Ultrasonic Analysis Report

22SYD-1514 – Gables: Old Pitt Town and Boundary Road, Planning Proposal - Ultrasonic Analysis Report

1. Methods

The Old Pitt Town and Boundary Road study area (hereafter, the study area) is located approximately 40 km west of Sydney's central business district.

Three (3) Anabat Swift ultrasonic microbat detectors were set to passively record microbat diversity and activity at three (3) locations within the study area. A total survey effort of 18 survey nights was achieved between 24 and 30 March 2022 (

Table 1). No microbat call data (instead, just noise files) were recorded on the night of 27 March 2022. Assuming that the devices had not been turned off, this failure to record microbat calls could have been a response to the climatic condition experienced that night.

The three detectors used during this survey were programmed to start recording microbat calls at dusk and to stop recording at dawn. Therefore, microbat call data were recorded throughout the entire night.

Table 1 provides an overview of the detectors that were used during the survey, the dates in which the recordings were undertaken, a description of the survey effort, and the proximity (in metres) to the nearest waterbody.

Table 1. Anabat detector identification names and reference numbers, survey dates, survey effort and distance from the water edge.

Detector ID	Detector reference number	Dates surveyed	Survey Effort	Distance to Waters edge
SYD01	514008	24 to 29 March 2022	6	1 m
WOL02	514281	24 to 28 March 2022	5	30 m
WOL03	583111	24 to 30 March 2022	7	1 m
Total survey effort			18	

2. Data Analysis

Microbat calls were recorded as WAV sound files. A total of 15,883 WAV files were submitted for analysis. The recorded microbat call files were subject to noise removal and decision tree filters using the software program Anabat Insight (Version 2.0.2-8-g50df387 (Titley Scientific).

Those files that were passed by these filters were then analysed in either ZC or full-spectrum formats. Call identifications were made by Rod Armistead using regional-based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New

South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from Sydney Basin, NSW (which is available at http://www.forest.nsw.gov.au/research/bats/default.asp). No microbats were captured during this survey and no site-specific reference microbat ultrasonic calls were collected. Consequently, the call identifications attained during this assessment followed the parameters provided in the microbat echolocation call guides that have been developed for New South Wales (Pennay *et al* 2004) and the south-east Queensland and north-east New South Wales (Reinhold *et al* 2001). The study area is located within the Sydney Basin biogeographical region as described in Pennay *et al.* 2004.

Species identifications were further guided by the species-specific distribution information provided in Churchill (2008); Pennay et al. (2011), Van Dyck and Strahan (2008), Van Dyck et al. (2013), and the Australian Bat Society web page (Ausbats - Welcome to the Australasian Bat Society).

To ensure reliable and accurate results the following protocols (adapted from Lloyd et al. 2006) were applied:

- Search phase calls are used preferentially when analysing the data because they contain more diagnostic features than cruise phase calls or feeding buzzes (McKenzie et al. 2002).
- Recorded calls containing less than three pulses are not analysed as they are often too short to confidently determine the identity of the species making the call (Law et al. 1999). These short sequences were either removed manually or were labelled as unidentifiable.
- For those calls that can be used to identify the species making the call, two categories of confidence are used (Mills et al. 1996):
    - Definitely present – the quality and structure of the call profile are such that the identity of the bat species making the calls is not in doubt.
    - Potentially present – the quality and structure of the call profile are such that there is some / low probability of confusion with species that produce similar calls profiles.
- Calls made by bats that cannot be used for identification purposes such as social calls, short and low-quality calls, cruise and approach phase calls were removed from the data.
- *Nyctophilus* species. (Long-eared Bats) are difficult to identify or separate confidently to species level based upon their recorded calls. In this survey, no attempt was made to separate any potential Long-eared Bat calls to species level. There are two non-threatened Long-eared Bats that occur in the Sydney Basin biogeographical region. This includes *N. geoffroyi* (Lesser Long-eared Bat) and *N. gouldii* (Gould's Long-eared Bat). Both species are relatively common and widely distributed across NSW.
- The Free-tailed Bats (previously referred to as the genus *Mormopterus or Tadarida*) have recently undergone taxonomic revision (Reardon et al. 2014) and now comprise four separate genus; *Austronomus*, *Micronomus, Ozimops* and *Setirostris* (Table 2). This report uses nomenclature for Free-tailed Bat species as referred to in Jackson and Groves (2015) and Armstrong et al. (2020). The correlation between the nomenclature used in this report and that used in NSW State legislation is presented in Table 2 below. Published reference calls for the genus *Ozimops* (Pennay et al. 2004) are believed to contain errors (Greg Ford pers comm.). Because of this uncertainty, all Free-tailed Bats in the new genus *Ozimops* recorded within the survey area will be referred to as being part of the *Ozimops* species complex.

- Jackson & Groves (2015) list the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) under the new name of *M. orianae* (Large Bent-winged Bat). However, we follow the NSW Department of Planning, Industry and Environment (DPIE) nomenclature as it applies to the eastern form of the species which occurs in NSW as a distinct sub-species; *M. o. oceanensis* (Large Bent-winged Bat) (see https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10534) (NSW Department of Planning, Industry and Environment (formerly the Office Environment and Heritage).
- Sequences not attributed to microbat echolocation calls (e.g. insect buzzes, wind, train and vehicle movement) were dismissed from the analysis.

Table 2: Correlations between current and previous nomenclature for the Free-tailed bats of NSW

Jackson and Groves 2015	Previously known as	Common Name	BC Act
Austronomus australis	*Tadarida australis*	White-striped Free-tailed Bat	
Micronomus norfolkensis	*Mormopterus norfolkensis*	Eastern Coastal Free-tailed Bat	Vulnerable
Ozimops petersi	*Mormopterus* species 3 (small penis)	Inland Free-tailed Bat	
Ozimops planiceps	*Mormopterus* species 4 (long penis eastern form)	Southern Free-tailed Bat	
Ozimops ridei	*Mormopterus* species 2	Ride's Free-tailed Bat	
Setirostris eleryi	*Mormopterus* species 6	Bristle-faced Free-tailed Bat	Endangered

3. Results and discussion

3.1 Summary

There were 6,710 microbat call sequences recorded during this survey. Of these, 6,406 (95.47%) were deemed useful, because these call profiles were of sufficient quality and/or length to enable the identification of a bat species to at least to genus (Results (diversity and activity) tables for each survey site

Table 4 and Table 6). The remaining 304 (4.53%) call sequences were either too short or were of low quality, thus preventing the identification of a bat species (Results (diversity and activity) tables for each survey site

Table 4 and Table 6).

There were at least eight and up to 17 species recorded during this survey (Table 3). This includes up to six species that are listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) (Table 3).

The species diversity and activity recorded on SYD01 were both greater than what was recorded on WOL02 and WOL03. For example, up to 17 species were recorded at SYD01, up to 12 species on WOL02,

and up to 10 species on WOL03. Microbat activity varied across the three surveys sites with 5,826 (90.96 %) of the usable calls being recorded on SYD01 (Table 4), and the remaining 579 (9.04%) calls were recorded on the remaining two detectors (Table 5 and Table 6). Of the 5,826 useable (definite and potential) calls recorded on SYD01, 5,368 were attributed to the threatened Southern Myotis. This represents an average of 1,073.6 Southern Myotis calls per survey night. This represents an unusually high level of activity by this species.

3.2 Threatened species

Based on the call profiles, three microbat species listed as Vulnerable under the BC Act were deemed to have been definitely present within the study area, including.

- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Myotis macropus* (Southern Myotis)

Four other threatened species listed as Vulnerable under the BC Act were deemed to be potentially present, including:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)

The call profiles of the four threatened species listed as being potentially present in the study area overlap, and are therefore easily confused, with the call profile of other threatened and non-threatened microbat species. Please see Section 4 Survey Limitations below for a more detailed explanation.

The most active threatened species was the Southern Myotis, with 5,736 definite and potential calls being attributed to this species. As stated previously, the majority (5,368) of the Southern Myotis calls were recorded on SYD01. SYD01 was set 1 m from the edge of a moderately sized farm dam with a patch of scattered trees located nearby. The high level of Southern Myotis activity suggests that the farms dams present in the study area form an important food resource to this species in the region.

The activity levels among the other threatened species are outlined below:

- 241 definite and potential calls were attributed to Eastern Coastal Free-tailed Bat
- 29 definite and potential calls were attributed to Large Bent-winged Bat
- 27 potential calls were attributed to Eastern False Pipistrelle or Greater Broad-nosed Bat
- 21 potential calls were attributed to Yellow-bellied Sheath-tailed Bat (only recorded on SYD01)
- 14 potential calls were attributed to Eastern Cave Bat

The Eastern Cave Bat, Large Bent-winged Bat and Southern Myotis are all listed as Species Credit Species under the Biodiversity Assessment Methodology (Office of Heritage 2018).

The presence (or potential presence) of the eight species listed as Vulnerable within the study area requires further consideration. A brief description of the threatened microbat species recorded during this survey and their habitat requirements is provided below.

3.2.1 Hollow dependant microbat species

Four of the threatened microbat species recorded during this survey are hollow dependent species. This includes East Coast Free-tailed Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat and Yellow-bellied Sheath-tailed Bat. No remanent or high-quality HBTs were determined as being present within the study area. However, some small 'pipe hollows' and 'mature trees' were observed within the study area. An assessment of the HBTs outside of the study area is encouraged.

3.2.2 Subterranean roosting species

Two threatened microbat species known to roost in subterranean or cave-like environments, including caves, mines, tunnels, bridges, culverts, and buildings, were recorded during this survey. This includes the Eastern Cave Bat and Large Bent-winged Bat. Of these two species, only the Large Bent-winged Bat was identified as being present in the study area with a high degree of confidence. In contrast, the Eastern Cave Bat was regarded as being potentially present only. This is because the calls of Eastern Cave Bat overlap with the calls of other non-threatened Eastern Forest Bat and Little Forest Bat.

Eastern Cave Bats will roost in sandstone caves, overhangs, boulder piles, mines and occasionally in buildings which would generally be within foraging range of sandstone escarpments (Churchill 2008). This species has been observed roosting in buildings near suitable natural habitat features that would normally provide suitable habitat at other sites in NSW and Qld. Apart from a few scattered buildings, the habitat for this species appears to be absent from the study area and nearby properties and road easements.

The Large Bent-winged Bat will roost in cement culverts, stormwater drains, bridges, disused mine shafts and caves (Churchill 2008). The underground habitats often used by these two species appear to be absent from the study area and the surrounding properties and road easements. A search for roost habitat and roosting bats in the nearby sheds and buildings is encouraged.

3.2.3 Southern Myotis

Southern Myotis is unique among the threatened microbat species recorded during this survey because it will roost in both tree hollows and subterranean habitats (e.g., caves, culverts and underneath bridges) (Churchill 2008; Campbell 2009).

The level of Southern Myotis activity recorded during this survey requires further investigation. Especially when the lack of quality HBTs or underground habitats within or near the study area that would support this species is considered. A search for roost habitat and roosting bats in the nearby sheds and buildings is encouraged.

4. Survey Limitations

Calls were only positively identified when the defining characteristics were present and there was no chance of confusion between species with overlapping and/or similar calls. In this survey, some call sequences could not be positively identified to species level. Further, some species recorded in this

survey have call profiles that overlap with the call profiles of other threatened and non-threatened species. When an overlap occurs and it is difficult to the separate a call, that call would be assigned to a multi-species complex that could consist of two or more potential species depending on the characteristics displayed in the recorded call sequences.

The species recorded in this survey that have overlapping call profiles are described in detail below.

The calls of the non-threatened *Austronomus australis* (White-striped Free-tailed Bat) can be confused with calls of the threatened Yellow-bellied Sheath-tailed Bat. White-striped Free-tailed Bats generally produced calls with a frequency range of 10 – 15, while the calls of Yellow-bellied Sheath-tailed Bat range between 20 and 22.5 kHz. Irregular White Striped Free-tailed Bat calls with frequencies greater than 15 kHz, and Yellow-bellied Sheath-tailed Bat lowers harmonic calls with frequencies less than 20 kHz can overlap. Calls overlapping these frequencies with no distinguishing characteristics were assigned to multi-species groups.

Chalinolobus gouldii (Gould's Wattled Bat), *Ozimops ridei* (Ride's Free-tailed Bat) and the Eastern Coastal Free-tailed Bat have calls that overlap in the range 28.5 kHz and 32 kHz. Calls were identified as Ride's Free-tailed Bat if the call shape was flat (initial slope S1 of less than 100 octaves per second) and the frequency was between 28 – 32 kHz. Gould's Wattled Bat was distinguished by a frequency of 27.5 – 32.5 kHz and alternation in call frequency between pulses. The threatened Eastern Coastal Free-tailed Bat calls are identified by flat pulses (initial slope S1 of less than 100 OPS), alternation in call frequency between pulses and a frequency range of 31 kHz to 36 kHz. Calls with intermediate characteristics were assigned mixed-species labels.

Calls were identified as Ride's Free-tailed Bat if the call shape was flat (an initial slope (S1) that is less than 100 octaves per second) and the frequency was between 28 – 32 kHz. Gould's Wattled Bat was distinguished by a frequency of 27.5 – 32.5 kHz and alternation in call frequency between pulses. The threatened Eastern Coastal Free-tailed Bat calls are identified by flat pulses (initial slope (S1) that is less than 100 OPS), alternation in call frequency between pulses, and a frequency range of 31 kHz to 36 kHz. Calls with intermediate characteristics were assigned mixed-species labels.

The calls of *Chalinolobus morio* (Chocolate Wattled Bat), Eastern Forest Bat (50 – 58 kHz), Eastern Cave Bat (49 – 52 kHz) and Little Forest Bat calls (48.5 – 53 kHz) overlap in the range 49 kHz to 52 kHz. Chocolate Wattled Bats display a curved call with a down-sweeping tail whereas Little Forest Bats display a curved call with an up-sweeping tail. Call profiles above 54khz with upward-facing tails can be attributed to the Eastern Forest Bat. However, when there are no upward-facing tails, or the data ha is present calls are assigned mixed-species labels of Chocolate Wattled Bat / Eastern Forest Bat, Eastern Cave Bat, and Little Forest Bat.

As stated above, the calls of Eastern Forest Bat, Eastern Cave Bat, and Little Forest Bat can overlap in the Sydney basin. All three species have curved upward-facing tails. Consequently, it can be difficult to separate these three species based on the structure of the call profile. However, it is possible to separate these species based on characteristic frequency (as shown above). Otherwise, when it is not possible to separate a call based on the characteristic frequency, it was assigned a multi-species label.

The calls of Greater Broad-nosed Bat, Eastern False Pipistrelle, and *Scotorepens orion* (Eastern Broad-nosed Bat) calls can be difficult to separate as their call frequencies and some other call characteristics overlap.

- Eastern False Pipistrelle bat calls have a characteristic frequency between 35 and 39 kHz, display curved, often steep pulses without up-sweeping tails and sometimes with down-sweeping tails. The pre-characteristic section is often long (greater than 3 kHz). This species can only be separated from Eastern Broad-nosed Bat when the characteristic frequency is above 37 kHz. There are no records of this species from within 30 km of the Study area and this species was excluded from the analysis based on distribution and a lack of suitable habitat.
- Greater Broad-nosed Bats can be distinguished by a frequency of 32 – 36 kHz, lack of a tail or short down-sweeping tail, frequency of the knee greater than 37 kHz, and drop of more than 3 kHz from the knee to the characteristic section. A longer pre-characteristic section can separate Greater Broad-nosed Bats from Eastern False Pipistrelles at lower frequencies (below 36.5 kHz).
- Eastern Broad-nosed Bat calls fall between 28 and 36 kHz, are curved and usually have a down-sweeping or absent tail but can have an up-sweeping tail. This species can be distinguished from an Eastern False Pipistrelle and Greater Broad-nosed Bat call profile by the frequency of the knee which is generally lower than 37 kHz.

In those cases when the calls could not be assigned to any-one species individually, they were consequently labelled as multi-species combinations dependent upon which of the characteristics matched the call profile.

The characteristic frequency calls of *Miniopterus orianae oceanensis* (Large Bent-winged Bat) overlap in frequency with those of *V. regulus* (Southern Forest Bat). Large Bent-winged Bat calls are distinguished by down-sweeping tails, while the Southern Forest Bat has curved pulses, regular pulse shape, and generally has up-sweeping tails. When no distinguishing characteristics were present calls were assigned to multi-species groups.

The calls of Southern Myotis are very similar to the two species of Long-eared Bat that are known to or are predicted to occur within the study area. Consequently, it is often difficult to separate these species on characteristics of the recorded call data alone. Calls can be attributed to a Long-eared Bat when the time between calls (TBC) is higher than 95 milliseconds (ms) and the initial slope S1 is lower than 300 octaves per second (OPS). Calls can be attributed to Southern Myotis when the time between calls (TBC) is lower than 75ms, and the initial slope (S1) is greater than 400 (OPS). When the TBC is between 75 and 95ms and the initial slope (S1) is between 300 and 400 OPS calls are assigned a mixed-species label of Southern Myotis / Long-eared Bats (Pennay et al. 2004).

Furthermore, calls produced by different bat species differ in fundamental ways related to the foraging mode/activity of each species. Calls of different species and the different types of calls produced by each species (cruise, search, social, approach, attack) are not equally recorded by ultrasonic detectors. Weather and climatic conditions affect the quality and quantity of recorded data as well as the availability of insect prey and therefore the suitability of each site at a given time as a foraging habitat.

For example, in this survey 126 difficult to interpret call profiles were recorded SYD01. These call profiles displayed a variety of pulse types (including flat, slightly curved with some almost horizontal pulse that could represent a feeding or social buzz). Further, some calls exhibited subtle changes in characteristic

frequency (Fc) over time. For example, the Fc at the beginning of some of these calls ranged between ~37 - 35 kHz, which decreased to ~30 kHz towards the end of the call. Rather than dismiss these call profiles and classify them as being of 'low' quality, these calls were given a multi-species label including Greater broad-nosed Bat and the Eastern Coastal Free-tailed Bat.

5. Overall biodiversity tables

Table 3. Microbat species diversity was recorded ultrasonically at study area

Scientific Name	Common Name	Survey site		
		SYD01	WOL02	WOL03
Austronomus australis	White-Striped Free-tailed Bat	D	D	D
Chalinolobus gouldii	Gould's Wattled Bat	D	D	D
Chalinolobus morio	Chocolate Wattled Bat	D	D	-
*Falsistrellus tasmaniensis**	Eastern False Pipistrelle	P	-	P
*Micronomus norfolkensis**	Eastern Coastal Free-tailed Bat	D	D	D
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	D	D	-
*Myotis macropus**	Southern Myotis	D	D	D
Nyctophilus geoffyori	Lesser Long-eared Bat	P	P	P
Nyctophilus gouldi	Gould's Long-eared Bat	P	P	P
Ozimops ridei	Ride's Free-tailed Bat	D	D	D
*Saccolaimus flaviventris**	Yellow-bellied Sheath-tailed Bat	P	-	-
*Scoteanax rueppellii**	Greater Broad-nosed Bat	P	-	P
Scotorepens orion	Eastern Broad-nosed Bat	P	-	P
Vespadelus pumilus	Eastern Forest Bat	P	P	-
Vespadelus regulus	Southern Forest Bat	D	-	-
*Vespadelus troughtoni**	Large Forest Bat	P	P	-
Vespadelus vulturnus	Little Forest Bat	P	P	-

D = Definitely recorded, P = Potentially recorded. *Listed as threatened under the BC Act

6. Results (diversity and activity) tables for each survey site

Table 4: Microbat species diversity and number of microbat ultrasonic calls recorded on SYD01 (Reference # 514008).

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Austronomus australis	White-Striped Free-tailed Bat	19	0	19
Austronomus australis / *Saccolaimus flaviventris**	White-Striped Free-tailed Bat / Yellow-bellied Sheath-tailed Bat	0	21	21
Chalinolobus gouldii	Gould's Wattled Bat	25	32	57
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	0	66	66
Chalinolobus morio	Chocolate Wattled Bat / Forest Bat Spp.	3	0	3
Chalinolobus morio / *Vespadelus pumilus* / *Vespadelus troughtoni** / *Vespadelus vulturnus*	Chocolate Wattled Bat / Eastern Forest Bat / Eastern Cave Bat / Little Forest Bat	0	2	2
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern broad-nosed Bat	0	4	4
*Micronomus norfolkensis**	Eastern Coastal Free-tailed Bat	76	10	86
*Micronomus norfolkensis** / *Ozimops ridei*	Eastern Coastal Free-tailed Bat / Ride's Free-tailed Bat	0	120	120
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	20	0	20
*Miniopterus orianae oceanensis** / *Vespadelus regulus*	Large Bent-winged Bat / Southern Forest Bat	0	1	1
*Myotis macropus**	Southern Myotis	1439	0	1439
*Myotis macropus** and *Nyctophilus* species, in this region *N. geoffroyi* and *N. gouldii* are likely to be present.	Southern Myotis and Large-eared Bats, in this region Gould's Long-eared Bat and Lesser Long-eared Bat are likely to be present.	0	3929	3929

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Ozimops ridei	Ride's Free-tailed Bat	35	6	41
Vespadelus regulus	Southern Forest Bat	6	1	7
Vespadelus pumilus / *Vespadelus troughtoni** / *Vespadelus vulturnus*	Chocolate Wattled Bat / Eastern Forest Bat / Eastern Cave Bat / Little Forest Bat	4	8	12
Unidentifiable				203
Useable calls				5827
Total Calls				6030
Percentage identifiable / total calls				96.63

*Identifies those species listed as threatened under the BC Act

Table 5: Microbat species diversity and number of microbat ultrasonic calls recorded on WOL2 (Reference # 514281).

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Austronomus australis	White-Striped Free-tailed Bat	1	0	1
Chalinolobus gouldii	Gould's Wattled Bat	6	6	12
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	0	26	26
Chalinolobus morio	Chocolate Wattled Bat	4	1	5
Chalinolobus morio / *Vespadelus pumilus* / *Vespadelus troughtoni** / *Vespadelus vulturnus*	Chocolate Wattled Bat / Eastern Forest Bat / Eastern Cave Bat / Little Forest Bat	0	5	5
*Micronomus norfolkensis**	Eastern Coastal Free-tailed Bat	1	0	1
*Micronomus norfolkensis** / *Ozimops ridei*	Eastern Coastal Free-tailed Bat / Ride's Free-tailed Bat	0	2	2
*Miniopterus orianae oceanensis**	Large Bent-winged Bat	6	2	8
*Myotis macropus**	Southern Myotis	4	0	4
*Myotis macropus** *and Nyctophilus* species, in this region *N. geoffroyi* and *N. gouldii* are likely to be present.	Southern Myotis and Large-eared Bats, in this region Gould's Long-eared Bat and Lesser	0	28	28

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
	Long-eared Bat are likely to be present.			
Ozimops ridei	Ride's Free-tailed Bat	7	2	9
Vespadelus pumilus / *Vespadelus troughtoni** / *Vespadelus vulturnus*	Chocolate Wattled Bat / Eastern Forest Bat / Eastern Cave Bat / Little Forest Bat	1	1	2
Unidentifiable				43
Useable calls				103
Total Calls				146
Percentage identifiable / total calls				70.55

*Identifies those species that are listed as Vulnerable under the BC Act

Table 6: Microbat species diversity and number of microbat ultrasonic calls recorded on WOL3 (Reference # 583111).

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Austronomus australis	White-Striped Free-tailed Bat	17	0	17
Chalinolobus gouldii	Gould's Wattled Bat	2	8	10
Chalinolobus gouldii / *Ozimops ridei*	Gould's Wattled Bat / Ride's Free-tailed Bat	0	44	44
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	0	24	24
*Micronomus norfolkensis**	Eastern Coastal Free-tailed Bat	12	3	15
*Micronomus norfolkensis** / *Ozimops ridei*	Eastern Coastal Free-tailed Bat / Ride's Free-tailed Bat	0	17	17
*Myotis macropus**	Southern Myotis	60	0	60
*Myotis macropus** and *Nyctophilus* species, in this region *N. geoffroyi* and *N. gouldii* are likely to be present.	Southern Myotis and Large-eared Bats, in this region Gould's Long-eared Bat and Lesser Long-eared Bat are likely to be present.	0	276	276

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Ozimops ridei	Ride's Free-tailed Bat	13	0	13
Unidentifiable				58
Useable calls				476
Total Calls				534
Percentage identifiable / total calls				89.14

*Identifies those species listed as threatened under the BC Act

7. Example Call Profiles

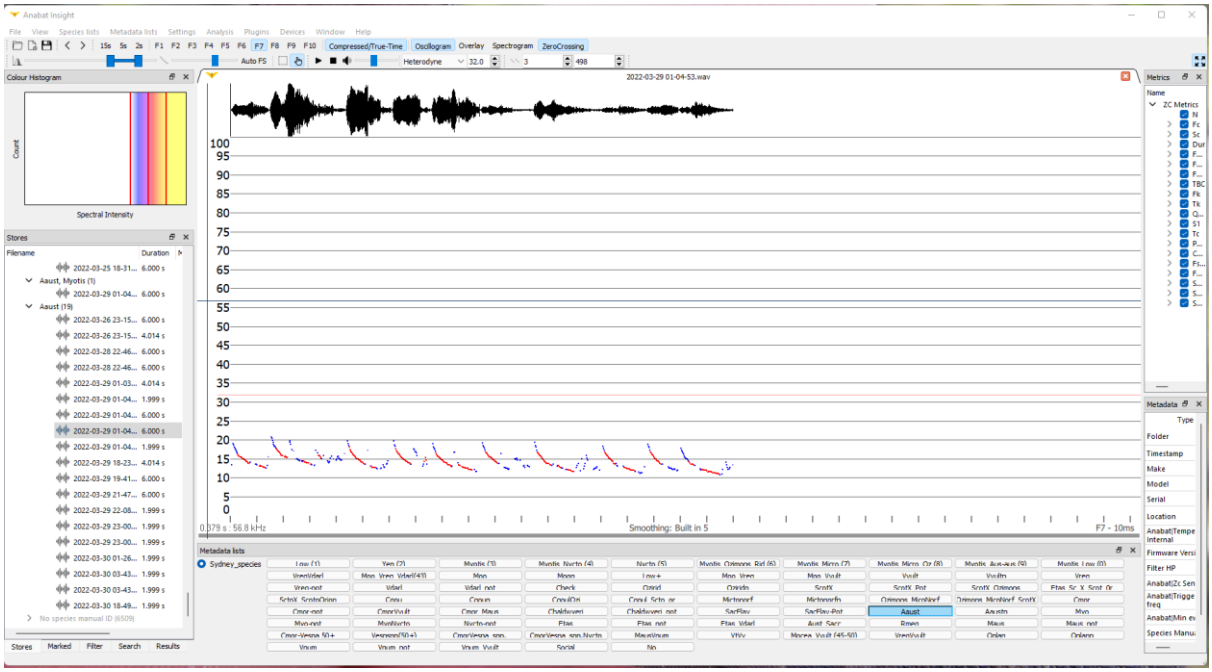

Figure 1. Call profile for *Austronomus australis* (White-striped Free-tailed Bat) that was recorded on Anabat Swift WOL03 (583111) at 0104 (1:04 a.m.) on 29 March 2022

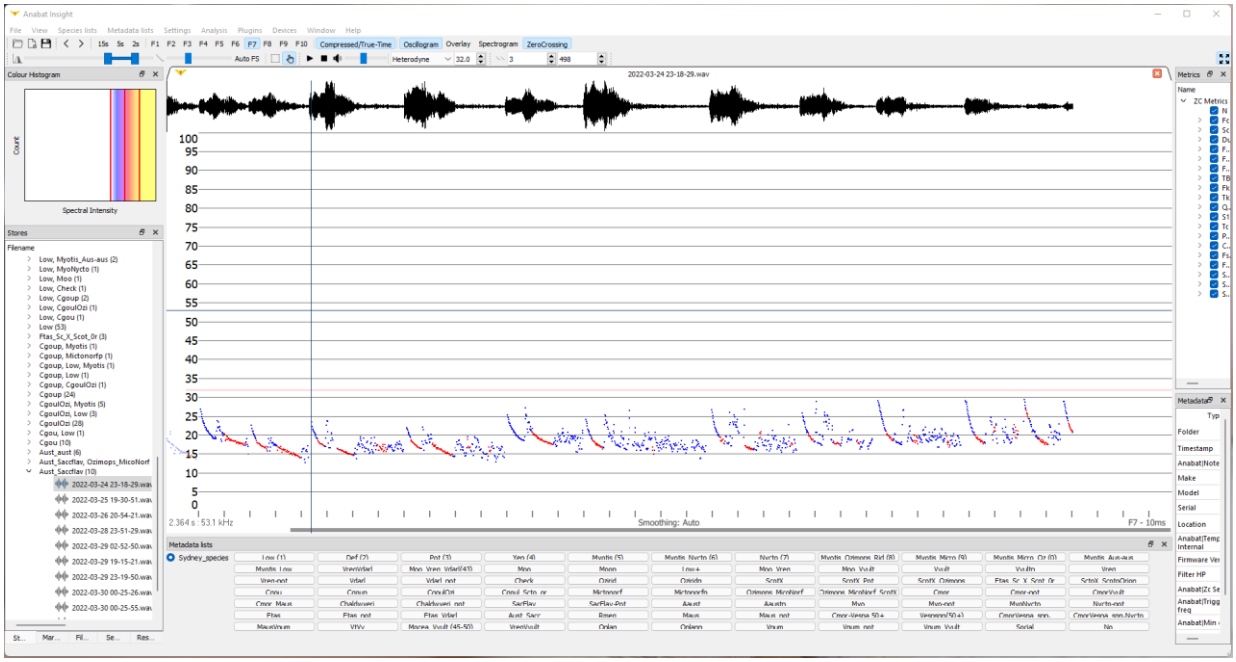

Figure 2. Potential call profile for *Austronomus australis* (White-striped Free-tailed Bat) / *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat) that was recorded on Anabat Swift SYD01 (5541008) at 1829 (6:29 p.m.) on 24 March 2022.

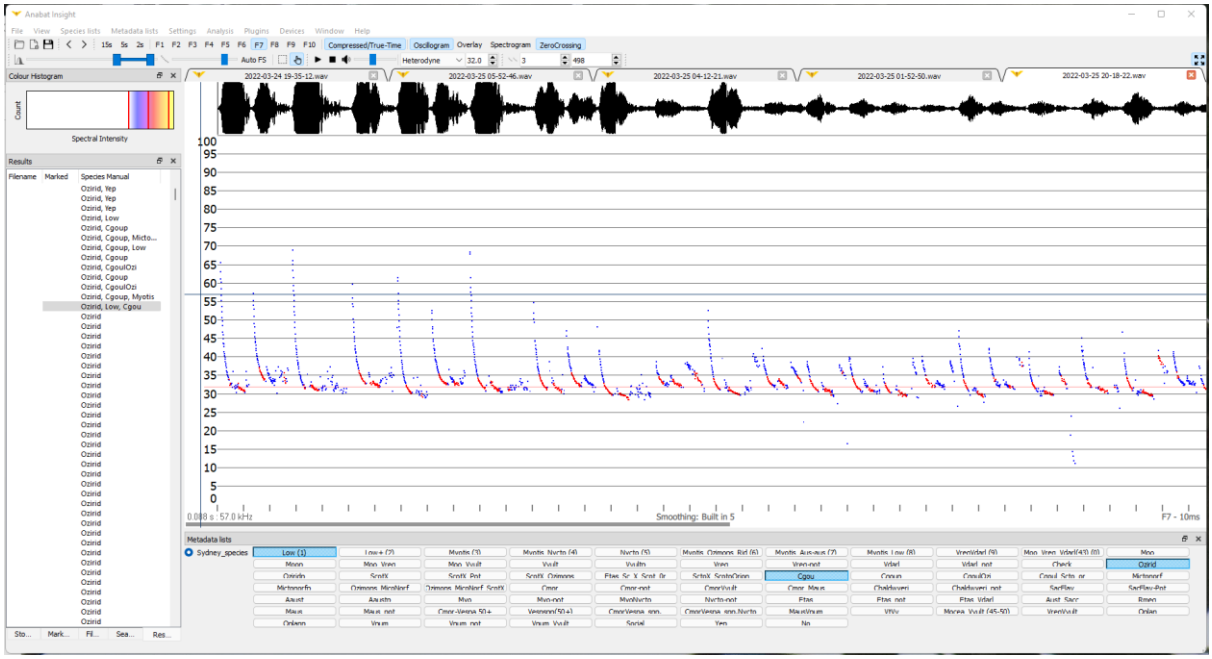

Figure 3. Call profile for *Chalinolobus gouldii* (Gould's Wattled Bat) that was recorded on SYD01 (514008) at 2018 (8.18 p.m.) on 25 March 2022.

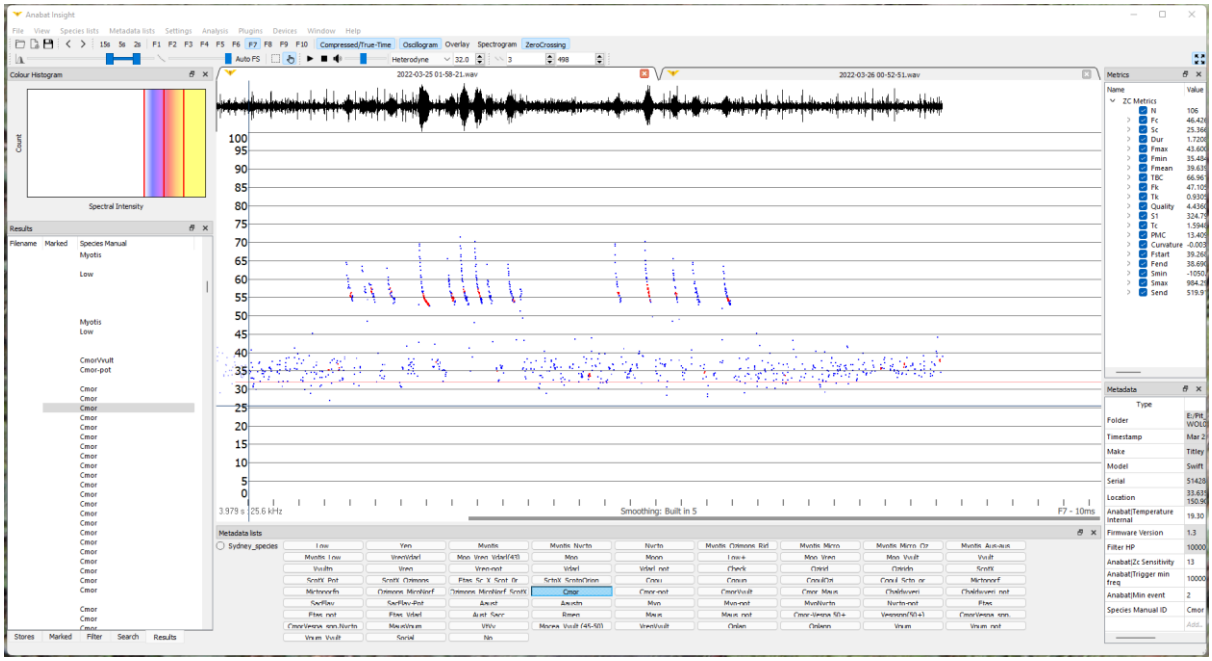

Figure 4. Potential call profile for *Chalinolobus morio* (Chocolate Wattled Bat) that was recorded on Anabat Swift SYD01 (514008) at 2018 (8.18 p.m.) 25 March 2022.

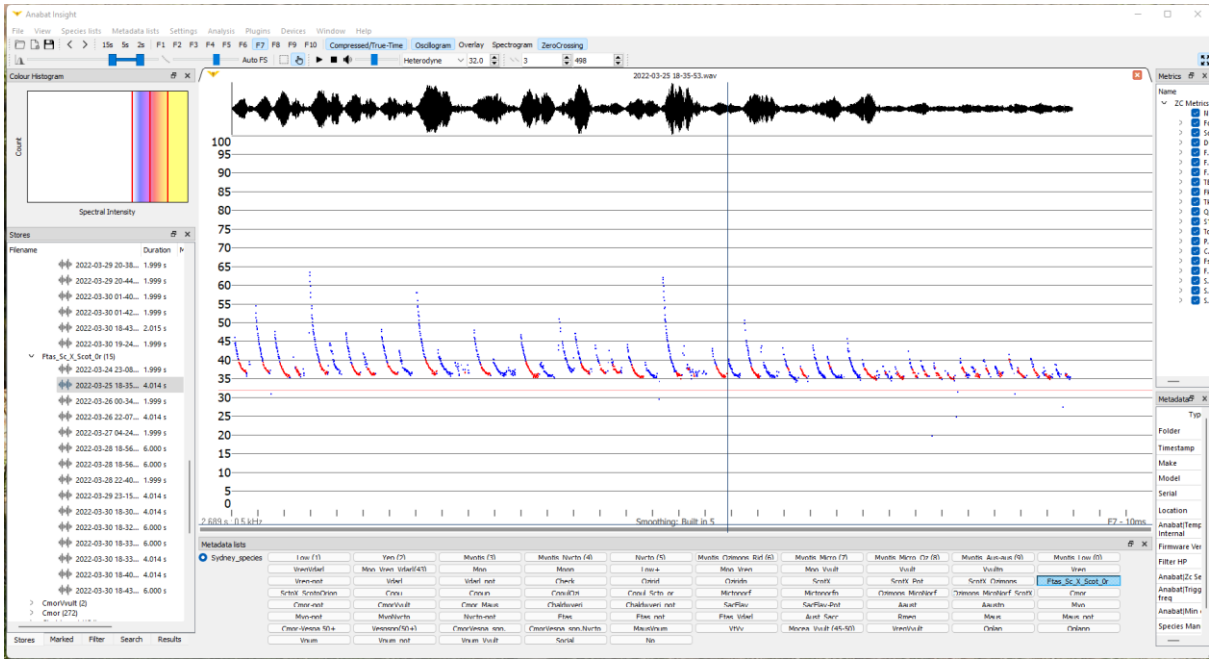

Figure 5. Potential call profile for *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) / *Scoteanax rueppellii* (Greater Broad-nosed Bat) / *Scotorepens orion* (Eastern Broad-nosed bat) that was recorded on Anabat Swift WOL03 (583111) at 1835 (6.35 p.m.) 25 March 2022.

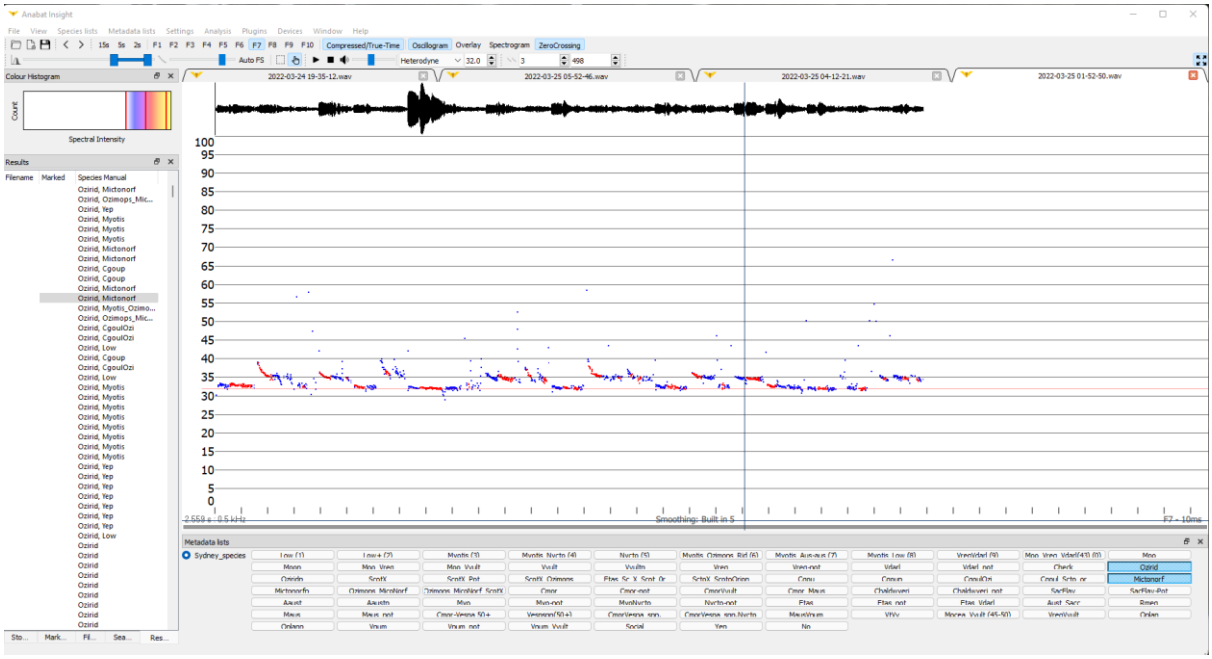

Figure 6. Call profile for *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat) that was recorded on Anabat Swift SYD01 (514008) at 0152 (1:52 a.m.) on 25 March 2022.

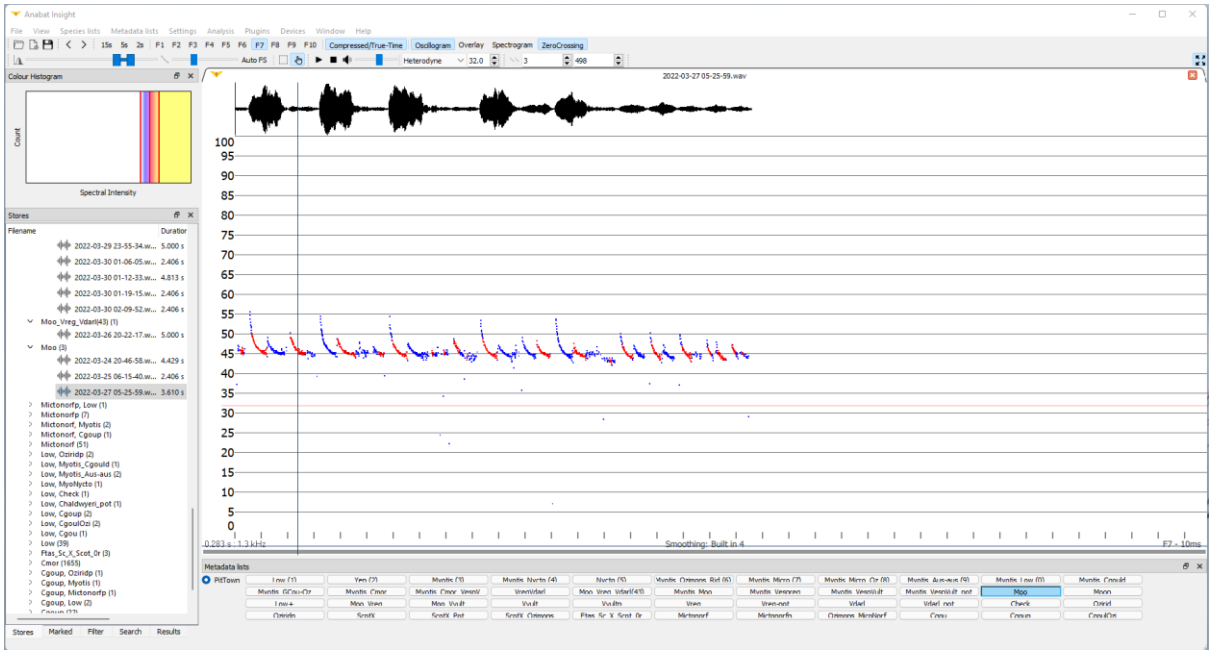

Figure 7. Call profile for *Miniopterus orianae oceanensis* (Large Bent-winged Bat) that was recorded on Anabat Swift SYD01 (514008) at 0525 (5:25 a.m.) on 27 March 2022.

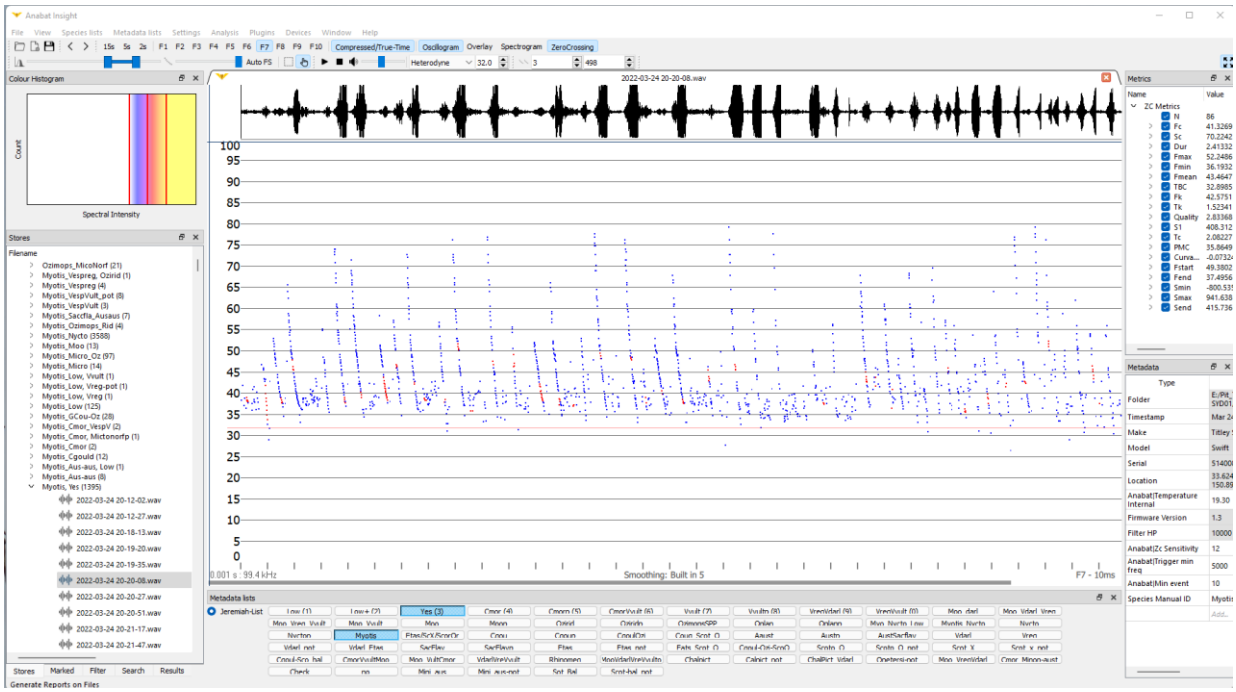

Figure 8. Potential call profile for *Myotis macropus* (Southern Myotis) that was recorded on Anabat Swift SYD01 (514008) at 2020 (8:20 a.m.) on 24 March 2022

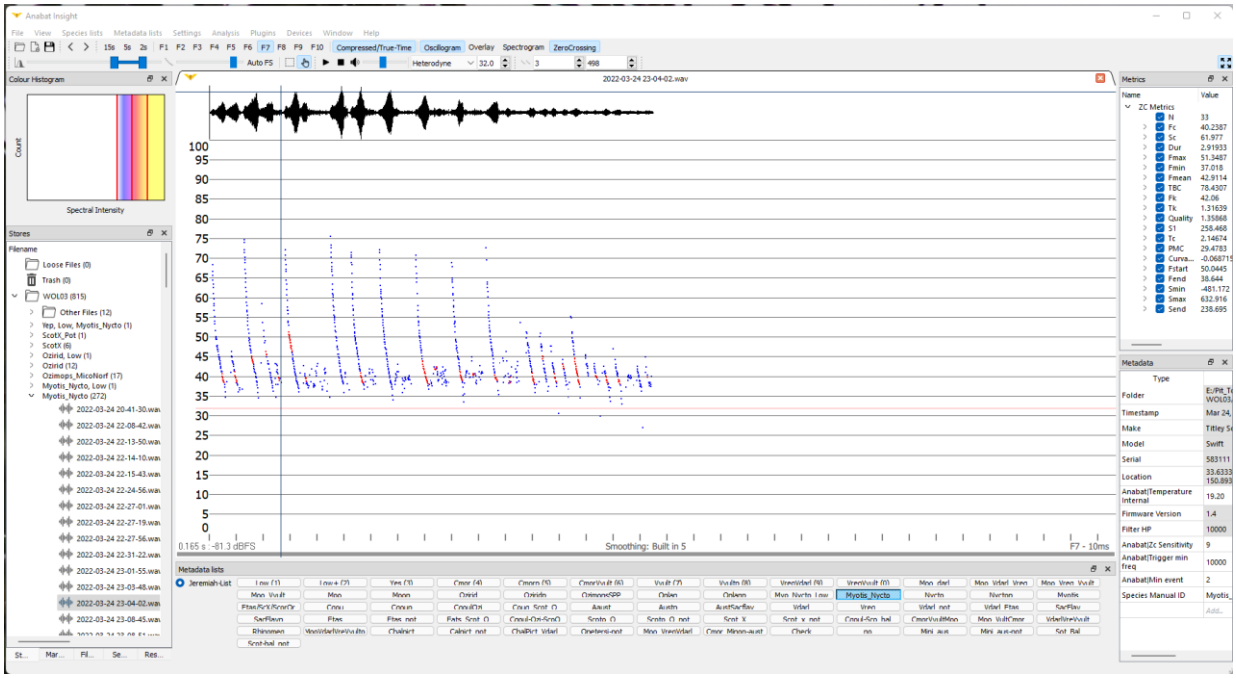

Figure 9. Potential call profile for *Myotis macropus* (Southern Myotis) / *Nyctophilus gouldi* (Gould's Long-eared Bat) / *Nyctophilus geoffroyi* Lesser Long-eared Bat) that was recorded on Anabat Swift SYD01 (514008) at 2304 (11:04 p.m.) on 24 March 2022

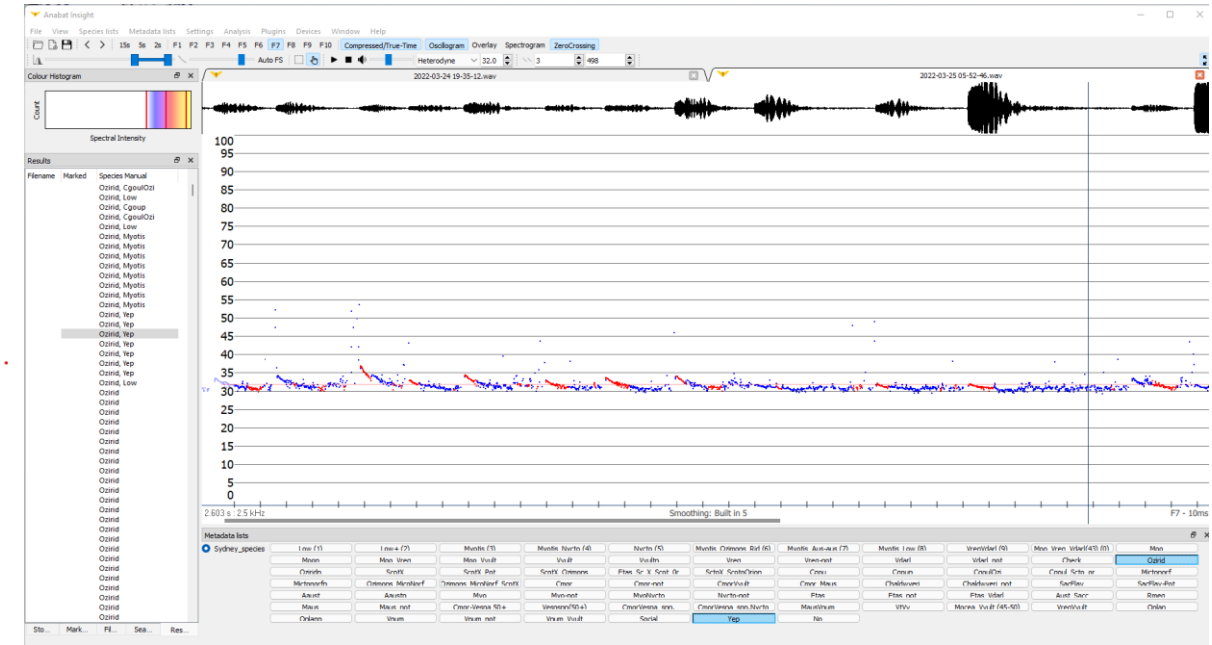

Figure 10. Call profile for *Ozimops ridei* (Ride's Free-tailed Bats) that was recorded on Anabat Swift SYD01 (514008) at 0552 (5:52 a.m.) on 25 March 2022.

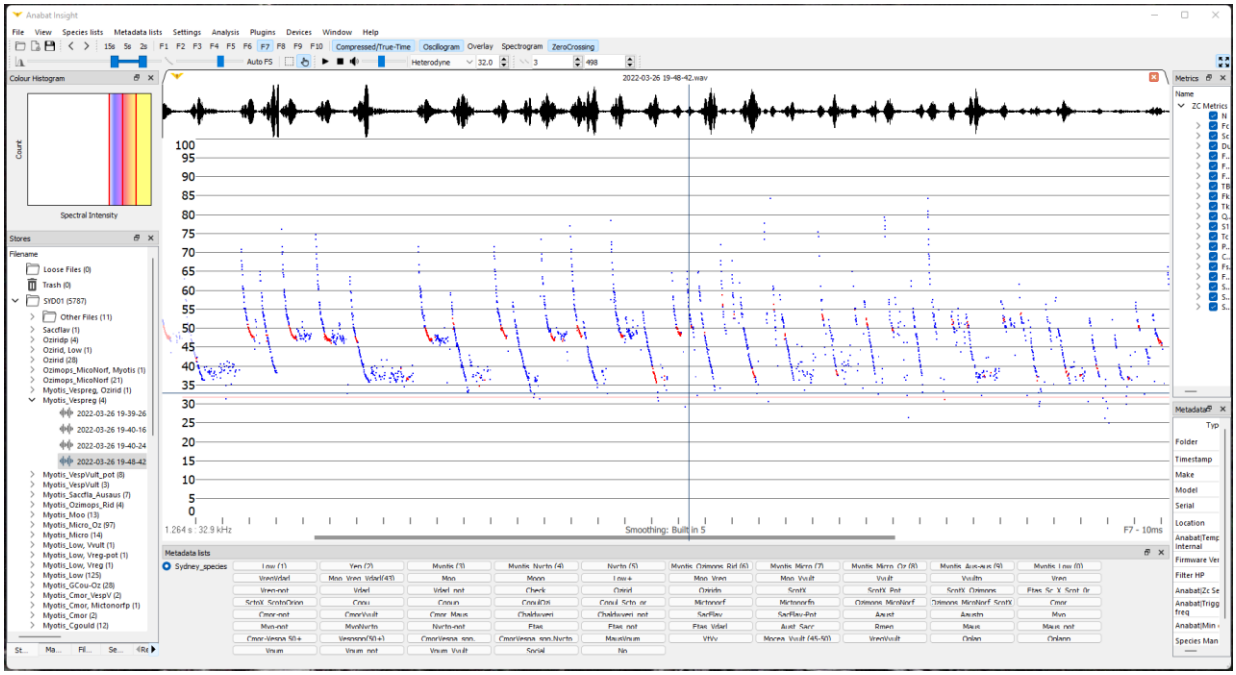

Figure 11. Call profile for *Vespadelus regulus* (Southern Forest Bat) (higher frequency call with hooked pulses at ~47 kHz) with a *Myotis macropus* (Southern Myotis) call (call with almost vertical pluses at ~40 kHz) that was recorded on Anabat Swift SYD01 (514008) at 1948 (7:48 p.m.) on 26 March 2022.

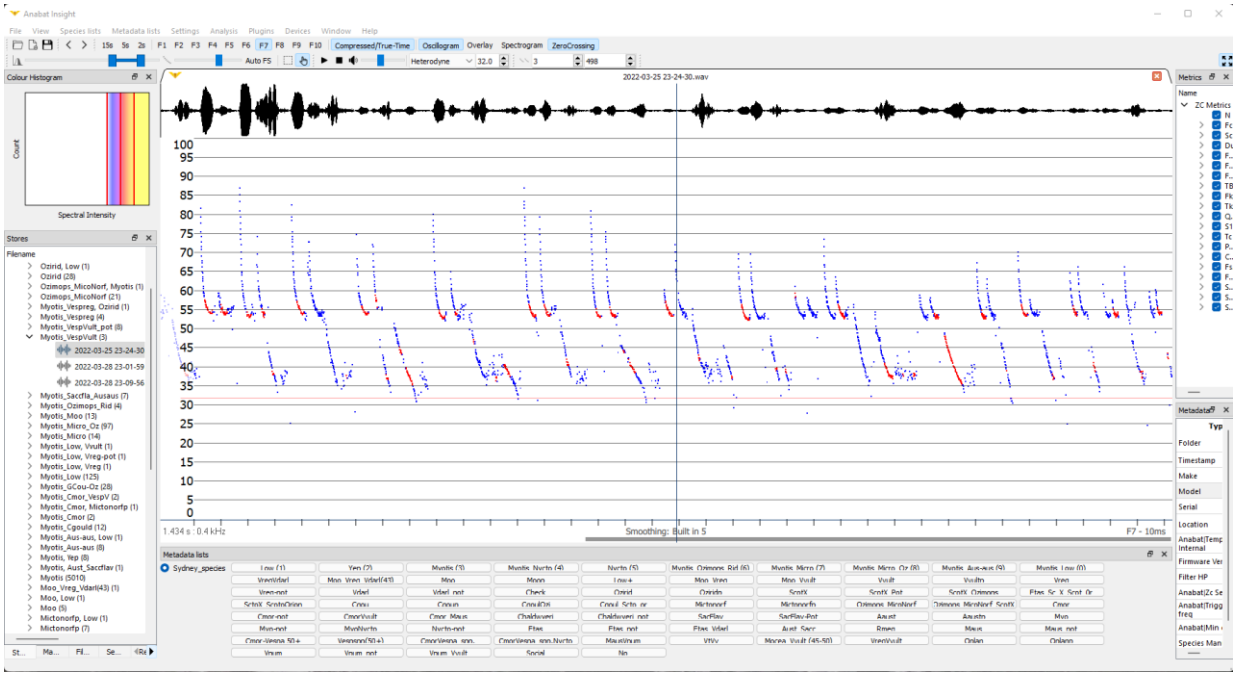

Figure 12. Call profile for *Vespadelus pumilus* (Eastern Forest Bat) / *Vespadelus troughtoni* (Eastern Cave Bat) / *Vespadelus vulturnus* (Little Forest Bat) (higher frequency call with hooked pulses at ~55 kHz) with a *Myotis macropus* (Southern Myotis) call (call with almost vertical pluses at ~40 kHz) that was recorded at 2324 (11:24 p.m.) on 25 March 2022.

8. References

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