

## 5.0 Results

### 5.1 Fauna Habitats

The fauna habitats defined for the study area broadly aligned with the land systems present, with the further delineation of some prominent landforms that occur over multiple land systems but support a distinct assemblage and so were defined as a separate habitat (Table 5.1 and Figure 5.1). Example photographs of each habitat type are presented in Plate 5.1 - Plate 5.6.

Sand dunes and plains were differentiated into coastal and inland habitat types, while the gravelly lateritic rises and rock outcropping habitats only present in the inland areas (see Table 5.1 and Figure 5.1).



Plate 5.1: Shrub and spinifex on sandplain.



Plate 5.2: Gravelly lateritic rises.



Plate 5.3: Inland sand dune.



Plate 5.4: Rock outcropping.



Plate 5.5: Beach and foredunes.



Plate 5.6: Paleo-tidal coastal plains.

**Table 5.1: Fauna habitats of the study area and the survey sites at which they were sampled.**

Habitat	Land System	Notes	Area (ha)
Shrub and spinifex on sandplain	Primarily Nita but also Little Sandy where the inter-dune distance is large	The dominant habitat of the study area. These broad plains comprised pink to red pindan soils. These were in Excellent condition and supported typical pindan vegetation, comprising occasional trees of species such as <i>Corymbia zygophylla</i> (Broome Bloodwood), <i>Erythrophleum chlorostachys</i> (Ironwood) and <i>Owenia reticulata</i> (Native Walnut) over open to moderately dense mixed shrublands, typically dominated by wattes ( <i>Acacia</i> spp.), over hummock grasslands of <i>Triodia schinzii</i> and <i>T. epactia</i> . <b>Survey sites:</b> AHF01, AHF02, AHF04, AHF05, AHF06, AHF07, AHF10, AHF12, AHF13, AHF16, AHF17, AHFSRE03, AHFSRE04, AHFSRE05	60,5647.7
Gravelly lateritic rises	Primarily Buckshot but also occurs within Nita	Patchily distributed habitat type but much of its regional extent occurs within the study area. Low rises with a surface covering of laterite gravel and pebbles occurred sporadically through the study area. These supported open hummock grasslands of <i>Triodia epactia</i> with a low open shrubland of the wattles <i>Acacia hilliana</i> (Hill's Tabletop Wattle) and <i>A. adoxa</i> var. <i>adoxo</i> (Grey Whorled Wattle); taller shrubs were typically sparse but included species such as <i>Grevillea refracta</i> (Silver-leaf Grevillea) and <i>G. wickhamii</i> (Wickham's Grevillea). <b>Survey sites:</b> AHF03, AHF08, AHFSRE06, AHFSRE07	31,001.4
Inland sand dunes	Primarily Little Sandy and a small number of dunes within Nita	Dominant within the south-eastern portion of the study area. The sand dunes in inland areas had a pink to red pindan sand substrate, and were typically long linear dunes trending east-west. These were dominated by mixed open shrublands over open hummock grasslands of <i>Triodia schinzii</i> (Feathertop Spinifex). <b>Survey sites:</b> AHF15, AHF18, AHF19, AHF20, AHFSRE02	23,577.1
Rock outcropping	Callawa	Patchily distributed and occurs as rock piles, rocky ridges and breakaway landforms. These rocky areas supported some species that were not found in any other habitats in the study area, including <i>Ficus brachypoda</i> (Rock Fig), <i>Mallotus nesophilus</i> (Yellow Ball Flower), <i>Trichosanthes cucumerina</i> (Snake Gourd) and <i>Triumfetta incana</i> . <b>Survey sites:</b> AHF09E, AHF14E, AHFSRE01	387.2
<b>Inland habitats subtotal:</b>			<b>660,613.3</b>
Beach and foredunes	Eighty Mile	Small extent within the study area, occurring where indicative cable route meets the coast. The primary dunes and associated swales had a white sand substrate, and occupied the areas closest to the coast. These were dominated by hummock grasslands of <i>Spinifex longifolius</i> (Beach Spinifex) and <i>Triodia epactia</i> (Humpback Spinifex) and would comprise part of the "Eighty Mile Land System" PEC (Biota 2018b). <b>Survey sites:</b> AHFSRE09	42.6
Paleo-tidal coastal plains	Anna and Mannerie	Small extent within the study area, occurring where cable route meets the coast. Low-lying habitat located between the coastal dunes and inland plains. The plains near the coast had a grey silty loam to light clay substrate, and were extensively degraded through weed invasion and heavy grazing by cattle. These areas would presumably once have supported hummock grasslands of <i>Triodia epactia</i> , which were now replaced by tussock grasslands of <i>*Cenchrus ciliaris</i> (Buffel Grass) and <i>*C. setiger</i> (Birdwood Grass). <b>Survey sites:</b> AHFSRE08, AHFSRE10	39.8
<b>Coastal habitats subtotal:</b>			<b>82.4</b>
<b>Total:</b>			<b>660,695.7</b>



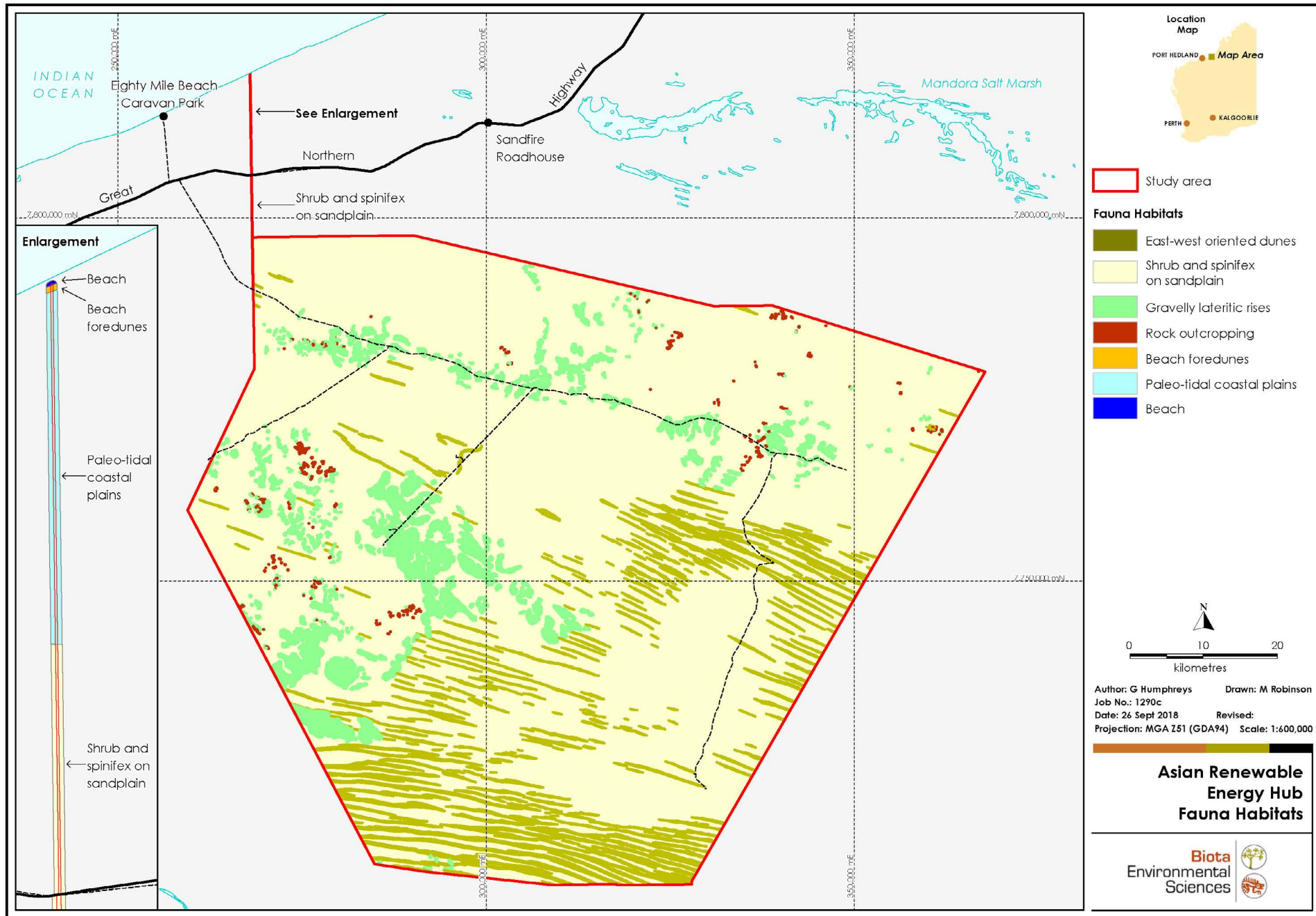


Figure 5.1: Fauna habitats defined within the study area.

## 5.2 Desktop Review

### 5.2.1 Potential Faunal Assemblage

The desktop review returned 364 species, comprising 55 mammals (27 native non-volant, 15 bats and 13 non-native), 183 birds (53 of which are largely reliant on freshwater or marine habitats), 116 reptiles and 10 amphibians.

Tables summarising the full lists of species returned from each desktop review source are presented in Appendix 1.

### 5.2.2 Fauna of Conservation Significance

Species returned from the desktop review were considered to be of elevated conservation significance if they have a formal conservation ranking under the EPBC Act, *Wildlife Conservation Act 1950* (WC Act) or are listed as a DBCA priority species. Appendix 5 details categories of conservation significance recognised under these three frameworks.

An assessment of the likelihood of occurrence of each species of conservation significance was made based on availability of suitable habitat, whether it is core or secondary, as well as records of the species during the current or past studies included in the desktop review (Table 5.2). Some species returned during the desktop review were confidently assessed as unlikely to occur due to an absence of specific habitat requirements within the study area or a well-defined distribution that does not include the study area. When conducting the desktop review to ascertain the conservation significant species that may occur, a conservative approach was taken that included studies in the wider region such as those at Goldsworthy and Yarrie. This broader approach was taken due to the lack of local survey data on which to draw.

A large number of migratory bird species were returned from the desktop review reflecting the proximity of the study area to the Mandora Marsh and coastline. These species are the subject of a separate specialist study and as such the current study incorporated minimal effort targeting such species. Therefore, their likelihood of occurrence has been noted here, but further detail on their occurrence has been reported separately (Biota 2018a).

Table 5.2 details the likelihood assessment for each conservation significant species. Due to a lack of past biological survey in the study area, no fauna species of conservation significance had been recorded at the time of the desktop review.

Those that were considered likely to occur in the study area, or may potentially occur, were targeted during the field survey, and details on those recorded as a result of this are provided in Sections 6.1 to 6.3. Section 6.4 also provides a review of the species that were assessed as likely to occur in the desktop review, but for which there was no evidence of their presence recorded during the survey.

Table 5.2: Conservation significant fauna returned from the desktop review with their likelihood of occurrence.

Species Name	Common Name	Conservation Status (State; Commonwealth)	EPBC	NatureMap	ALA	WAM GSD (1983)	Gold'w Lvl1 (1995)	Gold'w Lvl2 (2005)	Mandora Mammals (2008)	Notes
<b>Mammals</b>										
<b>Likely to occur</b>										
<i>Dasyurus hallucatus</i>	Northern Quoll	Schedule 2; Endangered	✓				✓	✓		Records from the locality and suitable habitat in southwest of study area
<i>Macrotis lagotis</i>	Bilby	Schedule 3; Vulnerable	✓	✓		✓	✓		✓	Multiple records from locality and habitat suitable.
<i>Notoryctes caurinus</i>	Northern Marsupial Mole	Priority 4; N/A				✓				Records from the locality and suitable habitat present
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	Priority 4; N/A		✓			✓	✓		Records from the locality and suitable habitat present
<i>Dasyercus blythi</i>	Brush-tailed Mulgara	Priority 4; N/A								Habitat available and records from the locality
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	Priority 4; N/A		✓				✓		Habitat available and records from the locality
<b>Unlikely to occur</b>										
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-wallaby	Schedule 2; Endangered								No records from the locality
<i>Lagorchestes hirsutus</i>	Rufous Hare-wallaby	Schedule 2; Endangered				✓				No recent records and study area well outside documented distribution
<i>Macroderma gigas</i>	Ghost Bat	Schedule 3; Vulnerable	✓		✓		✓			No suitable cave habitat
<i>Isoodon auratus</i>	Golden Bandicoot	Schedule 3; Vulnerable				✓				No records from the locality and well outside documented distribution
<i>Rhinonictes aurantius</i>	Pilbara Leaf-nosed Bat	Schedule 3; Vulnerable	✓				✓	✓		No suitable cave habitat for roosting
<i>Phascogale calura</i>	Red-tailed Phascogale	Schedule 6; Vulnerable				✓				Outside documented distribution but continuous with central desert habitats
<i>Dasyercus cristicauda</i> <sup>2</sup>	Crest-tailed Mulgara	Priority 4; Vulnerable				✓	✓	✓		Habitat available but no vouchered records from locality <sup>2</sup>
<i>Lagorchestes conspicillatus</i>	Spectacled Hare-wallaby	Priority 3; N/A								Habitat available but no records from locality
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	Priority 4; N/A					✓			No records from the locality and little suitable habitat present
<b>Birds</b>										
<b>Likely to occur</b>										
<i>Glareola maldivarum</i>	Oriental Pratincole	Schedule 5; Marine, Migratory	✓	✓	✓					Previous records from the locality, records during shorebird study relating to this project (Biota 2018a) and utilises plains habitats
<i>Apus pacificus</i>	Fork-tailed Swift	Schedule 5; Marine, Migratory	✓	✓	✓					Records from the locality and suitable habitat present, but largely aerial, does not rely on terrestrial habitats
<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 7; N/A		✓	✓	✓				Records from the locality and some core habitat in the form of breakaways in south of study area
<i>Numenius minutus</i>	Little Curlew	Schedule 5; Marine, Migratory	✓	✓	✓					Previous records from the locality, and records during shorebird study relating to this project (Biota 2018a) and utilises plains habitats
<i>Charadrius veredus</i>	Oriental Plover	Schedule 5; Marine, Migratory	✓	✓	✓					Previous records from the locality, and records during shorebird study relating to this project (Biota 2018a) and utilises plains habitats
<b>Unlikely to occur</b>										
<i>Pezoporus occidentalis</i>	Night Parrot	Schedule 1; Endangered	✓							Difficult to assess such a rarely recorded species but no records from the locality and study area does not contain accepted preferred habitat of old spinifex in proximity to varied foraging habitat plants or saline grasslands.
<i>Polytelis alexandrae</i>	Princess Parrot	Priority 4; Vulnerable	✓			✓				No records from the locality and only a small area of suitable habitat present
<b>Reptiles</b>										
<b>Likely to occur</b>										
<i>Natator depressus</i>	Flatback Turtle	Schedule 3; Vulnerable, Marine, Migratory								Known nesting activity on Eighty Mile Beach.
<i>Aspidites ramsayi</i>	Woma	Priority 1; N/A		✓		✓				Records from the locality and suitable habitat present
<i>Lerista separanda</i>	Dampierland Plain Slider	Priority 2; N/A		✓	✓					Records from the locality and suitable habitat present
<b>May potentially occur</b>										
<i>Liopholis kintorei</i>	Great Desert Skink	Schedule 3; Vulnerable				✓				Habitat available in the study area but no recent records from the locality

<sup>2</sup> Past records from historical surveys most likely to be *Dasyercus blythi*, based on recent WA Museum re-determinations of vouchered material.

Species Name	Common Name	Conservation Status (State; Commonwealth)	EPBC	NatureMap	ALA	WAM GSD (1983)	Gold'w Lvl1 (1995)	Gold'w Lvl2 (2005)	Mandora Mammals (2008)	Notes
<b>Unlikely to occur</b>										
<i>Caretta caretta</i>	Loggerhead Turtle	Schedule 2; Endangered, Marine, Migratory								No nesting activity recorded anywhere within Eighty Mile Beach Marine Park.
<i>Chelonia mydas</i>	Green Turtle	Schedule 3; Vulnerable, Marine, Migratory								No nesting activity recorded anywhere within Eighty Mile Beach Marine Park.
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Schedule 3; Vulnerable, Marine, Migratory								No nesting activity recorded anywhere within Eighty Mile Beach Marine Park.
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Schedule 3; Vulnerable	✓				✓	✓		No records from the locality and preferred habitat absent
<i>Ctenotus angusticeps</i>	-	Priority 3; Vulnerable	✓							Outside known distribution and only a very small amount coastal habitat within study area

## 5.3 Recorded Assemblage

### 5.3.1 Overview

The combined trapping and search effort over the two phases recorded a total of 177 species (Table 5.3). Across all trap sites (including targeted trapping) 2,803 individuals were trapped (including 2,489 reptiles, 95 amphibians and 219 mammals) and 820 bird individuals were observed. A further 587 individuals (462 birds, 82 reptiles, 21 amphibians and 22 mammals) were observed either opportunistically or during searches. Nineteen species (five mammals, 12 reptiles and two amphibians) were recorded by methods other than trapping (e.g. point searches, walking transect and nocturnal searches) while 10 bird species were recorded opportunistically only. The use of automated recorded units added seven additional species to the inventory that were not recorded by any other method.

Each phase of the study recorded an equal number of species, although the second phase of survey added 31 species not recorded during the first phase.

**Table 5.3: Overview of vertebrate fauna recorded from the study area.**

Faunal Group	Number of Species			Total Number of Species
	Phase 1	Phase 2	Biota (2018a)*	
Native non-volant mammals	15	10	-	18
Introduced ground-dwelling mammals	4	4	-	5
Bats	8	4	-	9
Birds	41	38	40	68
Reptiles	55	64	-	73
Amphibians	1	4	-	4
<b>Totals</b>	<b>124</b>	<b>124</b>	<b>40</b>	<b>177</b>

\* waterbirds and migratory shorebirds study

The study area is situated in the interzone between the Pilbara and Kimberley regions, but the faunal assemblage shared greater similarity with that of the Pilbara and very few species with Kimberley distributions were recorded.

A number of species recorded in this study have well understood distributions in the Pilbara but had not previously been recorded as far north as the current study area. Specific examples within each class of fauna are provided in Sections 5.3.2 to 5.3.5 below.

### 5.3.2 Mammals

#### 5.3.2.1 Non-Volant Mammals

Nine small to medium weight-range mammal species (including eight native and the introduced House Mouse) were recorded from the trapping sites (Table 5.4). Few were abundant; the tiny dasyurid Long-tailed Planigale (*Planigale ingrami*) and the Sandy Inland Mouse (*Pseudomys hermannsburgensis*) were the most common and were recorded at five sites (Table 5.4). Three of the species were uncommonly recorded, comprising the Kaluta (*Dasykaluta rosamondae*), Rory's Pseudantechinus (*Pseudantechinus roryi*) and the Desert Mouse (*Pseudomys desertor*), which were only recorded from a single site on one day of the trapping (Table 5.4).

A single individual of the Black-footed Rock-wallaby (*Petrogale lateralis lateralis* - Schedule 2; Endangered) was recorded via cage trap at a site targeting the species in rocky habitat (Table 5.4). The species was further recorded from scats and video footage.

An additional four mammal species of elevated conservation significance were recorded from their distinctive burrow formations (Table 5.4). These were the Western Pebble-mound Mouse (*Pseudomys chapmani* – Priority 4), Bilby (*Macrotis lagotis* – Schedule 3; Vulnerable), Brush-tailed Mulgara (*Dasyercus blythi* – Priority 4) and the Northern Marsupial Mole (*Notoryctes caurinus* – Priority 4). The Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti* – Priority 4) was recorded once via tracks.

Further detail of these conservation significant mammal species recorded during the survey is presented in Section 6.1.

Seven non-volant mammal species were observed opportunistically only and included the following native species: Agile Wallaby (*Notamacropus agilis*), Red Kangaroo (*Osphranter rufus*) and Dingo (*Canis dingo*), in addition to the following introduced species: Dog (*Canis lupus*), Red Fox (*Vulpes vulpes*), Cat (*Felis catus*) and Camel (*Camelus dromedarius*) (Table 5.4).

### **5.3.2.2 Bats**

Nine bat species were identified from ultrasonic call recordings (Table 5.5). None of the species recorded were of elevated conservation significance.



Table 5.4: Non-volant mammals recorded during the survey.

Family Species	Common Name	State <sup>o</sup>	Commonwealth <sup>o</sup>	AHF01 AHF02 AHF03 AHF04 AHF05 AHF06 AHF07 AHF08 AHF10 AHF12 AHF13 AHF14 AHF15 AHF16 AHF17 AHF18 AHF19 AHF20 AHF E22 AHF-PM-01 AHFCAM26-01																	Trace <sup>^</sup>	Hand capture or observation				
				AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF10	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19			AHF20	AHF E22	AHF-PM-01	AHFCAM26-01
<b>Dasyuridae</b>																										
<i>Dasyercus blythi</i>	Brush-tailed Mulgara, Ampurta	P4																				1				
<i>Dasykaluta rosamondae</i>	Kaluta										1															
<i>Dasyurus hallucatus</i>	Northern Quoll	S2	EN																			2				
<i>Ningai timealeyi</i>	Pilbara Ningai												3													
<i>Planigale ingrami</i>	Long-tailed Planigale				4	2		6		5								1								
<i>Pseudantechinus roryi</i>	Rory's Pseudantechinus							1																		
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart									1	1	1					1		1							
<b>Thylacomyidae</b>																										
<i>Macrotis lagotis</i>	Bilby, Dalgyte	S3	VU																		1	1	28			
<b>Notoryctidae</b>																										
<i>Notoryctes caurinus</i>	Northern Marsupial Mole	P4																				1				
<b>Macropodidae</b>																										
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby	P4																				1				
<i>Notamacropus agilis</i>	Agile Wallaby																						5			
<i>Osphranter rufus</i>	Red Kangaroo, Marlu																						1			
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-wallaby	S2	EN										1									72	13			
<b>Muridae</b>																										
<i>Mus musculus*</i>	House Mouse					1												1	1		1					
<i>Notomys alexis</i>	Spinifex Hopping-mouse								1					1	1		4						1			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4																				2	6			
<i>Pseudomys desertor</i>	Desert Mouse					1																				
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse						1			1	2	3					1			5						
<b>Canidae</b>																										
<i>Canis dingo</i>	Dingo																						1			
<i>Canis lupus*</i>	Dog																						1			
<i>Vulpes vulpes*</i>	Red Fox																					1				
<b>Felidae</b>																										
<i>Felis catus*</i>	Cat																					2	6			
<b>Camelidae</b>																										
<i>Camelus dromedarius*</i>	Dromedary, Camel																					2	1			
<b>Total Number of Species:</b>				<b>0</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>8</b>	<b>12</b>

\* Introduced species

<sup>o</sup>P4 = Priority 4, S2 = Schedule 2, S3 = Schedule 3, VU = Vulnerable, EN = Endangered<sup>^</sup> Trace includes sign evidence such as tracks, scats or burrows

Table 5.5: Bats recorded during the survey.

Family Species	Common Name	State	Commonwealth	Cam-654-14E	AHF897-1	AHFBat1169-01	AHF827-1	AHF897-02	AHF1169-02	AHF654-02	AHF04195-01	AHF04195-02	AHF5M2827	Trace	Observation
<b>Emballonuridae</b>															
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat					•			•			•			
<i>Taphozous georgianus</i>	Common Sheath-tailed Bat			•					•				•	•	•
<b>Molossidae</b>															
<i>Austronomus australis</i>	White-striped Free-tailed Bat					•			•						
<i>Chaerephon jobensis</i>	Greater Northern Free-tailed Bat								•						
<i>Ozimops lumsdenae</i>	Northern Free-tailed Bat								•						
<b>Vespertilionidae</b>															
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat			•		•			•						
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat								•						
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			•		•			•			•			
<i>Vespadelus finlaysoni</i>	Finlayson's Cave-bat										•				
<b>Total Number of Species:</b>				<b>3</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>

### 5.3.3 Birds

The terrestrial bird assemblage recorded within the study area largely comprised species commonly recorded in the Pilbara, although the overall species richness was relatively low. The dominance of open plain habitat and scarcity of dense tree and shrub layers or water sources that are typically areas of avifauna diversity are likely contributors to the lack of species richness.

Sixty-eight species from 26 families were recorded from 1,798 individuals (Table 5.6). Birding at trapping sites yielded 44 species while 44 species were recorded opportunistically, 15 of which had not been recorded at the trap sites (Table 5.6). Thirty-eight species were recorded by the automated recording units, of which eight had not been recorded by other means (Table 5.6).

The most species-rich families recorded were the Accipitridae (all diurnal raptors except falcons and kestrels) with eight species, and Meliphagidae (honeyeaters and chats), with eight species (Table 5.6). The most abundant bird species were the Singing Honeyeater (*Lichenostomus virescens*) and the Crimson Chat (*Epthianura tricolor*), which accounted for 26% and 18% respectively of all individual bird species recorded from the study area (Table 5.6).

There are no bird species endemic to the Great Sandy or Little Sandy Deserts and the only species to be confined to deserts in Western Australia is the Princess Parrot, which was not recorded during this survey (Burbidge and McKenzie 1983). Two conservation significant bird species were recorded within the study area: the Oriental Pratincole (*Glareola maldivarum* - Schedule 5; Migratory) and the Rainbow Bee-eater (*Merops ornatus* - Marine) (Table 5.6). Further detail of these latter two species is provided below in Section 6.2.

### 5.3.4 Reptiles

The recorded reptiles assemblage of 73 species included one turtle, 16 species of gecko, five legless lizards, nine dragons, 24 skinks, six goannas, three blind snakes, two pythons and seven elapid snake species (Table 5.7). The recorded assemblage included a large proportion of that known from the Great Sandy Desert (Burbidge and McKenzie 1983), and was dominated by species with Eremean distributions with almost no Kimberley representatives. *Gehyra kimberleyi* represented the only real exception, but this is also a recently described species (Doughty et al. 2012b) so the full extent of its distribution may not yet have been ascertained.

The records of *Antaresia stimsoni* (Stimson's Python), *Demansia psammophis* (Yellow-faced Whipsnake), *Varanus giganteus* (Perentie) and *Demansia rufescens* (Rufous Whipsnake), all represent minor northerly extensions to the species, distributions as currently described using NatureMap records (Table 5.7).

The DBCA Priority 2 species *Lerista separanda* (Dampierland Plain Slider) was a notable record given how rarely it has been recorded to date (Table 5.7). Originally described solely from the Dampier Peninsula, records from this study and the Pilbara Biological Survey where it was recorded from Warrawagine (Doughty et al. 2011) indicate it has a considerably broader distribution. Only one other species recorded during the survey has a restricted northern Pilbara distribution: *Diporiphora vescus*, which was first described in 2012 (Doughty et al. 2012a).

Two skink species recorded during the survey, *Lerista vermicularis* and *Lerista ips* (Table 5.7), represent perhaps the only two vertebrate species endemic to the Great Sandy Desert.

### 5.3.5 Amphibians

Four frog species were recorded; two species via trapping and an additional two species opportunistically (Table 5.8). The trapped species, *Notaden nichollsi* and *Uperoleia russelli* typically burrow in red dune habitats, and often burrow together (Cartledge et al. 2006)

While 10 species were returned from the desktop review (Appendix 1), it is common to record relatively few desert frogs during surveys due to their tendency to aestivate and remain cryptic during dry conditions. They are typically recorded opportunistically following rainfall.

Table 5.6: Birds recorded within the study area.

Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF09E	AHF10	AHF11	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	Opportunistic	Trapped	Automated recorders
<b>Casuariidae</b>																										
<i>Dromaius novaehollandiae</i>	Emu																									
<b>Phasianidae</b>																										
<i>Coturnix ypsilophora</i>	Brown Quail																									•
<b>Columbidae</b>																										
<i>Phaps chalcoptera</i>	Common Bronzewing							1																		
<i>Ocyphaps lophotes</i>	Crested Pigeon			6	1		2																	19		•
<i>Geopelia cuneata</i>	Diamond Dove				1		1			1	2							2								
<b>Podargidae</b>																										
<i>Podargus strigoides</i>	Tawny Frogmouth																								3	
Eurostopodidae																										
<i>Eurostopodus argus</i>	Spotted Nightjar																								5	
<b>Pelecanidae</b>																										
<i>Pelecanus conspicillatus</i>	Australian Pelican						5																		3	
<b>Ardeidae</b>																										
<i>Ardea pacifica</i>	White-necked Heron						1																		1	
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron																									•
<b>Accipitridae</b>																										
<i>Elanus axillaris</i>	Black-shouldered Kite				1																					
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard																								2	
<i>Haliastur sphenurus</i>	Whistling Kite			1																					1	
<i>Accipiter fasciatus</i>	Brown Goshawk																			1					1	
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk																								1	
<i>Circus assimilis</i>	Spotted Harrier						1			1							1								1	
<i>Aquila audax</i>	Wedge-tailed Eagle																								1	
<i>Hieraaetus morphnoides</i>	Little Eagle																								1	
<b>Falconidae</b>																										
<i>Falco cenchroides</i>	Nankeen Kestrel									1			1		1										1	6
<i>Falco berigora</i>	Brown Falcon																									4
<i>Falco longipennis</i>	Australian Hobby																								1	
<b>Otididae</b>																										
<i>Ardeotis australis</i>	Australian Bustard			1	1								1		1	1										8
<b>Charadriidae</b>																										
<i>Elsyornis melanops</i>	Black-fronted Dotterel																									•
<i>Vanellus miles</i>	Masked Lapwing																									•
<b>Turnicidae</b>																										
<i>Turnix velox</i>	Little Button-quail			2	1	1	3	3		1		1	1		1	1	3	1					1	2	2	7
<b>Glareolidae</b>																										
<i>Glareola maldivarum</i>	Oriental Pratincole	S5	MI																							•
<b>Cacatuidae</b>																										
<i>Calyptorhynchus banksii samuelli</i>	Red-tailed Black-Cockatoo			5																					13	•
<i>Eolophus roseicapillus</i>	Galah			2								1														•
<i>Nymphicus hollandicus</i>	Cockatiel																								53	•



Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF09E	AHF10	AHF11	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	Opportunistic	Trapped	Automated recorders
<b>Psittacidae</b>																										
<i>Melopsittacus undulatus</i>	Budgerigar			1	2					2						13				13		2		28		•
<b>Cuculidae</b>																										
<i>Centropus phasianinus</i>	Pheasant Coucal																2									
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo									2									1							
<i>Chalcites osculans</i>	Black-eared Cuckoo																									•
<i>Cacomantis pallidus</i>	Pallid Cuckoo			1																						•
<b>Tytonidae</b>																										
<i>Tyto javanica</i>	Eastern Barn Owl																									•
<b>Halcyonidae</b>																										
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher			1						2			1					2						3		•
<b>Meropidae</b>																										
<i>Merops ornatus</i>	Rainbow Bee-eater		Ma										1			3			2					11		•
<b>Maluridae</b>																										
<i>Malurus leucopterus</i>	Black and White Fairy-wren																							3		
<i>Malurus lamberti</i>	Variegated Fairy-wren				1		3	4		5						6		3					4	3		•
<i>Amytornis striatus</i>	Striated Grasswren				1																					
<b>Meliphagidae</b>																										
<i>Certhionyx variegatus</i>	Pied Honeyeater																							3		•
<i>Lichenostomus virescens</i>	Singing Honeyeater			5	5	6	6	2	4	23	9		16		11	21	16	17	2	8	48	14	25	5		•
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater											2							2					1		•
<i>Manorina flavigula</i>	Yellow-throated Miner			11	1	3				2	1		2			1	2	2		14	2	1	3			•
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater																									•
<i>Epthianura tricolor</i>	Crimson Chat									2								14	47	3		7	57	81		•
<i>Sugomel niger</i>	Black Honeyeater																							1		•
<i>Lichmera indistincta</i>	Brown Honeyeater												1		1			1				2		3		•
<b>Eupetidae</b>																										
<i>Psophodes occidentalis</i>	Chiming Wedgebill																	3	7	1		1		1		
<b>Campephagidae</b>																										
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				1												1				1			1		•
<i>Lalage sueurii</i>	White-winged Triller									1								1	12	1	2	3	6	4		
<b>Pachycephalidae</b>																										
<i>Pachycephala rufiventris</i>	Rufous Whistler																									•
<i>Oreoica gutturalis</i>	Crested Bellbird									4					1			5		1		1				•
<b>Artamidae</b>																										
<i>Artamus personatus</i>	Masked Woodswallow						1																	653		•
<i>Artamus cinereus</i>	Black-faced Woodswallow			1			9	4					1		1	3	1	8	6		1		4	3		•
<i>Cracticus nigrogularis</i>	Pied Butcherbird			1	7	1				1	1					2								2		•
<b>Rhipiduridae</b>																										
<i>Rhipidura leucophrys</i>	Willie Wagtail			1	2			2		2			1				5	1	2							•
<b>Corvidae</b>																										
<i>Corvus bennetti</i>	Little Crow																							29		•
<i>Corvus orru</i>	Torresian Crow														1											•

Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF09E	AHF10	AHF11	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	Opportunistic	Trapped	Automated recorders	
<b>Alaudidae</b>																											
<i>Mirafrja javanica</i>	Horsfield's Bushlark					5	2	1	4		1													1			
<b>Megaluridae</b>																											
<i>Cincloramphus mathewsi</i>	Rufous Songlark												2								2	1					
<i>Cincloramphus cruralis</i>	Brown Songlark													5	1						1			7			
<i>Eremiornis carteri</i>	Spinifexbird																									•	
<b>Hirundinidae</b>																											
<i>Petrochelidon ariel</i>	Fairy Martin																							14		•	
<b>Estrildidae</b>																											
<i>Taeniopygia guttata</i>	Zebra Finch						15			18	9		6				4							3		•	
<i>Emblema pictum</i>	Painted Finch				1		1						2											24		•	
<i>Heteromunia pectoralis</i>	Pictorella Mannikin																							3			
<b>Motacillidae</b>																											
<i>Anthus novaeseelandiae</i>	Australasian Pipit													1												•	
<b>Total number of species:</b>				<b>14</b>	<b>14</b>	<b>5</b>	<b>13</b>	<b>7</b>	<b>2</b>	<b>16</b>	<b>6</b>	<b>3</b>	<b>13</b>	<b>1</b>	<b>9</b>	<b>7</b>	<b>12</b>	<b>12</b>	<b>10</b>	<b>8</b>	<b>11</b>	<b>11</b>	<b>7</b>	<b>44</b>	<b>1</b>	<b>38</b>	

° S5 = Schedule 5, Mi = Migratory, Ma = Marine

Table 5.7: Reptiles recorded during the survey.

Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF10	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	AHFCAM015-01	AHFCAM08-01	Trace	Hand Captures and Opp. Sightings	
<b>Cheloniidae</b>																										
<i>Natator depressus</i>	Flatback Turtle	S3	VU, Ma, Mi																					1		
<b>Carphodactylidae</b>																										
<i>Nephrurus laevis</i>																1			14	2				1		
<i>Nephrurus levis</i>								1		1			2			1		1								
<b>Diplodactylidae</b>																										
<i>Diplodactylus laevis</i>	Desert Fat-tailed Gecko			7	3		11	14	14	26	6	21	16	8					3	3	14					
<i>Lucasium stenodactylum</i>				6	1		4	4		1		2	6	7		3	11	28	3	3	2					
<i>Oedura fimbria</i>	Western Marbled Velvet Gecko																							1	2	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko			3	1		1		1	2		14	9	3		3	1	6	3		1				1	
<i>Strophurus ciliaris</i>				2		2	8	13	9	5		1	2	1		5		1	6	3	8				1	
<i>Strophurus elderi</i>													2		1			1		5	1					
<i>Strophurus jeanae</i>				2			1					1									1					
<b>Gekkonidae</b>																										
<i>Gehyra kimberleyi</i>	Robust Termitaria Gecko								1																	
<i>Gehyra montium</i>							1		1																	1
<i>Gehyra pilbara</i>									3																	2
<i>Gehyra punctata</i>																										1
<i>Gehyra purpurascens</i>				1												1		1								

Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF10	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	AHFCAM015-01	AHFCAM08-01	Trace	Hand Captures and Opp. Sightings		
<i>Gehyra variegata</i>				1			1					2					1	1	1	1	2						
<i>Heteronotia binoei</i>	Bynoe's Gecko							2	9	1				2				1	1	4							
<b>Pygopodidae</b>																											
<i>Delma butleri</i>				1	4			5	2				1	2						1							
<i>Delma desmosa</i>				2	9	1	3	4	3	1	1	1	2	3		1			3	7	2						
<i>Delma nasuta</i>													5							1	1						
<i>Lialis burtonis</i>				3	3		4	1				1	1				1		1	6	3						
<i>Pygopus nigriceps</i>				1			1		2	3		4													1		
<b>Agamidae</b>																											
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon																									5	
<i>Ctenophorus isolepis</i>	Military Dragon			26	9	2	34	37	23	21	1	35	39	49		28	28	69	44	37	25						
<i>Ctenophorus nuchalis</i>	Central Nettle Dragon								3			1				1		7		1					1		
<i>Diporiphora paraconvergens</i>	Grey-striped Western Desert Dragon						2		1	1								1	1	4	2						
<i>Diporiphora pindan</i>	Pindan Dragon			1			4	1								3	1		2	3					1		
<i>Diporiphora vescus</i>	Northern Pilbara Tree Dragon						1											1									
<i>Gowidon longirostris</i>	Long-nosed Dragon																	1									
<i>Moloch horridus</i>	Thorny Devil																									1	
<i>Pogona minor</i>				1	2		2	3	3	3											4	1				1	
<b>Scincidae</b>																											
<i>Carlia triacantha</i>				1	1	4	1	1		1		3	6														
<i>Ctenotus brooksi</i>																				7							
<i>Ctenotus calurus</i>										1																	
<i>Ctenotus grandis</i>				2			2				2	3		1		1		1	3								
<i>Ctenotus helenae</i>							1						1			4	1	2	5	1	1						
<i>Ctenotus pantherinus</i>	Leopard Ctenotus			7	7	6	12	14	4	5	1	2	11	21		5	2	6	28	8	12	1					
<i>Ctenotus piankai</i>				1	4		1	1	2		3	1	1	2			2		1	1	1						
<i>Ctenotus quattuordecimlineatus</i>							2			1			1			1	5		2	2	4						
<i>Ctenotus rufescens</i>					5		1	1										2		1							
<i>Ctenotus saxatilis</i>	Rock Ctenotus				2	8					2															1	
<i>Ctenotus schomburgkii</i>					5			1	11	1	9	1	1														
<i>Egernia cygnitos</i>	Western Pilbara Spiny-tailed Skink																									3	
<i>Eremiascincus isolepis</i>																										1	
<i>Eremiascincus musivus</i>	Mosaic Desert Skink			2						5			2	1		1	2	6	3	1							
<i>Eremiascincus pallidus</i>	Western Narrow-banded Skink			1						1			1	2		15	1	4	3	1	1						
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer						1																				
<i>Lerista bipes</i>				6	49		39	32	22	64	2	32	15	5		56	58	77	56	39	56						
<i>Lerista clara</i>																										1	
<i>Lerista separanda</i>	Dampierland Plain Slider	P2									1								1	1							
<i>Lerista vermicularis</i>																4	1			87							
<i>Menetia greyii</i>				1						2				2													
<i>Morethia ruficauda</i>				2			1	1		2			5	2			1		4	1						1	

Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF10	AHF12	AHF13	AHF14	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	AHFCAM015-01	AHFCAM08-01	Trace	Hand Captures and Opp. Sightings	
<i>Notoscincus ornatus</i>				1			1	2	4	5	2	11	8	1			1	1	2	1	2					
<i>Tiliqua multifasciata</i>	Central Blue-tongue					1	1	3		1	1	2													1	
<b>Varanidae</b>																										
<i>Varanus acanthurus</i>	Spiny-tailed Goanna				2			1		1	2						1				1			1	1	
<i>Varanus brevicauda</i>	Short-tailed Pygmy Goanna			1			2							1					2	3						
<i>Varanus eremius</i>	Pygmy Desert Goanna			2			1	4	2	2		4	3	7		2	1		2	4	2					
<i>Varanus giganteus</i>	Perentie																						2		4	
<i>Varanus gilleni</i>	Pygmy Mulga Goanna																	2	1							
<i>Varanus gouldii</i>	Bungarra or Sand Goanna					1		1					1	2		1			1		2				1	
<b>Typhlopidae</b>																										
<i>Aniliios ammodytes</i>				1	9		5	1	3		4	3	1	2		3										
<i>Aniliios grypus</i>							1			1						1	4	1		6						
<i>Aniliios pilbarensis</i>																			1							
<b>Pythonidae</b>																										
<i>Antaresia stimsoni</i>	Stimson's Python				2																					
<i>Aspidites melanocephalus</i>	Black-headed Python																								1	
<b>Elapidae</b>																										
<i>Demansia psammophis</i>	Yellow-faced Whipsnake																								2	
<i>Demansia rufescens</i>	Rufous Whipsnake																								1	
<i>Furina ornata</i>	Moon Snake										1															
<i>Pseudechis australis</i>	Mulga Snake							1							1										2	
<i>Pseudonaja mengdeni</i>	Western Brown Snake						2	1		2																
<i>Pseudonaja modesta</i>	Ringed Brown Snake				1	1	1	2	5	1	1								1		1				2	
<i>Simoselaps anomalus</i>	Desert Banded Snake			4			3	2	1	9				1		29	3	9	4	6	3					
<b>Total Number of Species:</b>				<b>28</b>	<b>19</b>	<b>9</b>	<b>34</b>	<b>28</b>	<b>23</b>	<b>29</b>	<b>16</b>	<b>21</b>	<b>23</b>	<b>24</b>	<b>1</b>	<b>20</b>	<b>23</b>	<b>22</b>	<b>30</b>	<b>33</b>	<b>28</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>26</b>	

Table 5.8: Amphibians recorded during the survey.

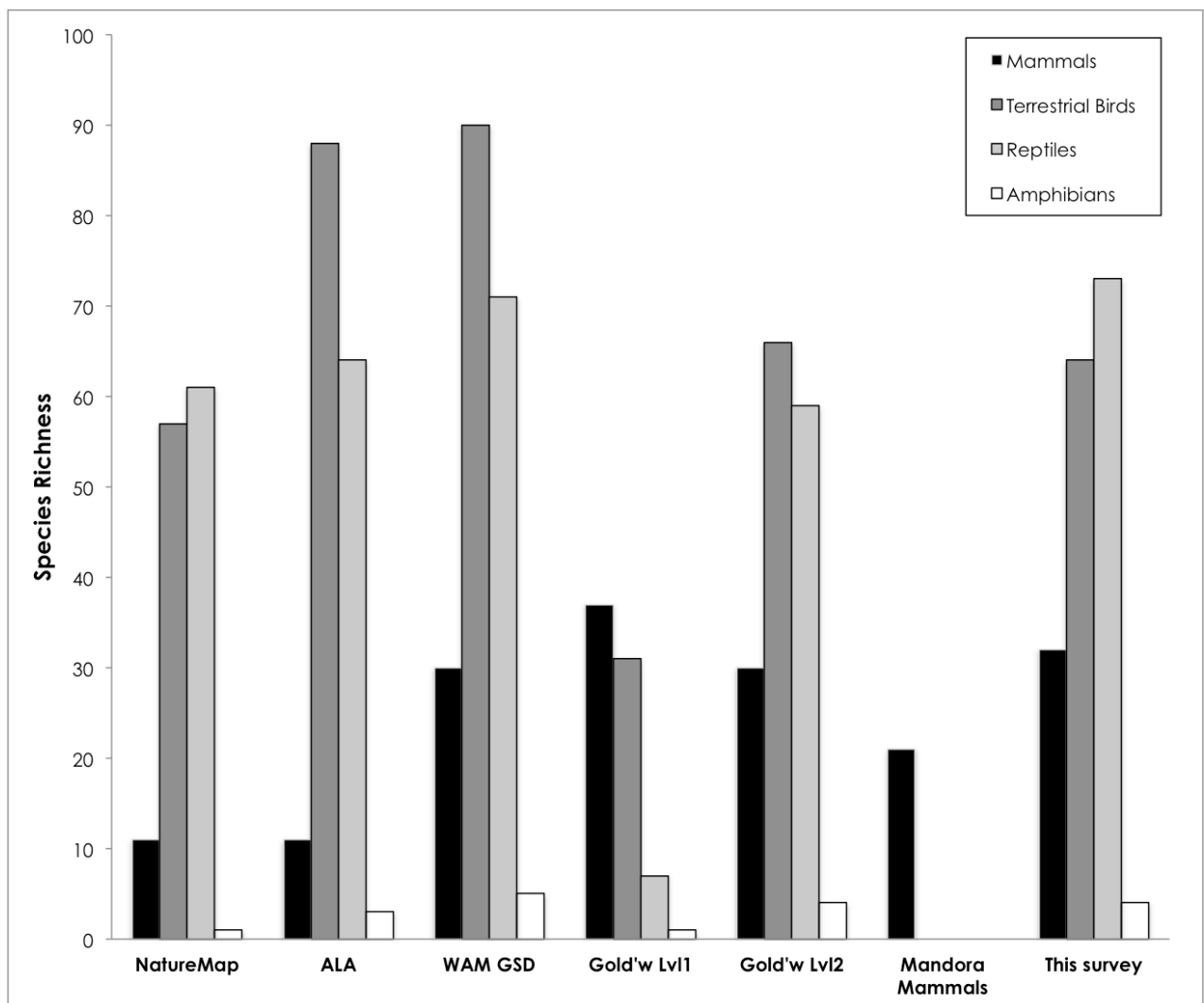
Family Species	Common Name	State	Commonwealth	AHF01	AHF02	AHF03	AHF04	AHF05	AHF06	AHF07	AHF08	AHF10	AHF12	AHF13	AHF14E	AHF15	AHF16	AHF17	AHF18	AHF19	AHF20	Trace	Hand Captures and Opp. Sightings			
<b>Hylidae</b>																										
<i>Cyclorana australis</i>	Giant Frog																								3	
<i>Cyclorana longipes</i>	Long-footed Frog																								14	
<b>Limnodynastidae</b>																										
<i>Notaden nicholli</i>	Desert Spadefoot			6			2			4		1				41	2	6	3	5	7				4	
<b>Myobatrachidae</b>																										
<i>Uperoleia russelli</i>	Northwest Toadlet															5				13						
<b>Total Number of Species:</b>				<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>		



## 5.4 Survey Adequacy

As a broad gauge of survey adequacy, the number of taxa recorded during this survey was compared with historical data for the locality from databases (NatureMap and Atlas of Living Australia (ALA)) which incorporate the results of several surveys, as well as the results of two individual Level 2 style studies (Burbidge and McKenzie 1983, ecologia 2005) which comparable effort to that of the current survey (Figure 5.2).

The current study recorded more reptile species than any other individual study or the consolidated list returned from database searches, more mammals species than all but one source reviewed and as many amphibians. The number of terrestrial birds recorded was on par with the number returned from NatureMap and the Goldsworthy Level 2 survey (ecologia 2005), but notably less than returned from the ALA database and the study of the WA Museum survey of the Great Sandy Desert (Burbidge and McKenzie 1983). Given the substantial effort applied to the recording of birds during this study (23 hours of dedicated bird census and considerable opportunistic effort, together with 2,340 days of automated recordings scanned by an ornithologist), we assume that the recorded bird assemblage is relatively complete for the study area. The lower species richness recorded is more likely to reflect a lack of diversity in habitat availability. For example, the WA Museum Great Sandy Desert (Burbidge and McKenzie 1983) study included wetland fringing habitats including samphire as well as woodland habitat; these habitats were absent from the current study area and are well known to support high bird diversity in arid areas.



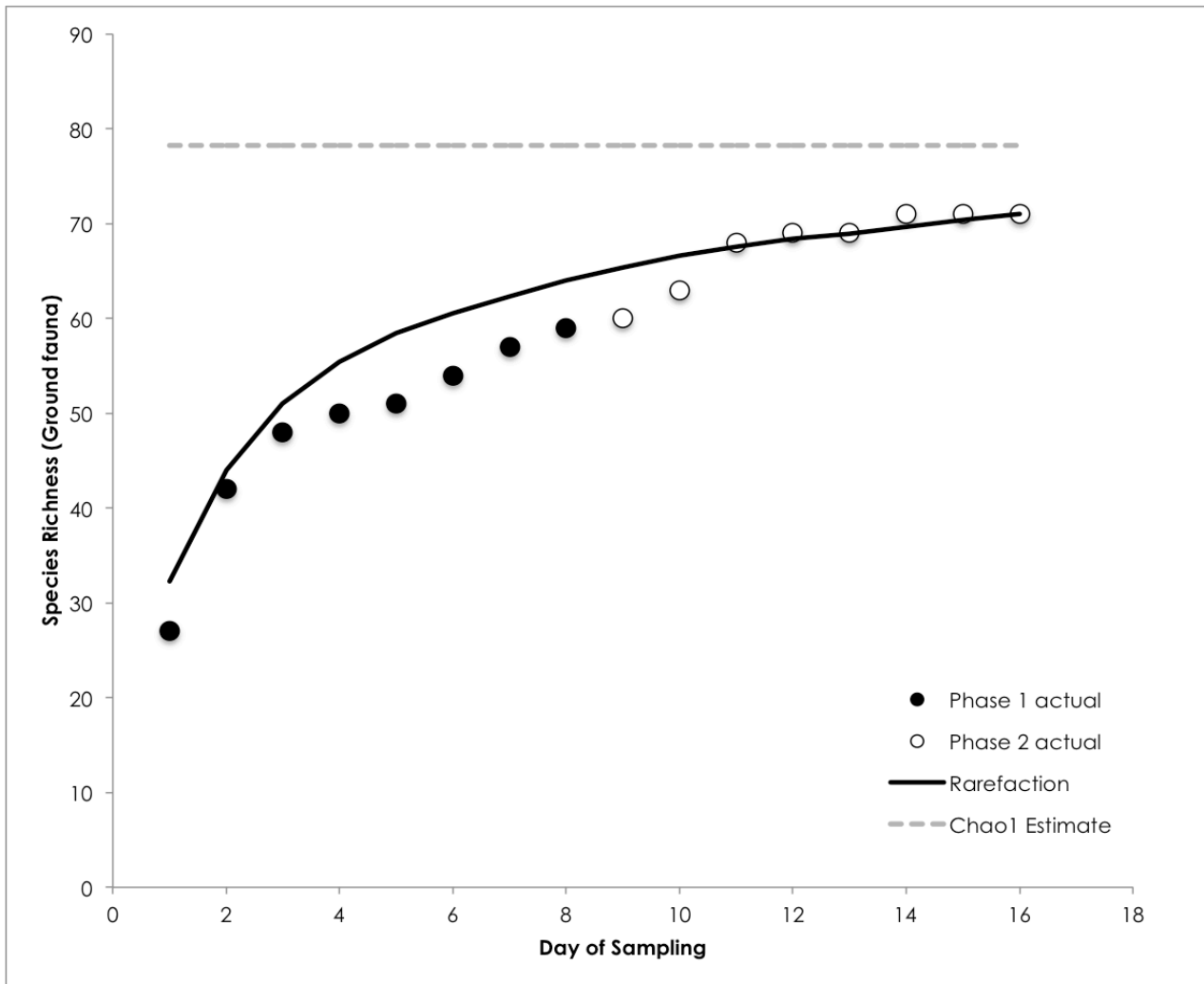
**Figure 5.2:** Species richness returned from database searches and other surveys in the region relative to the current study.

## 5.5 Species Accumulation

### 5.5.1 Ground Fauna

Seventy-two species of ground fauna were recorded from the sites trapped with a consistent trapping methodology and equal effort (pitfall and funnel transects,  $n = 16$ ). Figure 5.3 displays both the actual accumulation of species with each day of trapping at these sites as well as the randomised rarefaction curve. Both show a relatively rapid initial increase in species recorded which flattens toward an asymptote, suggesting adequate sampling (Figure 5.3).

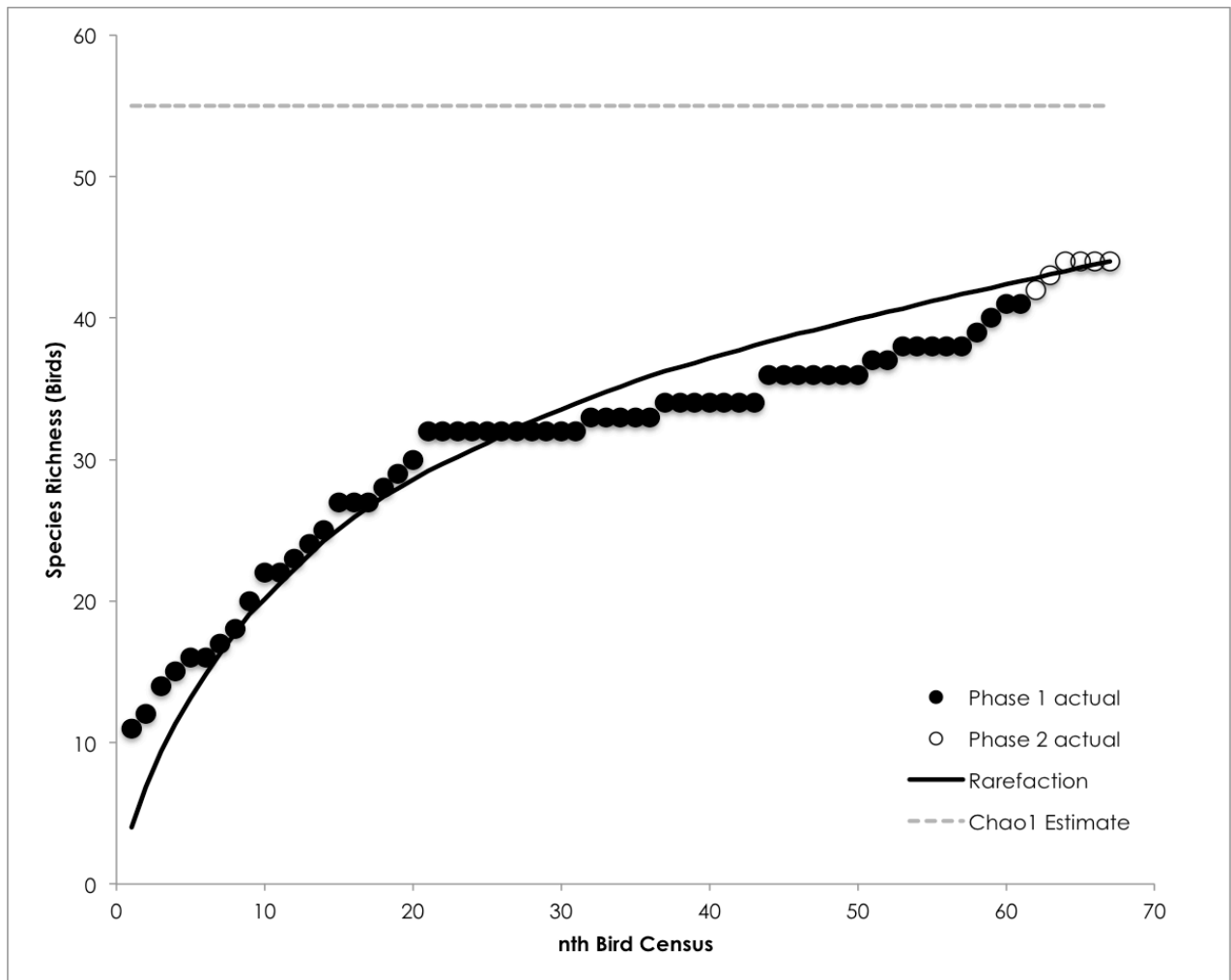
The Chao1 estimator predicts a maximum species richness of 78.2 species based on the data set (shown dashed in Figure 5.3), again indicating that the actual tally of 72 species from the survey has recorded the majority of the ground fauna assemblage.



**Figure 5.3:** Rarefaction curve, actual species accumulation and estimated species richness (Chao1) for ground fauna species recorded at the 16 systematic trapping sites.

### 5.5.2 Birds

Forty-four bird species were recorded across 816 individuals during the bird censuses conducted at trapping sites, which represent the data included in the species accumulation analysis. The number of species approached a plateau relatively quickly which was sustained through considerable further effort. However, the addition of five new species in the last day of the first phase, and the relatively high proportion of species recorded as singletons (11 of 44), would indicate that further bird survey effort may have yielded more species (Figure 5.4). The rarefaction constructed from these data was consistent with this, which, while flattening somewhat were not as strongly asymptotic as the ground fauna accumulation (Figure 5.4).



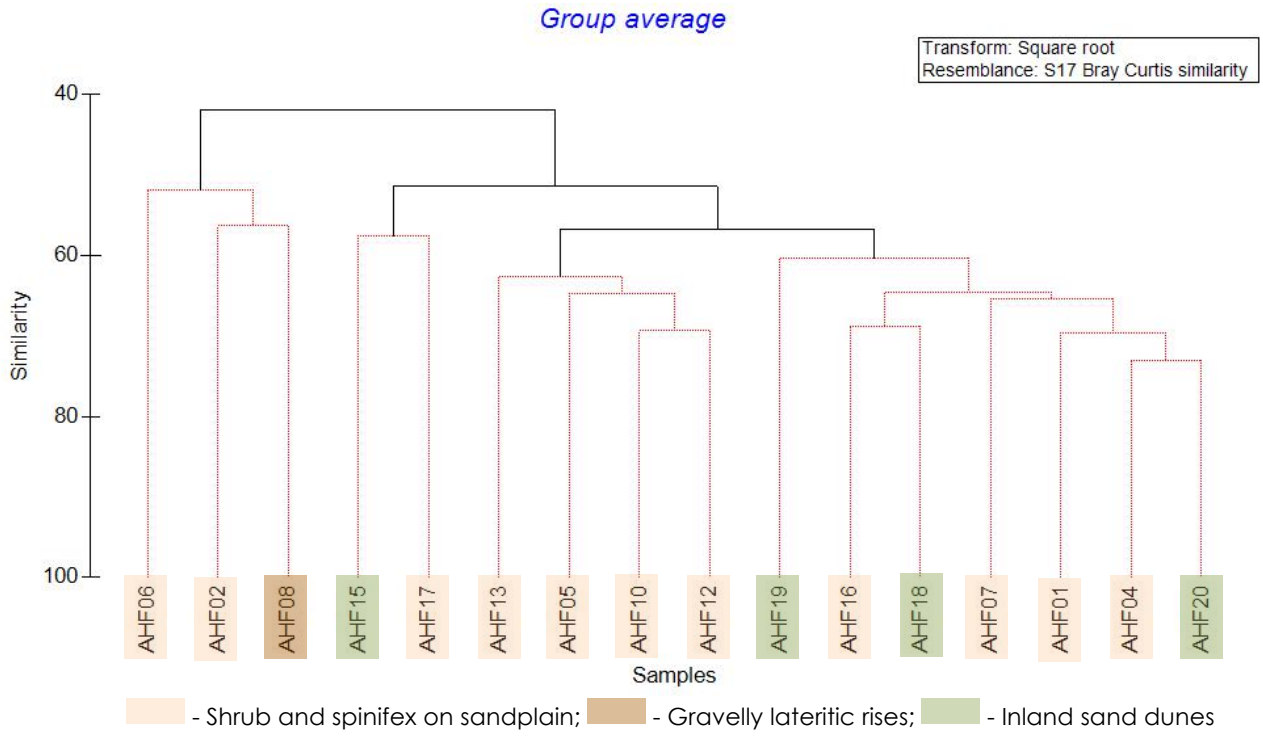
**Figure 5.4:** Rarefaction curve and estimated species richness (Chao1) for bird species recorded via dedicated bird census at the systematic sampling sites.

The Chao1 estimator predicted a maximum species richness of 55 species (Figure 5.4). It is important to note, however, that in addition to bird surveys at trap sites, birds were also surveyed in during targeted censuses in other habitats during the survey, often recorded opportunistically, and via the use of automated recording units. Together these latter methods added 24 species to the avifauna inventory, bringing it to 68 species, exceeding the species richness predicted by the nonparametric estimator.

## 5.6 Faunal Assemblage Analysis

The ground fauna species composition was compared across the systematic sampling sites using Bray-Curtis measure of similarity. The analysis was run twice, once with abundance of each species included and once using presence/absence data only. Both analyses yielded very similar results. Similarity with abundance data included, is displayed as a dendrogram in Figure 5.5.

Four groupings were statistically significant different (illustrated by the black dendrogram branches in Figure 5.5). Relationships between site habitat type and land system were investigated, but little correlations with the four groupings, with sites from different habitats within the same cluster and no consistent grouping of a single habitat type within any of the four groups (Figure 5.5). This may indicate that there is little distinction in the ground faunal assemblages across the survey area between the habitat types as defined.



**Figure 5.5:** Dendrogram display of Bray-Curtis Similarity between systematic sites and the habitats that they sampled (ground fauna only).



## 6.0 Conservation Significant Vertebrate Fauna

Eleven vertebrate species of conservation significance were recorded in the study area during the survey, comprising:

- Northern Quoll (*Dasyurus hallucatus*) – Schedule 2; Endangered;
- Black-footed Rock-wallaby (*Petrogale lateralis lateralis*) – Schedule 2; Endangered;
- Bilby (*Macrotis lagotis*) – Schedule 3; Vulnerable;
- Flatback Turtle (*Natator depressus*) – Schedule 3; Vulnerable, Marine, Migratory;
- Oriental Pratincole (*Glareola maldivarum*) - Schedule 5; Migratory;
- Rainbow Bee-eater (*Merops ornatus*) - Marine
- Dampierland Plain Slider (*Lerista separanda*) – Priority 2;
- Spectacled Hare-wallaby *Lagorchestes conspicillatus* – Priority 3;
- Brush-tailed Mulgara (*Dasycercus blythi*) – Priority 4;
- Northern Marsupial Mole (*Notoryctes caurinus*) – Priority 4; and
- Western Pebble-mound Mouse (*Pseudomys chapmani*) – Priority 4.

The location at which each conservation significant species was recorded during this study are shown in Figure 6.1, with a detailed account of each species following Sections 6.1 to 6.3. Two of the species above, the Black-footed Rock Wallaby and the Spectacled Hare-wallaby, were considered unlikely to occur on the basis of the desktop review (Section 5.2.2; Table 5.2); highlighting the value of the field survey effort invested in this previously unsurveyed study area.

Previous records and habitat availability reviewed during the desktop review (Section 5.2; Appendix 1), indicate a further five conservation significant species are Likely to occur, but no evidence of their presence was recorded during the survey. Section 6.4 provides an overview of the ecology and status of these latter species and an assessment of their likelihood of occurrence. The five species were:

- Fork-tailed Swift (*Apus pacificus*) - Schedule 5; Marine, Migratory;
- Little Curlew (*Numenius minutus*) - Schedule 5; Marine, Migratory;
- Oriental Plover (*Charadrius veredus*) - Schedule 5; Marine, Migratory;
- Peregrine Falcon (*Falco peregrinus*) - Schedule 7; and
- Short-tailed Mouse (*Leggadina lakedownensis*) - Priority 4.

Three of the conservation significant species that were assessed as Unlikely to occur in the study area (Section 5.2.2) and were not recorded during the survey but are difficult to detect, were given additional consideration in the interests of a precautionary assessment. Appendix 6 discusses these three species, which comprise:

- Night Parrot (*Pezoporus occidentalis*) - Schedule 1; Endangered;
- Great Desert Skink (*Liopholis kintorei*) - Schedule 3, Vulnerable; and
- Princess Parrot (*Polytelis alexandrae*) - Priority 4; Vulnerable.

No evidence that any of these latter species currently occur in the study area was recorded, as discussed in Appendix 6.

### 6.1 Mammals

#### 6.1.1 Northern Quoll (*Dasyurus hallucatus*) - WC Act Schedule 2; EPBC Act Endangered

Two records of the Northern Quoll were confirmed during the survey, both of which came from rocky habitat in the central study area (Figure 6.1).

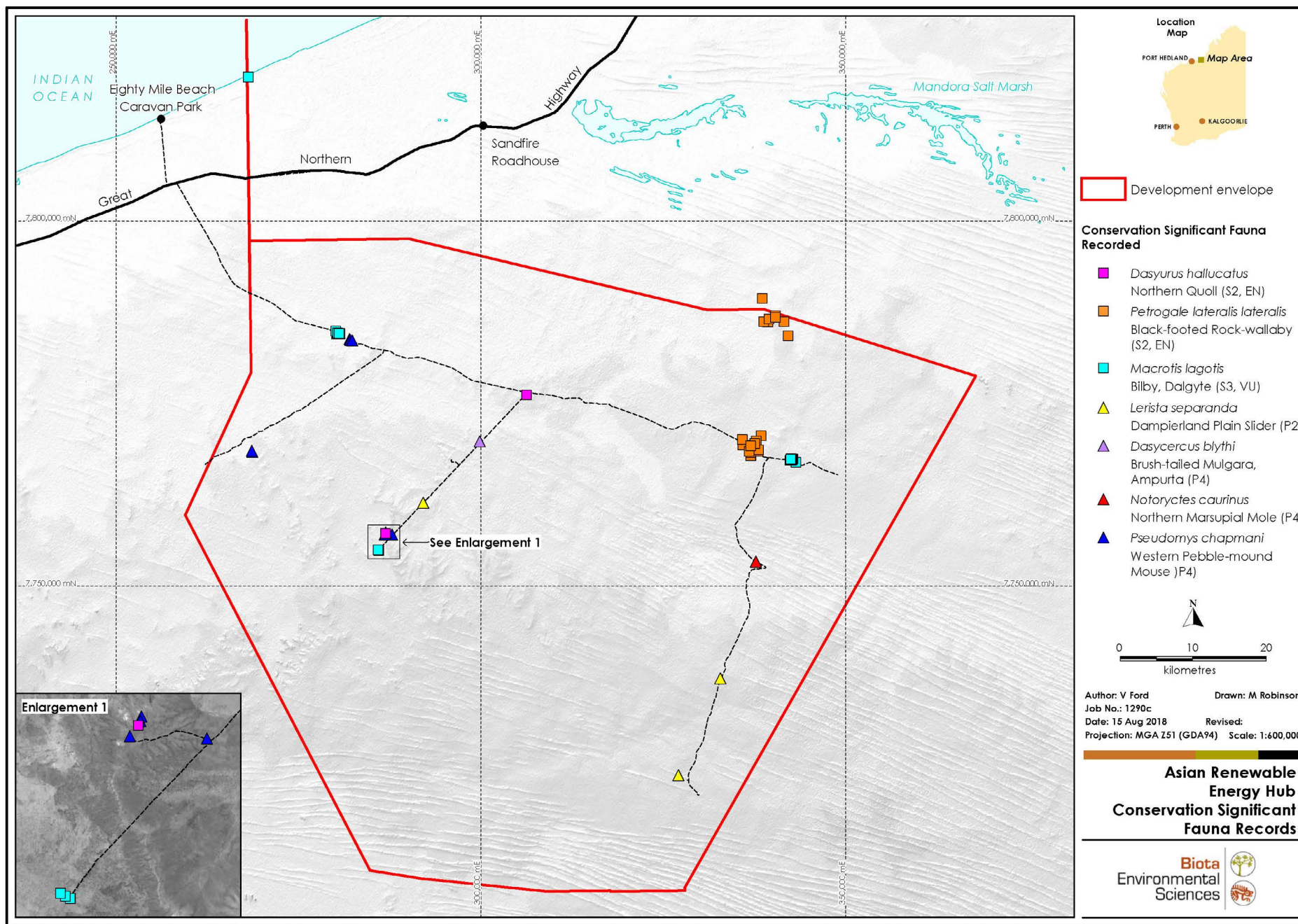


Figure 6.1: Records of conservation significant vertebrate fauna from this study.

The Northern Quoll is a medium-sized dasyurid marsupial, with adult weight ranging from 300 to 1,200 g. It is considered a partially arboreal and aggressive carnivore, preying on a varied diet of small invertebrates and vertebrates, including lizards, birds, snakes, small mammals and frogs (Oakwood 2008). It is also known to feed on fleshy fruit and carrion. The Northern Quoll is mostly nocturnal, although crepuscular (dusk and dawn) activity also occurs. The species makes a den in spaces amongst rocks or in log and tree hollows. Many records from the Pilbara bioregion have come from mesa and breakaway features abutting large creeks (Biota 2010) and from boulder tors of the Abydos-Woodstock Plain (How et al. 1991).

The Northern Quoll is a short-lived mammal, with both sexes maturing at 11 months. Females reproduce only once each year and all males die shortly after reproducing (Dickman and Braithwaite 1992, Oakwood 2000). The discrete male cohorts that arise within populations can make quolls more susceptible to local population extinctions. If no juvenile male quolls survive to adulthood, there will be no males available for mating the following year and the local population will rapidly go extinct (Braithwaite and Griffiths 1994, Oakwood 2000). Therefore, any factor that results in significant increases in mortality rates of female and juvenile quolls could result in the loss of local populations.

Two single scats of the species were found but no evidence of denning in the form of larger scat piles was recorded, no individuals were trapped and none were recorded on automated cameras. On the mainland of Western Australia, the species is generally described as occurring within the Pilbara and the north-west Kimberley, and as such the records of the species within the study area represents one of the most northerly occurring of the Pilbara records.

Given the extensive search of rocky habitat undertaken to target the Black-footed Rock-wallaby within the study area, the paucity of denning evidence of the Northern Quoll would seem to indicate that it is occurring at most on a transient. Areas utilised intensively by Northern Quolls are readily identified by the presence of latrines, at their dens, which remain in the landscape for many years even when the dens cease to be used.

### **6.1.2 Black-footed Rock-wallaby (*Petrogale lateralis lateralis*) - WC Act Schedule 2; EPBC Act Endangered**

Multiple records of the Black-footed Rock-wallaby were recorded from rock pile habitat in the northeast of the study area (Figure 6.1). The species is known from a series of isolated, patchily distributed populations in Western Australia and the Northern Territory (Pearson 2013, Woinarski et al. 2014). The records of the species within the study area are significant not only due to the conservation significance of the species overall, but also because it appears to represent the only recent record of the species from the Great Sandy Desert, and was a previously unknown colony prior to the completion of this study (Section 5.2.2).

This nocturnal species requires shelter in the form of caves, cliffs and boulder scree during the day. Habitat critical to survival requires sufficient cave and crevice development to provide shelter from extremes of temperature and predators (Pearson 2013). Free water is usually not required unless the animals are occupying sub-optimal habitat that has inferior thermal refuges (Pearson 2013). The species is susceptible to predation by foxes and cats and habitat degradation by introduced herbivores.

Most effort targeting this species was directed at recording its presence via secondary signs to maximise the amount of prospective rocky habitat that could be searched. Rocky habitat in the form of breakaways and rock piles (Plate 6.1 and Plate 6.2) was searched, yielding numerous scat and track records (Plate 6.3 and Plate 6.4). In addition, two individuals were recorded in cage traps and on motion cameras (Figure 6.1), and individuals were also sighted on the rock piles just after dawn. Records were concentrated in two areas in the northeast of the study area (Figure 6.1), but it is possible that other similar rock pile habitat occurs in the study area, which may also be utilised by the species.





**Plate 6.1:** Typical Black-footed Rock-wallaby habitat within the study area.



**Plate 6.2:** Typical Black-footed Rock-wallaby habitat within the study area.



**Plate 6.3:** Black-footed Rock-wallaby shelter and scat piles within the study area.

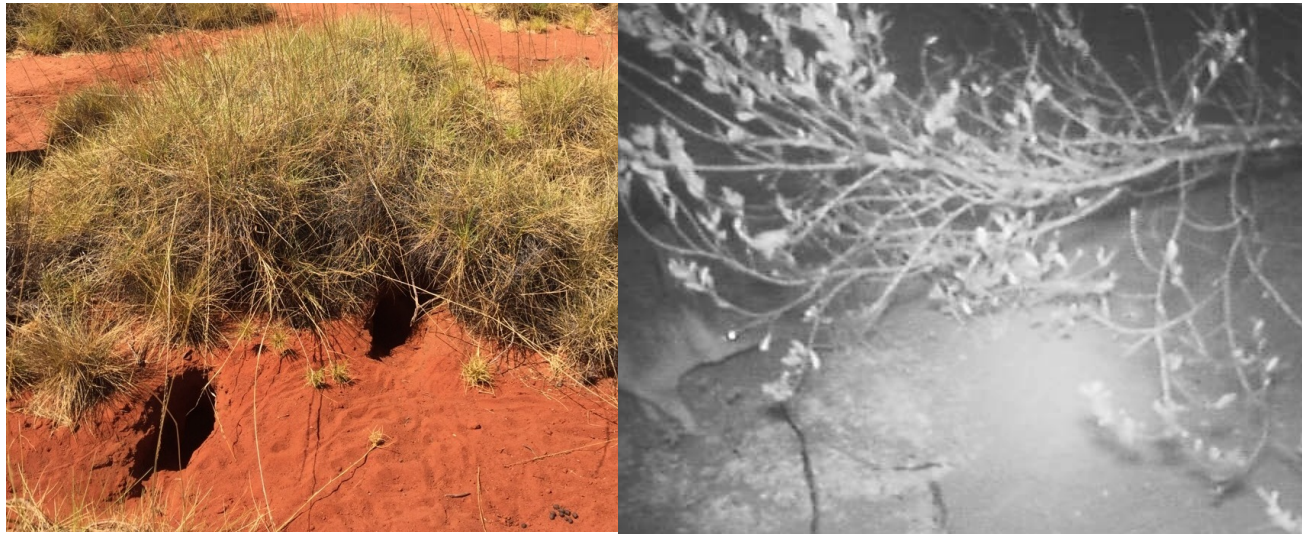


**Plate 6.4:** Black-footed Rock-wallaby tracks within the study area.



### 6.1.3 Bilby (*Macrotis lagotis*) - WC Act Schedule 3; EPBC Act Vulnerable

Effort recording the species focused on finding burrows via walking linear transects in line with DBCA Guideline (2017). Evidence of Bilby presence, in the form of recent diggings, burrows (Plate 6.5) and tracks, was found in three general locations within the study area (Figure 6.1), and the species was also recorded via motion camera (Plate 6.6).



**Plate 6.5:** Bilby burrow in Shrub and spinifex on sandplain habitat.

**Plate 6.6:** Bilby record from automatic camera.

The Bilby is a medium sized ground mammal, ranging in weight from 1.0-2.5 kg. The species is apparently strictly nocturnal and constructs a substantial burrow system, which may be up to 3 m in length (Flannery et al. 1990). The former range of the Bilby included most of the semi-arid areas of mainland Australia, however it is now confined to *Triodia* hummock grassland and *Acacia* scrub across parts of northern Australia.

Similar to the Mulgara (*Dasyercus cristicauda*), the species has been documented as showing temporary home ranges and relatively rapid changes in distribution in response to variation in habitat resources (Johnson 1995). While fox and cat predation and the effect of rabbits and stock are thought to be the principal factors in the decline of this species, fire has also been suggested as an important factor in maintaining habitat diversity for this species (Johnson 1995).

### 6.1.4 Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) - DBCA Priority 3

Tracks of the Spectacled Hare-wallaby were recorded at a single location in the west of the study area during the survey (Figure 6.1).

There are scattered records of this species from the Kimberley and Pilbara regions of Western Australia. It has declined in numbers over most of its range, and has declined drastically and is rare in the Pilbara region (Ingleby 1991, van Dyck and Strahan 2008). While abundant on Barrow Island, it was eliminated from the Montebello group of islands (located just to the north of Barrow Island) prior to 1950, most likely as a result of predation by feral cats (Burbidge 1971). Mostly solitary, but sometimes feeding in groups of up to three (van Dyck and Strahan 2008), mainland individuals occupy home ranges of about 1.77 km<sup>2</sup> (McCosker 1997). The species prefer large spinifex (*Triodia*) clumps in which to shelter during the day.

The species can be hard to detect, and is most commonly recorded incidentally when flushed from its daytime hummock shelter. As a result, it is difficult to assess the distribution of the Spectacled Hare-wallaby within the study area, but areas supporting large spinifex hummocks, which are common in the study area and wider locality, represent suitable habitat.



### 6.1.5 Brush-tailed Mulgara (*Dasyercus blythi*) - DBCA Priority 4

The Brush-tailed Mulgara is currently listed as a Priority 4 species (DBCA 2017c). It was recognised as a separate species to the Crest-tailed Mulgara (*Dasyercus cristicauda*) based on a morphological study by Woolley (2005). Molecular analyses later confirmed that the two species were separate species living in partial sympatry (Pavey et al. 2011).

This species is known to inhabit spinifex grasslands on sand plains and sandy swale between low dunes from south-western Queensland across the Simpson, Tanami, and Great Sandy Deserts of southern and central Northern Territory and central Western Australia. It is also known to inhabit areas on gibber (rock and pebble covered flat plains), and is closely associated with gently sloping to flat topographic positions rather than steep-sided sandridges (Pavey et al. 2011).

A single burrow of what is inferred to be Brush-tailed Mulgara (i.e. not the Crest-tailed Mulgara *D. cristicauda*) based on habitat and most recent descriptions of distribution was recorded (Plate 6.7 and Plate 6.8).



Plate 6.7: Mulgara burrow within typical habitat.



Plate 6.8: Mulgara burrow.

### 6.1.6 Northern Marsupial Mole (*Notoryctes caurinus*) - DBCA Priority 4; EPBC Act Vulnerable

The fossorial (burrowing) species has prominent morphological adaptations to its almost entirely subterranean habit, including being blind, without ears and the modification of limbs to form paddle-like structures to aid 'swimming' through sand (Warburton 2006).

The species occurs in the Great Sandy, Little Sandy and the northern Gibson Deserts of Western Australia, and probably in the western Tanami Desert of Western Australia and western Northern Territory. Marsupial Moles inhabit sand dunes and, to a lesser extent, adjacent swales where there is suitable deep, loose sand. There is no robust estimate of population size (Department of the Environment and Energy 2018) likely due to their cryptic nature.

Recorded via "trenching" dunes within study area represent habitat.

### 6.1.7 Western Pebble-mound Mouse (*Pseudomys chapmani*) - DBCA Priority 4

The species was detected via five mounds at three locations during the survey, all of which were in Gravelly lateritic rise habitat (Figure 6.1).

Once described as endemic to the central and eastern parts of the Pilbara (Menkhorst and Knight 2011), this species is now much more widely known over the entire Pilbara region and into the Gascoyne (NatureMap records). This species is typically found on stony hillsides with hummock grasslands (Menkhorst and Knight 2011) and is common to very common in suitable habitat within the Hamersley and Chichester subregions of the Pilbara bioregion. The Western Pebble-mound Mouse is well known for its behaviour of constructing extensive mounds of small stones covering areas from 0.5 to 9.0 m<sup>2</sup> (van Dyck and Strahan 2008). This mound formation is most common on spurs and gentle slopes where suitably sized stones are present. Habitat destruction and altered fire regimes that remove old growth habitat constitute the main threatening processes for this species.

The occurrence of the species in the study area was notable as it falls north of where the species has typically been recorded, probably reflecting a lack of survey given the conspicuous nature of the mounds. Active mounds are discernible by factors such as the presence of maintained turrets and lack of debris in the turrets. Inactive mounds generally display a more flattened and consolidated appearance due to the lack of routine maintenance and pebble movement. These parameters are generally used when determining likely mound status. One mound recorded during the survey was classified as active (Plate 6.9) while the remainder were inactive.



Plate 6.9: Active Western Pebble-mound Mouse mound.

## 6.2 Birds

### 6.2.1 Oriental Pratincole (*Glareola maldivarum*) - WC Act Schedule 5; EPBC Act Migratory

Oriental Pratincole were recorded via three observations and an audio-recording of Pratincole within or near the study area in February and March 2018, two of which involved foraging flocks (Biota 2018a).

A medium-sized tern-like shorebird with short legs, very long pointed wings and short decurved bill (Geering et al. 2007). Gregarious, found in small to very large flocks on open plains, bare grounds and around the margins of wetlands and on mudflats. Most often seen hunting in flight, capturing insects with aerobatic manoeuvres. (Geering et al. 2007).



## 6.2.2 Rainbow Bee-eater (*Merops ornatus*) - EPBC Act Marine

The Rainbow Bee-eater was recorded from 17 individuals at four locations (Section 5.3.3), but is likely to be widespread in the study area on a transitory basis.

This species occurs through the majority of the western third of Western Australia, usually where free water is readily available. Some individuals migrate northward during winter, either within Australia or as far as Indonesia (Johnstone and Storr 1998), however most birds residing in Western Australia do not migrate outside of the country. Rainbow Bee-eaters forage aerially for insects and nest in burrows in the ground (Johnstone and Storr 1998). The species occurs in a variety of habitats that are generally well watered, lightly wooded with suitable (sandy) soil for nesting and a tall stratum of vegetation for perching.

The Rainbow Bee-eater has a very large range, population size appears stable and under no substantiated threat (Department of the Environment 2015).

## 6.3 Reptiles

### 6.3.1 Flatback Turtle (*Natator depressus*) - WC Act Schedule 3; EPBC Act Vulnerable, Marine, Migratory

This species is the only sea turtle restricted to Australian waters between the Pilbara and east coast of Queensland (Wilson and Swan 2017) and one of only two sea turtles without a global distribution. In Western Australia, Eighty Mile Beach is a recognised nesting location (Hale and Butcher 2009).

A track belonging to the species was recorded on Eighty Mile Beach where the northernmost part of the study area intersects the beach. As a marine species, the occurrence of the Flatback Turtle is discussed in more detailed in the marine environmental impact assessment undertaken by BMT (2018).

### 6.3.2 Dampierland Plain Slider (*Lerista separanda*) - DBCA Priority 2

Records of this small burrowing skink were obtained from three locations within the study area (Figure 6.1). The species has four well-developed limbs (Plate 6.10) and a preference for sandy substrates (Wilson and Swan 2017), consistent with the records from the current study. The records of this species from this study represent a range extension on its previously known distribution, which was generally described as the southern Kimberley coast, between Kimbolton and Nita Downs. However the NatureMap database does include records of the species from Warrawagine Homestead (Doughty et al. 2011) located approximately 30 km south of the study area.

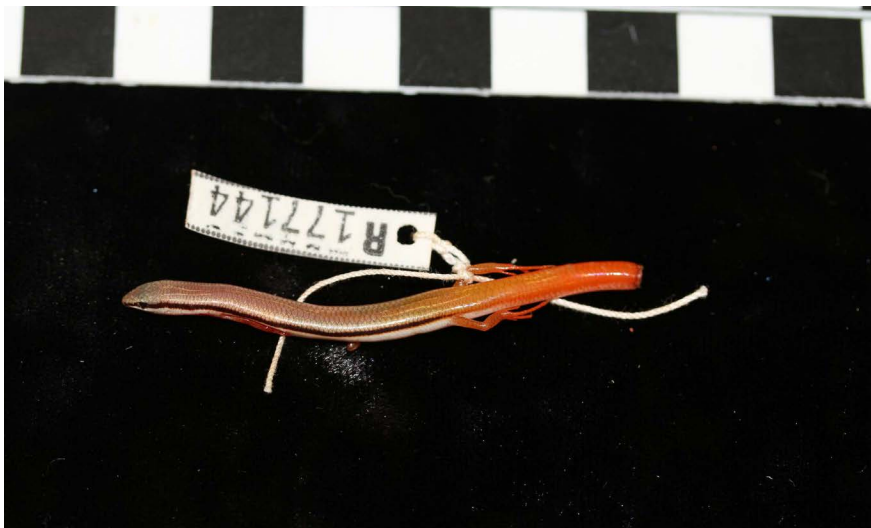


Plate 6.10: *Lerista separanda* specimen from the survey vouchered with the WA Museum.

## 6.4 Conservation Significant Fauna Likely to Occur but Not Recorded

### 6.4.1 Mammals

#### 6.4.1.1 Short-tailed Mouse (*Leggadina lakedownensis*) – DBCA Priority 4

Prior to 1997, only two specimens of this species had been collected, however the number of records of this species has increased substantially since this time (Cooper et al. 2003). In Western Australia the distribution of *Leggadina lakedownensis* includes the Pilbara and Kimberley regions (Menkhorst and Knight 2011) although NatureMap records also place it within the Great Sandy Desert. Regional records suggest that the primary mainland habitat comprises areas of cracking clay and adjacent habitats. Consistent with this habitat description, Biota records include trapping the species on cracking clay communities from Cape Preston (60 km west of Dampier) in the west, to the northern flanks of the Fortescue Marshes in the east (Halpern Glick Maunsell et al. 2001). However, other sources provide a more diverse picture of habitat utilisation that includes areas of open tussock and hummock grassland, *Acacia* shrubland and savannah woodland, sandy soils as well as cracking clays (Morris et al. 2008).

The study area is mostly dominated by *Triodia* hummock grasslands, which are not preferred by the species, and while the species was not recorded during the survey, areas of more suitable mixed grasslands and shrublands do occur.

### 6.4.2 Birds

#### 6.4.2.1 Peregrine Falcon (*Falco peregrinus*), WC Act Schedule 7

The Peregrine Falcon has an almost cosmopolitan distribution, but is absent from most deserts and the Nullarbor Plain (Johnstone and Storr 2004). The only subspecies in Australia (*macropus*) is widespread throughout Australia (Marchant and Higgins 1993) and is not considered as threatened by Garnett et al. (2011).

This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country (Pizzey and Knight 2007). Home ranges are probably defended year round and are variable in size, though not typically less than 480 ha (Marchant and Higgins 1993). The species typically nests on ledges in cliffs, granite outcrops and quarries, but also in hollow trees and in old nests constructed by other species such as Wedge-tailed Eagles and Ravens (Johnstone and Storr 2004). Breeding typically occurs between August and November (Johnstone and Storr 2004). Their diet consists almost exclusively of birds such as pigeons, parrots and passerines, which are captured in flight (Johnstone and Storr 2004). Mammals such as possums and rabbits have also been recorded as prey items (Marchant and Higgins 1993).

Some core habitat in the form of breakaways was available in the south of the study area, but species or nests were not recorded during the field survey.

#### 6.4.2.2 Fork-tailed Swift (*Apus pacificus*), WC Act Schedule 5; EPBC Act Marine, Migratory

The Fork-tailed Swift is most often observed following thunderstorms and cyclonic weather patterns and the associated emergence of invertebrate fauna, which are a food source for this species (Johnstone et al. 2013). Fork-tailed Swifts are thought to be exclusively aerial in Australia as they breed in the northern hemisphere, migrating south to the Australasian region from October to April. The species is an irregular summer visitor to the Pilbara during November to early April (Johnstone et al. 2013). Fork-tailed Swifts do not rely on terrestrial habitats, but may overfly the study area episodically.



**6.4.2.3 Oriental Plover (*Charadrius veredus*) and Little Curlew (*Numenius minutus*) - WC Act Schedule 5; EPBC Act Marine, Migratory**

Migratory shorebirds have been the subject of a separate report focussed on Eighty Mile Beach and the Mandora Marsh (Biota 2018a) so the details of the large majority of migratory species restricted to marine habitats have not been reported here.

However, two species listed under the WC Act as Schedule 5 and EPBC Act as Migratory and Marine warrant special consideration because they are likely to utilise terrestrial habitats within the study area: Oriental Plover (*Charadrius veredus*) and Little Curlew (*Numenius minutus*), which forage in large numbers on and over the plains inland from Eighty Mile Beach and Broome (Sitters et al. 2004, Piersma and Hassell 2010). On this basis, both are considered likely to occur within the study area, even though they were not recorded during the current survey or the parallel Biota (2018a) targeted migratory bird survey.

## 7.0 Invertebrate Fauna

In total, 63 invertebrate fauna samples were collected from a combination of dry pitfall trapping and targeted searching of microhabitats likely to support SRE taxonomic groups.

The collected samples comprised 29 spiders from 10 sampling locations, 10 scorpions from four locations and 24 snails from four sampling locations. All specimens were sequenced by Helix to assign them to species level taxa and place them into regional context (Appendix 4).

### 7.1.1 Spiders

#### 7.1.1.1 Mygalomorphae

All of the specimens collected belonged to the family Nemesiidae and genus *Aname*. By applying the 9.5% sequence divergence 'cut-off' that was tested by Castalanelli et al. (2014), the levels of sequence divergence recorded among the specimens indicates that they belong to four distinct nemesiid species. These species are all undescribed, and three of the species are likely to be newly recorded taxa. The fourth species, which one of which as was associated with a previously collected species from 245 km away, suggesting it belongs to a widespread species (Helix 2018) (Appendix 4).

The remaining three putative species showed no affinities to previously collected trapdoor spiders and should be conservatively treated as potential SREs (Biota 2018c).

#### 7.1.1.2 Araneomorphae

Nine of the sequenced spider specimens were placed within the Araneomorphae sub-order of spiders (modern spiders) on the basis of the sequence data. As no groups within the Araneomorphae are known to include SRE species, no further analysis was conducted on these specimens.

### 7.1.2 Scorpions

#### 7.1.2.1 Buthidae

Nine of the ten specimens of buthid scorpions were successfully sequenced for the COI gene. Due to limitations on publicly available genetic sequences, Helix Molecular Solutions sought assistance from the WA Museum (Helix 2018). Collaboration with Dr. Joel Huey, a researcher at the WA Museum, enabled more accurate placement of the buthid scorpions (Appendix 4).

The specimens were included in a phylogenetic analysis with a more extensive collection of sequences, which placed them into a species clade with specimens identified as *Lychas annulatus* by Lorenzo Prendini (American Museum of Natural History). This species is also recognised as *Hemilychas alexandrinus*, which has a distribution extending across the Australia arid zone, and the species is therefore not considered to be an SRE.

### 7.1.3 Snails

#### 7.1.3.1 Camaenidae

All snails collected were identified as belonging to the family Camaenidae and the genus *Rhagada*; the most species-rich genus of land snails in Australia's semi-arid Pilbara region (Johnson et al. 2004, Hamilton 2015).

Twenty-four specimens of camaenid *Rhagada* land snails from the development envelope were sequenced and assessed for variation at the COI mtDNA gene (Helix 2018) (Appendix 4). The molecular data were then placed into an existing molecular taxonomic framework for *Rhagada*, using publicly available COI sequences, which indicated that all specimens collected from the development envelope represented the same recently described species: *Rhagada karajarri* (Helix 2018).

The records from the development envelope extend the distribution of the species by approximately 180 km, suggesting that it is not an SRE.

#### **7.1.4 Potential SRE Taxa and Habitats**

Three potential SRE taxa, all trapdoor spiders, were recorded from the study area, with the remaining fourth trapdoor spider taxon, and the scorpion and land snail species recorded, demonstrated to be more widespread and not SREs.

This latter result is generally consistent with the overall character of the landscape of the study area, which is strongly dominated by very extensive and contiguous sandplain and interconnected linear dune habitats. These landforms have few obvious geographic barriers to dispersal that might restrict gene flow and promote short range endemism (EPA 2016c).

While the three newly recorded trapdoor spiders have been conservatively treated here as potential SREs, it is possible that they are also more widely distributed. While all were recorded from only one or two specimens, which hampers a true assessment of distribution and potential short-range endemism: all three came from widely-connected sandplain habitats with no barriers to dispersal, within the very widespread Nita and Little Sandy land systems. The risk that these species are restricted to very small distributions is therefore likely to be low.

## 8.0 Conclusions

A total of 177 vertebrate fauna species were recorded from the study area during the seasonal survey. While the study area is situated on the boundary of the Pilbara and Kimberley, the faunal assemblage showed a strong association with the Pilbara bioregion and very few species with typical Kimberley distributions were recorded. The locality has been subject to little previous fauna survey effort and the records of a number of species represented northerly extensions to their previously known distributions.

Eleven vertebrate species of conservation significance were recorded in the study area during the survey, comprising:

- Bilby (*Macrotis lagotis*) – Schedule 3; Vulnerable;
- Black-footed Rock-wallaby (*Petrogale lateralis lateralis*) – Schedule 2; Endangered;
- Northern Quoll (*Dasyurus hallucatus*) – Schedule 2; Endangered;
- Flatback Turtle (*Natator depressus*) – Schedule 3; Vulnerable, Marine, Migratory;
- Oriental Pratincole (*Glareola maldivarum*) - Schedule 5; Migratory;
- Rainbow Bee-eater (*Merops ornatus*) - Marine
- Dampierland Plain Slider (*Lerista separanda*) – Priority 2;
- Spectacled Hare-wallaby *Lagorchestes conspicillatus* – Priority 3;
- Brush-tailed Mulgara (*Dasyercus blythi*) – Priority 4;
- Northern Marsupial Mole (*Notoryctes caurinus*) – Priority 4; and
- Western Pebble-mound Mouse (*Pseudomys chapmani*) – Priority 4.

Most of the above species were expected for the study area, but the discovery of a previously unknown colony of the Black-footed Rock-wallaby was a significant outcome from the field survey.

Six major fauna habitats were identified within the study area. The mapping of fauna habitats was conducted using aerial photography and existing thematic layers such as land systems but was also extensively ground-truthed by zoologists and during the Biota (2018b) flora and vegetation survey, where a helicopter was utilised to ensure all landforms and habitats of the study area were identified and that the systematic sampling sites adequately represented the range of habitats present in the overall study area. As a result we are confident that the habitat mapping is a true reflection of the range of habitats present and they results of the systematic sampling sites reported here are representative of the faunal assemblage of the study area.

Several measures of adequacy indicate a thorough survey has been conducted:

- The current study recorded more reptile species than any individual study or database search reviewed, more mammals than all but one source reviewed, and as many amphibians. The number of terrestrial birds recorded was less than some sources (the ALA database and the WAM survey of the GSD) but these sources include much higher effort and a greater diversity of habitats preferable to birds.
- Species accumulation and nonparametric estimators for ground fauna suggest that 92% of the assemblage was recorded.
- The desktop review indicated that up to 14 conservation significant species were Likely to occur within the study area, and 11 species of conservation significance were recorded during the survey.

Of the six fauna habitats occurring within the study area, one warrants further consideration based on the criteria defined in Section 4.2: Rocky outcropping. The areas of more significant rock outcropping in the study area were found to support two species listed as Endangered at both the state and Commonwealth level; the Black-footed Rock-wallaby (Schedule 2; Endangered) and based on the finding of two scats, occasionally also by the Northern Quoll (Schedule 2; Endangered).

Geographically, this habitat type occurs as isolated patches in the landscape, and the conservation significant species utilising it are strongly associated with it, making it a habitat type that warrants specific consideration during environmental impact assessment.

## 9.0 Glossary

ARU	Automated Recording Unit
Biota	Biota Environmental Sciences
Conservation significant	A species listed under the EPBC Act, WC Act or as a DBCA priority
DBCA	Department of Parks and Wildlife, Western Australia (formerly the Department of Environment and Conservation)
Elliott trap	A collapsible aluminium box trap
EPA	Environmental Protection Authority, Western Australia.
EPBC Act	<i>Federal Environment Protection and Biodiversity Conservation Act 1999</i>
Fauna habitat	A collection of similar landforms likely to a discrete assemblage.
IBRA	Interim Biogeographic Regionalisation for Australia
Land System	A system of land classification. This system divides the region into broad units, each consisting of a series of "land units" that occur on characteristic physiographic types within the land system.
Opportunistic record	Recorded by non-systematic sampling methods
Study area	The area in which the fauna study was conducted, corresponding to the project development envelope
Systematic sampling	Sampling using trapping (including pitfall traps, Elliott traps and/or funnel traps) installed in a defined habitat.
WC Act	<i>Western Australian Wildlife Conservation Act 1950</i>



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# Appendix 1



## Desktop Review Results







## A1: Mammals

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	Mandora Mammals	This survey
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna						•	•		
<i>Dasyercus blythi</i>	Brush-tailed Mulgara	P4								•
<i>Dasyercus cristicauda</i>	Crest-tailed Mulgara	P4; VU					•	•		
<i>Dasykaluta rosamondae</i>	Little Red Kaluta			•	•	•	•	•		•
<i>Dasyurus hallucatus</i>	Northern Quoll	S2; EN	•				•	•		•
<i>Ningauai ridei</i>	Wongai Ningauai					•				
<i>Ningauai timealeyi</i>	Pilbara Ningauai			•	•		•	•		•
<i>Planigale ingrami</i>	Long-tailed Planigale					•	•			•
<i>Planigale maculata</i>	Common Planigale						•		•	
<i>Pseudantechinus macdonnellensis</i>	Fat-tailed Pseudantechinus					•	•			
<i>Pseudantechinus roryi</i>	Rory's Pseudantechinus			•	•					•
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	P4					•			
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart					•	•	•	•	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart			•	•	•		•	•	•
<i>Macrotis lagotis</i>	Bilby	S3; VU	•	•		•	•		•	•
<i>Notoryctes caurinus</i>	Northern Marsupial Mole	P4				•				•
<i>Notamacropus agilis</i>	Agile Wallaby								•	•
<i>Osphranter robustus</i>	Euro				•		•	•	•	
<i>Osphranter rufus</i>	Red Kangaroo, Marlu					•	•	•	•	•
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-wallaby	S2; VU								•
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby						•	•		
<i>Leggadina lakedownensis</i>	Short-tailed Mouse	P4						•		
<i>Mus musculus</i>	House Mouse		•	•	•	•	•	•	•	
<i>Notomys alexis</i>	Spinifex Hopping-mouse					•	•		•	•
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse	P4		•			•	•		•
<i>Pseudomys delicatulus</i>	Delicate Mouse					•	•	•		
<i>Pseudomys desertor</i>	Desert Mouse			•	•			•	•	•
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse			•	•	•	•	•	•	•
<i>Pseudomys nanus</i>	Western Chestnut Mouse					•			•	
<i>Rattus rattus</i>	Black Rat		•							
<i>Zyzomys argurus</i>	Common Rock-rat						•	•		
<i>Oryctolagus cuniculus</i>	European Rabbit					•				
<i>Pteropus scapulatus</i>	Little Red Flying-fox					•				
<i>Rhinonictes aurantia</i> (Pilbara Form)	Pilbara Leaf-nosed Bat	S3; VU	•				•	•		
<i>Macroderma gigas</i>	Ghost Bat	S3; VU	•		•		•			
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat					•	•	•	•	•
<i>Taphozous georgianus</i>	Common Sheath-tailed Bat			•	•		•	•		•

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	Mandora Mammals	This survey
<i>Taphozous hilli</i>	Hill's Sheath-tailed Bat					•	•	•		
<i>Austronomus australis</i>	White-striped Free-tailed Bat					•				•
<i>Chaerephon jobensis</i>	Greater Northern Free-tailed Bat					•	•	•	•	•
<i>Ozimops lumsdenae</i>	Northern Free-tailed Bat					•				•
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat					•	•	•		•
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat					•	•	•	•	•
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat					•				
<i>Scotorepens greyii</i>	Little Broad-nosed Bat						•	•		•
<i>Vespadelus baverstocki</i>	Inland Forest-bat							•		
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat			•	•		•	•		•
<i>Canis dingo</i>	Dingo					•	•	•	•	•
<i>Canis lupus</i>	Dog		•							•
<i>Vulpes vulpes</i>	Red Fox		•				•		•	•
<i>Felis catus</i>	Cat		•			•	•	•	•	•
<i>Equus asinus</i>	Donkey		•				•		•	
<i>Equus caballus</i>	Horse		•				•			
<i>Sus scrofa</i>	Pig		•							
<i>Camelus dromedarius</i>	Camel		•			•	•		•	•
<i>Bos taurus</i>	European Cattle							•	•	
<i>Capra hircus</i>	Goat						•			
<b>TOTAL</b>				<b>11</b>	<b>11</b>	<b>27</b>	<b>37</b>	<b>30</b>	<b>21</b>	<b>30</b>

## A2. Birds

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Dromaius novaehollandiae</i>	Emu					•			•
<i>Coturnix ypsilophora</i>	Brown Quail			•	•	•		•	•
<i>Pavo cristatus</i>	Indian Peafowl				•				
<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck			•	•				
<i>Stictonetta naevosa</i>	Freckled Duck				•				
<i>Cygnus atratus</i>	Black Swan				•	•			
<i>Tadorna tadornoides</i>	Australian Shelduck				•	•			
<i>Chenonetta jubata</i>	Australian Wood Duck				•	•			
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck			•	•	•			
<i>Anas gracilis</i>	Grey Teal			•	•	•	•	•	
<i>Anas superciliosa</i>	Pacific Black Duck		•		•			•	

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Aythya australis</i>	Hardhead			•	•	•		•	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe				•	•	•		
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe					•			
<i>Phaps chalcoptera</i>	Common Bronzewing					•		•	•
<i>Ocyphaps lophotes</i>	Crested Pigeon			•	•	•		•	•
<i>Geophaps plumifera</i>	Spinifex Pigeon			•	•	•	•	•	
<i>Geopelia cuneata</i>	Diamond Dove			•	•	•		•	•
<i>Geopelia striata</i>	Peaceful Dove			•	•	•		•	
<i>Geopelia humeralis</i>	Bar-shouldered Dove				•				
<i>Podargus strigoides</i>	Tawny Frogmouth								•
<i>Eurostopodus argus</i>	Spotted Nightjar			•	•	•	•	•	•
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar			•	•	•		•	
<i>Apus pacificus</i>	Fork-tailed Swift	S5; Ma, MI	•		•				
<i>Anhinga novaehollandiae</i>	Australasian Darter			•		•			
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant							•	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant							•	
<i>Pelecanus conspicillatus</i>	Australian Pelican			•		•		•	•
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork				•			•	
<i>Ardea pacifica</i>	White-necked Heron			•	•	•	•	•	•
<i>Ardea modesta</i>	Eastern Great Egret		•		•	•		•	
<i>Ardea intermedia</i>	Intermediate Egret				•				
<i>Ardea ibis</i>	Cattle Egret		•						
<i>Egretta novaehollandiae</i>	White-faced Heron				•	•		•	
<i>Egretta garzetta</i>	Little Egret				•				
<i>Nycticorax caledonicus</i>	Nankeen Night-Heron			•	•	•			•
<i>Plegadis falcinellus</i>	Glossy Ibis	S5; Ma, MI			•			•	
<i>Threskiornis molucca</i>	Australian White Ibis				•				
<i>Threskiornis spinicollis</i>	Straw-necked Ibis			•	•	•		•	
<i>Platalea regia</i>	Royal Spoonbill		•	•				•	
<i>Platalea flavipes</i>	Yellow-billed Spoonbill		•	•				•	
<i>Pandion cristatus</i>	Eastern Osprey	S5; Ma						•	
<i>Elanus axillaris</i>	Black-shouldered Kite				•	•		•	•
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard			•	•	•			•
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		•						
<i>Haliastur sphenurus</i>	Whistling Kite			•	•	•	•	•	•
<i>Milvus migrans</i>	Black Kite			•	•	•			
<i>Accipiter fasciatus</i>	Brown Goshawk				•	•		•	•
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					•			•



Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Circus assimilis</i>	Spotted Harrier			•	•	•		•	•
<i>Circus approximans</i>	Swamp Harrier				•	•			
<i>Aquila audax</i>	Wedge-tailed Eagle			•	•	•	•	•	•
<i>Hieraaetus morphnoides</i>	Little Eagle			•	•	•		•	•
<i>Falco cenchroides</i>	Nankeen Kestrel			•	•	•		•	•
<i>Falco berigora</i>	Brown Falcon			•	•	•	•	•	•
<i>Falco longipennis</i>	Australian Hobby			•	•	•		•	•
<i>Falco subniger</i>	Black Falcon					•			
<i>Falco peregrinus</i>	Peregrine Falcon	S7		•	•	•			
<i>Grus rubicunda</i>	Brolga				•	•			
<i>Porphyrio porphyrio</i>	Purple Swamphen				•				
<i>Gallirallus philippensis</i>	Buff-banded Rail				•			•	
<i>Porzana pusilla</i>	Baillon's Crake				•				
<i>Porzana fluminea</i>	Australian Spotted Crake							•	
<i>Tribonyx ventralis</i>	Black-tailed Native-hen					•			
<i>Fulica atra</i>	Eurasian Coot				•	•			
<i>Ardeotis australis</i>	Australian Bustard			•	•	•		•	•
<i>Burhinus grallarius</i>	Bush Stone-curlew							•	
<i>Himantopus himantopus</i>	Black-winged Stilt			•		•			
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet					•			
<i>Charadrius ruficapillus</i>	Red-capped Plover			•		•		•	
<i>Charadrius veredus</i>	Oriental Plover	S5; Ma, MI	•						
<i>Charadrius australis</i>	Inland Dotterel					•			
<i>Euseyonis melanops</i>	Black-fronted Dotterel					•		•	•
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel					•		•	
<i>Vanellus miles</i>	Masked Lapwing								•
<i>Rostratula australis</i>	Australian Painted Snipe	S2; EN	•						
<i>Numenius madagascariensis</i>	Eastern Curlew	S3&S5; CR, Ma, MI	•						
<i>Actitis hypoleucos</i>	Common Sandpiper	S5; Ma, MI	•			•		•	
<i>Tringa nebularia</i>	Common Greenshank	S5; Ma, MI	•		•	•		•	
<i>Tringa stagnatilis</i>	Marsh Sandpiper	S5; Ma, MI						•	
<i>Tringa glareola</i>	Wood Sandpiper	S5; Ma, MI					•	•	
<i>Calidris canutus</i>	Red Knot	EN, Ma, MI	•						
<i>Calidris ruficollis</i>	Red-necked Stint	S5; Ma, MI		•		•			
<i>Calidris fuscicollis</i>	White-rumped Sandpiper			•					
<i>Calidris melanotos</i>	Pectoral Sandpiper	S5; Ma, MI	•						
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	S5; MI	•						
<i>Calidris ferruginea</i>	Curlew Sandpiper	S3&S5; CR&MI	•						

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Turnix velox</i>	Little Button-quail			•	•	•		•	•
<i>Glareola maldivarum</i>	Oriental Pratincole	S5; MI	•		•				•
<i>Siltia isabella</i>	Australian Pratincole				•	•			
<i>Gelochelidon nilotica</i>	Gull-billed Tern	S5; MI				•			
<i>Hydroprogne caspia</i>	Caspian Tern	S5; MI				•			
<i>Chlidonias hybrida</i>	Whiskered Tern				•	•			
<i>Chlidonias leucopterus</i>	White-winged Black Tern	S5; MI			•				
<i>Chroicocephalus novaehollandiae</i>	Silver Gull					•			
<i>Calyptrorhynchus banksii</i>	Red-tailed Black-Cockatoo				•				•
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo					•			
<i>Eolophus roseicapillus</i>	Galah			•	•	•	•	•	•
<i>Cacatua sanguinea</i>	Little Corella			•	•	•	•	•	
<i>Nymphicus hollandicus</i>	Cockatiel			•	•	•			•
<i>Polytelis alexandrae</i>	Princess Parrot	P4; VU	•			•			
<i>Barnardius zonarius</i>	Australian Ringneck			•	•			•	
<i>Melopsittacus undulatus</i>	Budgerigar			•	•	•			•
<i>Pezoporus occidentalis</i>	Night Parrot	S1; EN	•						
<i>Centropus phasianinus</i>	Pheasant Coucal				•			•	•
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo				•	•		•	•
<i>Chalcites osculans</i>	Black-eared Cuckoo								•
<i>Cacomantis pallidus</i>	Pallid Cuckoo			•	•	•	•		•
<i>Cuculus optatus</i>	Oriental Cuckoo	S5; MI	•						
<i>Ninox novaeseelandiae</i>	Southern Boobook				•	•		•	
<i>Tyto javanica</i>	Eastern Barn Owl								•
<i>Dacelo leachii</i>	Blue-winged Kookaburra					•	•	•	
<i>Todiramphus pyrrophygius</i>	Red-backed Kingfisher			•	•	•		•	•
<i>Todiramphus sanctus</i>	Sacred Kingfisher				•	•		•	
<i>Merops ornatus</i>	Rainbow Bee-eater	MA	•	•	•	•	•	•	•
<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird			•	•				
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird							•	
<i>Malurus leucopterus</i>	White-winged Fairy-wren			•	•	•		•	•
<i>Malurus lamberti</i>	Variiegated Fairy-wren			•	•	•		•	•
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren					•			
<i>Amytornis striatus</i>	Striated Grasswren						•	•	•
<i>Calamanthus fuliginosus</i>	Striated Fieldwren					•			

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Pyrrholaemus brunneus</i>	Redthroat				•				
<i>Smicrornis brevirostris</i>	Weebill					•			
<i>Gerygone fusca</i>	Western Gerygone			•	•	•			
<i>Acanthiza apicalis</i>	Inland Thornbill					•			
<i>Aphelocephala nigricincta</i>	Banded Whiteface				•	•			
<i>Pardalotus rubricatus</i>	Red-browed Pardalote					•	•	•	
<i>Pardalotus striatus</i>	Striated Pardalote					•		•	
<i>Certhionyx variegatus</i>	Pied Honeyeater			•	•	•			•
<i>Lichenostomus virescens</i>	Singing Honeyeater				•	•	•	•	•
<i>Lichenostomus unicolor</i>	White-gaped Honeyeater				•				
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater				•	•	•	•	•
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater							•	
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater							•	
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater				•	•	•	•	
<i>Purnella albifrons</i>	White-fronted Honeyeater			•	•	•			
<i>Manorina flavigula</i>	Yellow-throated Miner			•	•	•	•	•	•
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater			•	•	•			•
<i>Epthianura tricolor</i>	Crimson Chat			•	•	•			•
<i>Epthianura aurifrons</i>	Orange Chat				•	•			
<i>Sugomel niger</i>	Black Honeyeater				•	•			•
<i>Lichmera indistincta</i>	Brown Honeyeater			•	•	•	•	•	•
<i>Melithreptus gularis</i>	Black-chinned Honeyeater			•	•	•		•	
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler					•		•	
<i>Pomatostomus superciliosus</i>	White-browed Babbler					•			
<i>Psophodes occidentalis</i>	Chiming Wedgebill			•	•	•			•
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			•	•	•	•	•	•
<i>Lalage sueurii</i>	White-winged Triller				•	•		•	•
<i>Pachycephala rufiventris</i>	Rufous Whistler			•	•	•		•	•
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			•	•	•	•		
<i>Oreoica gutturalis</i>	Crested Bellbird			•	•	•			•
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow			•	•				

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Artamus personatus</i>	Masked Woodswallow			•	•	•			•
<i>Artamus superciliosus</i>	White-browed Woodswallow			•	•				
<i>Artamus cinereus</i>	Black-faced Woodswallow			•	•	•	•	•	•
<i>Artamus minor</i>	Little Woodswallow					•	•	•	
<i>Cracticus nigrogularis</i>	Pied Butcherbird			•	•	•	•	•	•
<i>Cracticus tibicen</i>	Australian Magpie			•	•				
<i>Rhipidura leucophrys</i>	Willie Wagtail			•	•	•	•	•	•
<i>Corvus bennetti</i>	Little Crow				•		•		•
<i>Corvus orru</i>	Torresian Crow			•	•	•	•	•	•
<i>Grallina cyanoleuca</i>	Magpie-lark			•	•	•	•	•	
<i>Microeca fascinans</i>	Jacky Winter			•	•				
<i>Petroica goodenovii</i>	Red-capped Robin			•	•	•			
<i>Melanodryas cucullata</i>	Hooded Robin			•	•				
<i>Mirafra javanica</i>	Horsfield's Bushlark			•	•	•		•	•
<i>Acrocephalus australis</i>	Australian Reed-Warbler				•	•			
<i>Cincloramphus mathewsi</i>	Rufous Songlark				•			•	•
<i>Cincloramphus cruralis</i>	Brown Songlark				•	•		•	•
<i>Eremiornis carteri</i>	Spinifexbird				•	•	•	•	•
<i>Cheramoeca leucosterna</i>	White-backed Swallow					•			
<i>Hirundo rustica</i>	Barn Swallow	S5; MI	•						
<i>Petrochelidon ariel</i>	Fairy Martin				•	•	•	•	•
<i>Petrochelidon nigricans</i>	Tree Martin				•	•		•	
<i>Dicaeum hirundinaceum</i>	Mistletoebird					•		•	
<i>Taeniopygia guttata</i>	Zebra Finch			•	•	•	•	•	•
<i>Neochmia ruficauda</i>	Star Finch							•	
<i>Emblema pictum</i>	Painted Finch				•	•	•	•	•
<i>Heteromunia pectoralis</i>	Pictorella Mannikin							•	•
<i>Anthus novaeseelandiae</i>	Australasian Pipit				•	•	•	•	•
<i>Motacilla tschutschensis</i>	Yellow Wagtail	S5; MI	•						
<i>Motacilla cinerea</i>	Grey Wagtail	S5; MI	•						
<b>TOTAL (includes water birds)</b>				72	116	120	35	90	68
<b>TOTAL (Terrestrial)</b>				<b>55</b>	<b>84</b>	<b>87</b>	<b>30</b>	<b>64</b>	<b>60</b>



**A3: Reptiles**

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Chelodina steindachneri</i>	Flat-shelled Turtle							•	
<i>Nephurus laevis</i>				•	•	•			•
<i>Nephurus levis</i>				•	•	•		•	•
<i>Crenadactylus ocellatus</i>								•	
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko			•	•	•		•	
<i>Diplodactylus laevis</i>	Desert Fat-tailed Gecko			•					•
<i>Diplodactylus savagei</i>	Southern Pilbara Beak-faced Gecko							•	
<i>Lucasium stenodactylum</i>				•	•	•		•	•
<i>Lucasium wombeyi</i>				•	•			•	
<i>Oedura fimbria</i>	Marbled Velvet Gecko			•	•	•			•
<i>Rhynchoedura ornata</i>	Western Beaked Gecko			•	•	•		•	•
<i>Strophurus ciliaris</i>				•	•	•		•	•
<i>Strophurus elderi</i>				•	•	•			•
<i>Strophurus jeanae</i>						•			•
<i>Gehyra pilbara</i>				•	•	•			•
<i>Gehyra punctata</i>				•	•			•	•
<i>Gehyra purpurascens</i>				•	•	•		•	•
<i>Gehyra variegata</i>				•	•	•	•	•	•
<i>Hemidactylus frenatus</i>	Asian House Gecko				•				
<i>Heteronotia binoei</i>	Bynoe's Gecko			•	•	•		•	•
<i>Heteronotia spelea</i>	Pilbara Cave Gecko							•	
<i>Delma borea</i>						•			
<i>Delma butleri</i>	Delma haroldi				•				•
<i>Delma desmosa</i>				•	•				•
<i>Delma elegans</i>								•	
<i>Delma nasuta</i>				•	•	•			•
<i>Delma pax</i>				•				•	
<i>Delma tinctoria</i>								•	
<i>Lialis burtonis</i>				•	•	•		•	•
<i>Pygopus nigriceps</i>				•		•			•
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon			•	•	•	•	•	•
<i>Ctenophorus clayi</i>	Collared Dragon					•			
<i>Ctenophorus isolepis</i>	Crested Dragon			•	•	•	•	•	•
<i>Ctenophorus nuchalis</i>	Central Notted Dragon				•	•	•	•	•
<i>Diporiphora paraconvergens</i>	Grey-striped Western Desert Dragon			•	•				•
<i>Diporiphora pindan</i>	Pindan Dragon			•	•	•			•
<i>Diporiphora vescu</i>	Northern Pilbara Tree Dragon								•

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Gowidon longirostris</i>	Long-nosed Dragon			•		•		•	•
<i>Lophognathus gilberti</i>	Ta-Ta or Gilbert's Dragon			•	•				
<i>Moloch horridus</i>	Thorny Devil			•	•	•			•
<i>Pogona minor</i>	Dwarf Bearded Dragon			•	•	•		•	•
<i>Carlia munda</i>								•	
<i>Carlia triacantha</i>	Desert Rainbow Skink			•	•	•		•	•
<i>Cryptoblepharus plagiocephalus</i>						•	•	•	
<i>Ctenotus angusticeps</i>		P3; VU	✓						
<i>Ctenotus ariadnae</i>						•			
<i>Ctenotus brooksi</i>				•	•	•			
<i>Ctenotus calurus</i>				•	•	•			•
<i>Ctenotus colletti</i>						•			
<i>Ctenotus duricola</i>				•	•				
<i>Ctenotus dux</i>						•			
<i>Ctenotus grandis</i>				•		•			•
<i>Ctenotus hanloni</i>						•			
<i>Ctenotus helenae</i>				•	•	•		•	•
<i>Ctenotus inornatus</i>					•				
<i>Ctenotus leonhardii</i>						•			
<i>Ctenotus nasutus</i>				•	•	•			
<i>Ctenotus pantherinus</i>	Leopard Ctenotus			•				•	•
<i>Ctenotus piankai</i>				•	•	•		•	•
<i>Ctenotus quattuordecimlineatus</i>				•	•	•			•
<i>Ctenotus rubicundus</i>								•	
<i>Ctenotus rufescens</i>									•
<i>Ctenotus saxatilis</i>	Rock Ctenotus			•		•		•	•
<i>Ctenotus schomburgkii</i>					•				•
<i>Ctenotus tanamiensis</i>						•			
<i>Cyclodomorphus melanops</i>	Slender Blue-tongue			•	•			•	
<i>Egernia cygnifos</i>	Western Pilbara Spiny-tailed Skink					•		•	•
<i>Eremiascincus isolepis</i>					•	•			•
<i>Eremiascincus musivus</i>	Mosaic Desert Skink			•	•				•
<i>Eremiascincus pallidus</i>	Western Narrow-banded Skink			•	•	•			•
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer					•			•
<i>Lerista bipes</i>				•	•	•		•	
<i>Lerista clara</i>					•				•

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Lerista ips</i>				•	•	•			
<i>Lerista jacksoni</i>								•	
<i>Lerista separanda</i>	Dampierland Plain Slider	P2		•	•				•
<i>Lerista verhmens</i>				•	•				
<i>Lerista vermicularis</i>						•		•	
<i>Liopholis kintorei</i>	Great Desert Skink	S3; VU				•			
<i>Liopholis striata</i>	Night Skink					•			
<i>Menetia greyii</i>				•	•	•		•	•
<i>Morethia ruficauda</i>				•	•	•		•	
<i>Notoscincus ornatus</i>				•		•			•
<i>Proablepharus reginae</i>				•		•			
<i>Tiliqua multifasciata</i>	Central Blue-tongue			•	•	•			•
<i>Varanus acanthurus</i>	Spiny-tailed Monitor			•		•		•	•
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor			•	•	•			•
<i>Varanus caudolineatus</i>						•		•	
<i>Varanus eremius</i>	Pygmy Desert Goanna					•		•	•
<i>Varanus giganteus</i>	Perentie							•	•
<i>Varanus gilleni</i>	Pygmy Mulga Goanna					•			•
<i>Varanus gouldii</i>	Bungarra or Sand Monitor			•	•	•	•	•	•
<i>Varanus panoptes</i>	Yellow-spotted Goanna							•	
<i>Varanus pilbarensis</i>	Northern Pilbara Rock Goanna							•	
<i>Varanus tristis</i>	Racehorse Goanna					•		•	
<i>Anilius ammodytes</i>					•				•
<i>Anilius endoterus</i>						•			
<i>Anilius grypus</i>					•	•		•	•
<i>Anilius hamatus</i>					•				
<i>Anilius pilbarensis</i>					•				•
<i>Antaresia perthensis</i>	Pygmy Python			•	•	•		•	
<i>Antaresia stimsoni</i>	Stimson's Python							•	•
<i>Aspidites melanocephalus</i>	Black-headed Python			•	•				•
<i>Aspidites ramsayi</i>	Woma	P1		•		•			
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	S3; VU	•				•	•	
<i>Acanthophis pyrrhus</i>	Desert Death Adder				•			•	
<i>Brachyuropis approximans</i>								•	
<i>Brachyuropis fasciolatus</i>	Narrow-banded Shovel-nosed Snake			•	•				
<i>Demansia psammophis</i>	Yellow-faced Whipsnake							•	•
<i>Demansia rufescens</i>	Rufous Whipsnake							•	•
<i>Furina ornata</i>	Moon Snake				•	•		•	•

Species Name	Common Name	Conservation Status (State; C'w)	EPBC PMST	Nature Map	ALA	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Pseudechis australis</i>	Mulga Snake			•	•	•		•	•
<i>Pseudonaja mengdeni</i>	Western Brown Snake				•				•
<i>Pseudonaja modesta</i>	Ringed Brown Snake			•	•	•		•	•
<i>Pseudonaja nuchalis</i>	Gwardar; Northern Brown Snake							•	
<i>Simoselaps anomalus</i>	Desert Banded Snake			•	•	•		•	•
<b>TOTAL</b>				<b>61</b>	<b>64</b>	<b>70</b>	<b>7</b>	<b>59</b>	<b>70</b>

**A4: Amphibians**

Species Name	Common Name	Conservation Status (State; C'w)	Nature Map	ALA	EPBC PMST	WAM GSD	Gold'w Lvl1	Gold'w Lvl2	This survey
<i>Cyclorana australis</i>	Giant Frog			•		•			•
<i>Cyclorana longipes</i>	Long-footed Frog								•
<i>Cyclorana maini</i>	Sheep Frog					•		•	
<i>Cyclorana occidentalis</i>	Water Holding Frog								
<i>Litoria rubella</i>	Little Red Tree Frog					•		•	
<i>Neobatrachus aquilonius</i>	Northern Burrowing Frog		•	•					
<i>Notaden nichollsi</i>	Desert Spadefoot			•		•			•
<i>Platyplectrum spenceri</i>	Centralian Burrowing Frog					•		•	
<i>Uperoleia glandulosa</i>	Glandular Toadlet							•	
<i>Uperoleia micromeles</i>	Tanami Toadlet								•
<i>Uperoleia russelli</i>	Northwest Toadlet						•		
<b>TOTAL</b>			<b>1</b>	<b>3</b>	<b>0</b>	<b>5</b>	<b>1</b>	<b>4</b>	<b>4</b>





## Appendix 2

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### Database Search Results







# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 15/08/17 16:50:00

[Summary](#)

[Details](#)

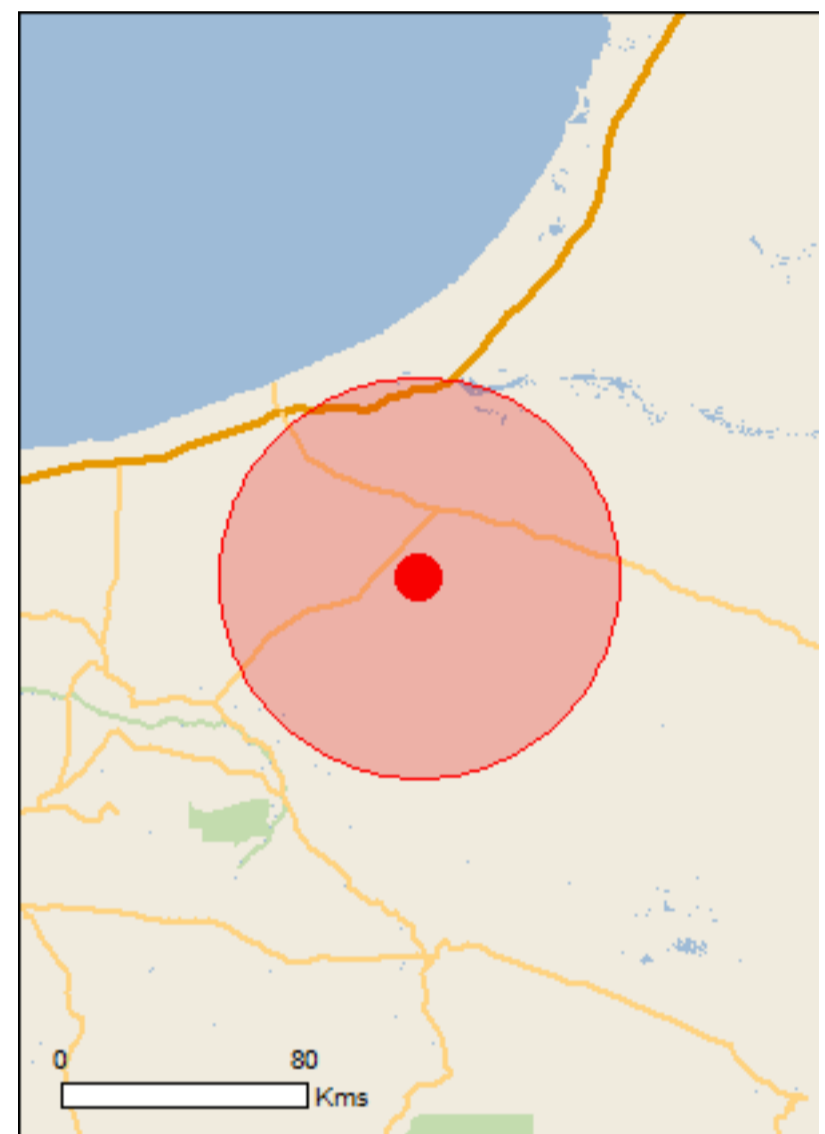
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

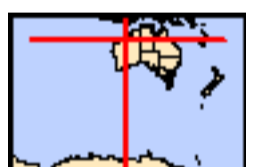
[Acknowledgements](#)



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Buffer: 65.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	1
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	12
<a href="#">Listed Migratory Species:</a>	15

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	20
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	12
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[ Resource Information ]
Name	Proximity
<a href="#">Eighty-mile beach</a>	Within Ramsar site

## Listed Threatened Species [ Resource Information ]

Name	Status	Type of Presence
------	--------	------------------

<b>Birds</b>		
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area

<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
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<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
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<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
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<a href="#">Polytelis alexandrae</a> Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
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<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
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## Mammals

<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
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<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
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<a href="#">Macrotis lagotis</a> Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
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<a href="#">Rhinonicteris aurantia (Pilbara form)</a> Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
---	------------	--

## Reptiles

<a href="#">Ctenotus angusticeps</a> Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat may occur within area
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<a href="#">Liasis olivaceus barroni</a> Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species
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Name	Status	Type of Presence
habitat likely to occur within area		
<b>Listed Migratory Species</b>		<a href="#">[ Resource Information ]</a>
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat known to occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Other Matters Protected by the EPBC Act

### Listed Marine Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a>		
Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Apus pacificus</a>		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a>		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a>		
Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a>		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a>		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a>		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a>		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Charadrius veredus</a>		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Cuculus saturatus</a>		
Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a>		
Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a>		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Hirundo rustica</a>		
Barn Swallow [662]		Species or species habitat known to occur within area
<a href="#">Merops ornatus</a>		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a>		
Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a>		
Yellow Wagtail [644]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

## Extra Information

State and Territory Reserves	[ Resource Information ]
Name	State
Nyangumarta Warrarn	WA

Invasive Species	[ Resource Information ]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
<b>Mammals</b>		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
<b>Reptiles</b>		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-20.29018 121.09472

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



# NatureMap Species Report

Created By Jacinta King on 15/08/2017

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 121° 25' 07" E, 20° 10' 46" S  
**Buffer** 35km  
**Group By** Species Group

Species Group	Species	Records
Bird	33	106
Reptile	15	44
<b>TOTAL</b>	<b>48</b>	<b>150</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Bird</b>				
1.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
2.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
3.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
4.	24357 <i>Artamus superciliosus</i> (White-browed Woodswallow)			
5.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
6.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
7.	24564 <i>Certhionyx variegatus</i> (Pied Honeyeater)			
8.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
9.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
10.	25701 <i>Coturnix ypsilophora</i> (Brown Quail)			
11.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
12.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
13.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
14.	25621 <i>Falco berigora</i> (Brown Falcon)			
15.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
16.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
17.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
18.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
19.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
20.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
21.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
22.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
23.	25693 <i>Microeca fascians</i> (Jacky Winter)			
24.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
25.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
26.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
27.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
28.	24390 <i>Psophodes occidentalis</i> (Western Wedgebill, Chiming Wedgebill)			
29.	42344 <i>Purnella albifrons</i> (White-fronted Honeyeater)			
30.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
31.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
32.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
33.	24851 <i>Turnix velox</i> (Little Button-quail)			
<b>Reptile</b>				
34.	25320 <i>Aspidites melanocephalus</i> (Black-headed Python)			
35.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
36.	25045 <i>Ctenotus helenae</i>			
37.	25064 <i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)			
38.	24926 <i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
39.	24896 <i>Diporiphora pindan</i> (Pindan Dragon)			
40.	24956 <i>Gehyra pilbara</i>			
41.	24957 <i>Gehyra purpurascens</i>			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
42.	24961	<i>Heteronotia binoei</i> (Bynoe's Gecko)			
43.	24967	<i>Nephrurus levis</i> subsp. <i>levis</i>			
44.	25263	<i>Pseudonaja modesta</i> (Ringed Brown Snake)			
45.	24982	<i>Rhynchoedura ornata</i> (Western Beaked Gecko)			
46.	24924	<i>Strophurus ciliaris</i> subsp. <i>aberrans</i>			
47.	25202	<i>Tiliqua multifasciata</i> (Central Blue-tongue)			
48.	25218	<i>Varanus gouldii</i> (Bungarra or Sand Monitor)			

**Conservation Codes**

T - Rare or likely to become extinct  
 X - Presumed extinct  
 IA - Protected under international agreement  
 S - Other specially protected fauna  
 1 - Priority 1  
 2 - Priority 2  
 3 - Priority 3  
 4 - Priority 4  
 5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# NatureMap Species Report

Created By Jacinta King on 15/08/2017

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 120° 57' 26" E, 20° 06' 01" S  
**Buffer** 35km  
**Group By** Species Group

Species Group	Species	Records
Bird	41	143
Mammal	3	9
Reptile	24	69
<b>TOTAL</b>	<b>68</b>	<b>221</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Bird</b>				
1.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
2.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
3.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
4.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
5.	25567 <i>Artamus leucorhynchus</i> (White-breasted Woodswallow)			
6.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
7.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
8.	24564 <i>Certhionyx variegatus</i> (Pied Honeyeater)			
9.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
10.	25593 <i>Corvus orru</i> (Torresian Crow)			
11.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
12.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
13.	<i>Eolophus roseicapillus</i>			
14.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
15.	25621 <i>Falco berigora</i> (Brown Falcon)			
16.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
17.	25623 <i>Falco longipennis</i> (Australian Hobby)			
18.	25585 <i>Geopelia striata</i> (Zebra Dove)			
19.	24271 <i>Gerygone fusca subsp. fusca</i> (Western Gerygone)			
20.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
21.	24295 <i>Haliastur spheurnus</i> (Whistling Kite)			
22.	24297 <i>Hamirostra melanosternon</i> (Black-breasted Buzzard)			
23.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
24.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
25.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
26.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
27.	47997 <i>Melanodryas cucullata</i> (Hooded Robin)			
28.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
29.	25693 <i>Microeca fascinans</i> (Jacky Winter)			
30.	25542 <i>Milvus migrans</i> (Black Kite)			
31.	25545 <i>Mirafra javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
32.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
33.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
34.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
35.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
36.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
37.	42344 <i>Purnella albifrons</i> (White-fronted Honeyeater)			
38.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
39.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
40.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
41.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			

**Mammal**

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
42.	24168 <i>Macrotis lagotis</i> (Bilby, Dalgyte)		T	
43.	24175 <i>Taphozous georgianus</i> (Common Sheath-tailed Bat)			
44.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
<b>Reptile</b>				
45.	30831 <i>Amphibolurus gilberti</i> (Ta-ta, Gilbert's Dragon)			
46.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
47.	25236 <i>Aspidites ramsayi</i> (Woma)			
48.	42374 <i>Brachyurophis fasciolatus</i> subsp. <i>fasciatus</i> (Narrow-banded Shovel-nosed Snake)			
49.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
50.	25461 <i>Ctenotus brooksi</i>			
51.	25045 <i>Ctenotus helenae</i>			
52.	25064 <i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)			
53.	25062 <i>Ctenotus piankai</i>			
54.	25073 <i>Ctenotus saxatilis</i> (Rock Ctenotus)			
55.	24926 <i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
56.	24896 <i>Diporiphora pindan</i> (Pindan Dragon)			
57.	41409 <i>Eremiascincus musivus</i> (Mosaic Desert Skink)			
58.	24956 <i>Gehyra pilbara</i>			
59.	24957 <i>Gehyra purpurascens</i>			
60.	24959 <i>Gehyra variegata</i>			
61.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
62.	24904 <i>Moloch horridus</i> (Thorny Devil)			
63.	24966 <i>Nephruerus laevissimus</i>			
64.	24967 <i>Nephruerus levis</i> subsp. <i>levis</i>			
65.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
66.	24982 <i>Rhynchoedura ornata</i> (Western Beaked Gecko)			
67.	24924 <i>Strophurus ciliaris</i> subsp. <i>aberrans</i>			
68.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			

**Conservation Codes**

T - Rare or likely to become extinct  
 X - Presumed extinct  
 IA - Protected under international agreement  
 S - Other specially protected fauna  
 1 - Priority 1  
 2 - Priority 2  
 3 - Priority 3  
 4 - Priority 4  
 5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# NatureMap Species Report

Created By Jacinta King on 15/08/2017

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 121° 10' 59" E, 20° 33' 08" S  
**Buffer** 35km  
**Group By** Species Group

Species Group	Species	Records
Bird	1	1
Invertebrate	3	3
Mammal	7	11
Reptile	26	51
<b>TOTAL</b>	<b>37</b>	<b>66</b>

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Bird</b>				
1.	24613 <i>Colluricincla harmonica subsp. rufiventris</i> (Grey Shrike-thrush)			
<b>Invertebrate</b>				
2.	<i>Aname ellenae</i>			
3.	<i>Morebilus diversus</i>			
4.	<i>Xestaspis linnaei</i>			
<b>Mammal</b>				
5.	24091 <i>Dasykaluta rosamondae</i> (Little Red Kaluta)			
6.	24223 <i>Mus musculus</i> (House Mouse)	Y		
7.	24105 <i>Pseudantechinus roryi</i> (Rory's Pseudantechinus)			
8.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadji)		P4	
9.	24235 <i>Pseudomys desertor</i> (Desert Mouse)			
10.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
11.	24120 <i>Sminthopsis youngsoni</i> (Lesser Hairy-footed Dunnart)			
<b>Reptile</b>				
12.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
13.	25017 <i>Carlia triacantha</i> (Desert Rainbow Skink)			
14.	24865 <i>Ctenophorus caudicinctus subsp. caudicinctus</i> (Ring-tailed Dragon)			
15.	24876 <i>Ctenophorus isolepis subsp. isolepis</i> (Crested Dragon, Military Dragon)			
16.	25032 <i>Ctenotus calurus</i>			
17.	25036 <i>Ctenotus duricola</i>			
18.	25057 <i>Ctenotus nasutus</i>			
19.	25064 <i>Ctenotus pantherinus subsp. ocellifer</i> (Leopard Ctenotus)			
20.	25090 <i>Cyclodomorphus melanops subsp. melanops</i> (Slender Blue-tongue)			
21.	30830 <i>Delma desmosa</i>			
22.	25001 <i>Delma nasuta</i>			
23.	24926 <i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
24.	24896 <i>Diporiphora pindan</i> (Pindan Dragon)			
25.	41409 <i>Eremiascincus musivus</i> (Mosaic Desert Skink)			
26.	24958 <i>Gehyra punctata</i>			
27.	24959 <i>Gehyra variegata</i>			
28.	25125 <i>Lerista bipes</i>			
29.	25170 <i>Lerista separanda</i> (Dampierland Plain Slider, skink)		P2	
30.	30925 <i>Lerista verhmens</i>			
31.	25005 <i>Lialis burtonis</i>			
32.	30933 <i>Lucasium stenodactylum</i>			
33.	30934 <i>Lucasium wombeyi</i>			
34.	24904 <i>Moloch horridus</i> (Thorny Devil)			
35.	25194 <i>Morethia ruficauda subsp. ruficauda</i>			
36.	24907 <i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
37.	25199 <i>Proablepharus reginae</i>			

Name ID Species Name

Naturalised

Conservation Code

<sup>1</sup>Endemic To Query Area

**Conservation Codes**

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



# NatureMap Species Report

Created By Jacinta King on 15/08/2017

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 120° 48' 57" E, 20° 25' 38" S  
**Buffer** 35km  
**Group By** Species Group

Species Group	Species	Records
Amphibian	1	2
Bird	52	73
Invertebrate	58	60
Mammal	9	19
Reptile	48	165
<b>TOTAL</b>	<b>168</b>	<b>319</b>

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Amphibian</b>				
1.	25422 <i>Neobatrachus aquilonius</i> (Northern Burrowing Frog)			
<b>Bird</b>				
2.	24312 <i>Anas gracilis</i> (Grey Teal)			
3.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
4.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
5.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
6.	24318 <i>Aythya australis</i> (Hardhead)			
7.	<i>Barnardius zonarius</i>			
8.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
9.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
10.	24785 <i>Calidris fuscicollis</i> (White-rumped Sandpiper)			Y
11.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
12.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
13.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
14.	24613 <i>Colluricincla harmonica</i> subsp. <i>rufiventris</i> (Grey Shrike-thrush)			
15.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
16.	24363 <i>Coracina novaehollandiae</i> subsp. <i>subpallida</i> (Black-faced Cuckoo-shrike)			
17.	25593 <i>Corvus orru</i> (Torresian Crow)			
18.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
19.	24325 <i>Dendrocygna eytoni</i> (Plumed Whistling Duck)			
20.	<i>Eolophus roseicapillus</i>			
21.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
22.	25621 <i>Falco berigora</i> (Brown Falcon)			
23.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
24.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
25.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
26.	24404 <i>Geophaps plumifera</i> (Spinifex Pigeon)			
27.	24271 <i>Gerygone fusca</i> subsp. <i>fusca</i> (Western Gerygone)			
28.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
29.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
30.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
31.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
32.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
33.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
34.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
35.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
36.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
37.	24589 <i>Melithreptus gularis</i> subsp. <i>laetior</i> (Black-chinned Honeyeater)			
38.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
39.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
40.	25542 <i>Milvus migrans</i> (Black Kite)			
41.	25545 <i>Mirafra javanica</i> (Horsfield's Bushlark, Singing Bushlark)			
42.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
43.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
44.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
45.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
46.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
47.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
48.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
49.	24757 <i>Ptilonorhynchus maculatus</i> subsp. <i>guttatus</i> (Western Bowerbird)			
50.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
51.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
52.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
53.	24851 <i>Turnix velox</i> (Little Button-quail)			

**Invertebrate**

54.	' <i>Amphitritecandona</i> ' <i>prima</i> (pss)			
55.	<i>Acariformes</i> sp.			
56.	<i>Achnanthyidium minutissima</i> (Kütz.) Czarneci			
57.	<i>Alona rectangula novaezealandiae</i>			
58.	<i>Aname ellenae</i>			
59.	<i>Anisops canaliculatus</i>			
60.	<i>Anisops elstoni</i>			
61.	<i>Anisops nasuta</i>			
62.	<i>Anisops stali</i>			
63.	<i>Anomoeoneis styriaca</i> (Grun.) Hust.			
64.	<i>Bennelongia barangaroo</i>			
65.	<i>Boeckella triarticulata</i>			
66.	<i>Calamoecia baylyi</i> (Cue form) (ex nr <i>lucasi</i> CB)			
67.	<i>Cloeon</i> sp.			
68.	<i>Conchostraca</i> (unident.)			
69.	<i>Copelatus nigrolineatus</i>			
70.	<i>Craticula cuspidata</i> (Grun. ex. Van Heurck) Mann			
71.	<i>Cyprretta seurati</i>			
72.	<i>Cypricercus salinus</i>			
73.	<i>Daphnia projecta</i>			
74.	<i>Diaphanosoma unguiculatum</i>			
75.	<i>Enochrus deserticola</i>			
76.	<i>Eretes australis</i>			
77.	<i>Euchlanis</i> sp.			
78.	<i>Eunotia pectinatus</i> (Dillw.) Rabh.			
79.	<i>Halacaridae</i> sp.			
80.	<i>Hantzschia virgata</i>			
81.	<i>Helochares foveicollis</i>			Y
82.	<i>Hemicordulia tau</i>			
83.	<i>Hydroglyphus basalis</i> var <i>fuscolineatus</i>			Y
84.	<i>Hydroglyphus grammopterus</i> (=trilineatus)			
85.	<i>Hydrophilus brevispina</i>			
86.	<i>Hydrovatus rufofiger</i>			
87.	<i>Hyphydrus lyratus</i>			
88.	<i>Ilyocypris australiensis</i>			
89.	<i>Ischnura aurora aurora</i>			
90.	<i>Lecane</i> cf. <i>spenceri</i> (PSW)			
91.	<i>Limnocytheridae</i> n.gen. sp 419 (CB)			
92.	<i>Mesocyclops notius</i>			
93.	<i>Micronecta virgata</i>			
94.	<i>Morebilus diversus</i>			
95.	<i>Navicula molestiformis</i> Hust.			
96.	<i>Navicula subrhynchocephala</i> Hust.			
97.	<i>Nitzschia calida</i> Grun.			
98.	<i>Nitzschia filiformis</i> (W. Sm.) Van Heurck			
99.	<i>Nitzschia palea</i> (Kütz.) W. Sm.			
100.	<i>Nitzschia umbonata</i> (Ehr.) Lange-Bertalot			
101.	<i>Oecetis</i> sp.			
102.	<i>Pentaneurini</i> sp.			
103.	<i>Polypedilum leei</i>			
104.	<i>Procladius Pilbara</i> sp. 1 (PSW)			
105.	<i>Regimbartia attenuata</i>			
106.	<i>Stauroneis anceps</i> Ehr.			
107.	<i>Tamopsis facialis</i>			
108.	<i>Testudinella</i> cf. <i>elliptica</i> (PSW)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
109.	<i>Thermocyclops decipiens</i>			Y
110.	<i>Xestaspis linnaei</i>			Y
111.	<i>Zonocyprretta kalimna</i>			
<b>Mammal</b>				
112.	24091 <i>Dasykaluta rosamondae</i> (Little Red Kaluta)			
113.	24095 <i>Ningaiu timealeyi</i> (Pilbara Ningai)			
114.	24105 <i>Pseudantechinus roryi</i> (Rory's Pseudantechinus)			
115.	24233 <i>Pseudomys chapmani</i> (Western Pebble-mound Mouse, Ngadji)		P4	
116.	24235 <i>Pseudomys desertor</i> (Desert Mouse)			
117.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
118.	24120 <i>Sminthopsis youngsoni</i> (Lesser Hairy-footed Dunnart)			
119.	24175 <i>Taphozous georgianus</i> (Common Sheath-tailed Bat)			
120.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
<b>Reptile</b>				
121.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
122.	25318 <i>Antaresia perthensis</i> (Pygmy Python)			
123.	25017 <i>Carlia triacantha</i> (Desert Rainbow Skink)			
124.	25459 <i>Ctenophorus isolepis</i> (Crested Dragon, Military Dragon)			
125.	24876 <i>Ctenophorus isolepis</i> subsp. <i>isolepis</i> (Crested Dragon, Military Dragon)			
126.	25461 <i>Ctenotus brooksi</i>			
127.	25032 <i>Ctenotus calurus</i>			
128.	25036 <i>Ctenotus duricola</i>			
129.	25462 <i>Ctenotus grandis</i>			
130.	25045 <i>Ctenotus helenae</i>			
131.	25057 <i>Ctenotus nasutus</i>			
132.	25463 <i>Ctenotus pantherinus</i> (Leopard Ctenotus)			
133.	25064 <i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i> (Leopard Ctenotus)			
134.	25066 <i>Ctenotus quatuordecimlineatus</i>			
135.	25073 <i>Ctenotus saxatilis</i> (Rock Ctenotus)			
136.	30830 <i>Delma desmosa</i>			
137.	25002 <i>Delma pax</i>			
138.	24926 <i>Diplodactylus conspicillatus</i> (Fat-tailed Gecko)			
139.	47934 <i>Diplodactylus laevis</i> (Desert Fat-tailed Gecko)			Y
140.	42401 <i>Diporiphora paraconvergens</i> (Grey-striped Western Desert Dragon)			
141.	24896 <i>Diporiphora pindan</i> (Pindan Dragon)			
142.	41409 <i>Eremiascincus musivus</i> (Mosaic Desert Skink)			
143.	43381 <i>Eremiascincus pallidus</i> (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)			
144.	24956 <i>Gehyra pilbara</i>			
145.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
146.	25125 <i>Lerista bipes</i>			
147.	25142 <i>Lerista ips</i>			
148.	25170 <i>Lerista separanda</i> (Dampierland Plain Slider, skink)		P2	
149.	30933 <i>Lucasium stenodactylum</i>			
150.	25184 <i>Menetia greyii</i>			
151.	24904 <i>Moloch horridus</i> (Thorny Devil)			
152.	25495 <i>Morethia ruficauda</i>			
153.	25194 <i>Morethia ruficauda</i> subsp. <i>ruficauda</i>			
154.	24966 <i>Nephurus laevissimus</i>			
155.	25499 <i>Notoscincus ornatus</i>			
156.	<i>Oedura fimbria</i>			Y
157.	24976 <i>Oedura marmorata</i> (Marbled Velvet Gecko)			
158.	24907 <i>Pogona minor</i> subsp. <i>minor</i> (Dwarf Bearded Dragon)			
159.	24908 <i>Pogona minor</i> subsp. <i>mitchelli</i> (Dwarf Bearded Dragon)			
160.	25261 <i>Pseudechis australis</i> (Mulga Snake)			
161.	25009 <i>Pygopus nigriceps</i>			
162.	24982 <i>Rhynchoedura ornata</i> (Western Beaked Gecko)			
163.	25305 <i>Simoselaps anomalus</i> (Desert Banded Snake)			
164.	24924 <i>Strophurus ciliaris</i> subsp. <i>aberrans</i>			
165.	24927 <i>Strophurus elderi</i>			
166.	25209 <i>Varanus acanthurus</i> (Spiny-tailed Monitor)			
167.	25210 <i>Varanus brevicauda</i> (Short-tailed Pygmy Monitor)			
168.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			

**Conservation Codes**  
T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
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- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Scientific Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family	Number of records
<i>Acanthophis pyrrhus</i>	Boulenger, 1898	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	2
<i>Acanthophis rugosus</i>	Loveridge, 1948	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	2
<i>Anilius ammodytes</i>	(Montague, 1914)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	TYPHLOPIDAE	5
<i>Anilius grypus</i>	(Waite, 1918)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	TYPHLOPIDAE	1
<i>Anilius hamatus</i>	(Storr, 1981)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	TYPHLOPIDAE	2
<i>Anilius pilbarensis</i>	(Aplin & Donnellan, 1993)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	TYPHLOPIDAE	4
<i>Antaresia perthensis</i>	(Stull, 1932)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYTHONIDAE	3
<i>Aspidites melanocephalus</i>	(Krefft, 1864)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYTHONIDAE	1
<i>Aspidites ramsayi</i>	(Macleay, 1882)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYTHONIDAE	2
<i>Brachyuropis fasciolatus fasciatus</i>	(Sterling & Zietz, 1893)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	1
<i>Carlia triacantha</i>	(Mitchell, 1953)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	3
<i>Ctenophorus caudicinctus caudicinctus</i>	(GÄ¼nther, 1875)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	2
<i>Ctenophorus caudicinctus</i>	(GÄ¼nther, 1875)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	1
<i>Ctenophorus isolepis isolepis</i>	(Fischer, 1881)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	27
<i>Ctenophorus isolepis</i>	(Fischer, 1881)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	3
<i>Ctenophorus nuchalis</i>	(De Vis, 1884)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	2
<i>Ctenotus brooksi</i>	(Loveridge, 1933)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	3
<i>Ctenotus calurus</i>	Storr, 1969	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Ctenotus duricola</i>	Storr, 1975	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	4
<i>Ctenotus helenae</i>	Storr, 1969	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	4
<i>Ctenotus inornatus</i>	(J.E. Gray, 1845)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	7
<i>Ctenotus nasutus</i>	Storr, 1969	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	4
<i>Ctenotus pantherinus ocellifer</i>	(Boulenger, 1896)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	5
<i>Ctenotus piankai</i>	Storr, 1969	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Ctenotus quattuordecimlineatus</i>	(Sternfeld, 1919)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	3
<i>Ctenotus schomburgkii</i>	(Peters, 1863)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Cyclodomorphus melanops melanops</i>	(Stirling & Zietz, 1893)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	2
<i>Delma desmosa</i>	Maryan, Aplin & Adams, 2007	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYGOPODIDAE	8
<i>Delma haroldi</i>	Storr, 1987	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYGOPODIDAE	1
<i>Delma nasuta</i>	Kluge, 1974	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYGOPODIDAE	4
<i>Diplodactylus conspicillatus</i>	Lucas & Frost, 1897	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	7
<i>Diporiphora paraconvergens</i>	Doughty, Kealley & Melville, 2012	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	2
<i>Diporiphora pindan</i>	Storr, 1979	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	9
<i>Eremiascincus isolepis</i>	(Boulenger, 1887)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Eremiascincus musivus</i>	Mecke, Doughty & Donnellan, 2009	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	7
<i>Eremiascincus pallidus</i>	(GÄ¼nther, 1875)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	6
<i>Furina ornata</i>	(J.E. Gray, 1842)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	2
<i>Gehyra pilbara</i>	Mitchell, 1965	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	6
<i>Gehyra punctata</i>	(Fry, 1914)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	4
<i>Gehyra purpurascens</i>	Storr, 1982	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	3
<i>Gehyra variegata</i>	(DumÄ©ril & Bibron, 1836)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	3
<i>Hemidactylus frenatus</i>	DumÄ©ril & Bibron, 1836	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	1
<i>Heteronotia binoei</i>	(J.E. Gray, 1845)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	GEKKONIDAE	6
<i>Lerista bipes</i>	(Fischer, 1882)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	22
<i>Lerista clara</i>	Smith & Adams, 2007	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Lerista ips</i>	Storr, 1980	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	9
<i>Lerista separanda</i>	Storr, 1976	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	9
<i>Lerista verhmens</i>	Smith & Adams, 2007	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	2
<i>Lialis burtonis</i>	J.E. Gray, 1835	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	PYGOPODIDAE	2
<i>Lophognathus gilberti</i>	J.E. Gray, 1842	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	1
<i>Lucasium stenodactylum</i>	Boulenger, 1896	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	3
<i>Lucasium wombeyi</i>	(Storr, 1978)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	1
<i>Menetia greyii</i>	J.E. Gray, 1845	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	4
<i>Moloch horridus</i>	J.E. Gray, 1841	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	4
<i>Morethia ruficauda ruficauda</i>	(Lucas & Frost, 1895)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	5
<i>Nephrurus laevisissimus</i>	Mertens, 1958	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	CARPHODACTYLIDAE	6
<i>Nephrurus levis levis</i>	De Vis, 1886	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	CARPHODACTYLIDAE	2
<i>Notoscincus ornatus ornatus</i>	(Broom, 1896)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	2
<i>Oedura marmorata</i>	J.E. Gray, 1842	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	10
<i>Pogona minor minor</i>	Sternfeld, 1919	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	3
<i>Pogona minor mitchelli</i>	(Badham, 1976)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	AGAMIDAE	2
<i>Pseudechis australis</i>	(J.E. Gray, 1842)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	1
<i>Pseudonaja mengdeni</i>	Wells & Wellington, 1985	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	2
<i>Pseudonaja modesta</i>	(GÄ¼nther, 1872)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	3
<i>Rhynchoedura ornata</i>	GÄ¼nther, 1867	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	1
<i>Simoselaps anomalus</i>	(Sternfeld, 1919)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	ELAPIDAE	3
<i>Strophurus ciliaris aberrans</i>	(Glauret, 1952)	subspecies	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	33
<i>Strophurus ciliaris</i>	(Boulenger, 1885)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	2
<i>Strophurus elderi</i>	(Stirling & Zietz, 1893)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	DIPLODACTYLIDAE	3
<i>Tiliqua multifasciata</i>	Sternfeld, 1919	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	SCINCIDAE	1
<i>Varanus brevicauda</i>	Boulenger, 1898	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	VARANIDAE	1
<i>Varanus gouldii</i>	(J.E. Gray, 1838)	species	ANIMALIA	CHORDATA	REPTILIA	SQUAMATA	VARANIDAE	3

Scientific Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family	Number of records
<i>Dasykaluta rosamondae</i>	(Ride, 1964)	species	ANIMALIA	CHORDATA	MAMMALIA	DASYUROMORPHIA	DASYURIDAE	5
<i>Macroderma gigas</i>	(Dobson, 1880)	species	ANIMALIA	CHORDATA	MAMMALIA	CHIROPTERA	MEGADERMATIDAE	9
<i>Mus musculus</i>	Linnaeus, 1758	species	ANIMALIA	CHORDATA	MAMMALIA	RODENTIA	MURIDAE	1
<i>Ningauai timealeyi</i>	Archer, 1975	species	ANIMALIA	CHORDATA	MAMMALIA	DASYUROMORPHIA	DASYURIDAE	2
<i>Osphranter robustus robustus</i>	(Gould, 1841)	subspecies	ANIMALIA	CHORDATA	MAMMALIA	DIPROTODONTIA	MACROPODIDAE	1
<i>Pseudantechinus roryi</i>	Cooper, Aplin & Adams, 2000	species	ANIMALIA	CHORDATA	MAMMALIA	DASYUROMORPHIA	DASYURIDAE	1
<i>Pseudomys desertor</i>	Troughton, 1932	species	ANIMALIA	CHORDATA	MAMMALIA	RODENTIA	MURIDAE	8
<i>Pseudomys hermannsburgensis</i>	(Waite, 1896)	species	ANIMALIA	CHORDATA	MAMMALIA	RODENTIA	MURIDAE	4
<i>Sminthopsis youngsoni</i>	McKenzie & Archer, 1982	species	ANIMALIA	CHORDATA	MAMMALIA	DASYUROMORPHIA	DASYURIDAE	4
<i>Taphozous georgianus</i>	Thomas, 1915	species	ANIMALIA	CHORDATA	MAMMALIA	CHIROPTERA	EMBALLONURIDAE	4
<i>Vespadelus finlaysoni</i>	(Kitchener, Jones & Caputi, 1987)	species	ANIMALIA	CHORDATA	MAMMALIA	CHIROPTERA	VESPERTILIONIDAE	4



Scientific Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family	Number of records
<i>Cyclorana australis</i>	(Gray, 1842)	species	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	HYLIDAE	7
<i>Neobatrachus aquilonius</i>	Tyler, Davies & Martin, 1981	species	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	LIMNODYNASTIDAE	2
<i>Notaden nicholli</i>	Parker, 1940	species	ANIMALIA	CHORDATA	AMPHIBIA	ANURA	LIMNODYNASTIDAE	2

Scientific Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family	Vernacular Name	Number of records
<i>Acanthagenys rufogularis</i>	Gould, 1838	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		2
<i>Accipiter (Leucospiza) fasciatus</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		6
<i>Acrocephalus (Acrocephalus) australis</i>	(Gould, 1838)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ACROCEPHALIDAE	Australian reed warbler	2
<i>Aegotheles (Aegotheles) cristatus</i>	(Shaw, 1790)	species	ANIMALIA	CHORDATA	AVES	APODIFORMES	AEGOTHELIDAE		1
<i>Anas (Anas) superciliosa</i>	Gmelin, 1789	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE		4
<i>Anas (Nettion) gracilis</i>	Buller, 1869	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE	Grey teal	19
<i>Anthus (Anthus) novaeseelandiae</i>	(Gmelin, 1789)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MOTACILLIDAE	Australian Pipit	13
<i>Aphelocephala nigricincta</i>	(North, 1895)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ACANTHIZIDAE		1
<i>Apus (Apus) pacificus</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	APODIFORMES	APODIDAE	Fork-tailed swift	1
<i>Aquila (Uroaetus) audax</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		4
<i>Ardea (Ardea) pacifica</i>	Latham, 1801	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	Pacific Heron	16
<i>Ardea (Casmerodius) modesta</i>	J.E. Gray, 1831	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	Great white egret	14
<i>Ardea (Mesophoxys) intermedia intermedia</i>	Wagler, 1829	subspecies	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	Intermediate Egret	3
<i>Ardeotis australis</i>	(J.E. Gray, 1829)	species	ANIMALIA	CHORDATA	AVES	GRUIFORMES	OTIDIDAE		11
<i>Artamus (Angroyan) cinereus cinereus</i>	Vieillot, 1817	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE		28
<i>Artamus (Artamus) leucorhynchus</i>	(Linnaeus, 1771)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE		2
<i>Artamus (Campbellornis) personatus</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE	Masked woodswallow	21
<i>Artamus (Campbellornis) superciliosus</i>	(Gould, 1837)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE	White-browed woodswallow	1
<i>Aythya (Nyroca) australis</i>	(Eyton, 1835)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE		8
<i>Barnardius zonarius</i>	(Shaw, 1805)	species	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	PSITTACIDAE		1
<i>Cacatua (Licmetis) sanguinea sanguinea</i>	Gould, 1843	subspecies	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	CACATUIDAE		10
<i>Cacomantis (Vidgenia) pallidus</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	CUCULIFORMES	CUCULIDAE	Pallid Cuckoo	11
<i>Calyptrorhynchus (Calyptrorhynchus) banksii</i>	(Latham, 1790)	species	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	CACATUIDAE		4
<i>Centropus (Polophilus) phasianinus</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	CUCULIFORMES	CENTROPODIDAE		1
<i>Certhionyx (Certhionyx) variegatus</i>	Lesson, 1830	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		13
<i>Chenonetta jubata</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE	Australian wood duck	1
<i>Chlidonias (Chlidonias) leucopterus</i>	(Temminck, 1815)	species	ANIMALIA	CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	White-winged Black Tern	1
<i>Chlidonias (Pelodes) hybrida</i>	(Pallas, 1811)	species	ANIMALIA	CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	Whiskered Tern	17
<i>Chrysococcyx basalis</i>	(Horsfield, 1821)	species	ANIMALIA	CHORDATA	AVES	CUCULIFORMES	CUCULIDAE		10
<i>Cincloramphus (Cincloramphus) cruralis</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MEGALURIDAE		8
<i>Cincloramphus (Macleannania) mathewsi</i>	Iredale, 1911	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MEGALURIDAE		5
<i>Circus approximans</i>	Peale, 1848	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE	Australasian harrier	4
<i>Circus assimilis</i>	Jardine & Selby, 1828	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		12
<i>Colluricincla (Colluricincla) harmonica rufiventris</i>	Gould, 1841	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PACHYCEPHALIDAE		1
<i>Colluricincla (Colluricincla) harmonica</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PACHYCEPHALIDAE		2
<i>Coracina (Coracina) novaehollandiae subpallida</i>	Mathews, 1912	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	CAMPEPHAGIDAE		1
<i>Coracina (Coracina) novaehollandiae</i>	(Gmelin, 1789)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	CAMPEPHAGIDAE	Black-faced cuckoo-shrike	11
<i>Corvus bennetti</i>	North, 1901	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	CORVIDAE		2
<i>Corvus orru orru</i>	Bonaparte, 1850	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	CORVIDAE		12
<i>Coturnix (Synoicus) ypsilophora</i>	Bosc, 1792	species	ANIMALIA	CHORDATA	AVES	GALLIFORMES	PHASIANIDAE	Brown quail	1
<i>Cracticus nigrogularis</i>	(Gould, 1837)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE		15
<i>Cracticus tibicen</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ARTAMIDAE	Australian Magpie	3
<i>Cygnus (Chenopsis) atratus</i>	(Latham, 1790)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE	Black Swan	10
<i>Dendrocygna (Leptotarsis) eytoni</i>	(Eyton, 1838)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE		2
<i>Egretta garzetta</i>	(Linnaeus, 1766)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	Little Egret	8
<i>Egretta novaehollandiae</i>	(Latham, 1790)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	White-faced heron	5
<i>Elanus axillaris</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		1
<i>Emblema pictum</i>	Gould, 1842	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ESTRILIDAE		1
<i>Eolophus roseicapillus</i>	(Vieillot, 1817)	species	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	CACATUIDAE	Galah	1
<i>Ephippiorhynchus (Ephippiorhynchus) asiaticus</i>	(Latham, 1790)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	CICONIIDAE		2
<i>Epthianura (Aurepthianura) aurifrons</i>	Gould, 1838	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		1
<i>Epthianura (Parepthianura) tricolor</i>	Gould, 1841	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		18
<i>Eremiornis carteri</i>	North, 1900	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MEGALURIDAE		1
<i>Eurostopodus (Eurostopodus) argus</i>	(Hartert, 1892)	species	ANIMALIA	CHORDATA	AVES	CAPRIMULGIFORMES	CAPRIMULGIDAE		3
<i>Falco (Falco) longipennis longipennis</i>	Swainson, 1838	subspecies	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	FALCONIDAE		2
<i>Falco (Hierofalco) peregrinus</i>	Tunstall, 1771	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	FALCONIDAE		1
<i>Falco (teracidea) berigora berigora</i>	Vigors & Horsfield, 1827	subspecies	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	FALCONIDAE		18
<i>Falco (Tinnunculus) cenchroides</i>	Vigors & Horsfield, 1827	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	FALCONIDAE	Nankeen kestrel	26
<i>Fulica atra</i>	Linnaeus, 1758	species	ANIMALIA	CHORDATA	AVES	GRUIFORMES	RALLIDAE	Australasian coot	7
<b>GALLIFORMES</b>		order	ANIMALIA	CHORDATA	AVES			Game Birds and Allies	2
<i>Gallirallus philippensis</i>	(Linnaeus, 1766)	species	ANIMALIA	CHORDATA	AVES	GRUIFORMES	RALLIDAE	Banded Rail	1
<i>Gavialis virescens</i>	(Vieillot, 1817)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		47
<i>Geopelia cuneata</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		9
<i>Geopelia humeralis</i>	(Temminck, 1821)	species	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		4
<i>Geopelia striata placida</i>	Gould, 1844	subspecies	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		3
<i>Geopelia striata</i>	(Linnaeus, 1766)	species	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		3
<i>Geophaps (Lophophaps) plumifera plumifera</i>	Gould, 1842	subspecies	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		1
<i>Gerygone fusca fusca</i>	(Gould, 1838)	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ACANTHIZIDAE		3
<i>Glareola (Glareola) maldivarum</i>	J.R. Forster, 1795	species	ANIMALIA	CHORDATA	AVES	CHARADRIIFORMES	GLAREOLIDAE	Oriental Pratincole	3
<i>Grallina cyanoleuca</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MONARCHIDAE		36
<i>Grus (Mathewsia) rubicunda</i>	(Perry, 1810)	species	ANIMALIA	CHORDATA	AVES	GRUIFORMES	GRUIDAE		10
<i>Haliastur sphenurus</i>	(Vieillot, 1818)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		28
<i>Hamirostra melanosternon</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		5
<i>Hieraetus (Hieraetus) morphnoides</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE		5
<i>Lalage (Lalage) sueurii</i>	(Vieillot, 1818)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	CAMPEPHAGIDAE	Australian White-winged Triller	17
<i>Lichmera (Lichmera) indistincta</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		11
<i>Malacorhynchus membranaceus</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE	Pink-eared duck	2
<i>Malurus (Leggeornis) lamberti assimilis</i>	North, 1901	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MALURIDAE		1
<i>Malurus (Leggeornis) lamberti lamberti</i>	Vigors & Horsfield, 1827	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MALURIDAE		18
<i>Malurus (Musciparus) leucopterus leucopterus</i>	Dumont, 1824	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MALURIDAE		8
<i>Manorina (Myzantha) flavigula</i>	(Gould, 1840)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		43
<i>Melanodryas (Melanodryas) cucullata</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PETROICIDAE		1
<i>Melithreptus (Eidopsarus) gularis laetior</i>	Gould, 1875	subspecies	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		1
<i>Melopsittacus undulatus</i>	(Shaw, 1805)	species	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	PSITTACIDAE		15
<i>Merops (Merops) ornatus</i>	Latham, 1801	species	ANIMALIA	CHORDATA	AVES	CORACIFORMES	MEROPIDAE		20
<i>Microeca (Microeca) fascinans</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PETROICIDAE		1
<i>Milvus migrans</i>	(Boddaert, 1783)	species	ANIMALIA	CHORDATA	AVES	FALCONIFORMES	ACCIPITRIDAE	Black kite	16
<i>Mirafra (Mirafra) javanica</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ALAUDIDAE		11
<i>Ninox (Ninox) novaeseelandiae boobook</i>	(Latham, 1801)	subspecies	ANIMALIA	CHORDATA	AVES	STRIGIFORMES	STRIGIDAE		1
<i>Nycticorax caledonicus</i>	(Gmelin, 1789)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	ARDEIDAE	Nankeen night heron	3
<i>Nymphicus hollandicus</i>	(Kerr, 1792)	species	ANIMALIA	CHORDATA	AVES	PSITTACIFORMES	CACATUIDAE		4
<i>Ocyphaps lophotes</i>	(Temminck, 1822)	species	ANIMALIA	CHORDATA	AVES	COLUMBIFORMES	COLUMBIDAE		15
<i>Oreocia gutturalis</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	OREOIDIDAE		1
<i>Pachycephala (Alisterornis) rufiventris</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PACHYCEPHALIDAE		10
<i>Pavo cristatus</i>	Linnaeus, 1758	species	ANIMALIA	CHORDATA	AVES	GALLIFORMES	PHASIANIDAE	Peafowl	6
<i>Petrochelidon (Hylochelidon) nigricans</i>	(Vieillot, 1817)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	HIRUNDINIDAE	Tree martin	6
<i>Petrochelidon (Petrochelidon) ariel</i>	(Gould, 1842)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	HIRUNDINIDAE	Fairy martin	2
<i>Petroica (Petroica) goodenovii</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PETROICIDAE		5
<i>Plegadis falcinellus</i>	(Linnaeus, 1766)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	THRESKIORHITHIDAE	Glossy ibis	3
<i>Porphyrio (Porphyrio) porphyrio melanotus</i>	Temminck, 1820	subspecies	ANIMALIA	CHORDATA	AVES	GRUIFORMES	RALLIDAE	Pukeko	1
<i>Porzana (Porzana) pusilla</i>	(Pallas, 1776)	species	ANIMALIA	CHORDATA	AVES	GRUIFORMES	RALLIDAE	Marsh Crake	1
<i>Psophodes (Sphenostoma) occidentalis</i>	(Mathews, 1912)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PSOPHODIDAE		1
<i>Ptilonorhynchus maculatus</i>	Gould, 1837	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	PTILONORHYNCHIDAE		1
<i>Ptilotula keartlandi</i>	(North, 1895)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		5

<i>Ptilotula penicillata</i>	(Gould, 1837)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		5
<i>Purnella albifrons</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		2
<i>Pyrrholaemus brunneus</i>	Gould, 1841	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ACANTHIZIDAE		1
<i>Rhipidura (Sauloprocta) leucophrys</i>	(Latham, 1801)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	RHIPIDURIDAE	Willie Wagtail	25
<i>Stictonetta naevosa</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE		1
<i>Stiltia isabella</i>	(Vieillot, 1816)	species	ANIMALIA	CHORDATA	AVES	CHARADRIIFORMES	GLAREOLIDAE		7
<i>Stomiopera unicolor</i>	(Gould, 1843)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		1
<i>Sugomel niger</i>	(Gould, 1838)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	MELIPHAGIDAE		8
<i>Tachybaptus novaehollandiae</i>	(Stephens, 1826)	species	ANIMALIA	CHORDATA	AVES	PODICIPEDIFORMES	PODICIPEDIDAE		4
<i>Tadorna (Casarca) tadornoides</i>	(Jardine & Selby, 1828)	species	ANIMALIA	CHORDATA	AVES	ANSERIFORMES	ANATIDAE	Australian Shelduck	1
<i>Taeniopygia guttata</i>	(Vieillot, 1817)	species	ANIMALIA	CHORDATA	AVES	PASSERIFORMES	ESTRIDIDAE		25
<i>Threskiornis molucca</i>	(Cuvier, 1829)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	THRESKIORNITHIDAE	White Ibis	6
<i>Threskiornis spinicollis</i>	(Jameson, 1835)	species	ANIMALIA	CHORDATA	AVES	CICONIIFORMES	THRESKIORNITHIDAE	Straw-necked ibis	26
<i>Todiramphus (Cyanalcyon) pyrrhopygius</i>	(Gould, 1840)	species	ANIMALIA	CHORDATA	AVES	CORACIIFORMES	ALCEDINIDAE		10
<i>Todiramphus (Todiramphus) sanctus</i>	(Vigors & Horsfield, 1827)	species	ANIMALIA	CHORDATA	AVES	CORACIIFORMES	ALCEDINIDAE	Sacred kingfisher	2
<i>Tringa (Glottis) nebularia</i>	(Gunnerus, 1767)	species	ANIMALIA	CHORDATA	AVES	CHARADRIIFORMES	SCOLOPACIDAE	Greenshank	3
<i>Turnix (Alphaturnia) velox</i>	(Gould, 1841)	species	ANIMALIA	CHORDATA	AVES	TURNICIFORMES	TURNICIDAE		5

## Appendix 3

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### Regulation 17 Licence







**Wildlife Conservation Act 1950**  
**REGULATION 17**

**Regulation 17 – Licence to take fauna for scientific purposes (Regulation 17 - Standard)**

**The undermentioned person may take fauna for research or other scientific purposes and where authorised, keep it in captivity, subject to the following and attached conditions, which may be added to, suspended or otherwise varied as considered fit.**

**Director General**

**Conditions**

- 1 The licensee shall comply with the provisions of the Wildlife Conservation Act 1950, Wildlife Conservation Regulations 1970 and any Notices in force under this legislation.
- 2 The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.
- 3 Unless specifically authorised in the conditions of this Licence or otherwise in writing by the Director General, species of fauna declared as likely to become extinct, rare or otherwise in need of special protection shall not be taken.
- 4 Any by-catch of fauna, which is declared to be rare, likely to become extinct, or otherwise in need of special protection shall be released immediately at the point of capture. Where such fauna taken under this licence is injured or deceased, the licensee shall contact the Department's Wildlife Licensing Section for advice on disposal. Records must be kept of any such fauna so captured and details are to be included in the report required under further condition below.
- 5 Any interaction involving Gazetted Threatened Fauna that may be harmful to the fauna and/or invasive may require approval from the Commonwealth Department of the Environment ph 02 6274 1111. Interaction with such species is controlled by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the Wildlife Conservation Act 1950 and Wildlife Conservation Regulations 1970.
- 6 No fauna shall be taken in areas where it would impinge on pre-existing scientific research programs.
- 7 Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers used, and signs and structures erected by the licensee shall be removed and the environment returned to its original condition.
- 8 Not more than ten specimens of any one protected species of fauna shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.
- 9 The licensee shall not release any fauna or their progeny in any area where it does not naturally occur, nor hand such fauna over to any other person or authority unless approved by the Director General, nor dispose of the remains of such fauna in any manner likely to confuse the natural or present day distribution of the species.
- 10 Bioprospecting involving the removal of sample aquatic and terrestrial organisms for chemical extraction and bioactivity screening shall not be conducted without specific written approval by the Director General.
- 11 No fauna shall be taken from any CALM land, as defined in the Conservation and Land Management Regulations 2002, without prior written approval of the Director General. No fauna shall be taken from any public land without the prior written approval of the Government Authority managing that land.
- 12 The licensee shall not enter upon any private property or pastoral lease for the purposes of this licence, nor take any fauna from any private land or pastoral lease without the prior consent in writing of the owner or occupier. Similarly, in the case of Aboriginal lands, the licensee must not enter upon or take fauna from such lands without the written approval of the Department of Aboriginal Affairs and/or the relevant native title holders or applicants.
- 13 Copies of this licence and any written approval or consent required by conditions of this licence must be carried by the licensee and any person/s authorised under the licence at all times when conducting activities relevant to the licence

# DEPARTMENT OF PARKS AND WILDLIFE



Department of  
Parks and Wildlife



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Correspondance: **Locked Bag 30**  
**Bentley Delivery Centre WA 6983**

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**NO.** 08-000993-3

and must be presented to an authorised officer of the Department upon request.

- 14 All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range shall upon request be donated to the Western Australian Museum.
- 15 To prevent any unnecessary collecting in this State, all specimens and material taken and retained under the authority of this license shall, upon request, be loaned to the Western Australian Museum. Any unused portion or portions of any specimen collected under the authority of this license shall be offered to the Western Australian Museum for inclusion in its collection or made available to other scientific workers if so required.
- 16 Within one month of the expiration of this licence, the holder shall submit an electronic return into the department's Wildlife Licensing System, detailing the locality, site, geocode, date and number of each species of fauna captured, sighted or vouchered during the currency of the licence. A copy of any paper, report or thesis resulting from the research shall upon completion be lodged with the Director General.

## Purpose

Level 1 reconnaissance survey by opportunistic observation; and a Level 2 fauna survey using cage, Elliott, dry pit and funnel traps, hand foraging, and via spotlighting/head torching, secondary signs/evidence and habitat assessment; and a Targeted conservation significant fauna survey for bilby (*Macrotis lagotis*) by active searching, secondary signs/evidence and habitat assessment; and a Short Range Endemic (SRE) invertebrate fauna survey by foraging (raking, sieving and excavation); and a Targeted wader (shorebirds and migratory birds) survey by visual observation, secondary signs/evidence and habitat assessment. Captured vertebrate fauna will be release at capture site and collected invertebrate fauna may be retained as specimens. For the Asian Renewable Energy Hub Terrestrial Environmental Impact Assessment

## Locations

Pilbara Region, near the southwest boundary of the Kimberley region, approximately 30km inland from Eighty Mile Beach and extending east onto the margin of the Great Sandy Desert.

## Authorised Person

<b>Surname</b>	<b>Given name(s)</b>
Humphreys	Garth
Teale	Roy
Ford	Stewart
Greenham	Michael
Keirle	David
Sawers	Paul
Traditional Landowners	rangers
King	Jacinta



# DEPARTMENT OF PARKS AND WILDLIFE



Department of  
Parks and Wildlife



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**Date of Issue** 15/08/2017  
**Valid From** 15/08/2017  
**Date of Expiry** 23/08/2018

**Licensee:** Mr Daniel Kamien  
**Address** Biota Environmental Sciences Pty Ltd  
PO Box 155  
Leederville WA 6903  
Australia

Issued by a Wildlife Licensing Officer of the Department of Parks and Wildlife under delegation from the Minister for Environment pursuant to section 133(1) of the Conservation and Land Management Act 1984.



**Wildlife Conservation Act 1950**  
**REGULATION 17**

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**The undermentioned person may take fauna for research or other scientific purposes and where authorised, keep it in captivity, subject to the following and attached conditions, which may be added to, suspended or otherwise varied as considered fit.**

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- 13 Copies of this licence and any written approval or consent required by conditions of this licence must be carried by the licensee and any person/s authorised under the licence at all times when conducting activities relevant to the licence

# DEPARTMENT OF PARKS AND WILDLIFE



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**NO.** 08-000993-4

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## Purpose

Level 1 reconnaissance survey by opportunistic observation; and a Level 2 fauna survey using cage, Elliott, dry pit and funnel traps, hand foraging, and via spotlighting/head torching, secondary signs/evidence and habitat assessment; and a Targeted conservation significant fauna survey for bilby (*Macrotis lagotis*) by active searching, secondary signs/evidence and habitat assessment; and a Short Range Endemic (SRE) invertebrate fauna survey by foraging (raking, sieving and excavation); and a Targeted wader (shorebirds and migratory birds) survey by visual observation, secondary signs/evidence and habitat assessment. Captured vertebrate fauna will be release at capture site and collected invertebrate fauna may be retained as specimens. For the Asian Renewable Energy Hub Terrestrial Environmental Impact Assessment

## Locations

Pilbara Region, near the southwest boundary of the Kimberley region, approximately 30km inland from Eighty Mile Beach and extending east onto the margin of the Great Sandy Desert, wader and waterbird surveys at Walyarta (Mandora Marsh) and nearby areas of 80 mile beach.

## Authorised Person

<b>Surname</b>	<b>Given name(s)</b>
Humphreys	Garth
Teale	Roy
Ford	Stewart
Greenham	Michael
Keirle	David
Sawers	Paul
Traditional Landowners	Nyangumarta Rangers
King	Jacinta
Graff	John

# DEPARTMENT OF PARKS AND WILDLIFE



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Australia

Issued by a Wildlife Licensing Officer of the Department of Parks and Wildlife under delegation from the Minister for Environment pursuant to section 133(1) of the Conservation and Land Management Act 1984.

# Appendix 4

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## Helix Molecular Solutions Report







# Helix

## Molecular Solutions

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9 August 2018

Garth Humphreys  
Biota Environmental Sciences  
Level 1 / 228 Carr Place  
Leederville WA 6007

Via email

**Re. Report on the molecular systematics of the targeted SRE invertebrates from the Asian Hub RE Fauna survey.**

Dear Garth,

Following is a summary of the results of the invertebrate molecular investigation we have completed for the Asian Hub Re Fauna survey. Results suggest that all camaenid snail specimens belong to the described *Rhagada karajarri* and these records extend the species distribution substantially. Nine of the ten buthid scorpions were successfully sequenced and belong to two clades of *Lychas annulatus* (also recognised as *Hemilychas alexandrinus*) and show mean sequence divergence of 7.8 % from one another. Amongst the 29 spider specimens, 15 belonged to four distinct species of nemesiid mygalomorphs and belonging to a single genus *Aname*, three of the species haven't been recorded previously. Nine specimens of spiders were found to be Araneomorphae with their family placement uncertain. A further five spider specimens were unsuccessful during the sequencing process. All twenty-four specimens of camaenid snails sequenced belonged to the recently described *R. karajarri* species and these records markedly increase the distribution of the species.

Thanks once again for collaborating on this project with Helix. We hope we can continue to provide you with useful information, and feel free to contact us if you have any questions or would like to discuss the results in detail.

Sincerely,

Dr. Zoë Hamilton, Dr. Terrie Finston and Yvette Hitchen  
Helix Molecular Solutions





## Background and Objective

Sixty-three specimens of invertebrate fauna belonging to four taxonomic groups (Camaenidae, Buthidae, Araneae, Araneomorphae) from the Asian Hub RE Fauna Survey area in the Great Sandy Desert and Dampierland biogeographic Regions were sequenced for variation at the mitochondrial cytochrome oxidase subunit I gene (*COI*). The resulting molecular sequences were then assessed to determine the number of taxa present and compare these results to those sequences publically available on GenBank and those already in Helix's database for context.

## Executive summary

- Twenty-four specimens of camaenid *Rhagada* land snails from the survey area were sequenced and assessed for variation at the *COI* mtDNA gene. The molecular data were then placed within an existing molecular taxonomic framework for *Rhagada*, using *COI* mtDNA sequences from GenBank in order to accurately determine what species the Asian Hub camaenids showed affinity to. A single species *Rhagada karajarri* was recorded.
- Two divergent clades of buthid scorpions were sequenced for *COI* mtDNA. Preliminary analyses with sequences available on GenBank found two divergent lineages with mean divergence of 7.8%. Collaboration with Dr. Joel Huey from the WA Museum enabled more accurate resolution of these specimens. These specimens show affinity to the *Lychas annulatus* species clade (also recognised as *Hemilychas alexandrinus*), this species has an extensive distribution across the arid interior of Australia. There was substantial divergence between the clades, the significance of which cannot be resolved until the buthid phylogenetic relationships and taxonomy have been revised.
- Four species of nemesiid mygalomorph spiders all belonging to the genus *Aname* were amongst the fifteen successfully sequenced mygale specimens. Three of these have not been recorded previously.
- Nine spider specimens sequenced belonged to the Araneomorphae infraorder and family placement was undetermined with the sequence data available.

## Methods

Twenty-four specimens of camaenid land snails from four sampling locations all belonging to the genus *Rhagada*, along with ten specimens of buthid scorpions from four sampling locations, and twenty-nine suspected mygalomorph spiders from ten sampling locations were sequenced for variation at the cytochrome oxidase subunit I gene (*COI*) using primers LCOI & HCO2 (Folmer *et al.*, 1994)

All resulting sequences were edited using SEQUENCHER software (Gene Codes Corporation, Ann Arbor, MI, USA). Alignment was performed with CLUSTAL W (Thompson *et al.*, 1994) using default parameters. DNA nucleotide sequences were translated into protein sequences to ensure that the amplified sequences corresponded to the target mtDNA. The translated protein sequences were then checked for the presence of stop codons. All sequences were 'BLAST'ed (Basic Local Alignment Search Tool) with the NCBI (National Centre for Biotechnology Information). This program compares DNA nucleotide sequences with a library of sequences and identifies sequences within the database that resemble the query sequences above a certain threshold. Genetic distances between unique genetic sequences (haplotypes) were measured using uncorrected p-distances (total percentage of nucleotides different between sequences). To account for polymorphism within lineages, the net genetic diversity of Nei (1987) was calculated to give a 'corrected' distance between lineages.

For phylogenetic analysis, likelihood ratio tests using the Bayesian Information Criterion were calculated in MEGA 6.06 (Tamura *et al.*, 2013) to determine the best-fit model of evolution. Maximum Likelihood was used to construct the phylogenetic tree, incorporating the best-fit model of evolution. Details of analyses are described for each taxonomic group.

## Results

### Camaenidae

The camaenid genus *Rhagada* is the most species-rich genus of land snails in Western Australia's semi-arid Pilbara region, where it shows both morphological conservatism within and among species over large distances (Solem, 1997; Johnson *et al.*, 2012; Hamilton & Johnson, 2015), and extreme morphological diversification of shell traits over relatively small areas (Stankowski, 2011, 2013, 2015; Stankowski & Johnson, 2014; Johnson *et al.*, 2016). This contrasting pattern of morphological variation in the genus, in addition to repeated incidences of convergent shell morphologies between distinct cryptic taxa (Hamilton, in prep), and the occurrence of narrow hybrid zones with morphological intermediates between distinct taxa (Hamilton & Johnson, 2015) highlights the need for the use of molecular markers in addition to morphological taxonomy for species diagnosis.

#### *Reference specimens and outgroups*

A number of reference samples of *Rhagada* were obtained from GenBank for the purposes of providing a taxonomic framework in which the specimens from the survey could be accurately placed. These included all described species from the Pilbara region, previously examined in tests of species taxonomy (Johnson *et al.*, 2012; 2016), plus several species from the Kimberley region, from which the Pilbara lineages were derived (Köhler & Criscione, 2013; Burghardt & Köhler, 2014). GenBank accession numbers are shown in parenthesis for the samples used in the analyses and included *Rhagada convicta* (KF151996; JQ362681.1; KF151996.1; JQ362679.1; JQ362696.1; JQ362689.1; JQ362682.1), *R. capensis* (JQ362694.1; JQ362693.1), *R. barrowensis* (KC617888.1; KC617889.1), *R. torulus* (JQ362699.1; JQ362700.1), *R. globosa* (JQ362697.1; JQ362698.1), *R. richardsonii* (JQ362675.1; JQ362676.1; KC703158.1), *R. sp.* 'Pannawonica' (KM405439.1; KM405441.1; KM405442.1), *R. radleyi* (JQ362687.1; JQ362688.1; JQ362685.1; JQ362686.1), *R. pilbarana* (JQ362683.1; JQ362684.1), *R. ngurrana* (JQ362717.1; JQ362718.1), *R. elachystoma* (KP085400.1), *R. dampierana* (KP085399.1), *R. minima* (KF152059.1), *R. dringi* (JQ362674.1; JQ362673.1), *R. karajarri* (KC703133.1; [WAM S49582a]; KC703134.1 [WAM S49582b]), *R. warora* (KC703111.1 [WAM S49580a]), *R. kessneri* (KC703109.1 [WAM S37678a]), *R. harti* (KC703143.1 [WAM S49576]), and *R. biggeana* (KC703112.1 [WAM S36739a]).

A COI sequence belonging to the land snail *Baudinella tuberculata* (HQ245450.1 [WAM S37063]) was used as the outgroup for all analyses, owing to its relationship with *Rhagada* within the Camaenidae (Johnson *et al.*, 2012).

#### *Phylogenetic Analysis*

Phylogenetic analyses were calculated in MEGA 6.06 (Tamura *et al.*, 2013) using maximum likelihood (ML) with 1000 bootstrap replicates, based on the genetic distances with T92 + G + I as the best-fit model of evolution (Tamura Nei, with gamma distribution and invariant sites). The parameter for the gamma distribution was 0.89. The phylogenetic analysis, which included the fifteen camaenid snail specimens from the survey area, as well as fifty-one reference *Rhagada* specimens obtained from GenBank, placed the Asian Hub *Rhagada* specimens within the *R. karajarri* lineage (Figure 2).

#### *Differentiation within and between lineages*

Of the fifteen Asian hub *Rhagada* specimens examined (Table 1), six had shared haplotypes, the remaining nine all had unique haplotypes. Amongst these *Rhagada* specimens from the study area, there was 0.0 % to 5.9 % molecular variation at COI (Table 2). The mean sequence divergence between the *Rhagada* specimens from the Asian Hub sample sites, and specimens of *R. karajarri*, the species to which they showed most affinity was 6.1 %. The *R. karajarri* specimens were from Port Smith around 185 km to the north (Table 3). This contrasts the vast amount of differentiation (17.3 %, Table 3) found between the Asian Hub *Rhagada* specimens and *R. dringi*, just 40 km to the north-east. This is a remarkable result as the sample localities for the Asian hub *Rhagada* place these specimens well within the distribution of the described distribution of *R. dringi* according to Solem (1997). However, the molecular results imply that a revision of this species' distribution is required. The results reveal that *Rhagada* from the study area form a strongly supported group with the recently described *R. karajarri* (Burghardt & Köhler, 2014). This extends the distribution of this species significantly, and furthermore suggests that what Solem (1997) described as *R. dringi* (from morphological characters only) may well be

the *R. karajarri* species, and what we have interpreted previously as *R. dringi* (Johnson *et al.*, 2012; Burghardt & Köhler, 2014) is in fact an undescribed *Rhagada* species with an extremely limited distribution.

### **Buthidae**

The Buthidae are the largest family of scorpions with 1053 species known under 92 genera (Rein, 2015). Few molecular investigations of phylogenetic relationships in the family Buthidae are available (Gantenbein *et al.*, 2000; 2003; Fet *et al.*, 2003; Gantenbein & Largiadèr, 2003; Mirshamsi *et al.*, 2010; Sousa *et al.*, 2010, 2011; Suranse *et al.*, 2017). Nevertheless, all these studies agree that morpho-taxonomy has limitations in differentiating and defining species boundaries, with findings that several currently recognized species are species groups comprising undescribed taxa. Morphological variability in buthids within taxa, along with morphological similarity between taxa, has led to taxonomic confusion and underscores the value of the inclusion of molecular data for species delineation in scorpions (Yamashita & Rhoads, 2013).

### Summary

Nine of the ten specimens of buthid scorpions were successfully sequenced for COI (Table 4). Phylogenetic analyses including the limited available buthid GenBank specimens imply that two clades exist amongst the collected specimens with up to 8.00 % sequence divergence between them (7.8 % mean divergence between clades) (Table 5 & 6)). Collaboration with Dr. Joel Huey, a researcher at the WA Museum, enabled more accurate placement of the buthid scorpions in question. The nine specimens were included in a subsequent phylogenetic analysis by Dr. Joel Huey with his more extensive collection of sequences, which are not yet publically available. This analysis placed the Asian Hub specimens in a species clade along with specimens identified as *Lychas annulatus* by Lorenzo Prendini (American Museum of Natural History). This species is also recognised as *Hemilychas alexandrinus*, which according to the Atlas of Living Australia has a large distributional range across the arid zone of Australia.

### Reference specimens and outgroups

Four haplotypes were among the nine successfully sequenced specimens from the Asian Hub study area, one of which was shared amongst five individuals. These sequences were analysed along with reference scorpion specimens belonging to the family Buthidae. These included one specimen of *Mesobuthus martensii* (GenBank accession # JF700146.1), one specimen of *Lychas tricarinatus* (GenBank accession # KT716037.1), three specimens of *Lychas mucronatus* (GenBank accession # JN018211.1, JN018153.1, & JN018210.1) and one specimen of *Centruroides vittatus* (GenBank accession # EU404114.1). The *Mesobuthus* and *Centruroides* sequences were used as outgroups in the analysis.

### Phylogenetic analysis

Phylogenetic analyses were calculated in MEGA 6.06 (Tamura *et al.*, 2013) using maximum likelihood (ML) with 1000 bootstrap replicates, based on the genetic distances with Tamura-Nei with gamma distribution as the best-fit model of evolution (TN93 + G). The parameter for the gamma distribution was 0.17. The preliminary phylogenetic analysis, which included the nine specimens from the survey area, as well as the four reference specimens obtained from GenBank, revealed two distinct and strongly supported clades of Asian Hub specimens (Figure 2). Subsequent analysis performed by Dr. Joel Huey (WA Museum) with the use of his extensive collection of Australian buthid sequences that are not yet publicly available place the two clades of buthid scorpions within the *Lychas annulatus* clade. This species is also recognised as *Hemilychas alexandrinus*.

### Differentiation within and between lineages.

The two lineages of *Lychas annulatus* (Dr. Joel Huey pers. comm.) from the Asian Hub study area showed sequence divergence from one another by a mean of 7.8 %. Each lineage showed a mean within divergence of 0.00 % (0.00 - 0.00) (clade A) and 0.10 % (0.9 – 1.2) (clade B).

### **Family undetermined**

Nine of the sequenced spider specimens did not belong to the Mygalomorphae infraorder (Table 7). Instead a 'megablast' search places them within the Araneomorphae. Their family assignment is unresolved as numerous identity assignments were found including the families Deinopidae, Mesysmaucheniidae, Dictynidae, Salticidae, Sparassidae, and Phyxelididae with 88% similarity (see appendix 1 –'megaBLAST' results).

### **Araneae**

The infraorder of Arachnida, Mygalomorphae, includes trapdoor spiders and their kin, and they are frequently identified as short-range endemics (SREs) (e.g. Harvey *et al.*, 2011; Castalanelli *et al.*, 2014). Identification of species has traditionally been performed using morphological techniques, however, only males can be used in identification, as both females and juveniles lack the diagnostic characters used in identification, and furthermore there is a large backlog of undescribed taxa. DNA barcoding with the use of COI mtDNA has become a rapid, objective method aiding mygalomorph species identifications and their distributions, and is recognised as providing important information that regulatory authorities can use to assess environmental impacts of large-scale developments (Harvey *et al.*, 2008; Environmental Protection Authority, 2009; Castalanelli *et al.*, 2014). Extensive molecular work has been conducted on the trap-door spider fauna of Western Australia (Helix, 2009a & b, 2010, 2011a - k, 2012a - h, 2013a & b, 2014a - d, 2015a - e). The resulting dataset provides a molecular framework that can be used to provide regional context for localised sampling.

#### *Reference specimens and outgroups*

A number of reference specimens (n = 460) were used including in preliminary analyses to determine the family placement of the mygale specimens. This included 71 Barychelidae samples, 37 Ctenizidae samples, 115 Idiopidae samples, 207 Nemesiidae samples, and 30 Actinopidae samples. Preliminary analyses placed the Asian hub mygale specimens within the Nemesiidae family (Table 7), subsequent analyses therefore included only nemesiid specimens that were within 15 % sequence divergence.

The family Nemesiidae is one of the most diverse and species-rich mygalomorph families in Australia, with 15 genera and 99 named species (Castalanelli *et al.*, 2014; 2017). Representative specimens from four other mygalomorph families were used as outgroups (T112080 Synothele MYG127 BBW from Barychelidae; T96581-Conothele MYG059 CAN from Ctenizidae; T96336 Aganippe MYG017 IDI 173 from Idiopidae; T96308 Missulena MYG049 A2 from Actinopidae).

#### *Phylogenetic analysis*

Phylogenetic analyses were calculated in MEGA 6.06 (Tamura *et al.*, 2013) using maximum likelihood (ML) with 1000 bootstrap replicates, based on the genetic distances with Tamura-Nei with Gamma distribution as the best-fit model of evolution (TN93 + G). The parameter for the gamma distribution was 0.23. The phylogenetic analysis, which included the thirteen haplotypes for the fifteen specimens from the survey area, as well as the forty-six nemesiid reference specimens within 15% sequence divergence obtained both from Helix's database and from GenBank. Fifteen nemesiid mygale specimens were amongst the samples collected from the Asian Hub survey. Phylogenetic analyses found four distinct clades of nemesiid mygalomorph spiders amongst these specimens.

#### *Differentiation within and between lineages*

Thirteen haplotypes existed amongst the fifteen nemesiid specimens (Table 8). None of the specimens sequenced match haplotypes on our molecular database, or on GenBank. The mygale specimens belonged to four separate clades (N7, N138, N139, N140). These clades showed mean divergences of 3.2 % (N7) & 0.4 % (N140) within and substantial between clade divergences with mean divergence ranging from 12.1 % to 19.2 % (Tables 8 & 9). By applying the 9.5 % sequence divergence 'cut-off' that was tested by Castalanelli *et al.*, (2014), these levels of sequence divergence indicate that the specimens belong to four distinct nemesiid species. One clade showed associations with reference specimens with individuals showing between 3.8 % to 6.3 % sequence divergence from the 'KJ744648' individual from Genbank, 4.8 % to 5.8 % from the KJ744648 GenBank specimen, and 4.6 % to 6.3 % divergence from the

NBT\_N7\_AD748. These reference specimens (KJ744649, KJ744648, & NBT\_N7\_AD748) were collected between 245 km & 300 km to the south-west of the Asian Hub specimens from the same lineage (see Appendix 2 for genetic p-distance between all specimens). This result implies this species has a large distribution. The remaining three clades are only distantly associated with reference specimens (Table 9), with sequence divergences of 10.9 % ('NN35' & KJ745288) to the closest related samples for clade N138, and sequence divergences of 17.0 % for clade N139 ('NN29' & KJ744688), and 14.5 % for clade N140 ('NN32' with individuals JQ772139, KJ45375, NBC\_N6\_AD577), and are therefore likely to be new species (see Appendix 2 for genetic p-distances between all specimens).

## Conclusions

The mtDNA gene cytochrome oxidase 1 (*COI*) is widely considered to show suitable variation to distinguish species (Hebert *et al.*, 2003a), and the use of this gene can be extremely effective for 'DNA barcoding' in taxa where clear differentiation exists between intra and interspecific levels of divergence (e.g. Hebert *et al.*, 2004a; 2004b). In a comparison of *COI* sequences for over 13,000 pairs of taxa, Hebert *et al.* (2003b) found a mean of 11.1% sequence divergence between distinct species. Nearly 80% of these comparisons found that species pairs differed from one another by greater than 8% sequence divergence. Despite its merits in barcoding however, a taxon by taxon approach, examining the amount of phylogenetic variation within and between taxa is the most widely accepted method of delineating species and their distributions, especially in areas where rapidly expanding mining operations outpace taxonomic treatment of unresolved taxa.

### Camaenidae

The *Rhagada* land snail specimens undoubtedly belong to the recently described *R. karajari* species, and extend its distribution markedly (by 180 km). This result also calls for a revision of the *R. dringi* species and its apparently very limited distribution. Morphological similarities between the species have led to taxonomic confusion with a perceived extensive distribution for *R. dringi* according to Solem (1997) based on morphological characters alone.

### Buthidae

Two distinct clades were evident amongst the buthid specimens sequenced. These appear to be two divergent clades belonging to *Lychas annulatus*. The significance of the divergent clades cannot be resolved until the buthid phylogenetic relationships and taxonomy have been revised.

### Araneae

Four distinct undescribed species of nemesiid mygales were apparent, all from the genus *Aname* three of which are likely to be newly recorded species.



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**Table 1.** Camaenid *Rhagada* snail specimens used in the present study, and the genetic lineage to which they belong.

Biota Specimen ID	Helix Lab ID	Genetic Lineage/ Taxonomic ID
Cable track site 2-01	NN40	<i>Rhagada karajarri</i>
Cable track site 2-02	NN41	<i>Rhagada karajarri</i>
Cable track site 2-03	NN42	<i>Rhagada karajarri</i>
Cable track site 2-04	NN43	<i>Rhagada karajarri</i>
Cable track site 2-05	NN44	<i>Rhagada karajarri</i>
Cable track site 2-06	NN45	<i>Rhagada karajarri</i>
Opp North Beach-01	NN46	<i>Rhagada karajarri</i>
Opp North Beach-02	NN47	<i>Rhagada karajarri</i>
Opp North Beach-03	NN48	<i>Rhagada karajarri</i>
Paddock-01	NN49	<i>Rhagada karajarri</i>
Paddock-02	NN50	<i>Rhagada karajarri</i>
Paddock-03	NN51	<i>Rhagada karajarri</i>
Paddock-04	NN52	<i>Rhagada karajarri</i>
Paddock-05	NN53	<i>Rhagada karajarri</i>
Paddock-06	NN54	<i>Rhagada karajarri</i>
Paddock-07	NN55	<i>Rhagada karajarri</i>
Paddock-08	NN56	<i>Rhagada karajarri</i>
Paddock-09	NN57	<i>Rhagada karajarri</i>
Inland Dunes-01	NN58	<i>Rhagada karajarri</i>
Inland Dunes-02	NN59	<i>Rhagada karajarri</i>
Inland Dunes-03	NN60	<i>Rhagada karajarri</i>
Inland Dunes-04	NN61	<i>Rhagada karajarri</i>

**Table 2.** Genetic p-distance (below) and the associated standard error (above) between camaenid haplotypes of *Rhagada* from the Asian Hub area as shown in Figure 1. Specimens identified with '\*' are those representing shared haplotypes. Un-corrected p-distances do not account for mutational saturation, which results from back mutations, and therefore provide a conservative estimate of genetic distance.

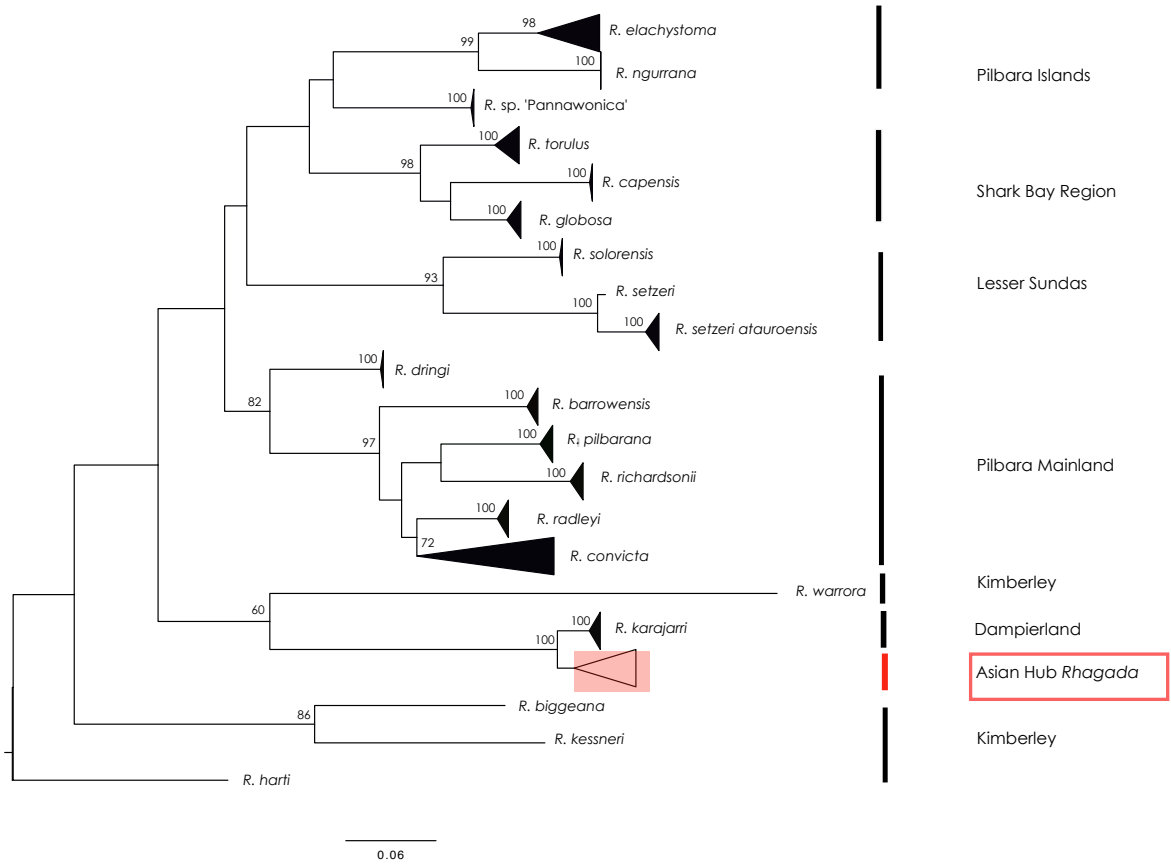
	NN40	NN41	NN45*	NN46*	NN48	NN50	NN51*	NN56*	NN57*	NN58	NN61*
NN40		0.003	0.003	0.009	0.003	0.003	0.003	0.003	0.002	0.002	0.008
NN41	0.009		0.002	0.009	0.002	0.002	0.002	0.003	0.003	0.003	0.009
NN45*	0.007	0.004		0.009	0.002	0.002	0.001	0.002	0.002	0.003	0.009
NN46*	0.056	0.059	0.057		0.009	0.009	0.009	0.009	0.009	0.009	0.003
NN48	0.007	0.004	0.003	0.054		0.002	0.001	0.002	0.002	0.003	0.008
NN50	0.007	0.004	0.003	0.057	0.003		0.001	0.002	0.002	0.003	0.009
NN51*	0.006	0.003	0.001	0.056	0.001	0.001		0.001	0.002	0.002	0.009
NN56*	0.007	0.004	0.003	0.054	0.003	0.003	0.001		0.002	0.003	0.008
NN57*	0.003	0.006	0.004	0.056	0.004	0.004	0.003	0.004		0.001	0.008
NN58	0.004	0.007	0.006	0.056	0.006	0.006	0.004	0.006	0.001		0.008
NN61*	0.054	0.057	0.056	0.004	0.053	0.056	0.054	0.053	0.054	0.054	

**Table 3.** Mean between group distances (below) and standard error (s.e.) (above) for 22 lineages of camaenid snails utilised in analyses.

	Asian Hub Rhagada	Baudinella	R. barrowensis	R. capensis	R. convicta	R. elachystoma	R. dringi	R. globosa	R. ngurrana	R. pilbarana	R. radleyi	R. richardsonii	R. sp. Pannawonica	R. torulus	R. karajarri	R. biggeana	R. harti	R. kessneri	R. setzeri	R. waroora
Asian Hub Rhagada		0.017	0.015	0.015	0.014	0.015	0.014	0.014	0.016	0.015	0.014	0.015	0.015	0.015	0.009	0.015	0.015	0.015	0.016	0.016
Baudinella	0.214		0.017	0.018	0.015	0.015	0.017	0.016	0.016	0.016	0.016	0.016	0.017	0.016	0.018	0.017	0.016	0.016	0.017	0.017
R. barrowensis	0.182	0.202		0.016	0.011	0.015	0.014	0.015	0.015	0.014	0.012	0.013	0.015	0.015	0.016	0.017	0.016	0.016	0.016	0.016
R. capensis	0.192	0.195	0.172		0.014	0.014	0.015	0.012	0.015	0.015	0.015	0.015	0.015	0.012	0.016	0.017	0.015	0.017	0.016	0.017
R. convicta	0.185	0.193	0.118	0.165		0.013	0.011	0.013	0.014	0.011	0.010	0.012	0.014	0.014	0.015	0.015	0.014	0.015	0.015	0.015
R. elachystoma	0.181	0.185	0.173	0.143	0.158		0.014	0.013	0.011	0.014	0.014	0.014	0.014	0.014	0.016	0.015	0.015	0.015	0.014	0.016
R. dringi	0.173	0.180	0.139	0.163	0.124	0.154		0.014	0.015	0.014	0.013	0.014	0.014	0.015	0.015	0.016	0.015	0.016	0.015	0.017
R. globosa	0.164	0.176	0.159	0.096	0.154	0.137	0.149		0.015	0.014	0.015	0.015	0.014	0.011	0.015	0.016	0.015	0.016	0.016	0.017
R. ngurrana	0.199	0.186	0.173	0.158	0.169	0.102	0.157	0.156		0.015	0.015	0.015	0.015	0.015	0.016	0.017	0.016	0.017	0.016	0.017
R. pilbarana	0.199	0.210	0.131	0.177	0.115	0.166	0.154	0.155	0.163		0.012	0.012	0.014	0.015	0.016	0.016	0.014	0.016	0.016	0.018
R. radleyi	0.175	0.193	0.109	0.159	0.095	0.147	0.129	0.155	0.159	0.104		0.013	0.015	0.015	0.015	0.016	0.015	0.016	0.016	0.016
R. richardsonii	0.183	0.188	0.124	0.165	0.117	0.155	0.143	0.165	0.169	0.108	0.110		0.015	0.015	0.016	0.016	0.015	0.016	0.016	0.017
R. sp. Pannawonica	0.195	0.192	0.171	0.147	0.164	0.143	0.146	0.138	0.148	0.165	0.165	0.161		0.014	0.016	0.017	0.015	0.017	0.017	0.017
R. torulus	0.183	0.189	0.174	0.107	0.168	0.146	0.156	0.089	0.164	0.159	0.162	0.165	0.141		0.015	0.016	0.015	0.017	0.016	0.017
R. karajarri	0.061	0.220	0.185	0.195	0.186	0.181	0.166	0.177	0.199	0.195	0.180	0.179	0.197	0.181		0.017	0.016	0.016	0.017	0.016
R. biggeana	0.208	0.196	0.192	0.194	0.192	0.186	0.186	0.190	0.199	0.200	0.178	0.188	0.194	0.189	0.207		0.015	0.015	0.017	0.018
R. harti	0.193	0.181	0.168	0.171	0.169	0.183	0.152	0.155	0.186	0.167	0.163	0.168	0.172	0.162	0.190	0.155		0.016	0.016	0.017
R. kessneri	0.193	0.205	0.181	0.204	0.182	0.163	0.186	0.189	0.181	0.181	0.165	0.176	0.179	0.202	0.180	0.143	0.183		0.017	0.017
R. setzeri	0.188	0.185	0.171	0.169	0.176	0.154	0.168	0.161	0.170	0.180	0.164	0.175	0.172	0.173	0.184	0.199	0.185	0.197		0.018
R. waroora	0.198	0.210	0.205	0.213	0.201	0.205	0.207	0.207	0.181	0.210	0.193	0.203	0.216	0.223	0.199	0.214	0.190	0.214	0.212	
R. solorensis	0.185	0.186	0.178	0.176	0.176	0.161	0.165	0.156	0.156	0.169	0.165	0.186	0.151	0.164	0.187	0.198	0.177	0.192	0.129	0.214
R. setzeri	0.203	0.201	0.182	0.175	0.186	0.164	0.174	0.173	0.175	0.190	0.174	0.189	0.180	0.181	0.195	0.206	0.187	0.198	0.039	0.222
R. zuroensis																				

**Table.** Mean within group p-distances for the twenty-two clades of *Rhagada* and the associated variance (s.e.), representing the seventy-three individuals of camaenid snails utilised in analyses. n/a= not applicable

	Species	p-distance	s.e.
80-mile Beach	Asian Hub Rhagada	0.027787934	0.004473486
Dampierland	<i>R. karajarri</i>	0.007312614	0.002986689
Pilbara Mainland	<i>R. dringi</i>	0.003656307	0.002449676
	<i>R. convicta</i>	0.070647979	0.006588534
	<i>R. pilbarana</i>	0.010968921	0.00419212
	<i>R. radleyi</i>	0.012797075	0.004568103
	<i>R. richardsonii</i>	0.009140768	0.004057425
	<i>R. sp. Pannawonica</i>	0.002437538	0.001670985
	<i>R. barrowensis</i>	0.007312614	0.003402982
Shark Bay Region	<i>R. capensis</i>	0.001828154	0.001733956
	<i>R. torulus</i>	0.020109689	0.005928764
	<i>R. globosa</i>	0.016453382	0.005209184
Pilbara Islands	<i>R. ngurrana</i>	0	0
	<i>R. elachystoma</i>	0.0511883	0.007477044
Kimberley Region	<i>R. waroora</i>	n/a	n/a
	<i>R. biggeana</i>	n/a	n/a
	<i>R. harti</i>	n/a	n/a
	<i>R. kessneri</i>	n/a	n/a
	Baudinella (outgroup)	n/a	n/a
Lesser Sundas	<i>R. setzeri</i>	n/a	n/a
	<i>R. solorensis</i>	0.001828154	0.001792877
	<i>R. setzeri aturoensis</i>	0.010603291	0.002637137



**Figure 1.** Maximum likelihood analysis of *Rhagada* COI mtDNA sequences, showing the placement of the Asian Hub *Rhagada* within the current taxonomic framework of *Rhagada* species from the Pilbara, Dampierland, Kimberley and Lesser Sundas. Terminal nodes are collapsed. Numbers on nodes indicate nodal support by means of maximum likelihood (ML) bootstrap values. Bootstrap values <60 are not shown. Scale indicates inferred evolutionary distance (substitutions/site).

**Table 4.** Buthid scorpion specimens used in the present study, and the species and genetic lineage to which they belong. Highlighted specimens were unsuccessful during the PCR process.

Biota Specimen ID	Helix Lab ID	Taxonomic ID	Genetic lineage
Sc20170828AHF16-2	NN01	<i>Lychas annulatus</i>	B
Sc20170828AHF15-1	NN02	PCR unsuccessful	n/a
Sc20170828AHF19-2	NN03	<i>Lychas annulatus</i>	B
Sc20170939AHF16-1	NN04	<i>Lychas annulatus</i>	B
Sc20170828AHF19-2	NN05	<i>Lychas annulatus</i>	B
Sc20170828AHF19-3	NN06	<i>Lychas annulatus</i>	A
Sc20170828AHF19-1	NN07	<i>Lychas annulatus</i>	A
Sc20170828AHF19-1	NN08	<i>Lychas annulatus</i>	A
Sc20170828AHF18-1	NN09	<i>Lychas annulatus</i>	B
Sc20170828AHF19-4	NN10	<i>Lychas annulatus</i>	B

**Table 5.** Genetic p- distance (below) and associated standard error (above) between haplotypes of buthid specimens of *Lychas annulatus* as shown in Figure 2. Specimens identified with ‘\*’ represent shared haplotypes. Un-corrected p-distances do not account for mutational saturation, which results from back mutations, and therefore provide a conservative estimate of genetic distance.

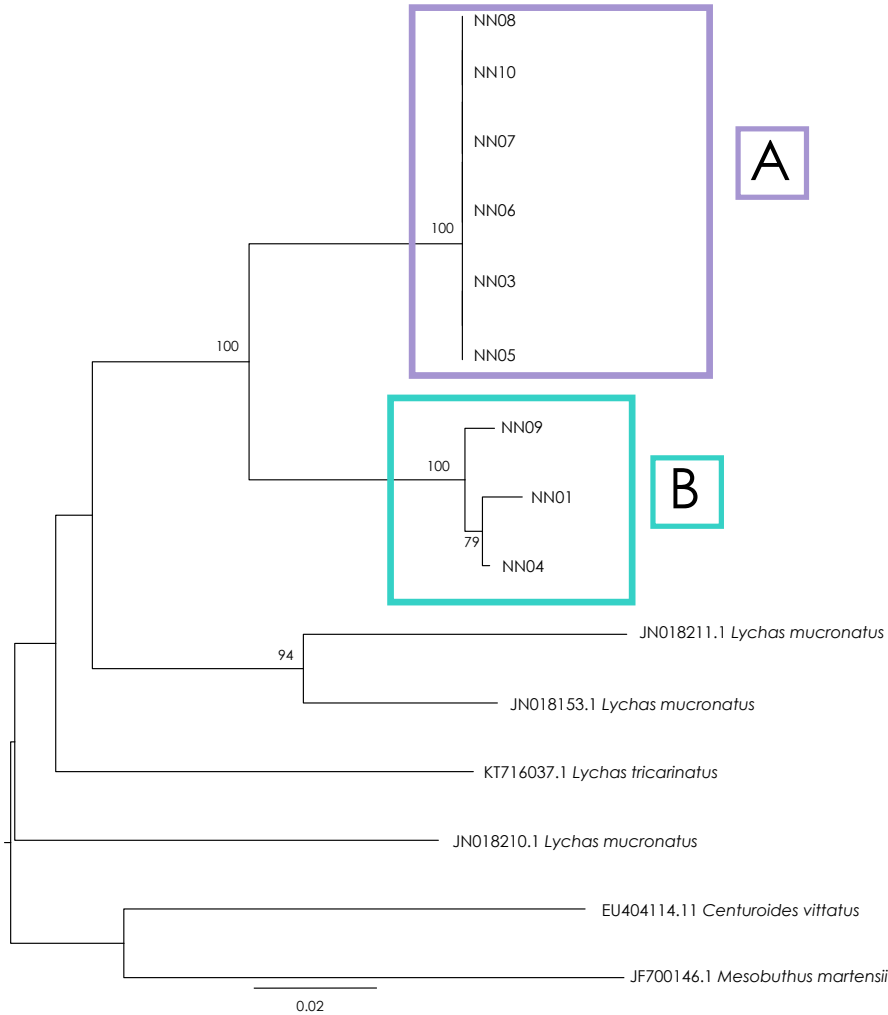
	NN01 B	NN09 B	NN04 B	NN03 A
NN01 B		0.004	0.003	0.010
NN09 B	0.012		0.003	0.010
NN04 B	0.009	0.009		0.010
NN03 * A	0.082	0.076	0.076	

**Table 6.** Genetic p-distance (below) and associated standard error (above) between Asian Hub buthid specimens and reference buthid specimens obtained from GenBank

	NN01	NN03	NN04	NN05	NN06	NN07	NN08	NN09	NN10	KT716037.1 <i>Lychas fricarinatus</i>	JN018211.1 <i>Lychas mucronatus</i>	JN018153.1 <i>Lychas mucronatus</i>	JN018210.1 <i>Lychas mucronatus</i>	EU404114.1 <i>Centruroides vittatus</i>	JF700146.1 <i>Mesobuthus martensii</i>
NN01		0.012	0.004	0.012	0.012	0.012	0.012	0.005	0.012	0.016	0.016	0.015	0.016	0.016	0.017
NN03	0.084		0.011	0.000	0.000	0.000	0.000	0.012	0.000	0.015	0.016	0.014	0.015	0.016	0.017
NN04	0.008	0.076		0.011	0.011	0.011	0.011	0.005	0.011	0.016	0.016	0.015	0.016	0.016	0.017
NN05	0.084	0.000	0.076		0.000	0.000	0.000	0.012	0.000	0.015	0.016	0.014	0.015	0.016	0.017
NN06	0.084	0.000	0.076	0.000		0.000	0.000	0.012	0.000	0.015	0.016	0.014	0.015	0.016	0.017
NN07	0.084	0.000	0.076	0.000	0.000		0.000	0.012	0.000	0.015	0.016	0.014	0.015	0.016	0.017
NN08	0.084	0.000	0.076	0.000	0.000	0.000		0.012	0.000	0.015	0.016	0.014	0.015	0.016	0.017
NN09	0.014	0.078	0.010	0.078	0.078	0.078	0.078		0.012	0.015	0.015	0.015	0.016	0.016	0.017
NN10	0.084	0.000	0.076	0.000	0.000	0.000	0.000	0.078		0.015	0.016	0.014	0.015	0.016	0.017
KT716037.1 <i>Lychas fricarinatus</i>	0.162	0.138	0.154	0.138	0.138	0.138	0.138	0.152	0.138		0.017	0.016	0.015	0.016	0.017
JN018211.1 <i>Lychas mucronatus</i>	0.152	0.160	0.156	0.160	0.160	0.160	0.160	0.150	0.160	0.158		0.012	0.016	0.018	0.018
JN018153.1 <i>Lychas mucronatus</i>	0.148	0.126	0.142	0.126	0.126	0.126	0.126	0.144	0.126	0.166	0.088		0.015	0.016	0.016
JN018210.1 <i>Lychas mucronatus</i>	0.154	0.148	0.154	0.148	0.148	0.148	0.148	0.152	0.148	0.156	0.170	0.154		0.016	0.018
EU404114.1 <i>Centruroides vittatus</i>	0.162	0.182	0.162	0.182	0.182	0.182	0.182	0.166	0.182	0.166	0.202	0.180	0.166		0.016
JF700146.1 <i>Mesobuthus martensii</i>	0.182	0.182	0.182	0.182	0.182	0.182	0.182	0.184	0.182	0.182	0.200	0.172	0.182	0.164	

**Table 7.** Mean within group distances for the two lineages of *Lychas annulatus*.

	distance	s.e.
<b>A</b>	0.000	0.000
<b>B</b>	0.010	0.003



**Figure 2.** Maximum Likelihood analysis of COI haplotypes of buthid scorpion specimens of *Lychas annulatus* from the Asian Hub study area. Numbers on nodes correspond to bootstrap support. Bootstrap < 65 not shown. Lineages are labelled A and B, as referred to in the text and Tables 5 and 7. Scale bar = number of substitutions per site.



**Table 8.** Mygalomorph specimens used in the present study, and the genetic lineage to which they belong. Grey shading represents either unsuccessful sequencing, or non-mygalomorph lineages. Coloured shading corresponds to colour-coding of species represented in Figure 3.

Biota Specimen ID	Helix Lab ID	Taxonomic ID	Genetic lineage	Species
M20170831.AHF01-01	NN11	Nemesiidae	NRF	N7
M20170904.AHF01-01	NN15	Nemesiidae	NRG	N7
M20170903.AHF06-01	NN16	Nemesiidae	NRH	N7
M20170830.AHF07-01	NN17	Nemesiidae	NRI	N7
M20170830.AHF07-02	NN18	Nemesiidae	NRJ	N7
M20170903.AHF07-01	NN19	Nemesiidae	NRI	N7
M20170830.AHF10-01	NN20	Nemesiidae	NRK	N7
M20170904.AHF10.SRE-01	NN21	Nemesiidae	NRL	N7
M20170901.AHF.SRE03-01	NN29	Nemesiidae	NRR	N139
M20170901.AHF.SRE03-02	NN30	Nemesiidae	NRR	N139
M20170830.AHF.SRE02-02	NN32	Nemesiidae	NRS	N140
M20170829.AHF13.SRE-01	NN35	Nemesiidae	NRP	N138
M20170904.AHF13.SRE-01	NN36	Nemesiidae	NRQ	N138
M20170904.AHF12.SRE-01	NN37	Nemesiidae	NRM	N7
M20170904.AHF???.Bary-02	NN38	Nemesiidae	NRO	N7
M20170828.AHF12-01	NN25			Unusable sequence
M20170902.AHF13-01	NN26			Unusable sequence
M20170902.AHF13-02	NN27			Unusable sequence
M20170903.AHF13-01	NN28			Unusable sequence
M20170830.AHF.SRE02-01	NN31			Failed PCR
M20170903.AHF01-01	NN12			Not mygalomorph
M20170903.AHF01-02	NN13			Not mygalomorph
M20170903.AHF01-03	NN14			Not mygalomorph
M20170904.AHF10.SRE-03	NN22			Not mygalomorph
M20170904.AHF10.SRE-04	NN23			Not mygalomorph
M20170904.AHF10.SRE-05	NN24			Not mygalomorph
M20170904.AHF07.SRE-01	NN33			Not mygalomorph
M20170904.AHF07.SRE-01b	NN34			Not mygalomorph
M20170904.AHF07.SRE-02	NN39			Not mygalomorph

**Table 9.** Genetic p-distance (below) and the associated variance (s.e. – above) between the 13 haplotypes (lineages) representing the 15 sequenced specimens of nemesiid mygalomorphs, as shown in Figure 3. Shading in distance matrix corresponds to colour-coding of lineages in Figure 3. Un-corrected p-distances do not account for mutational saturation, which results from back mutations, and therefore provide a conservative estimate of genetic distance.

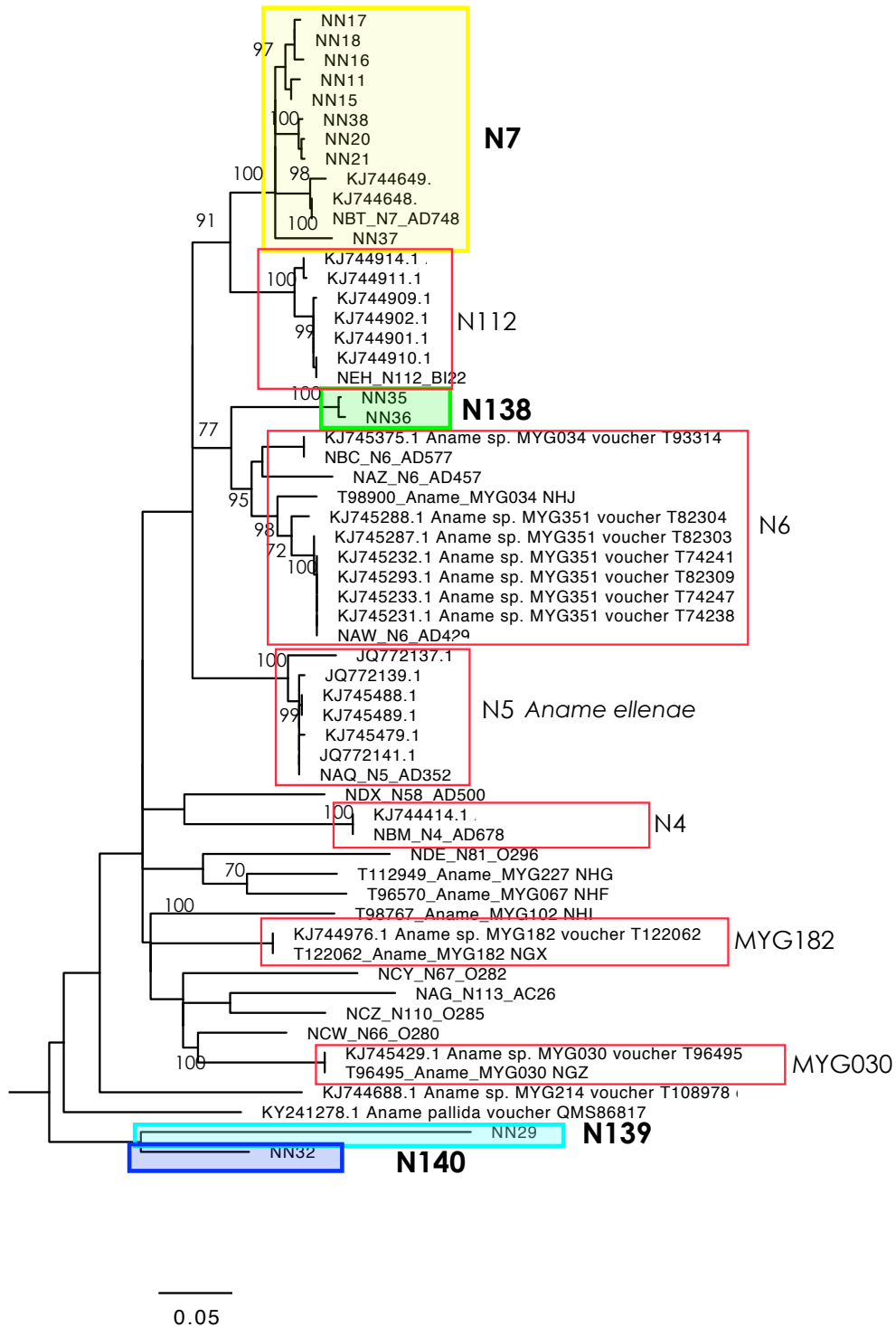
		N7									N138		N139	N140
		NRF_N7_NN11	NRG_N7_NN15	NRH_N7_NN16	NRI_N7_NN17	NRJ_N7_NN18	NRK_N7_NN20	NRL_N7_NN21	NRM_N7_NN37	NRO_N7_NN38	NRP_N138_NN35	NRQ_N138_NN36	NRR_N139_NN29	NRS_N140_NN32
N7	NRF_N7_NN11		0.004	0.005	0.004	0.005	0.007	0.007	0.008	0.006	0.012	0.012	0.015	0.013
	NRG_N7_NN15	0.012		0.006	0.005	0.005	0.007	0.007	0.008	0.007	0.011	0.011	0.014	0.012
	NRH_N7_NN16	0.022	0.025		0.004	0.004	0.007	0.007	0.009	0.007	0.012	0.012	0.015	0.013
	NRI_N7_NN17	0.015	0.018	0.013		0.003	0.007	0.007	0.008	0.007	0.011	0.011	0.015	0.013
	NRJ_N7_NN18	0.015	0.018	0.010	0.009		0.007	0.007	0.008	0.006	0.011	0.011	0.015	0.013
	NRK_N7_NN20	0.034	0.040	0.038	0.037	0.037		0.002	0.008	0.004	0.012	0.012	0.015	0.013
	NRL_N7_NN21	0.034	0.040	0.038	0.037	0.037	0.003		0.008	0.004	0.012	0.012	0.015	0.013
	NRM_N7_NN37	0.047	0.050	0.055	0.050	0.050	0.052	0.055		0.009	0.012	0.013	0.015	0.013
NRO_N7_NN38	0.032	0.038	0.034	0.035	0.032	0.010	0.010	0.056		0.012	0.012	0.015	0.013	
N138	NRP_N138_NN35	0.117	0.112	0.122	0.115	0.115	0.124	0.124	0.128	0.125		0.003	0.014	0.013
N138	NRQ_N138_NN36	0.119	0.115	0.121	0.117	0.117	0.127	0.127	0.131	0.128	0.004		0.014	0.013
N139	NRR_N139_NN29	0.193	0.190	0.196	0.190	0.192	0.187	0.184	0.206	0.186	0.190	0.195		0.014
N140	NRS_N140_NN32	0.146	0.149	0.152	0.150	0.152	0.150	0.150	0.164	0.149	0.165	0.170	0.162	

**Table 10.** Mean within group distances for the four lineages of nemesiid mygalomorph spiders. n/a= not applicable.

	Mean Within group p-dist	s.e.
<b>N7</b>	0.042259657	0.004966469
<b>N112</b>	0.012475278	0.00288803
<b>N6</b>	0.048504211	0.004855819
<b>N5</b>	0.016430853	0.00274486
<b>N4</b>	0	0
<b>MYG182</b>	0	0
<b>MYG030</b>	0	0
<b>N138</b>	0.004792332	0.00268387
<b>N139</b>	n/a	n/a
<b>N140</b>	n/a	n/a

**Table 11.** Mean between group (species) p-distances (below) and associated variance (s.e. – above). Species names correspond to those depicted in Figure 3.

	<b>N7</b>	<b>N112</b>	<b>N6</b>	<b>N5</b>	<b>N4</b>	<b>MYG182</b>	<b>MYG030</b>	<b>N138</b>	<b>N139</b>	<b>N140</b>
<b>N7</b>		0.009	0.011	0.011	0.012	0.012	0.012	0.012	0.014	0.013
<b>N112</b>	0.093		0.011	0.012	0.012	0.013	0.012	0.012	0.015	0.014
<b>N6</b>	0.122	0.126		0.012	0.012	0.013	0.012	0.011	0.015	0.013
<b>N5</b>	0.131	0.130	0.133		0.013	0.013	0.013	0.013	0.015	0.014
<b>N4</b>	0.139	0.141	0.164	0.159		0.014	0.012	0.013	0.016	0.014
<b>MYG182</b>	0.141	0.135	0.167	0.160	0.145		0.014	0.013	0.015	0.015
<b>MYG030</b>	0.151	0.141	0.150	0.140	0.137	0.152		0.014	0.016	0.014
<b>N138</b>	0.127	0.121	0.114	0.139	0.161	0.147	0.148		0.015	0.014
<b>N139</b>	0.201	0.196	0.200	0.200	0.214	0.196	0.195	0.200		0.014
<b>N140</b>	0.163	0.172	0.172	0.174	0.184	0.176	0.168	0.178	0.171	



**Figure 3.** Maximum likelihood analysis of *COI* haplotypes of mygalomorph spider specimens from the Asian Hub area along with reference nemesiid lineages within 15 % sequence divergence. Numbers on nodes correspond to posterior probabilities. Numbers on nodes represent bootstrap support. Support < 65 not shown. Scale bar = number of substitutions per site.

## Appendix 1. 'megaBLAST' search results for Aranemorph specimen 'NN12'.

Query sample	Sequence ID of reference specimen	Identity (%)	Maximum Score
NN12	KY017668.1	88.113	797
NN12	KY017666.1	87.982	793
NN12	MF467716.1	88.316	787
NN12	KY017865.1	87.892	785
NN12	KP209084.1	88.244	784
NN12	KP209083.1	88.244	784
NN12	KP209044.1	88.244	784
NN12	KP209064.1	87.994	776
NN12	JN817103.1	87.225	774
NN12	KP209067.1	87.897	773
NN12	KP209040.1	87.86	773
NN12	LC310806.1	87.389	771
NN12	KY017626.1	88.438	771
NN12	KY017896.1	87.332	769
NN12	MF811495.1	87.709	767
NN12	KX537030.1	87.709	767
NN12	KX536941.1	87.709	767
NN12	KP209089.1	87.786	767
NN12	KP209042.1	87.746	767
NN12	JF886125.1	87.709	767
NN12	JF886119.1	87.709	767
NN12	LC310805.1	87.24	765
NN12	KP253809.1	87.69	765
NN12	KF442792.1	88	765
NN12	JF411100.1	87.69	765
NN12	FJ525318.1	87.709	765
NN12	KP271816.1	87.221	763
NN12	KM244672.1	86.95	763
NN12	MG816011.1	87.519	760
NN12	KY018010.1	87.164	760
NN12	KY017931.1	87.145	758
NN12	KP209075.1	87.481	756
NN12	JN817216.1	86.676	756
NN12	JN308800.1	87.405	756
NN12	KY018006.1	87.988	754
NN12	KY017776.1	86.924	754
NN12	KY017677.1	86.996	754
NN12	KX537443.1	87.405	754
NN12	KX536876.1	87.405	754
NN12	JN817253.1	86.569	754
NN12	JN817244.1	86.569	754
NN12	JN817199.1	86.745	754
NN12	KY778983.1	87.771	752
NN12	KY018062.1	86.905	752
NN12	KY017920.1	86.924	752
NN12	KY017816.1	86.924	752
NN12	KP646410.1	87.462	752
NN12	JF411084.1	87.273	750
NN12	KY018047.1	86.756	749
NN12	KY017863.1	86.866	749
NN12	KM831538.1	87.234	749
NN12	JF884504.1	87.234	749
NN12	HQ924668.1	87.215	749
NN12	KY017715.1	87.234	747
NN12	KY017671.1	86.846	747
NN12	KP646571.1	87.309	747
NN12	JN817081.1	86.423	747
NN12	KY778930.1	87.695	745
NN12	KU875804.1	87.082	745
NN12	KX762063.1	87.102	745
NN12	KP209090.1	87.141	745
NN12	KP209041.1	87.121	745
NN12	KP651040.1	87.121	745
NN12	JF884514.1	87.082	745
NN12	KY017593.1	86.716	743
NN12	KY268627.1	87.062	743
NN12	LN887155.1	86.736	743

Query sample	Sequence ID of reference specimen	Identity (%)	Maximum Score
NN12	KP650494.1	87.062	743
NN12	KM825530.1	87.082	743
NN12	KM507783.1	86.277	743
NN12	JN817198.1	86.451	743
NN12	JF411087.1	87.102	743
NN12	JF884507.1	87.082	743
NN12	JF884494.1	87.082	743
NN12	GU682805.1	87.062	743
NN12	FJ263794.1	86.297	743
NN12	MF812590.1	86.97	741
NN12	KY778791.1	87.422	741
NN12	KY017688.1	86.587	741
NN12	KY017672.1	86.677	741
NN12	KY017559.1	86.607	741
NN12	KP648977.1	87.156	741
NN12	KT174686.1	87.009	741
NN12	KT174685.1	87.102	741
NN12	KT174684.1	87.009	741
NN12	JN018132.1	87.956	741
NN12	GU682857.1	87.043	741
NN12	KY017695.1	86.567	739
NN12	KY269287.1	86.95	739
NN12	KY268719.1	86.93	739
NN12	KY268704.1	86.95	739
NN12	KY268308.1	86.95	739
NN12	KX537479.1	86.93	739
NN12	KX537432.1	86.95	739
NN12	KX537196.1	86.95	739
NN12	GU682908.1	87.062	739
NN12	LC310804.1	86.558	737
NN12	KY017787.1	86.567	737
NN12	KY268430.1	86.93	737
NN12	KX537314.1	86.91	737

# Appendix 5

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## Conservation Significance Framework



## **Commonwealth EPBC Act**

Fauna species of national environmental significance are listed under the Commonwealth EPBC Act (Department of the Environment 2017), and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk', which are consistent with IUCN categories.

**Critically Endangered (CR):** a taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

**Endangered (EN):** a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

**Vulnerable (VU):** a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

**Lower Risk (LR):** a taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (CD).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (NT).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (LC).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

**Migratory species** are also protected under the EPBC Act as species of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. The list of migratory species consists of those species listed under the following international conventions:

1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
2. China-Australia Migratory Bird Agreement (CAMBA);
3. Japan-Australia Migratory Bird Agreement (JAMBA); and,
4. Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

**Marine species** are also protected under the EPBC Act, and are listed to ensure the long-term conservation of the species. Marine species include all Australian sea snakes, seals, crocodiles, dugongs, marine turtles, seahorses and seabirds that naturally occur in the Commonwealth marine area.

## **Western Australian Wildlife Conservation Act 1950**

Classification of rare and endangered fauna under the state *Wildlife Conservation (Specially Protected Fauna) Notice 2016* (State of Western Australia 2017), recognises seven distinct schedules of taxa:

**Schedule 1:** fauna that are rare or likely to become extinct as critically endangered fauna (CR).

**Schedule 2:** fauna that are rare or likely to become extinct as endangered fauna (EN).

**Schedule 3:** fauna that are rare or likely to become extinct as vulnerable fauna (VU).

**Schedule 4:** fauna presumed to be extinct (EX).

**Schedule 5:** birds that are subject to an agreement between the government of Australia and the governments of Japan, China and the Republic of Korea relating to the protection of migratory birds, and birds in danger of extinction, which are declared to be fauna in need of special protection.

**Schedule 6:** fauna that is of special conservation need as conservation dependent fauna (CD). This category of species contains those taxa that do not meet the criteria for listing as threatened, but which are being maintained by specific management programs.



**Schedule 7:** Other specially protected fauna (OS). This category contains those taxa that are at risk from harvesting, or other human interactions, which have potential to affect their conservation status if not appropriately managed.

### **Department of Biodiversity, Conservation and Attractions Priority Fauna**

In addition, the Department of Biodiversity, Conservation and Attractions maintains a list of Priority species that have not been assigned statutory protection under the *Wildlife Conservation Act 1950* (DBCAs 2017c). Species on this list are considered to be of conservation priority because there is insufficient information to make an assessment of their conservation status or they are considered to be rare but not threatened and are in need of monitoring. Under this list, species are classified according to five Priority categories:

#### **Priority One: Taxa with few, poorly known populations on threatened lands**

Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Two: Taxa with few, poorly known populations on conservation lands**

Taxa that are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Three: Taxa with several, poorly known populations, some on conservation lands**

Taxa that are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

#### **Priority Four: Taxa in need of monitoring**

Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

#### **Priority Five: Taxa in need of monitoring**

Taxa that are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.



## Appendix 6

### Conservation Significant Species Considered Unlikely to Occur





## **Fauna of Conservation Significance Assessed as Unlikely to Occur but are Challenging to Detect**

### **Night Parrot (*Pezoporus occidentalis*) - WC Act Schedule 1; EPBC Act Endangered**

The Night Parrot is a small ground-dwelling parrot endemic to Australia, occurring in arid to semi-arid regions where it requires dense, low vegetation, under or in which they hide during the day. Historical records indicate that the Night Parrot was once widespread and relatively common in the arid zone until late in the 19<sup>th</sup> Century (Murphy et al. 2017) but then a hiatus in records of almost 100 years followed, despite considerable search effort. Then in 1990 and 2006, two specimens were collected in southwest Queensland with the first photographic evidence presented in 2013 (Dooley 2013). In March 2017 there was a confirmed record from the Murchison (Jones 2017). A published article also details a number of sightings in the Lorna Glen and Millrose Station area, which straddles the Murchison/Gascoyne bioregions (Hamilton et al. 2017).

The current descriptions of the species' habitat preferences are broad, reflecting the wide variety of habitats the species was historically known from. The Department of Biodiversity, Conservation and Attractions Guideline (2017a) details old-growth spinifex (*Triodia* spp.) as habitat for roosting and nesting as has been recorded in western Queensland (Murphy et al. 2017). Foraging habitats are broadly described as grasses and herbs that may or may not contain shrubs or low trees. Johnstone and Storr (1998) mention sparsely-wooded *Triodia* spp. near water as the habitat preferred by this species, while Pizzey and Knight (2007) list the following additional habitats: seeding spinifex on stony rises, breakaway country, sandy lowlands, shrubby glasswort, chenopods, succulents on flats around salt lakes, flooded claypans, saltbush, bluebush and bassia associations.

The following potential threats have been suggested for the decline of the species: predation by feral cats and foxes, degradation of habitat due to fire, grazing or rabbits, reduction in the availability of water due to consumption by feral camels and reduced maintenance of waterholes (Department of the Environment 2016).

The current survey incorporated 2,340 days of automated acoustic recording over 10 sites, which did not detect the species and would have included seasonal improvements in foraging habitat. The study of Murphy et. al. (2017) describes three nests each consisting of a hollow chamber ranging in size from 20 – 28 cm in a spinifex hummock with each chamber leading to the outside via a tunnel of length 20 – 33 cm. The size of the hummocks was not stated but we infer that they must have been at least 40 - 50 cm in size. We assume, based on this information, that the structural elements of a chamber and tunnel are required for nest success and although perhaps the tunnel and chamber size may be tailored somewhat to the size of hummock, a minimum size of hummocks of 40 – 50 cm diameter seems reasonable. The dominance of spinifex on sandplain throughout the study area is likely to support hummocks of a size potentially suitable for nesting, though the current high frequency of major fires reduces the suitability of this aspect of the habitat (by removing large and mature hummocks from the landscape). Preferred nesting habitat is also likely to be in proximity to favourable feeding habitat, which can at times represent seeding *Triodia*, but sources of more constant feeding plants such as chenopod have been coincident with most recent records. This type of habitat may be available north of the study area fringing the Mandora Marsh but does not occur within the study area.

### **Great Desert Skink (*Liopholis kintorei*) - WC Act Schedule 3, EPBC Act Vulnerable**

This species is patchily distributed in the Great Sandy Desert, Gibson Desert and Tanami Desert. *Liopholis kintorei* occurs in a variety of desert habitats on sandy, clay and loamy soils (Storr et al. 1999). Although poorly documented, it is known to inhabit burrow complexes.

Suitable habitat for this species is available throughout the study area, but warrens of this large skink species are distinctive (especially when latrines are present) but were not detected during transect walks. Furthermore, the study occurs outside the range of records to date, however, given the availability of habitat within the study area and lack of previous survey work in the area it must be considered possible that it occurs.

### **Princess Parrot (*Polytelis alexandrae*) - DBCA Priority 4; EPBC Act Vulnerable**

This species occupies the eastern deserts of Western Australia, extending into South Australia. There are records from as far west as Wiluna, Wanjarri Nature Reserve, Sandstone and Laverton.

This highly nomadic species prefers lightly wooded habitat including open mallee/spinifex and open marble gum woodlands (Johnstone and Storr 2004). Its diet includes *Triodia* and wattle seeds, and it has also been observed feeding from *Hakea* and *Grevillea* (Johnstone and Storr 1998).

NatureMap records indicate that the species has not been recorded within 40 km of the study area and the eucalypt-dominated woodlands preferred by the species for roosting and nesting are absent from the study area. Princess Parrots are, however, highly nomadic and they could occasionally utilise spinifex seeding events for foraging on a transient basis.