

Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)
Surveys of the Warrigal North Deposit

18th – 23rd Oct 2012

14th – 22nd May 2013



Mesas in the Warrigal North area. Photo: Wes Bancroft

Prepared for: Strategen Environmental Consultants
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4th July 2013

1 Introduction

As part of the Nullagine Joint Venture (NJV) on Bonney Downs Station, BCIron Ltd (BCI) proposes the development of an iron ore mine and associated infrastructure at the Warrigal North deposit. This area lies within the current distribution of the threatened Pilbara Leaf-nosed Bat (PLNB; *Rhinonictoris aurantia*– Pilbara form). Bamford Consulting Ecologists was commissioned by Strategen Environmental Consultants, on behalf of BCI, to conduct a survey for PLNB in the Warrigal North area. This report details the methods used, the results obtained and suggestions for future work.

2 Background

2.1 Pilbara Leaf-nosed Bat (*Rhinonictoris aurantia*– Pilbara form)

2.1.1 Conservation Status

The PLNB is listed as Vulnerable (high risk of extinction in the wild in the near future) under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* and Vulnerable (high risk of extinction in the wild in the immediate future) under the Western Australian *Wildlife Conservation Act 1950*.

Known or perceived threats to the species (SEWPaC, 2012) include:

- Habitat loss, modification and/or degradation;
- Restricted geographical distribution (area of occupancy and extent of occurrence);
- Habitat destruction, disturbance and/or modification due to mining activities;
- Human induced disturbance due to unspecified activities; and
- Low numbers of individuals.

2.1.2 Distribution

The PLNB is restricted to the Pilbara, with the study area near the eastern edge of their distribution. Largely restricted in range by the presence of suitable caves, the PLNB is likely to have been aided by historic mining activity that created deep chambers, which are suitable for maintaining favourable microclimatic conditions.

2.1.3 Ecology

The biology and ecology of the PLNB, as compiled by Churchill (2008) and SEWPaC (2012), is summarised below:

2.1.3.1 Habitat

Because of physiological limitations, the PLNB requires roosting sites (e.g. caves or mines) that maintain very hot and humid microclimates (i.e. 28-32°C and 96-100% relative humidity) during the dry season. Some roost caves appear to be used consistently throughout the year, whilst others are only used seasonally. During suitable conditions they may abandon roost caves and become tree roosting. Roosts may be used during the usual

main period of (diurnal) inactivity ('day-roosts') but, in some cases, bats may not stay in flight continuously for the whole night and may also use 'night-roosts' for shelter during these rest periods.

The nearest known PLNB day-roost (to the survey area) is at the Copper Hills mine, north of Nullagine and c. 40 km north of the Warrigal North area. In 2001 there were 10-20 individuals likely to be present at this roost.

2.1.3.2 Breeding

Mating occurs in July, with young born in late December and early January. Young are weaned and independent by late February. Unlike some other species (e.g. Ghost Bat *Macroderma gigas*), it is not thought that the PLNB congregates in specific 'maternity roosts' during the offspring-rearing period.

2.1.3.3 Diet

The PLNB is an opportunistic insectivore, with moths and beetles forming the majority of the diet. During periods of flying termite emergence, these may briefly dominate the dietary intake.

3 Methods

3.1 Site Description

The survey covered the Warrigal North deposit and some adjacent areas; situated c. 15 km south-west of Nullagine, along Bonnie Creek. Figure 1 shows the Warrigal North deposit footprint and adjacent areas.

The foothills of the Chichester Ranges support a range of habitats including areas of spinifex plains, mulga/acacia woodlands without spinifex understorey, all dissected by eucalypt dominated watercourses (e.g. Bonnie Creek).

3.2 Survey Dates, Licences and Personnel

The initial survey was conducted between the 18th and 23rd October 2012. All fieldwork was conducted under DEC Regulation 17 licence number SF008814. Personnel that were involved in the October 2012 survey included:

- Dr Wes Bancroft *BSc(Zool./Microbiol.), Hons(Zool.), PhD(Zool.)* – BCE
- Mr Brenden Metcalf *BSc(Env. Sci), Hons(Biol.)* – BCE
- Mr Ian Gale *Assoc. Dip. (Env. & Waste Mgt.)* – BCI

A second survey to assess usage of potential cave roosts within the study area was conducted from the 14th – 22nd May 2013 (in conjunction with Northern Quoll Monitoring). All fieldwork was conducted under DEC Regulation 17 licence number SF008814. Personnel involved in the May 2013 survey included:

- Dr Mike Bamford *BSc (Biol), Hons (Biol.), PhD (Biol.)* – BCE
- Mr Brenden Metcalf *BSc (Env. Sci), Hons(Biol.)* – BCE
- Mr Peter Smith *Dip Ag* – BCE
- Mrs Sarah Smith *BSc (Biol.)* – BCE
- Mr Ian Gale *Assoc Dip (Env. & Waste Mgt.)* – BCI
- Ms Emma Porter - BCI

The report was prepared and updated by Brenden Metcalf and Dr Mike Bamford.

3.3 Survey Techniques

The survey methodology was developed with reference to the “Survey guidelines for Australia’s threatened bats” (DEWHA, 2010), with the following techniques being employed during the October 2012 survey:

1. *Passive acoustic detection.* A combination of SM2 (Wildlife Acoustics) and Anabat (Titely Electronics) units was used to conduct passive monitoring across the project area. Five to six units were deployed each night, monitoring from dusk to dawn (or from the end of an active monitoring session to dawn). The units were deployed at a range of location throughout the study area (see Figure 2 and Table 1 for details).
2. *Active acoustic detection.* 1.8 to 2 hour transects were conducted during four evenings of the survey period, actively surveying for bats in gullies, gorges or along watercourses. During each transect, two field personnel together walked a pre-determined transect, wearing head-torches and monitoring bat calls with Anabat detectors (see Figure 3 for routes taken and Table2 for further details).
3. *Exploration for potential roosts.* The study area was searched extensively for relatively deep caves, but few were located. Those caves that looked most suitable were surveyed as a “passive acoustic detection” site.

Based on the results of the October 2012 survey, a second survey was conducted in May 2013 to assess usage of potential cave roosts within the study area i.e. confirm whether PLNB use caves within the study area as day roosts. Roost occupancy was assessed using methodology detailed in the “Survey guidelines for Australia’s threatened bats” (DEWHA, 2010):

1. *Determining roost occupancy.* The cave entrance/s were sealed completely in late afternoon, using a cloth curtain. Both sides of the curtain were monitored from dusk onwards using Anabat units directed either in or out. Curtains were removed one hour after dusk.

Anabat and SM2 data were analysed by Dr Kyle Armstrong of Specialised Zoological (see Appendix 1 and Appendix 2 for the report).

3.3.1 Other Fauna

All fauna species recorded during the field survey were noted, with a full species list from the October 2012 survey provided in Appendix 2

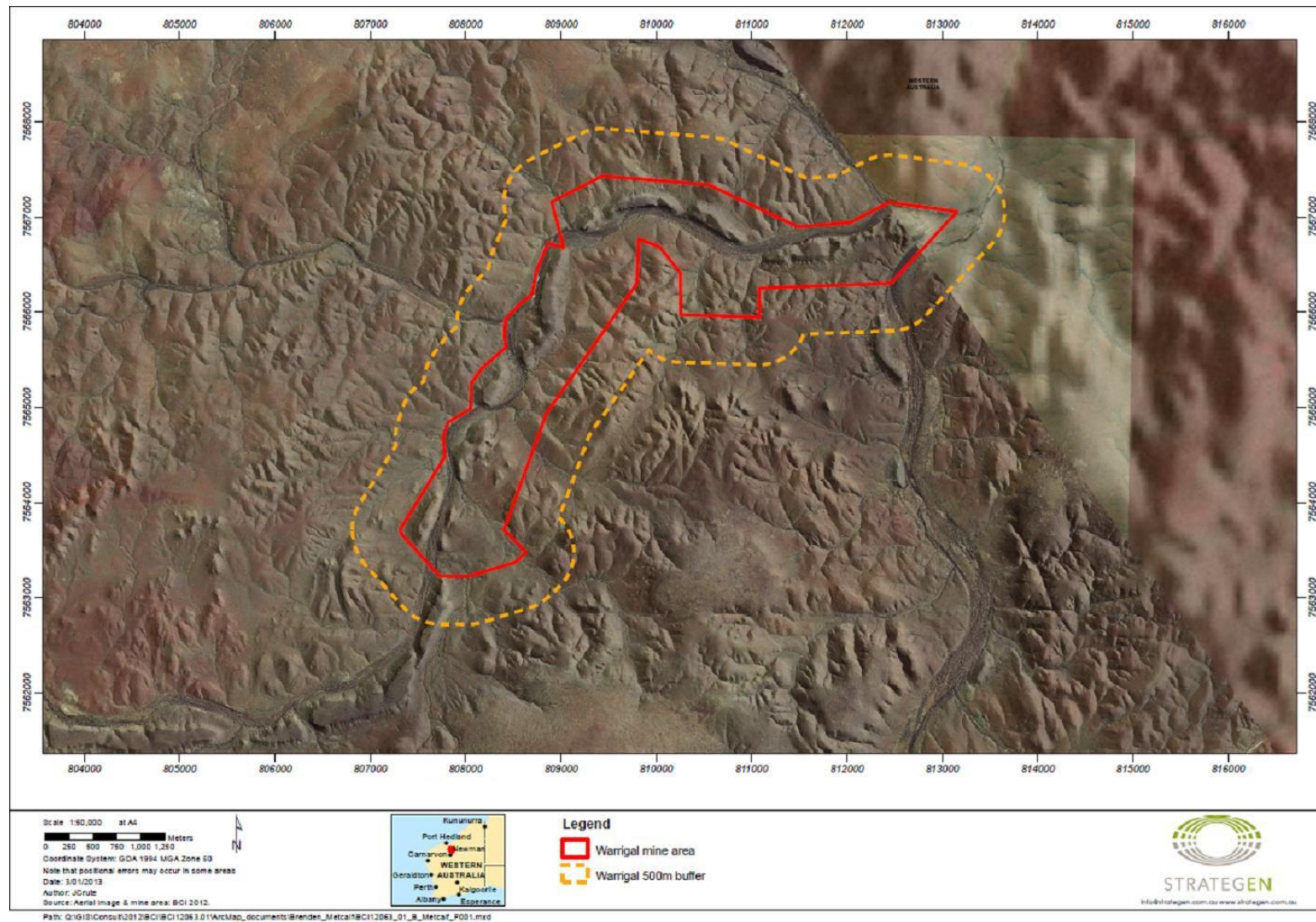


Figure 1. Warrigal North deposit and adjacent areas.

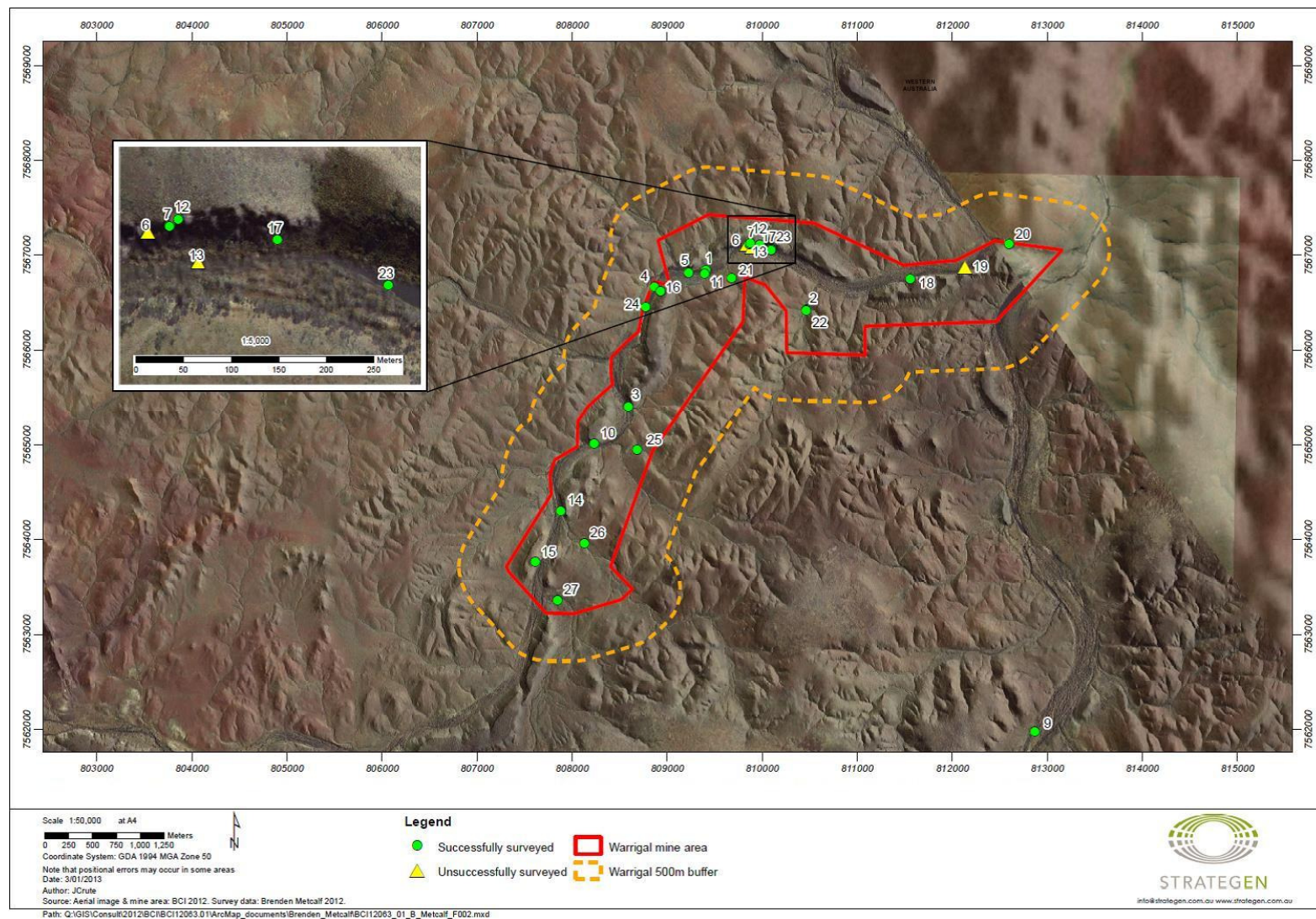


Figure 2. Location of passive monitoring sites across the Warrigal North study area (further details of each site provided in Table 1).

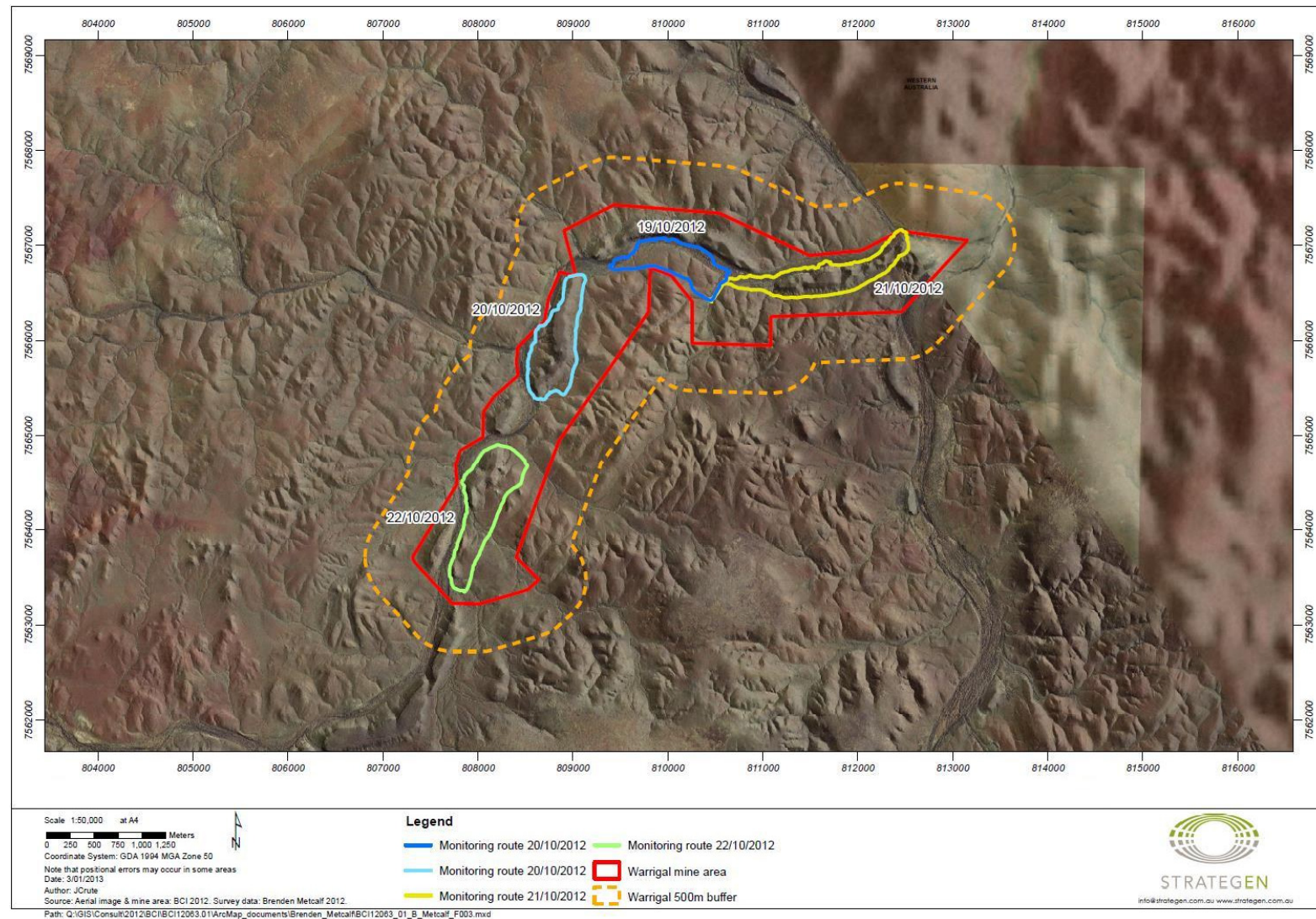


Figure 3. Active monitoring routes through the Warrigal North study area (with further details of each active monitoring session in Table 2).

Table 1. Details of sites where passive acoustic monitoring was undertaken within and adjacent to the Warrigal North deposit footprint.
^A Sites where PLNB was recorded.

^B Sites where surveys were unsuccessful due to technical issues with equipment.

Date	Unit	Serial	Wypt	Co-ordinates	Description
18/10/2012	SM2	8045	01 ^A	50K 809410 7566840	Creekline near Bonnie Pool.
	SM2	6670	02 ^A	51K 190842 7566450	Small gully at eastern end of Lease.
	Anabat	5395	03 ^A	50K 808593 7565395	Between mesas along Bonnie Creek.
	SM2	7014	04 ^A	50K 808867 7566660	Bonnie Creek, south of Bonnie Pool.
	Anabat	4868	05 ^A	50K 809227 7566813	Bonnie Pool.
19/10/2012	SM2	6670	06 ^B	51K 190192 7567110	Cave entrance where <i>Taphozous</i> sp. was seen.
	SM2	8045	07 ^A	51K 190215 7567117	Beneath cave/overhang.
	SM2	7014	09 ^A	51K 193422 7562094	Nullagine River.
	Anabat	4868	10 ^A	50K 808232 7565009	Creek between mesas.
	Anabat	5395	11	50K 809397 7566801	Bonnie Pool.
20/10/2012	SM2	8045	12 ^A	51K 190224 7567124	Fissure in cliff face.
	SM2	6670	13 ^B	51K 190246 7567079	Cave.
	SM2	7014	14 ^A	50K 807880 7564298	Near pool in creek.
	Anabat	5395	15	50K 807613 7563764	Small cave near Warrigal Well.
	Anabat	4868	16	50K 808929 7566619	Edge of mesa slope.

Date	Unit	Serial	Wypt	Co-ordinates	Description
21/10/2012	SM2	8045	17 ^A	51K 190329 7567107	Cave at eastern end of mesa.
	SM2	7014	18 ^A	51K 191923 7566815	Pool on Bonnie Creek towards Nullagine River.
	SM2	10890	19 ^B	51K 192495 7566962	Edge of dry creek bed.
	Anabat	4868	20 ^A	51K 192949 7567228	Pool on Bonnie Creek near Nullagine River.
	Anabat	5395	21	50K 809680 7566760	Small gully.
	Anabat	1509	22	51K 190840 7566439	Small gully at eastern end of Lease (same as Wypt 02)
22/10/2012	SM2	8045	23 ^A	51K 190447 7567064	Near pool in creek.
	SM2	7014	24 ^A	50K 808775 7566452	Near pool in creek.
	Anabat	4868	25	50K 808684 7564950	Small gully.
	Anabat	1509	26 ^A	50K 808130 7563953	Small gully near Warrigal Well.
	Anabat	5395	27	50K 807845 7563360	Warrigal Well.

Table 2. Details of active monitoring transects.

Date	Start – End Times	Anabat Units used	Location of transect
19/10/2012	18:35-20:05	5395 and 1509	Bonnie Pool and east.
20/10/2012	18:40-20:10	4868 and 1509	Bonnie Creek - south.
21/10/2012	18:30-20:25	5395 and 1509	Bonnie Creek - east.
22/10/2012	18:10-20:05	5395 and 1509	Along Bonnie Creek, from Warrigal Well.

Table 3. Details of potential roost caves assessments conducted in May 2013.

Date	Location Wypt (see Table 1 for details)	Anabat Units used	Details
15/5/2013	06	1514	facing inside
		3230	facing outside
	12	3006	facing inside
		3186	facing outside
16/5/2013	07	3006	facing inside
		3186	facing outside
	13	1514	facing inside
		3230	facing outside
17/5/2013	17	3006	facing inside
		3186	facing outside
20/5/2013	Bonney Pool	3186	Near Bonney Pool @ 50 K 809389 7566844
21/5/2013	Bonney Downs Hmstd	3186	Near Bonney Downs Homestead @ 50 K 802490 7543852

4 Results and Discussion

4.1 Passive Acoustic Detection (Passive Monitoring Sites) - October 2012

A total of 23 passive monitoring sites was successfully surveyed from a range of landform features across the Warrigal North study area, including major and minor watercourses and caves. Three passive monitoring sites were unsuccessfully surveyed due to technical issues with electronic equipment (see Table 1). PLNB calls were recorded from 16 of the 23 successfully surveyed sites (see Table 1 and Appendix 1). These 16 sites included caves, major watercourses and minor watercourses (see Figure 4 and Plate 1 - Plate 3 for examples of each landform feature).

PLNB were recorded from three cave sites (at waypoints 7, 12 and 17; see Table 1). Analysis of activity levels (based on number of calls over a night – see Appendix 1) suggested that none of these sites was being utilised as a day-roost, however further work is required to confirm this. It should be noted that SM2 units were used at each of the cave sites where PLNB calls were recorded. These units have a multi-directional microphone making it quite possible that bats commuting past the cave were recorded (i.e. not necessarily bats investigating or utilising the cave).

4.2 Active Acoustic Detection (Active Monitoring Transects) - October 2012

Four active monitoring transects were conducted during the October 2012 field survey (see Table 2), covering a range of landform features across the landscape, but focussing on Bonnie Creek and associated gorges (see Figure 3). No PLNB calls were recorded during these transects.

4.3 Exploration for Potential Roost Sites – October 2012

Although several caves were recorded and inspected from within the Warrigal North study area, none looked suitable for creating the strict microclimatic requirements of PLNB. Four caves were successfully surveyed as Passive Monitoring Sites, with three of these caves recording calls of the PLNB (i.e. waypoints 07, 12 and 17 – see Table 1 for further details and Figure 4 for location within the study area).

4.4 Assessment of Potential Cave Roosts – May 2013

A follow-up survey to assess potential cave roosts was conducted in response to the results of the October 2012 survey, where PLNB calls were recorded from three cave sites and a further two cave sites were not successfully monitored due to technical issues with equipment. All five sites were assessed in May 2013, with no PLNB calls recorded from any of the caves, either inside or outside the barrier (refer to Section 3.3 for further details on methodology; See Appendix 2 for results of the call analysis). A further two sites (Bonney Pool and Bonney Downs Homestead) were also monitored, with no PLNB recorded at either.

As previously stated, perhaps due to their directional microphone (which makes them suitable for targeted surveys of roosting caves), Anabat units may not record PLNB calls as successfully as SM2 units – therefore the lack of call records from this cave-focussed survey should not be extrapolated to suggest that PLNB were not present within the area during the May 2013. What appeared to be a PLNB (a small, possibly orange bat but colour can be difficult to discern under some artificial lights) was observed foraging around a spotlight near the Bonney Downs Homestead (pers. obs B. Metcalf), although without call recordings it is difficult to verify the record.

4.5 Other Fauna

A range of other fauna species was recorded from the study area during the October 2012 field survey (see Appendix 3), including four recognised as being conservation significant:

- Australian Painted Snipe (*Rostratula australis*) seen at a pool along Bonnie Creek (51K1907357566961). Listed as Vulnerable and as a Migratory species under the EPBC Act and the WA Wildlife Conservation Act. Considered to be a “rare summer visitor to the north-west” by Johnstone and Storr (1998).
- Australian Bustard (*Ardeotis australis*) was seen regularly along Bonnie Creek. Listed as Priority 4 by DEC, although Garnett *et al.* (2011) consider the northern population to be stable.
- Rainbow Bee-eater (*Merops ornatus*) is listed as a Migratory species under the EPBC Act, but it is recognised as being common and often benefiting from disturbance i.e. by increasing availability of nesting sites.
- Rothschild’s Rock-Wallaby (*Petrogale rothschildii*) is listed as Least Concern by Roache (2011), however the species is uncommon and endemic to the Pilbara, and has the potential to be impacted by habitat loss as a result of ongoing mining activity.

Plate 1. An example of a cave site where PLNB calls were recorded (Wypt #07).



Plate 2. An example of a major watercourse site where PLNB calls were recorded (Wypt #04).



Plate 3. An example of a minor watercourse site where PLNB calls were recorded (Wypt #26).





Figure 4. Locations of Pilbara Leaf-nosed Bat calls recorded in the Warrigal North area in October 2012.

5 Conclusions and Future Work

The October 2012 survey resulted in the positive identification of PLNB calls from recordings made within the Warrigal North deposit area. Calls were widespread throughout the study area, across a range of landform features including caves, major watercourses and minor watercourses. The caves identified within the study area looked marginal for PLNB to use as day-roosts because they appeared unlikely to provide the required temperature and humidity conditions due to insufficient depth of caves and the limited availability of groundwater in the region; however further work was undertaken to confirm these caves were not used for day-roosts.

Five cave sites were identified as requiring an assessment of daytime occupancy by PLNB; this included three sites where PLNB were identified from call recordings and two sites that were not monitored successfully due to technical issues.

In May 2013, the five cave sites were assessed for daytime occupancy by PLNB, however no PLNB calls were recorded from any of the sites i.e. they were not used as day-roosts. The previous calls recorded from caves were probably of bats commuting past rather than utilising the cave. It is probable that the bats are commuting from nearby areas but to date no research has been conducted on the nightly commuting distances of PLNB; SEWPaC (2012) uses the estimate of c. 10 km (away from their day-roost) based on anecdotal information.

The results of the October 2012 and May 2013 surveys indicate that although bats forage throughout the study area, they do not utilise day-roosts within the study area. Foraging is likely to concentrate around Bonnie Creek and the nearby Nullagine River. Impacts to such foraging areas should be minimised.

6 References

- DEWHA (2010). *Survey guidelines for Australia's threatened bats*.
<http://www.environment.gov.au/epbc/publications/pubs/survey-guidelines-bats.pdf>
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- Garnett, S.T, Szabo, J.K. and Dutson, G. (2011). *The action plan for Australian Birds*. CSIRO Publishing.
- Johnstone, R.E. & G.M. Storr (1998). *Handbook of Western Australian Birds*. Vol. 1: Non-passerines (Emu to Dollarbird). Perth, Western Australia: WestAustralianMuseum.
- Roache, M. ed (2011). *The Action Plan for Threatened Australian Macropods, 2011-2021*. World Wildlife Fund for Nature.

SEWPaC (2012). Orange Leaf-nosed Bat (Pilbara form) - SPRAT profile.


http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82790#threat_class_summary (accessed 10th Dec 2012).

7 Appendices

Appendix 1. Report from Specialised Zoological for October 2012 survey – (see attached report)

	
Bat call identification from Nullagine, WA	
Type:	Acoustic analysis
Prepared for:	MJ & AR Bamford Consulting Ecologists
Date:	7 January 2013
Job No.:	SZ291b
Prepared by:	Kyle Armstrong and Yuki Konishi Specialised Zoological ABN 92 265 437 422 Tel 0404 423 264 kyle.n.armstrong@gmail.com http://www.szool.com.au
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**Appendix 2. Report from Specialised Zoological for May 2013 survey –
(see attached report)**

	
Bat call identification from Nullagine, WA	
Type:	Acoustic analysis
Prepared for:	MJ & AR Bamford Consulting Ecologists
Date:	17 June 2013
Job No.:	SZ291c
Prepared by:	Kyle Armstrong and Yuki Konishi Specialised Zoological ABN 92 265 437 422 Tel 0404 423 264 kyle.n.armstrong@gmail.com http://www.szool.com.au
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Appendix 3. Annotated species list of fauna recorded from the Warrigal North study area, October 2012.

FROGS

Hylidae (Tree frogs)

<i>Litoria rubella</i>	Desert Tree Frog	Heard along Bonnie Creek.
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REPTILES

Agamidae (Dragons)

<i>Amphibolurus sp.</i>	dragon	Several running around camp.
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<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	One or two seen most days throughout.
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Diplodactylidae (Diplodactylid geckoes)

<i>Lucasium stenodactylum</i>	Sand-plain Gecko	One found during spotlighting along creek.
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<i>Oedura marmorata</i>	Marbled Velvet Gecko	One found during spotlighting along creek.
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Gekkonidae (Gekkonid geckoes)

<i>Gehyra punctata</i>	Spotted Dtella	Several seen each night during spotlighting.
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<i>Gehyra variegata</i>	Variegated Dtella	Many seen each night during spotlighting.
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<i>Heteronotia binoei</i>	Bynoe's Gecko	One found during spotlighting along creek.
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Scincidae (Skinks)

<i>Ctenotus saxatilis</i>	Rock Ctenotus	One or two seen each day in rocks/spinifex.
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Elapidae (Venomous land snakes)

<i>Furina ornata</i>	Moon Snake	One on road near camp on one evening.
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<i>Suta fasciata</i>	Rosen's Snake	One at camp one evening.
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BIRDS

Casuariidae (Cassowaries and emus)

<i>Dromaius novaehollandiae</i>	Emu	Two birds in spinifex near Bonnie Pool on one day. One dead bird in creek.
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Anatidae (Ducks and allies)

<i>Cygnus atratus</i>	Black Swan	Two birds on pool of Bonnie Creek, near Nullagine River.
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<i>Chenonetta jubata</i>	Australian Wood Duck	Nine birds in pool on Bonnie Creek on one day.
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<i>Anas gracilis</i>	Grey Teal	Two birds in pool on Bonnie Creek on one day.
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<i>Anas superciliosa</i>	Pacific Black Duck	Usually up to ten birds in pools along Bonnie Creek; 22 in one count on one day.
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Podicipedidae (Grebes)		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	Up to six or ten birds on pools in creek each day.
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Columbidae (Pigeons and doves)		
<i>Phaps chalcoptera</i>	Common Bronzewing	One bird flushed near Bonnie Pool.
<i>Ocyphaps lophotes</i>	Crested Pigeon	Several around camp.
<i>Geophaps plumifera</i>	Spinifex Pigeon	Common in spinifex throughout (flocks of up to 40 along Bonnie Creek floodplain in south of Warrigal area).
<i>Geopelia cuneata</i>	Diamond Dove	Very common throughout.
<i>Geopelia striata</i>	Peaceful Dove	One bird seen at Bonnie Pool.
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Eurostopodidae (Eared-nightjars)		
<i>Eurostopodus argus</i>	Spotted Nightjar	One bird flushed in Warrigal south area.
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Aegothelidae (Owlet-nightjars)		
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	One bird in Warrigal south area.
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Anhingidae (Darters)		
<i>Anhinga novaehollandiae</i>	Australasian Darter	Several birds around pools of Bonnie Creek.
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Phalacrocoracidae (Cormorants)		
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	Several birds around pools of Bonnie Creek.
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	Several birds around pools of Bonnie Creek; 56 counted near one pool on one day.
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Pelicanidae (Pelican)		
<i>Pelecanus conspicillatus</i>	Australian Pelican	Three birds flying over Bonnie Pool one day, fourteen roosting on rocks near pool along creek on one day.
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Ardeidae (Heron, bitterns and egrets)		
<i>Ardea pacifica</i>	White-necked Heron	One bird in pool on Bonnie Creek.
<i>Ardea modesta</i>	Eastern Great Egret	One or two birds in pools along Bonnie Creek and Nullagine River.
<i>Ardea intermedia</i>	Intermediate Egret	Two birds on pool of Bonnie Creek.
<i>Egretta novaehollandiae</i>	White-faced Heron	Several individuals spread along pools of Bonnie Creek.
<i>Nycticorax caledonicus</i>	Nankeen Night Heron	Several birds roosting in trees at Bonnie Pool.
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Threskiornithidae (Ibises and spoonbills)		
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	One bird at Bonnie Pool.
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Accipitridae (Osprey, hawks and eagles)		

<i>Haliastur sphenurus</i>	Whistling Kite	Several birds seen each day throughout.
<i>Accipiter fasciatus</i>	Brown Goshawk	Individual birds seen on several occasions.
<i>Circus assimilis</i>	Spotted Harrier	One or two birds seen each day throughout.
<i>Aquila audax</i>	Wedge-tailed Eagle	One or two birds seen each day in the vicinity of Bonnie Creek.
Falconidae (Falcons)		
<i>Falco cenchroides</i>	Nankeen Kestrel	One or two birds seen each day throughout.
<i>Falco berigora</i>	Brown Falcon	Several birds seen each day throughout.
<i>Falco longipennis</i>	Australian Hobby	One bird hunting around camp on one morning.
Otididae (Bustards)		
<i>Ardeotis australis</i>	Australian Bustard	One bird seen most days near Bonnie Pool, and one seen most days near camp.
Charadriidae (Lapwings, plovers and dotterels)		
<i>Elsemyornis melanops</i>	Black-fronted Dotterel	Up to six or eight seen on pools along Bonnie Creek each day
Rostratulidae (Painted Snipe)		
<i>Rostratula australis</i>	Australian Painted Snipe	One bird seen near pool in Bonnie Creek.
Turnicidae (Button-quails)		
<i>Turnix velox</i>	Little Button-quail	Very common throughout.
Cacatuidae (Cockatoos)		
<i>Eolophus roseicapillus</i>	Galah	Pairs and small flocks seen on most days along creeklines.
<i>Cacatua sanguinea</i>	Little Corella	Up to 15-20 around Bonnie Pool each day.
<i>Nymphicus hollandicus</i>	Cockatiel	Small flock (15-20) seen along haul road on one day.
Psittacidae (Parrots)		
<i>Barnardius zonarius</i>	Australian Ringneck	Pairs and small flocks seen each day along creeklines.
<i>Melopsittacus undulatus</i>	Budgerigar	One large flock (300+) in eucalypts along Bonnie Creek (smaller flocks near pools along creek each day).
Strigidae (Hawk owls)		
<i>Ninox novaeseelandiae</i>	Southern Boobook	One in cave.
Halcyonidae (Tree kingfishers)		

<i>Todiramphus sanctus</i>	Sacred Kingfisher	Individual birds seen on several occasions.
Meropidae (Bee-eaters)		
<i>Merops ornatus</i>	Rainbow Bee-eater	Heard along creeklines most days.
Ptilonorhynchidae (Bowerbirds)		
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird	One seen near top of mesa on one day.
Maluridae (Fairy-wrens, emu-wrens and grasswrens)		
<i>Malurus lamberti</i>	Variegated Fairy-wren	Party seen in Bonnie Creek bed, near Nullagine River intersection.
Acanthizidae (Australasian warblers)		
<i>Smicronis brevirostris</i>	Weebill	Heard in eucalypts along creeklines on some days.
Pardalotidae (Pardalotes)		
<i>Pardalotus rubricatus</i>	Red-browed Pardalote	Heard in eucalypts along creeklines on one or two days.
Meliphagidae (Honeyeaters)		
<i>Lichenostomus virescens</i>	Singing Honeyeater	Several seen most days, throughout.
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	Several in eucalypts around most large pools of water along creeklines.
<i>Manorina flavigula</i>	Yellow-throated Miner	Reasonably common - recorded along creeklines at almost every area visited.
<i>Epthianura tricolor</i>	Crimson Chat	One bird seen in camp gardens on one day.
<i>Lichmera indistincta</i>	Brown Honeyeater	Seen or heard along creeklines most days.
Pomatostomidae (Babblers)		
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	Several parties, usually near creeklines, throughout.
Campephagidae (Cuckoo-shrikes and trillers)		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Several birds seen each day throughout.
Pachycephalidae (Whistlers, shrike-thrushes and allies)		
<i>Pachycephala rufiventris</i>	Rufous Whistler	One or two birds heard along Bonnie Creek, in the vicinity of Warrigal Well.
Artamidae (Woodswallows, butcherbirds and currawongs)		
<i>Artamus personatus</i>	Masked Woodswallow	Small flock high overhead (above creek) on one day.
<i>Artamus cinereus</i>	Black-faced Woodswallow	Several birds seen each day throughout.

<i>Artamus minor</i>	Little Woodswallow	Several seen along high, steep mesa edges along the eastern section of Bonnie Creek towards Nullagine River. Possibly nesting in holes in rock.
<i>Cracticus nigrogularis</i>	Pied Butcherbird	One bird in creek near Warrigal Well.
<i>Cracticus tibicen</i>	Australian Magpie	Flock around camp each day.
Rhipiduridae (Fantails)		
<i>Rhipidura leucophrys</i>	Willie Wagtail	Single birds or pairs seen mostly in creeklines.
Corvidae (Crows and allies)		
<i>Corvus orru</i>	Torresian Crow	Ones or pairs in the vicinity of creeklines on each day.
Monarchidae (Flycatchers, monarchs and magpie-lark)		
<i>Grallina cyanoleuca</i>	Magpie-lark	Many birds seen each day, around pools on creeklines and camp.
Alaudidae (Old world larks)		
<i>Mirafra javanica</i>	Horsfield's Bushlark	One bird seen in camp gardens on one day.
Megaluridae (Grassbirds)		
<i>Cincloramphus cruralis</i>	Brown Songlark	One or two birds seen on one or two days.
Hirundinidae (Swallows and martins)		
<i>Petrochelidon nigricans</i>	Tree Martin	10-20 birds around Bonnie Pool most days.
<i>Petrochelidon ariel</i>	Fairy Martin	Several nests under overhangs.
Estrildidae (Finches)		
<i>Taeniopygia guttata</i>	Zebra Finch	Very common throughout.
<i>Emblema pictum</i>	Painted Finch	Very common throughout.
Motacillidae (Old world wagtails and pipits)		
<i>Anthus novaeseelandiae</i>	Australasian Pipit	Several seen each day, throughout.

MAMMALS

Macropodidae (Kangaroos, wallabies and tree kangaroos)

<i>Macropus robustus</i>	Euro	Several seen each day/night, throughout.
<i>Macropus rufus</i>	Red Kangaroo	One or two seen most days.
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby	One disturbed at top of mesa east of Bonnie Pool.

Emballonuridae (Sheathtail bats)

<i>Tapozous georgianus</i>	Common Sheathtail Bat	Several disturbed in caves around the lease.
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<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	Calls recorded from the study area (see Appendix 1).
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Hipposideridae (Leaf-nosed bats)		
<i>Rhinonictus aurantius</i>	Pilbara (Orange) Leaf-nosed Bat	Calls recorded from the study area (see Appendix 1).
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Vespertilionidae (Evening bats)		
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Calls recorded from the study area (see Appendix 1).
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	Calls recorded from the study area (see Appendix 1).
<i>Nyctophilus</i> spp.	unknown Long-eared Bat	Calls recorded from the study area (see Appendix 1).
<i>Vespadelus finlaysoni</i>	Inland Cave Bat	Calls recorded from the study area (see Appendix 1).
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Molossidae (Free-tail bats)		
<i>Chaerephon jobensis</i>	Northern Free-tail Bat	Calls recorded from the study area (see Appendix 1).
<i>Mormopterus beccarii</i>	Beccari's Free-tail Bat	Calls recorded from the study area (see Appendix 1).
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Felidae (Cats)		
<i>Felis catus</i>	Cat	Tracks.
