

Desert Discovery Inc - Tjirrkarli Project

25th August – 14th September 2014



Northwest of Tjirrkarli with Boyd Lagoon on the horizon – photograph by Libby Sakker

TJIRRKARLI PROJECT REPORT

Item	Subject	Authors	Page
1	Cover		
2	Contents Listing		2
3	Introduction	Keith Johnson	3
4	History of Tjirrkarli	David Hewitt	5
5	Location Map	Maree Goods	8
6	Logistics Report	Ben Blomfield	9
7	List of Participants		11
8	Weather Report	Eric Loughton	13
9	Bird Report	Cheryl Gole	15
10	Botany Report	Maree Goods	27
11	Botany - Mount Worsnop & Alexander Spring	Trevor Blake	43
12	Grasses around Tjirrkarli	Alan Bedggood	49
13	Mammals & Reptiles	John Harris/Kathy Himbeck/ Nathan Johnson	54
14	Bilbies & Great Desert Skinks	Joss Haiblen/Trish Macdonald	89
15	Marsupial Moles	Keith Johnson	110
16	Fungi	Mal McKinty	112
17	Butterflies	Ian Miles	121
18	Tempe Downs	Trevor Blake/Mick Lumb	124
19	School Visits	Allen Hyde/Judy McKinty	126
20	Feral Animal Sightings		131
21	Thanks	Keith Johnson	132

Other items on Disc

Appendices

- Birds
- Fauna (Mammals & Reptiles)
- Bilbies
- Great Desert Skinks

Photograph album

Fauna Powerpoint show Colleen Barnes

Introduction to the Tjirrkarli Project

Keith Johnson

The venue for our 2014 project was suggested by Alex Knight, Manager Land and Culture Ngaanyatjarra Council during 2012 while we were preparing for the Rawlinson Project. Representatives from the Tjirrkarli Community attended the Rawlinson Project to familiarise themselves with our people, our camp set up and the way we conduct our field work.

A reconnaissance of the Tjirrkarli Reserve and some of the country to the west was conducted at the close of the Rawlinson Project. The DD team met with a party of community leaders accompanied by Anthropologist, Gemma Aldred, at the abandoned exploration camp within the Reserve. Some time was spent seeking a suitable site for a base camp along the Hunt Oil Road. A number of abandoned exploration camps were checked without finding suitable water. After a search out to Mt Worsnop the community leaders suggested we consider Ambulance Bore for a base camp. Ambulance Bore is located eight Km to the NW of the Tjirrkarli Community. The site was visited on the last day of the recce and deemed to be suitable for a base camp. A water sample was taken for analysis and it was found to be potable.

Planning for the project commenced with a priority to establish the roads and tracks that would be available for field work and excursions by our non scientific members. The Hunt Oil Road and the Gunbarrel Highway were identified as key tracks. The David Carnegie Road (DCR) to the west of the Hunt Oil Road was also identified as a possibility for non scientific use but, as it turned out, it wasn't needed. The DCR is beyond the western boundary of Ngaanyatjarra Lands so wasn't of interest for field work. We realised that the Tjirrkarli Reserve, the approach road to the community, the Gunbarrel Highway and the Hunt Oil Road would provide sufficient country to keep our field teams busy for three weeks.

To provide a ring road around the proposed Area of Operation we sought and were granted access to the Kanpa Track (the link between the two communities) and access via Kanpa to the Hunt Oil Road. Some work was done on the northern section of the Kanpa Track.

During set up of the base camp, Daniel Johanson and the Ngaanyatjarra Rangers marked five internal tracks for our use. This made life very simple for our field teams and was greatly appreciated by all concerned.

There was only one sacred location and this was clearly marked by Daniel and his team.

Tjirrkarli in the Ngaanyatjarra language means Pencil Yam. Although out of season, our hosts found some in a creek bank. These were delivered to the WA Herbarium along with 20+ presses of plant specimens.

As will be seen from the following articles, the project was very successful across a wide field. The visits by local school children were also very successful. The interaction between hosts and visitors was outstanding and went a long way to making the project the success it was.

What did we learn from the Tjirrkarli project?

- We can set up and operate close to a community provided there is adequate community involvement in the planning stages including the reconnaissance.
- Light plywood toilets and commercial box toilets are practical alternatives to steel drums.

- DD needs to acquire some remote cameras for field work and have personnel trained in their use.
- Visits by local schools are a successful way of achieving our secondary aim of involving students in our projects.



Figure 1: Ambulance Bore, the base camp. Track at right leads to Gunbarrel Highway.



Figure 2: Pencil Yam 'Tjirrkarli' – Photographs by Keith Johnson

A Brief History of the Tjirrkarli Region

David Hewitt

The region around the site of the 2014 Desert Discovery project was occupied by the Ngaanyatjarra people - they referred to themselves as 'Yarnangu' - until the 1940s when they started moving to Laverton, to sheep stations in the Leonora/Laverton area and to Warburton Mission. Many of the men became outstanding stockmen and were much in demand by the stations or by sandalwood pulling contractors.

The first 'outsiders' to visit the region were John Forrest and his party in 1874 on their trek from Geraldton to the Overland Telegraph Line. The party consisted of John Forrest and his brother Alexander; James Sweeney, farrier; James Kennedy a policeman and Aboriginal men from the south west of WA, Tommy Windich and Tommy Pierre. Forrest used horses and his party was in the desert after what was thought to be particularly good summer rains. Part of the success of the Forrest expedition can be attributed to his Aboriginal companions. The leader wrote of Tommy Windich: *"I am much indebted for his services as a bushman. Accompanying me on many occasions, often in circumstances of difficulty and privation, I ever found him a good and honest companion"*. And Tommy was reported to have said: *"John Forrest good man but not much good without Tommy Windich"*. No doubt they complemented each other. Ernest Giles and William Gosse had already failed in attempts to cross the western half of the continent during the previous year. Giles later called on camels owned by SA pastoralist and philanthropist Sir Thomas Elder and successfully crossed the Nullarbor, returning in 1876 slightly north of Forrest's route. Blyth Pool near our Desert Discovery camp was named by Forrest after The Hon Arthur Blyth, South Australian Chief Secretary on 20th July 1874.

Unlike many of the inland explorers, the Forrests were born in WA. Over 40 years they made an outstanding contribution to the development of Western Australia. Alexander led a trek to the Kimberley in 1879, accompanied by another brother, Matthew that resulted in the opening up of the Kimberley to pastoral development. John had already led two previous expeditions, one searching for lost explorer, Ludwig Leichhardt. Later he became Surveyor General of WA, first Premier of WA and a member of Federal Parliament. He died at sea on his way to London to be invested as Baron Forrest of Bunbury.

The next recorded visitor to the area was W Carr-Boyd, a prospector who travelled from Kalgoorlie to Alexander Spring and return to Kalgoorlie. He was closely followed by David Carnegie and four companions including a faithful Aboriginal man who trekked from Coolgardie to Halls Creek. Not satisfied with a very trying trip north, during which a member of his party was accidentally killed, Carnegie returned to Coolgardie the following year on a more easterly course, calling at Blyth Pool and naming Lake Breaden (just north of the DD camp) after a member of his party. Carnegie who was only 23 at the time is specially remembered for his detailed journal, published as 'Spinifex and Sand'. He met an untimely end five years later after being hit by a poisoned arrow in Nigeria.

In the early part of the nineteenth century many adventurers and prospectors headed out from the settled areas of Laverton and Kalgoorlie to the Warburton Range and sometimes up to the Rawlinsons. They usually passed just south of our project area. Most notable of these was the Border Exploration Syndicate led by Harry Hill, Frank Hann, Sam Hazlett, geologist HWB Talbot and Government surveyors, Payne and Barclay. The Quest Expedition led by LA Wells; and missionary Bill Wade accompanied by RM Williams, on behalf of the Aboriginal Friends Society

came up from Oodnadatta. Later doggers followed and recruited Aboriginal people to assist them in trapping dingoes for which there was a bounty.

Two trips by Williams and Wade, the first in 1926, led to the establishment of Warburton Mission by the United Aborigines Mission in 1933. The first mission settlement was at a spot called 'Old Well' on Elder Creek that flows out of the Warburton Range. By 1937 over 300 Yarnangu were in contact with the mission. The main aims of the UAM were to discourage the movement of Yarnangu from the desert to Laverton where many of their people were exploited, also to present the Christian message to the traditional Aborigines. In 1951 the State Education Department took responsibility for the school but the UAM ran the mission for 40 years, with little government support till they relinquished control to an elected community council in 1973.

The Mission and later private contractors ran a profitable sandalwood pulling program in the breakaway country to the north west of Warburton and an Aboriginal family at Tjirrkarli is continuing with this today. Some of the tracks which our members travelled on during the project are used as access to the stands of sandalwood. The Desert Discovery project at Plumridge Lakes in 2000 also made use of old sandalwood tracks and an abandoned campsite.

In 1958, a team led by Len Beadell built a road later to be called the 'Gunbarrel Highway' from Giles Meteorological Station past the Rawlinson Range to Jackie Junction with a diversion to Warburton, and from Jackie Junction to Carnegie Station. In September of that year the 'Gunbarrel Road Construction Party' passed just north of the site of our Desert Discovery base camp, to Mt Beadell, Everard Junction and west to Carnegie. In 1965 Len Beadell wrote "Too Long in the Bush" on the construction of the Gunbarrel Highway followed by five other books, accompanied by his own photos and sketches on his roadbuilding experiences in the Australian outback. Len passed away in May 1995. His daughter Connie continues the family tradition of close contact with the bush through Beadell Tours, running tag-along tours into remote parts of the Western deserts. Connie and her husband Mick Hutton have been great supporters of Desert Discovery.

The Hunt Oil Company conducted oil exploration through the Gibson and Great Victoria Deserts between 1960 and 1966. The 2010 Desert Discovery project made use of an old Hunt Oil campsite. The Shell Development Company followed with further investigations in 1980 and 1981. The area bounded by Lake Gruszka in the north and the Parallel Road to the south was surveyed and two exploratory holes were drilled for oil, one at the site of the present Kanpa community. Most of the tracks used by our project teams were Shell seismic lines and our base camp at Ambulance Bore was a survey camp.

The mid 1970s saw the outstation movement take hold in remote indigenous communities with big increases in funding from the Federal Government. Outstations or homelands from Docker River in the Northern Territory and Warburton included Tjukurla, Wingellina, Blackstone, Jameson and Warakurna and they soon became self-administered communities. Tjirrkarli was one of the later outstations and was set up at the former Shell Exploration base, making use of the company's excellent water supply and large airstrip.

In 1981, the Ngaanyatjarra Council was incorporated, bringing together seven communities where a similar language was spoken. Since then another five communities have joined the council that provides services for around 1500 Aboriginal people, with the administration office in Alice Springs. The Land and Culture section anthropologists support the traditional owners (TO's) in

managing their lands and negotiating with mining companies and others who may wish to access the Lands. It also encourages the documenting of Yarnangu ecological knowledge.

Desert Discovery was fortunate in having Traditional Owners from the Tjirrkarli area and Land and Culture staff sharing with our experts in this year's project.

For further reading on the history of this area:

Giles, Ernest *Australia Twice Traversed - the Romance of Exploration*, Sampson Low, Marston, Searle and Rivington Limited, London 1889. (This edition, Doubleday Australia)

Forrest, John *Explorations in Australia*, 1875. (This edition, Libraries Board of South Australia, facsimile edition, 1969)

Carnegie, David W *Spinifex and Sand*, C Arthur Pearson Limited, London, 1898

Terry, Michael *Untold Miles*, Selwyn and Blount, London, 1934

Feeken, Erwin and Gerda and Spate OHK *The Discovery and Exploration of Australia*, Thomas Nelson Australia 1970

Williams, Reginald Murray *A Song in the Desert*, Angus and Robertson, Australia, 1998

Beadell, Len *Too long in the Bush*, Rigby Limited, Adelaide 1965

Hill, Henry William *Desert, Drought and Death - The Border Exploration Syndicate Expedition*, Hesperian Press, Perth, 2009

Tjulyuru Cultural Centre *Mission Time in Warburton*, Warburton Arts Centre, 2002

Shephard, Mark *A lifetime in the Bush - the biography of Len Beadell*, Corkwood Press, North Adelaide, 1998

Hema *Great Desert Tracks maps, South West sheet*. Brisbane 2007

Deckert, John *The Gunbarrel Highway map*, Westprint, Nhill Victoria.

Map of Area of Operation within the Gibson Desert centred on Tjirrkarli Community



Base map courtesy of Wesprint Maps

— Approximate position of tracks used by Desert Discovery participants for survey work.

- T1 = Track to Boyd Lagoon
- T4 = Track linking Tjirrkarli to the Hunt Oil Road
- T5 = Cave Track

Logistics Report - 2014 Tjirrkarli

Ben Blomfield

The Project preparations started later than usual with the reorganising and reloading of the DD Equipment onto the trailer performed at Stuart Kostera's yard in July. Unfortunately, it poured with rain and the strong winds put a definite dampener on the activity. This was improved by the delicious morning tea provided by Cheryl and Martin Gole, and Sue and Mark Conlan. DD thanks these folk plus Eric Loughton who soldiered on in appalling conditions and managed to get the trailer loaded that day and ready for departure. It was delivered to NATS Transport the next week, and they trucked it to Warburton to be ready the week before it was required. We thank Ted Box, Manager of Warburton Roadhouse for looking after the trailer until it was picked up by Allen Hyde. Many thanks to Allen for towing it to Tjirrkarli and Peter and Colleen Barnes for taking it back to Warburton. Nathan Johnson also assisted by towing Allen's trailer from Warburton to project.

This Project saw reduced pre trip preparations in the West with the decision to use plywood toilets instead of our usual 200L drum models. This had Allen Hyde and Keith Johnson feverishly hammering, sawing and gluing to create the fantastic Thrones which graced the Tjirrkarli DD Camp. Thanks to Allen Hyde for the Jimmy's Thunderbox Dunny which proved useful when the numbers swelled. Thanks to Keith Johnson and his son who welded up some spare Marquee anchor pickets.

We proposed a cautious approach with respect to water plans so only erected one shower. The planned system of pumping water from the existing 500L storage tank on Ambulance Bore using the DD Centrifugal Pump failed, so Eric Loughton implemented Plan B and used a small back up Submersible Pump. This proved very effective and performed well for the rest of the Project. Eric maximised solar pumping performance by servicing the Solar Pump Filters, after which the existing Solar System on the bore cooperated very well and had water available for tank top ups as required.

This method used substantially less fuel in the Generator than in previous Projects. The Generator performed well throughout the Project.

Dust proved to be a problem in the Camp Area. Vehicle speeds must be reduced in consideration to other campers.

These are some of the casualties; one section of Marquee canvas wall sustained a small tear which will require repairing. The DD Centrifugal Water Pump failed to pump which will require a strip down and service. The Gazebo sustained fatal damage from a strong gust of wind and will be replaced before next Project. The shower taps need the washers replaced as they drip.

DD extends many thanks to the group of early arrivals who enthusiastically assisted in the preparation and setting up of the camp facilities. Also, thanks to everyone who assisted with the smooth running of the Project equipment, and to all who assisted with the dismantling of the facilities. I owe Eric Loughton a huge THANKYOU for all his efforts before, during and after the Project. Eric coordinated the DD 2014 Logistics effort in my absence and expertly attended to the many challenges involved.



Figure 1; Solar system – photograph Keith Johnson

Participants - Tjirrkarli Project

Martin & Sandra Bailey

Peter & Colleen Barnes

Denham Barnes

Alan & Wendy Bedggood

Trevor & Beryl Blake

Fred Bohner

Keith & Norma Boschen

Mark & Sue Conlan

Lawrie & Pat Draper

Andre & Judy du Plessis

Martin & Cheryl Gole

Graham & Maree Goods

Joss Haiblen & Trish MacDonald

Bob & Kathy Hancock

John Harris & Kathy Himbeck

John Hazledine

David & Margaret Hewitt

Bruce & Anne Hillas

Allen & Robyn Hyde

Keith & Shirley Johnson

Nathan Johnson

Stuart Kostera & Meg Carty

Eric & Joy Loughton

Mick & Judy Lumb

Andreas & Christine Magun

Malcolm & Judy McKinty

David & Mim Mell

Ian Miles

Stewart & Pamela Pinney

Ivan & Sandra Reynolds

Elizabeth Sakker

Garth & Jan Strong

Colleen Thorne

Phil Trickett & Catriona Bate

Russell Wait

Stephen Walsh

John Wilkinson

Graham Young

Working on Country Co-ordinator

Daniel Johanson

Visitor

David McNamara

Traditional Owners/community members

Redina Frazer

Valeska Frazer

Jennifer Jones (Nadia)

Joyce Nelson

Melanie Nelson

Alberta Robinson

Emily Robinson

Terri-Anne Robinson

Gloria Turner (Nita)

Lillian Turner

Sharna Turner

Dulcie Watson

Natasha Watson

Brayden Bennett

Brendan Lawson

Damian Munroe

Andrew Watson

Rangers

Elton Frazer

Michael Carnegie

James Smythe

Sherma Newberry

Tjirrkarli Weather

Eric Loughton

DATE Aug/ Sept	MIN C	MAX C	WIND	CLOUD *	RAIN mm
Mon 25 th	9.5	27.5	light N	0	Nil
Tue 26 th	6.5	30	light N	0	Nil
Wed 27 th	6	31	light N-N/E	0	Nil
Thur 28 th	6.8	30	light N-N/E	0	Nil
Fri 29 th	7.2	30.5	light N- N/E	0	Nil
Sat 30 th	6.2	31.5	variable N- N/W	.5	Nil
Sun 31 st	5.5	32	Gusty N- N/W	0	Nil
Mon 1 st	10.5	27	Mod E- S/E	3	Nil
Tue 2 nd	12.5	31	Gusty E- N/E	3	Nil
Wed 3 rd	12.8	33.2	Strong- Gusty N-S/W	7	Nil
Thur 4 th	13	33	Light E- S/E	7	Nil
Fri 5 th	17.5	27	Light E S/E	8	Trace
Sat 6 th	10.8	33.5	Light E- N/E	1	Nil
Sun 7 th	14.5	34	Strong Gusts N/W	1	Nil
Mon 8 th	22	31.5	Strong N/W-W	0	Nil
Tue 9 th	10.7	31.2	Light S	0	Nil
Wed 10 th	7	31	Light S- S/E	0	Nil
Thur 11 th	14.5	31.5	Light S- S/E	0	Nil
Fri 12 th	14.5	31.5	Light S/E	0	Nil

- Cloud cover, 0 = nil 8 = full cloud cover

The weather watching duties were once again the responsibility of Eric Loughton for the Tjirrkarli project in 2014. Eric's "sensitive and expensive" equipment was damaged as a result of poor packing practices during transportation and it was feared that the accurate reliable reporting we have all come to expect would suffer as a result. Eric overcame this major setback with his resourcefulness and some borrowed equipment, which when it was teamed with the damaged gear, he was once again spot on with the weather reporting, predictions and performances.

As this 2014 project was held in a neighbouring location to the last 2012 Rawlinson Range area, we all could or should have expected the weather to be the same or very similar. And we were not disappointed. Mild nights with an average temperature of 10.9 and day time temperatures under the clear skies predominately in the low 30's kept all participants reasonably happy. The days only seemed warm to those who were active during the middle period of the day but the light and variable breezes gave them some welcome relief. The Fauna teams would have preferred warmer nights to encourage the movement of the nocturnal mammals and reptiles.

There was a "trace" of rain one evening (Peter Barnes actually caught several drops on his book cover whilst at the evening camp fire) that sent a wave of concern through the camp however it had cleared before the morning leaving the camp dry and dusty again.

The winds were light and variable for the most part with only 2 days where the wind created havoc with participants. This was a result of the upper edges of an extremely strong cold front that passed over the lower part of Western Australia with winds in excess of 100kms per hour battering the Perth Coastal areas. The winds although strong did not reach that strength at Tjirrkarli, however, the botanist gazebo suffered life threatening damage during the strongest gusts. I believe it has since been put to rest.

All in all, it was another very successful project from the weather department.



Photograph by Keith Johnson

Summary

Between 25th August and 14th September, volunteer Desert Discovery members and invited participants undertook bird surveys in the Desert Discovery Tjirrkarli Project region. Eighty three bird species were recorded and there were more than 700 individual records of birds. Thirteen observers undertook surveys and four contributed incidental records. The bird surveys have contributed significant data to the Ngaanyatjarra people, hopefully also providing a contribution to Indigenous Protected Area plans, and also to BirdLife Australia's national Bird Atlas database, the single largest citizen science project in Australia. The surveys also built a legacy of survey sites that might be repeatedly surveyed in the future.

Introduction

The 2014 Desert Discovery Tjirrkarli Project was conducted in the Gibson Desert, 125 km west-north-west of Warburton. One of the aims of the Tjirrkarli Project (hereafter called the project) was to survey as much of the region as possible for birds. Desert Discovery members and experienced invited participants were invited to undertake bird surveys and all project participants were invited to opportunistically contribute incidental records. Bird surveys commenced as Desert Discovery members and invited observers moved into the project region and ran between 25th August and 10th September 2014.



Figure 1: Crested Bellbird, one of the most commonly recorded bird species, often heard calling in variable habitats. Photo by Graham Goods.

Methods

The project region in the Ngaanyatjarra lands accessed for bird surveys was very large, and track access only possible in some areas. Due to limited time and small numbers of observers, there could be no attempt to systematically survey the entire region. Rather, an attempt was made to thoroughly

survey as many areas as possible. Surveys were either opportunistic or conducted at set distances along tracks. In addition, an attempt was also made to sample as many habitat types as possible. Most surveys were conducted during planned excursions or expeditions from the base camp at Ambulance Bore. These included a ten day expedition by six members of the team that focussed intensive survey effort on the project region, generally at two kilometre intervals on tracks, but also included less intensive surveys of the adjacent non-project areas outside Ngaanyatjarra lands along the Gunbarrel Highway, the Gibson Desert Nature Reserve, and the Hunt Oil Road. Bird survey data from outside the project region are not considered in this report. Most surveys were contributed by the bird survey team; other Desert Discovery members contributed small numbers of surveys or incidental records.



Figure 2: Male Variegated Fairy-wren. Parties of these small insectivores were generally recorded in small groups in mulga woodland and dense shrubland. Photo by Graham Goods.

Desert Discovery continues to utilise the accepted BirdLife Australia Atlas bird survey methods. These include the preferred method of surveying two hectares for birds for 20 minutes; area searches of habitat within a radius of 500 metres (preferred) or 5 kilometres; and incidental records (i.e. records outside systematic surveys). Breeding records were included opportunistically – i.e., systematic surveys were not undertaken for breeding birds.

Observers were asked to count all individual birds so that some assessment of abundance could be made. Observers were also asked to provide a basic vegetation description for each survey site, with observations being recorded in the comments section of the Atlas forms. A list of habitat description terms was provided to observers. Habitat descriptions included assessment of vegetation type (woodland, shrubland, spinifex, grassland, mulga); landform type (sandplain, breakaway, dune, swale); and soil types (sandy, loamy, gravelly, rocky). Agreed descriptors were designated for open and closed vegetation cover and whether shrubs or trees were scattered. We also attempted to assess the time since fire, and record whether plants used by nectarivorous bird species were in

flower. When analysed, most of these records were utilised for the annotated bird list (see Appendix); further analysis of the vegetation descriptions was not undertaken. Other survey data collected by observers included observer name, date, location name and positional data. Observers completed hard copy Atlas survey forms; the survey data were then scanned into BirdLife Australia's Atlas database, and unscanned data such as positional data and bird counts were manually entered.



Figure 3: Boyd Lagoon. Eight water-dependent species were recorded here, including two of conservation significance. Photo by David Mell.

Results

Three hundred and nineteen surveys were completed across the project region and an additional 94 in adjacent areas outside the project area (Table 1). Eighty one percent of the surveys used the preferred 2-hectare survey method (258 of 319 surveys; Table 2), while 9 percent (28) of the 319 surveys were contributed by area searches and 10 percent (33) by incidentals.

Table 1: Areas surveyed for birds, and numbers of bird surveys conducted for the Desert Discovery Tjirrkarli 2014 Project.

Survey area	Number of surveys	Percentage of all surveys
Project region within Ngaanyatjarra lands including the Tjirrkarli access track, areas surrounding Ambulance Bore base camp, community tracks including T1-T5 and the sandalwood track, the Tjirrkarli to Gunbarrel Highway, sections of the Gunbarrel Highway and Hunt Oil Road in Ngaanyatjarra lands, Kanpa track, and sections of the Heather Highway.	319	77%
Non-project region, including the Gibson Desert Nature Reserve and the section of the Gunbarrel Highway and Hunt Oil Road outside Ngaanyatjarra lands.	94	23%
Total number of surveys	413	



Figure 4: Male Rufous Whistler, one of the most commonly recorded species, and the most commonly recorded of the insectivores. Photo by Graham Goods.

Table 2: types of bird surveys conducted in the Desert Discovery Tjirrkarli project region between 25th August and 14th September 2014 (n = 319).

Survey type	Number of surveys
2-hectare search	258 (81%)
Area search, within 500 m or 5km radius	28 (9%)
Incidental record	33 (10%)
Total surveys	319

Four bird species of conservation significance were recorded in the Tjirrkarli project region (Table 3). The threatened Grey Falcon *Falco hypoleucos* is listed as Vulnerable under the WA Wildlife Conservation Act 1950. No species listed as Vulnerable, Endangered or Critically Endangered by the national Environment Protection and Biodiversity Act (EPBC) 1999 was recorded in the region. Major Mitchell’s Cockatoo *Cacatua leadbeateri* is a WA Schedule 4 ‘Other specially protected fauna’ species under the WA Wildlife Conservation Act 1950. Two shorebird species nationally listed as migratory species protected under international treaty were recorded; these were the Wood Sandpiper and Sharp-tailed Sandpiper.

Table 3: Bird species of conservation significance recorded in the Tjirrkarli project region between 25th August and 14th September 2014. Species of conservation concern are either listed as migratory species under the federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), or as threatened or in need of special protection under the WA Wildlife Conservation Act 1950.

Species	Conservation significance
Grey Falcon <i>Falco hypoleucos</i>	WA Wildlife Conservation Act 1950, Schedule 1 (Vulnerable)
Wood Sandpiper <i>Tringa glareola</i>	Listed under the following conventions: Bonn; CAMBA; JAMBA;ROKAMBA*
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Listed under the following conventions: Bonn; CAMBA; JAMBA;ROKAMBA*
Major Mitchell’s Cockatoo <i>Cacatua leadbeateri</i>	WA Wildlife Conservation Act 1950, Schedule 4 (Other specially protected fauna)

*The list of migratory species established under the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Most observers recorded vegetation types in survey areas. Observers included sufficiently detailed descriptions that some assessment of habitat preference was possible for most birds recorded. Although some observers attempted to identify time since fire in 2 ha survey sites, the results were not consistent across observers, nor were we confident that the results were accurate. No analysis of the relationship between bird species presence and fire age was performed on the Tjirrkarli bird survey data.



Figure 5: Mount Beadell, one of several mesas in the Tjirrkarli project region. All habitat types on survey routes were surveyed for birds. Photo by David Mell.

As expected, given the dry conditions across the project region the number of species recorded in each survey was relatively low. Seven hundred and eighteen (718) individual bird records were recorded in 319 surveys, an average of 2.25 birds per survey. Twenty one percent (54) of all systematic 2 hectare surveys resulted in no birds being recorded in the survey site.

Eighty four (84) species were recorded across the project region during the project period (Appendix). Of the ten most commonly recorded birds, two were honeyeaters (Singing and Spiny-cheeked Honeyeater). The most commonly recorded birds (Table 4) also included two seedeaters (Zebra Finch and Crested Pigeon); an aerial insectivore (Black-faced Woodswallow) and six ground and shrub layer insectivores (Rufous Whistler, Crested Bellbird, Willie Wagtail, Red-capped Robin and Variegated and White-winged Fairy-wrens). By far the most common species was Singing Honeyeater, recorded on 117 surveys (37% of surveys; Table 4). Most birds were

present in low numbers although Zebra Finch was recorded in hundreds coming to water at some rockholes. Only one species was recorded in adjacent country outside the project region in Ngaanyatjarra lands and not recorded in the project area itself. This was a single record for a group of Yellow-throated Miners, a widespread species without conservation significance.

Table 4: The eleven most commonly recorded bird species in bird surveys conducted for the Desert Discovery 2014 Tjirrkarli project. Surveys = 319.

Species	Number of records
Singing Honeyeater	117
Zebra Finch	49
Rufous Whistler	39
Black-faced Woodswallow	37
Crested Bellbird	32
Spiny-cheeked Honeyeater	27
Willie Wagtail	23
Red-capped Robin	23
Variegated Fairy-wren	22
Crested Pigeon	16
White-winged Fairy-wren	16

Twenty (20) bird species were only recorded once. These were Emu, Stubble Quail, Grey Teal, Hardhead, White-necked Heron, Tawny Frogmouth, Brown Goshawk, Collared Sparrowhawk, Spotted Harrier, Australian Hobby, Banded Lapwing, Black-eared Cuckoo, Redthroat, Slaty-backed Thornbill, Varied Sittella, Grey Butcherbird, Grey Fantail, Magpie-lark, White-backed Swallow, and Fairy Martin. These species were either patchily distributed in low numbers in the project region, or were recorded at Boyd Lagoon, the only site holding a large water body. Other waterbirds were recorded more often at Boyd Lagoon, and those records may also represent the same individuals.

During the project, eight species of waterbirds were recorded at Boyd Lagoon. Although some rockholes were holding water and attracted terrestrial species, only the brackish water of Boyd Lagoon attracted water dependent species. These included two species of migratory shorebirds, three Australian resident shorebird species, two species of ducks and one species of heron. While individual numbers of some water dependent species varied during surveys of the Lagoon, it is possible that the number of birds was fairly constant (see Appendix).



Figure 6: Sharp-tailed Sandpiper, one of two migratory shorebirds recorded at Boyd Lagoon. This species, along with the Wood Sandpiper also recorded at Boyd Lagoon, are of international conservation significance. Both are listed as protected by conservation treaties to which Australia is a signatory. Photo by David Mell.

Thirty five bird families were recorded (Table 5). Honeyeaters were the most commonly recorded species (10 species) followed by Eagles and Kites; Thornbills and Gerygones; and Woodswallows, Currawongs, Butcherbirds and Magpie (six species in each family). Night birds were poorly represented in surveys, with only one record of a frogmouth, and no records of owls or owl-nightjars.

Table 5: number of species in bird families recorded in bird surveys in the 2014 Tjirrkarli project.

Family	Number of Species
Emus and Cassowaries	1
Pheasants and Quail	1
Ducks, Geese and Swans	2
Pigeons and Doves	2
Frogmouths	1
Hérons, Egrets and Bitterns	1
Eagles, Kites, Goshawks and Osprey	6
Falcons	4
Bustards	1

Family	Number of Species
Stilts and Avocets	1
Plovers, Dotterel and Lapwings	3
Snipe, Sandpipers, Godwits, Curlew, Stints and Phalaropes	2
Cockatoos and Corellas	3
Parrots, Lorikeets and Rosellas	4
Cuckoos	2
Kingfisher	1
Fairy-wrens, Emu-wrens and Grasswrens	4
Thornbills and Gerygones	6
Pardalotes	1
Honeyeaters and Chats	10
Australian Babblers	1
Whipbirds and Wedgebills	2
Sittellas	1
Cuckoo-shrikes and Trillers	2
Whistlers, Shrike-thrushes and Allies	3
Woodswallows, Currawongs, Butcherbirds and Magpie	6
Fantails	2
Crows and Ravens	2
Monarch and Flycatchers	1
Australian Robins	2
Grassbirds	1
Swallows and Martins	2
Sunbirds and Flowerpeckers	1
Weaver Finches	1
Pipits and Wagtails	1
Total number families	35
Total number species	84

Vegetation descriptions provided by observers were included with the bird survey data. These were summarised to provide a basic assessment of the main habitat types in which birds were recorded, and included in the annotated bird species list (Appendix). Records were also assessed to determine if birds were recorded throughout the region or were more restricted in occurrence. The annotated bird list also includes the number of times a species was recorded in each of the main survey types. From this it can be seen that most species were recorded in 2-hectare surveys.



Figure 7: Transcribing field notebook bird survey records onto data sheets. This task occupied bird survey team members for many hours. Photo by Cheryl Gole.

Discussion

The Tjirrkarli project region in the Gibson Desert is relatively remote and rarely surveyed for birds, particularly in areas away from major roads and tracks such as the Great Central Road, Heather Highway and Gunbarrel Highway. The Desert Discovery project provided the first attempt to systematically survey the extended region. Despite access limitations in some areas and low numbers of observers, the surveys provided an insight into bird distribution and numbers. It is significant that 81% of all surveys (258 of 319) were conducted using the preferred 2-hectare bird survey method. This was an important result and provides a basis for repeatable surveys in the future. When seasonal conditions are taken into account, it seems likely that most of the bird species in the region were recorded. Given different seasonal conditions, including prolonged drought or particularly wet periods, recording rates and species numbers might be quite different. The surveys have made a significant contribution to knowledge, particularly as all records have been included in Australia's largest citizen science initiative, BirdLife Australia's national Bird Atlas database.



Figure 8: Brown Falcon, the most commonly recorded raptor. This species was recorded nesting at the Ambulance Bore base camp. Photo by David Mell.

Nineteen of the 84 species were not recorded using the preferred 2 ha approach. These include night birds (no 2 ha surveys are done at night when most night birds are recorded), and those that are patchily distributed and in low numbers. In addition, some species were recorded only in larger survey areas around base camps where opportunistic records increased the species numbers. The use of 2 hectare surveys is important as a repeatable method for future surveys. The survey results from this project justify the continued use of 2 hectare surveys by Desert Discovery.

The number of significant bird species recorded during the project was, as expected, low, as few threatened species and other bird species of conservation significance occur in the region. Nonetheless, four species of conservation significance were recorded: Grey Falcon, a Schedule 1 threatened species in Western Australia, Major Mitchell's Cockatoo, listed as Other specially protected fauna; and Wood Sandpiper and Sharp-tailed Sandpiper, two migratory shorebirds listed nationally by the EPBC due to international treaties of protection. Two parties of Rufous-crowned Emu-wren were recorded but the project failed to record Striated Grasswren, despite a number of searches of long-unburnt spinifex. It is significant that this widespread grasswren species is recorded so seldom: the 2012 Desert Discovery project at the Rawlinson Range recorded it once, and the 2010 Sykes Bluff Desert Discovery Project in the Great Victoria Desert failed to record it at all. Now listed under the national Action Plan for Australian Birds as Near Threatened, it is possible that this species may be declining in areas where more frequent fire does not allow the establishment of large areas of unburnt dense spinifex and associated shrubland. Rufous-crowned Emu-wren may also be declining due to changes in fire regimes, although this is speculative and more systematic survey work such as that undertaken by Desert Discovery is needed in these regions.



Figure 9: Open grassland with scattered shrub overstorey, probably burnt within the last five years. All habitats, including open habitats such as this, were systematically surveyed for birds. Photo by David Mell.

Acknowledgements

The Tjirrkarli Project region was very large, and the bird survey team did a wonderful job covering as large an area as practicable and completing so many surveys. Thanks are due to Beryl Blake, Andre du Plessis, Judy du Plessis, Cheryl Gole, Martin Gole, Judy Lumb, David Mell, Miriam Mell, Ivan Reynolds and Sandra Reynolds for their bird survey efforts. John Harris, Kathy Himbeck and Fred Bohner recorded birds in area searches while undertaking mammal and reptile trapping. A number of other people contributed opportunistic surveys or incidental records that added value to the bird survey results: these were Joss Haiblen, Keith Johnson, David McNamara, and Ian Miles. Andrew Silcocks made available the pre-existing Bird Atlas records for the project region and Keith Johnson entered the data for the manual data entry component of the data entry process. Graham Goods and David Mell provided photographs. The Ngaanyatjarra people, the traditional owners of the region, generously allowed unrestricted access to their country. To all, my thanks.

See Appendices for bird list.

Botany Report for Tjirrkarli Project

Maree Goods

The project for 2014 was held in the Tjirrkarli Aboriginal Reserve in the Gibson Desert with permission from the Ngaanyatjarra Council (Aboriginal Corporation) Land & Culture. We were privileged to be their guests and we thank them very much for this.

The work of the Botany team was done in partnership with the Ngaanyatjarra Council (Aboriginal Corporation) Land & Culture and the Western Australian Herbarium. The Herbarium provided us with presses, data sheets and guidelines for collecting. The criteria for the survey were to collect, for each species, at least three specimens which had reproductive structures (flowers, buds and/or fruit), place the specimens into plant presses, record the date, name the species (if possible), record the GPS waypoint using Map Datum WGS 84, give the general location, complete a field data sheet for each record and photograph the specimens. At the completion of the project all pressed specimens were forwarded to the Western Australian Herbarium (WAH) for formal identification.

The Botany team consisted of two main groups but sometimes a third group operated. This approach enabled us to cover as much of the area as possible. Maree Goods - Team Leader, Graham Goods, Russell Wait, Keith and Norma Boschen, Phil Trickett, Catriona Bate, Alan and Wendy Bedggood with support crew Stephen Walsh and John Hazledine formed one team (sometimes splitting into two teams). The second group consisted of Trevor and Beryl Blake, Mick and Judy Lumb, Garth and Jan Strong, and Mark and Sue Conlan.

One of our priorities was to collect a No 1 Priority plant, *Philotheca eremicola*. The location we had been given by the Herbarium was in land which did not have public access. We are very grateful for the Elders of the Warburton/Tjirrkarli communities for allowing a male representative of our team, Graham Goods, to accompany three of their rangers, Michael Carnegie, Elton Frazer, James Smythe and the Men's Working on Country Co-ordinator, Daniel Johanson, into this area in search of the elusive specimen. Despite all their hard work the search was unsuccessful. This was quite likely due to the dry conditions.

Despite the dry conditions, we still managed to collect 258 records from over 200 species. A further 35 specimens were collected outside the reporting region on the northern Hunt Oil Road and the Gunbarrel Highway. Even though there was a doubling up of some specimens, due to two or more teams working in the field, it was still worth it, because of the greater variety of specimens collected. One team would not achieve what three can. Teams were allocated their region for field work. Where two or more of the same species were collected they were at least from different areas.

Areas that had been previously burnt within the last two years yielded the greatest variety of specimens. Regions which have not previously been burnt in the last few years are very limited but do offer a different range of vegetation.

Formal identification has been received from the WA Herbarium with the following comments: *Overall most collection well collected, one likely new species and many range extensions along with new records for the Gibson Desert IBRA.* The likely new species is highlighted in yellow in the following Table and the range extensions and first time for the Gibson Desert are highlighted in green. All these specimens are recorded on Table 2. See Figure 9 for a photograph of the likely new plant.

Table 1

Date	Voucher No.	Name of plant collected	Location
24/05/2014	DD621	<i>Eremophila metallicorum</i>	8 km north of Tjirrkarli
24/05/2014	DD625	<i>Eremophila duttonii</i>	8 km north of Tjirrkarli
24/05/2014	DD623	<i>Maireana georgei</i>	8 km north of Tjirrkarli
24/05/2014	DD624	<i>Maireana triptera</i>	8 km north of Tjirrkarli
24/05/2014	DD622	<i>Scaevola spinescens</i>	8 km north of Tjirrkarli
25/08/2014	DD641	<i>Atriplex vesicaria</i>	Boyd Lagoon
25/08/2014	DD642	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Boyd Lagoon
25/08/2014	DD643	<i>Kippistia suaedifolia</i>	Boyd Lagoon
25/08/2014	DD644	<i>Streptoglossa liatroides</i>	Boyd Lagoon
25/08/2014	DD640	<i>Zygophyllum simile</i>	Boyd Lagoon
25/08/2014	DD654	<i>Amphipogon caricinus</i>	10 km north Tjirrkarli
25/08/2014	DD655	<i>Calotis hispidula</i>	10 km north Tjirrkarli
25/08/2014	DD627	<i>Dicrastylis exsuccosa</i>	Boyd Lagoon
25/08/2014	DD630	<i>Enchylaena tomentosa</i>	Boyd Lagoon
25/08/2014	DD646	<i>Eremophila glabra</i>	Boyd Lagoon
25/08/2014	DD626	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>	9 kms north of Tjirrkarli
25/08/2014	DD650	<i>Eremophila platythamnos</i> subsp. <i>aff. exotrachys</i>	10 km north Tjirrkarli
25/08/2014	DD634	<i>Frankenia cordata</i>	Boyd Lagoon
25/08/2014	DD635	<i>Lawrencia glomerata</i>	Boyd Lagoon
25/08/2014	DD628	<i>Maireana pyramidata</i>	Boyd Lagoon
25/08/2014	DD637	<i>Maireana</i> sp. (no record from WA Herbarium)	Boyd Lagoon
25/08/2014	DD629	<i>Melaleuca glomerata</i>	Boyd Lagoon
25/08/2014	DD639	<i>Podolepis capillaris</i>	Boyd Lagoon
25/08/2014	DD649	<i>Pterocaulon sphacelatum</i>	Boyd Lagoon
25/08/2014	DD636	<i>Rhodanthe tietkensis</i>	Boyd Lagoon
25/08/2014	DD651	<i>Scaevola collaris</i>	Boyd Lagoon
25/08/2014	DD631	<i>Sclerolaena eurotioides</i>	Boyd Lagoon
25/08/2014	DD645	<i>Solanum lasiophyllum</i>	Boyd Lagoon
25/08/2014	DD647	<i>Pluchea dunlopilii</i>	Boyd Lagoon
25/08/2014	DD633	<i>Tecticornia bibenda</i> (P3, 400 km range ext.)	Boyd Lagoon

25/08/2014	DD652	<i>Paraneurachne muelleri</i>	10 km north Tjirrkarli
25/08/2014	DD653	<i>Monocather paradoxus</i>	10 km north Tjirrkarli
25/08/2014	DD638	Unknown - small everlasting (no record from WA Herbarium)	Boyd Lagoon
25/08/2014	DD656	<i>Vittadinia eremaea</i>	10 km north Tjirrkarli
25/08/2014	DD632	<i>Zygophyllum aurantiacum</i>	Boyd Lagoon
25/08/2014	DD648	<i>Zygophyllum simile</i>	Boyd Lagoon
26/08/2014	DD752	<i>Acacia melleodora</i>	14 km north Tjirrkarli
26/08/2014	DD660	<i>Acacia ligulata</i>	14 km north Tjirrkarli
26/08/2014	DD664	<i>Acacia murrayana</i>	14 km north Tjirrkarli
26/08/2014	DD663	<i>Aluta maisonneuvei</i>	14 km north Tjirrkarli
26/08/2014	DD668	<i>Androcalva loxophylla</i>	14 km north Tjirrkarli
26/08/2014	DD761	<i>Anthotroche pannosa</i>	14 km north Tjirrkarli
26/08/2014	DD757	<i>Bonamia erecta</i>	14 km north Tjirrkarli
26/08/2014	DD671	<i>Calandrinia eremaea</i>	14 km north Tjirrkarli
26/08/2014	DD672	<i>Calandrinia balonensis</i>	14 km north Tjirrkarli
26/08/2014	DD758	<i>Calotis erinacea</i>	14 km north Tjirrkarli
26/08/2014	DD659	<i>Calytrix carinata</i>	14 km north Tjirrkarli
26/08/2014	DD756	<i>Chrysocephalum eremaeum</i>	14 km north Tjirrkarli
26/08/2014	DD755	<i>Crotalaria cunninghamii</i>	14 km north Tjirrkarli
26/08/2014	DD666	<i>Dampiera cinerea</i>	14 km north Tjirrkarli
26/08/2014	DD760	<i>Dampiera ramosa</i>	14 km north Tjirrkarli
26/08/2014	DD753	<i>Dicrastylis</i> sp. (sterile discarded)	14 km north Tjirrkarli
26/08/2014	DD754	<i>Dicrastylis</i> sp. (sterile discarded)	14 km north Tjirrkarli
26/08/2014	DD669	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	14 km north Tjirrkarli
26/08/2014	DD751	<i>Grevillea eriostachya</i>	14 km north Tjirrkarli
26/08/2014	DD657	<i>Gyrostemon ramulosus</i>	14 km north Tjirrkarli
26/08/2014	DD673	<i>Leucochrysum stipitatum</i>	14 km north Tjirrkarli
26/08/2014	DD665	<i>Newcastelia cephalantha</i>	14 km north Tjirrkarli
26/08/2014	DD764	<i>Pimelea trichostachya</i>	14 km north Tjirrkarli
26/08/2014	DD670	<i>Podolepis canescens</i>	14 km north Tjirrkarli
26/08/2014	DD661	<i>Santalum lanceolatum</i>	14 km north Tjirrkarli
26/08/2014	DD667	<i>Scaevola basedowii</i>	14 km north Tjirrkarli

26/08/2014	DD762	<i>Sida</i> sp. sand dunes	14 km north Tjirrkarli
26/08/2014	DD763	<i>Sida</i> sp.	14 km north Tjirrkarli
26/08/2014	DD662	<i>Solanum coactiliferum</i>	14 km north Tjirrkarli
26/08/2014	DD759	<i>Trichodesma zeylanicum</i>	14 km north Tjirrkarli
26/08/2014	DD658	<i>Triodia schinzii</i>	14 km north Tjirrkarli
27/08/2014	DD677	<i>Acacia pachyacra</i>	14 km west Tjirrkarli
27/08/2014	DD679	<i>Alyogyne pinoniana</i>	18 km west Tjirrkarli
27/08/2014	DD675	<i>Dodonaea petiolaris</i>	6 km west Tjirrkarli
27/08/2014	DD676	<i>Corymbia candida</i>	6 km west Tjirrkarli
27/08/2014	DD674	<i>Pluchea dentex</i>	6 km west Tjirrkarli
27/08/2014	DD678	<i>Triodia schinzii</i>	14 km west Tjirrkarli
28/08/2014	DD680	<i>Acacia burkittii</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD690	<i>Acacia tetragonophylla</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD700	<i>Alternanthera nodiflora</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD694	<i>Calandrinia Ptychosperma</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD766	<i>Centipeda thespidioides</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD697	<i>Centipeda crateriformis</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD689	<i>Chloris truncata</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD688	<i>Eragrostis setifolia</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD681	<i>Eremophila gilesii</i> subsp. <i>gilesii</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD687	<i>Euphorbia boophthona</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD693	<i>Eriachne flaccida</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD699	<i>Dicanthium sericeum</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD683	<i>Ptilotus helipteroides</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD684	<i>Rhodanthe charsleyae</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD686	<i>Rhodanthe propinqua</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD765	<i>Rutidosis helichrysoides</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD691	<i>Sclerolaena eriacantha</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD692	<i>Sclerolaena densiflora</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD685	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD682	<i>Senna notabilis</i>	12.2 km East Abandoned Hunt oil camp
28/08/2014	DD701	<i>Solanum orbiculatum</i>	11 km East Abandoned Hunt oil camp

28/08/2014	DD696	<i>Swainsona tenuis</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD767	<i>Themeda triandra</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD702	<i>Trachymene bialata</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD698	<i>Evolulus alsinoides</i> var. <i>villosicalyx</i>	11 km East Abandoned Hunt oil camp
28/08/2014	DD695	<i>Wahlenbergia tumidifructa</i>	11 km East Abandoned Hunt oil camp
29/08/2014	DD718	<i>Acacia abrupta</i>	18.5 km East Mt Worsnop
29/08/2014	DD708	<i>Acacia pteraneura</i>	8.5 km South abandoned Hunt oil camp
29/08/2014	DD724	<i>Acacia murrayana</i>	6.5 km South West Mt Worsnop
29/08/2014	DD723	<i>Acacia prainii</i>	6.5 km South West Mt Worsnop
29/08/2014	DD768	<i>Anthobolus leptomerioides</i>	25.3 East Mt Worsnop
29/08/2014	DD706	<i>Aristida contorta</i>	9.6 km South abandoned Hunt oil camp
29/08/2014	DD717	<i>Brunonia australis</i>	17.1 km South abandoned Hunt oil camp
29/08/2014	DD710	<i>Dysphania kalpari</i>	8.5 km South abandoned Hunt oil camp
29/08/2014	DD705	<i>Dysphania rhadinostachya</i>	9.6 km South abandoned Hunt oil camp
29/08/2014	DD713	<i>Eremophila serrulata</i>	16.5 km South abandoned Hunt oil camp
29/08/2014	DD720	<i>Goodenia lyrata</i>	6.8 km South West Mt Worsnop
29/08/2014	DD709	<i>Monochather paradoxus</i>	8.5 km South abandoned Hunt oil camp
29/08/2014	DD721	<i>Eragrostis lanipes</i>	6.8 km South West Mt Worsnop
29/08/2014	DD716	<i>Hibiscus burtonii</i>	17.1 km South abandoned Hunt oil camp
29/08/2014	DD715	<i>Indigofera georgei</i>	17.1 km South abandoned Hunt oil camp
29/08/2014	DD703	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	9.6 km South abandoned Hunt oil camp
29/08/2014	DD722	<i>Macgregoria racemigera</i>	6.5 km South West Mt Worsnop
29/08/2014	DD719	<i>Olearia decurrens</i>	6.8 km South West Mt Worsnop
29/08/2014	DD714	<i>Salsola australis</i>	16.5 km South abandoned Hunt oil camp
29/08/2014	DD712	<i>Santalum spicatum</i>	16.5 km South abandoned Hunt oil camp
29/08/2014	DD711	<i>Schoenia cassiniana</i>	8.5 km South abandoned Hunt oil camp
29/08/2014	DD707	<i>Sclerolaena densiflora</i>	9.6 km South abandoned Hunt oil camp
29/08/2014	DD704	<i>Sida</i> sp. <i>Excedentifolia</i>	9.6 km South abandoned Hunt oil camp
30/08/2014	DD801	<i>Stackhousia megaloptera</i> ²	Link Road from Tjirrkarli to Hunt Oil Road
31/08/2014	DD809	<i>Acacia ligulata</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD816	<i>Alyogyne pinoniana</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD803	<i>Anthobolus leptomerioides</i>	30 kms east of Mt Worsnop

31/08/2014	DD831	<i>Calandrinia ptychosperma</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD811	<i>Maireana</i> sp. (sterile, not retained)	6 kms south of Mt Worsnop on HOR
31/08/2014	DD821	<i>Chrysocephalum</i> sp.	6 kms south of Mt Worsnop on HOR
31/08/2014	DD806	<i>Codonocarpus cotinifolius</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD807	<i>Dicrastyliis exsuccosa</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD725	<i>Eremophila falcata</i>	2 km East Mt Worsnop
31/08/2014	DD804	<i>Eremophila forrestii</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD824	<i>Eremophila gilesii</i> subsp. <i>gilesii</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD812	<i>Eremophila glabra</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD830	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD837	<i>Eremophila glabra</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD832	<i>Frankenia</i> sp.	4 kms south of Mt Worsnop on HOR
31/08/2014	DD817	<i>Goodenia lyrata</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD822	<i>Grevillea juncifolia</i> (no record from WA Herbarium)	6 kms south of Mt Worsnop on HOR
31/08/2014	DD805	<i>Hakea lorea</i> subsp. <i>lorea</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD839	<i>Tecticornia indica</i> subsp. <i>leiostachya</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD819	<i>Leucochrysum stipitatum</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD823	<i>Macgregoria racemigera</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD825	<i>Maireana carnososa</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD810	<i>Maireana georgei</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD826	<i>Maireana triptera</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD827	<i>Maireana pyramidata</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD802	<i>Mistletoe - Amyema</i> sp. (not retained)	30 kms east of Mt Worsnop
31/08/2014	DD828	<i>Olearia decurrens</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD842	<i>Pterocaulon sphacelatum</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD818	<i>Ptilotus polystachyus</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD808	<i>Ptilotus obovatus</i>	10 kms south of Mt Worsnop on HOR
31/08/2014	DD813	<i>Sclerolaena deserticola</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD840	<i>Sclerolaena eurotioides</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD820	<i>Senna artemisioides</i> subsp. <i>petiolaris</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD815	<i>Senna artemisioides</i> subsp. <i>petiolaris</i>	6 kms south of Mt Worsnop on HOR

31/08/2014	DD835	<i>Solanum coactiliferum</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD814	<i>Solanum lasiophyllum</i>	6 kms south of Mt Worsnop on HOR
31/08/2014	DD829	<i>Podolepis capillaris</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD833	<i>Maireana amoema</i>	4 kms south of Mt Worsnop on HOR
31/08/2014	DD834	<i>Dodonaea viscosa</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD836	<i>Pluchea rubelliflora</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD841	<i>Tecticornia halocnemoides</i>	5 kms south of Mt Worsnop on HOR
31/08/2014	DD838	<i>Chrysocephalum eremaeum</i>	5 kms south of Mt Worsnop on HOR
1/09/2014	DD849	<i>Acacia ramulosa</i> (no record from WA Herbarium)	3 kms south of Mt Worsnop
1/09/2014	DD848	<i>Acacia sibirica</i>	3 kms south of Mt Worsnop
1/09/2014	DD854	<i>Acacia ? paraneura</i>	1.8 kms south of Mt Worsnop
1/09/2014	DD874	<i>Acacia aptaneura</i>	Alexander Spring
1/09/2014	DD857	<i>Acacia tetragonophylla</i>	1.5 kms south of Mt Worsnop
1/09/2014	DD856	<i>Aluta maisonneuvei</i>	1.5 kms south of Mt Worsnop
1/09/2014	DD845	<i>Atriplex semilunaris</i>	3 kms south of Mt Worsnop
1/09/2014	DD866	<i>Atriplex vesicaria</i>	1 km north-east of Mt Worsnop
1/09/2014	DD861	<i>Calotis multicaulis</i>	1 km north-east of Mt Worsnop
1/09/2014	DD860	<i>Convolvulus clementii</i>	1 km north-east of Mt Worsnop
1/09/2014	DD875	<i>Dodonaea petiolaris</i>	Alexander Spring
1/09/2014	DD851	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	3 kms south of Mt Worsnop
1/09/2014	DD847	<i>Enchylaena tomentosa</i>	3 kms south of Mt Worsnop
1/09/2014	DD865	<i>Eremophila eriocalyx</i>	1 km north-east of Mt Worsnop
1/09/2014	DD872	<i>Eremophila exilifolia</i>	Alexander Spring
1/09/2014	DD855	<i>Eremophila glabra</i>	1.5 kms south of Mt Worsnop
1/09/2014	DD863	<i>Eremophila youngii</i> subsp. <i>youngii</i>	1 km north-east of Mt Worsnop
1/09/2014	DD871	<i>Erodium cygnorum</i>	1 km north-east of Mt Worsnop
1/09/2014	DD853	<i>Halgania erecta</i>	1.8 kms south of Mt Worsnop
1/09/2014	DD852	<i>Spartothamnella teucriflora</i>	2 kms south of Mt Worsnop
1/09/2014	DD869	<i>Maireana tomentosa</i>	1 km north-east of Mt Worsnop
1/09/2014	DD843	<i>Maireana tomentosa</i>	3 kms south of Mt Worsnop
1/09/2014	DD846	<i>Maireana georgei</i>	3 kms south of Mt Worsnop
1/09/2014	DD850	<i>Maireana georgei</i>	3 kms south of Mt Worsnop

1/09/2014	DD864	<i>Cucumis maderaspatana</i>	1 km north-east of Mt Worsnop
1/09/2014	DD870	<i>Pittosporum angustifolium</i>	1 km north-east of Mt Worsnop
1/09/2014	DD867	<i>Ptilotus macrocephalus</i>	1 km north-east of Mt Worsnop
1/09/2014	DD858	<i>Senna artemisioides</i> subsp. <i>artemesioides</i> (no record from WA Herbarium)	1 km north-east of Mt Worsnop
1/09/2014	DD877	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	Alexander Spring
1/09/2014	DD878	<i>Sida</i> sp. Golden calyces glabrous	Alexander Spring
1/09/2014	DD876	<i>Sida calyxhymenia</i>	Alexander Spring
1/09/2014	DD868	<i>Rhodanthe propinqua</i>	1 km north-east of Mt Worsnop
1/09/2014	DD879	<i>Solanum lasiophyllum</i>	Alexander Spring
1/09/2014	DD862	<i>Streptoglossa liatroides</i>	1 km north-east of Mt Worsnop
1/09/2014	DD859	<i>Swainsona tenuis</i>	1 km north-east of Mt Worsnop
1/09/2014	DD873	<i>Wahlenbergia tumidifructa</i>	Alexander Spring
1/09/2014	DD844	<i>Rhodanthe battii</i>	3 kms south of Mt Worsnop
2/09/2014	DD885	<i>Acacia abrupta</i>	3.5 kms north of Alexander Spring
2/09/2014	DD886	<i>Acacia rhodophloia</i>	3.5 kms north of Alexander Spring
2/09/2014	DD892	<i>Acacia rhodophloia</i>	2.5kms north of Alexander Spring
2/09/2014	DD880	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Alexander Spring
2/09/2014	DD893	<i>Eremophila latrobei</i>	Alexander Spring
2/09/2014	DD884	<i>Eremophila punctata</i>	3 kms north of Alexander Spring
2/09/2014	DD890	<i>Eremophila granitica</i>	3.5 kms north of Alexander Spring
2/09/2014	DD888	<i>Goodenia azurea</i> subsp. <i>hesperia</i>	3.5 kms north of Alexander Spring
2/09/2014	DD891	<i>Halgania solanacea</i> var. Mt Doreen	4 kms north of Alexander Spring
2/09/2014	DD889	<i>Hybanthus aurantiacus</i>	3.5 kms north of Alexander Spring
2/09/2014	DD887	<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	3.5 kms north of Alexander Spring
2/09/2014	DD882	<i>Marsilea exarata</i>	Alexander Spring
2/09/2014	DD883	<i>Santalum acuminatum</i>	1 km north of Alexander Spring
2/09/2014	DD894	<i>Scaevola spinescens</i>	500 mts south of Alexander Spring
2/09/2014	DD881	<i>Alternanthera nodiflora</i>	Alexander Spring
3/09/2014	DD903	<i>Acacia victoriae</i>	1 km north of Mt Worsnop
3/09/2014	DD899	<i>Brachyscome ciliaris</i>	2 kms south of Alexander Spring
3/09/2014	DD895	<i>Eremophila clarkei</i>	2 kms south of Alexander Spring
3/09/2014	DD896	<i>Eremophila hygrophana</i>	2 kms south of Alexander Spring

3/09/2014	DD900	<i>Eremophila platycalyx</i> subsp. <i>platycalyx</i>	2.5 kms south of Alexander Spring
3/09/2014	DD905	<i>Paractaenum refractum</i>	Hunt Oil Road
3/09/2014	DD904	<i>Hibiscus arenicola</i>	Hunt Oil Road
3/09/2014	DD901	<i>Kennedia prorepens</i>	2.5 kms south of Alexander Spring
3/09/2014	DD897	<i>Ptilotus helipteroides</i>	2 kms south of Alexander Spring
3/09/2014	DD898	<i>Ptilotus polystachyus</i>	2 kms south of Alexander Spring
3/09/2014	DD902	<i>Themeda triandra</i>	2.5 kms south of Alexander Spring
4/09/2014	DD789	<i>Acacia ramulosa</i> var. <i>linophylla</i>	25 km North Tjirrkarli
4/09/2014	DD787	<i>Calandrinia balonensis</i> (seed immature)	25 km North Tjirrkarli
4/09/2014	DD784	<i>Codonocarpus cotinifolius</i>	33 km North Tjirrkarli
4/09/2014	DD781	<i>Cymbopogon obtectus</i>	44 km North Tjirrkarli
4/09/2014	DD786	<i>Dicrastylis</i> aff. <i>lewellinii</i>	25 km North Tjirrkarli
4/09/2014	DD785	<i>Eremophila</i> sp. (undescribed taxon, looks closely related to <i>E. shonae</i>)	29 km North Tjirrkarli
4/09/2014	DD782	<i>Grevillea juncifolia</i>	35 km North Tjirrkarli
4/09/2014	DD779	<i>Halgania glabra</i>	48 km North Tjirrkarli
4/09/2014	DD788	<i>Haloragis</i> sp. (no record from WA Herbarium)	25 km North Tjirrkarli
4/09/2014	DD780	<i>Ptilotus schwarzii</i>	48 km North Tjirrkarli
4/09/2014	DD783	<i>Sida cardiophylla</i> (no record from WA Herbarium)	35 km North Tjirrkarli
4/09/2014	DD790	<i>Velleia glabrata</i>	25 km North Tjirrkarli
5/09/2014	DD791	<i>Acacia quadrimarginea</i>	Camel Bore
5/09/2014	DD793	<i>Eremophila ramiflora</i>	8 kms south-west of Tjirrkarli
5/09/2014	DD792	<i>Spartothamnella teucrifolia</i>	Camel Bore
7/09/2014	DD908	<i>Corymbia opaca</i> (no record from WA Herbarium)	7 kms south of Tjirrkarli
7/09/2014	DD906	<i>Eremophila duttonii</i>	7 kms south of Tjirrkarli
7/09/2014	DD907	<i>Eucalyptus</i> sp.	7 kms south of Tjirrkarli
8/09/2014	DD909	<i>Acacia maitlandii</i> (fine leaf form)	13.4 kms south-east of Tjirrkarli
8/09/2014	DD915	<i>Androcalva loxophylla</i>	13.4 kms south-east of Tjirrkarli
8/09/2014	DD910	<i>Gompholobium polyzygum</i>	13.4 kms south-east of Tjirrkarli
8/09/2014	DD913	<i>Goodenia azurea</i> subsp. <i>hesperia</i>	13.4 kms south-east of Tjirrkarli
8/09/2014	DD912	<i>Goodenia triodiphila</i>	13.4 kms south-east of Tjirrkarli
8/09/2014	DD918	Grass (no record from WA Herbarium)	13.7 kms south-east of Tjirrkarli

8/09/2014	DD916	<i>Petalostylis cassioides</i>	13.7 kms south-east of Tjirrkarli
8/09/2014	DD920	<i>Ptilotus clementii</i>	Heather Hwy - 6 kms south-east of turn-off to Tjirrkarli
8/09/2014	DD917	<i>Sida cardiophylla</i>	13.7 kms south-east of Tjirrkarli
8/09/2014	DD919	<i>Stenanthemum petraeum</i>	Heather Hwy - 6 kms south-east of turn-off to Tjirrkarli
8/09/2014	DD911	<i>Heliotropium chrysocarpum</i>	13.4 kms south-east of Tjirrkarli
8/09/2014	DD914	<i>Dampiera dentata</i>	13.4 kms south-east of Tjirrkarli

Table 2 - New Records

DD 633 *Tecticornia bibenda* (P3, 400 km range ext. (First record for GD))

DD 639 *Podolepis capillaris* (First record for GD)

DD 640 *Zygophyllum simile* (First record for GD)

DD 643 *Kippistia suaedifolia* (First record for GD)

DD 644 *Streptoglossa liatroides* (First record for GD)

DD 648 *Zygophyllum simile* (probably mixed collection (First record for GD))

DD 719 *Olearia decurrens* (First record for GD)

DD 760 *Dampiera ramosa* (First record for GD)

DD 785 *Eremophila* sp. (undescribed taxon, looks closely related to *E. shonae*)

DD 786 *Dicrastylis* aff. *lewellinii*

DD 825 *Maireana carnosae* (First record for GD)

DD 828 *Olearia decurrens* (First record for GD)

DD 833 *Maireana amoema* (First record for GD)

DD 839 *Tecticornia indica* subsp. *leiostachya* (First record for GD)

DD 841 *Tecticornia halocnemoides* (First record for GD)

DD 845 *Atriplex semilunaris* (First record for GD)

DD 862 *Streptoglossa liatroides* (First record for GD)

All specimens were collected under the permits of Graham Goods, Permit No SW016359, Maree Goods, Permit No SW016358, Trevor Blake No SW0103641 and Russell Wait No SW016363

Acknowledgements:

I would like to thank all the team who put in such a fantastic effort and spent many a long hour not only out in the warm sun collecting specimens but researching through books, spending time on the computer, cataloguing photos and pressing specimens.

I would like to acknowledge those who so willingly transported presses to DD from Perth. A special thank you to Keith and Shirley Johnson who made the extensive detour to deliver the majority of the presses back to Perth.

We value the continuing relationship with the Western Australian Herbarium whose staff give us wonderful support and always willingly provide us with the necessary feedback for our reports. Their guidance, through Karina Knight, Collections Manager, is invaluable. Thank you to Rob Davis, Botanist, who meticulously went through all our specimens and formally identified them. A special thank you to Kevin Thiele, Curator of the Herbarium, for giving DD a copy of the software *FloraBase in the Field*, and assisting with setting it up.

Last but not least, our leader for the project, Keith Johnson. His contribution was enormous. He was always available for advice. His leadership was exemplary.

References:

Books

Moore, P. (2005). *A Guide to Plants of Inland Australia*.

Kutsche, F & Lay, B. (2003) *Field Guide to the Plants of Outback South Australia*.

Jessop, J., Dashorst, G.R.M. & James, F.M. (2006) *Grasses of South Australia*.

Australian Daisy Study Group. (2002). *Everlasting Daisies of Australia*.

Online Resources

Atlas of Living Australia (2014). Viewed November 2014. www.ala.org.au.

Flora Base, WA Herbarium (2014). Viewed November 2014.
<http://florabase.dpaw.wa.gov.au/search/advanced>

Flora of Western Australia unplugged.



Figure 1: Some of the Botany Team on top of Mt Beadell – time lapse photograph supplied by Graham & Maree Goods. Back: Stephen Walsh; Middle: Russell Wait, Phil Trickett, Keith Boschen, Maree Goods, Norma Boschen, Alan Bedggood; Front: John Hazledine, Wendy Bedggood, Catriona Bate, Graham Goods. See page 1 for the names of all members of the Botany group.



Figure 2: *Scaevola collaris* – Catriona Bate



Figure 3: *Macgregoria racemigera* – Keith Boschen



Figure 4: *Kennedia prorepens* – Graham Goods



Figure 5: *Ptilotus helipteroides* – Judy Lumb



Figure 6: *Halgania glabra* – Maree Goods



Figure 7: *Grevillea eristachya* – Russell Wait



Figure 8: *Tecticornia bibenda* a P3 priority plant has been given a 400 km range extension. - Catriona Bate.



Figure 9: New species of Eremophila. Insert showing hairs on the fruit – Russell Wait

These photographs, and others, are displayed in the photo album under # 406.

The whole area of the project provided bags of interest for all participants who ventured into Tjirrkarli. From close to Warburton the roadsides indicated there had been rain earlier in the season and in the newly disturbed areas beside the bitumen there was a spectacular display of vegetation in full flower.

As we progressed further north towards the DD base camp evidence of rain diminished considerably and for those who ventured to the Gunbarrel Track it became considerably drier and hence the flowering lessened in its spectacular capability.

A couple of km. before we reached Mt Worsnop in a dune area were plants of *Anthrotroche pannosa*, a silver-leaved shrub but a little too early to see its unusual black flowers. *Dodonaea viscosa* which is a colonizing species on disturbed sands happened to be on the rises beside a dried claypan. What a wealth of flora in a small area on the pan – *Maireana planifolia*, a shrubby species with almost iridescent golden fruits. Some of the nasty ones, *Sclerolaena deserticola*, with their impressive prickles, that if embedded in your socks demand instant attention., *Atriplex vesicaria* ssp. *variabilis*, a widespread saltbush, *Calandrinia balonensis*, a spectacular Parakeelya with its fleshy leaves and brilliant purple flowers, *Alyogyne pinoniana*, from the Hibiscus family with large purple flowers were on sandy rises above the clay. A little further along this claypan where there was evidence of crusted salt was a red, fleshy-leaved plant that is regularly associated with this sort of habitat, *Tecticoma indica*.

The area we paid a little more attention to was well along the Hunt Oil Track. - Mt Worsnop, Alexander Spring area – a vastly more used track than when we visited in 1999. Having a group of low mesas and breakaway country it seemed to attract a little more rain than surrounding areas. Mt Worsnop itself is quite visible from a distance sticking up out of the plain with Mt Allot and breakaways to the north east.

The approach was from the south through the Common Mulga and out onto scrubby plain which was dotted with dry soaks that supported more robust growth of many different species to the surrounding Chenopod plain, of mainly *Atriplex vesicaria*. These depressions were quite dry but they had been moist as the low herbaceous plants indicated.

The golden flowers of *Senna artemisioides* were massed on compact bushes and the outliers were some of the toughest of all wattles *Acacia tetragonophylla* – the ‘Dead Finish’ and a *Hakea leucoptera* with its prickly, needle-like foliage. *Eremophila latrobei* with its red tubular flowers and silvery foliage survived well here too. The floor of the soaks were covered with *Goodenia lyrata*, *Ptilotus polystachyus*, *Streptoglossa liatroides*, *Swainsona tenuis*, the creeper, *Convolvulus clementii* and another trailing through the shrubbery, *Mukia maderaspatana*. A little yellow daisy *Rhodanthe battii* and that bizarre dwarfed white clump of flowers usually found at the base of Spinifex, *Macgregoria racemigera*. Anything that looked like an *Eremophila longifolia* was eaten to a stick by camels and yet *Eremophila youngii* existed here too but was left well alone. A burst of *Ptilotus macrocephalus* tucked under the shrubbery had not been trampled.

Any young seedlings of *Pittosporum angustifolium* were well and truly ravaged making me wonder how two mature trees of this species had survived - they probably had grown large enough prior to the camel invasion. One of the dwellers of this tree decided to make its presence known as we collected fruit and flower, - A large golden orb weaver spider paraded down the trunk – impressive!

Out on the plain were chewed down specimens of *Eremophila eriocalyx* and the saltbushes *Maireana tomentosa* and *villosa*, while on the sides of Mt Worsnop were stairways of the compact low *Eremophila hygrophana* with their spectacular silvery leaves and contrasting purple flowers.

On the arid summit of this alpine monster that rises almost 50 metres from the plain is more Mulga, *Acacia aneura* and, of course, *Ptilotus obovatus* the Mulla Mulla which seems to be forever in flower and everywhere you look with its grey pompom heads.

The pea sized gravel covering much of our study area has been millions of years in the making and these hills we were scrambling around are the clue to the original height of the land. Erosion has done the rest as it has worn away the sands and soft material leaving a concentration of pebbles or gravels on the surface of the soils building up over eons – gibber plains have formed in the same way.

From the vantage point of our ‘Alpine Summit’ could be seen a good healthy line of gum trees *Corymbia terminalis* indicating a reliable creek line. The flats or, at times, the flood plain was covered in a magnificent lawn of Kangaroo Grass, *Themeda triandra* a metre high, and along the tracks were the far less plentiful but striking and unmistakable Lemon Grass, *Cymbopogon oblectus*. Dotted along the drainage lines was the widespread purple, pea-flowered creeper, *Kennedia prorepens*. two *Ptilotus*, *P. helipteroides*, and *P. gaudichaudii* – and a *lachnostachys* sp. The universal everlasting, *Helipterum floribundum* was widespread on this flatter country but not abundant. The striking silver- leafed shrub with the masses of fluffy golden ball flowers was one of the group of *Dicrastylis exsuccosa* and this was ssp. *cinerea* with a very yellow coloration. Amongst all this vegetation were some fascinating insects and the grasshoppers were plentiful and varied.

The walk along the creek to Alexander Spring produced a surprising group of species *Eremophila punctata*, *maculata* ssp. *brevifolia*, the latter with its narrow grey warty leaves. The creek itself had ample clumps of Mulga and a Rock Fern, *Cheilanthes sieberi* which was tucked in along the creek banks and in the protection of shrubs. Nardoo, *Marsilea exarata* and the prostrate herbaceous plant, *Alternanthera nodiflora* were growing in any little pockets of moisture. Into this mix of species we recorded *Eremophila platycalyx* ssp. *platycalyx* with its showy spotted corolla. A striking shrub growing in almost pure rock with greatly enlarged seed pods was one of the Hopbushes, *Dodonaea petiolaris* and at the bases of these and the predominant tall Mulga were tiny yellow flowered *Sida* plants with their wispy stems and a red and orange fruited scrambling species *Enchylaena tomentosa*. The pool of historic significance (Alexander Spring) was quite obvious and relatively deep compared with our 1999 visit – it and the whole creek had been scoured of heavy sand.

The rise beyond the spring was covered with more Mulga and an old friend that yielded so much evidence of Bilby activity that Trish and Joss were plotting and monitoring – *Acacia rhodophloia* with the Minni-Ritchi bark. Purple flowers seemed to abound with *Eremophila granitica*, the Bush Tomato, *Solanum coactiliferum* and the striking *Halgania solanacea*. Amongst the prickly *Triodia basedowii* grew the upright, blue-flowered *Goodenia azurea* and mixed in with this was the strange yellow-flowered *Hybanthus aurantiacus* with its apron-like flowers.

The campsites in the area were plentiful and we spent a couple of nights with the Goles Birdo team relating more tall stories and experiences along these tracks.

My thanks to the team for their consistent hard work:-

Mick & Judy Lumb, Sue & Mark Conlan, Jan & Garth Strong & Beryl Blake.

References:-

‘*Flora of Australia*’, Bureau of Flora & Fauna

'Flora of Central Australia', Aust Systematic Botany Society

'Eremophila & Allied Genera', Chinnock

'Plants of Inland Australia' Moore

'Flora Base', WA Herbarium



Figure 1: Judy Lumb, Trevor Blake, Mick Lumb & Sue Conlan – Photograph by Garth Strong.

The following photographs were supplied by Trevor Blake. These plant photographs and others submitted by Trevor's party are included in the main photo album under # 405.



Figure 2- *Acacia rhodophloia*



Figure 3 – *Eremophila punctata*



Figure 4 – *Alyogyne pinoniana*



Figure 5 – *Eremophila revoluta*



Figure 6 – *Eremophila youngii*



Figure 7 – *Seringia elliptica*

The inclusion of grasses in the 2014 DD plant collecting survey was to me a very satisfying experience, my addition to a very sociable and cohesive group who all added their bit to make a very pleasurable and productive activity. I can't wait for the next survey.

Our first day at DD was spent on an induction foray to Boyd Lagoon to collect plants. The formal nature of collecting for herbarium collections soon became apparent and our group naturally fitted into roles that met our personal interests and skills, the scribes, the photographers, the collectors and the pressers, and, of course, our most knowledgeable and very diplomatic leader Maree.

After a full session of collecting, we departed the lagoon and stopped on the way home to collect yet another plant. By chance Catriona (Gaelic for Katrina) found a grass clump with distinctive dried heads (glumes and rachis). Not knowing its name botanically, this became known to us as *Catriona Grass*. We collected another couple of grasses and this started what was to become a personal interest for the rest of the DD tour (and beyond). We saw this grass at many other stops every day of our tour and the name *Catriona Grass* rolled off the tongue readily. This was later determined to be *Amphipogon caricinus*.

I have an understanding of what is required for herbarium collections as I made a plant collection of mostly grasses in my Burnley Horticultural College course many years ago. I have also spent nearly 40 years in rainfed-cropping agriculture as an occupation which built on grasses, both as a weed in crops and as a cereal crop in the Victorian barley breeding program.

Plant breeding also involves careful observation of plant structure to select out individual plant types and so the auricles become important - "big in barley" to be able to separate wheat and barley plants very early in the season, awned and awnless, smooth awned types and the like. Thus, I tend to see differences in the grasses (maturities, growth stages, head types, colour) rather than the general observation of "just another grass".

Armed with this background, I began to see grasses at every turn or stop. The same familiar species kept appearing, spinifex of course, *Triodia sp*, but also *Catriona grass*, *Amphipogon caricinus*, several species of three-awned grass including *Aristida holathera* and *A contorta* and several *Eragrostis spp*, especially the distinctive wooly butt, *Eragrostis eriopoda*. The distinctive head types and dried glume/rachis combinations soon enabled the grasses to be at least grouped to genera.

Being aware of the *Eucalyptus* species being associated with soil types, I soon realised that the grass species were responding in the same way. The deep sands were colonised by the spinifex *Triodia sp* but as the sands morphed with the sandy loams, species of *Amphipogon* and *Aristida* were interspersed with the *Triodia*, sometimes in mixed combinations, other times more restricted.

There were occasions where large areas of a single species occurred (*Amphipogon*, *Aristida*, *Eragrostis*, *Eriachne*) presumably on patches of suitable soils and where the fire regime (timing - after or before seed set, intensity - killing some clumps but not others with rhizomes, etc) had benefited that species (or a combination of both).

Intermittent water courses were usually of heavier soil types and obviously have longer moisture availability. These were better suited to additional species such as Windmill Grass *Enteropogon sp*,

Blue Grass *Dichanthium sp*, Silky Browntop *Eulalia aurea* and Cotton Grass *Digitaria brownii*. These combinations were found quite commonly on our survey path where the moisture collected, on our way to the Hunt Oil Road, in depressions along that road, at Camel Get In Bore, etc.

In addition to these was the Lemon Scented Grass, *Cymbopogon oblectus*, that was quite widespread but still preferred "moisture" and shaded areas. (An infusion of green leaves in boiling water for five minutes made a nice cup of tea).

This delineation of grass species to suitable soil/moisture combinations was illustrated most strikingly at the Hunt Oil Camp No 8, just prior to Alexander Spring, where there was a river of Kangaroo Grass, *Themeda triandra*. This species prefers moisture soils and it had colonised the narrow band of the watercourse for a hundred metres or more, not in the rocky headwater area but along the silty/loamy bed of the watercourse.

Another striking illustration of the plant - soil relationships was seen on the way into the Camel Get In Bore where we passed through a rocky, rubbly area of mulga with single-species grass areas of "Worsnop" grass. This was seen on top of Mount Worsnop and on the surrounding scree area and was later identified as Mountain Wanderrie Grass, *Eriachne mucronata*.

The DD experience had a lasting influence on me. I enjoyed immensely the camaraderie of our group and the willing acceptance of all members. The shared contribution each of our areas of interest and the willingness to allow time for each of us to "find" things was great. I did not mind (smilingly ignored) the "not another grass Alan" comment when I called for another one to be collected.

I am looking forward to participating in 2016, God willing.

Upon returning to home, I now own Grasses of South Australia (Jessop, *et al*) and Grasses of New South Wales (Jacobs, *et al*) which add to our Flora of Victoria - *Poacea* chapter by Neville Walsh (*whose brother Steve was an enthusiastic member of our DD group*). I have also purchased a self-lit 40X hand lens and some hobbyist spectacles with 10X – 25X lens. I have pressed over 30 plants and have identified all to genera but only some to species. I now need to retire so that I have time to commit to yet another area of interest.

I now see grasses along every road and footpath, most commonly the introduced species but more spectacularly the natives. *Austrostipa elegantissima* appears to be very widely distributed as I have seen it across Victoria and eastern South Australia as well as in the south west of Western Australia. Why haven't I seen this before?



Figure 1: *Amphipogon caricinus*, known to us as Catriona grass. Photographer Catriona Bate.



Figure 2: *Themeda triandra*, Kangaroo Grass - Photographer Keith Boschen



Figure 3: *Dichanthium sp.*, Blue Grass - Photographer Catriona Bate



Figure 4: *Cymbopogon oblectus*, Lemon Scented Grass - Photographer Alan Bedgood



Figure 5: *Eriachne aristidea* - Photographer Graham Goods

Tjirrkarli Project Fauna Survey Report

John Harris, Kathy Himbeck and Nathan Johnson

INTRODUCTION

The boundaries managed by the traditional owners associated with the Tjirrkarli Aboriginal Community was the focus area for the 2014 Desert Discovery Project fauna survey group. The Tjirrkarli Aboriginal Community is located in the “rirra” (plateau of ironstone pebbles) country approximately 110km north-west of Warburton in a direct path and approximately 150km by road, within the *Ngaanyatjarra* Council area. The community is named after a native yam (Tjirrkarli).

Two teams combined to survey a range of vegetation types that were accessible using the existing network of tracks extending approximately 25km north-west and 16km south-west of the Tjirrkarli Aboriginal Community. In the absence of Clive Crouch, one team was led by Nathan Johnson with the assistance of Elizabeth Sakker, John Wilkinson and Peter, Colleen and Denham Barnes (Team 1). The second team was led by John Harris and Kathy Himbeck and assisted by Fred Bohner (Team 2). Others assisted the teams throughout the survey as time permitted. With two teams operating, this was the biggest and most successful survey effort for the any Desert Discovery Project to date. In summary, the two teams surveyed for 2328 trap nights capturing 503 animals from 68 species. Members of all reptile families along with mammals and three bird species were recorded using the various techniques outlined later in this report.

Fauna surveys were conducted between 25 August and 13 September 2014. A range of survey methods were employed across the three weeks including a variation in methodology between the two teams. Team 1 used the method of trapping for 3 nights at a single vegetation type and Team 2 trapped for 5-6 nights in a general area covering multiple vegetation types. Each of the two teams operated independently over the survey period, but was in collaboration prior to the commencement of each week to ensure as many of the different vegetation types occurring within the area were sampled and there were minimal overlaps. The use of pitfall traps was the main method employed by both teams across most of the various vegetation types, unless the ground was impenetrable. Elliott/Box traps, harp traps and cameras were also used in conjunction with active searches.



Photo 1: Desert Banded Snake *Simoselaps anomalus*

During the first two weeks, both teams were based out of Ambulance Bore, the nominated base camp for the project, located approximately 6km north of the Tjirrkarli Aboriginal Community. Team Two continued to be based out of Ambulance Bore during the third week and Team One set up a mobile camp for three days near 'The Cave', approximately 16km south-west of the Tjirrkarli Aboriginal Community.

Throughout the three weeks, incidental fauna observations were also made by members of the fauna survey team and other Desert Discovery participants whilst travelling the network of tracks of the larger survey area. Unless the animal was characteristically identified, photographic evidence was required to confirm any observation recorded by another member of Desert Discovery that was not part of the fauna team. These have been included in the report.

This survey was conducted following the terms and conditions of *License to take Fauna for Scientific Purposes No. 009934* and *No. 009961*, issued by the Western Australian Department of Parks and Wildlife. As a condition of the DPAW permit all fauna observations were added to the Fauna Survey section of the DPAW website (www.dec.wa.gov.au/fauna/returns)

Taxonomy mentioned in this report is based on Wilson and Swan (2013) for reptiles, Van Dyck *et al* (2013) for mammals and Christidis and Boles (2008) for birds.

STUDY AREA

The area of survey was predominately within the boundaries of Tjirrkarli Aboriginal Reserve, extending out into the surrounding *Ngaanyatjarra* lands to the north and south of the Tjirrkarli Aboriginal Community. The study area is completely within the Gibson Desert and is situated approximately 60km south of the Gibson Desert Nature Reserve.

The study area is within the Gibson Desert bioregion. This bioregion supports vast, undulating sand plains, dune field and lateritic gibber plains. The vegetation within the bioregion is generally described as mainly mulga and other mixed shrubs over spinifex (McKenzie *et al* 2003).

The Gibson Desert has an arid climate with variable and unpredictable rainfall. The mean annual rainfall is 200mm with most falling in summer (Graham *et al* 2001).

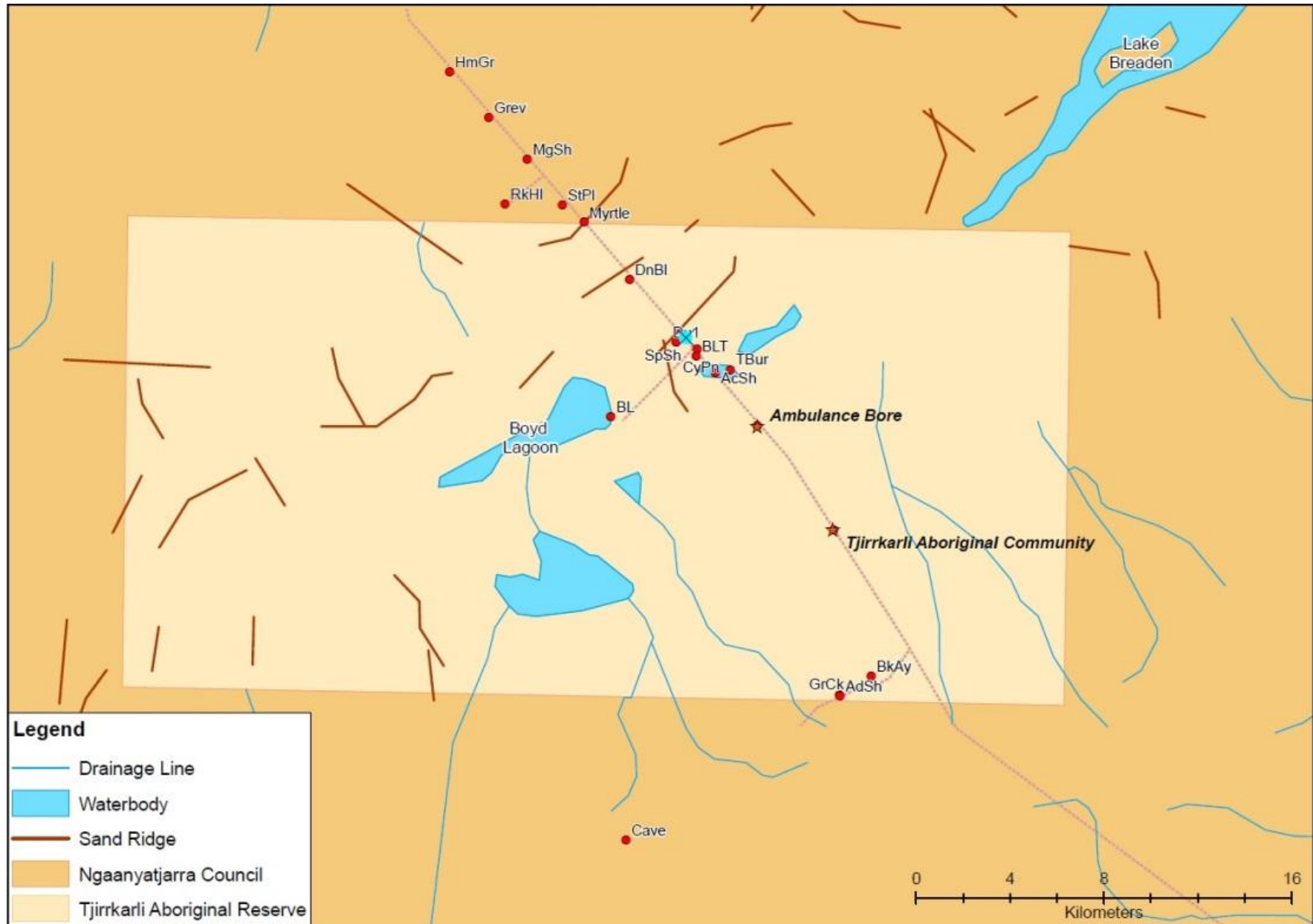
Survey sites were based on accessibility, using the existing network of tracks extending approximately 25km north-west and 16km south-west of the Tjirrkarli Aboriginal Community.

SITE DESCRIPTIONS

Sites were selected based on the following criteria: gaining a representative sample of the local habitats; unusual or unique habitats; and ease of access from base camp in order to ensure checks could be carried out within the applicable time period as well as for the benefit of the school groups that came to the project during the second week.

Over the three weeks, a total of 34 sites were surveyed. These 34 sites were grouped into 11 broad communities based on similarities of vegetation or landform. The 11 communities are Hummock Grassland, Mulga Shrubland, Dune Shrubland, Stony Plain, Claypan, Acacia Shrubland, Breakaways, Grassy Creekline, Arid Shrubland, Salt Lake and Corymbia Woodland. A description of each site within these communities is below and the coordinates for each site can be found in Table 1.

Figure 1. Extent of the Fauna Survey Area Showing Individual Sites.



Hummock Grassland

The four 'spinifex plains' sites were located in a large open hummock grassland plain. All sites were characterised by having dense, mature Hard Spinifex *Triodia basedowii*, to 1m in height, on a lateritic buckshot soil. There were occasional medium to small shrubs, Honey Grevillea *Grevillea eriostachya*, *Acacia* sp and Cassia *Senna* sp, Felty Bellflower *Bonamia rosea*, Upside-down Plant *Leptosema chambersii*, *Dicrastylis Dicrastylis exsuccosa cinerea* with trailing Scarlet Runner *Kennedia prorepens*. Woollybutt grass *Eragrostis eriopoda* was also present. Spinifex Sites 2 and 3 were devoid of shrubs, while Site 1 had a few dead trunks of taller shrubs, more representative of the vegetation community approximately 50m south. (see Appendix 2, Photo 11).

Mulga Shrubland

Mature, open Mulga *Acacia* sp up to 5m, over scattered *Eremophila* sp with a moderate cover of Hard Spinifex, forming large rings. Streaked Goodenia *Goodenia centralis* was also present as a creeping groundcover. This community was also on lateritic soils. The large spinifex rings, upwards of 3m, were evidence of a relatively large post-fire history. (see Appendix 2, Photo 12).

Dune Shrubland

Eleven slightly differing sites were combined into this community. The sites were located on parallel red sand dunes, each running east-west approximately 2km apart. All sites had shrubs as the dominant vegetation type with Hard Spinifex, other grasses and groundcovers as the predominant understorey.

'Grevillea Dune'

These three sites were situated on the crest of a dune with Rattlepod Grevillea *Grevillea stenobotrya* the dominant overstorey with occasional Large-fruited Mallee *Eucalyptus youngiana*, *Acacia* sp., Corky Bark *Gyrostemon ramulosus* and Desert Heath Myrtle *Aluta maisonneuvei*. The understorey was composed of Hard Spinifex, Woollybutt grass and Wilcox Bush *Eremophila forrestii*. There were thick blankets of leaf litter under the Rattlepod Grevilleas. (see Appendix 2, Photo 13).

'Heath Myrtle Dune'

The two heath myrtle dunes sites were dominated by Desert Heath Myrtle along with wattles, cassias and scattered Corky Bark. The understorey was clumps of spinifex with small herbs with a considerable amount of bare sand between. DnSh1 was across the top of the dune in a more open area than DnSh2. It also had a depression in the dune nearby, where a camera was set up. DnSh2 supported more shrub and spinifex cover along with fallen timber compared to the first site. (see Appendix 2, Photo 14).

'Spinifex Shrubland'

The four sites were positioned across the top of the dune, lower on the dune towards the swale on the northern side, mid-dune on the southern side and in a swale on the southern side. The top of the dune (SS1) and lower northern side (SS2) had similar species being Rattlepod Grevillea, Desert Heath Myrtle, Hard Spinifex, Corky Bark, *Dicrastylis Dicrastylis exsuccosa cinerea* and daisy bushes. SS2 had more Hard Spinifex and immature shrubs in the understorey.

The third site (SS3), on the southern side of the dune, also contained Corkwood *Hakea lorea* and scattered dead shrubs and prone timber. Further to the south in the swale, SS4 had scattered scrubs to 3m, spinifex understorey and *Melaleuca* sp. This site had been burnt sometime in the past (several years?). (see Appendix 2, Photo 15).

'Dune Bowl'

A large, long, continuous dune with 'bowl' feature. Dune Shrubland community with vegetation consisting of a wide range of species dominated by Spinifex *Triodia* sp. and Corky Bark. The size and age of most of the vegetation (mainly up to 50cm) suggests it had been burned within the last five years. (see Appendix 2, Photo 16).

'Dune 1'

A large continuous dune with a dense covering of medium to large shrubs of high diversity dominated by Desert Heath Myrtle, surrounded by Mulga shrubland. (see Appendix 2, Photo 17).

Stony Plain

This was an area of open lateritic sandstone, either embedded or as loose pebbles or rocks on the surface. The site had very little vegetation cover due to fire some time ago. The minor drainage lines that traversed the plain effectively contained the only groundcover species, namely a range of grasses. Standing, dead tree trunks were also part of this community. (see Appendix 2, Photo 18).



Photo 2: Ooldea Dunnart *Sminthopsis ooldea*

Boyd Lagoon

A salt lake with dense covering of samphire *Tecticornia bibenda* at the inlet, surrounded by high soft dunes dominated by wattles and spinifex species. (see Appendix 2, Photo 19).

Claypan

This claypan had an interesting vegetation composition. The northern side of the eastern portion was primarily composed of Buffel Grass *Cenchrus ciliaris*, the middle of the claypan was dominated by Heart-leaved Frankenia *Frankenia cordata*, while other smaller areas were dominated by mixed shrub species or cassia and mixed chenopods. All these differing compositions were within 100m of each other. The sites are described further below. The western portion had ‘islands’ of shallow sand and mulga shrubland also.

‘Buffel Grass Plain’

This area of the claypan was dominated by Buffel Grass, an introduced species, with scattered Woollybutt, *Melaleuca* and cassias on a sandy clay soil. The area of Buffel Grass was on the northern side of the claypan and did not extend far into the claypan. With the presence of in the middle of the claypan, one thought is that there is a higher salt content in the middle of the claypan which excludes Buffel Grass as it is only moderately salt tolerant. Buffel is also sensitive to waterlogging. (see Appendix 2, Photo 20).

‘Mixed Shrubland’

This shrubland community was on consolidated sand marginally higher (<50cm) than the surrounding clay pan. It was dominated by a mix of medium-sized shrubs *Melaleuca*, *Eremophila*, *Senna* and *Acacia* spp. These shrubs were over an open grassy understorey with Woollybutt, Buffel and other grasses. The soil was of a sandy clay composition. (see Appendix 2, Photo 21).

‘Chenopod Shrubland’

Open shrubland comprising of taller cassias over Mulla Mulla *Ptilotus* sp with various chenopod species and Woollybutt as low shrubs and groundcover. The soil was more sandy in composition but had been compacted. (see Appendix 2, Photo 22).



Photo 3: Western Beaked Gecko *Rhynchoedura ornatus*, a common claypan gecko.

'Boyd Lagoon Track'

A hard clay pan sparsely covered with Heart-leaved Frankenia, intermittent small islands of shallow sand with a sparse covering of shrubs and a shallow sand Mulga shrubland to the west. (see Appendix 2, Photo 23).

Acacia Shrubland

All three sites in this community were open shrubland with wattles dominating the overstorey. A variety of smaller shrubs and grasses scattered throughout.

The second site (AcSh2) had occasional large *Acacia* sp but was dominated by Silver Tails *Ptilotus obovatus*. Cassia species were also present with the groundcover consisting of scattered spinifex and Woollybutt. (see Appendix 2, Photo 24).

The other two sites (AcSh1 and AcSh3) were dominated by *Acacia* sp with occasional Corkwood, however these shrubs were scattered through most area. Silver Tails was present in the understorey dominated by spinifex. AcSh1 had less Silver Tails and Corkwood present and was lacking the many fallen, dead shrubs that were present in AcSh3 (see Appendix 2, Photo 25).

Breakaway Country

The Breakaway Country was scattered to the south and west of Ambulance Bore, consisting of hard rock on the surface with crumbling rock faces forming narrow cliffs with scree slopes below.

'The Cave'

A large area of exposed rock ending in a cliff with numerous small to medium caves and one large cave. Immediately in front of the caves was a stony plain with a sparse covering of grasses and shrubs, surrounded by Mulga shrubland. (see Appendix 2, Photo 26).



Photo 4: Harp traps set at the entrance to the cave.

Breakaways

The Breakaway country had tall mature wattles and eucalypt shrubs/small trees on the slopes. The understorey had small scattered shrubs, open areas of rock, graduating downslope to an open, low pan with chenopods present. The edge of the breakaway was crumbly in nature, forming shelves and crevices. The scree slopes were composed of small rocks rather than slabs (see Appendix 2, Photo 27).

Grassy Creekline

Both creekline sites were beside a dry watercourse. The vegetation consisted of dense grasses including *Cymbopogon* sp. There was occasional cassias, *Ptilotus* sp in the understorey also. Mature Mulga and *Grevillea* sp were very sparsely distributed across the sites. There were cracking clay soils near the waterline (see Appendix 2, Photo 28).

Arid Shrubland

Sites 1 and 2 were side by side but differed in their characteristics. The area supported mature and senescing Mulga with an understorey of cassia, *Ptilotus*, *Eremophila* and *Maireana* spp.

AdSh1 was amongst senescing and dead Mulga on a hard clay soil. The understorey was almost not existent, being sparsely vegetated with the above species. There was a considerable amount of fallen logs lying on the ground and large areas of bare soil. To the east of this site, was dense shrubby vegetation along a dry drainage line. AdSh2 was situated amongst a taller, denser stand of Mulga. The understorey was thicker than AdSh1 but lacked the fallen timber of that site, while the soil was more of a sandy-clay (see Appendix 2, Photo 29).

The third site (AdSh3) was predominantly an 'Island' of Mulga and taller shrubs, with a small shrub and grass understorey. Surrounding this patch was a sparsely vegetated, low chenopod stony pan.

'Rock Holes'

A small area of exposed rock with two naturally occurring depressions up to 1m deep, that can hold water for some months after rain. This formation is surrounded by an open Mulga grassland (see Appendix 2, Photo 30).

'The Burrows'

A series of networked burrows in a sparsely vegetated area of stony plain with the occasional *Eremophila* sp. and surrounded by *Corymbia* woodland (see Appendix 2, Photo 31).

Table 1. Coordinates for each of the survey sites.

Site	Community	Code	Coordinates		
			Zone	Easting	Northing
Spinifex Plain (4)	Hummock Grassland	HmGr4	51	730987	7141406
Spinifex Plain (3)	Hummock Grassland	HmGr3	51	730927	7141357
Spinifex Plain (2)	Hummock Grassland	HmGr2	51	731155	7141251
Spinifex Plain (1)	Hummock Grassland	HmGr1	51	731068	7141179
Mulga	Mulga Shrubland	MgSh1	51	734357	7137561
Grevillea Dune (1)	Dune Shrubland	DnSh5	51	732660	7139345
Grevillea Dune (2)	Dune Shrubland	DnSh4	51	732705	7139333
Grevillea Dune (3)	Dune Shrubland	DnSh3	51	732746	7139362
Heath Myrtle Dune (1)	Dune Shrubland	DnSh2	51	736767	7134876
Heath Myrtle Dune (2)	Dune Shrubland	DnSh1	51	736739	7134854
Spinifex Shrubland (1)	Dune Shrubland	DnSh6	51	741040	7129954
Spinifex Shrubland (2)	Dune Shrubland	DnSh7	51	741051	7129992
Spinifex Shrubland (3)	Dune Shrubland	DnSh8	51	741099	7129956
Spinifex Shrubland (4)	Dune Shrubland	DnSh9	51	741170	7129895
Dune Bowl	Dune Shrubland	DnSh10	51	738704	7132420
Dune 1	Dune Shrubland	DnSh11	51	740682	7129766
Stony Plains	Stony Plain	StPl	51	735838	7135612
Boyd Lagoon	Salt Lake / Dune Shrubland	BL	51	737912	7126602
Buffel Grass Plain	Claypan	CyPn1	51	741521	7129535
Mixed Shrubland	Claypan	CyPn2	51	741492	7129433
Chenopod Shrubland	Claypan	CyPn3	51	741665	7129476
Boyd's Lagoon Track	Claypan	CyPn4	51	741543	7129171
Acacia Shrubland (1)	Acacia Shrubland	AcSh1	51	742300	7128477
Acacia Shrubland (2)	Acacia Shrubland	AcSh2	51	742415	7128505
Acacia Shrubland (3)	Acacia Shrubland	AcSh3	51	742361	7128398
The Cave	Breakaways	BkAy1	51	738548	7108537
Breakaways	Breakaways	BkAy2	51	748998	7115549
Creekline (1)	Grassy Creekline	GrCk1	51	747653	7114776
Creekline (2)	Grassy Creekline	GrCk2	51	747608	7114735
Arid Shrubland (1)	Arid Shrubland	AdSh1	51	747674	7114672
Arid Shrubland (2)	Arid Shrubland	AdSh2	51	747662	7114700
Shrubby 'Island' (3)	Arid Shrubland	AdSh3	51	748726	7115302
'Rock Holes'	Breakaway / Mulga grassland	RkHl	51	733395	7135656
'The Burrows'	Corymbia Woodland	TBur	51	743000	7128606

METHODOLOGY

Week 1

In the first week, Team 1 surveyed sites within 'Dune Bowl' that are within the 'Dune Shrubland' community between 25 and 28 August and 'Boyd Lagoon' between 28 and 31 August. The survey used a combination of Box and pitfall traps for 'Dune Bowl' and a combination of Box, Pitfall and cage traps for 'Boyd Lagoon'. Team 1 also set camera traps at the 'Rock Holes' from 27 August until 1 September.

Team 2 surveyed the vegetation types 'Hummock Grassland', 'Mulga Shrubland', 'Stony Plain' and 'Grevillea' and 'Heath Myrtle Dune' vegetation types of the broader 'Dune Shrubland' community between 25 and 31 August 2014. The survey incorporated a combination of Elliott, Pitfall and camera traps plus active searches.

Week 2

During the second week both teams surveyed the vegetation type 'Dune 1' within the 'Dune Shrubland' community and Boyd Lagoon Track within the 'Clay Pan' community, but utilising different regimes. Team 1 surveyed the 'Dune 1' between 31 August and 3 September and 'Boyd Lagoon Track' between 3 to 6 September. The survey for both vegetation types used a combination of Box and Pitfall traps. Team 1 also used camera traps at 'The Burrows', a site near the *Corymbia* woodland from 1 to 7 September.

Team 2 also surveyed the vegetation types 'Spinifex Shrubland' within the 'Dune Shrubland' community, along with 'Buffel Grass Plain', 'Mixed Shrubland' and 'Chenopod Shrubland' within the 'Clay Pan' community, plus 'Acacia Shrubland' between 1 to 6 September. The survey used a combination of Elliott, Pitfall and camera traps plus active searches.

At the end of the second week, members from both teams combined to conduct a brief survey at 'The Cave' for 4 hours on 6 September 2014, extending from the late afternoon into the evening. The survey used a combination of Box traps, harp traps and active searching.

Week 3

During the third week Team 1 set up a mobile camp near 'The Cave' and surveyed the vegetation type 'Breakaway' between 8 and 11 of September 2014. The survey used a combination of Box, Pitfall, cage and camera traps plus active searches.

Team 2 surveyed a similar vegetation type of 'Breakaway', 'Arid Shrubland' and 'Grassy Creekline' between 8 and 13 of September 2014. The survey used a combination of Elliott, Pitfall, cage, Camera and Harp traps and active searches.

Pitfall Trap

The two teams used slightly differing techniques for their pitfall trapping. Pitfall traps comprise a 35-40cm high drift fence made of aluminium flywire or shade cloth up to 30m long over a number of 20L plastic buckets dug into the ground. The buckets had holes in the bottom, covered by flywire to prevent small animals escaping, along with sand, leaf litter or other vegetation and sections of egg carton to provide shelter for animals caught in them. The drift fence was held in place using wire pegs. Team 2 used sheets of corflute to cover each bucket acting as a weather shelter.

During the first two weeks, Team 2 used five buckets evenly spaced along the drift fence while there were six per drift fence for surveys conducted during the third week. A variation of this technique was employed during the third week at Arid Shrubland 3 (AdSh3) where Elliott-style traps, instead of buckets, were evenly placed along the drift fence which was t-shaped rather than straight.

Team 1 employed their pitfalls for a three night period while Team 2 left their pitfalls open at the same site for five to six nights.



Photo 5: Pitfall trap showing Centralian Blue-tongue moving towards the bucket, along the fence.

Crouch Box Trap

These are small wooden traps made from marine ply measuring 300mm x 160mm x 130mm with a simple treadle plate mechanism. The bait used was a combination of rolled oats, peanut butter, sunflower seeds and apple. Traps were placed on the southern side and under vegetation for shelter.

‘Elliott-style’ Trap

These traps are folding, aluminium-sided box traps that are treadle operated. A bait ball consisting of peanut butter, rolled oats and golden syrup was placed inside the trap, behind the treadle. ‘Bedding’ material comprising leaf litter, dried grass or leaves was also placed inside the trap. The trap was then wrapped in a strip of hessian before being placed into position in a covered, shady location wherever possible.

Cage Trap

Cage traps are larger than other enclosed trap types and in turn, designed for larger fauna.

Team 1

Steel frame traps with mesh sides using a treadle plate mechanism measuring approximately 500mm x 350mm x 300mm. Various baits were utilised including peanut butter, rolled oats, sunflower seeds and chicken meat. These were placed on the southern side of large shrubs for shelter.

Team 2

These traps were only used at the Breakaways, due to the possibility of catching larger fauna. The traps were baited with the same mixture as the ‘Elliott’s’. They were wrapped in hessian and placed alongside the edge of the Breakaways near crevices.

Harp Trap

Harp traps consist of a square, rigid aluminium tubular frame that supports two banks of vertical strands of fishing line (Churchill, 2008). Bats cannot detect the fishing line so get caught between the two banks of line. The bat then flutters downwards and gets caught in the large cloth holding bag below. The traps were checked each morning.

These traps were set up in areas that were considered to be potential flyways for the bats such as along dry watercourses, gaps between taller vegetation or at the entrance to a cave system.

All harp traps were set overnight, except for the night at the ‘Bat Cave’ which was only set for approx. 2.5 hours, due to distance of the cave from base camp and that it was apparent that this cave was a maternity cave for at least one species of bat.

Camera Trap

Team 1

Two types of cameras were used; Reconyx HC550 Hyperfire and Faunatech KG-680. The cameras were attached either to a tripod or star picket and either not baited (when positioned adjacent to a rock-hole for example) or baited with a combination of sunflower seeds and apple. The cameras were programmed to take photos only.



Photo 6: Dingo captured on camera, sniffing bait station.

Team 2

Camera traps were used at various locations using two types of lures. The carnivorous lure consisted of tuna oil and water, with the general mammal lure consisting of peanut butter, vanilla essence, honey and oil. Wadding was soaked in these mixtures, separately, then placed into PVC tubes and pegged into the ground (Ritchie *pers comm*, 2014). Cameras were mounted on star pickets, or tree trunks, 2-3m away from the lure. The cameras were programmed to take either a series of three photos or a short length of video.

Active Searches

Active searching was undertaken at a number of sites and involved looking under fallen timber and rocks, raking leaf-litter, looking under bark of standing trees, spotlighting and general observations while within each site.

Incidental Observations

These observations were made where animals, mainly reptiles, were seen from the vehicle while travelling between sites or within the wider Tjirrkarli community.

Table 2: Trapping Effort per Site

Week	Code	Duration (Nights)	Trap Effort (nights)					
			Pitfall	Elliott	Box	Cage	Harp	Camera
1	HmGr4	6	120	30				
1	HmGr3	6						
1	HmGr2	6						
1	HmGr1	6						
1	MgSh1	4	20					
1	DnSh5	6	85					
1	DnSh4	6						
1	DnSh3	5						
1	DnSh2	5	45	40			10	
1	DnSh1	4						
1	StPl	4		150				
1	DnSh10	3	120		120			
1	SL	3	90		120	6		
1	RkHl	6					12	
2	DnSh6	5	100	100			2	
2	DnSh7	5						
2	DnSh8	5						
2	DnSh9	5						
2	CyPn1	5	75					
2	CyPn2	5						
2	CyPn3	5						
2	DnSh11	3	105		120			
2	CyPn4	3	105		120			
2	AcSh1	5	70					
2	AcSh2	5						
2	AcSh3	4						
2	TBurr	6					12	
3	BkAy1	3	18		120	6	5 Hours	9
3	GrCk1	5	50	50				
3	GrCk2	5						
3	AdSh1	5	45	50			5	4
3	AdSh2	4						3
3	BkAy2	5		150		8		4
3	AdSh3	3		18	6			
Total Trapping Effort			1048	588	606	20	9*	57

Legend: Pitfall – Pitfall trap; Elliott – ‘ Elliott-style’ trap; Box – Crouch Box trap; Cage – Cage traps; Harp – Harp trap; Camera – Camera trap

RESULTS

As so many sites were surveyed during the three weeks, the combined results table highlighting species captured across all sites is provided in Appendix 3 Results for the individual or groups of sites are tabulated and discussed below. Where multiple sites were at the same location, the results are combined into the one table (eg Hummock Grasslands). Multiple sites that have been combined into one community (eg Dune Shrubland), as outlined in Table 1 above, a summary table of the combined results for the community and a separate table for the sites is included.

Hummock Grassland

Table 3. Results from the Hummock Grassland Community

Species Name	Common Name	Survey Method			
		Pitfall	Elliott	Active	Incidental
Skink	2	6	0	0	0
<i>Ctenotus nasutus</i>	Long-snouted Ctenotus	1			
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	5			
Dragon	2	0	0	1	1
<i>Ctenophorus isolepis gularis</i>	Central Military Dragon			1	
<i>Moloch horridus</i>	Thorny Devil				1
Pygopod	3	3	0	2	0
<i>Delma butleri</i>	Spinifex Delma	2			
<i>Delma nasuta</i>	Sharp-snouted Delma	1			
<i>Delma sp.</i>	Unidentified Delma			1	
<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot			1	
Mammal	4	1	0	0	3
* <i>Camelus dromedaries</i>	Dromedary Camel				1
<i>Canis lupus dingo</i>	Dingo				1
<i>Macropus rufus</i>	Red Kangaroo				1
<i>Ningauai ridei</i>	Wongai Ningauai	1			
Bird	1	0	0	0	1
<i>Ardeotis australis</i>	Australian Bustard				1
	TOTAL	10	0	3	5
	Total Individuals	18			
	Total Species	12			

Considering that nearly 20% of the pit traps employed by Team 2 were in this community, the results were quite poor. Only 10 individuals of 5 fauna species were captured with the Leopard Skink making up 50% of the captures. Pygopods had the highest species richness with three species, followed by skinks with two and one mammal. Varanids (Monitors), Geckos, Agamids (Dragons) and snakes were all absent from the captures, although Agamids were sighted during active searching in this habitat. All incidental records were based on identified tracks with the Thorny Devil tracks being observed along the pitline fences but were never captured.

Mulga Shrubland

Table 4. Results from the Mulga Shrubland Community

Species Name	Common Name	Survey Method	
		Pitfall	Active
Skink	2	2	0
<i>Ctenotus brooksi</i>	Brooks' Wedge-snouted Ctenotus	1	
<i>Menetia greyii</i>	Common Dwarf Skink	1	
Total Individuals		2	
Total Species		2	

The Mulga Shrubland was depauperate of non-avian fauna species, despite it being a mature community. The soil was exceptionally hard to dig and was quite an effort to establish one pitline *let alone* more. Both skinks were common species encountered at a number of different sites throughout the entire survey. Despite the presence of mature spinifex in large rings with dead leaf litter in the middle, active searching yielded no further species or individuals than those already caught.

Dune Shrubland

Table 5. Combined Results from the Dune Shrubland Community

Fauna Groups	Sp.	Indiv'l	Survey Site									
			Grevillea		Heath		Spinifex		Bowl		Dune 1	
			Sp	Ind	Sp	Ind	Sp	Ind	Sp	Ind	Sp	Ind
Gecko	6	29	1	3	3	6	4	11	2	2	2	7
Skink	16	127	5	11	6	8	5	22	9	53	8	33
Dragon	4	7			1	1	2	3	2	2	1	1
Pygopod	3	3	1	1					1	1	1	1
Monitor	2	2					2	2				
Snake	2	11					2	4			2	7
Mammal	6	18			3	5	3	4	1	3	3	6
Total	39	197	7	15	13	20	18	46	4	61	17	55

The Dune Shrubland community, comprising of five different vegetation assemblages was the most heavily sampled with 455 pit, 380 Elliott's or box and 12 camera trap nights combined. Six different sites were sampled in Week 1 of the survey with this community being heavily surveyed again in Week 2 at five sites. The Week 2 sites were chosen due to the close proximity to our base camp at Ambulance Bore, as students from Ngaanyatjarra schools were our guests during that week so the trapping sites had to be accessible for the school vehicles.

With the increased trapping effort at the 11 sites within this vegetation community, it is not surprising that over half of all fauna species captured and recorded during this survey were from this community. Skinks were by far the largest number of species and individuals captured with 10 more species and nearly 100 more individuals than any other group.

‘Grevillea Dune’

Table 6. Results from the ‘Grevillea Dune’ Site

Species Name	Common Name	Survey Method	
		Pitfall	Active
Gecko	1	3	0
<i>Nephrurus laevisissimus</i>	Pale Knob-tailed Gecko	3	
Skink	5	9	2
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	1	
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	1	
<i>Lerista bipes</i>	Western Two-toed Slider	5	
<i>Morethia ruficauda</i>	Fire-tailed Skink	2	
<i>Tiliqua multifasciata</i>	Centralian Blue-tongue		2
Pygopod	1	1	0
<i>Delma butleri</i>	Spinifex Delma	1	
	TOTAL	13	2
	Total Individuals	15	
	Total Species	7	

Despite the amount of leaf litter from grevilleas on the ground, spinifex being present and some fallen timber, the number of fauna captured was quite low. The two Centralian Blue-tongues were captured along or near the fence but not in the pit traps. No animals were found during active searching, primarily raking, despite the large amounts of leaf litter present.

‘Heath Myrtle’ Dune

Table 7. Results from the ‘Heath Myrtle Dune’ Site

Species Name	Common Name	Survey Method			
		Pitfall	Elliott	Active	Camera
Gecko	3	6	0	0	0
<i>Nephrurus laevisissimus</i>	Pale Knob-tailed Gecko	2			
<i>Strophurus ciliaris</i>	Northern Spiny-tailed Gecko	3			
<i>Strophurus elderi</i>	Jewelled Gecko	1			
Skink	6	8	0	0	0
<i>Ctenotus brooksi</i>	Brooks’ Wedge-snouted Ctenotus	1			
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	1			
<i>Ctenotus leae</i>	Centralian Coppertail	1			
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	1			
<i>Ctenotus schomburgkii</i>	Barred Wedge-snouted Ctenotus	1			
<i>Lerista bipes</i>	Western Two-toed Slider	3			
Dragon	1		0	1	0
<i>Ctenophorus isolepis gularis</i>	Central Military Dragon			1	
Mammal	3	1	0	0	4
* <i>Camelus dromedarius</i>	Dromedary Camel				1

Species Name	Common Name	Survey Method			
		Pitfall	Elliott	Active	Camera
<i>Canis lupus dingo</i>	Dingo				1
<i>Notomys alexis</i>	Spinifex Hopping-mouse	1			2
TOTAL		15	0	1	4
Total Individuals		20			
Total Species		13			

While slightly less effort was put into this site, it produced a range of reptiles and one mammal from the pit traps. Only one juvenile Spinifex Hopping Mouse was captured at this site, however it was found dead in the pit trap during the morning check. Cause of death is unknown however one possible explanation was large number of predatory Carabidae (ground) beetles that were on the deceased mouse or nearby, but which came first? Due to camera malfunction, no photos of hopping mice were captured on the first night despite large amounts of footprints observed around the ‘general’ bait station the following morning. The camera was changed and hopping mice were recorded on following nights. A Camel and Dingo were recorded from the camera with the ‘predator’ bait station.

‘Spinifex’ Shrubland

Table 8. Results from the ‘Spinifex Shrubland’ Site

Species Name	Common Name	Survey Method				
		Pitfall	Elliott	Active	Camera	Inc’t
Gecko	4	11	0	0	0	0
<i>Diplodactylus conspicillatus</i>	Burrow-plug Gecko	2				
<i>Gehyra purpurascens</i>	Purple Dtella	4				
<i>Nephrurus laevisimus</i>	Pale Knob-tailed Gecko	4				
<i>Strophurus elderi</i>	Jewelled Gecko	1				
Skink	5	22	0	0	0	0
<i>Ctenotus brooksi</i>	Brooks’ Wedge-snouted Ctenotus	13				
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	2				
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	2				
<i>Eremiascincus fasciolatus</i>	Narrow-banded Sand-swimmer	1				
<i>Lerista bipes</i>	Western Two-toed Slider	4				
Dragon	2	2	0	1	0	0
<i>Ctenophorus isolepis gularis</i>	Central Military Dragon	1		1		
<i>Ctenophorus nuchalis</i>	Central Netted Dragon	1				
Monitor	2	1	0	1	0	0
<i>Varanus eremius</i>	Pygmy Desert Monitor	1				
<i>Varanus gouldii</i>	Gould's Monitor			1		
Snake	2	3	0	0	0	1
<i>Ramphotyphlops endoterus</i>	Desert Blind Snake	1				1
<i>Simoselaps anomalus</i>	Desert Banded Snake	2				

Species Name	Common Name	Survey Method				
		Pitfall	Elliott	Active	Camera	Inc't
Mammal	3	4	0	0	0	0
<i>Ningauai ridei</i>	Wongai Ningauai	2				
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	1				
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart	1				
	TOTAL	43	0	2	0	1
	Total Individuals	46				
	Total Species	18				

Across the three weeks, the dune system that these trap lines were located produced the highest species richness of all the sites with 18 species recorded. Three species were only recorded here, they were Pygmy Desert Monitor, Narrow-banded Sand-swimmer and Gould's Monitor. While the first two were captured in the pitfalls, the Gould's Monitor was dug up by two of the students from its hibernation burrow. Of note was that despite suitable habitat for legless lizards, they were the only family of lizards not caught at this site.

Dune Bowl

Table 9. Results from the 'Dune Bowl' Site

Species Name	Common Name	Survey Method	
		Pitfall	Box
Gecko	2	2	0
<i>Diplodactylus conspicillatus</i>	Burrow-plug Gecko	1	
<i>Nephrurus laevisissimus</i>	Pale Knob-tailed Gecko	1	
Skink	9	53	0
<i>Ctenotus brooksi</i>	Brooks' Wedge-snouted Ctenotus	19	
<i>Ctenotus helenae</i>	Dusky Ctenotus	1	
<i>Ctenotus leae</i>	Centralian Coppertail	18	
<i>Ctenotus piankai</i>	Pianka's Ctenotus	1	
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	4	
<i>Ctenotus schomburgkii</i>	Barred Wedge-snouted Ctenotus	4	
<i>Lerista bipes</i>	Western Two-toed Slider	3	
<i>Menetia greyii</i>	Common Dwarf Skink	2	
<i>Notoscincus ornatus ornatus</i>	Ornate Snake-eyed Skink	1	
Dragon	2	2	0
<i>Ctenophorus nuchalis</i>	Central Netted Dragon	1	
<i>Pogona minor minor</i>	Dwarf Bearded Dragon	1	
Pygopod	1	1	0
<i>Lialis burtonis</i>	Burton's Snake Lizard	1	
Mammal	1	1	2
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	1	2
	TOTAL	59	2
	Total Individuals	61	
	Total Species	15	

‘Dune Bowl’ consisted of four pitfall lines and four Crouch Box trap lines with ten traps in each. Two of each of these was placed at the crest of the dune, one in and over the lip of the ‘bowl’ feature, and two of each were placed in the swale. This site proved to be extremely active, most notably for skinks with a total of 53 captures over three nights. The ‘bowl’ feature is thought to be one of the contributing factors as it provides shelter from wind and retains its residual heat for a longer period than the surrounding dune. Two species were captured in very high numbers: Brooks’ Wedge-snouted Ctenotus and Centralian Coppertail indicating an abundance of their preferred food sources and suitable habitat, perhaps showing a preference for this habitat in particular, especially the coppertail.

‘Dune 1’

Table 10. Results from the ‘Dune 1’ Site

Species Name	Common Name	Survey Method			
		Pitfall	Box	Incidental	
Gecko		2	7	0	0
<i>Nephrurus laevisissimus</i>	Pale Knob-tailed Gecko		1		
<i>Rhynchoedura ornata</i>	Western Beaked Gecko		6		
Skink		8	31	0	2
<i>Ctenotus brooksi</i>	Brooks’ Wedge-snouted Ctenotus		20		2
<i>Ctenotus calurus</i>	Blue-tailed Ctenotus		2		
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus		2		
<i>Ctenotus piankai</i>	Pianka’s Ctenotus		1		
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus		2		
<i>Liopholis inornata</i>	Desert Skink		2		
<i>Menetia greyii</i>	Common Dwarf Skink		1		
<i>Tiliqua multifasciata</i>	Centralian Blue-tongue		1		
Dragon		1	0	0	1
<i>Diporiphora paraconvergens</i>	Grey-striped Western Desert Dragon				1
Pygopod		1	1	0	0
<i>Delma nasuta</i>	Sharp-snouted Delma		1		
Snake		2	6	0	1
<i>Ramphotyphlops endoterus</i>	Desert Blind Snake		2		
<i>Simoselaps anomalus</i>	Desert Banded Snake		4		1
Mammal		3	5	1	0
<i>Ningauai ridei</i>	Wongai Ningauai		3		
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse			1	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart		2		
	TOTAL		50	1	4
	Total Individuals		55		
	Total Species		17		

‘Dune 1’ consisted of three lines of pitfall and Crouch Box traps, a line of ten of each on the dune, a line of ten of each in the swale and a line with fifteen pitfalls and twenty Crouch Box traps which began at the top of the dune and descended down into the swale. This site yielded excellent results with both high numbers of species and individuals trapped as well as being from a wide range of animal groups. Surprisingly one Centralian Blue-tongue was captured in a pitfall line near the top of the dune. Brooks’ Wedge-snouted Ctenotus was again in high numbers at this site.

Stony Plain

Table 11. Results from the Stony Plain Community

Species Name	Common Name	Survey Method
		Elliott
Mammal	2	2
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	1
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	1
	Total Individuals	2
	Total Species	2

Due to the nature of the terrain in this location, only Elliott traps were used as it would have been practically impossible to dig holes for the pit buckets *let alone* knock in the pegs to support the pit fence. Finding sheltered sites to place the traps was also difficult as there was very little undergrowth following a fire some time ago. While appearing to be in the most open habitat of this site, one line of traps caught both animals.

Boyd Lagoon

Table 12. Results from the Boyd Lagoon Community

Species Name	Common Name	Survey Method		
		Pitfall	Box	Cage
Gecko	2	2	0	0
<i>Diplodactylus conspicillatus</i>	Burrow-plug Gecko	1		
<i>Nephrurus laevisimus</i>	Pale Knob-tailed Gecko	1		
Skink	6	24	0	0
<i>Ctenotus brooksi</i>	Brooks' Wedge-snouted Ctenotus	13		
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	4		
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	1		
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	1		
<i>Liopholis inornata</i>	Desert Skink	2		
<i>Menetia greyii</i>	Common Dwarf Skink	3		
Mammal	3	1	2	0
<i>Notomys alexis</i>	Spinifex Hopping-mouse		1	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse		1	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart	1		
	TOTAL	27	2	0
	Total Individuals	29		
	Total Species	11		

'Boyd Lagoon' consisted of three lines of pitfall and Crouch Box traps. One line of ten of each type was placed on the salt pan near the inlet to the lagoon and two lines were placed on the adjoining dunes, one with ten of each type and one with ten pitfalls and twenty Crouch Box traps. Two cage traps were also set near the edge of the lagoon. This site was selected due to its uniqueness both in the habitat that the salt lake provides as well as its uncommon occurrence across the survey area. It should be noted that the traps set on the salt pan itself yielded only one Common Dwarf Skink, while the surrounding dunes yielded good results for both reptiles and mammals with Brooks' Wedge-snouted Ctenotus again in high numbers.

Claypan

Table 13. Combined Results from the Claypan Community

Fauna Groups	Sp.	Indivi'l	Survey Site							
			Buffel		Mixed		Chenopod		BLT	
			Sp.	Ind	Sp.	Ind	Sp.	Ind	Sp.	Ind
Gecko	4	30	1	2	2	6	2	9	4	13
Skink	10	29	2	3	5	8	2	3	7	15
Dragon	1	2							1	2
Pygopod	1	1							1	1
Snake	1	1							1	1
Mammal	4	9			2	2			3	7
Total	21	72	3	5	9	16	4	12	17	39

The Claypan sites were relatively varied for such a small area, from almost a monoculture of Buffel Grass to mixed shrubland to small islands of shallow sand and a Mulga shrubland. The Boyd Lagoon Track site encompassing the small islands, clay pan and Mulga shrubland were more diverse than the other three sites combined. This community had the second highest species count with 21, probably as a result of the intensity of trapping in this area and the diverse habitats that the claypan supported.

'Buffel Grass Plain'

Table 14. Results from the 'Buffel Grass Plain' Site

Species Name	Common Name	Survey Method
		Pitfall
Gecko		1
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	2
Skink		2
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	3
<i>Menetia greyii</i>	Common Dwarf Skink	2
	Total Individuals	5
	Total Species	3

This site was almost a monoculture of Buffel Grass, with the odd scattered shrub. Like the Mulga shrubland of week 1, there was a paucity of individuals and species captured from the pitfalls at this site. Of the three species recorded, the Western Beaked Gecko was captured at all four claypan sites and the two skinks were recorded at many sites across the survey.

'Mixed Shrubland'

Table 15. Results from the 'Mixed Shrubland' Site

Species Name	Common Name	Survey Method
		Pitfall
Gecko		2
<i>Gehyra purpurascens</i>	Purple Dtella	6
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	1
		5

Species Name	Common Name	Survey Method	
		Pitfall	
Skink	5	8	
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	1	
<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus	2	
<i>Lerista bipes</i>	Western Two-toed Slider	2	
<i>Liopholis inornata</i>	Desert Skink	2	
<i>Morethia ruficauda</i>	Fire-tailed Skink	1	
Mammal	2	2	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	1	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart	1	
Total Individuals		16	
Total Species		9	

This area of shrubland was relatively small in comparison to other areas within the claypan but had the highest count for an individual habitat site on the eastern side of the claypan. Apart from the Western Beaked Gecko, all other species were captured in low numbers, either ones or twos.

‘Chenopod Shrubland’

Table 16. Results from the ‘Chenopod Shrubland’ Site

Species Name	Common Name	Survey Method	
		Pitfall	
Gecko	2	9	
<i>Diplodactylus conspicillatus</i>	Burrow-plug Gecko	4	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	5	
Skink	2	3	
<i>Ctenotus greeri</i>	Greer's Ctenotus	2	
<i>Lerista bipes</i>	Western Two-toed Slider	1	
Total Individuals		12	
Total Species		4	

Only geckos and skinks were caught in this Chenopod shrubland. Multiple individuals of both gecko species were caught across the week and from biometric data taken, including weight and SVL, each capture was a new individual. The Burrow-plug Gecko was only caught at this site on the eastern side of the claypan. This was also the only site north of Ambulance Bore that Greer’s Ctenotus was recorded.

Boyd Lagoon Track

Table 17. Results from the Boyd Lagoon Track Site

Species Name	Common Name	Survey Method	
		Pitfall	Box
Gecko	4	13	0
<i>Diplodactylus conspicillatus</i>	Burrow-plug Gecko	3	
<i>Gehyra purpurascens</i>	Purple Dtella	1	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	8	
<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko	1	

Species Name	Common Name	Survey Method	
		Pitfall	Box
Skink	7	15	0
<i>Ctenotus dux</i>	Narrow-lined Ctenotus	7	
<i>Ctenotus helenae</i>	Dusky Ctenotus	1	
<i>Ctenotus pantherinus ocellifer</i>	Leopard Ctenotus	2	
<i>Lerista bipes</i>	Western Two-toed Slider	1	
<i>Lerista desertorum</i>	Great Desert Slider	1	
<i>Liopholis inornata</i>	Desert Skink	2	
<i>Menetia greyii</i>	Common Dwarf Skink	1	
Dragon	1	2	0
<i>Ctenophorus isolepis gularis</i>	Central Military Dragon	2	
Pygopod	1	1	0
<i>Lialis burtonis</i>	Burton's Snake Lizard	1	
Snake	1	1	0
<i>Ramphotyphlops endoterus</i>	Desert Blind Snake	1	
Mammal	3	4	3
* <i>Mus musculus</i>	House Mouse		1
<i>Ningauai ridei</i>	Wongai Ningauai	1	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	3	2
	Total	36	3
	Total Individuals	39	
	Total Species	17	

'Boyd Lagoon Track' consisted of three separate sites, one on the claypan and across the shallow islands of sand, one in the adjoining shrubland with slightly deeper sand and one approximately three-hundred metres away with low dunes and larger shrubs. The first two sites had ten of each trap type and the third had fifteen pitfalls and twenty Crouch Box traps. This site yielded a wide range of species with two (Western Spiny-tailed Gecko and Great Desert Slider) not being captured at any other site.

Acacia Shrubland

Table 18. Results from the Acacia Shrubland Community

Species Name	Common Name	Survey Method	
		Pitfall	Active
Gecko	2	7	0
<i>Gehyra purpurascens</i>	Purple Dtella	5	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	2	
Skink	4	2	3
<i>Lerista bipes</i>	Western Two-toed Slider	1	1
<i>Lerista sp.</i>	Sand-slider		1
<i>Morethia ruficauda</i>	Fire-tailed Skink	1	
<i>Tiliqua multifasciata</i>	Centralian Blue-tongue		1
Monitor	2	1	1
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor	1	

Species Name	Common Name	Survey Method	
		Pitfall	Active
<i>Varanus gilleni</i>	Pygmy Mulga Monitor		1
Mammal	1	1	0
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	1	
	TOTAL	11	4
	Total Individuals	15	
	Total Species	9	

The three sites that made up the Acacia Shrubland community, were relatively close to Ambulance Bore, being approximately 500m north. This community was the only one that the world's smallest monitor, the Short-tailed Pygmy Monitor was caught. The total length of a full grown adult doesn't exceed 230mm with the snout-vent length (SVL) being 39-118mm (Storr *et al*, 1983). The SVL of the captured animal was 73mm, making it a small adult or sub-adult.

While pitfall traps were the only traps employed at this site, active searching yielded nearly half of the species and 25% of the individuals captured. At least on species, the Pygmy Mulga Monitor was not captured at any other site across the three weeks, while an unidentified (as yet) *Lerista* sp was captured during raking. Also a Centralian Blue-tongue was observed in a smallish burrow under some fallen timber.

Breakaway Country

Table 19. Combined Results from the Breakaway Country Community

Fauna Group	Sp.	Individuals	Survey Site			
			Cave		Breakaway	
			Sp.	Individ.	Sp.	Individ.
Gecko	3	15	3	14	1	1
Skink	1	1	1	1		
Monitor	1	1			1	1
Mammal	4	11	3	7	1	4
Total	9	28	7	22	3	6

The Breakaway Country was rather difficult to survey comprehensively due to the nature of the soil type, Team 1 did however manage to get a pit line with six buckets in, while staying at the Cave, on the flats adjacent to the breakaways. From the 300 plus trap nights, mainly Box and Elliott Traps, most species caught were captured on camera or during active searching (23 of 28 captures). Of the captures, harp traps provided four of the five individuals, although they were only used for a combined five hour period.

'The Cave'

Table 19. Results from 'The Cave' Site

Species Name	Common Name	Survey Method				
		Pitfall	Box	Active	Harp	Camera
Gecko	3	1	0	13	0	0
<i>Gehyra punctata</i>	Spotted Rock Dtella			7		
<i>Gehyra purpurascens</i>	Purple Dtella			4		
<i>Heteronotia binoei</i>	Bynoe's Gecko	1		2		

Species Name	Common Name	Survey Method				
		Pitfall	Box	Active	Harp	Camera
Skink	1	0	0	1	0	0
<i>Lerista timida</i>	Dwarf Three-toed Slider			1		
Mammal	3	0	0	1	4	2
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna					2
<i>Taphozous hilli</i>	Hill's Sheath-tailed Bat				1	
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat			1	3	
TOTAL		1	0	15	4	2
Total Individuals		22				
Total Species		7				

‘The Cave’ consisted of one pitfall line of five traps placed along the edge of the adjoining creekline with ten Crouch Box traps adjacent, three lines of ten Crouch box traps on and around the breakaway and one pitfall trap at the entrance to one of the smaller caves. A harp trap, two cage traps and two camera traps were also utilised at this site. Although there were relatively low captures at this site there were several species not recorded at other sites. The most notable record at this site was Short-beaked Echidna which was captured on two separate cameras on the same night. It is possible that this was the same individual.

Although the harp traps were only set up for 2.5 hours, they captured the two most likely species of cave-occupying bats in the Gibson Desert area. The traps were dismantled, once females of the two species were noted as being gravid, to avoid impacting on the maternity colonies of these bats.

‘Breakaways’

Table 20. Results from the ‘Breakaways’ Site

Species Name	Common Name	Survey Method				
		Elliott	Cage	Active	Camera	Incid'l
Gecko	1	0	0	1	0	0
<i>Gehyra purpurascens</i>	Purple Dtella	0		1		
Monitor	1	0	0	1	0	0
<i>Varanus tristis tristis</i>	Black-headed Monitor			1		
Mammal	1	0	0	0	3	1
<i>Canis lupus dingo</i>	Dingo				3	1
TOTAL		0	0	2	3	1
Total Individuals		6				
Total Species		3				

This Breakaways site had potential to yield a number of new species for the survey, with a large number of crevices into the cliffs, boulders and scree however it produced very little. No a single capture for the 150+ trap nights with the only records coming from active searching including spotlighting, the two cameras set up or an incidental sighting of a Dingo while we were setting up. The Black-tailed Monitor capped off all of the possible varanids for this area of the Gibson Desert. It was captured after being observed basking on rocks.

Grassy Creekline

Table 21. Results from the Grassy Creekline Community

Species Name	Common Name	Survey Method		
		Pitfall	Elliott	Incidental
Skink	2	3	0	0
<i>Ctenotus greeri</i>	Greer's Ctenotus	1		
<i>Menetia greyii</i>	Common Dwarf Skink	2		
Pygopod	1	1	0	0
<i>Delma desmosa</i>	Desert Delma	1		
Mammal	2	1	3	4
* <i>Camelus dromedarius</i>	Dromedary Camel			4
* <i>Mus musculus</i>	House Mouse	1	3	
	TOTAL	5	3	4
	Total Individuals	12		
	Total Species	5		

This Grassy Creekline was the most successful site for the Elliott traps capturing three House Mice. Apart from one capture at The Boyd Lagoon Track site, this and the neighbouring Arid Shrubland site were the only other sites to capture House Mice, a total of six individuals recorded. With the closest habitation being Tjirrkarli community approximately 7km north of this site, this shows the remarkable adaptability of the House Mouse to habitats away from human dwellings. Also of note at these two sites was the only record of Desert Delma for the entire survey, this species was again caught on the last morning of trapping. The four camels were observed while checking the traps one morning. Due to the nature of the clay creek bed, these sites could provide habitat for frogs following sufficient rain to enable the creek to form pools, if not flow.

Arid Shrubland

Table 22. Results from the Arid Shrubland Community

Species name	Common Name	Survey Method				
		Pitfall	Elliott	Active	Harp	Camera
Gecko	2		0	2	0	0
<i>Gehyra purpurascens</i>	PurpleDtella			1		
<i>Heteronotia bineoi</i>	Bynoe's Gecko			1		
Skink	2	2	0	0	0	0
<i>Ctenotus greeri</i>	Greer's Ctenotus	1				
<i>Menetia greyii</i>	Common Dwarf Skink	1				
Dragon	1	1	0	0	0	0
<i>Ctenophorus reticulatus</i>	Western Netted Dragon	1				
Mammal	3	3	0	0	0	3
<i>Canis lupus dingo</i>	Dingo					2
* <i>Mus musculus</i>	House Mouse	1				1
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	2				
Bird	2	0	0	0	1	1

Species name	Common Name	Survey Method				
		Pitfall	Elliott	Active	Harp	Camera
<i>Oreoica gutturalis</i>	Crested Bellbird					1
<i>Phaps chalcoptera</i>	Common Bronzewing				1	
	TOTAL	6	0	2	1	4
	Total Individuals	13				
	Total Species	10				

For a site that had fallen timber, dead stags, a variety of vegetation layers and leaf litter on the ground the number of species captured in the pitfalls was quite low. Only two mammal species and three reptile species were caught. The unexpected capture was the Common Bronzewing in the harp trap, on the last morning. From the two cameras that were set at this site we recorded a Dingo at the camera with the ‘predator bait’ and a Crested Bellbird recorded on the ‘general bait’ camera. Neither of these birds were recorded during the bird survey at this site. A further two reptile species, both geckos, were found nearby under an old glovebox door lying beside the track. The experiment at site 3 of placing box and Elliott traps along the pitfence, instead of buckets dug into the ground, proved a waste of time on this occasion as nothing was caught at this site.

‘Rock Holes’

Table 23. Results from the ‘Rock Holes’ Site

Species Name	Common Name	Survey Method
		Camera
Mammal	3	6
* <i>Camelus dromedarius</i>	Dromedary Camel	1
<i>Canis lupus dingo</i>	Dingo	4
* <i>Vulpes vulpes</i>	Red Fox	1
	Total Individuals	6
	Total Species	3

This site was selected due to its rarity as a source of water for a relatively long period in such an arid environment. This geological feature, while not unique, is uncommon in the survey area. Three out of four of the large mammals recorded during the survey were captured at this site, with the notable exception of any macropods.

‘The Burrows’

Table 24. Results from ‘The Burrows’ Site

Species Name	Common Name	Survey Method
		Camera
Mammal	2	4
<i>Canis lupus dingo</i>	Dingo	1
* <i>Oryctolagus cuniculus</i>	European Rabbit	3
	Total Individuals	4
	Total Species	2

This site was selected due to the presence of fresh Perentie tracks entering one of the rabbit burrows, however none were captured on camera.

DISCUSSION

With two teams operating across the three weeks, this was by far the largest and most successful fauna survey undertaken for Desert Discovery. With a combined effort of 2328 trap nights comprising 1048 pitfalls, 588 Elliotts, 600 Crouch box traps, 20 cages, 9 harp traps and 33 cameras along with active searching and incidental records, it is little wonder that over 500 animals were recorded.

To sample the range of vegetation communities, a variety of survey methods were required. The extensive dune systems enabled the predominant use of pitfalls due to their ease of installation. Other vegetation types on harder soils made the installation of pitfalls difficult to impossible, which is reflected in Table 2, showing that Elliott / Box traps were more heavily used in Week 3 in comparison to pitfalls.

Although some habitats were sampled more heavily than others, such as Dune Shrubland, it was agreed that this was roughly indicative of the survey area based on the observations of the survey team members, and that most of the less abundant habitats were sampled in some capacity.

There were some differences between the methodologies employed by the two teams. The pitfall lines contained varying numbers of traps along the length of drift fence, different type of fence material was used and Team 2 utilised shade covers over each bucket. Aside from these, the main difference in pitfall methodology was trap saturation versus trap duration. Team 1 employed all pitfalls in one community over a short period (saturation) whereas Team 2 employed pitfalls at a number of communities for a longer period (duration). Team 1 used only Crouch Box traps and Team 2 used mainly Elliott traps. Harp traps were only used by Team 2, and they were also the team that predominately used the technique of active searching. The collective data from all survey techniques by Team 1 recorded a total of 39 species and 210 individuals while Team 2 recorded 52 species and 188 individuals. Within these results there were 27 species captured by both teams; 12 species were captured by Team 1 alone with Team 2 capturing 25 species not recorded by Team 1. The significant difference between the species captured may be explained by the extended duration of the pitfall surveys and use of additional techniques (harp traps) and more time spent undertaking active searches at each community. Active searching alone, proved to be an important technique yielding six species that were not captured by any other method.

The implementation of two independent teams provided some challenges to the dynamics of undertaking an effective and efficient survey; however, given the scale of the survey effort, the size of the study area and the excellent results of the survey, both teams agree that little more could have been achieved under the circumstances and with the available resources.

Graham *et al* (2001) states that the central Australian deserts (of which the Gibson Desert is a part) are known to exhibit particularly high reptile species richness, so it is no wonder that nearly 75% of the species and individuals captured were reptiles. The most abundant reptile species captured were Brooks' Wedge-snouted Ctenotus (69) Western Beaked Gecko (35), Purple Dotted Tree Frog (29) and Western Two-toed Slider (21). These four species made up 30% of all fauna recorded for the survey. The Common Dwarf Skink was recorded at the most communities (6) with Purple Dotted Tree Frog being recorded at five. Of the rest, 34 species were only recorded at one or two communities. Looking at the mammals, Camels (53) were the most recorded however 46 individuals came from incidental sightings. Dingos (18) were primarily captured by the cameras with Sandy Inland Mouse (13) actually trapped. These three species were also the most widespread with Dingos being recorded from six communities with Camels and Sandy Inland Mice four each.

Over the three week survey period it was noted that there was a distinct lack of snakes and larger goannas either seen or caught. Of the 16 species of snakes that would possibly occur in the area of the survey, within the vicinity of the Gibson Desert, based on the distribution maps in Wilson and

Swan (2013), only two species were captured. Both of these species, Desert Blind Snake and Desert Banded Snake, are relatively small (<400mm total length) and active at night. The majority of the remaining species are diurnal. As for the goannas, the only Gould's Monitors that were recorded during the survey were those that were dug up from their hibernation burrows. Of these, the majority were dug up by the local women who were assisting with the Bilby surveys with one dug up by a couple of the boys from Blackstone, we were hosting during the second week. A Perentie was captured by the local men to the east of Ambulance Bore and two incidental sightings approximately 70km south-west of Ambulance Bore at Mt Worsnop and Alexander Spring.



Photo 7: Short-tailed Pygmy Monitor *Varanus brevicauda*, the world's smallest monitor.

Even though the weather during the surveys was considered warm with daytime temperatures averaging around the high 20°C's to low 30°C's, the goannas were still hibernating and the snakes not active, it is obvious that they require slightly warmer conditions before they become active. This is supported by comments made by the traditional owners, indicating that our visit was too early, with the presence the snakes (especially the pythons) and goannas generally noted about mid to late October, when the weather gets warmer.

Of the 68 species recorded during the fauna surveys, one species, the Ornate Snake-eyed Skink, is considered to be extra-limital, that is found outside of its known range. According to both Wilson and Swan (2013) and Cogger (2014) this skink species doesn't reach this area of the Gibson Desert but this may be due to the lack of survey effort in this part of WA. The Atlas of Living Australia (ALA) (2015) shows one record from Clutterbuck Hills in the Gibson Desert Nature Reserve, approximately 180km to the north-east of Ambulance Bore. .



Photo 8: Ornate Snake-eyed Skink *Notoscincus ornatus ornatus*, an extra-limital species.

Another species, the Western Grey Kangaroo *Macropus fuliginosus*, while not observed during the survey period, has the potential to also be considered as extralimital. The traditional men raised a query with us about another kangaroo that was smaller than the Red Kangaroo (marlu), with large, pointy ears. Discussions with the traditional owners, through their coordinator, provided convincing evidence to suggest that this species had been seen within their traditional lands, in low numbers. It was determined with the traditional owners looking at photos and from the information in the field guide, that the most likely macropod that fitted the rough identification was the Western Grey Kangaroo, even though it is well outside of its range. While this is not conclusive evidence that Western Grey Kangaroo inhabits this area of the Gibson Desert, it is definitely worth noting as the closest this species is recorded in the ALA (2015) is approximately 460km SE in the Great Victoria Desert.

During the first and second week, at sites within sandy soils, numerous tracks belonging to Centralian Blue-tongue, Thorny Devil and Spinifex Hopping-mice were regularly observed along the pitfall fences but few if any captures of these species were recorded in the traps. During the first week, a blue-tongue was observed, and filmed, walking along the fence towards a pitfall. When it got to the bucket, it stopped, looked in and walked off away from the pitfall. From this behaviour and the low number caught compared to their relative abundance seen incidentally, we surmise that as they are relatively slow-moving (unless disturbed) compared to other fauna and they are less likely to be caught in pitfalls. It is considered that they have potentially more time to 'judge' their surroundings rather than just run along the fence and fall into the pitfall. This theory could possibly also be applied to the Thorny Devil, a slow-moving dragon.

There were limited opportunities for using Harp traps during this survey as most of the sites during the first two weeks had low vegetation and definitely no 'fly-ways'. From the rough maps provided of the area, a few scattered caves were identified and mentioned to the local men that we would be interested in finding them. One of the traditional owners knew of a cave but had not visited it since he was child, so the men's group spent the next two days looking for it. They found the cave and noted bats flying around in the cave system. Arriving at this cave late in the afternoon, two harp

traps were set in the mouth of the cave and left for a couple of hours until after night fall. The first check of the traps caught three Inland Cave Bats and the second check at about 7.45pm yielded a Hill's Sheath-tailed Bat. The sheath-tailed and one cave bat were both gravid indicating that the cave was a maternal site so it was decided to dismantle the traps after only two and a half hours, to limit any further impact on these breeding colonies.

During the first two weeks of the survey, we noted the capture of nocturnal species during the afternoon checking of the pitfalls. This occurred on three separate days at different sites. The first two occasions a single animal was captured, the first was a Jewelled Gecko from the Heath Myrtle Dune in the afternoon on 30 August. A Wongai Ningui was found dead on 3 September at one of the Dune Shrubland sites. However, on 4 September four Beaked Geckos were caught at four sites. Three of these sites were within the Claypan vegetation community (CyPn1-3) with the fourth being in Acacia Shrubland (AcSh3). Capturing species that are generally known to be nocturnal during the day is unusual although members of the *Strophurus* genus can be diurnal (Eipper pers comm 2015), but to record six individuals during the day is an anomaly that is worth noting. It was observed at the time that the weather on 4 September was overcast for most of the day, so maybe these particular weather conditions can result in unusual diurnal activity.

In the second week, two mole pits (see Section 17) were dug on the same sand-dune that the two teams were surveying. Between the two teams 220 pitfalls set, yet one species of reptile, the Grey-striped Western Desert Dragon, was only 'caught' in the mole pit. This small-sized dragon is very slender with long limbs and known to inhabit sand dunes of the western deserts (Wilson and Swan 2013). Surprisingly, this was to be the only capture and sighting of this dragon for the entire survey. Other reptiles caught in the mole pits were individuals of Wedgesnout Ctenotus and Desert Banded Snake. Even though trapping fauna was not the intention of the mole pits, they did provide a new reptile species to the list. It should be noted and taken into consideration for future surveys, that mole pits should be regularly checked for captured fauna and that branches and other devices be put into the mole pits to enable self-evacuation of incidental captures.



Photo 9: Hill's Sheath-tailed Bat *Taphozous hilli* gravid female.

The sites in the third week were more suitable for the use of Harp traps, being light to moderately timbered watercourses and a vehicle track passing through this Arid Shrubland community. Despite this more suitable habitat, no bats were caught in the eight Harp trap nights. However, there was an uncommon but interesting capture of a Common Bronzewing, a bird, on the last night.

Only two Spinifex Hopping-mice were captured, one in a box trap and the other, a juvenile, was found dead in a pitfall. At the same site as the juvenile was caught, a number of hopping-mice were recorded on camera and copious footprints observed along the pit fence suggesting a bigger population than one capture would indicate. Elliott traps were also set at this site to no avail. One possible reason for the few captures could be that the hopping mice have an amazing ability to jump a significant height vertically, enabling them to potentially escape from a pitfall trap if captured. Records from the 2012 Desert Discovery project (Crouch 2012) also support this as only one hopping mouse was caught in a pitfall but 35 were caught in box / Elliott traps, many from the same sites.

With the traditional owners mainly assisting with the Bilby surveys, time was limited to be spent with the fauna survey group. It was thought that highly beneficial information could have been gathered had there been more time to discuss with the traditional owners the local environment and their insights into the different vegetation communities.



Photo 10: Young members of the Tjirrkarli community assisting with trap checking

After reviewing the distribution maps of reptiles and mammals from Wilson and Swan (2013) and Van Dyck *et al* (2013) to compile a possible fauna list for this area of the Gibson Desert, a total of 112 species were identified as possibly occurring within, or near to, the study area. Combining the results of the survey, a total of 65 species were recorded (nearly 60%), which is quite a good result considering the short duration and season of the survey. Various environmental and climatic factors such as fire, temperature, rainfall and season, can influence the presence and abundance of fauna species. For example, Kerle *et al* (2008) in discussing the Desert Mouse *Pseudomys desertor* (a

species not caught during this survey, but captured during the 2012 Desert Discovery project, from the Rawlinson Range near Warakuna, WA (Crouch 2012)) says that it is like many other Australian rodents which survive in low numbers in pockets of preferred habitat expanding their range following suitable rainfall and subsequent vegetation growth. Surveys conducted at other times of the year or after rain would produce a different suite of fauna that could be added to those of this survey to produce a more comprehensive picture of the fauna found within the Tjirrkarli Aboriginal Community.

ACKNOWLEDGEMENTS

Many thanks must go to the Traditional Owners for allowing us access onto their country and for imparting some of their traditional knowledge on their country.

Much credit must go to all the fauna team members including Elizabeth Sakker, John Wilkinson, Kathy Himbeck, Fred Bohner, Peter, Colleen and Denham Barnes, Eric, Andre, Judy, Graham and Colleen as well as all the various helpers we had over the course of the survey for their sterling and unceasing efforts carrying equipment, digging holes.

The photos provided in the report were taken by John Harris, Kathy Himbeck, Nathan Johnson.

REFERENCES

- ALA (2015) *bie.ala.org.au*, Atlas of Living Australia website visited on March 2015.
- Christidis, L. & Boles, W. E. (2008) *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Collingwood, Victoria.
- Cogger, H. (2014) *Reptiles & Amphibians of Australia* Seventh edition. CSIRO Publishing, Victoria.
- Crouch, C. (2012). *Rawlinson Range Project Fauna Survey Report*. Desert Discovery Inc. Melbourne.
- Graham, D., Barton, B. & Cowan, M. (2001) *Gibson Desert 1 (GD1 – Lateritic Plain subregion)* in A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, Perth.
- Kerle, J. A., Kutt, A. S. & Read, J. L. (2008) *Desert Mouse Pseudomys desertor*, in *The Mammals of Australia, Third Edition*, ed Van Dyck, S. & Strahan, R. New Holland Publishers, Sydney.
- McKenzie, N. L., May, J. E. & McKenna, S. (2003) *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*. Department of Conservation and Land Management, Perth.
- Moore, P. (2005) *A Guide to Plants of Inland Australia*. New Holland Publishers, Sydney
- Storr, G. M., Smith, L. A. and Johnstone, R. E. (1983). *Lizards of Western Australia II Dragons and Monitors*. Western Australian Museum, Perth.

Van Dyck, S., Gynther, I. & Baker, A. (2013) *Field Companion to the Mammals of Australia*. New Holland Publishers, Sydney

Wilson, S. & Swan, G. (2013) *A Complete Guide to Reptiles of Australia* Fourth edition. New Holland Publishers, Sydney.

See Appendices for further details.

Bilby and Great Desert Skink Surveys *Trish Macdonald and Joss Haiblen*

We, Trish Macdonald and Joss Haiblen, were asked by Desert Discovery president Keith Johnson to coordinate searches for signs of the Greater Bilby *Macrotis lagotis* (locally known as ‘Ninu’) and the Great Desert Skink (GDS) *Liopholis kintorei* (‘Tjakura’).

We employed three survey methods: Indigenous Ecological Knowledge (IEK) searches, plot searches, and a line search. Opportunistic observations were recorded by Desert Discovery participants working on other surveys. There was no attempt to encounter live animals (other than setting up infrared cameras at 6 bilby burrows) as we did not work at night when bilbies are active. Great Desert Skinks were still hibernating, with night temperatures still well below 20°C.

Bilby Surveys

Background

The Ngaanyatjarra Lands represent the southern edge of currently known bilby distribution in Australia. Bilbies historically were distributed throughout the arid lands, covering 70% of the Australian mainland. The contraction of their distribution can be attributed to land use changes, the spread of introduced predators (particularly cats and foxes) and changes in fire regimes.

Over the last two decades, bilbies disappeared from the same latitude as Tjirrkarli in South Australia and over the last decade from the Northern Territory. In 2001 the National Bilby Recovery Team identified the bilby population around Tjirrkarli as the highest priority to protect, being the most southerly wild population known in Australia. As such, extensive surveys have been conducted on Ngaanyatjarra Lands between 2002 and 2005, and in 2012.

The surveys in 2012 showed that the southern edge of the bilby range had been maintained over the past decade and active or recent sign was found across a 50km wide area around Tjirrkarli. However, fewer active sites were found in the region in 2012. It is not known if this reflected a drop off in hunting from the previous surveys and thus less opportunity to find sign of bilbies, or if the drop off is due to a smaller bilby population. This highlights the shortcomings of depending on the IEK method to survey populations. As the level of hunting activity among community residents decreases, local knowledge about current locations of animals diminishes, and a survey that relies heavily on local knowledge to detect occupied areas is likely to produce fewer records over time regardless of the size of the bilby population.

Based on this, in 2012 it was recommended that a more repeatable method, which would produce more consistent data over time, be used to survey for bilbies. This involved searching a series of randomly selected plots - commonly achieved by stopping at set intervals (e.g. every 5km) along roads or tracks. Because the random plot method is rarely as productive in finding bilbies as the local knowledge method, the two methods were combined by selecting general survey routes based on recent bilby sightings and then conducting systematic searches along those roads at 5km intervals.

It was recommended that a routine monitoring program for bilby on the Ngaanyatjarra Lands be established, surveying 50 tracking plots at the same time every year or every second year. Desert Discovery carried out these plot surveys in the Tjirrkarrli area. IEK surveys were also undertaken, as they provided training for Desert Discovery participants in signs to look for and hands-on experience in the local environment, and added to the overall knowledge of the bilby population at Tjirrkarrli.

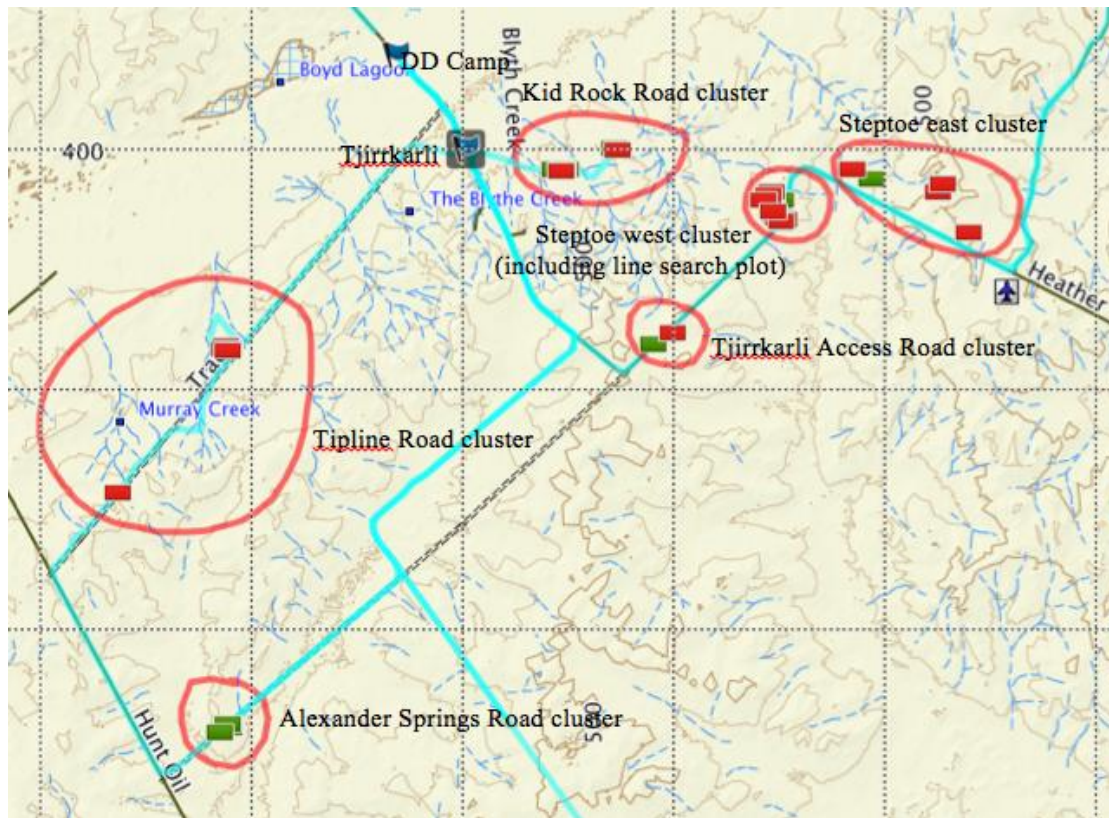
Indigenous Ecological Knowledge searches

The IEK searches took place over two weeks under the guidance of Ngaanyatjarra Traditional Owner and Elder Dulcie Watson and Council Chairperson Joyce Nelson. They assembled a team of 14 ladies who were gracious and tireless in showing us their country and teaching us and other Desert Discovery participants about Ninu and much more (Photos 1 and 2). We thank them for their companionship and the key role they played in this part of the Desert Discovery project.

The ladies generally took us to places where they knew of bilby activity or where they thought activity would be likely due to habitat. They taught us to differentiate bilby burrows from goanna and rabbit burrows. Occasionally they found sites unexpectedly, such as when we stopped along the Alexander Spring Road at a suitable shady spot for lunch, and promptly found several active burrows. The five principal clusters of IEK sites are shown in Map 1.

It was unfortunate that Gemma Aldred could not attend the project. As the Women's Working on Country Coordinator, she had been working with the ladies on searches for these two species, and could have added further background information for us. Having said that, the ladies, who had done field work with Gemma, were able to answer many of our questions.

A feature of the largely vehicle-based IEK searches was that we often moved too quickly to record site details beyond waypoints and activity.



Map 1: Clusters of bilby burrows found during IEK searches.

Note: Red rectangles indicate inactive burrows, and green active, however each cluster, particularly Steptoe west and Steptoe east, contains many more sites than is apparent on this map (see Attachment 1 for details of all sites).

Plot searches

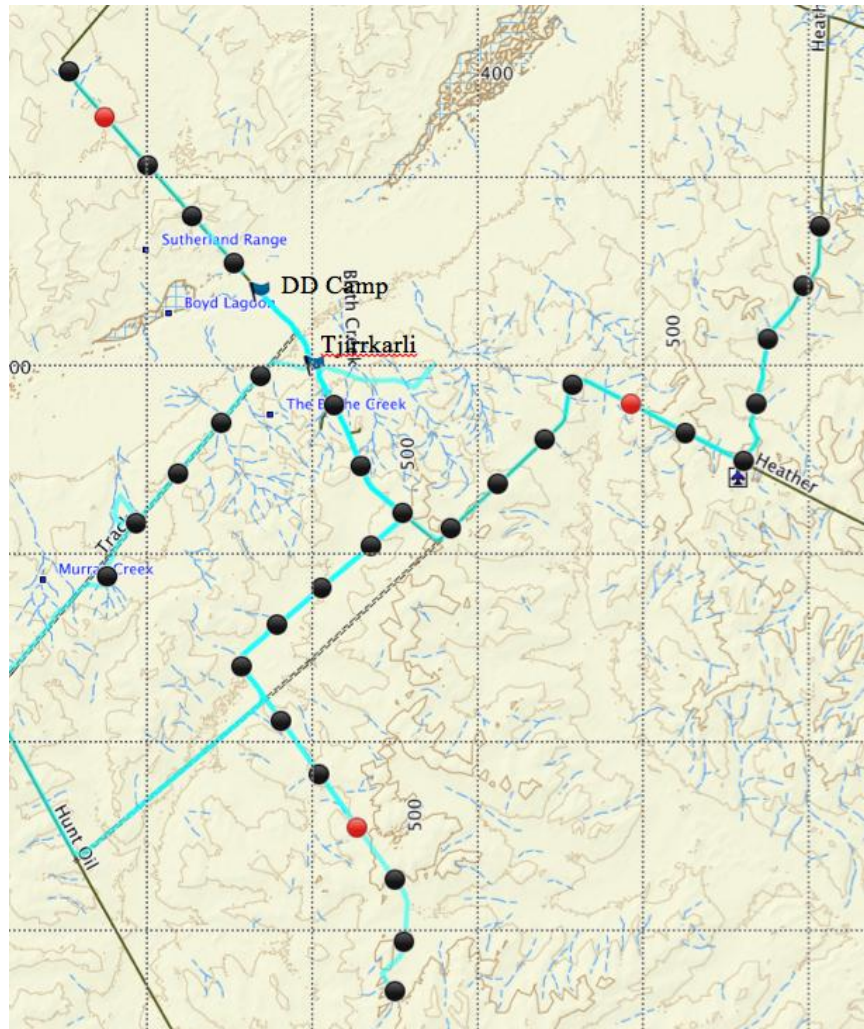
This part of the survey followed recommendations made by Rachel Paltridge¹ and used the search methodology outlined in *Tales in the Sand* (Moseby et al, 2011). This involved searching a 2 hectare area (plot) every 5km along tracks. The tracks and roads selected for searches were those where there were previous records (written and oral) of bilby presence. Two areas recommended for survey were not surveyed because one was not in the Tjirrkarli area (Rurrur Road) and the other was subject to restricted access for cultural reasons (Kid Rock Road).

Plot searches were conducted using the 2ha track-plot method and datasheet found in *Tales in the Sand*. This method targets a range of species including bilbies, and we recorded all sign that we found (tracks, scats, burrows and diggings) of the species listed on the data sheet. Thankfully the datasheet does not include lizards (other than GDS) so we were able to ignore the abundant signs of goannas, skinks and dragons. Most of the plots were on ‘rira’ – sandy country with a capping of ‘buck shot’ gravel - so only the tracks of larger animals were visible (particularly camel). For bilbies, burrows and feeding diggings were the major

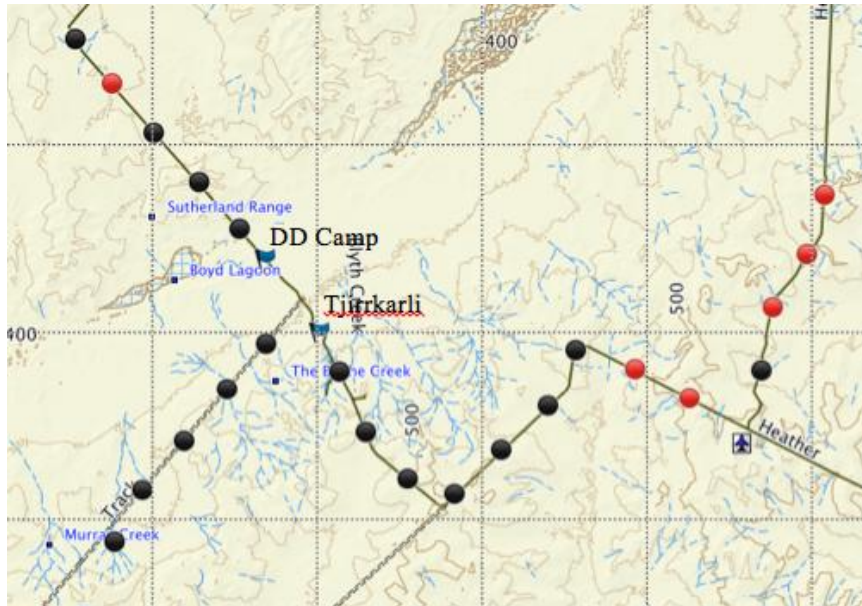
¹ Paltridge R. 2012. *Biological Resources of the Ngaanyatjarra Indigenous Protected Area*. Unpublished Report prepared for the Ngaanyatjarra Council by Desert Wildlife Services, Alice Springs.

recordable signs. Bilby scats were only found during the IEK survey, and these were located on spoil heaps of feeding digs.

In order to maximise our surveys for both bilbies and GDS, at each 5km site we surveyed two adjacent 2ha plots (except for the Kanpa Road sites). We completed two of the 2ha track-plot datasheets and one 4ha GDS datasheet over the same area (the national standard for GDS site recording is a 4ha plot search method with a datasheet provided by Danae Moore) (Maps 2 and 3). We therefore surveyed 23 GDS plots and 57 track (Bilby) plots (Maps 2, 3 and 5).



Map 2: Primary standard method 2ha plots (black) including those with bilby evidence (red). Note: These 34 2ha plots are immediately adjacent to roadways. Some are ‘stand-alone’ and some are paired with adjacent secondary 2ha plots (see Map 3).



Map 3: Secondary 2ha plots (black) including those with bilby evidence (red)

Note: These ‘outer’ 23 2ha plots are immediately adjacent to 23 of the ‘inner’ primary 2ha plots shown on Map 2.

Line search

Our third method was a targeted line search in the particularly active (as regards bilbies) Steptoe area, to which we had been introduced by the ladies. This search was made possible by the availability of 23 Desert Discovery participants on the nominated day. The line search method and results are detailed in a following section of this report.

Opportunistic observations

Opportunistic observations were recorded, stemming from the interest among Desert Discovery participants generated by their involvement in the search methods above. Thus we can thank Mick and Judy Lumb for a bilby site encountered while doing vegetation surveys along the Hunt Oil Road, David McNamara for a special bilby site incorporated into a 2ha Plot on the Camel Get In Road, and Cheryl Gole for a possible GDS site encountered while bird surveying along the Hunt Oil Road (see Table 3).

Cameras

Six cameras were set out to record activity at the most active bilby burrows. The cameras were supplied by John Harris. One was set up by him and five by us. Disappointingly, all cameras had technical problems, particularly in recording the all-important nocturnal activity. As such, no bilby images were obtained from these cameras. However, the sites lend themselves to another attempt by the rangers or other researchers.

On the first day of the IEK survey a camera that had been set up previously by Gemma Aldred and the Tjirrkarli Rangers was retrieved. It had photos of bilby, including on the night prior to the first day of the Desert Discovery program (Photos 3 and 3a).

Determining the level of activity at sites

Bilby burrows were recorded as active if:

- there were fresh tracks and disturbance on the entrance mound,
- there were fresh feeding diggings nearby, and
- the burrow contained no wind-blown debris or spider webs.

(Photos 1 & 2)

Otherwise they were recorded as inactive, some with notations such as recently inactive, old or very old. These were purely descriptive notes. We occasionally found mounds up to a metre in diameter without any indication of a hole or burrow. Due to their location in the landscape, it is likely that these are very long abandoned bilby burrows, however, we did not record them.

Results

A total of 87 bilby burrows were recorded over the survey period, using the four methods described above (Table 1).

Table 1: Summary of bilby burrows observed

	IEK Search	Plot Search	Line Search	Opportunistic	Total
Active	23	6	7	0	36
Inactive	22	12	16	1	51
Total	45	18	23*	1	87

(* adjusted for the 3 active sites and 1 inactive site common to the IEK search)

IEK survey. These searches for bilby burrows focused on areas where the Ngaanyatjarra Ladies knew bilby to be currently present, or present in the recent past (Map 1). The majority of the 45 burrows located on this survey were in the Steptoe area. The three burrows detected on the Alexander Spring road were fortuitous discoveries. IEK searches were an effective method of survey, however, future such surveys may be affected by loss of local knowledge about bilby presence.

Plot survey. While recording fewer burrows than the IEK method, the plot surveys were an effective, repeatable method of surveying for bilby. While the searches were focused on areas where bilbies had previously been recorded, the methodology provides a consistently comparable survey method over time, important if monitoring for changes in the population.

Because we needed to search 4ha plots for sign of GDS, we surveyed two adjacent 2ha 'bilby' plots as often as possible (at 23 sites in total). This allowed for a comparison of a 2ha search with a 4ha search as regards bilby sign (Maps 2 & 3). Had we conducted only one 2ha search at each of these 23 sites, we would have found seven burrows on two plots. By adding an adjacent 2ha plot at each of the 23 sites, we found 17 burrows on six plots. This raises the question as to the effectiveness of a 2ha plot verses a 4ha plot for surveying bilby presence, especially in circumstances where bilby numbers are low or decreasing.

Line Search

A line search for bilby burrows in the Steptoe west area (Map 1) was conducted using 23 Desert Discovery participants. The objective was to compare a search ‘on foot’ with the searches by vehicle conducted with the Ngaanyatjarra Ladies. The line search was conducted in an area between two areas of bilby activity that the ladies had previously shown us.

The line search consisted of searchers spaced approximately 30m apart and covered an area measuring 689m x 1100m (75.9ha). Searchers had been briefed on the appearance of active and inactive bilby burrows.

Active and inactive burrows were GPS’ed and changes in vegetation across the plot were recorded (burned and unburned Spinifex grassland/shrubland, and burned and unburned Mulga woodlands - see Map 4 and Table 2). The search took 1 hour and 10 minutes.

The area had been burned in April 2014 when a fire was lit as a signal for assistance following a vehicle breakdown on the adjacent road. The fire burned 45% of the plot. 25% of the plot was burned Spinifex/Acacia shrubland (vegetation category 1) and burned to bare soil. 20% of the plot was burned Mulga woodland (vegetation category 4) leaving scorched leaves on the trees and only larger woody fuel on the ground.

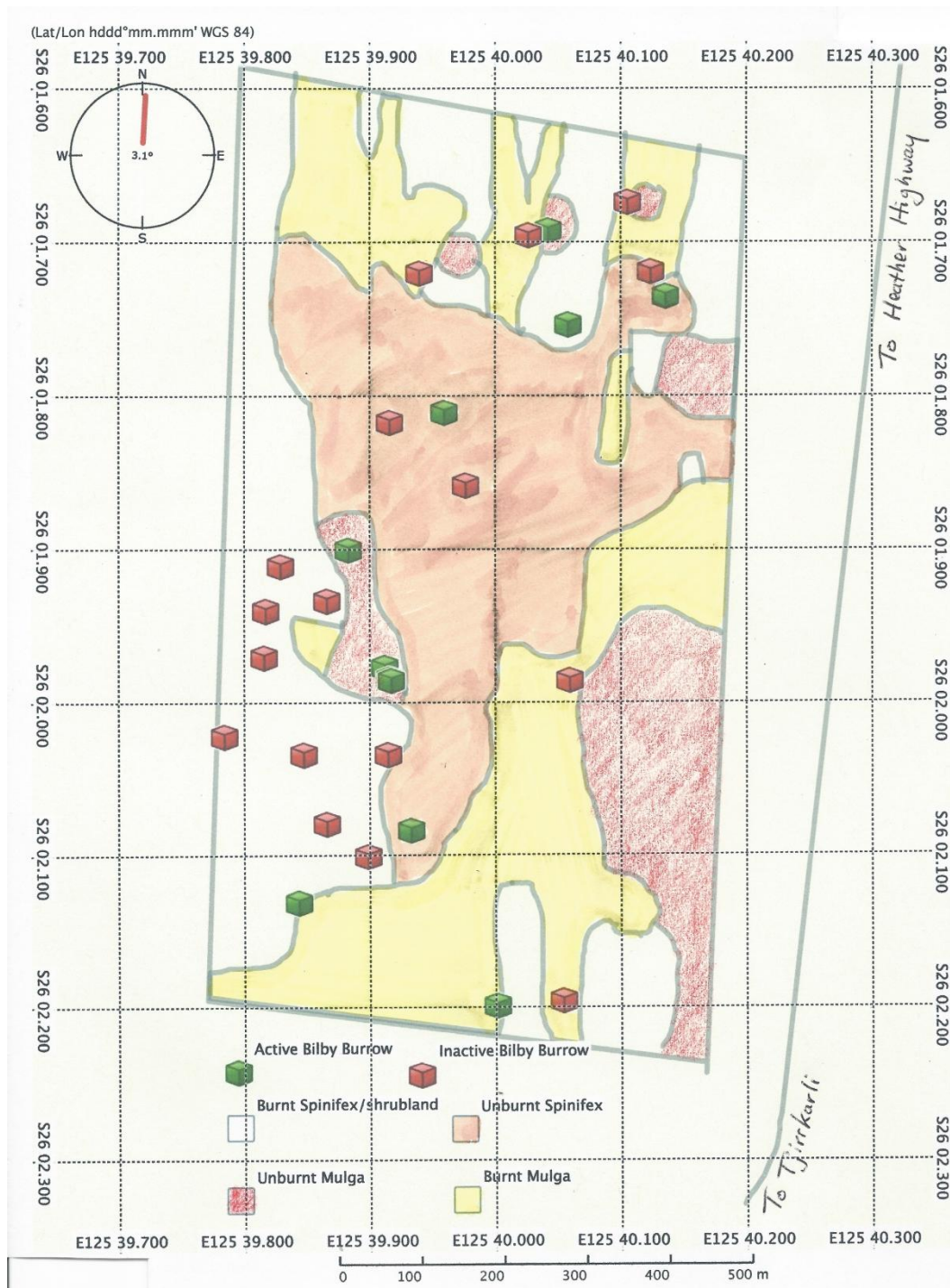
Table 2: Active and inactive bilby burrows observed during line search

	1: Burnt Spinifex Acacia shrubland 25% of plot	2: Unburnt Spinifex 40% of plot	3: Unburnt Mulga 15% of plot	4: Burnt Mulga 20% of plot	Total
Active	2	3	4	1	10
Inactive	9	2	0	6	17
Total	11	5	4	7	27

The data suggests that the fire has impacted the bilbies use of the burrows. In the unburned vegetation seven of the nine burrows recorded were still actively being used, while in the burnt vegetation only three of the 18 recorded burrows were being actively used.

Interestingly, in parts of the burned Spinifex/Acacia shrubland the burnt Bardi Bush *Acacia rhodophloia* had recently (within the previous month) been targeted by bilbies for the bardi grub (a witchetty grub). Subsequently the ladies confirmed that grubs could remain in a recently burnt area, by digging up bardi grubs in a burnt area for bush tucker. We were not able to determine how long the bardi grubs could persist in the dead plants. (Photos 4 and 5)

One active burrow in the burnt Spinifex/Acacia shrubland had had a camera trap installed by Gemma Aldred (anthropologist) in June 2014. During the period that the camera was active (June 6 – August 22, 2014) bilbies were recorded using the burrow area on ten nights, including the final night (Photos 3 and 3a). This showed a bilby continuing to use the burnt area, 100+m from unburnt vegetation that would offer some protection from predators, 3-4 months after fire. The camera also recorded a fox visiting the site on one night. Foxes are considered a major factor in the decline of the overall Australian bilby population.



Map 4: Line search vegetation categories and bilby burrows. The search began on the northern margin, and proceeded south.

General Comments

The most obvious indicator of potential bilby presence was the occurrence of *Acacia rhodophloia* – referred to as ‘Bardi Bush’ by the Tjirrkarli Ladies (Photo 4). However, plots where Bardi Bush occurred did not always have evidence of bilby presence. Another indicator plant appeared to be the presence of *Eremophila latrobei* (occasionally observed with digging

at the roots for bardi grubs). Many sites where bilby presence was recorded had some Mulga *Acacia aneura* present.

The large mound on a 2ha plot on the Camel Get In Road deserves special mention. It is a very large structure that catches the eye in the same way as do relict earthworks from Burrowing Bettongs *Bettongia leseur graai* (we encountered several old bettong warrens during the project). The mound is at least 5m in diameter and is quite high (~600mm). It appears to be currently inactive, but there are many fairly recent (in the last year) feeding diggings in the area and five other inactive burrows nearby on the 2ha plots 21a and 21b. It is possible that this structure was built up by concentrated bilby activity on this site over a very long time. We saw nothing else like this during the project.

Great Desert Skink Survey

We would like to thank Danae Moore for an excellent briefing on the habitat and signs of the nationally-listed threatened Great Desert Skink (GDS). Prior to the Desert Discovery project, we spent several days learning from Danae. Following the survey, Danae reviewed our survey work and provided advice regarding evidence of GDS presence.²

The Great Desert Skink - Tjakura (*Liopholis kintorei*) is listed under national legislation as vulnerable. Restricted to sandy and gravelly habitats in the western deserts region of Central Australia, the Great Desert Skink has a scattered distribution across its range and is known to have disappeared from former habitats, particularly in the Gibson Desert, Great Victoria Desert and Great Sandy Desert regions. The type specimen was collected in 1891 from the northern Great Victoria Desert, about 150km southeast of Warburton.

In 1997 local Aboriginal people took scientists to a new locality north of Warburton in Western Australia, producing the first museum specimen of the Great Desert Skink from WA in 33 years. On a later survey in the Gibson Desert Nature Reserve (north of Tjirrkarli) several Traditional Owners showed surprise and alarm that no Great Desert Skink burrows were located during a 3-day transect. People had been confident at the start of the journey that Great Desert Skinks occurred 'all across the rira³ country' that they drove through (McAplin 2001).

The greatest threat to GDS is changed fire regimes. Fire regimes changed from traditional fine-scale patch burning (60 years ago) to large-scale fires following fuel build up in the 'good' years. This in turn leads to a loss of cover that provides shelter from feral predators (cats and foxes). Ngaanyatjarra Council is working to reinstate traditional small patch burning.

²Danae Moore works for the Australian Wildlife Conservancy managing their Newhaven Wildlife Sanctuary, 350km north west of Alice Springs. She is completing a Masters thesis investigating the effect of fire on GDS burrow occupancy, breeding activity and predator pressure. She is a member of the Great Desert Skink National Recovery Team.

³Rira a gravelly, lateritic, undulating plain vegetated by scattered Black Gidgee (*Acacia pruinocarpa*) or Mulga (*Acacia aneura*) over spinifex (Hard Spinifex *Triodia basedowii*) and low, scattered shrubs. This seems to be the habitat most widely used by Great Desert Skink in the Gibson Desert.

Survey method

The recommended national standard for GDS site recording is a 4ha plot search of one person for one hour with a standardised datasheet, as developed by the Great Desert Skink National Recovery Team. In order to maximise our survey effort, GDS survey plots overlaid the Bilby survey plots (2 x 2ha adjacent plots). Due to time constraints and an initial lack of local information, less effort was specifically focused on the GDS survey. Twenty-three plots were surveyed for the presence of Great Desert Skink. Other survey teams (birds and vegetation) kept a look out for signs of GDS burrows, and one such site was reported (Site GDS 10 – see Map 5 and Table 3).

While working with the Ngaanyatjarra ladies we asked if they could show us any GDS sites and include GDS in the searches for the bilby. They correctly described the ecology of the GDS and the burrow system. At one bilby burrow site great excitement was generated when, while digging for sand goanna, they unearthed a ‘Tjakara’. This happened on two occasions. However, in both cases the skink was a Night Skink *Liopholis striata* (Photo 6). The women did not differentiate between the two similarly coloured but different sized skinks, using the same traditional name ‘Tjakara’ for both. No GDS sites were found while searching with the ladies.

Two days before the end of the survey we were given the GPS locations for four sites where the women had recorded GDS earlier in the year. No other information was supplied. On the last day of the survey we went to each of these sites. Two of the sites (GDS1 and GDS2) had burrows with multiple entrances and latrine sites (Photo 7). These were mapped, photographed and scats collected. We were unable to find any GDS burrows at either of the other two locations, though extensive searching was not carried out due to time constraints. Sites GDS 1-4 were not plot surveyed using the 4ha plot survey technique. They were visited only briefly due to time constraints.

Photos, scats and information about the GDS sites were sent to Danae Moore for analysis.

Results

Analysis of material sent to Danae Moore is incorporated into the ‘Results’ column in Table 3. In summary, two sites were confirmed as being GDS burrow systems, with one having had breeding success last summer, and the other having adult GDS present last summer.

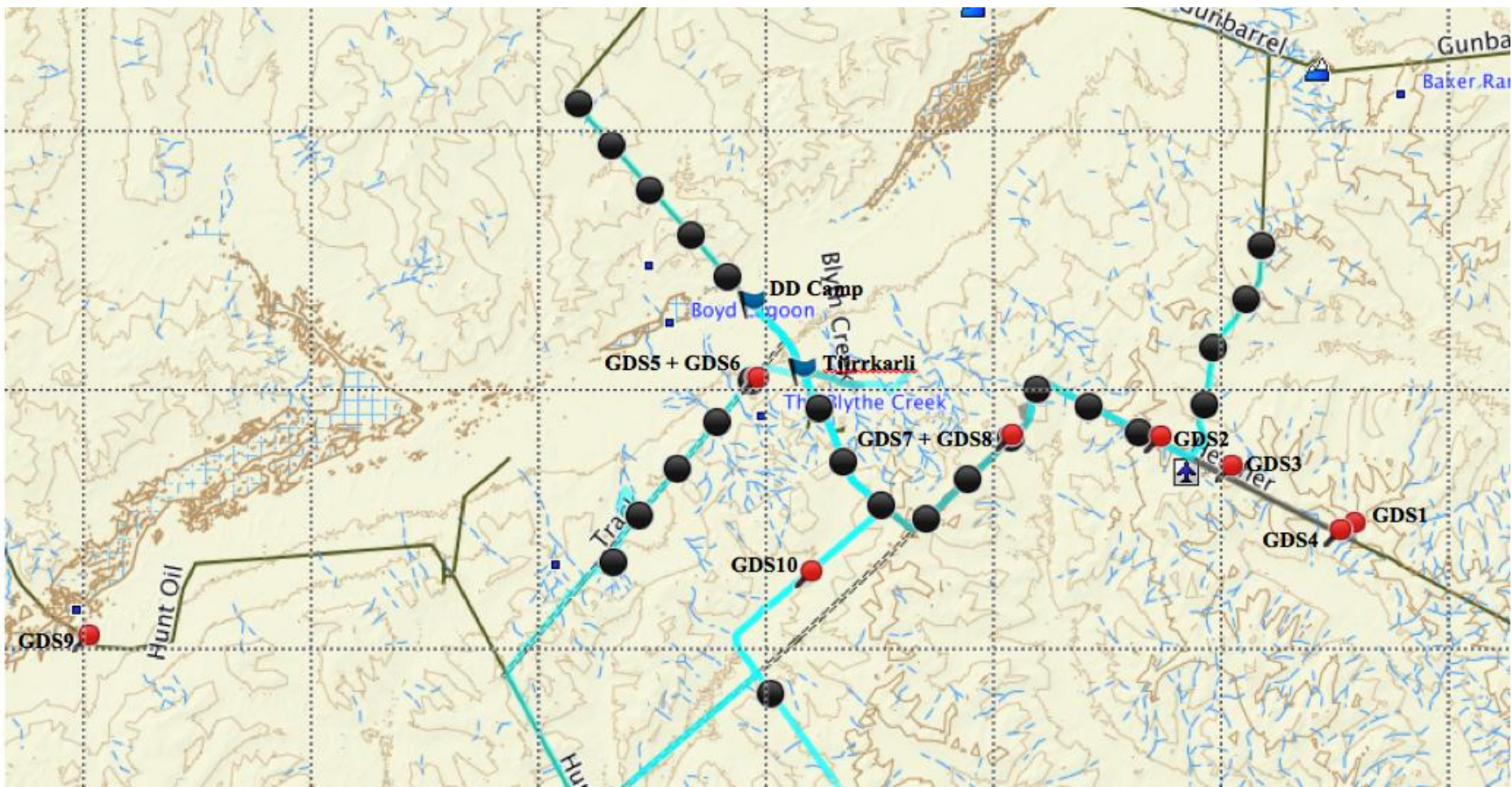
In conclusion, it appears that GDS are still present in the Tjirrkarli area. Future survey/searches for GDS should focus specifically on the species and not be an adjunct to another species survey. It is recommended that initial work commence in the areas that GDS have been confirmed during the current survey (see Table 3).

Table 3: Great Desert Skink Search Observations

Site	Lat Long	General location	Reported by	Vegetation	GDS evidence	Action taken	Result
GDS1	S26° 07.173 E125° 57.425 Same site – re GPS'ed S26 07.181 E125 57.420	Heather Highway	Ngaanyatjarra Ladies via Gemma Aldred Verified and re-GPS'ed by T Macdonald and J Haiblen	Spinifex and annual grasses on Rira, burnt within the last year.	30m diameter low mound with 4 open burrows and 2 latrines, possibly one adult and one juvenile - see Figure 1 and Photo 7.	Photos, scats and plans to Danae Moore	Confirmed GDS family burrow with breeding success last summer
GDS2	S26°03.199 E125° 47.046 Same site – re GPS'ed S26 03.187 E125 47.048	Tjirrkarli access road near Heather Hwy	Ngaanyatjarra Ladies via Gemma Aldred Verified and re-GPS'ed by T Macdonald and J Haiblen	Unidentified shrub covering disturbed area of warren; surrounded by Spinifex, <i>Dicrastylis</i> <i>exsuccosa ssp. cinerea</i> , sparse <i>Acacia pruinocarpa</i> on Rira burnt within the last year	15m diameter low mound with 7 open burrows and 1 latrine - see Figure 2.	Photos, scats and plans to Danae Moore	Confirmed GDS adult scats
GDS3	S26° 04.508 E125° 50.842	Heather Highway	Ngaanyatjarra Ladies via Gemma Aldred Relocated by Macdonald/Haiblen	Rira, Spinifex with perennial grasses and occasional <i>Dicrastylis</i> and <i>Solanum</i> bushes, area burnt within the past year	Possibly very old warren, no open holes	Site photos only	Suggest reference/site and area be searched more extensively by ladies
GDS4	S26° 07.570 E125 56.620	Heather Highway	Ngaanyatjarra ladies via Gemma Aldred	Rira, area partially burnt within the past year	This waypoint is on the Heather Hwy roadway; no GDS evidence found in brief search of adjacent area	No action	Suggest reference/site and area be searched more extensively by ladies

Con't -

Site	Lat Long	General location	Reported by	Vegetation	GDS evidence	Action taken	Result
GDS5	S26° 00.410 E125° 25.534	Tipline Road	T Macdonald and J Haiblen GDS survey form plot 18	Sandplain with scattered <i>Acacia pruinocarpa</i> and <i>Corymbia opaca</i> , and spinifex and shrubs, burned approx. 1 year ago		Photos to Danae Moore	.
GDS6	S26° 00.427 E125° 25.649	Tipline Road	T Macdonald and J Haiblen GDS survey form plot 18	As above		Photos and scats to Danae Moore	Scat not GDS
GDS7	S26° 03.111 E125° 39.176	Tjirrkarli access road Steptoe area	T Macdonald and J Haiblen GDS survey form plot 8	Sandplain with very sparse <i>Grevillea juncifolia</i> and <i>Acacia ligulata</i> , spinifex and shrubs, burned 3-5 years ago.	Mounding suggests very old GDS warren, no open holes	No photos taken	Recommend broader search of the area
GDS8	S26° 03.112 E125° 39.138	Tjirrkarli access road Steptoe area	T Macdonald and J Haiblen GDS survey form plot 8	As above	Several holes but possibly a smaller lizard		
GDS9	S26° 12.483 E124° 50.067	Hunt Oil Road	Cheryl Gole (Desert Discovery) No GDS survey form	Not known	Single entrance, sparse latrine, small size scats.	Photos and scats to Danae Moore	Not GDS – more likely a small dragon they shelter in shallow burrows in winter and often have a small latrine because they are not active that much.
GDS 10	S26° 09.437 E 125° 28.482	Kanpa road, SW of Tjirrkarli	T Macdonald and J Haiblen No GDS survey form (but mentioned on bilby plot 26 form)	Sand Plain burned 2-3 years previously – <i>Acacia aneura</i> with <i>Codonocarpus</i> and spinifex and small shrubs.	Possible GDS burrow with single entrance, no latrine, but large basking mound relative to burrow entrance	Photos to Danae Moore	Unable to confirm if GDS, Recommend broader search of the area



Map 5: Possible Great Desert Skink sites identified during the survey (red), and the 4ha GDS survey plots (black)

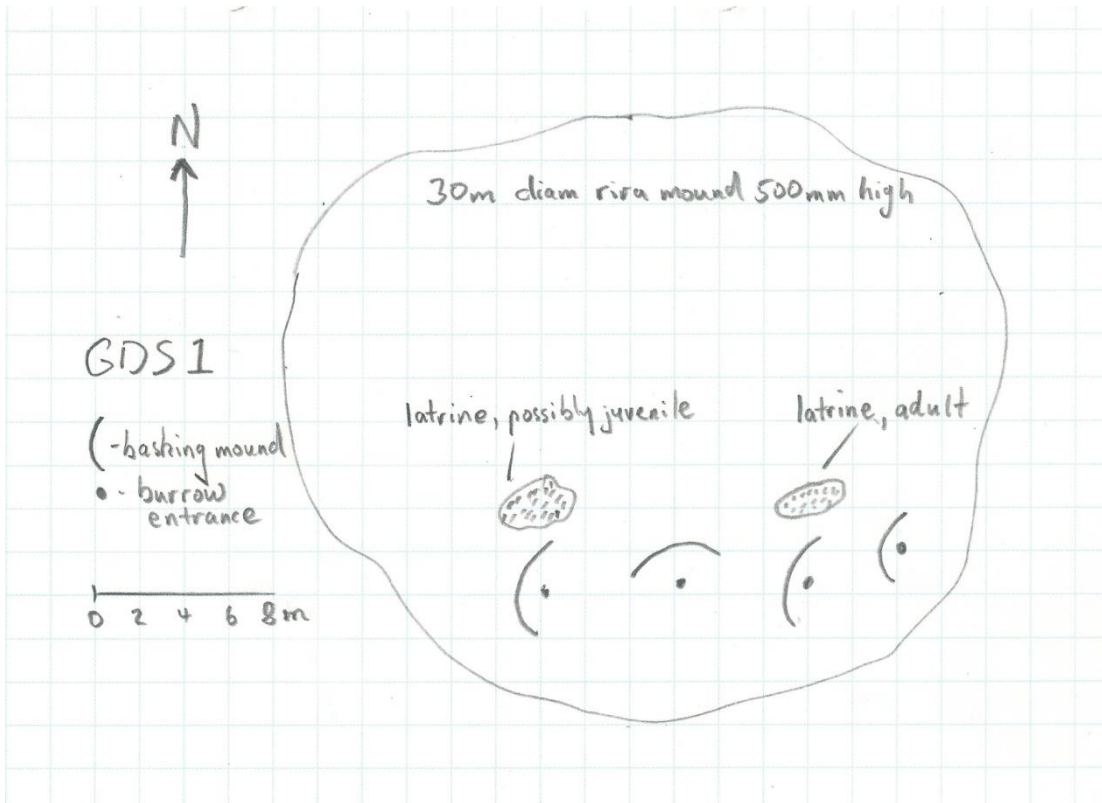


Figure 1: Plan of Great Desert Skink Burrow system at site GDS1

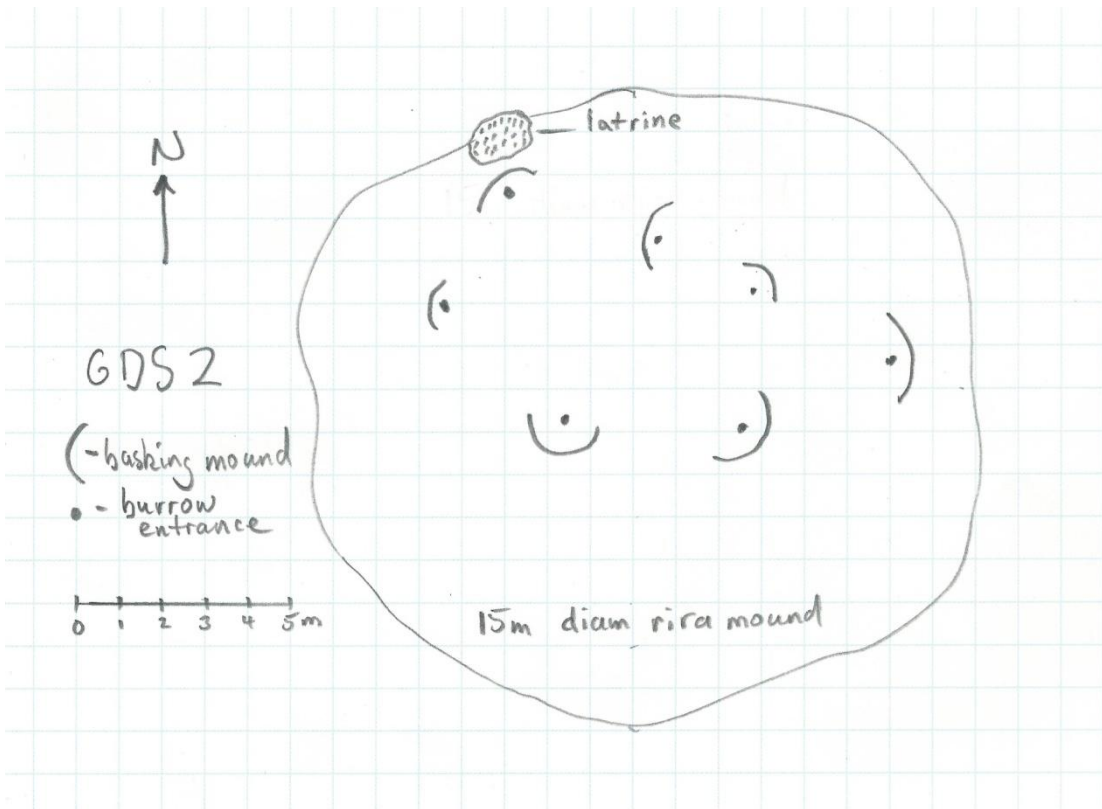


Figure 2: Plan of Great Desert Skink Burrow system at site GDS2

Acknowledgements

A limited number of Desert Discovery participants were able to join the IEK searches, and others helped with the plot surveys. All available Desert Discovery personnel assisted with the line search for bilby burrows. We would like to mention Keith Johnson and David McNamara for their stellar service in helping us survey many of the plots.

We would like to thank all the ladies from Tjirrkarli and Warburton who helped us with the surveys. Without their expert knowledge we would not have been able to conduct a successful survey. Thank you to Dulcie Watson, Joyce Nelson, Lillian (Nita) Turner, Terry-Anne Robinson, Emily Robinson, Sherma Newbury, Melanie Nelson, Natasha Watson, Gloria Turner, Shana Turner, Alberta Robinson, Jennifer (Nadia) Johns, Redina Fraser and Valeska Fraser.

References

Moseby KE, Nano T, and Southgate R. 2011. *Tales in the Sand; A guide to identifying Australian arid zone fauna using spoor and other signs*. Ecological Horizons, South Australia.

McAlpin S. 2001. *A Recovery Plan for the Great Desert Skink (Egernia kintorei) 2001–2011*. Arid Lands Environment Centre, Alice Springs NT.

Paltridge R. 2012. *Biological Resources of the Ngaanyatjarra Indigenous Protected Area*. Unpublished Report prepared for the Ngaanyatjarra Council by Desert Wildlife Services, Alice Springs.

Attachment 1. See Appendices

Photos



1. Nita Turner and Joyce Nelson at an inactive bilby burrow



2. Dulcie Watson at an active bilby burrow



3. Bilby on camera the night before commencement of the Desert Discovery project



3a. Bilby on camera trap



4. Bilby digging at roots of Bardi Bush *Acacia rhodophloia*, with bilby droppings in foreground



5. Bardi grub in root of Bardi Bush *Acacia rhodophloia*



6. Night skink *Liopholis striata*



7. Great Desert Skink site – burrow and basking mound on right with latrine site on left indicated by white urea pellets

Marsupial Moles

Keith Johnson

Mole Field Work

As with projects since 2006, some trenching was done on behalf of Dr Joe Benshemesh. The work was done to the north of the project base camp in a narrow strip of sand dunes to the south of the Gunbarrel Highway. The dunes are of a reasonable height (according to Natmap they average 14 metres) but are not continuous and are separated by broad swales. They are lightly vegetated with grasses and scattered shrubs.

The dunes in this part of the Gibson Desert are an isolated pocket of approximately 70 x 20km.

The aim for our mole work at Tjirrkarli was simply to see if marsupial moles were present.

They are! A total of 17 burrows of varying ages were observed in four trenches. Two trenches were dug on the southern most dune and another two on a tall dune four kilometres further north.

The trenches were at least a metre wide and 80cm deep.

All the data and photographs have been passed to Dr Benshemesh for analysis.

We did not collect predator scats at this project.

Photographs by Keith Johnson.



Figure 1: View of dune country for trenching



Figure 2: A trench ready for reading



Figure 3: Evidence of Marsupial Mole activity

Fungi at Tjirrkarli

Malcolm McKinty

material and in the recycling of essential nutrients, particularly carbon and nitrogen.

a. Background to fungi

Fungi are present throughout most organic material in the environment – such as wood, plant litter, humus, soil, dung and carcasses – and play important roles in the ecology of natural ecosystems. Through the processes of decay they are recyclers of organic material, releasing nutrients back into the soil. Symbiotic relationships between fungi and the roots of plants ensure the survival of both. They are critical food sources for many native mammals, reptiles and invertebrates.

Fungi are a very large group of living organisms that usually reproduce by spores – minute reproductive cells, up to 10 microns in diameter – which are dispersed by air, water, animals and sometimes the fungus itself.

Unlike green plants, fungi lack chlorophyll for photosynthesis, so must absorb their energy and nutrients from the substrate in which they grow. They comprise microscopic filaments (hyphae) which form a web-like mass (mycelium) ramifying throughout the substrate. The mycelium is the actual fungus – its vegetative structure – and, while individual hyphae are rarely seen, the mycelial mass can sometimes be seen in the substrate (such as the bright red mycelium of *Pycnoporus coccineus*).

The relationship between fungi and their substrates varies with species. Saprotrophic fungi gain their energy from dead organic material by breaking down the lignin, cellulose or chitin. Some such fungi are specialised coprophiles – developing on dung. Saprotrophs play a vital role in reducing the accumulation of dead organic



Fruit-body and mycelium of *Pycnoporus coccineus*

A saprotrophic fungus in wood.

Some fungi are parasites, obtaining their nutrients from living organisms with no benefit to the respective host and, at times, killing it.

Other fungi have a mutually-beneficial symbiotic relationship with a living organism. Mycorrhizal fungi form a special relationship with the rootlets of trees and other plants. In return for having their energy needs met, the hyphae of these species greatly increase the volume of soil from which the plant can take up water, nutrients and trace elements. Such fungi are essential for the healthy growth of native forests in Australia's impoverished soils.

Under favourable conditions fungi produce reproductive structures (fruit-bodies) from which their spores are dispersed. Fruit-bodies take a wide range of forms according to the particular species and, for the macrofungi (in which the fruit-bodies are large enough to be seen with the unaided eye), it is largely by their fruit-bodies that fungi are identified.

The fungal kingdom is considered to comprise at least four main divisions based on microscopic characteristics. The vast majority of the macrofungi fall into two of them – the Basidiomycota, where the spores are produced on the outside of specialised club-shaped cells (this division contains most of the fungi seen in the bush) and the Ascomycota, in which the spores are produced inside specialised sac-like cells, called asci.

Depending on the fungus' species group, the spores may be produced on the surface of the fruit-body, on specialised surfaces such as gills (or lamella) that are like the leaves of a book, spines, or the lining of tubes or, as for the powdery spore mass in a puffball, within the fruit-body.



Montagnea arenaria (Desert Inkcap)

The spores of this species are produced on the brittle gills.

b. Environmental conditions for fungi at Tjirrkarli

This survey took place over only nine days from 1st September 2014. It is understood that there had been no significant rain since the previous April. Accordingly any of the more fragile fungal species that may have fruited after those rains would have matured and deteriorated long ago. Indeed, one of the Traditional Owners commented that there would be “no mushrooms as they only come up after rain”.

Ground conditions were dry. The most prevalent grazing animal in the area was the Camel, while other dung suggested the presence of native grazers and localized Rabbit infestations. However, grazing pressure on the shrubs and grasses appeared to be limited and a healthy litter layer was present under most trees and shrubs. The soil surface generally was relatively intact with little evidence of disturbance.

Dung, principally of Camels, provided the necessary resources for some species of fungus to develop, albeit in competition with termites.



Immature Bird's-nest Fungus on Camel dung

Desiccation probably halted the development of these fruit-bodies of *Cyathus stercoreus*.

c. Survey and recording

The ephemeral nature of the fruit-bodies of most species of fungus means that finding them is largely serendipitous and depends on a search coinciding with their location, their emergence and before they deteriorated or were consumed.

At Tjirrkarli, formal searches were conducted by the conventional head-bowed wandering walk of the amateur mycologist. The area covered was broadened by eagle-eyed Judy McKinty and Ian Miles occasionally looked down from birds to assist. Informally, on learning of this relatively new field of discovery, members of the DD team reported casual observations or brought samples of fungi in to the base camp. The promise of a potentially interesting fungus species found by the fauna team was used to conscript the author to help with digging pit-fall traps.

Where possible, surveys included a range of vegetation types. Within the time available, fungi were sought in the vicinity of, and in the dune country to the north-west of, Ambulance Bore, near Camel-Get-In Bore, at the south-eastern tributary to Boyd Lagoon, along the T5 Track and on the track south of the Tjirrkarli Community to the caves.

Recording fungi is similar to that for plant species. However, as well as the scientific name (if known), location in terms of latitude and longitude (in degrees, minutes, seconds), locality and vegetation type, the substrate on which the fungus is growing is also recorded as well as the identity of the nearest tree/shrub - which may help in future studies of mycorrhizal fungi.

In situ photographs are taken as well as any other photos that may help with identification.



The author

Shade to counter the intense sunlight for photography.

d. Fungi found at Tjirrkarli

Although the environmental conditions at the time of the survey were not conducive to finding a large variety of fungi, 15 different species, described below, were recorded from 38 sites in the Tjirrkarli lands. All were species expected to be found in arid and semi-arid environments and all belong to the Basidiomycota.

Puffballs and their allies

The spores of puffballs are produced as a mass within the body (peridium) of the fungus.



Podaxis pistillaris (Black Powderpuff)

A saprotrophic fungus, this stalked puffball grows in soil.

Supported by a woody/fibrous stem, the dark brown spore mass is revealed when the pale outer sheath lifts and shreds.

It is a common and persistent fungus of arid and semi-arid areas and was recorded from five of the sites investigated at Tjirrkarli (all except the track to the caves).



Pisolithus arhizus (Horse Dung Fungus)

The peridium of this puffball progressively disintegrates downwards to a persistent stump-like base, exposing the brown spore-mass. It grows in soil.

Several specimens of this fungus occurred along the main track north from Ambulance Bore.



***Scleroderma* sp.**

This mauve-spored puffball was found in soil under Mulga at both Camel-Get-In Bore and on the track to the caves.



Puffball sp.2

This pale brown-spored puffball was also found in soil under Mulga at Camel-Get-In Bore and again near Ambulance Bore.

For the following three puffballs, the spores are ejected through a stoma (pore) in the top of the

thin-walled spherical peridium which acts like bellows when raindrops strike it. All three grow in soil



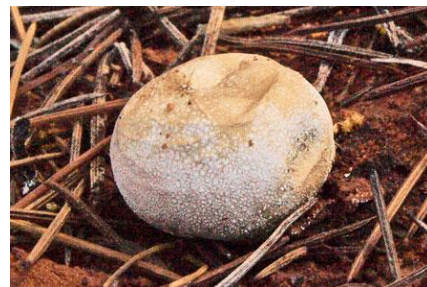
Tulostoma sp.1 (a Stalkball)

This relatively common long-stemmed stalked puffball erupted in clusters and was found south of the Tjirrkarli Community, near Ambulance Bore and in the dunes to the north.



Tulostoma sp.2 (a Stalkball)

A short-stemmed stalked puffball found in the dunes to the north of Ambulance Bore.



Bovista sp.

Stalkless, this puffball was found to the north-east of Ambulance Bore.

Geastars (earth stars) are puffballs which have a double-layered peridium enclosing the immature puffball. The outer layer splits to form a number of rays – like a star – to expose the central puffball containing the spores.

The spores of these species are also ejected through a stoma under the impact of rain. The rays of the ‘star’ act to raise the puffball above the ground litter to better access the raindrops. Two species were found at Tjirrkarli.



Geastrum sp.1

The rays of the ‘star’ of this species barely raise the puffball above the ground and the stoma are unornamented.

Found in several sites - on the T5 Track, north-east of Ambulance Bore and in the dune country to the north.



Geastrum pectinatum (Beaked Earth Star)

Here, the rays of the ‘star’ give substantial lift to the shortly-stalked puffball and the raised stoma is distinct within a fibrillose area.

Found north-east of Ambulance Bore.



Schizostoma laceratum (Splithead Puffball)

The spore sac on this woody-stemmed stalked puffball peels back like flower petals to reveal the spore mass.

Usually found singly in dry, sandy soil in arid zones, several specimens of this saprotrophic species were found on a high red sand dune at Boyd Lagoon.

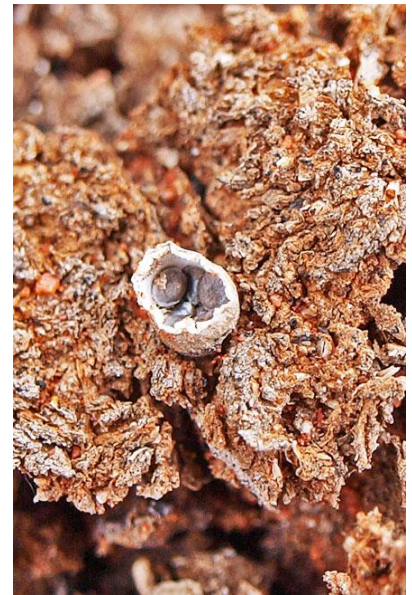
Considered rare, this is the second record for Western Australia (the *Atlas of Living Australia* records place the other in the Little Sandy Desert.).

Cyathus stercoreus (a Bird's-nest Fungus)

The spores of Bird's-nest Fungi are carried in tiny bean-shaped objects (peridioles) in open nest-like structures. The peridioles are usually scattered by the action of rain drops falling into the 'nest'.

This species, only about 5mm diameter, grew from Camel dung. It was found north-east of Ambulance Bore. Large numbers of immature fungi of the same/similar species were found nearby and on Camel dung on the track to the caves (See the image in Section b. above.).

It is probable that the peridioles of this particular species adhered to grass stalks after ejection from the 'nest' and were ingested by herbivores. As a result the fungal spores most likely existed in the dung when it was deposited.



Polypores

The polypores are a large group of fungi in which

the spores are produced from tubes (which appear as pores) under a cap. Three species were found.



Upper surface

Bracket sp.1

A large number of these tough brackets were found on the trunk and branch of a Desert Bloodwood, north-east of Ambulance Bore.

Pore surface (underside)



Phellinus sp.

This hard, woody fungus was growing in a Mulga at Camel-Get-In Bore.



Pore surface



Pycnoporus coccineus (Scarlet Bracket Fungus)

This polypore is a common wood-decaying (saprotrophic) fungus found across Australia from the deserts to moist fern gullies. It can persist for many years before decaying.

At Tjirrkarli it was found growing on the dead wood of *Gyrostemon* sp (dune country to the north of Ambulance Bore) and Desert Bloodwood (Camel-Get-In Bore).

The bright red mycelium causes white rot in the substrate. When extracted, the colour from the fungus can be used as a fabric dye.



Pore surface

Agarics

The spores of this group of fungi are carried on gills under a cap. Agarics incorporate the majority of fungi and include the 'mushrooms'. The fruit-body of most agarics comprise some

90% water and develop and deteriorate over a short time so it is uncommon to find the more delicate fungi in the drier regions. Only one species of agaric was found at Tjirrkarli.



Montagnea arenaria (Desert Inkcap)

This agaric is adapted to drier regions and has a woody stem and brittle gills.

It grows in sandy soils and is considered uncommon. A single specimen was found under a Casuarina near Ambulance Bore but several groups of the species were growing on a high red sand dune at Boyd Lagoon.

Bibliography

Atlas of Living Australia; <http://www.ala.org.au>

Bougher, N.L. & Syme K. (1988) *Fungi of Southern Australia*. University of Western Australia Press, Nedlands.

Fuhrer, B. (2005) *A Field Guide to Australian Fungi*. Bloomings Books Pty Ltd, Melbourne.

Grey, P. & Grey, E. (2005) *Fungi Down Under – the Fungimap Guide to Australian Fungi*. Fungimap, Royal Botanic Gardens, Melbourne.

Keeton, W.T. (1980) *Biological Science*. W.W. Norton & Company Inc., USA

Young, A.M. (2009) *A Field Guide to the Fungi of Australia*. University of New South Wales Press Ltd, Sydney.

Assistance with identification of several species was provided by mycologist Tom May and Graham Patterson at FUNGIMAP (c/o Royal Botanic Gardens Melbourne).

Introduction

This text and the identification of butterflies at Tjirrkarli are based on the “The Complete Guide to Butterflies of Australia” by Michael F Braby (2012).

The Australian butterfly fauna is relatively poor, compared with other parts of the world. However, nearly half of the species here are found nowhere else. Butterflies are primarily a tropical group of insects and are not well adapted to arid environments. Of the nearly 400 species identified on mainland Australia, 92 (23%) have been recorded from inland Australia, which receives an annual rainfall of less than 500 mm per annum.

It is, therefore, not surprising that the range of only six butterfly species overlap the Tjirrkarli project area. A further eight species are sporadically distributed across arid Australia and may occur in the Tjirrkarli area. These 14 species represent five of the six butterfly families found in Australia. The project area was reasonably dry with little or no standing water present, other than in Boyd Lagoon, a saline lake, and a few rock holes.

Identification methods

Butterflies were collected with the use of a net, observed in flight or at rest and/or photographed. Many of the DD participants also provided information about the location and description of butterflies they had seen. These were followed up by visits to the areas in which they were seen or through identification via photographs taken by the observers.

During the 11 days at Tjirrkarli, nine species were observed and confirmed (see table below).

Table 1. Butterflies observed on the Tjirrkarli Project Area

Scientific Name	Common Name	Australian Distribution	Tjirrkarli Abundance*	Range extension
<i>Eurema smilax</i>	Small Grass-yellow	Widespread	Common	No
<i>Belenois java</i>	Caper White	Widespread	Uncommon	Close to western limit
<i>Junonia villida</i>	Meadow Argus	Widespread	Common	No
<i>Vanessa kershawi</i>	Australian Painted Lady	Widespread, except NW Australia	Uncommon	Yes
<i>Danaus chrysippus</i>	Lesser Wanderer	Widespread	Common	No
<i>Ogyris amaryllis</i>	Satin Azure	Extensive	Common	Yes
<i>Nacaduba biocellata</i>	Two-spotted Line-blue	Widespread, except Northern Australia	Uncommon	No
<i>Theclinesthes miskini</i>	Wattle Blue	Extensive	Very Common	No
<i>Candalides heathi</i>	Rayed Blue	Patchy distribution across Australia	Uncommon	Yes

*Abundance is based on Braby 2012. Rare: 0-1 per day; Uncommon: 2-9 per day; Common: 10-99 per day; Very common: More than 100 per day.

Discussion

Despite the dry conditions, butterflies were reasonably common in most areas visited across the project area, including the dune country north of the camp, the Rock Holes, Camel Get In Bore, Boyd Lagoon, the track to the Caves, and the extended area around the main camp (approximately 1.5 kilometre radius). The main camp area was also a good location for observing various species. In particular, *Ogyris amaryllis* (Satin Azure) was common around the camp wherever there were mature mulga trees with mistletoe.

Based on the information in Table 1, three species have had their ranges extended as a result of the Tjirrkarli project and another is very close or just beyond its western limit. Four species that might possibly have been encountered at Tjirrkarli have distributions that are patchy across the continent and are, therefore, less likely to be observed. Another species, *Papilio demoleus* (Chequered Swallowtail), is widespread across Australia, including the Tjirrkarli area. However, it was not observed on the project area, although it is common further east toward the WA/NT border. A number of sightings were made of *Catopsilia pomona* (Lemon Migrant) at the main camp and at Camel Get in Bore, but none was captured to confirm its presence.

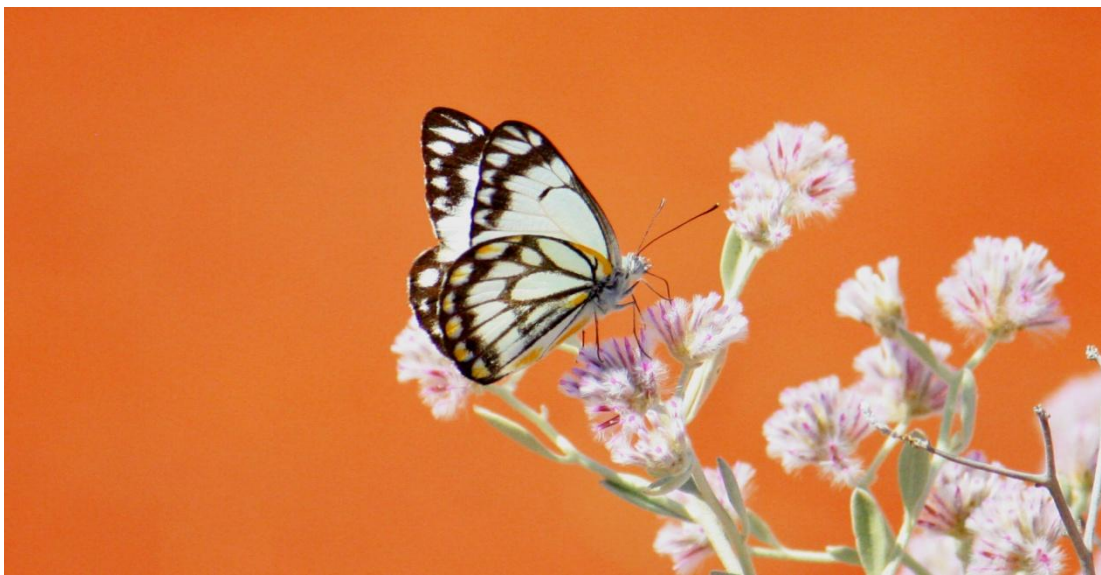


Figure 1: Belenois Java Caper White



Figure 2: Danaus Chrysippus Lesser Wanderer



Figure 3: Junonia Villida Meadow Argus

Photographs by Ian Miles. See the photo Album for further photographs.

The Tempe Downs Project

Trevor Blake & Mick Lumb

Immediately after the Tjirrkarli project a group of seven of us joined a Central Land Council (CLC) project, funded as part of the National Biodiversity Project, to undertake benchmark surveys on an ex-cattle station known as Tempe Downs. This had been purchased by the CLC on behalf of the local Luritja people in 1993. Since then some outstations have been established but the property has not been managed as a working cattle station.

With the full approval of the traditional owners (TO's), a group comprising specialists from the Northern Territory Government, three senior CLC people and the Desert Discovery contingent met with some 15 TO's to begin assembling the first scientific data for the property.

Situated about 40km east of Kings Canyon (Watarrka National Park), it covers an area of nearly 500,000ha with the communities of Areyonga and Ntaria (Hermannsburg) to the north. It encompasses some of the moister areas of the Central Ranges and extends to drier areas with lower ranges in the west.

This was a two-week project with the first week being centred around the old homestead of Tempe Downs. DD was asked to join the team in the second week of the project and so we all met up in a sandy creek bed near the remains of the McRae cattle yards. We had a helicopter at our disposal as so much of the property was inaccessible by tracks. The helicopter ferried us to remote places for half a day, then returned to camp.

The trap lines and Elliott traps were set at four sites with two lines of pitfalls on each. Fungi documentation was enthusiastically welcomed as nothing had been done in the area. Mal McKinty found some 15 fungi species, three of which were not found at the DD project, and all were amazed at the number of collections made. The botany was mainly carried out by Peter Latz, a botanist, naturalist and iconic character of the Centre, who was mainly interested in rare plants or those poorly represented in the NT Herbarium's collection. Judy McKinty spent time with the TO's who were intrigued by her string games. The bird team of Ian Miles, Beryl Blake and Judy Lumb were the only birdos and they recorded 57 species over three days.

At each of the trapping sites 20 minute bird surveys were done and every living plant remnant was recorded over a 25 metre diameter circle. This really did surprise, as despite the aridity and the impact of feral animals, over 38 species of plants were recorded from individual sites. It was not uncommon to find large grinding stones and flints as reminders of the long-gone inhabitants.

One of the major undertakings of the CLC prior to the scientific assessment was to remove feral animals and some 8,000 horses were shot. The scrub bulls were uncontrolled and were said to be killing the cows in their urge to mate. Some 2,000 horses and an unspecified number of camels and wild cattle remain. Long-term control is not easy as the involvement of neighbouring properties is essential. There are few fences out here!

The impact of feral animals is profound with all of the accessible flatter land bared to the ground with extensive sheet and gully erosion devastating the property. Every waterhole able to be reached had been fouled and rotting carcasses polluted most. As Trevor said 'in all my wanderings in the inland, I have not seen feral damage like this'.

So what is the future for Tempe Downs? The plant life had been chewed to oblivion and there seemed nothing left of the annuals and short-lived perennials but on close examination there are living

remnants of species that may have a chance to recolonise given some good seasons. The good news is that many of the rock holes in the gorges are inaccessible to the ferals and remain a life source for birds, water plants, ferns and dampness-loving plants as well as native fish. But recovery depends on a sequence of kind seasons and a continuing effort to exterminate the ferals.

We believe the future of Tempe Downs is not as a cattle station, as annual rainfall is increasingly variable. The TO's are very receptive to the idea of tourism and there are wonderful opportunities here with permanent water holes and outstandingly grand landscapes that visitors from throughout the world can only currently experience by helicopter flights from outside the station.

The DD team fitted easily into the CLC project. The CLC people and the NT Government scientists welcomed our involvement and thanked us for our highly useful contributions to the Tempe Downs project.

We thank the CLC for inviting DD to be part of this project and would welcome opportunities for DD people to be further involved in NT survey projects in the future.

Visits by School Groups

Allen Hyde

During the Week September 1st – 5th, 27 students from Warburton, Wanarn, Warakurna and Blackstone/Jamieson attended Desert Discovery Tjirrkarli Project.

The goals set for the students during their visit were to:

1. Study, and increase their knowledge of, fauna and flora in the local region;
2. Gain and understanding of the work that scientists do in furthering knowledge; and
3. Work cooperatively in groups or teams when completing Scientific Investigation.

It was a great pleasure having the students at Desert Discovery (Tjirrkarli). They were enthusiastic, attentive, interested in the work of the scientists, excellently behaved and generally a pleasure to have at camp.

The students attended the project in two groups, the first group arrived on Monday and departed on Wednesday, with the second group arriving on Wednesday and departing on Friday. During their stay the students were involved with studying tracks, setting Elliot and box traps, pit traps along a pit line and studying plants and animals at a nearby lagoon. Students also learnt about scientific measurement and recording information and how to identify specimens collected during the day. They also learnt about the ethical treatment of animals and what steps needed to be taken to ensure their wellbeing whilst in captivity.

The students were actively involved with a comprehensive program from 7am until dusk. On their day of arrival the students firstly set up camp and enjoyed some free time before departing to the study area, arriving at about 4pm. For the next hour and a half they helped the scientists set up some pit and box traps and observed those that the scientists had already deployed and checked them to see if any animals had been caught.

The interaction between the scientists and students was first class and the students quickly learnt how to deploy the various types of traps, including setting up sun shelters used to protect and captured animals during the hotter parts of the day. They assisted the scientists in identifying and counting the species trapped and they were shown the correct manner to handle and then release them.

Upon returning to camp the students prepared dinner and had the opportunity to observe in greater detail the animals brought back by the scientists for further study. A slide show was also prepared of the day's activities which the students enjoyed.

The following day departure for the study area was before breakfast at about 7:15am, arriving there at approximately 7:30am. As the students were at the study area for about one and a half hours, we and the teachers quickly came to realise that the students needed something to snack on to get them through to breakfast. On subsequent days this was done.

It was also found that the students enjoyed visiting traps that they had deployed in preference to ones deployed by someone else. They gained a great deal of satisfaction when "their" traps showed positive results.

They were also shown the trenches dug to reveal marsupial mole tunnels and the method used to identify them.

After breakfast the students had some free time and then attended an activity organised by one of DD's members. Three activities were organised: "String Figures"; "Animal Tear Outs"; and a presentation on "What a Scientist does". Two of these were undertaken on the students second day in camp and the third on the morning of their last day. A detailed account of "String Figures" is included elsewhere in the report.

Again at 4pm the students departed for the study area and then returned at about 5:30pm for dinner and subsequently attended our campfire. At the camp fire the students had the opportunity to meet with the indigenous advisors. They were also presented with their "Certificate of Achievement", recognising that they had successfully completed the stated goals.

On their last day, the students repeated the previous day's morning program. Following lunch they packed up for their trip home. Immediately prior to departure they were presented with gifts of texts, footballs and some other educational items.

String Games at Tjirrkarli

Judy McKinty

This year, students from Warakurna, Warburton, Wanarn and Blackstone were welcome visitors to the DD project. They came in two groups, each staying for two nights in camp and taking part in DD activities to learn about what scientists do and how scientific research is undertaken. At the end of their visits, each student was presented with a Certificate of Achievement at the evening gathering around the campfire.

While in camp, apart from playing footy at every opportunity (and catching the odd snake to add to the species list), the students visited pit trap lines with the fauna group and mole trenches with Keith, took part in Colleen's lively presentations about desert species - a slide show of plants, animals, insects and fungi taken during the survey and uploaded on the spot - and identified various tracks in the desert sand, among other activities.

A new addition to the students' program this year was string games, more commonly known to some people as the 'old-fashioned' game of Cat's Cradle. If you ever played a game at school where you put a loop of string or wool around your hands and moved your fingers in and out of the strings to make different shapes, then you've played string games. It's a game that's part of many people's childhood memories, no matter where you come from. What's not so well-known is that string games are also part of the rich cultural traditions of Indigenous people the world over, and Australian Aboriginal and Torres Strait Islander people were some of the most skilled. Aboriginal people created string figures to represent familiar animals, objects, people and scenes from everyday life, and they were passed along from person to person as part of their oral tradition.

Because the students at Tjirrkarli were learning about fauna research at DD, the string games sessions were based on animals and their habitat to complement this learning experience, and traditional Aboriginal string figures, tricks and stories were used to represent some of the species

familiar to the students. Some of the string figures were renamed to fit in with local knowledge, for instance the 'Man Climbing a Tree' became a goanna climbing a tree, and the 'Rabbit' with long ears became a bilby. As each figure was made, the students called out what they thought it could be, and that way everyone who wanted to could participate, as there were no 'right' or 'wrong' answers.

During the sessions, the students were taught how to do some simple string tricks and figures. The tricks were received particularly well, as there was no manipulation of the strings on the fingers, so everyone could do them. There was a wide range of ages and abilities in the

groups, and it was particularly pleasing to see some of the students trying again and again to master a string figure or trick until they finally succeeded, which produced big smiles and a boost in confidence. After the first session, which was a small group, there was a bit of extra time for a few interested students (and their teachers) to be taught some more complex figures, including ones that move. String figures are best taught one-to-one, with learner and teacher sitting or standing side by side, so it was good to have this opportunity to extend their individual knowledge and skills. There was also time to hold an impromptu session for some of the DD members who were interested in learning something a little bit different. (I hope you're all practising that magic trick, ladies!)

At the end of the second session, which was a large group of 18 students aged from around 8-15 years, they were asked to each choose one of the DD members who were watching from the sidelines, and teach them one of the tricks they'd just learned. This was a really interesting exercise, with one adult (Garth) being amazed at the persistence being shown by his 'teacher', who wouldn't let him stop until he'd done it right!

Some of the students already knew one or two string figures before the sessions began. The most common was the 'Indian Tent', which was a shape more commonly known as 'Parachute' turned upside-down. One of the teachers also mentioned that they'd been playing some string games with the children. During the sessions, the students learned quickly and were adept at using the loop of wool provided, and some were seen playing with the strings in their spare time in camp. Hopefully, they'll take what they've learned back into their communities to perhaps reconnect with one of their cultural traditions again.

String Figures



Top left – A flower

Top right – An Indian tent

Bottom left – Two fish swimming away – a moving figure

Bottom right – Practising the yam thief trick

Feral Animal Sightings

Keith Johnson

Participants are requested to record any sightings on a log in the marquee. The log recorded one sighting of a cat at Lat 25. 50. 18 Long 125. 17. 48 (near Camel-Get-In Bore). No foxes were reported but one was captured on Gemma's camera at a bilby site.

Small numbers of camels were seen regularly during field work. The only significant sightings were of a mob of ten on the Heather Highway on the approach to Tjirrkarli and another 14 seen 15km north of base camp. All camel sightings have been logged onto the FeralScan data base.

Rabbit scats were observed near Ambulance Bore, Boyd Lagoon and at several locations along the Gunbarrel Highway. Five rabbits were seen at Lat 25. 53. 14 Long 124. 38. 22 on the Hunt Oil Road.

Thanks

Keith Johnson

Once again we are indebted to the Ngaanyatjarra People for the invitation to conduct a project within their Lands. This was the third project in a row with our Ngaanyatjarra friends with Tjirrkarli preceded by Sykes Bluff in 2010 and the Rawlinson Range in 2012.

Without a suitable venue we don't have a project, so thanks are due firstly to Alex Knight of the Ngaanyatjarra Council (Aboriginal Affairs) Land & Culture for suggesting Tjirrkarli and to the Land Council for approving the project.

The enthusiastic support by the traditional owners at Tjirrkarli, (led by Joyce Nelson and aided by her Mother, Dulcie), was greatly appreciated and essential for the success of the project. They were available for the reconnaissance in September 2012 and then for the project. A full list of names of the traditional owners who worked with us is shown in Participants. If I have missed any one, I apologise.

As mentioned previously in this report, the track marking by Daniel Johanson and the Rangers was first class. That simplified our field work as we knew precisely where we were! Although Gemma Aldred could not be with us, her planning and preparation in the lead up to the project was invaluable.

The ongoing support from the Department of Parks and Wildlife for our projects in WA is appreciated. Thanks to Jennifer Jackson for her liaison work. We'd like to make special mention of the team at the WA Herbarium for their advice during the planning stage and for the loan of plant presses.

The reconnaissance in 2012 revealed a large wash away on the Hunt Oil Road that would deteriorate further by the time of the project. Thanks to Stuart Kostera, Meg Carty, Bob and Kathy Hancock for checking it out and ensuring a bypass was available before our participants passed through there.

The end of the project merely heralds the beginning of the report writing phase. Thanks to all who have contributed articles. Thanks also to the folk who provided photographs and thanks to Granddaughter Amber for help with publishing and displaying photographs. As always Libby Sakker has made a major contribution. Being a onetime birder I was able to identify two bird species that weren't recorded by our field teams while reviewing Libby's photographs! For the record, they were White-necked Heron and Grey Teal. Both species were at Boyd Lagoon. We welcome Joss Haiblen to the report editing team. Joss has replaced Libby as our scientific names editor.

Although participant numbers were lower than the norm, the DD team, including many first timers, did the job superbly from camp set up to close. The hours worked by our field teams exhausted me merely by watching it all unfold. Our Logistics guru, Ben Blomfield, wasn't available but Eric and Joy Loughton stepped in and it all happened. Even a faulty pump didn't stop the show for long.

Thanks to all concerned for a job well done. This was my last project as president and it was an ideal 'final curtain'. Shirley and I wish Allen and Robyn Hyde and the new committee all the best for the future.