedy News 23 July 2002

Left: Diagram of a trench (80 cm deep, facing north) exposing the intersected backfilled tunnel of a Marsupial Mole.

The different colour of the backfill dirt exposes the drive that the mole dug.

Mining inspectors note: for the Marsupial Mole's drive, PSPP's and pegs not required, nor is notification of use of earthmoving equipment; claim is fully reinstated to protect the fragile environment.

In the diagram, the choice of green for the colour of the backfilled dirt is not intended to convey any hidden political message.

Reproduced with permission from Coober Pedy News.

4.4 Mack's Musings

Judy Mack's talk at the SEG campfire on Monday 21st July 2003.

I have asked Richard if I could talk tonight because this is apparently the last night when we will all be together. I wish to frame my comments around **THANKYOU** - and I do not see these as entertainment along the lines of the other night-time performers, rather as Mack's Musings.

T has to begin with reference to **T**arts. You have little idea of how you became guinea pigs for my cooking on the night of our team's kitchen duty. I had never made a tart in my life and there was the instruction - make eight of them! Drawing on the experience and support of Corinne, I made them, and I must admit I was quite pleased with the results. **T** refers also to the **T**alents that everyone has brought to this Expedition. Apart from the specific skills of the scientific crew, there are the various talents of the volunteers, the obvious skills of the Park and Wildlife staff and the vital strengths of our Quartermaster. There are also the **T**heories and eventual **T**heses that will be supported by the information that we gather in these two weeks.

H represents the **H**ours of effort that we are putting in up here as well as the hours that must have been spent planning and negotiating over the past months in order for an undertaking of this size to be so well coordinated and be running so smoothly. The main **H** refers to the **H**onour and privilege that I feel when I consider the calibre of the people with whom I am working. I acknowledge the insight of those who were instrumental in the establishment of SEG, and the determination of those who are keeping it going, plus the abilities of those who have scientific purposes for being here.

Abilities are many and varied in this large group, as I have alluded to before, but there is one person who I would like to mention specifically and that is Alby. I really admire Alby's breadth of knowledge that becomes evident when he speaks with diverse groups. He talks with authority on the vegetation of the region, and the measures that have been undertaken to regenerate denuded areas. His actions and comments indicate respect and consideration for Indigenous people, their beliefs and wishes, and he is prepared to speak out when inappropriate actions or behaviour are contemplated or observed. His energy and efforts to help us ensure the success of this longterm date-palm eradication program have been obvious. I have come to these areas of knowledge fairly late in life, and I wish that I could have been as sensitive and aware as Alby much earlier. He has much to teach us.

Names are, for me, one of the main aspects of this Thankyou piece. Australians are slowly becoming accustomed to learning and using the Indigenous **N**ames for places, features and creatures. Uluru is a case in point. Who would have believed thirty years ago that that name would be as widely known and used as it is today. Those of us who have little knowledge of or access to the traditional names, have to cope with rather difficult-to-find sources of information if we try to become familiar with the far older names rather than the more recent European ones. My comments are pertinent to your future writings. When reports and papers are written in connection with this expedition, I ask that you consider including the Indigenous names for places, creatures and vegetation. If the results of the studies of the mound springs become as significant as we all hope they will prove to be, there is a chance that they will be read over many years. Maybe in thirty or forty years, Australian perspectives and understandings of Indigenous culture will have moved to the point where at least dual name swill be commonplace - it even could be that some European names will be dropped in favour of the traditional names. It would be important in my opinion, that your writings set a precedent that others will acknowledge as far-sighted and inclusive. I have forgotten the Indigenous name that Alby told me for the main spring - but I do remember that it could be translated as Healing Waters. To have the original place names and their translations in your reports would add significantly to the value of the documents, I believe.

K represents **K**nowledge – that which we already have and that we hope is gained from our efforts this trip. In our pursuit of facts relevant to the 21st century, I hope that we do not neglect to acknowledge and incorporate appropriate Indigenous knowledge as well. Maybe more sharing and understanding between cultures will lead to further unexpected discoveries.

Younger and

Older members of the group, and that means all of us, have all contributed according to our strengths and abilities. I have shown that my skills do not lie in a laboratory looking down a microscope - as Queale will attest to - but I have proved a deft hand at cutting rusty sections of galvanised wire at the exclosure.

Understanding - both in a technical sense and in human terms-is surely the ultimate aim of an organisation like SEG or a scientific undertaking like this one. I believe that it is vital for the future of humanity and for the environment that we all accept responsibility for the nurturing of knowledge, compassion and positive responses to problems that arise.

If my efforts have contributed a bit to some facet of understanding, I'll feel happy. For the chance to share this SEG experience with you all, I say again –

THANK YOU

4.5 Dalhousie Rap

(Editor's note: Characters and incidents mentioned in this article are entirely fictitious. It was used to reinforce the need to use protective equipment when handling palm trees.)

I want to tell you all about a place called Dalhousie.
Some poor people said that the place was lousy.
But I want to tell you, and believe me, mate,
That the place and the people there are really great.

One of those people was a lady called Kate.
Geoffrey thought she was quite a good mate.
But he gave her some lip and she answered back –
In fact, she went for a frontal attack.

She responded, with her usual charm,
And whacked his head with the frond of a palm.
Geoff sprang back with some alarm.
She said a little whack wouldn't do him any harm.

He bled a little bit, and there was a sort of drama,
Coz his blood group only matched a 3-humped llama.
Things settled down, and, to avoid confusion,
She cooked him a meal instead of a transfusion.

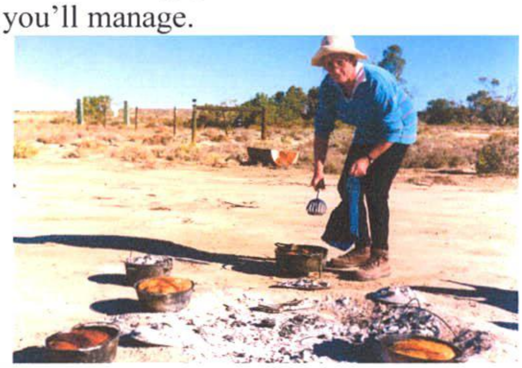
The Chilli-con-Carnage was a chef's delight.
At the end of it they'd settled their fight.
But Geoffrey knew, if he wanted to make passes
In the palm trees, he'd need protective glasses.

4.6 The Quartermaster

If you don't have something you think you orter
You'd better go and find our friend Trent Porter.
When he's not digging holes or strangling foxes
You'll find him sorting a pile of boxes.

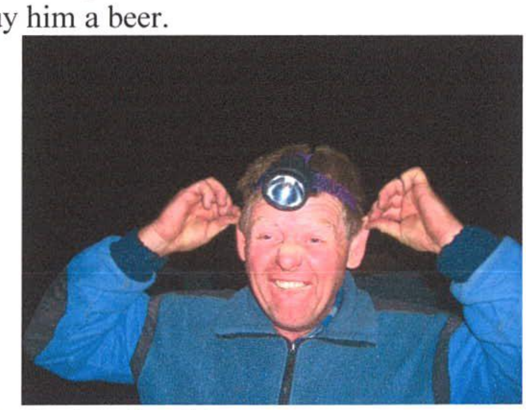
(Is he digging or watching?)

This is the man who keeps us eating,
With so much food that it keeps repeating.
From Spotted Dick to Chilli Con Carnage,
He'll feed you all the food you'll manage.



(He did have help, this is Gina the baker)

So make your way to the kitchen tent,
Stand at the door and shout "Hey Trent!"
You'll be greeted with his usual good cheer
So do him a favour and buy him a beer.



(Only one though!)

Now please don't just convulse into laughter,
But he's the guy you have to look after.
If we don't get the food we need
We'll very quickly go to seed.

5. APPENDICES

5.1 Summary of vegetation at fauna monitoring sites – Kingfisher and Banana Springs

*Introduced species.

SITE	DKF PATCH S	DKF PATCH N	DKF002 OUTFLOW	DKF003 OUTFLOW	DBS001 FOREST	DBS001 MOUND	DBS001 OUTFLOW CHANNEL	DBS002 MOUND	DBS002 OUTFLOW CHANNEL	TOTAL
LOCATION (WGS84)	551728 E 7078944 N (SW corner)	551734 E 7079017 N (SW corner)	551943 E 7078913 N (NW corner)	551929 E 7078825 N (NW corner)	551734 E 7079017 N (NW corner)	551058 E 7077205 N (NW corner)	551104 E 7077243 N (NW corner)	551184 E 7077359 N (NW corner)	551243 E 7077271 N (SW corner)	
QUADRAT	50 x 30 m	25 x25 m	50 x 30 m	80 x 20 m	30 x 30 m	30 x 20 m	100 x 20 m	50 x 50 m	50 x 50 m	
STRUCTURAL DESCRIPTION	Phoenix dactylifera *low closed forest*	Phoenix dactylifera *low closed forest*	Phoenix dactylifera *low open forest*	Phoenix dactylifera *low closed forest*	Melaleuca glomerata *low closed forest*	Melaleuca glomerata *low open forest*	Melaleuca glomerata *low open forest*	Melaleuca glomerata *low open forest*	Acacia salicina *tall open shrubland*	
SPECIES										
Acacia ligulata	+					+				2
Acacia salicina	+	+	+	+		+	+	+	+	8
Acacia victoriae							+			1
Aristida holathera *var.* holathera						+				1
Atriplex holocarpa							+		+	2
Atriplex nummularia *ssp.* nummularia		+			+			+	+	4
Chenopodium cristatum			+							1
Cyperus gymnocaulos		+		+			+			3
Eleocharis geniculata							+			1
Enchylaena tomentosa	+	+		+	+	+	+	+	+	8
Enneapogon cylindricus						+		+		2
Eragrostis dielsii *var.* dielsii						+	+			2
Eucalyptus coolabah *ssp.* arida				+						1
Euphorbia drummondii		+						+		2
Frankenia foliosa							+	+		2
Halosarcia *sp.*	+	+	+	+	+	+	+	+	+	9
Imperata cylindrica			+	+			+	+		4
Juncus kraussii	+						+			2
Lawrencia glomerata *complex*						+				1
Maireana appressa		+					+			2
Maireana pentatropis	+	+	+	+		+		+		6
Melaleuca glomerata			+		+	+	+	+		5
Mukia maderaspatana								+		1
Myoporum montanum	+			+	+				+	4
Nicotiana velutina						+		+		2
Nitraria billardierei	+	+	+	+	+	+		+	+	8
Osteocarpum dipterocarpum						+	+	+	+	4
*Phoenix dactylifera	+	+	+	+	+			+		6
Phragmites *sp.*	+		+	+		+	+	+	+	7
Pimelea microcephala *ssp.* microcephala							+			1
Pterocaulon sphacelatum						+				1
Ptilotus obovatus *ssp.* obovatus						+				1
Rhagodia spinescens	+						+	+	+	4
Salsola kali	+	+	+			+	+	+	+	7
Sclerolaena constricta		+								1
Sclerolaena lanicuspis							+	+		2
Sida fibulifera						+				1
*Sonchus oleraceus								+		1
Sporobolus virginicus	+			+	+	+	+	+		6
Trianthema triquetra	+		+			+		+	+	5
Triraphis mollis						+				1
Zygophyllum crassissimum								+		1
Zygophyllum simile						+		+		2
NO. OF SPECIES AT EACH SITE	14	12	11	12	8	22	20	24	12	

5.2 Dalhousie Springs Plant Vouchers - July 2003

Identifications confirmed and lodged at Adelaide Herbarium 11/07/2003

VOUCHER NO.	SPECIES	SURVEY COMPONENT	LOCATI ON		DETAILS
BS161-1	*Pycnoporus coccineus*	Opportunistic	551944	7079259	Mound spring outflow AA02; growing on *Melaleuca glomerata*.
BS161-2	?*Agrocybe* sp.	Opportunistic	551873	7078985	Dry spring mound; growing with *Nitraria billardierei*.
BS161-3	*Juncus kraussii*	Vertebrate fauna site	551728	7078944	DKS004 southern patch.
BS161-4	*Santalum lanceolatum*	Opportunistic	551793	7079067	Single-stemmed tree on east side of dry mound, AA06.
BS161-5	*Eucalyptus coolabah* ssp. *arida*	Vertebrate fauna site	551929	7078825	DKF003
BS161-6	*Triraphis mollis*	Invertebrate fauna site	551908	7079540	Spring outflow tail, AA03.
BS161-7	*Triraphis mollis*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-8	*Triraphis mollis*	Opportunistic	551874	7079513	Edge of spring outflow tail, AA03.
BS161-9	*Chenopodium cristatum*	Vertebrate fauna site	551943	7078913	DKF002
BS161-10	**Aster subulatus*	Invertebrate fauna site	551908	7079540	Spring outflow tail, AA03.
BS161-11	*Baumea juncea*	Opportunistic	551826	7079210	Small pool at northeastern side of spring pool, AA02.
BS161-12	*Lotus cruentus*	Opportunistic	551928	7079247	Edge of spring outflow tail, AA02.
BS161-13	*Streptaglossa liatroides*	Opportunistic	552174	7079363	Northern side of Kingfisher spring group.
BS161-14	*Eleocharis geniculata*	Vertebrate fauna site	551104	7077243	DBS001 outflow channel.
BS161-15	*Lawrencia glomerata* complex	Opportunistic	552039	7079322	Growing on western side of mound, AA08.
BS161-16	*Sclerolaena constricta*	Vertebrate fauna site	551734	7079017	DKF004 northern patch.
BS161-17	*Maireana appressa*	Vertebrate fauna site	551734	7079017	DKF004 northern patch.
BS161-18	*Nicotiana velutina*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-19	*Enneapogon cylindricus*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-20	*Zygophyllum simile*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-21	*Sida fibulifera*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-22	*Aristida holathera* var. *holathera*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-23	*Lawrencia glomerata* complex	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-24	*Eragrostis dielsii* var. *dielsii*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-25	*Atriplex holocarpa*	Vertebrate fauna site	551104	7077243	DBS001 outflow channel.
BS161-26	*Maireana appressa*	Vertebrate fauna site	551104	7077243	DBS001 outflow channel.
BS161-27	*Sclerolaena lanicuspis*	Vertebrate fauna site	551104	7077243	DBS001 outflow channel.
BS161-28	*Zygophyllum crassissimum*	Vertebrate fauna site	551184	7077359	DBS002 mound.
BS161-29	*Maireana pentatropis*	Vertebrate fauna site	551943	7078913	DKF002
BS161-30	*Atriplex nummularia* ssp. *nummularia*	Vertebrate fauna site	551734	7079017	DKF004 northern patch.
BS161-31	*Sonchus oleraceus*	Vertebrate fauna site	551184	7077359	DBS002 mound.
BS161-32	*Kippistia suaedifolia*	Opportunistic	551810	7078733	Growing on northeastern side of mound, AA05.
BS161-33	*Ptilotus obovatus* ssp. *obovatus*	Vertebrate fauna site	551058	7077205	DBS001 mound.
BS161-34	*Eleocharis pallens*	Opportunistic	551950	7091100	Swamp at Federal Waterhole.

BS161 *Baumea juncea* is a new record for Dalhousie Springs.

5.3 Dalhousie Insects

T. Gotch

DALHOUSIE malaise	Dkf 2ax1	Dkf 2A1	Dkf 2A	Dkf 001	Dkf 003	Dkf 2A	Dkf 2B3	Dkf 2C5	Dkf 2E1	
DIP: Agromyzidae				1			4		2	
DIP: Bibionidae										
DIP: Calliphora augur										
DIP: Calliphora dubia							13			
DIP: Cecidomyiidae	32	59	91	24	12	91	167	4	63	
DIP: Ceratopogonidae	42	145	187	58	3	187	139	2	67	
DIP: Chironomidae	105	246	351	945	232	351	1148	12	176	
DIP: Chloropidae	1	9	10	15	1	10	443	1	18	
DIP: Cryptochetidae			0			0	2			
DIP: Culicidae	13	16	29	8		29	45	30	5	
DIP: Dolichopodidae	300+	985	1285+	46	3	1300	245		24	
DIP: Drosophilidae	2	2	4			4				
DIP: Empididae/Scen	3	9	12	11		12	26		7	
DIP: Ephydridae	4 spot	5	9	4		9	68	1	8	
DIP: Fergussoninidae			0			0	?5			
DIP: Lauxaniidae			0			0	40		1	Homoneura
DIP: Muscidae		15	15	8		15	50		43	
DIP: Muscoids			0			0	12		56	
DIP: Mycetophilidae	5	9	14			14	14			
DIP: Odiniidae		?1	?1			1			?2	
DIP: Phoridae	100	331	431	206	8	431	277		37	
DIP: Pipunculidae			0			0	3		1	
DIP: Psychodidae	8	53	61	13	5	61	93	3	89	
DIP: Pyrgotidae			0	0		0				
DIP: Sarcophagidae		2	2			2				
DIP: Scatopsidae		3	3	1		3	7			
DIP: Sciaridae	45	102	147	48	15	147	337	2	23	
DIP: Sciomyzidae			0	1		0	3			
DIP: Sphaeroceridae	1	3	4	2		4	3			
DIP: Syrphidae	1 irid gr	6	7	5		7	m5, X6			
DIP: Tabanidae			0			0				
DIP: Tachinidae			0			0	9		6	
DIP: Tanyderidae			0			0				
DIP: Tephritidae	35	110	145	26	5	145	740		12	
Dip: Tipulidae	11	32	43	11	1	43	9	71	9	
DIP: Xenasteiidae	2	1	3	40		3	2			
DIP: family?			0	3		0				
Acarina (mite)		3	3	4	1	3			8	
Aranae (spider)		4	4	4		4			4	
Collembola (springtail)		13	13	5	4	13	1smin		1	
roach			0			0	1			
dragonfly		1	1	1		1				
Psocids (booklouse group)		2	2		6	2	4		1	

thrip		20	20	18		20	3	1	10	
bugs		14	14	20	1 aphid	14	147		11	Cic most, aphid, mirid
Hemerobiidae (brown lacewing)		1	1			1	2	1		
antlion			0			0	1			
Chrysopidae (green lacewing)			0	larv x2		0	3			
beetles		2	2	4		2	9*	1	7	*some staphy
caddis flies			0	26		0	2			
moths		11	11	9	5	11	99	2	105	
wasps		18	18	20+	4	18	274		39	
ants		5	5	3		5	10+ 2nb		3	native bee
totals				1570	305	2963	4435	131	836	

5.4 A very brief overview of Invertebrate Families

Calliforid – a blowfly
Cecidomyiidae - gall midge
Ceratopogonidae – sandfly, biting midge
Chironomidae - midge
Chloropidae – small bizarre fly
Cryptochetidae – parasitic
Empididae/Scen – predatory
Ephydridae – no common name
DIP: Fergussoninidae – gall midge
DIP: Lauxaniidae – fungus feeder
DIP: Muscidae – pesky flies including blowflies
DIP: Muscoids
DIP: Mycetophilidae - fungus gnats
DIP: Odiniidae - odd fly
DIP: Phoridae - odd fly
DIP: Pipunculidae – hover fly
DIP: Psychodidae – moth flies
DIP: Pyrgotidae – nocturnal parasitic
DIP: Sarcophagidae – flesh flies
DIP: Scatopsidae – fly
DIP: Sciaridae – plant feeders
DIP: Sciomyzidae – snail parasites/predator
DIP: Sphaeroceridae – v small flies faeces feeders
DIP: Syrphidae – hover
DIP: Tabanidae – march, horse
DIP: Tachinidae – insect parasite
DIP: Tanyderidae – rotting veg. feeders
DIP: Tephritidae – fruit flies (not all bad)
Dip: Tipulidae – crane flies
DIP: Xenasteiidae – v. small flies unknown habits

5.5 Invertebrate Traps At Dalhousie Mound Springs

(Overview L. Queale)

Malaise Traps

Dkf 2A1 showed a high number of dolichopodids (long-legged flies) ie 1200.
350 midges and 100 phorids and many other families.

Dkf001 showed a low number of dolichopodids (long-legged flies) ie 46.
High numbers of midges – 945, and 48 phorids

Dkf003 showed very low number of dolichopodids (long-legged flies) ie 3.
Medium numbers of midges – 232, and 15 phorids. In general very low numbers in total.

Dkf 2B3 showed high numbers of many groups eg of dolichopodids (long-legged flies) 245.
High numbers of midges – 1150, and 277 phorids. Also 443 Chloropids, 337 Sciarids, 740 Tephritids, 167 Cecidomyiids. The most prolific and various suite of species.

Dkf 2C5 showed no of dolichopodids (long-legged flies).
Very low numbers of midges – 12, and no phorids: very low diversity – so probably poor water or limited vegetation.

Dkf 2E1 showed a low number of dolichopodids (long-legged flies) 37, midges – 176, and 37 phorids. Also 50 muscids and 89 psychodids. Cecidomyiids and ceratapogonids: 60+

Dkf 003 and Dkf2C5 had low numbers of flies. This may have been because there was low diversity of vegetation, water factors nearby or perhaps too many dates.

Dkf 2B3 had high numbers in general so the habitat was very supportive for flies eg vegetation and perhaps salinity.

Dkf 2A1 had the highest number of long-legged flies and high numbers and diversity of other families.

Dkf 2E1 showed higher numbers of groups other than those favouring saline habitats.

Dkf001 had high numbers of midges and a suite of other families similar to Dkf 2E1.

The pit traps caught numbers of crickets (Gryllidae), springtails (Collembola) and ants. One site caught quite a few bugs that float on water – gerrids (water striders) and velids.
A small number of ostracods (small two shelled crustacea) were collected from the mud samples, which have yet to be identified. Molluscs were collected, mostly dead in the mud and looked similar to the snail genera *Thiara* and *Lymnaea*.

Many of the families collected in numbers >10 are known to be associated with wet habitats. It can be noted that the suite of families that dominate these collections show a strong preference for saline habitats. It may be interesting to compare salinity and other water chemistry with insect assemblages between sites in some depth.