29th June 2017

Natassja Bell
Senior Approvals Advisor
Atlas Iron Limited
Level 18, 300 Murray Street, Perth WA 6000

Dear Natassja,

As requested, please find a summary below of our current understanding of the importance and classification of cave CO-CA-03 for the Pilbara Leaf-nosed Bat *(Rhinonicteris aurantius*).

The cave CO-CA-03 was first identified and surveyed with a SM2 echolocation recorder for a total of eight nights during the Phase 1 vertebrate fauna survey in February – March 2014 (MWH 2016). The Pilbara Leaf-nosed Bat was recorded on every night, with a total of 192 passes. The first and last passes occurred >30 minutes before/after civil twilight suggesting the cave was being used as a Nocturnal Refuge for the species (i.e. not being used as a diurnal roost; (Bat Call 2016a). Given that the unit recorded the Pilbara Leaf-nosed Bat on every night of this survey, there is no reason to suspect that the unit was not collecting accurate results. During the dry season, approximately March to August, individuals aggregate in caves that retain a suitably warm, humid microclimate throughout the year; however, individuals disperse from these main colonies during the wet season, approximately September to February, when suitably humid caves are more widely available (Armstrong 2001, Bullen and McKenzie 2011, Churchill 1991). While survey guidelines do not recommend a specific survey season for the species, they do highlight that different caves may be available for use by the species depending upon seasonal changes in their microclimate (DEWHA 2010, DoE 2016). Consequently, the timing of the survey (end of the Pilbara wet season), was appropriate for surveying the species, with the survey coinciding with when the species would utilise a greater number of caves in the landscape due to them having seasonally warmer and more humid microclimates.

During the Phase 2 survey in October 2016, the cave was surveyed for an additional five nights (MWH 2016). The species was recorded on each night with the number of passes varying from 230-1,557 with an average of 806 (±242.4) (Bat Call 2016b). The timing of first and last call occurred close to civil twilight and was consistent with this cave being used for diurnal roosting on each of these nights (Bat Call 2016b). Additionally, approximately 10 individuals were visually seen in this cave on the 29th September 2016 (MWH 2016). The presence of roosting individuals in Phase 2, but the lack of such individuals in March 2014, suggests that the cave represents, at a minimum, a Transitory Diurnal Roost (as defined by; DoE 2016) or a satellite of the permanent roost at CO-CA-01 (Bat Call 2016b). However, because the species was recorded roosting during the breeding season, the cave was classified as a Non-Permanent Breeding Roost (as defined by; DoE 2016) – a roost with *"evidence of usage during some part of the 9-month breeding cycle (July–March), but not occupied year-round; considered as critical habitat that is essential for both the daily and long-term survival of the PLNB"*.

The cave CO-CA-03 was recently re-visited on 31 May 2017 during the establishment of an automated solar powered SM2 unit at the cave. The solar powered unit was installed so that baseline echolocation data could be collected over a continuous duration as SM2 internal batteries only last for 4-5 nights. The unit was established on a tripod within the cave pointing towards a constriction that opens up to a chamber where the bats are believed to have been roosting. During this establishment, the cave was inspected for the presence of Pilbara Leaf-nosed Bats, in particular the crevice deep in the cave where the bats had previously been recorded during the Phase 2 survey. No Pilbara Leaf-nosed Bats were observed in the cave during this site visit.

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The data from this solar powered unit was collected after a period of 10 nights (31st May – 10th June) and analysed by Bat Call WA (Bat Call 2017)(**Appendix A**). Although the gain settings on the unit meant that weak Pilbara Leaf-nosed Bat calls could not be detected (i.e., the total number of PLNB calls is likely to be an underestimation), the unit operated successfully over the duration of the survey period. This meant that analysis of the calls was able to determine the timing of first and last calls which is important to determine roost status. Calls were recorded on all ten nights of the survey and averaged approximately 900 calls per night which is higher than the 2014 survey results and similar to those of the Phase 2 survey in 2016. On most nights, the earliest calls were approximately 30 minutes after dusk which indicates that no Pilbara Leaf-nosed Bats were roosting within the cave, however on the 9th June, a small number of calls were detected at dawn and then at dusk the following evening (Bat Call 2017). This indicated that a few Pilbara Leaf-nosed Bats, probably less than five, roosted diurnally at the cave on that day (Bat Call 2017). The majority of the calls over the survey period showed a unimodal pattern which is typical of a preferred foraging cave with the majority of calls occurring around midnight (Bat Call 2017). This pattern of use during this most recent survey reaffirm the conclusion above that cave CO-CA-03 is a satellite roost of the permanent diurnal roost CO-CA-01. **This means that the cave does not meet the criteria of a Permanent Breeding Roost, but instead meets the criteria of a Non-Permanent Breeding Roost.** A summary of bat activity and observations at CO-CA-03 and CO-CA-01 since the Phase 1 2014 survey is provided in Table 1.

Table 1. Summary of Pilbara Leaf-nosed Bat Records at Cave CO-CA-01 and CO-CA-03

Cave	Pilbara Leaf-nosed Bat Records					
	2014 (Feb-Mar)	2014 (May to August)	2015 (July)	2016 (July)	2016 (Sep)	2017 (June)
CO-CA-01 (Permanent breeding roost)	Observations: 200+ Average no. of passes: 11.5* Temporal use: Diurnal roosting (14 nights)	Average no. of passes: 2,725 (±157.9) Temporal use: Diurnal roosting (105 nights)	Average no. of passes: 751.1 (±118.8) Temporal use: Diurnal roosting (9 nights)	Observations: 407 to 600 Average no. of passes: 2,071 (±239.5) Temporal use: Diurnal roosting (7 nights)	Average no. of passes: 171 (±70.8)^ Temporal use: Diurnal roosting (5 nights)	Average no. of passes: 500^ Temporal use: Diurnal roosting (10 nights)
CO-CA-03 (Non-Permanent breeding roost)	Average no. of passes: 24 Temporal use: Nocturnal refuge (8 nights)	-	-	-	Observations: 10 Average no. of passes: 806 (±242.4) Temporal use: Diurnal roost (5 nights)	Observations: 0 Average no. of passes: 900^ Temporal use: Nocturnal refuge, with the exception of one day of diurnal roosting (< 5 individuals). (10 nights)

* Unit only recorded for first half hour each night.
^ High gain setting on this unit may have underestimated the total number of PLNB calls.

The patterns of use of CO-CA-03 by the Pilbara Leaf-nosed Bat will continue to be monitored by the solar powered SM2 unit deployed at the cave. Data from this unit will provide additional information on the seasonal importance of this cave for the species (dry season vs wet season) and a clearer understanding of its classification depending upon its use during the 9-month breeding cycle.

Yours sincerely

Paul Bolton

Stantec Australia Pty Ltd

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Appendix A: Atlas Iron Limited Corunna Downs Project, Pilbara WA, May to June 2017. Echolocation Survey of Bat Activity at caves CO-CA-01 and CO-CA-03.

Atlas Iron Limited
Corunna Downs Project,
Pilbara WA,
May to June 2017

Echolocation Survey of Bat Activity at caves CO-CA-01 and CO-CA-03.

Prepared for Stantec Australia

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Issue 2
Prepared by: R. D. Bullen – Bat Call WA
29 June 2017

Background

Bat species presence, with an estimate of activity level, is presented for two caves at the proposed Atlas Corunna Downs project in the Pilbara, WA. Stantec Australia (Stantec) carried out an echolocation based survey at caves CO-CA-01 and CO-CA-03 using full spectrum Songmeter SM2 bat detectors. The survey was conducted during May and June 2017. Bat Call WA has reviewed the recordings and provided presence and activity levels for bats present. These data are then compared with the trend data from recent monitoring exercises at the caves.

Habitats

Bat detectors were deployed at two locations previously identified as roost caves for conservation significant bats, Pilbara leaf-nosed bats (*Rhinonicteris aurantia*, Pilbara form) (PLNb) and Ghost bats (*Macroderma gigas*) (PGb).

Site specific details are presented in table 1.

Survey Timing, Moon Phase and Weather

Data was collected between the 31st May and the 10th June 2017. The weather during the survey was warm and dry. Minimum overnight temperatures were between 10 and 15^{O}C. The moon in the period was first quarter to full. These conditions would typically result in high bat activity and echolocation call detections. Sunset, sunrise and dusk and dawn civil twilight (CT) were within 2 minutes of 17:26, 06:34, 17:50 and 06:09 respectively, depending upon date.

Survey Team

The bat sampling work was conducted by staff of Stantec. No activities conducted would have directly impacted upon the bat fauna present.

R.D. Bullen of Bat Call WA completed analysis of echolocation recordings.

Bat Fauna

One species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), the PLNb, was detected at two caves characterised as diurnal roosts, one being permanent and therefore assumed to be maternal. A second EPBC Act listed species, the PGb, was not detected ultrasonically due to an incorrect detector setting used, see below.

Cave CO-CA-01 was reconfirmed as a permanent diurnal PLNb roost however the call counts remained at a low level compared with 2014 (Bat Call 2014). Cave CO-CA-03 maintained the characteristics of a preferred foraging roost with a high call count and first call timing approximately half an hour after CT. The nightly temporal patterns indicated that a small number of PLNb roosted within the cave on the 9th June.

Sampling

The overnight recordings were made with SM2 detectors fitted with SMX-U1 microphones (Wildlife Acoustics, USA). The hardware rocker switch and firmware audio settings used followed

the manufacturer's recommendations for bat detection contained in the user manuals with the exception of the hardware gain. This was set at 48 dB rather than the 12 dB required by the 'U1 microphone. Selectable filters and triggers were also set using the manufacturer's recommendations.

The detector at CO-CA-01 was placed on large bolder in the outer chamber of the cave and faced into the cave towards a constriction. This position was similar to the position to where a unit was deployed during the long term monitoring undertaken in 2014 (Bat Call 2014) and was also similar to the SM4-0043 location shown in Bat Call (2016a) figure 2. The detector at CO-CA-03 was placed on a tripod within the cave pointing towards a constriction where the bats are believed to have been roosting.

For all recordings, once reformatted as .wav files, COOL EDIT 2000 (Now available as AUDITION from Adobe Systems Inc.) was used to display each "continuous call" sequence (EPA and DEC 2010) for identification. Only good quality call sequences were used. Details of calls analysed are provided in table 2 as recommended by Australasian Bat Society (ABS 2006). Reference data for the species identified are available in Bullen and McKenzie 2002, McKenzie and Bullen 2003 and McKenzie and Bullen 2009.

Survey Limitations

The sites surveyed were accessible on foot and the recorders were set at ground level with the microphone horizontal. The omni-directional microphones fitted to the detectors will successfully record all bats that pass within range under these conditions. Bat sound recordings began at sunset and continued until sunrise.

Bat headcount is impossible to estimate from echolocation records. Bat call count is therefore substituted as an approximate guide to the relative numbers of bats present.

Detectors at both cave sites were set up with high gain, precluding the identification of PGb and faint PLNb calls within the caves. These detectors only recorded strong PLNb calls from bats flying close to the microphone. PLNb call number counts are therefore considered to be low.

Results

Pilbara leaf-nosed bats

PLNb were detected at both sites surveyed (figures 1 and 2). Cave CO-CA-01 was confirmed as a diurnal roost during the survey with initial activity being detected within five minutes of dusk CT on all nights, figure 3. Recorded call counts at CO-CA-01 averaged approximately 500 per night which is lower than the recent census completed in 2016 (Bat Call 2016a) where call counts averaged approximately 2000 per night, but see discussion below. The temporal pattern of calls showed the bimodal activity peaks at dusk and dawn that was consistent with the cave continuing as a permanent diurnal roost. Call counts at cave CO-CA-03 averaged approximately 900 per night which is higher than the 2014 survey levels, when the nightly call count was only 30, and similar to 2016. On most nights, the earliest calls were detected approximately 30 minutes after dusk CT (figure 4) indicating that there were no PLNb consistently roosting within the cave during the survey. However, on the 9th June there were a small number of calls detected at dawn CT followed that evening by calls beginning at dusk CT. This indicated that a few PLNb, probably less than five, roosted diurnally at the cave on that day. The majority of the calls detected showed the unimodal pattern of a preferred foraging cave with the majority of calls occurring around midnight, figure 2. Early call timing was not detected in 2014 but was detected in 2016 indicating that this cave is a "satellite" of the permanent roost at CO-CA-01.

Ghost bats

No PGb results were available due to the detector settings used.

Discussion

The discovery of the previously unknown roost at Corunna Downs in 2014, together with the Dalton Creek Roost discovered in 2016 (Bat Call 2016b), brings the confirmed number of diurnal roosts in the district to seven. In addition there are a number of non-permanent "satellite" roosts that have been identified. Bats use diurnal roosts to rest during the day, before departing for foraging during the night. Bats return by sunrise. Foraging during the night includes visiting water holes for drinking and visiting sites including non-roost caves and other types of preferred habitat for feeding. Continuously occupied Pilbara diurnal roosts are suspected to be maternity roosts during the breeding season. The location of these roosts, being less than 40 km apart, potentially provides a very high level of connectivity between them. In addition, the scatter of sites where the bats have been detected (Bat Call 2016c) suggests the foraging pattern of the species is wide spread across the project area.

The first calls of PLNb at cave CO-CA-01 were consistently within minutes of dusk CT however the last calls prior to dawn showed an average timing of one hour before sunrise, or approximately 40 minutes before dawn CT, figure 3. This is not considered unusual for temporal patterns at permanent PLNb roosts during periods of low insect abundance and is similar to timings recorded in July 2014 and September 2016.

The call count at cave CO-CA-01 is significantly lower than that of 2014, but similar to the counts of July 2015 and September 2016, figure 3. During the July 2016 census, two detector locations were used. One was at the constriction with the microphone pointing into the cave's inner chamber. The second was in the outer chamber, similar to the 2014 and 2015 surveys. The call counts for July 2016 herein, figure 3, from the former location were higher than the latter, i.e. over 2000 call per nigh compared to 320 for the outer chamber detector. The result from this survey therefore shows that the activity at the cave has been constant since 2015 but at a significantly lower level from 2014.

The call count at cave CO-CA-03 was similar to the nightly count during 2016 when PLNb were roosting at that cave but was much higher than 2014 when no PLNb roosted diurnally. The comparison of the temporal patterns from this cave with those of CO-CA-01 however clearly shows that cave '-03 is a preferred foraging site for the species with an internal microclimate that supports its use as an occasional satellite diurnal roost to cave '-01.

Management Recommendations.

Recommendations for the protection of the diurnal roost at cave CO-CA-01 have been made (Bat Call 2016d, updated in Bat Call 2017) and a suitable quarantine area defined. Cave CO-CA-03 has been confirmed as a non-permanent satellite of '-01 and has not at this time been confirmed as a maternity roost for the species. As a satellite with occasional diurnal roosting, it must be protected from permanent damage to its structure and internal microclimate during the mining operations to allow the species to continue to use it following completion of the nearby operations. Atlas have committed to a 50 m buffer from the entrance (50K 776808mE 7623718mS). Based on current advice that the cave is under 30 m deep, does not have sinuous tunnels continuing off its internal extremity and has an elevated internal humidity level, such a buffer will be an adequate safeguard to allow its ongoing use long term providing:

1. The local geotechnical characteristics of the strata surrounding the cave are confirmed as stable and not subject to collapse from nearby blasting and ore removal activities.
2. The depth of the cave at under 30 m and the absence of any sinuous tunnels at the rear are confirmed.
3. The current internal microclimate (temperature, humidity and light levels) at the back of the cave is documented.
4. Mining operations do not open any unmapped deep cracks or tunnels behind the cave that will alter the through-flow of air and thereby modify the internal microclimate. In the event of an inadvertent modification to the internal air flow patterns, a technique must be developed to seal any opening(s) that may form.
5. Mining operations do not modify the ability of rainwater to seep into the rear of the cave thereby maintaining the natural internal humidity levels.

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Table 1 Site Specific details.

Site	Site description	Recording details	Zone	Easting	Northing
CO-CA-01	Cave Entrance	Seven nights SM2 recording (SN MWH-05)	50 K	777182	7629040
CO-CA-03	Cave Entrance	Eleven nights SM2 recording (SN MWH-08)	50 K	776906	7623697

Table 2: Summary of Echolocation call characteristics for microbat species present.

Genus species Authority	Common name	Typical F_{peak} kHz	Ave. Q	Typical Duration msec	Typical Call Shape
Macroderma gigas (Dobson 1880)	Ghost bat	20 – 52 variable	2 – 20 variable	variable	Complex FM
Rhinonicteris aurantia (Gray 1845)	Pilbara leaf-nosed bat	120	30	5 - 8	CF

Note: Fpeak and Q are defined in McKenzie and Bullen 2003, 2009.

Figure 1. Temporal patterns of Pilbara leaf-nosed bat calls detected at cave CO-CA-01

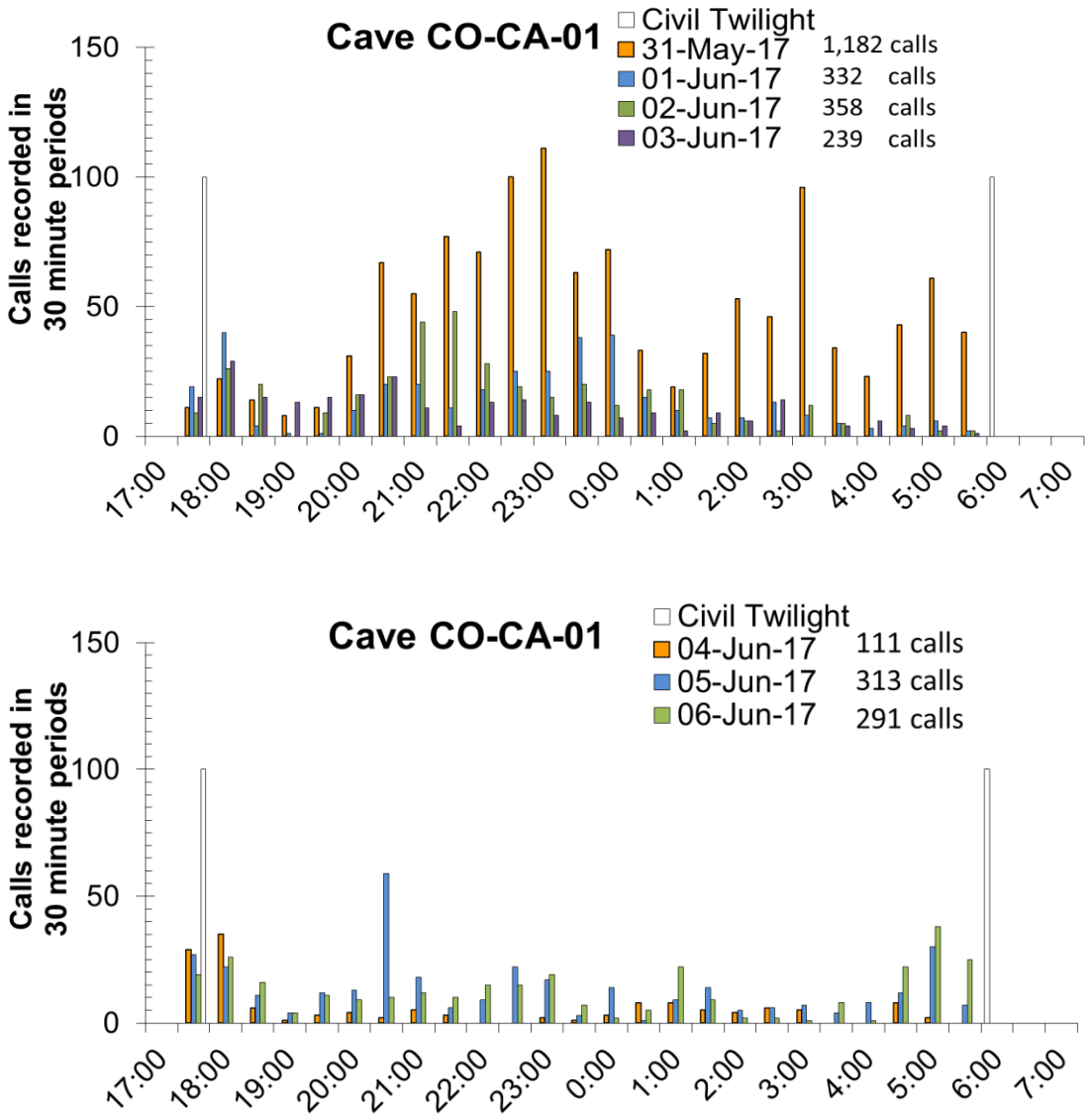


Figure 2. Temporal patterns of Pilbara leaf-nosed bat calls detected at cave CO-CA-03

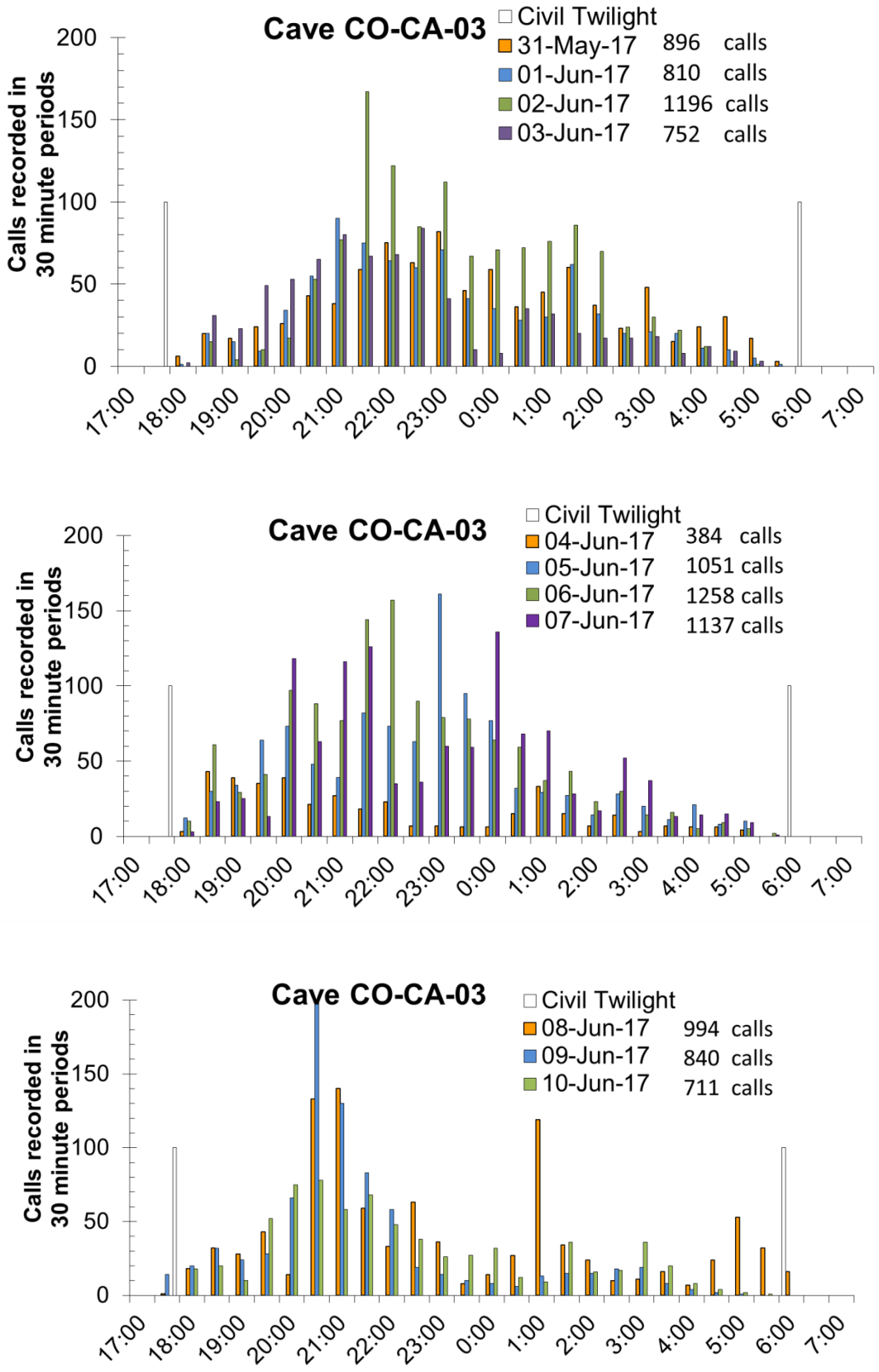
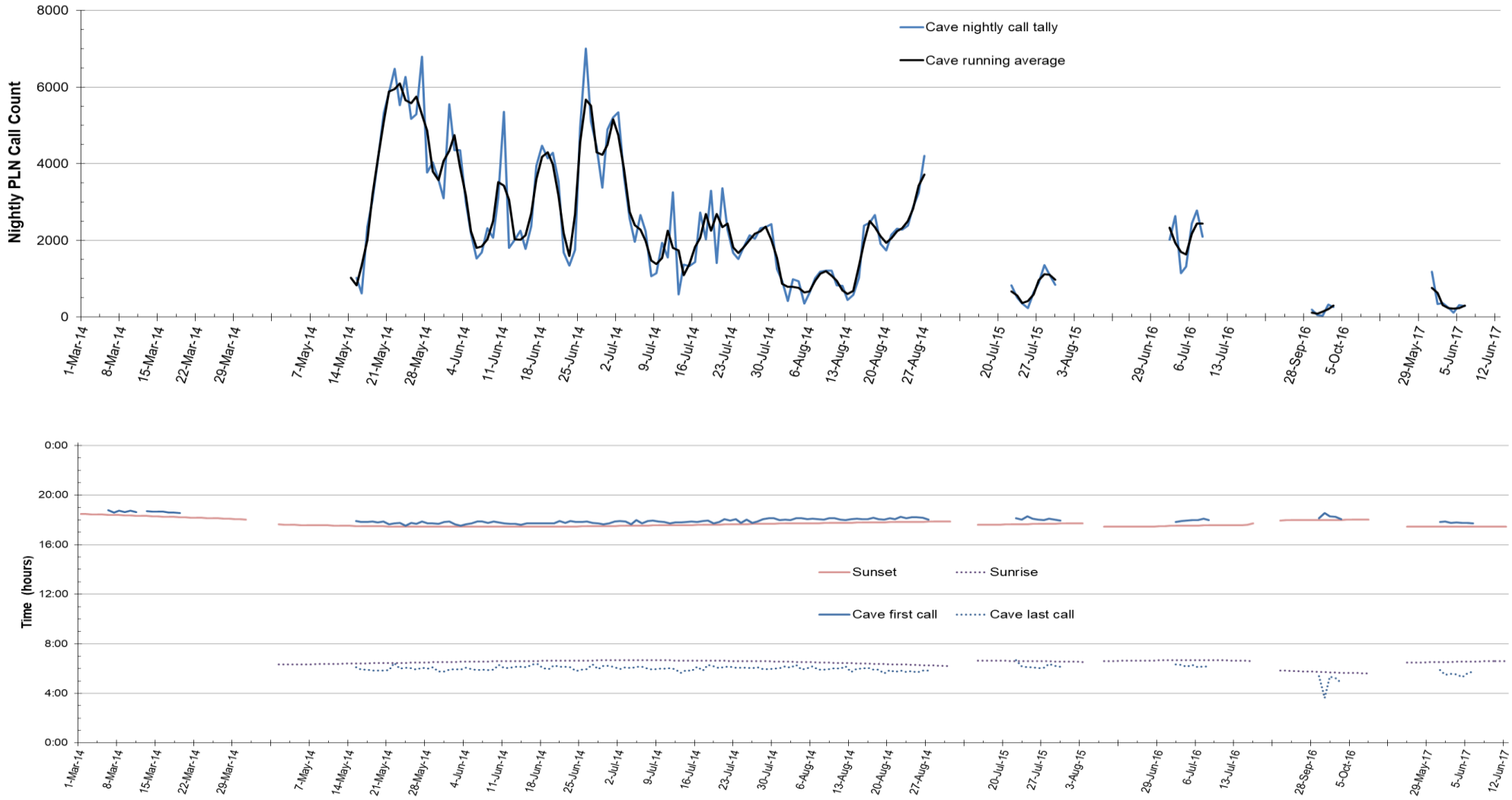


Figure 3: Pattern of PLNb calls and time differential of first and last PLNb calls at CO-CA-01 compared with sunset/rise and dusk and dawn civil twilight between March 2014 and June 2017. Data are from this study and Bat Call 2014, 2016a and 2016b.



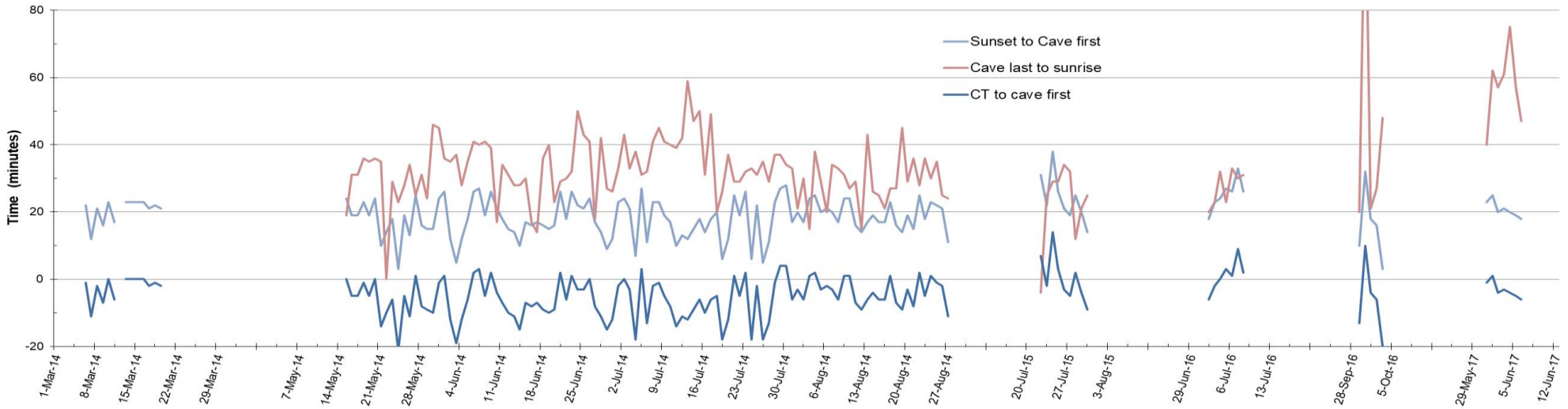
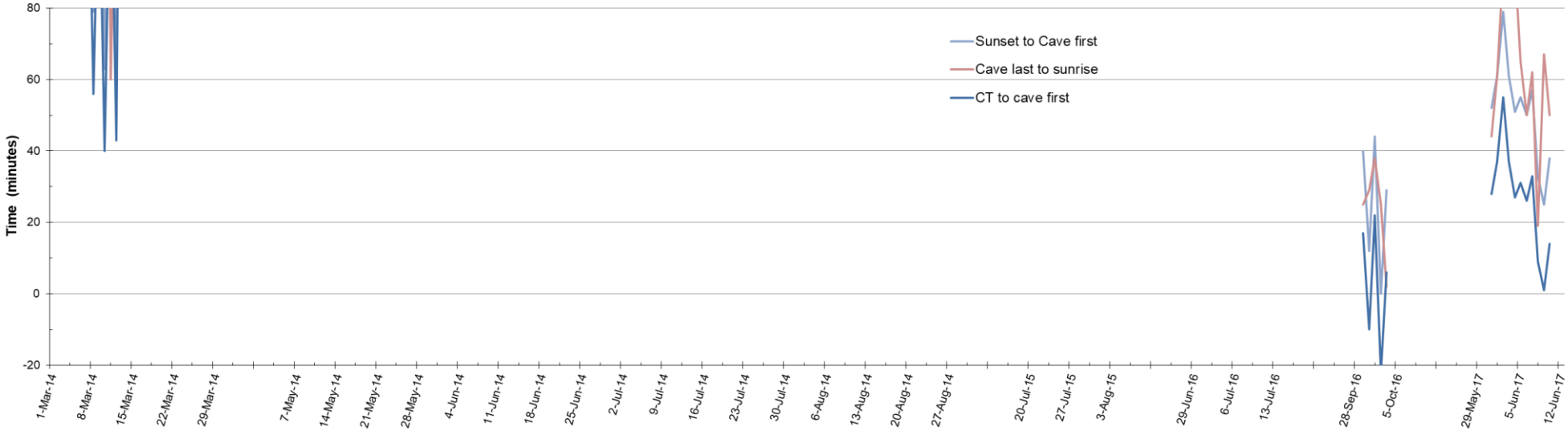

Sunset to Cave first
Cave last to sunrise
CT to cave first
Time (minutes)
80
60
40
20
0
-20
1-Mar-14
8-Mar-14
15-Mar-14
22-Mar-14
29-Mar-14
7-May-14
14-May-14
21-May-14
28-May-14
4-Jun-14
11-Jun-14
18-Jun-14
25-Jun-14
2-Jul-14
9-Jul-14
16-Jul-14
23-Jul-14
30-Jul-14
6-Aug-14
13-Aug-14
20-Aug-14
27-Aug-14
20-Jul-15
27-Jul-15
3-Aug-15
29-Jun-16
6-Jul-16
13-Jul-16
28-Sep-16
5-Oct-16
29-May-17
5-Jun-17
12-Jun-17

Figure 4: Pattern of PLNb calls and time differential of first and last PLNb calls at CO-CA-03 compared with sunset/rise and dusk and dawn civil twilight between March 2014 and June 2017. Data are from this study and Bat Call 2014, 2016a and 2016b.


Time (minutes)
80
60
40
20
0
-20
Sunset to Cave first
Cave last to sunrise
CT to cave first
1-Mar-14
8-Mar-14
15-Mar-14
22-Mar-14
29-Mar-14
7-May-14
14-May-14
21-May-14
28-May-14
4-Jun-14
11-Jun-14
18-Jun-14
25-Jun-14
2-Jul-14
9-Jul-14
16-Jul-14
23-Jul-14
30-Jul-14
6-Aug-14
13-Aug-14
20-Aug-14
27-Aug-14
20-Jul-15
27-Jul-15
3-Aug-15
29-Jun-16
6-Jul-16
13-Jul-16
28-Sep-16
5-Oct-16
29-May-17
5-Jun-17
12-Jun-17