

Terrestrial Vertebrate Fauna of the Katjarra area of the Birriliburu IPA

Report to the Birriliburu Native Title Holders and Central Desert Native
Title Services

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Nephurus levis-Photo M. Cowan

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Abstract

We undertook standardised sampling with pit, funnel and Elliot traps for frogs, reptiles and mammals at Katjarra over two week periods in August 2012, in May 2013 and again in late March and early April 2014. On each survey the trapping was supplemented with manual searching, spotlighting and the use of infrared motion sensitive cameras. The more than 600 captures and observations resulted in the identification of 90 species, of which almost half (43) were either new additions or confirmations of previously unsubstantiated fauna records. The total known frog, reptile and mammal fauna now stands at 100 native species. Four species of conservation significance, due to listing on State and or Commonwealth Threatened and Priority species lists, were identified in the study area. Evidence of the occurrence of two species now considered locally extinct was also recorded. At least 14 species from those newly recorded are approaching, or are at the limits of their known distributional ranges which contribute to the importance of Katjarra for conservation of biodiversity.

1. Introduction

The Birriliburu Indigenous Protected Area (IPA) was declared on the 23rd April 2013 and covers an area of around 66, 000 km² encompassing parts of the Little Sandy Desert, Gibson Desert and Gascoyne Bioregions of the Interim Bioregionalisation of Australia (Thackway and Cresswell, 1995). Within the IPA are three special category areas (IUCN III categories set aside to protect a specific natural monument) of which Katjarra, also known as Carnarvon Range, is one. The Katjarra protected area covers approximately 2,000 km² including the ranges, and is primarily within the southern extent of the Trainor subregion of the Little Sandy Desert Bioregion, but its south-western corner also extends into the Carnegie subregion of the Gascoyne Bioregion. The nearest populated centre is the small community of Wiluna which lies approximately 170km to the south (see introduction and Figure 1 in Gibson et al., 2013 for more detail).

Historically there has been little systematic biological survey work undertaken in and around Katjarra and consequently documented information on the biodiversity of the area is sparse. The earliest visits in which ground vertebrates were sampled and specimens lodged with the Western Australian Museum were undertaken in 1975 and 1976 when the then Department of Fisheries and Wildlife made two visits as part of a broader assessment of proposed desert conservation areas (McKenzie and Burbidge, 1979). Following these surveys there appears to have been almost no additional fauna survey until a Landscape Expedition in 2001 (Kenneally et al., 2001) and, while some previously unrecorded species were documented, most of the work was confined to a small area in the southern part of the range close to Kanatukul West, and only for a short period with relatively few pit and Elliot traps. A bioregional survey of the south western Little Sandy Desert was initiated in 1995 (van Leeuwen, 2002, Start et al., 2012) but the study area for this was to the north of Katjarra. More recently Martu Rangers responsible for the Birriliburu IPA have established monitoring plots and camera trap locations and undertaken systematic ground searches for signs of threatened species and feral animal activity.

At the invitation of the Birriliburu Native Title Holders, and as part of a larger biological survey undertaken by the Department of Parks and Wildlife (DPAW) in partnership with the Birriliburu Native Title holders and Central Desert Native Title Services, terrestrial vertebrate surveys were undertaken over a two week period in August of 2012, May 2013, and again in late March and early April 2014. While these surveys have been coordinated by staff from DPAW's Science Division, at differing times they have also involved Birriliburu Rangers, staff from DPAW's Goldfields Region and members of Central Desert Native Title Services.

The purpose of this first phase of work has been to document vertebrate biodiversity in and around the ranges with an overarching aim to establish long term monitoring sites which will assist with future management, and evaluation of management effectiveness, in respect to biodiversity conservation at Katjarra.

2. Methods

2.1 Site selection

As with many remote areas access is limited to a few existing tracks which are accessible by four-wheel drive vehicles only. Within these track constraints survey sites were selected to capture the major variation in geology, landform and vegetation types. The position of these sites and their relationship to broad habitat mapping, as defined by Gibson et al. (2013), is shown in Figure 1, and site details are summarised in Table 1.

Two camp sites were chosen from which to run surveys, one at the northern extent of the range and another at the southern extent. In the southern area, Kanatukul West, eight sites were chosen for pit trap establishment (six in August 2012 with two additional sites established in May 2013) and four sites with only Elliot traps (CR1 sites-Figure 2a). Here traps were open for the first week of the first two surveys and the second week of the third survey, except CR1 P9 and CR1 P10 which were not established for August 2012. Another eight pit trap sites were established in the northern area, Yamada North; again six of these were established in August 2012 and another two in May 2013, along with three Elliot trap lines (CR2 sites-Figure 2b). The Yamada North sites were operated during the second week of the first two surveys and the first week of the third survey, except for CR2 P7, CR2 P8, CR2 E10 and CR2 E11 which were only established and run during the second and third surveys. All CR1 sites were open for six nights in August 2012, four nights in May 2013 and seven nights in March/April 2014. For the CR2 sites they were open for three nights in August 2012, five nights in May 2013 and seven nights in March/August 2014. Photos of each of the pit trapping locations are presented in Appendix 2

During the course of the May 2013 and March/April 2014 surveys three mole trenches were excavated in an effort to determine the presence of marsupial moles. Additional to these Allan Burbidge excavated ten trenches in May 2014 while he was undertaking avifauna survey work at Katjarra. Coordinates of all mole trench locations, along with an image of a mole trench, are presented in Appendix 3.

Table 1 Trapping site details including site codes, coordinates, and trap types used

Site #	Latitude	Longitude	Site details	Traps
CR1 P1	-25.26783	120.62665	Sand dune crest	6 pits 6 funnels
CR1 P2	-25.26891	120.62674	Open spinifex sandplain	6 pits 6 funnels
CR1 P3	-25.26560	120.64729	Stony substrate at base of sandstone range with	6 pits 6 funnels
CR1 P4	-25.26269	120.65051	Drainage zone at base of sandstone range	25 type A 10 type B 6 pits 6 funnels
CR1 P5	-25.26385	120.55270	<i>Acacia</i> shrubland on breakaway slope	25 type A 6 pits

Site #	Latitude	Longitude	Site details	Traps
				6 funnels
CR1 P6	-25.27196	120.59509	<i>Acacia</i> shrubland on rocky plain	6 pits 6 funnels
CR1 E7	-25.27812	120.69180	Sandstone range	25 type A
CR1 E8	-25.28145	120.69173	Established in August 2012; Elliot's only; spinifex sandplain	25 type A
CR1 P9*	-25.25836	120.64681	Mulga over spinifex on sandplain	25 type A 6 pits 6 funnels
CR1 P10*	-25.27218	120.58901	Mulga and grass in drainage tract	6 pits 6 funnels
CR1 E11 [†]	-25.26983	120.56655	<i>Acacia</i> shrubland on rocky plain	25 type A
CR1 E12 [†]	-25.270686	120.60302	<i>Acacia</i> shrubland on rocky plain	25 type A
CR2 P1	-25.04351	120.74187	Sapphire on edge of salt lake	6 pits 6 funnels
CR2 P2	-25.04660	120.74078	Dune crest	25 Type A 6 pits 6 funnels
CR2 P3	-25.04559	120.74113	Spinifex sandplain	25 Type A 6 pits 6 funnels
CR2 P4	-25.10662	120.71425	<i>Eucalyptus camaldulensis</i> and dense shrubs in spring	6 pits 6 funnels
CR2 P5	-25.09709	120.72348	Mulga and tussock grass on sandplain	6 pits 6 funnels
CR2 P6	-25.11130	120.70806	Spinifex and <i>Acacia</i> stony substrate	25 type A 6 pits 6 funnels
CR2 P7*	-25.05753	120.73875	Dense <i>Aluta</i> shrubland on sandplain	6 pits 6 funnels
CR2 P8*	-25.12967	120.71752	Mallee over spinifex on sandplain	6 pits 6 funnels
CR2 E9	-25.11539	120.72224	Sandstone range	50 type A 10 type B
CR2 E10*	-25.12585	120.71647	Sandstone range and foot slopes	50 type A 10 type B
CR2 E11*	-25.13697	120.74317	Boulders along drainage line	10 type B

* established in May 2013

† established in March/April 2014

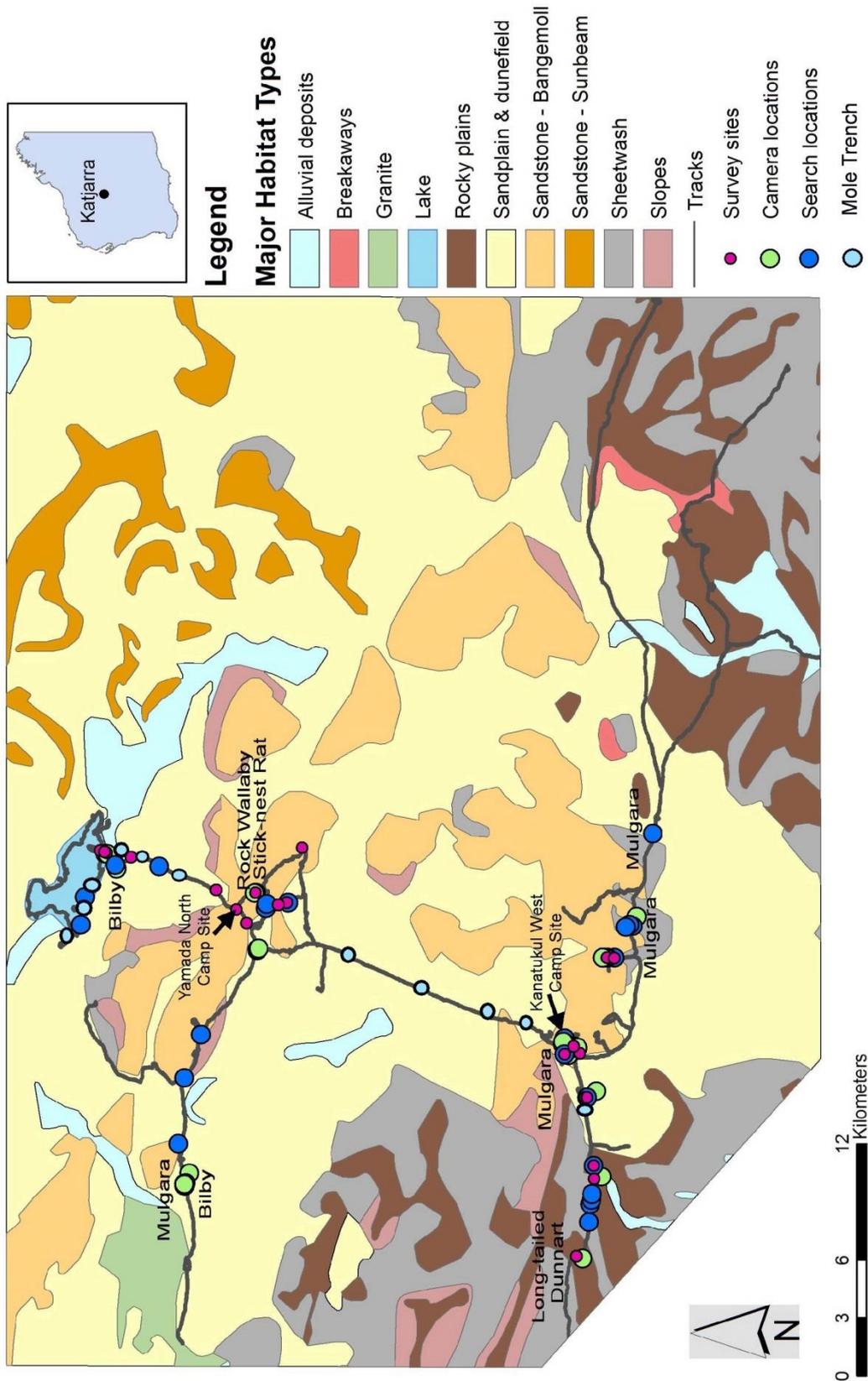


Figure 1 Major habitat types of Katjarra showing survey sites, search locations, mole trenches and, camera trap locations. Sites where there is current evidence of Bilby, Mulgara and Long-tailed Dunnart, along with signs of past occurrence of Rock Wallaby and Stick-nest Rat, are identified. (Habitat map is adapted from Gibson et al., 2013)

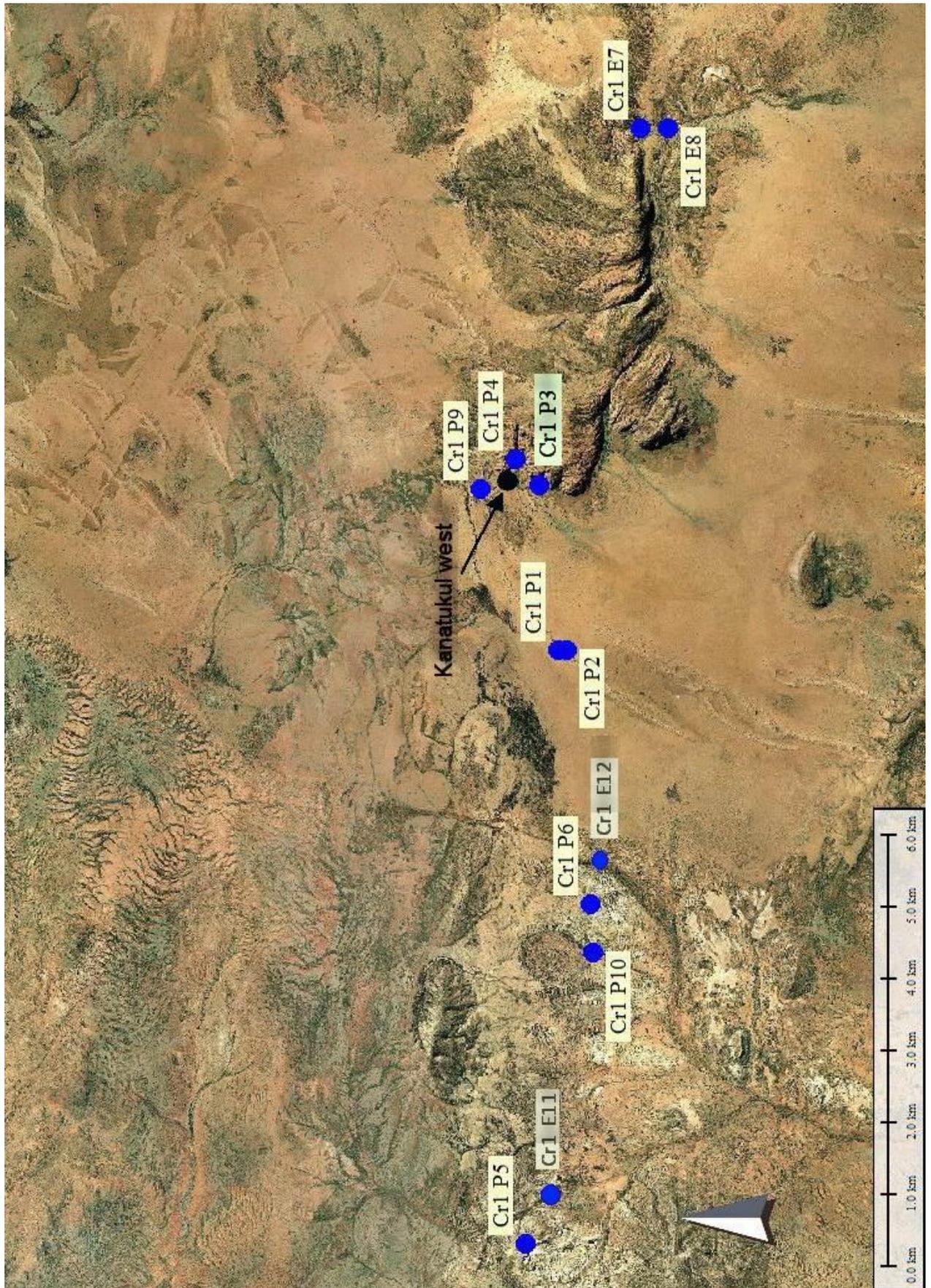


Figure 2a Orthophoto covering Kanatukul West trapping locations

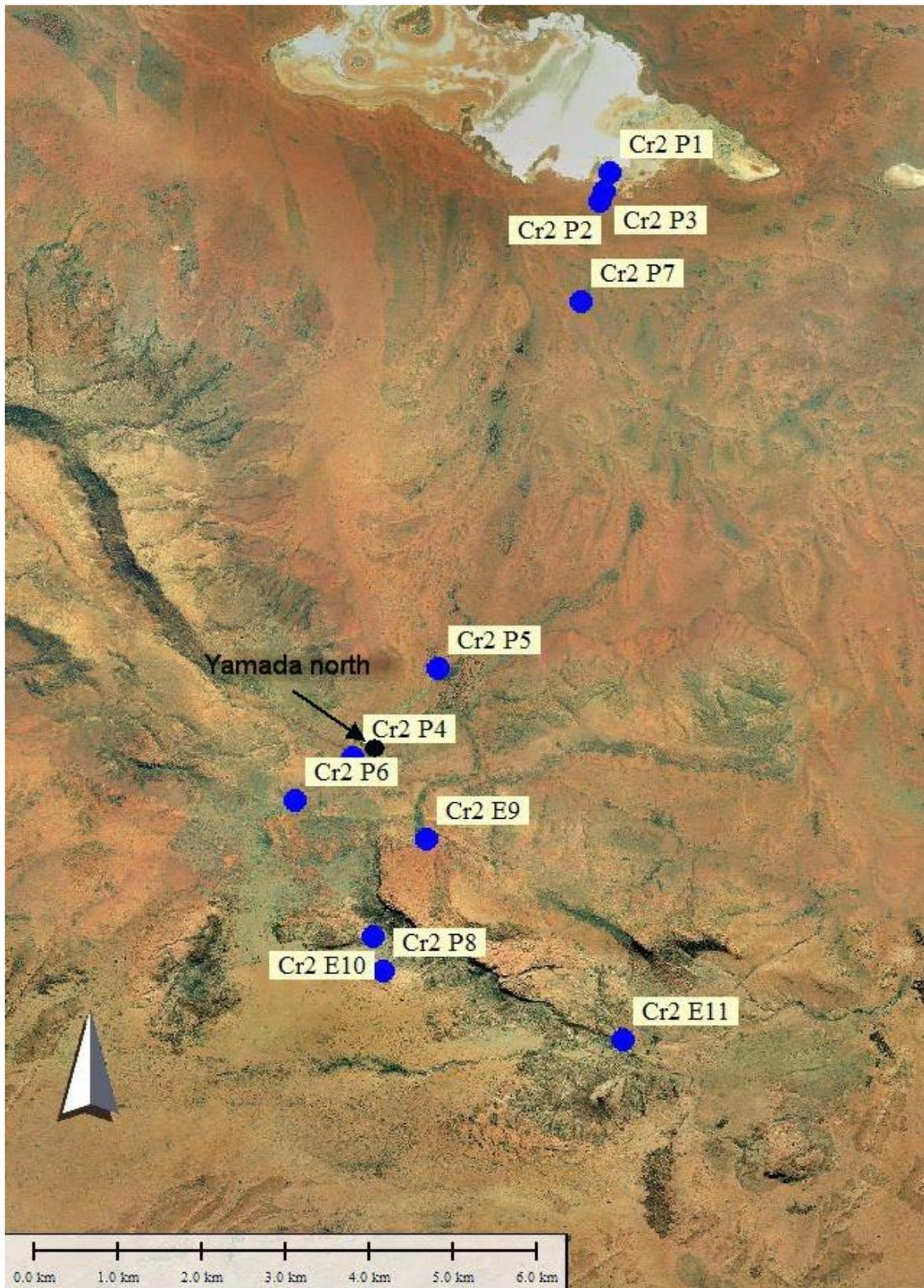


Figure 2b Orthophoto covering Yamada North trapping locations

2.2 Collection methods

Each pit trap survey site was sampled using a single 60 metre drift fence of 30 cm high aluminium fly wire with six 20 litre buckets located at approximately ten metre intervals along, and buried centrally under, the drift fence (Image 1). Up to six funnel traps were also used to supplement the pits and these were placed in pairs (one either side of the fence) along the same fence as the pit traps and midway between pits. At sites Cr1 P4, Cr1 P5, Cr1 P9, Cr2 P2, Cr2 P3 and Cr2 P2, 25 medium sized Elliot traps (type A) were also used. These were placed at 10 to 20 metre intervals, marked with flagging tape, and baited with universal bait, including the addition of chopped bacon.

Opportunistic sampling and camera trap establishment took place at some of the established survey locations, as well as at a number of additional locations (Figure 1). At these additional sites all sightings were recorded and we undertook active searches by turning rocks and logs or raking leaf litter in search of animals. Motion triggered infrared cameras (Reconyx HC600's) were set up on 450mm pegs and directed at areas of specific interest (e.g. burrow complexes) or baited with universal bait scattered 1.5 – 2 metres in front of the camera.

Owl pellets that contained vertebrate remains were collected in May 2013 from two caves in a breakaway near site CR1 P5 (46 pellets) and from the rocks around CR1 P4 (8 pellets). These were sent to Georgeanna Story (Scats About) who has over 13 years' experience in identifying vertebrate remains from scats and pellets.

Several nights on each trip involved some track driving and spotlighting but this had limited success during the first two surveys due to the coolness of the evenings. Information was also collated from other survey team members for opportunistic sightings providing identifications could be confirmed.



Image 1 Typical drift fence layout showing pit and funnel traps

2.3 Identifying the collections

Animals captured were generally identified in the field. The sex was determined and weights and lengths (pes and cranium for mammals, snout to vent and tail for reptiles) recorded prior to release at point of capture, although initially for some of the more complex species, including some members of the genus of striped skinks (*Ctenotus* species), individuals were taken back to base camp to be keyed out prior to release.

At least one voucher specimen of most species has been taken for lodgement in the WA Museum. These specimens were labelled with a field identification tag and a liver sample taken for preservation in 100% ethanol for future molecular analysis. Voucher specimens were fixed in 10% formalin for seven days and then transferred to 70% ethanol for preservation after flushing for 24 hours in water. Tissue samples were also taken from a number of species that were released and these will be lodged with the WA Museum and accessioned into their DNA tissue collection. A total of 182 samples of material available for molecular analysis were collected.

The primary sources of information for identification were the Western Australian Museum's reptile and amphibian field guides (Storr et al., 1983; Storr et al., 1990; Storr et al., 1999; Storr et al., 2002; Tyler et al., 2000) although reference was also sought from *The Mammals of Australia* (Van Dyck et al., 2008), *A Field Guide to the Mammals of Australia* (Menkhorst and Knight, 2011) and *A Complete guide to Reptiles of Australia* (Wilson and Swan, 2008).

2.4 Analysis

Due to the nature of the data collected here a detailed statistical analysis is not warranted. However, a generalised analysis is necessary to give some indication of the comprehensiveness of this survey from the trapping program, as well as a general comparison among survey sites to develop a broad understanding of community patterning across the study area. To achieve this species accumulation curves from our observations were calculated with two of the more robust indices, Chao 2 and Jackknife 2 (Magurran, 2004). As a result of differences in timing and sampling effort, comparisons between sites used presence/absence data with Sorensen's coefficient (Bray-Curtis where abundance data is used). The resultant association matrix was explored with clustering using unweighted pair group method with arithmetic mean (UPGMA). All analysis was performed with the software package Primer-E Version 6 (Clarke and Gorley, 2006).

3. Results

3.1 Overview of collecting

Prior to the present survey the Western Australian Museum had only 187 reptile and frog specimens and 62 mammal specimens from Katjarra with this representing just 44 species of reptiles and frogs and 10 species of mammals (WAM Database, 2014). For large vertebrates such as red kangaroos and dingos, introduced species including cats and camels or, difficult to observe species such as the bilby, while well known to

the Birriliburu Rangers and other Traditional Owners, records are generally absent from formal database systems such as Australia’s Living Atlas and NatureMap (Atlas of Living Australia, 2013 and NatureMap, 2007). However, McKenzie and Burbidge (1979) provide an annotated list of all species recorded during their surveys, including some of these larger species. This information is presented in conjunction with a list drawn from the collections of the Western Australian Museum, which also includes collections made by the 2001 Landscape Expedition, in Appendix 1.

Summarising the historic information for reptiles and amphibians there were 16 species of skink, six dragons, four goannas, nine geckoes (three families – Carphodactylidae, Diplodactylidae and Gekkonidae, Han et al., 2004), two legless lizard, one snake, and four frog species known. For the mammals there were six bats, four rodents, two small marsupials (dasyurids), two kangaroos and the dingo previously recorded.

During our recent surveys the August 2012 period had a mean maximum temperature of 28.6°C and the mean minimum temperature 11.2°C with no precipitation (Figure 3a). The May 2013 survey was considerably cooler with a mean maximum temperature of 23°C and a mean minimum temperature of just 9.0°C (Figure 3b), with some precipitation over the 19th and 20th of May. The final survey in late March and early April 2014 was the warmest period with a mean maximum temperature of 33.8°C and a mean minimum temperature of just 18.7°C (Figure 3c). There were two rain events during the 2014 survey with less than a millimetre fall on both the 31/3/2014 and the 5/4/2014, with the latter event resulting in a significant temperature drop. As reptiles are exothermic and generally prefer quite warm temperatures for peak activity, trap success for the first two surveys was less than optimal for this group, particularly in May 2013, and a considerable proportion (more than 30 %) of species were captured and identified through manual foraging by digging, raking, turning rocks and logs and general observation, rather than through trapping. The mammals however tend not to have such a significant response to temperature and trapping rates were reasonable. The trapping in March/April 2014 was productive though with almost half of all the records coming from this survey period alone.

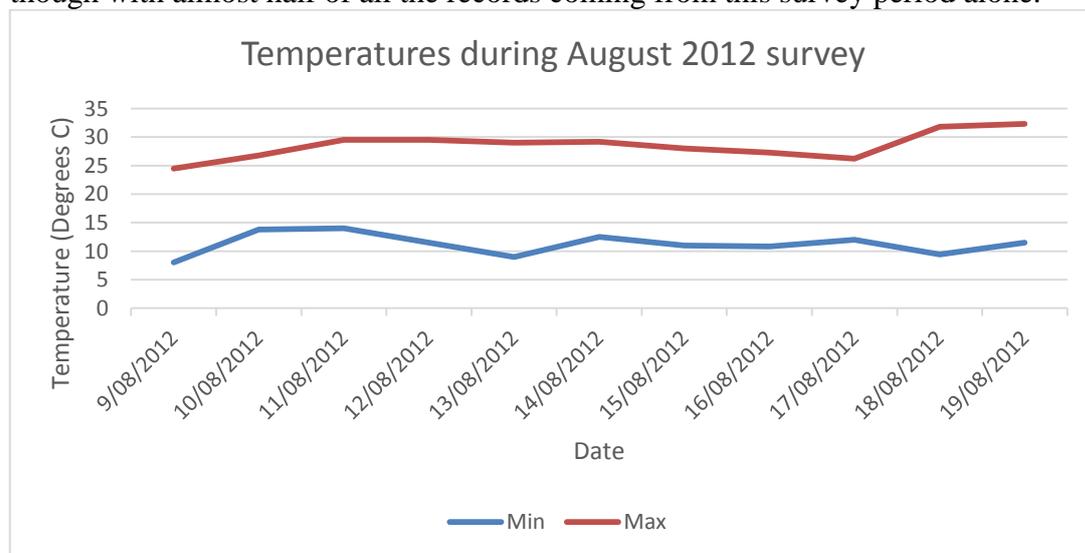


Figure 3a Maximum and minimum daily temperatures during the August 2012 Survey period.

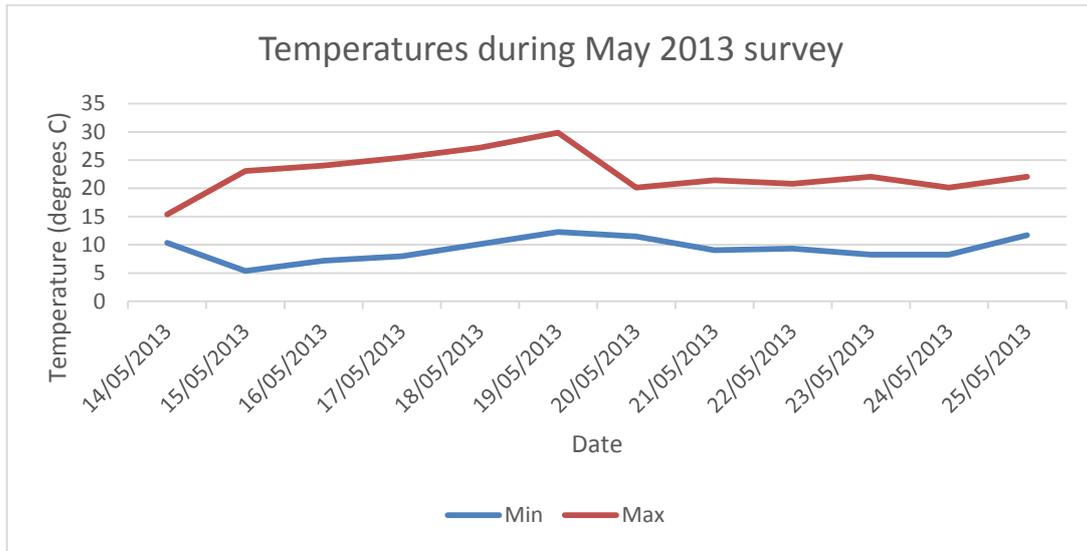


Figure 3b Maximum and minimum daily temperatures during the May 2013 Survey period.

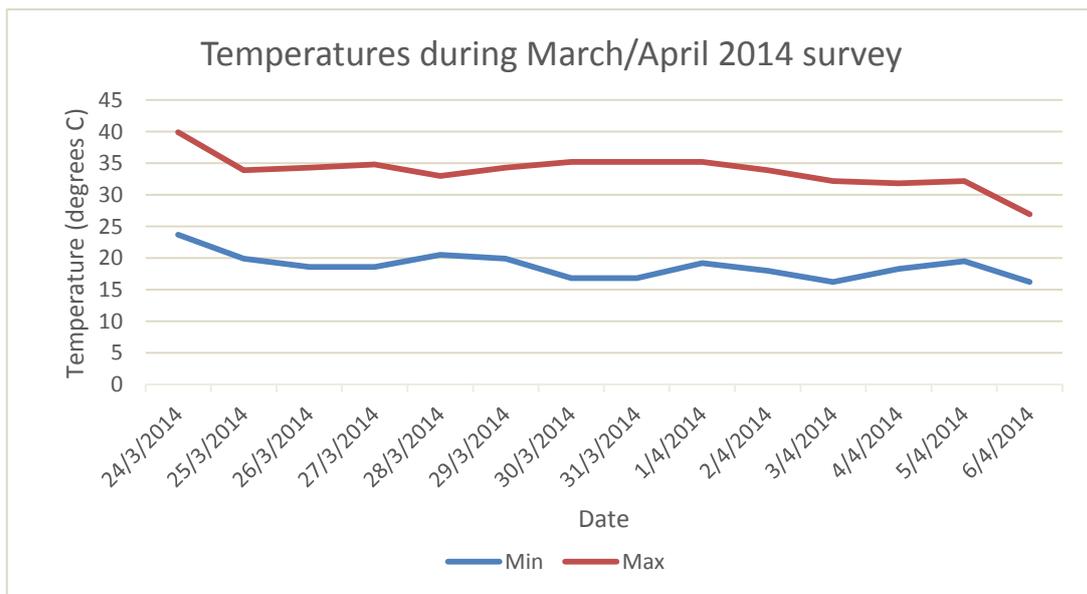


Figure 3c Maximum and minimum daily temperatures during the March/April 2014 Survey period.

Overall there were 600 individual animals captured or observed through all surveys (175 in August 2012, 137 in May 2013 and 288 in March/April 2014) using all methods. The number of species caught or observed on each trip was 36 in May 2012, 37 in August 2013 and 65 in March/April 2014 with the higher temperatures in the latter trip contributing to both an increase in abundance and species richness. These captures represented 22 skinks, nine dragons, three goannas, 15 geckoes, three legless lizards, nine snakes, and three frog species, along with four bats, five rodents, seven small marsupials, two kangaroos, the dingo and four other feral species. One additional species, the Kultarr (*Antechinomys laniger*), was identified post survey from owl pellets collected in May 2013. From these captures at least 41 species are

new records for the Katjarra area, however further work is likely to produce additional species. Groups with relatively low species numbers, or that are noticeably absent from survey records to date, include blind snakes, pythons, venomous snakes, dragons, goannas, and frogs. For example van Leeuwen (2002) recorded a total of 19 snakes (13 elapid snakes, four blind snakes and two pythons), 13 dragons, nine goannas and six frogs from their Little Sandy Desert Survey. Survey work undertaken to the south east of Katjarra at Matuwa (formerly Lorna Glen pastoral lease) has revealed 14 snakes, 10 dragons, seven goannas and five frogs (Cowan, unpublished). A number of species from these two surveys are in common and would be expected to occur within Katjarra. For example the ringed brown snake (*Pseudonaja modesta*), moon snake (*Furina ornata*), stripe tailed monitor (*Varanus caudolineatus*), and broad-banded sand swimmer (*Eremiascincus richardsonii*), among others.

The most common mammal species caught during our surveys include the spinifex hopping mouse (*Notomys alexis*), sandy inland mouse (*Pseudomys hermansburgensis*), common rock rat (*Zyromys argurus*) and the lesser hairy-footed dunnart (*Sminthopsis youngsoni*). Two of these species have reasonably specific habitat requirements with the common rock rat, as its name might suggest, almost exclusively found in rocky areas while the lesser hairy-footed dunnart is generally on sandy substrates. The other two species tend to be a little less habitat specific and may occur on loam and or sand substrates with a variety of vegetation, although often preferring an understorey of tussock or hummock grasses.

Of the reptiles, the leopard skink (*Ctenotus pantherinus*) and the desert slider (*Lerista desertorum*) were the most commonly encountered species. The leopard skink was regularly caught in pit traps where there is sand and spinifex and the desert slider was regularly caught in soil and leaf litter below eucalypt and acacia species while raking. A number of other species of striped skinks (*Ctenotus* species) that favour sandy locations were also prevalent.

3.2 Named taxa newly recorded for the reserve

Table 2 lists 42 species not previously recorded in the reviewed literature or the State's fauna collections databases and images of these along with their known distributions (WA Museum records) are presented in Appendix 4 . The common rock rat (*Zyromys argurus*), which was caught in large numbers in Elliot traps and on camera traps at sites CR1 P4 and CR1 E7 in August 2012, was far less prevalent in May 2013 and surprisingly to date is only recorded from the northern part of Katjarra within the second survey area at Yamada once by remote camera, and this was during the March/April 2014 survey. This is despite a significant Elliot trapping program of more than 500 Elliot trap nights and the deployment of a number of remote cameras. Its occurrence in the range around Kanatukul West probably represents the most south-easterly population known for this species. Woolley's false antechinus (*Pseudantechinus woolleyae*) was only recorded three times, once during the first survey at site CR1 E7 and twice in the final survey with one capture at CR1 E4 and also detected on a remote camera at Yamada West. It is likely to be widespread across the sandstone uplands however, although its occurrence here is probably close to the eastern extent of its known distribution. There were another five species of ground dwelling mammal recorded by this survey that have not previously been reported in the literature (Appendix 1) with three of these having some form of special conservation significance (see section 3.4).

For lizards there are 11 newly recorded skinks, two legless lizards, five geckoes, five dragons and one monitor lizard. There were eight new snakes and one frog. A number of these species are not only new records for Katjarra but also represent occurrences at or towards the edge of known distributions (see Table 2 for details). Surveying in warmer and more humid conditions will continue to reveal additional species, albeit at a reduced rate.

While museum records do not exist for a number of other larger species, including the perentie (*Varanus giganteus*), echidna (*Tachyglossus aculeatus*), euro (*Macropus robustus*) and red kangaroo (*Macropus rufus*) etc., these are all well-known from across Australia's arid interior and would still be frequently observed and sometimes hunted by Traditional Owners travelling on Country.

Table 2. Named taxa previously unrecorded from Katjarra.

Taxon	Comment
<i>Notaden nichollsi</i>	Widespread throughout arid interior usually associated with dune systems.
<i>Gowidon longirostris</i>	Widespread throughout arid interior often associated with riparian zones and drainage tracts.
<i>Ctenophorus nuchalis</i>	Widespread throughout arid interior associated with spinifex sandplains, particularly after fire.
<i>Ctenophorus scutulatus</i>	North eastern limit of range. Associated with Acacia on loamy soils with sparse understorey.
<i>Diporiphora amphiboluroides</i>	First records for the Little Sandy Desert and probably at the north eastern limit of the species range. Associated with Mulga flats.
<i>Tympanocryptis pseudosephos</i>	Found on gravelly surfaces. No previous records from Little Sandy Desert.
<i>Crenadactylus ocellatus</i>	Found in rocks and leaf litter. Taxonomic status for the species at Katjarra is uncertain.
<i>Diplodactylus granariensis</i>	First records for Little Sandy Desert and at the limits of north eastern extent.
<i>Lucasium squarrosum</i>	First records for Little Sandy Desert and at the limits of north eastern extent.
<i>Strophurus elderi</i>	Usually only found in spinifex although our single record came from samphire at the edge of Lake Kerrylyn. Widespread.
<i>Brachyuropis approximans</i>	Found in deep leaf litter. Eastern extent and not recorded in Little Sandy Desert bioregion.
<i>Gehyra punctata</i>	Towards eastern extent of range. Collected from rocks at Yamada.
<i>Demansia psammophis</i>	Occurs in a variety of habitats. Close to its north-eastern limit in WA.
<i>Parasuta monachus</i>	Only two records from Little Sandy Desert and towards north eastern extent of range.
<i>Pseudonaja mengdeni</i>	Widespread and occurring across most of Western Australia other than the more mesic south west corner.
<i>Simoselaps anomalus</i>	Found on sandy substrates with spinifex. At limit of south-western extent.
<i>Simoselaps bertholdi</i>	Found in sandy substrates. Edge of north-eastern extent.
<i>Delma desmosa</i>	Usually associated with spinifex on sand. South-western edge of extent.

Taxon	Comment
<i>Delma nasuta</i>	Usually associated with spinifex on sand. Widespread but few records from Little Sandy Desert or Gascoyne Bioregions.
<i>Ctenotus ariadnae</i>	Few records from Little Sandy Desert despite area being around centre of distribution. Usually associated with sand dunes.
<i>Ctenotus brooksi</i>	Sand dune with spinifex. Edge of range.
<i>Ctenotus helenae</i>	Within distributional range.
<i>Ctenotus leonhardii</i>	Very few records from Little Sandy Desert and towards northern extent of range although within expected distribution.
<i>Ctenotus nasutus</i>	Sand dune with spinifex. At south-western extent of known range.
<i>Eremiascincus pallidus</i>	Few records from Little sandy desert and these records form part of the southern boundary of known distribution.
<i>Lerista bipes</i>	Loose sand. A widespread common species.
<i>Lerista ips</i>	In sand usually associated with spinifex. At southern extent of known range.
<i>Lerista timida</i>	Under rocks or logs and in leaf litter. Widespread and common.
<i>Menetia greyii</i>	Common in a variety of soil and vegetation habitats.
<i>Morethia ruficauda</i>	Generally in rocky areas. South-western edge of range.
<i>Anilius hamatus</i>	No previous record from the Little Sandy Desert and occurrence is beyond north eastern extent of known distribution.
<i>Anilius</i> sp.	
<i>Varanus brevicauda</i>	Very few records from the Little Sandy desert but within expected range.
<i>Antechinomys laniger</i>	Identified from remains in owl pellets
<i>Dasycercus blythi</i>	Caught at site CR1-P9 and recorded on camera at two additional locations.
<i>Pseudantechinus woolleyae</i>	Caught at site CR1-E7. Eastern edge of range.
<i>Sminthopsis longicaudata</i>	Only recorded at breakaway CR1-P5 but likely to be widespread on rocky substrates. Edge of range.
<i>Sminthopsis macroura</i>	Found on stony substrates and in samphire.
<i>Notoryctes</i> sp.	Old burrows identified in “Mole trenches” excavated on sand dunes across the survey area. Not possible to determine which of the two species is present from burrows but distributional records would indicate that it should be the Northern Marsupial Mole (<i>Notoryctes caurinus</i>).
<i>Zyzomys argurus</i>	Caught in high numbers at CR1-P4 and CR1-E7 during August 2012. Lower abundance at same sites in May 2013. Most south-western records.
<i>Tachyglossus aculeatus</i>	Diggings and scats observed at numerous locations close to ranges.
<i>Macrotis lagotis</i>	Scats recorded ~15 km west of Yamada North camp site. Diggings and burrows observed around Lake Kerrylyn.

3.3 Introduced species

A list of introduced species is presented in Table 3. Signs of the presence of feral cats (*Felis catus*) were prevalent across many of the survey sites and this introduced predator is widespread across the arid interior and other parts of Australia. A large number of images were captured by remote camera around water, in particular at sites in the Yamada North area.

Wild dogs or dingoes were photographed with remote cameras and their tracks were regularly seen over our vehicle tracks. They were also heard on several nights around the camp at Kanatukul West. There is still considerable debate as to the role of this species in limiting activity and abundance of other predators such as cats and foxes. It is likely that dingoes would hunt species such as the bilby where the opportunity arises.

Images of foxes were caught on several remote cameras positioned near Yamada and Kanatukul. This species is thought to have a greater reliance on free standing water than does the cat but given the occurrence of water at a number of sites within Katjarra there are plenty of sites for this species to persist, even in the hottest of conditions.

Camels or signs of them were observed in both the northern and southern areas of Katjarra and prevalence of individuals and herds is likely to be driven by local conditions as they often move over significant distances in search of food and water.

Table 3. Introduced species

Species	Location sighted/observed	Indication of abundance
<i>Felis catus</i>	Caught on remote cameras at site CR2 E9 and CR2 E10. Tracks observed most sites with sand substrate and tracks often found crossing vehicle tracks on a daily basis during all three surveys.	Common
<i>Canis lupus dingo</i>	Tracks seen regularly at most locations and animals heard during several evenings. Caught on remote cameras around Yamada and Kanatukul.	Likely to be common
<i>Vulpes vulpes</i>	Caught on remote cameras around Yamada and Kanatukul.	Likely to be moderately common, particularly in vicinity of permanent water
<i>Camelus dromedaris</i>	Animals sighted at Lake Kerrylyn and tracks also evident at numerous sites.	Nomadic but common
<i>Oryctolagus cuniculus</i>	Lake Kerrylyn as well as Yamada and Kanatukul camp sites.	Likely to be locally common, particularly in good seasons.
<i>Mus musculus</i>	This species is widespread and was found at a number of survey sites	Common.

3.4 Vulnerable, threatened, endangered or priority species

Four species, the bilby (*Macrotis lagotis*), the brush-tailed mulgara (*Dasymercus blythi*), marsupial moles (*Notoryctes* sp.), but based on geography likely to be the northern marsupial mole, (*Notoryctes caurinus*) and the long-tailed dunnart (*Sminthopsis longicaudata*) are of particular significance. The bilby and marsupial mole are threatened species and listed as Vulnerable under both state and commonwealth legislation while the brush-tailed mulgara and long-tailed dunnart are both listed as Priority 4 species in Western Australia which means they are in need of monitoring. Images and sign of these species are presented below (Image 2, 3, 4 and 5). Locations from where signs or captures of these species were made are presented in Figure 1.



Image 2. Bilby scats



Image 3. Brush-tailed mulgara



Image 4. Long-tailed dunnart



Image 5. Marsupial mole burrow in wall of excavated trench on dune crest west of Kanatukul campsite (site CR1 P1).

Historically the area would have also supported a species of rock wallaby (*Petrogale* sp.) and stick nest rats (*Leporillus* sp.). Evidence of these were recorded in the form of scats and a partial skull for the rock wallaby (Image 6 and 7) and old nest remains for the stick-nest rat (Image 8). Localities where these species were recorded are presented in Figure 1.

It is also likely that the sandstone ranges within Katjarra would have supported the northern quoll (*Dasyurus hallucatus*) but we have been unable to find any evidence of it persisting, although habitat would seem suitable at a number of locations.

There is still some work to be done in resolving the status of the crest-tailed mulgara (*Dasyercus cristicauda*) in Western Australia but it is a species that could also have a distribution within Katjarra as early records from the 1940s exist from several locations along the Canning Stock Route (Woolley, 2005).

During May 2013, March/April 2014 and again in May 2014 we established a number of “mole trenches” (Benshemesh, 2005), that gave good overall geographic coverage across the study area from Kanatukul West through to Lake Kerrylyn. Evidence of mole activity (Image 5) was found at nine of the 13 trenches indicating this species is likely to be quite common. There are extensive sand dune areas where methods such as this can be applied in an effort to reveal more detail about the presence of this species.



Image 6. Rock wallaby scats

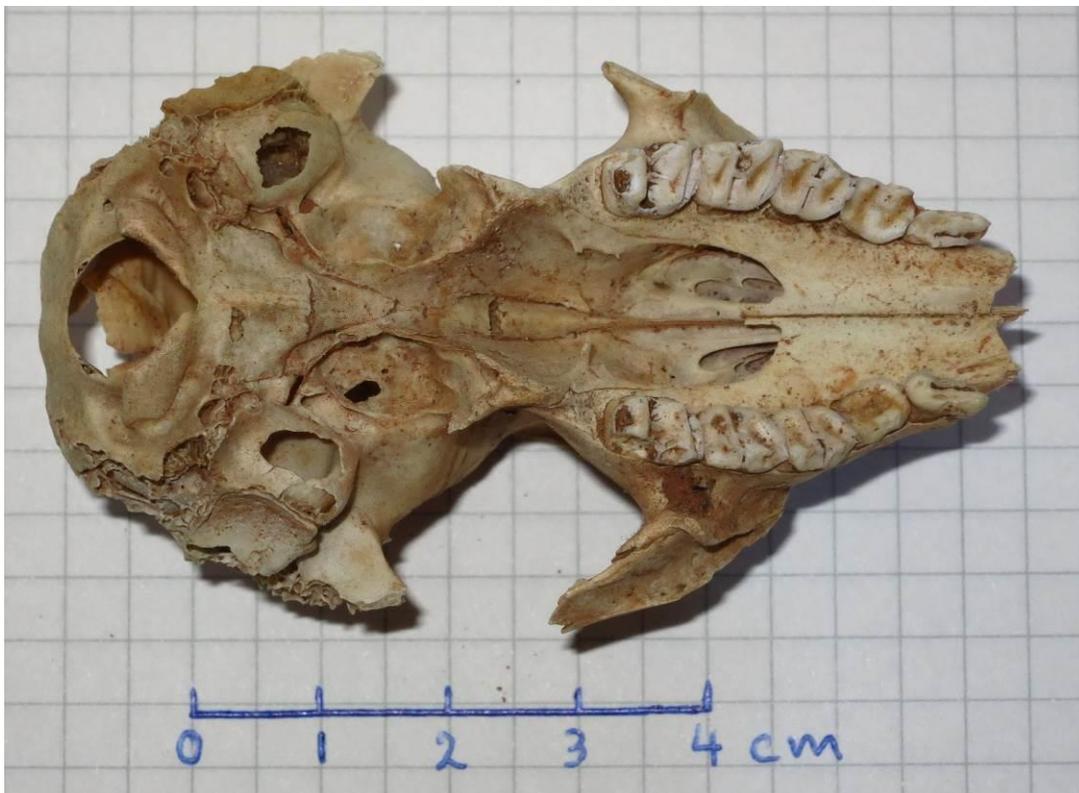


Image 7. Partial rock wallaby skull



Image 8. Stick-nest rat nest remains

3.5 Survey effort and survey site similarity

From the approximately 600 individual records and 77 native ground dwelling vertebrate species identified, the Chao2 index and Jackknife 2 index predict a total of 95 and 104 species respectively (Figure 4.) The species observed (77) therefore represent 74% predicted by the Jackknife 2 index and as high as 81% from the Chao 2 index thus further sampling effort is likely to reveal additional species not recorded during the three surveys undertaken for this program.

Few of the survey sites show high similarity to one another based on species composition (Figure 5), however further sampling under appropriate climatic conditions will continue to reveal additional species at the site scale and consequently this is likely to increase similarity, particularly for sites with comparable environmental attributes. Sites that show a moderate level of similarity(>50%) includes all those directly associated with sand dunes or immediately adjacent sandplains (CR1 P1, CR1 P2, CR2 P2 and CR2 P3), those with a stony substrate incorporating spinifex and Acacia shrubs (CR1 P3 and CR2 P6) and those comprising deep red sands on plains (CR2 P7 and CR2 P8). Site CR1 P10 has low richness but also has the only record of western stone gecko (*Diplodactylus granariensis*) and consequently this site has little similarity with any other site. Site CR1_4 is also differentiated from most other sites, in part due to the presence of two species of frogs, the desert tree frog (*Litoria rubella*) and Main's frog (*Cyclorana maini*), not recorded on any other trapping site, and the occurrence of the common rock-rat (*Zyzomys argurus*). It does not appear that there is any significant difference amongst

sites based on whether they are positioned in the northern or southern parts of the project area.

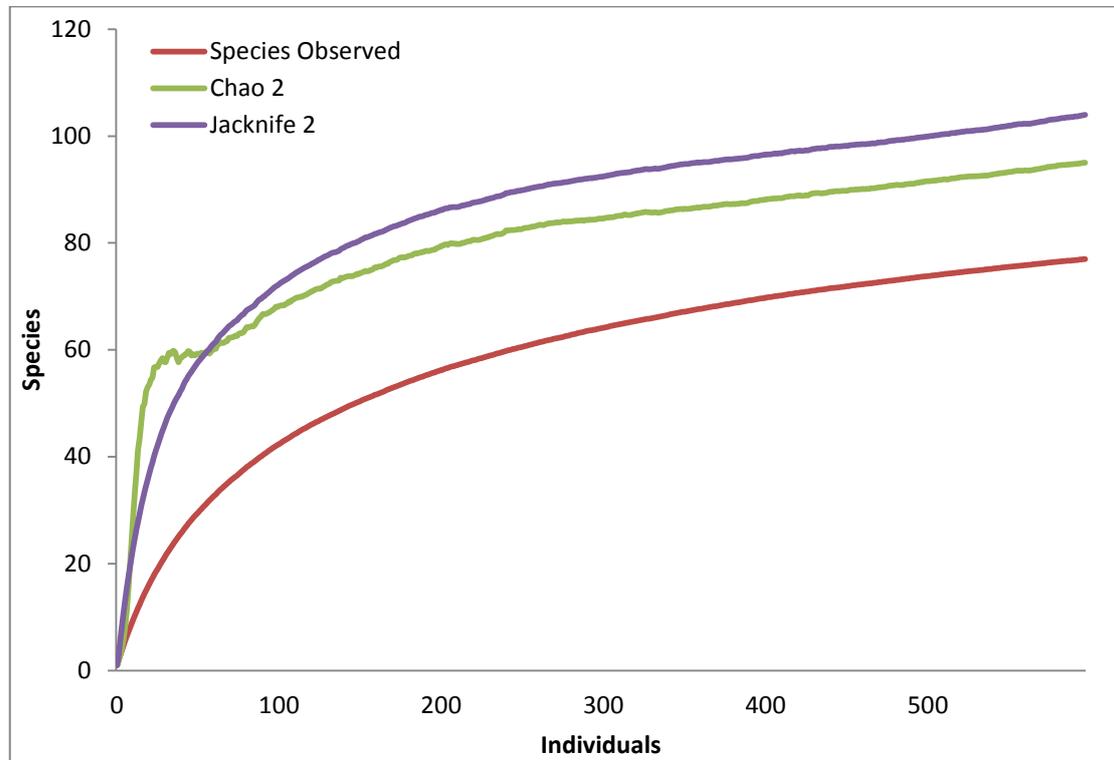


Figure 4. Permuted species accumulation for all surveys (species observed) along with the Chao 2 and Jackknife 2 indices.

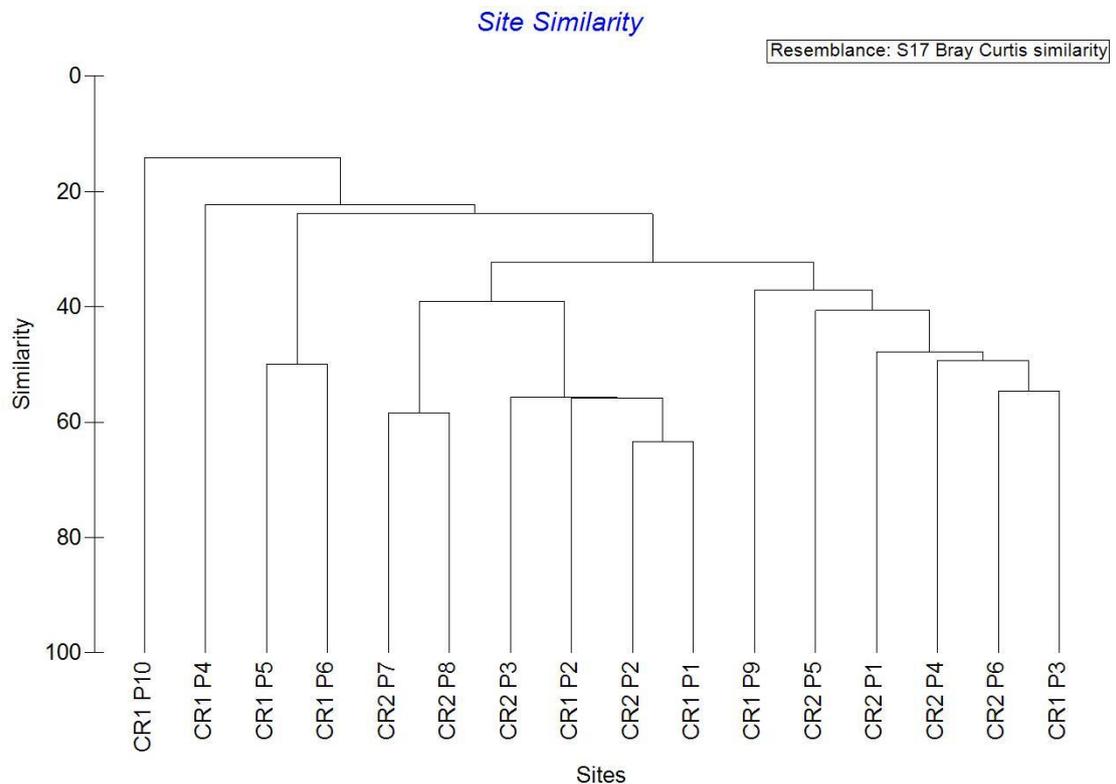


Figure 5. Similarity among all pit trapped sites (Sorensen's coefficient) for presence/absence data

4. Discussion

Only limited vertebrate species information was available for Katjarra prior to the current surveys due to scarcity of historical work in the area. The current work is the most comprehensive to date with the establishment of 16 pit trap/funnel lines and seven Elliot trap lines. The techniques employed, including the use of remote cameras and manual searching has allowed the documentation of more than 40 previously unrecorded species. The total number of known species now stands at four frogs, 57 reptiles, 16 native ground dwelling mammals and six species of bat. The number of introduced mammals, including the dingo stands at five. Given the diversity of habitats and the still comparatively small survey effort for the area, along with the diversity of species known to occur both north and south of the area, it is reasonable to expect the list of fauna to grow with continuing effort. This is particularly the case for reptiles as most survey work has been undertaken at times when activity might be expected to be quite low due to the prevailing cool conditions. The substantial amount of tissue collected (>180 samples) will allow for future molecular analysis and contribute to taxonomic and population studies. Lodgement of voucher specimens and DNA samples with the Western Australian Museum will also ensure the long term validity of data gathered from this survey.

While community comparison amongst sites has some patterning this would likely become more defined with further work at each of the sites during periods of peak activity. The species which have a relatively high level of habitat fidelity and are responsible for the current structure include *Ctenotus helenae*, *Sminthopsis ooldea* for the spinifex and chenopod sites on harder substrates while species such as *Notomys alexis*, *Ningauai ridei*, *Nephrurus laevissimus*, *Ctenotus quattuordecimlineatus*, and *C. pantherinus* are primarily associated with sand dunes and adjacent sand plains with spinifex. Species that are confined to stony substrates dominated by acacias include *Sminthopsis longicaudata*, *S. macroura* and *Tympanocryptis pseudosephos*.

Almost all species recorded thus far are typical of the arid zone although as many as 14 of the 21 previously unrecorded taxa are towards or at the known limits of their ranges. While most of these species have comparatively large geographic ranges a few are restricted to rocky habitats and thus occurrences are irregular across the landscape. Such species include Woolley's false antechinus (*Pseudantechinus woolyae*), common rock-rat (*Zyzomys argurus*), and marbled velvet gecko (*Oedura fimbria*), all of which are likely isolated populations with little or no gene flow from outside Katjarra region or even between ranges within Katjarra. Other important finds include those of the bilby (*Macrotis lagotis*), brush tailed mulgara (*Dasyercus blythi*) and long-tailed dunnart (*Sminthopsis longicaudata*) and further work may reveal more populations of these species. While it is difficult to make any quantitative assessments for marsupial moles (*Notoryctes* sp.) evidence suggests that they are quite widespread through the sand dune country within Katjarra.

Feral animals in the arid interior pose a threat to the persistence of some native species through both competition and predation. The presence of cats and foxes around permanent and semi-permanent water is of concern as these areas may form refuges for some native fauna in dry times or be frequented by a variety of other species, all of which may then be vulnerable to predation. Where cat detections were

observed to be high through remote camera sampling, concomitant detection of small mammals was low. If capacity to undertake feral cat or fox management eventuates, areas around water sources would be a worthwhile priority.

Acknowledgements

We are particularly grateful to the Birriliburu Native Title Holders for their invitation to undertake survey work at Katjarra and for their generosity in sharing their knowledge. We would also like to especially thank the Birriliburu Rangers for their assistance in establishing and running survey lines. Rob Thomas, Lindsey Langford and Hamish Morgan from the Central Desert Native Title Services provided logistic support and coordination as well as assisting with on ground work. Staff from the Department of Parks and Wildlife's Goldfields Regional Office were involved in the first two surveys. Last but not least we are grateful to our survey colleagues who provided additional observations. Permission was given by staff of the Western Australian Museum to access the vertebrate collection records. This work was carried out under AEC permit number 2013/11 and scientific fauna licence number 54747.

References

- Atlas of Living Australia (2013) Atlas of Living Australia Website. Available from <http://www.ala.org.au> [Accessed October 2013]
- Cowan, M., and Kendrick, P. (2003). Little Sandy Desert 2 (LSD2 – Trainor subregion). In 'A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002'. (Eds N. L. McKenzie and J. E. May.) pp. 413–422. (Department of Conservation and Land Management: Perth.)
- Clarke, K.R. and Gorley, R.N. (2006) *PRIMER v6: User manual/tutorial*. Primer-E, Ltd: Plymouth, U.K.
- Benshemesh, J. (2005) Manual for Marsupial Mole Survey and Monitoring by Trenches, Version 1.0. Report to Anangu-Pitjantjatjara Land Management and the Department of Heritage and Environment (SA). Department of Heritage and Environment, SA.
- Gibson, N., van Leeuwen, S., Langley, M.A. & Brown, K. (2013) Vascular flora of Katjarra IPA- A Report to the Birriliburu mob and Central Desert Native Title Services. Western Australian Department of Parks and Wildlife, Perth.
- Han, D., K. Zhou, & A. M. Bauer. 2004. Phylogenetic relationships among gekkotan lizards inferred from c-mos nuclear DNA sequences and a new classification of the Gekkota. *Biological Journal of the Linnean Society* 83: 353– 368.
- Kenneally, K., Edinger, D., Coate, K., How, R. and Cowan, M. (2001) Landscape of the heart - a journey to the Carnarvon Range. Landscape Expeditions Report No.42. Department of Conservation and Land Management, Perth.

- Magurran, A.E. (2004). *Measuring biological diversity*. Blackwell Science: Oxford
- Menkhorst, P. W. & Knight, F. (2004) A field guide to the mammals of Australia. Oxford University Press, Melbourne.
- McKenzie, N.L. and Burbidge, A.A. (eds.) (1979) The wildlife of some existing and proposed nature reserves in the Gibson, Little Sandy and Great Victoria Deserts, Western Australia. Wildlife Research Bulletin No.8, Dept. Fisheries and Wildlife, Perth.
- NatureMap (2007) Mapping Western Australia's Biodiversity. Department of Parks and Wildlife and Western Australian Museum, Perth. Available from: <http://naturemap.dpaw.wa.gov.au> [Accessed October 2013]
- Start, A. N., Burbidge, A. A., Kendrick, P. G., and McKenzie, N. L. (2013). Terrestrial mammals of the south-western Little Sandy Desert, Western Australia. *Australian Mammalogy* **35**, 54–64.
- Storr, G. M., Johnstone, R. E. & Smith, L. A. (1999) Lizards of Western Australia I. Skinks. Western Australian Museum. Perth.
- Storr, G. M., Johnstone, R. E. & Smith, L. A. (2002) Snakes of Western Australia. Western Australian Museum, Perth.
- Storr, G. M., Smith, L. A. & Johnstone, R. E. (1983) Lizards of Western Australia II Dragons and monitors. Western Australian Museum, Perth.
- Storr, G. M., Smith, L. A. & Johnstone, R. E. (1990) Lizards of Western Australia-Geckos and pygopods. Western Australian Museum, Perth.
- Thackway, R., and Cresswell, I. D. (1995) An interim biogeographic regionalisation for Australia : a framework for setting priorities in the National Reserves System Cooperative. National Reserves System Cooperative Program (Australia) Program / edited by R. Thackway and I.D. Cresswell. - Version 4.0. Canberra.
- Tyler, M. J., Smith, L. A. & Johnstone, R. E. (2000) Frogs of Western Australia. Western Australian Museum, Perth.
- Van Dyck, S. and Strahan, R. (2008) The mammals of Australia. New Holland Publishers, Sydney.
- Van Leeuwen S (ed) (2002) Biological survey of the south-western Little Sandy Desert: National Reserve System Project N709: final report, June 2002. Department of Conservation and Land Management, Perth.
- Western Australian Museum (2014) Terrestrial Vertebrates Fauna Collections Database. Western Australian Museum, Perth. [Accessed July 2014]
- Wilson, S. K. & Swan, G. (2008) A complete guide to reptiles of Australia. New Holland Publishers, Sydney.

Woolley, P.A. (2005) The species of *Dasycercus* Peters, 1875 (Marsupialia: Dasyuridae) *Memoirs of Museum Victoria* 62 (2): 213–221

Appendices

Appendix 1. List of Frogs, Reptiles and Mammals occurring at Katjarra.

Number of taxa: 100 species with six introduced

FAMILY	Species	Previous Survey	2012-2014 Survey	New record	Introduced	EPBC-Act Listed	State Listed
Hylidae	<i>Litoria rubella</i>	+	+				
Hylidae	<i>Cyclorana maini</i>	+*	+				
Limnodynastidae	<i>Neobatrachus sutor</i>	+					
Limnodynastidae	<i>Neobatrachus wilsmorei</i>	+					
Limnodynastidae	<i>Notaden nicholli</i>		+	×			
Agamidae	<i>Gowidon longirostris</i>	+	+				
Agamidae	<i>Ctenophorus caudicinctus</i>	+	+				
Agamidae	<i>Ctenophorus isolepis</i>	+	+				
Agamidae	<i>Ctenophorus nuchalis</i>		+	×			
Agamidae	<i>Ctenophorus scutulatus</i>		+	×			
Agamidae	<i>Diporiphora amphiboluroides</i>		+	×			
Agamidae	<i>Diporiphora paraconvergens</i>	+					
Agamidae	<i>Moloch horridus</i>	+	+				
Agamidae	<i>Pogona minor</i>	+	+				
Agamidae	<i>Tympanocryptis pseudosephos</i>		+	×			
Carphodactylidae	<i>Nephrurus laevis</i>	+	+				
Carphodactylidae	<i>Nephrurus levis</i>	+	+				
Diplodactylidae	<i>Crenadactylus ocellatus</i>		+	×			
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	+					
Diplodactylidae	<i>Diplodactylus granariensis</i>		+	×			
Diplodactylidae	<i>Lucasium squarrosus</i>		+	×			
Diplodactylidae	<i>Lucasium stenodactylum</i>	+	+				
Diplodactylidae	<i>Oedura fimbria</i>	+	+				
Diplodactylidae	<i>Rhynchoedura ornata</i>	+**	+	×			

FAMILY	Species	Previous Survey	2012-2014 Survey	New record	Introduced	EPBC-Act Listed	State Listed
Diplodactylidae	<i>Strophurus ciliaris</i>	+**	+	×			
Diplodactylidae	<i>Strophurus elderi</i>		+	×			
Diplodactylidae	<i>Strophurus wellingtonae</i>	+					
Gekkonidae	<i>Gehyra punctata</i>		+	×			
Gekkonidae	<i>Gehyra purpurascens</i>	+	+				
Gekkonidae	<i>Gehyra variegata</i>	+	+				
Gekkonidae	<i>Heteronotia binoei</i>	+	+				
Pygopodidae	<i>Delma desmosa</i>		+	×			
Pygopodidae	<i>Delma nasuta</i>		+	×			
Pygopodidae	<i>Lialis burtonis</i>	+	+				
Pygopodidae	<i>Pygopus nigriceps</i>	+					
Scincidae	<i>Cyclodomorphus melanops</i>	+					
Scincidae	<i>Egernia depressa</i>	+	+				
Scincidae	<i>Egernia formosa</i>	+*					
Scincidae	<i>Liopholis striata</i>	+	+				
Scincidae	<i>Tiliqua multifasciata</i>	+					
Scincidae	<i>Cryptoblepharus buchananii</i>	+	+				
Scincidae	<i>Menetia greyii</i>		+	×			
Scincidae	<i>Morethia ruficauda</i>		+	×			
Scincidae	<i>Ctenotus ariadnae</i>		+	×			
Scincidae	<i>Ctenotus brooksi</i>		+	×			
Scincidae	<i>Ctenotus calurus</i>	+	+				
Scincidae	<i>Ctenotus dux</i>	+	+				
Scincidae	<i>Ctenotus grandis</i>	+	+				
Scincidae	<i>Ctenotus helenae</i>		+	×			
Scincidae	<i>Ctenotus leonhardii</i>		+	×			
Scincidae	<i>Ctenotus nasutus</i>		+	×			
Scincidae	<i>Ctenotus pantherinus</i>	+	+				
Scincidae	<i>Ctenotus quattuordecimlineatus</i>	+	+				
Scincidae	<i>Ctenotus saxatilis</i>	+	+				
Scincidae	<i>Ctenotus schomburgkii</i>	+	+				
Scincidae	<i>Ctenotus uber</i>	+*	+	×			
Scincidae	<i>Eremiascincus pallidus</i>		+	×			
Scincidae	<i>Lerista bipes</i>		+	×			
Scincidae	<i>Lerista desertorum</i>	+	+				
Scincidae	<i>Lerista ips</i>		+	×			
Scincidae	<i>Lerista kingi</i>	+*					
Scincidae	<i>Lerista timida</i>		+	×			

FAMILY	Species	Previous Survey	2012-2014 Survey	New record	Introduced	EPBC-Act Listed	State Listed
Varanidae	<i>Varanus acanthurus</i>	+*					
Varanidae	<i>Varanus brevicauda</i>		+	×			
Varanidae	<i>Varanus eremius</i>	+	+				
Varanidae	<i>Varanus giganteus</i>	+	+				
Varanidae	<i>Varanus gouldii</i>	+	+				
Varanidae	<i>Varanus panoptes</i>	+*					
Elapidae	<i>Brachyuropis approximans</i>		+	×			
Elapidae	<i>Demansia psammophis</i>		+	×			
Elapidae	<i>Parasuta monachus</i>		+	×			
Elapidae	<i>Pseudechis australis</i>	+	+				
Elapidae	<i>Pseudonaja mengdeni</i>		+	×			
Elapidae	<i>Simoselaps anomalus</i>		+	×			
Elapidae	<i>Simoselaps bertholdi</i>		+	×			
Typhlopidae	<i>Anilius hamatus</i>		+	×			
Typhlopidae	<i>Anilius sp.</i>		+	×			
Tachyglossidae	<i>Tachyglossus aculeatus</i>	+**	+				
Dasyuridae	<i>Antechinomys laniger</i>		+ ^S	×			
Dasyuridae	<i>Dasycercus blythi</i>		+	×			×
Dasyuridae	<i>Ningau ridei</i>	+	+				
Dasyuridae	<i>Pseudantechinus woolleyae</i>		+	×			
Dasyuridae	<i>Sminthopsis longicaudata</i>		+	×			×
Dasyuridae	<i>Sminthopsis macroura</i>		+	×			
Dasyuridae	<i>Sminthopsis ooldea</i>		+	×			
Dasyuridae	<i>Sminthopsis youngsoni</i>	+	+				
Macropodidae	<i>Macropus robustus</i>	+**	+				
Macropodidae	<i>Macropus rufus</i>	+**	+				
Notoryctidae	<i>Notoryctes sp.</i>		+	×		×	×
Peramelidae	<i>Macrotis lagotis</i>		+	×		×	×
Muridae	<i>Mus musculus</i>	+	+		×		
Muridae	<i>Notomys alexis</i>	+	+				
Muridae	<i>Pseudomys desertor</i>	+	+				
Muridae	<i>Pseudomys hermannsburgensis</i>	+	+				
Muridae	<i>Zyzomys argurus</i>		+	×			

FAMILY	Species	Previous Survey	2012-2014 Survey	New record	Introduced	EPBC-Act Listed	State Listed
Camelidae	<i>Camelus dromedarius</i>	+**	+		✗		
Leperoridae	<i>Oryctolagus cuniculus</i>		+		✗		
Canidae	<i>Canis lupus dingo</i>	+**	+		✗		
Canidae	<i>Vulpes vulpes</i>		+		✗		
Felidae	<i>Felis catus</i>		+		✗		
Emballonuridae	<i>Saccolaimus flaviventris</i>	+	+				
Molossidae	<i>Mormopterus beccarii</i>	+					
Molossidae	<i>Tadarida australis</i>	+	+				
Vespertilionidae	<i>Chalinolobus gouldii</i>	+					
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	+					
Vespertilionidae	<i>Vespadelus finlaysoni</i>	+					

* - recorded at Katjarra but not within close proximity of current survey locations.

** - recorded by McKenzie and Burbidge (1979) but no specimens.

§ - sub-fossil remains identified from owl pellets

Appendix 2. Site Photos



Site CR1 P1



Site CR1 P2



Site CR1 P3



Site CR1 P4



Site CR1 P5



Site CR1 P6



Site CR1 P9



Site CR1 P10



Site CR2 P1



Site CR2 P2



Site CR2 P3



Site CR2 P4



Site CR2 P5



Site CR2 P6



Site CR2 P7



Site CR2 P8



CR2 E9 Elliot trapping location at Katjarra (Virgin Springs)



CR2 E10 Elliot trapping through spinifex side of range to base of cliffs



CR2 E11- Elliot trapping location, Talbot’s Rockhole

Appendix 3. Mole Trench Locations

Site Code	Latitude	Longitude	Evidence of Burrows	Time established
MC1	-25.26672	120.627798	yes	May 2013
MC2	-25.072655	120.734161	yes	March/April 2014
MC3	-25.079506	120.727867	no	March/April 2014
MT#1	-25.026528	120.698333	no	May 2014
MT#2	-25.036139	120.712472	yes	May 2014
MT#3	-25.039667	120.722056	yes	May 2014
MT#4	-25.054278	120.737833	no	May 2014
MT#5	-25.061722	120.742028	yes	May 2014
MT#6	-25.266056	120.629083	yes	May 2014
MT#7	-25.243667	120.660861	yes	May 2014
MT#8	-25.224278	120.664639	yes	May 2014
MT#9	-25.191972	120.678639	yes	May 2014
MT#10	-25.155	120.692389	yes	May 2014



Typical mole trench with the right hand side facing north to allow drying of the sand.

Appendix 4. Photos and Museum distributional records for previously unrecorded species.



Notaden nicholli



Gowidon longirostris (Juvenile)



Ctenophorus nuchalis





Ctenophorus scutulatus



Diporiphora amphiboluroides



Tympanocryptis pseudosephos





Crenadactylus ocellatus



Diplodactylus granariensis



Lucasium squarrosum





Strophurus elderi



Gehyra punctata



Brachyuropis approximans

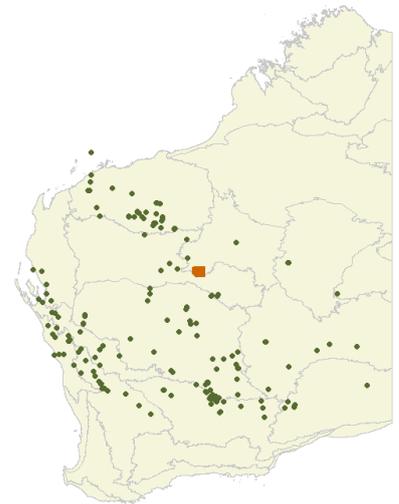




Demansia psammophis



Parasuta monachus



Pseudonaja mengdeni

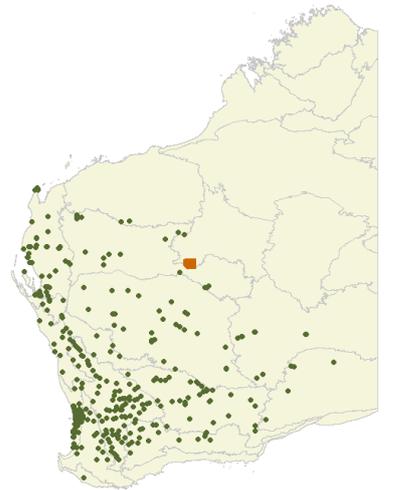




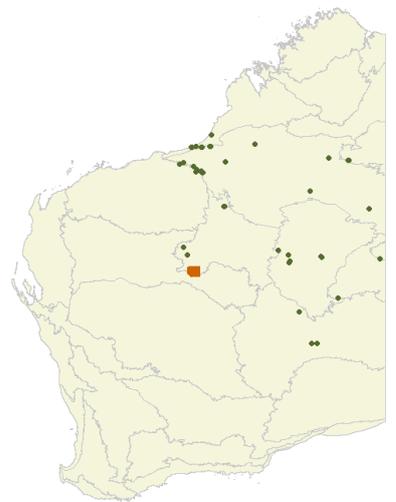
Simoselaps anomalus



Simoselaps bertholdi

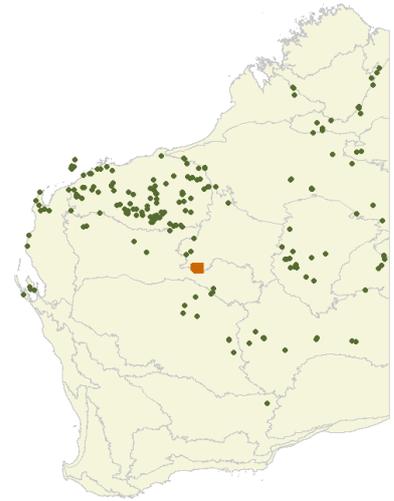


Delma desmosa





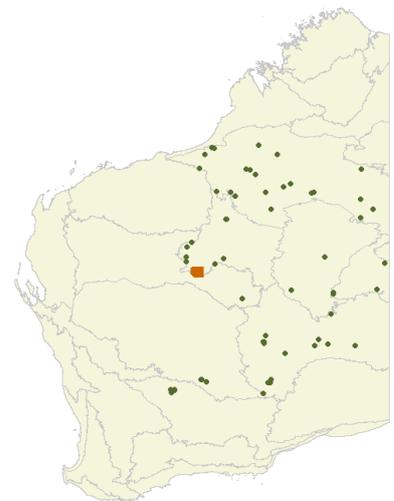
Delma nasuta



Ctenotus ariadnae

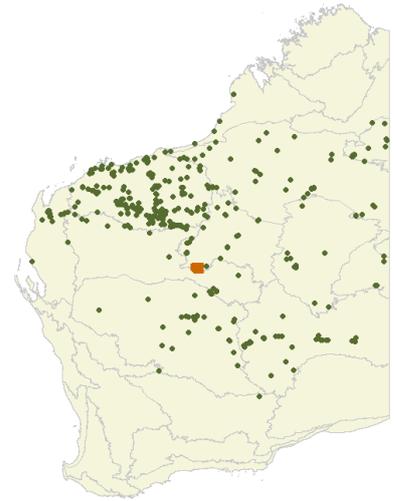


Ctenotus brooksi





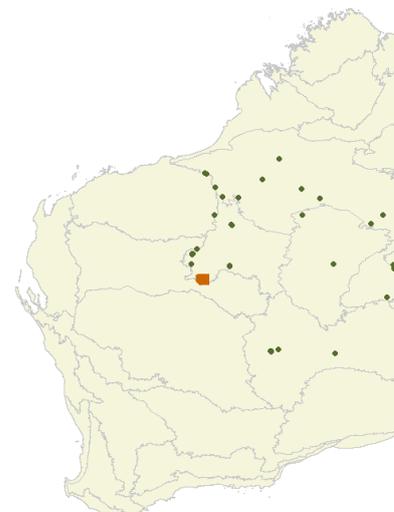
Ctenotus helenae



Ctenotus leonhardii

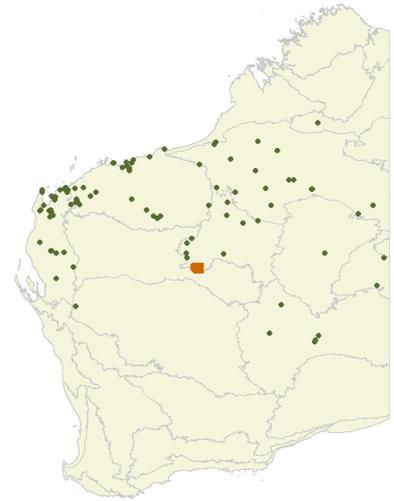


Ctenotus nasutus





Eremiascincus pallidus



Lerista bipes

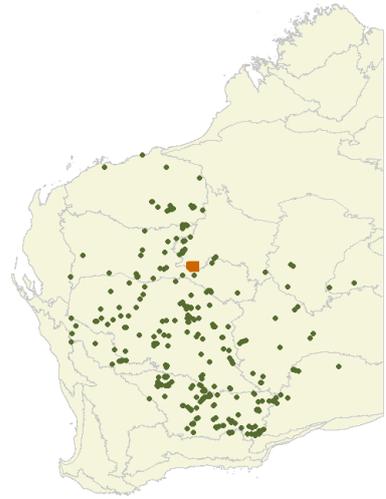


Lerista ips

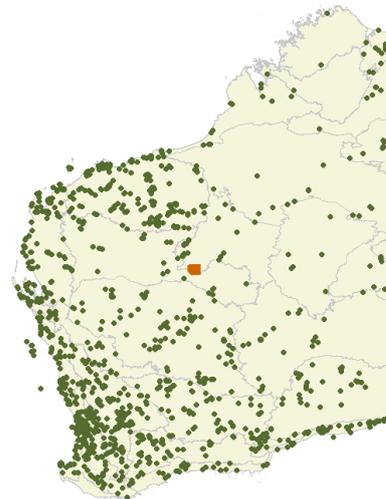




Lerista timida



Menetia greyii



Morethia ruficauda





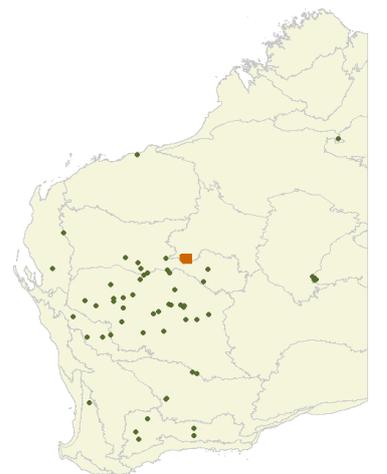
Anilius hamatus



Varanus brevicauda



Antechinomys laniger

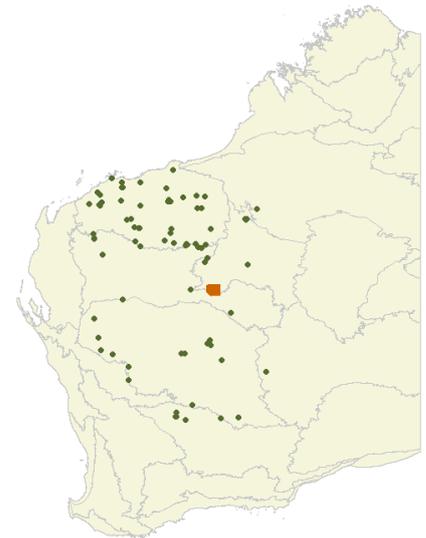




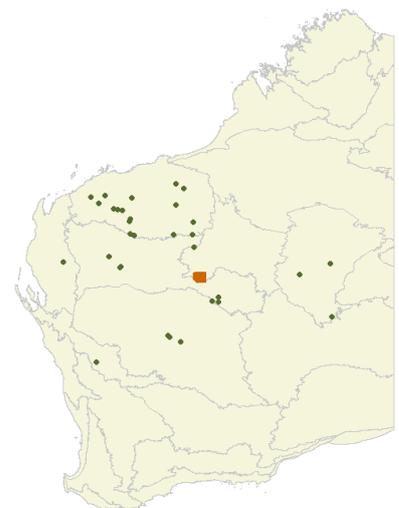
Dasyercus blythi



Pseudantechinus woolleyae



Sminthopsis longicaudata

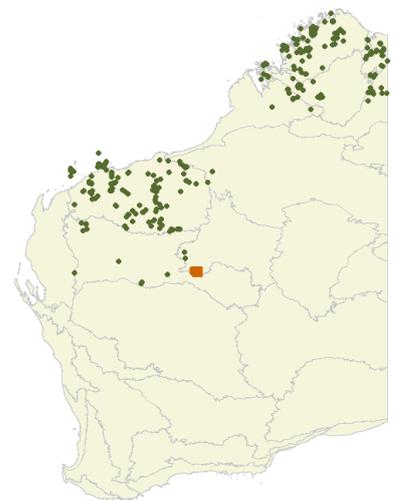




Sminthopsis macroura



Notoryctes caurinus



Zyzomys argurus