Biota Environmental Sciences

Mesa K Targeted Fauna Survey

Prepared for

Pilbara Iron

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1.0 Introduction

1.1 Project Background

Robe River Associates (Robe) proposes to recommence mining of the Mesa K iron ore deposit. Mesa K was previously mined with operations concluding in 1996, and approximately 40% of the original mesa formation now remains intact. The company plans to re-mine only parts of Mesa K, primarily within those areas of the mesa that have been previously disturbed, whilst leaving other areas of the mesa intact.

The Department of Industry and Resources (DoIR) has previously reviewed and concurred with Robe's Notice of Intent (NOI) to re-mine Mesa K. Robe now intends to refer the proposal to the Environmental Protection Authority (EPA) for assessment at the Environmental Protection Statement (EPS) level.

1.2 Scope of this Study

In order to assess potential rare fauna issues associated with the development, Biota Environmental Sciences conducted a targeted fauna survey of the Mesa K project area. Given the extent of previous survey work in area and the largely disturbed nature of the Mesa K, the focus of this study was on threatened fauna species that might occur in the area and potential Short Range Endemic (SRE) fauna. The identification of target threatened fauna species was based on reviews of database searches and the findings of fauna surveys totaling 92 systematic fauna survey sites completed elsewhere in the Robe Valley including:

- Mesa J (12 systematic survey sites; ecologia 1991);
- Mesa A and G (10 sites; Biota 2005);
- Mesa A Northern Rail Corridor and Warramboo (33 sites; Biota 2006a);
- Mesa A Southern Rail Corridor (20 sites; Biota unpublished data); and
- Bungaroo Creek (17 sites; Biota 2007).

Based on this, the study specifically targeted *Rhinonicteris aurantius* (Orange Leaf-nosed Bat), *Macroderma gigas* (Ghost Bat), *Dasyurus hallucatus* (Northern Quoll) and potential SRE invertebrates. An account of the other threatened species identified in the initial review is provided in Appendix 1 of this report.

1.3 Status of Target Threatened Species

1.3.1 Orange Leaf-nosed Bat and Ghost Bat

The Orange Leaf-nosed bat and the Ghost bat are similar in many respects, although the former is more rare. Fossil material of each has been discovered at Riversleigh in Queensland in early Pliocene limestone (Archer *et al*. 1991). Thus, they are both ancient relicts and are between 3-5 million years old. Both bats are the only representatives of their genus, are unique to Australia and are the only living representatives of their ancient lines of evolution. Therefore, these bats have scientific importance as well as being a very unique part of Australia's natural heritage.

They occupy similar distributions in northern Australia, which are fragmented into two or more isolated populations (Churchill 1998). Populations were once more widespread, especially that of the Ghost bat which was even present in the southwest of Western Australia and in the Flinders Range in South Australia (Molnar *et al.* 1984). It was originally thought that since the Orange Leaf-nosed bat was only known in significant numbers from mines, it had spread to the Pilbara from areas further north aided by man (e.g. in the movement of machinery). It has now been established that this species has been in the Pilbara for at least 100,000 years (before the formation of the Great Sandy Desert as a barrier to dispersal) and is not a robust, adaptable species easily able to colonise new areas (Armstrong 2001).

The preferred roost habitat of the Orange Leaf-nosed bat and the Ghost bat are caves, in particular those with elevated temperatures and humidity. Not all caves are suitable and the bats are generally only found in larger caves or mines that are able to support such extreme microclimates (Churchill 1991; Armstrong 2001). Studies on the physiology of the Orange Leaf-nosed bat have demonstrated that this species is unable to enter torpor to conserve energy and when exposed to relatively cool, dry environments, their condition will rapidly decline due to excessive loss of water and body heat (Kulzer *et al.* 1970; Baudinette *et al*. 2000). The Ghost bat is more physiologically robust but still relies on relatively warm, humid roost conditions, especially for breeding (Leitner and Nelson 1967; Kulzer *et al.* 1970; Toop 1985; Churchill 1991). The availability of suitable roost habitats controls the distribution of both species and possibly the degree to which dispersal occurs within populations. These species have established population strongholds in the eastern Pilbara in disused underground mines, but are also found scattered throughout the remainder of the Pilbara (Armstrong and Anstee 2000; Armstrong 2001).

The Orange Leaf-nosed Bat (Rhinonicteris aurantius) is considered 'rare and likely to become extinct' under Schedule 1 of the Wildlife Conservation Act (1950; Specially Protected Fauna Notice 1994). It is also considered as 'Vulnerable A1c' by the International Union for Conservation of Nature and Natural Resources (IUCN), (1996). Importantly, the Pilbara population is recognised as a separate form and given separate 'Vulnerable' status (VU A1c, B1, B2c) by the IUCN. In addition the Pilbara form is listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act 1999 (http://www.deh.gov.au/biodiversity/threatened/species/bats.html).

The Ghost Bat (*Macroderma gigas*) is listed as Priority 4 in the Department of Environment and Conservation Priority Fauna Listing. That is, "taxa which 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. Taxa which are declining significantly but are not yet threatened".

The Ghost Bat is considered as 'Vulnerable A2c' by the IUCN (1996). However, it has been delisted as vulnerable from the Environment Protection and Biodiversity Conservation Act 1999 (http://www.deh.gov.au/biodiversity/threatened/species/bats.html)

1.3.2 Northern Quoll

The Northern Quoll, *Dasyurus hallucatus*, was once the most widespread and common marsupial carnivore in northern Australia. Its former distribution was trans-tropical but it has now become restricted to small isolated populations in eastern Queensland and the Northern Territory, with larger populations in the northwest Kimberley and probably the Pilbara regions of Western Australia (Braithwaite and Griffiths 1994). It also occurs on numerous islands off the Australian coast (Abbott and Burbidge 1995, Burbidge and McKenzie 1978).

In addition to its fragmented distribution, there are growing concerns as to the continued persistence of the species in northern Australia where the impact of grazing and fires (Woinarski et al. 2001) have been shown to have an adverse effect on populations numbers and distribution. Recent studies have also found Cane Toads, *Bufo marinus*, extremely detrimental to the persistence of Northern Quoll in Queensland and the Northern Territory with the local extinction of many populations (Burnett 1997). The markedly changed range of the Northern Quoll in recent years has prompted the Federal Government to list the species as endangered under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. It is also considered 'rare and likely to become extinct' (endangered status) under Schedule 1 of the *Wildlife Conservation Act 1950.*

The predicted arrival of the Cane Toad into the Kimberley in the next few years has further highlighted the significance of the Northern Quoll populations of Western Australia where they persist in both the Kimberley and Pilbara (Figure 1.1). The Kimberley populations show marked seasonal fluctuations in numbers (Schmitt et al. 1987) and also longer-term changes in

abundance (Kenneally et al. 2002). However, there is limited published information on Quoll populations in the more arid Pilbara region of tropical Western Australia (How et al. 1991, How and Cooper 2002).

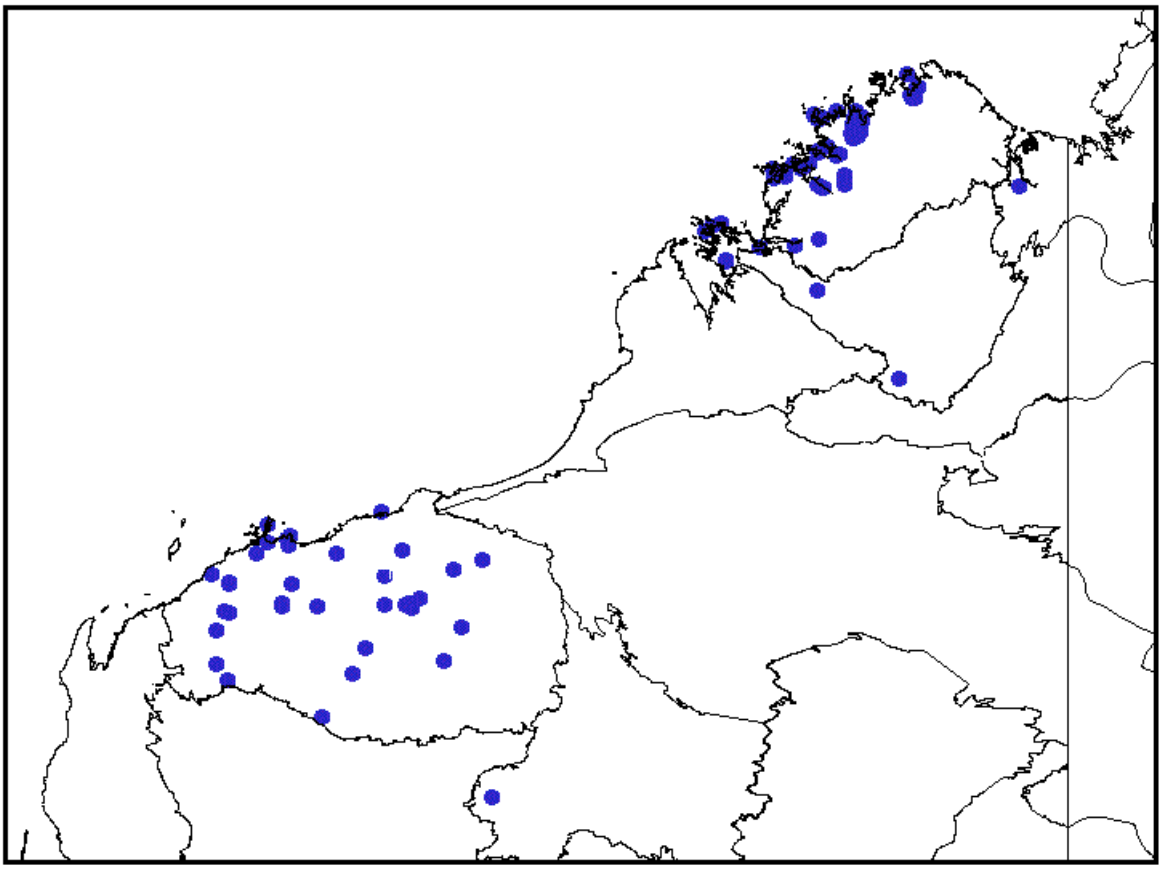

Figure 1.1 **Distribution of Western Australian Museum specimens of the Northern Quoll, *Dasyurus hallucatus*, from Western Australia.**

1.3.3 Short-range Endemic invertebrates

Taxonomic groups of invertebrates with naturally small distributions are described as short-range endemics and are in part characterised by poor dispersal capabilities, confinement to disjunct habitats and low fecundity (Harvey 2002, Ponder and Colgan 2002). Given the importance of short-range endemism to the conservation of biodiversity, the assessment of such invertebrate taxa is a potentially important component of impact assessment. Examples of taxonomic groups that show high levels of short-range endemism in this respect include mygalomorph (trapdoor) spiders, millipedes, pseudoscorpions and freshwater and terrestrial molluscs.

2.0 Methods

2.1 Northern Quoll

Site selection was conducted following examination of aerial photographs of Mesa K. The southern scarp of Mesa K was identified as potential quoll habitat based on:

- the presence of steep, rocky habitat; and
- the close proximity to dense riverine woodland.

Trapping was undertaken on five consecutive nights between 10th and 15th November 2006. All trapping involved the use of Elliott Type A medium size traps that were baited daily with universal bait comprising, rolled oats, peanut butter, and sardines. A single 400 m transect comprising 75 traps was set along the southern scarp of Mesa K (423765mE, 7596881mN; zone 50; GDA94; Figure 2.1). Traps, were placed in protected areas and shade, wherever possible, and checked early each morning.

All captured mammals were emptied from the traps into a cloth collecting-bag. The terminal centimetre of tail was taken and stored in absolute ethanol for later evaluation of molecular meta-population structure. This also allowed a determination as to whether the same individual was a first-time capture or a recapture and allowed a crude estimate of abundance to be made. All individuals were then released at point of capture.

2.2 Bats

The bat survey was conducted over two phases. The initial survey (Phase I) was undertaken between 10th and 15th November 2006. Intact portions of the edge of Mesa K were inspected for caves of sufficient depth to provide potential roost sited for Schedule or Priority bat species (i.e. Orange Leaf-nosed Bats or Ghost bats).

For caves of sufficient depth, bat echolocation calls were recorded at night using an Anabat II bat detector, which detects and transforms ultrasonic echolocation emitted during bat foraging. The Anabat unit comprises a data logger that records the frequency and temporal pattern of detected bat calls for subsequent analysis. Sampling was undertaken at the entrance of two caves only, as these were deemed the only caves within the project area potentially harbouring bat roosts. In addition, a harp net designed to capture micro-bats was installed at the larger of the two caves only (i.e. cave 2; Figure 2.1 and Table 2.1).

The Phase II survey was conducted between the 11th and 12th January 2007. This survey was designed to establish the significance of cave 2 at Mesa K for Orange Leaf-nosed Bats. That is, whether the cave is utilised by Orange Leaf-nosed Bats as a maternity roost (Table 2.1).

Table 2.1: Caves surveyed and survey method.

	Cave 1	Cave 2
Location	423728mE 7596870mN	423416mE 7596911mN
Anabat Unit dates	11/11/06 – 12/11/06	12/11/06 – 13/11/06, 15/11/06 11/01/07 – 12/01/07
Harp Net dates	Nil	12/11/06 – 13/11/06, 15/11/06 11/01/07 – 12/01/07

A sheet was placed over the entire cave entrance at 6:30 pm, approximately 1.5 hours before sunset. This was done to identify the origin of any bats (either from inside or outside of the cave) at

the time of emergence. An observer was situated on either side of the sheet, each with an Anabat unit to observe and record bat calls. The Anabats were oriented away from the cave entrance to ensure that signals from the opposite side of the sheet were not recorded. Calls were recorded from 7:30 pm to 10:00pm each night.

Identification of bats in the field was conducted by Dan Kamien and Mike Greenham (Biota Environmental Sciences). Identification of bat calls recorded on the Anabat unit was carried out by Dr Kyle Armstrong (Molhar Pty Ltd).

2.3 SRE Invertebrates

Invertebrate groups targeted during the survey included:

- Araneae (specifically trapdoor spiders)
- Pseudoscorpionida (pseudoscorpions);
- Diplopoda (millipedes); and
- Pulmonata (land snails);

Trapdoor spiders were targeted by searching for and excavating burrows. Individuals were subsequently preserved in 70% ethanol, with one leg removed and placed in 100% ethanol for future genetic studies.

Hand foraging was undertaken for pseudoscorpions, involving peeling bark and lifting rocks. The remaining two groups (millipedes and land snails) were searched for whilst raking leaf litter and other debris.

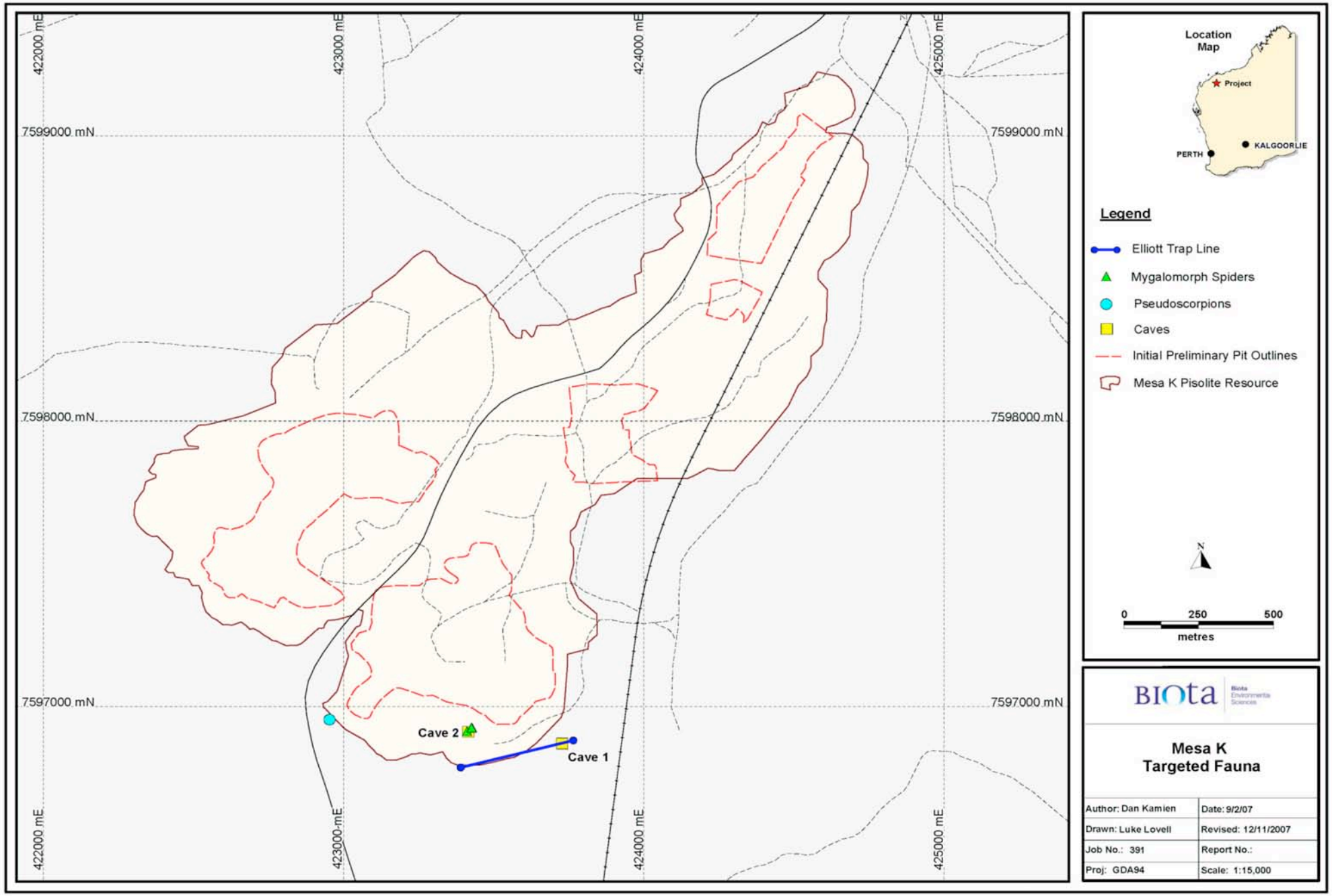

Figure 2.1: **Map of Mesa K indicating location of Elliott traps, sampled caves, and recorded short range endemic invertebrates.**

3.0 Results

3.1 Elliott Trapping

The Northern Quoll (*Dasyurus hallucatus*) was not captured during the targeted survey. However, a potential prey species, the Common Rock-rat *Zyzomys argurus* was captured on 54 occasions from 29 different Elliott traps. Of these records, seven were noted as recaptures.

In addition, four Woolley's False Antechinus (*Psuedantechinus woolleyae*) and one introduced house mouse (*Mus musculus*) were captured in Elliott traps during the survey.

3.2 Bats

Based on analysis of call sequences in combination with harp trapping, five species of micro-bat were either recorded or captured during the two survey phases (Table 3.1 and Appendix 2). These comprised one Rhinolophidae (Horseshoe bats), two Vespertilionidae (vespertilionid bats) and two Emballonuridae (sheathtail bats). The bat species recorded at Mesa K were:

- *Rhinonicteris aurantius* - Orange Leaf-nosed Bat
- *Vespadelus finlaysoni* – Inland Cave Bat (Figure 3.1)
- *Taphozous georgianus* – Common Sheathtail Bat (Figure 3.2)
- *Chalinolobus gouldii* – Gould's Wattled Bat (Figure 3.3)
- *Saccolaimus flaviventris* – Yellow-bellied Sheathtail Bat (Figure 3.4)

The occurrence of *R. aurantius* (Orange Leaf-nosed Bat) at Mesa K is of particular interest due to its conservation significance (see Section 1.2.1). A single individual was captured in a harp net at Cave 2 on 15 November 2006. This record provided the impetus for the Phase II survey that aimed to determine if Cave 2 contained a significant maternity roost of *R aurantius*. The Phase II survey did not record any further evidence of *R. aurantius* use of Cave 2.

Three additional bat species were recorded from Cave 2: *Vespadelus finlaysoni*, *Taphozous georgianus* and *Chalinolobus gouldii*. Based on call analysis alone, it is possible that a fourth species, *Taphozous hilli* may also occur in Cave 2 (Appendix 2). However, *T. hilli* has a very similar call pattern and frequency to *T. georgianus* and only *T. georgianus* was captured in the harp trap. Given this, we consider *T. georgianus* as the only *Taphozous* species confirmed as present during the survey.

Table 3.1: **Location and verification method of bats recorded at Mesa K.**

	Cave 1	**Cave 2**
Anabat Phase I	*V. finlaysoni* *T. georgianus* *C. gouldii*	*V. finlaysoni* *T. georgianus* *C. gouldii*
Harp Net Phase I	NA	*V. flnlaysoni* *T. georgianus* *R. aurantius*
Anabat inside cave Phase II	NA	*V. finlaysoni* *T. georgianus*
Anabat outside cave Phase II	NA	*V. finlaysoni* *T. georgianus* *S. flaviventris*

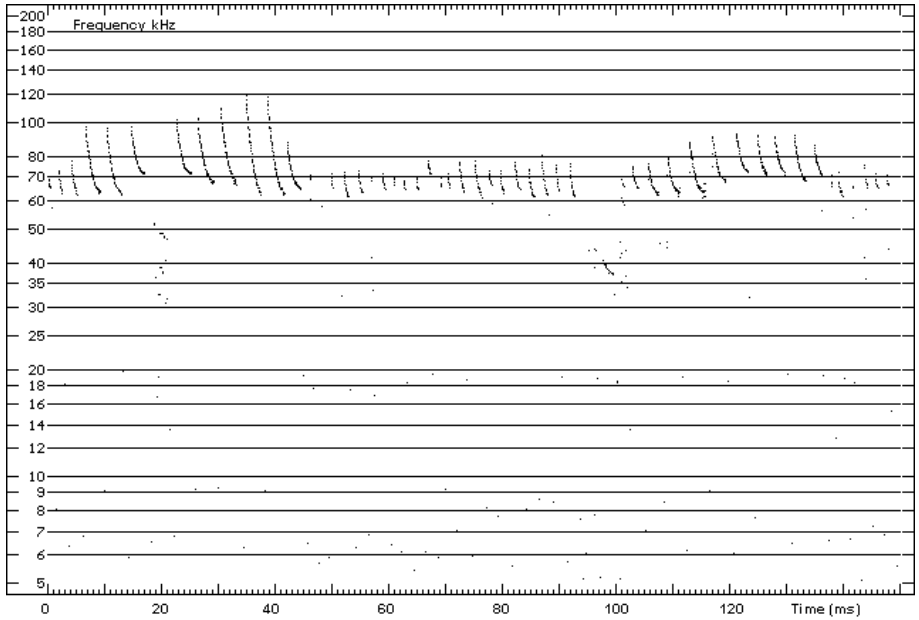

Figure 3.1: Call sequence identified as *Vespadelus finalysoni*

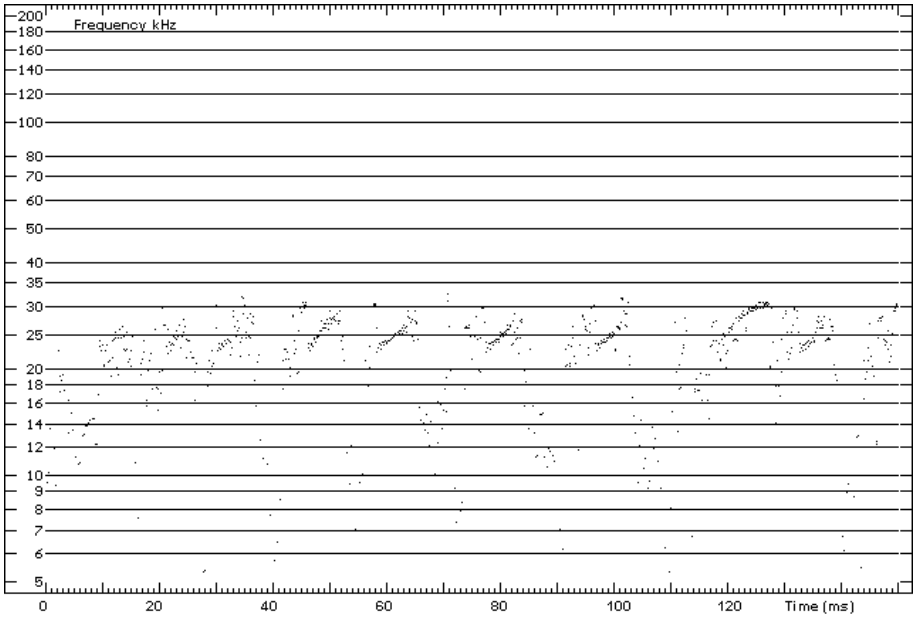

Figure 3.2: Call sequence identified as *Taphozous georgianus*

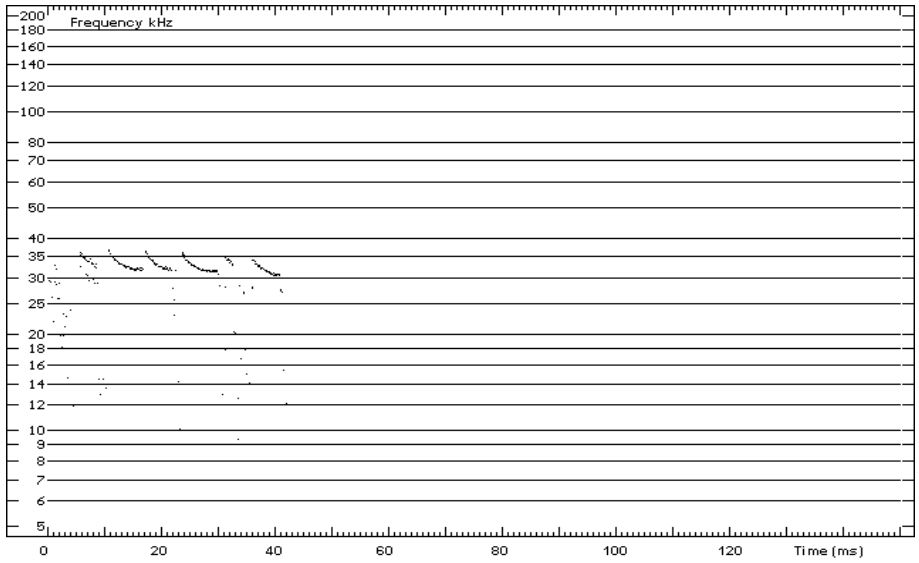

Figure 3.3: Call sequence identified at *Chalinolobus gouldii*

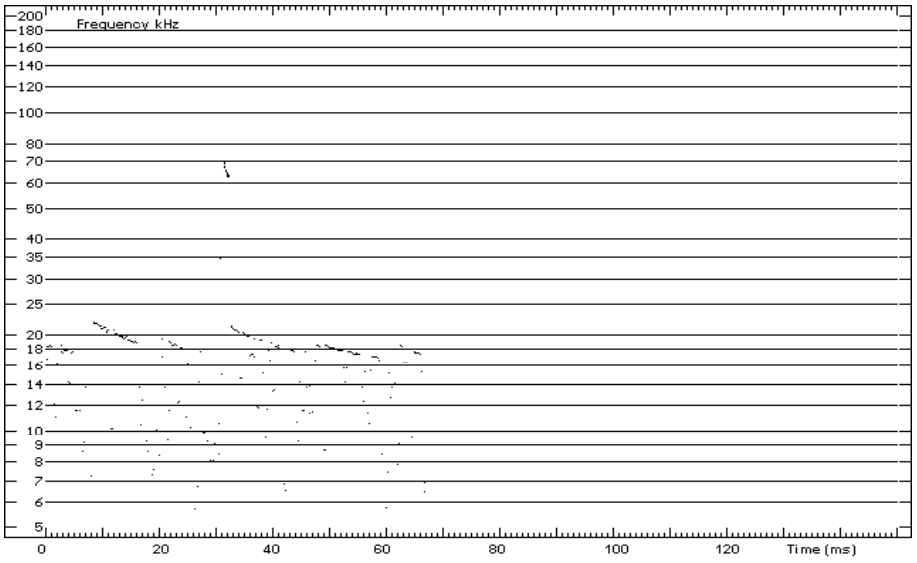

Figure 3.4: Call sequence identified as *Saccolaimus flaviventris*

3.3 SRE Invertebrates

Targeted searches for land snails and millipedes were unsuccessful during the current survey. However, both mygalomorph spiders (trapdoor spiders) and pseudoscorpions were recorded at Mesa K.

3.3.1 Mygalomoph spiders

A single species of mygalomorph spider was recorded at Mesa K. This comprised three records of an undescribed species belonging to the genus *Teyl* (Nemesiidae). One individual was excavated from its burrow and a further two individuals were identified from burrow characteristics only (Table 3.2). Burrows were typically located in patches of clay soil on the scarp, surrounded by rocks (Plate 3.1). Spider burrows were not found on the mesa plateau itself.

Plate 3.1: Entrance of *Teyl* sp. burrow.

Table 3.2: Location of mygalomorph spider burrows.

Location	Record
423411mE 7596913mN	Burrow only
423428mE 7596925mN	Spider and burrow
423426mE 7596926mN	Burrow only

3.3.2 Pseudoscorpions

A single species of pseudoscorpion was recorded at Mesa K under bark of *Eucalyptus* sp. (422953mE, 7596954mN; Figure 2.1). Dr. Mark Harvey of the Western Australian Museum identified the specimens as *Synsphyronus* sp. (family Garypidae).

4.0 Discussion

4.1 Quolls

The Northern Quoll is distributed widely through the Pilbara of Western Australia (based on Western Australian Museum records), but the status of resident populations has not been studied in detail (Biota 2006b).

Records from Kimberley populations suggest that female Northern Quolls give birth in July or August, after a major male die-off such that, usually, only females with pouch young remain in the population by September (Schmitt et al. 1989). However, in the Pilbara it is likely that the majority of births occur during September/October, so that during November only females with pouch young are present in the population (Biota database). This may be a contributing factor as to the apparent absence of recorded quolls during the November survey. That is, the overall number of adult quolls within the population may be diminished in November and remaining quolls are likely display cautious behaviour while tending to their offspring.

Northern Quoll populations are highly variable in both temporal and spatial scales. However, previous studies at other mesa scarps adjacent to the Robe River have demonstrated the presence of Quoll populations in the area (Biota database). Based on this, it is likely that Northern Quolls also occur at Mesa K despite their apparent absence during the current survey. Further, the abundance of Common Rock-rats (a prey item), dens and shelters at the southern scarp of Mesa K indicates good habitat for Northern Quolls.

4.2 Bats

Based on the intensive survey (Phase II), it can safely be concluded that the Orange Leaf-nosed Bat captured at Cave 2 during Phase I was an itinerant individual and that the caves examined do not constitute significant roost sites for Orange Leaf-nosed Bats. Based on the thorough search during Phase I it is unlikely a maternity roost of any bat species of conservation significance exists within or immediately near the project area at Mesa K.

4.3 SRE Invertebrates

Both the *Teyl* sp. mygalomorph spiders and *Synsphyronus* sp. pseudoscorpions belong to taxa that are currently undescribed (and therefore have no wider taxonomic or distributional context), but are unlikely to be limited in distribution to Mesa K.

Mygalomorph spiders were found only on the mesa scarp and not on the plateau itself. It is possible that much of the substrate on the mesa plateau is too hard for spiders to construct burrows, with only small niches available for burrow construction. This reinforces the importance of maintaining the scarp habitat, where patches of loose soil and clay may offer more opportunities. This should be achievable in the context of the proposed development at Mesa K (Section 1.1).

5.0 Recommendations

The following recommendations arise from the targeted fauna survey of the Mesa K study area:

1. The caves surveyed here did not contain Orange Leaf-nosed bat roosts and as a result ongoing management of the caves is unnecessary. Nevertheless, these caves (and any other caves or overhangs at Mesa K) provide important habitat to other bat species and disturbance should be kept to a minimum.

2. All members of the work force on site will be provided with an environmental induction to ensure they are familiarised with the presence of conservation significant fauna. This will include driving speed restrictions, ensuring that off-road driving is minimised, fire risk minimisation and minimising access to the mesa scarp.

3. Any future survey targeting Northern Quolls should be conducted in April or May when both male and female adults are active. This will increase the likelihood of recording quolls if they are present at Mesa K.

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Appendix 1

Preliminary Threatened Fauna Review

Wildlife Conservation Act 1950-1979 (State)

Searches of Department of Environment and Conservation and Western Australian Museum fauna databases, and findings from fauna surveys in the region, were reviewed to identify species of elevated conservation status which may potentially occur in the survey area. These searches yielded four Schedule listed species and nine Priority fauna that could potentially occur in the study area:

Species	State Conservation Level
Northern Quoll *Dasyurus hallucatus*	Schedule 1
Orange Leaf-nosed Bat *Rhinonicteris aurantius*	Schedule 1
Pilbara Olive Python *Liasis olivaceus barroni*	Schedule 1
Peregrine Falcon *Falco peregrinus*	Schedule 4
Ramphotyphlops ganei	Priority 1
Pilbara Dragonfly *Antipodogomphus hodgkini*	Priority 2
Pilbara Damselfly *Nososticta pilbara*	Priority 2
Long-tailed Dunnart *Sminthopsis longicaudata*	Priority 4
Ghost Bat *Macroderma gigas*	Priority 4
Western Pebble-mound Mouse *Pseudomys chapmani*	Priority 4
Star Finch (western) *Neochmia ruficauda subclarescens*	Priority 4
Fortescue Grunter *Leiopotherapon aheneus*	Priority 4
Notoscincus butleri	Priority 4

The results of recent extensive fauna survey work in the locality were reviewed to identify which species from this database listing might be likely to occur at Mesa K. This included the findings of fauna surveys totalling 92 systematic fauna survey sites completed elsewhere in the Robe Valley including:

- Mesa J (12 systematic survey sites; ecologia 1991);
- Mesa A and G (10 sites; Biota 2005);
- Mesa A Northern Rail Corridor and Warramboo (33 sites; Biota 2006a);
- Mesa A Southern Rail Corridor (20 sites; Biota unpublished data); and
- Bungaroo Creek (17 sites; Biota 2007).

After consideration of these data, and the nature of the habitats present at Mesa K, it was considered unlikely that most of the threatened species listed on database searches would occur in the project area or be reliant at the local population level on the habitats to be affected by the remnant mining proposal. The three species most likely to occur comprised:

- Northern Quoll *Dasyurus hallucatus* (Schedule 1);
- Orange Leaf-nosed Bat *Rhinonicteris aurantius* (Schedule 1);
- Ghost Bat *Macroderma gigas* (Priority 4).

Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 (Federal)

A point search using the DEW Protected Matters Search Tool was conducted using a 5 km buffer around 21°43'16"S and 116°15'40"E. The following matters of national environmental significance were yielded by the search:

Matters of National Environmental Significance

Threatened Species	Status	Type of Presence
Mammals		
Dasycercus cristicauda Mulgara	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantius (Pilbara form) Pilbara Leaf-nosed Bat	Vulnerable	Community likely to occur within area
Reptiles		
Morelia olivacea barroni Olive Python (Pilbara subspecies)	Vulnerable	Species or species habitat may occur within area

Habitat for the Mulgara does not occur within the project area though suitable habitat is present approximately 50 km to the west in the vicinity of Yaraloola Station. Of the remaining two taxa listed by the search, the Pilbara Leaf-nosed Bat was recorded by a targeted survey and is discussed elsewhere in detail. The Pilbara Olive Python is known from sites along the Robe River and may occur in the Mesa K project area but was not recorded during surveys.

Migratory Species	Status	Type of Presence
Migratory Terrestrial Species - Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Migratory Wetland Species - Birds		
Charadrius veredus Oriental Plover, Oriental Dotterel	Migratory	Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole	Migratory	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Migratory	Species or species habitat may occur within area

With the exception of Rainbow Bee-eater, none of the above species would be expected to occur in the project area as suitable habitat is absent. The Rainbow Bee-eater is not considered to be of elevated conservation significance in the Pilbara bioregion and is not discussed any further.

Other Matters Protected by the *EPBC Act 1999*

Listed Marine Species - Birds	Status	Type of Presence
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel	Listed - overfly marine area	Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel	Listed - overfly marine area	Species or species habitat may occur within area

The project does not encompass any marine habitat and the majority of the listed marine species would not occur in the Mesa K project area. The Fork-tailed Swift is likely to be an occasional visitor over the project area during suitable storm events as it is elsewhere in the Pilbara bioregion. The Great Egret is known from sites along the Robe River and may occasionally occur in the vicinity of Mesa K. The Rainbow Bee-eater has already been addressed above.

Appendix 2

Bat Call Identification Report – Dr Kyle Armstrong

MOLHAR PTY LTD
Applying DNA technology

Kyle Armstrong PhD
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22/1/07, 3 pages, via email

Mr Roy Teale
Biota Environmental Sciences Pty Ltd
PO Box 176,
North Perth, WA 6906.

Bat call identification verification at Mesa K: Pilbara leaf-nosed bat cave survey

Thank you for seeking my advice concerning your recent survey for the Pilbara leaf-nosed bat *Rhinonicteris aurantia* at Mesa K, near Pannawonica, Western Australia. This letter provides verification of bat species identification from echolocation call recordings. The best use of this advice is as a supporting document referred to and placed in the appendix of the report to your client.

Background information

As explained to me by Dan Kamien, on 15 November 2006 a single Pilbara leaf-nosed bat was captured in a harp trap placed near the entrance of a cave close to the Robe River (c. 100 m) on the southern scarp of Mesa K. This cave was identified as potentially suitable for the species. I gave advice concerning the simplest method of surveying the cave to confirm occupancy and provide an unambiguous determination of presence/roosting. This involved placing a sheet of cloth over the entire cave entrance in the late afternoon, and identifying the origin of any Pilbara leaf-nosed bat (either from inside or outside of the cloth barrier) at the time of their emergence at dusk. This approach was recommended because, while foraging, the species will visit structures at night that it may not necessarily roost in during the day. Thus, casual night visitation must be distinguished from first emergence at dusk. I recommended placing an observer on either side of the sheet with an Anabat detector to record calls from dusk, with care taken to orient the detector microphone away from the sheet to make sure that signals from the opposite side were not recorded.

When in confined spaces such as caves, bats that produce frequency modulated (FM; sweeping through a range of frequencies) type calls are known to produce calls that are quite different from the 'search-phase' calls produced outside the roost. These search-phase calls are used by biologists in species identification. The Pilbara leaf-nosed bat produces constant frequency (CF; a stable tone at one frequency) type calls, which do not change significantly when in a confined space. Thus, recordings taken with Anabat detectors inside the cave should allow identification of the species. It was suggested to allow sufficient time for any roosting Pilbara leaf-nosed bats to emerge after dusk.

Interpretation of Anabat recordings

I examined all calls made during one survey of the cave conducted in January 2007. There were two groups of calls, comprising sequences from inside and outside the cave. I observed that most calls from inside the cave were not typical search phase calls of the three FM-emitting species commonly found in caves in the Pilbara (common sheath-tailed bat *Taphozous georgianus*; Hill's sheath-tailed bat *Taphozous hilli*; Finlayson's cave bat *Vespadelus finlaysoni*). However it was obvious that two species were present: one of the two candidate sheath-tailed bat species, and Finlayson's cave bat (Figure 1). No calls of the Pilbara leaf-nosed bat were observed.

Calls from the detector placed outside the cave also derived from one of the two candidate sheath-tailed bat species, and Finlayson's cave bat. A third species was also identified (yellow-bellied sheath-tailed bat *Saccolaimus flaviventris*). No calls of the Pilbara leaf-nosed bat were observed.

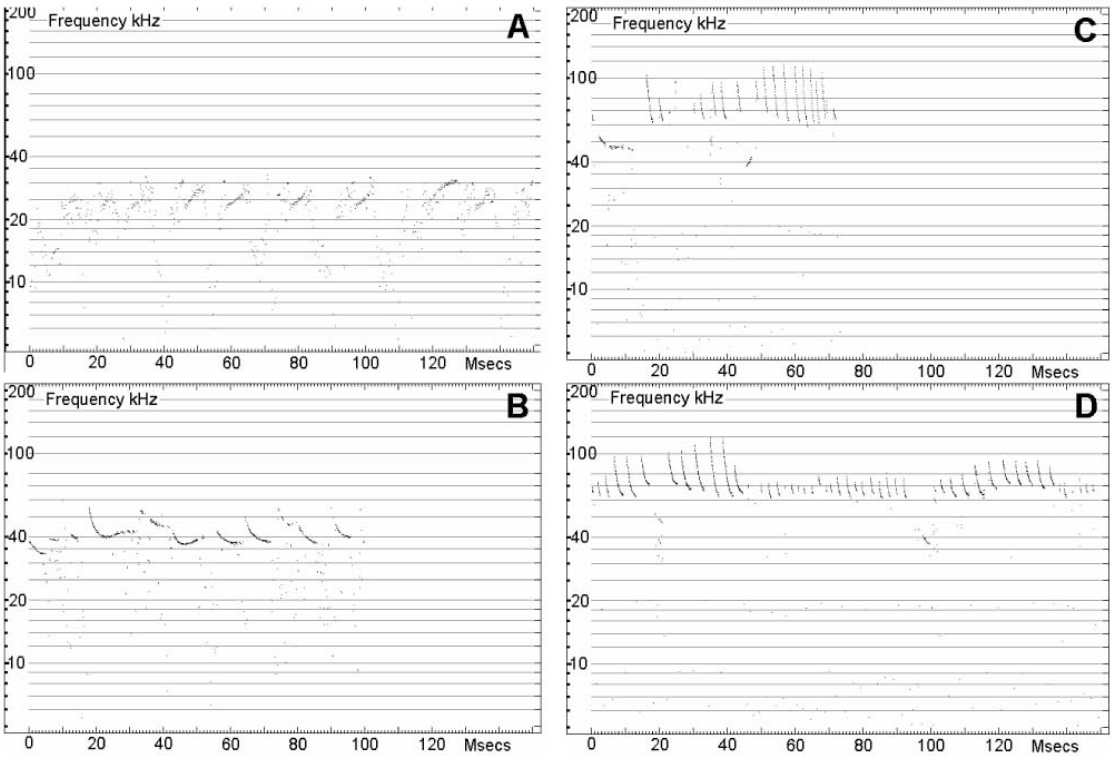

Figure 1. Calls recorded from inside the cave. A, B: *Taphozous* sp. probably *T. georgianus*; C, D: *Vespadelus finlaysoni*.

Final remarks

Dan Kamien mentioned that the cave appeared relatively shallow, which is generally not a characteristic of roosts of the Pilbara leaf-nosed bat. Even for such caves, the approach involving the barrier sheet will be the best to confirm occupancy, since bats might roost in a part of the cave that is difficult to survey. Waiting for emergence of bats will provide a greater chance of detection of this species. From these data, I conclude that the Pilbara leaf-nosed bat was not roosting in the structure at the time. Even in the unlikely event that this cave is used as a refuge during the day on occasions, its depth suggests that it would not be relatively important. It is more likely that a roost occurs in a deeper or more humid structure nearby.

Yours sincerely,
Kyle Armstrong PhD
Director, Zoologist