

**Rapid Acoustic Bat Assessment:
A Driving-Amble with a Bat Detector from
Endeavour (St. Ann) - Stewart Town (Trelawny)
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1. SUMMARY

In Fincham's (1997) *Jamaica Underground*, Parnell's Mustached Bat (*Pteronotus parnellii*) is reported to roost in the Drip Cave / Belmont Cave complex located in eastern Trelawny, approximately 2.5 kilometers south of Stewart Town. Previous research has identified that this species is one of Jamaica's most forest-dependent bats owing to the characteristics of its echolocation calls, which are highly-adapted for cluttered-space forest, and its associated preferred prey (see Emerich *et al.* 2013). Anecdotal observations of coordinated flight-lines to feeding areas confirm this species' avoidance of gaps in the forest canopy and open spaces over e.g., pastures (S. Koenig, unpubl. data). Although historically considered widespread across the insular Caribbean and continental mainland, recent molecular analyses reveal that this species should be recognized as endemic to Jamaica (Lim 2017).

Against the background of concerns expressed by community members for potential damage to caves and for deforestation which will occur under Special Mining Lease (SML) 173, as well as an anecdotal mention of a cave being exposed under SML-172 mining activities, I took advantage of a trip to St. Ann and undertook a 90-minute, slow-driving-amble along the unpaved road connecting Endeavour, St. Ann to Stewart Town, Trelawny. I conducted the equivalent of a bird-watcher's casual hike through the area; but in this case, ultrasonic bat detectors, not binoculars, were used to detect the nighttime fauna.

Key findings include:

- *Pteronotus parnellii*'s presence was confirmed at locations of cluttered forest located within a 900-m radius of the openings of Drip / Belmont Cave;
- A second species of mustached bat, *Pteronotus macleayii*, heretofore not reported for these caves, was recorded along forested edge habitat of the road;
- A new roost location for *Pteronotus parnellii* was identified; the positional coordinates for this cave enable an update to the Jamaican Caves database. As reported by Fincham

(1997) “Marsh Hill Cave was reported by McGrath, but no details known.” “March Hill Cave” as named by current community members, is ~770 m northeast of Fincham’s coordinates. Two species – *Pteronotus parnellii* and *Artibeus jamaicensis* were acoustically confirmed as they emerged from the cave at dusk; a third species, a small nectarivore, most likely *Glossophaga soricina*, was observed at one of the cave openings but it was not acoustically recorded to confirm species identity.

- A fifth species, *Molossus molossus*, was acoustically detected flying and hunting in the open air-space over the community and agricultural pastures. It was not detected at the March Hill Cave dusk emergence and, instead, likely roosts in buildings, incl. churches, in the area. Similar to the situation with *Pteronotus parnellii*, Lim and Arcila Hernandez (2016) suggest that a taxonomic revision is warranted, with *M. molossus* being recognized as a distinct, Jamaica-endemic species *Molossus milleri* Johnson 1952.
- Supplemental notes on the presence of the Jamaican Rock Frog (*Eleutherodactylus cundalli*) at the openings of March Hill Cave, audible choruses of bromeliad-dependent Laughing Frogs (*Osteopilus ocellatus* [formerly *brunneus*]) and the presence of bioluminescent click beetles and fireflies assist in documenting bio-indicators of the health of the forest in the landscape.

The results of this extremely rapid assessment revealed: (a) the continued usage of local caves for roosting bat colonies; (b) the need for maintaining the closed-canopy forest for *Pteronotus parnellii*, both for its feeding requirements and for ensuring connectivity between feeding areas and its roosting caves; and (c) the need for wider-scale surveys to identify forested flight corridors which this species will use to access feeding areas further afield, such as coastal habitats like the Coral Spring-Mountain Spring Protected Area.

The results also underscore the critical need for a rigorous assessment of how mining under SML-173 will impact, potentially irreversibly, the bat communities, their associated cave ecosystems, and the ecosystem services they provide.

2. THE SLOW-AMBLE ASSESSMENT

Date: 17 June 2019

Lunar cycle: Full moon

Weather during acoustic survey: clear sky; minimal breeze (Beaufort # 0-1).

Time in the area: 15:00 – 21:10

15:30 – 16:00: visual examination of the twilight openings of March Hill Cave; attention was giving to minimizing any disturbance within the cave.

16:00 – 18:00: recording points were identified, flagged, and photographed along the unpaved road; points were identified to ensure that major landuse categories were evaluated (e.g. community housing; pasture, forest edge with open canopy over the road; forest edge with closed-canopy over the road) (Figure 1).

18:02 – 19:30 SongMeter SM2-BAT datalogger positioned approximately 20 m from the opening of March Hill Cave; EchoMeter hand-held at one of the east-facing openings of the cave.

19:30 – 21:00 Slow-driving transect, with stops at flagged points.

Length of driving transect: ~5.5 km

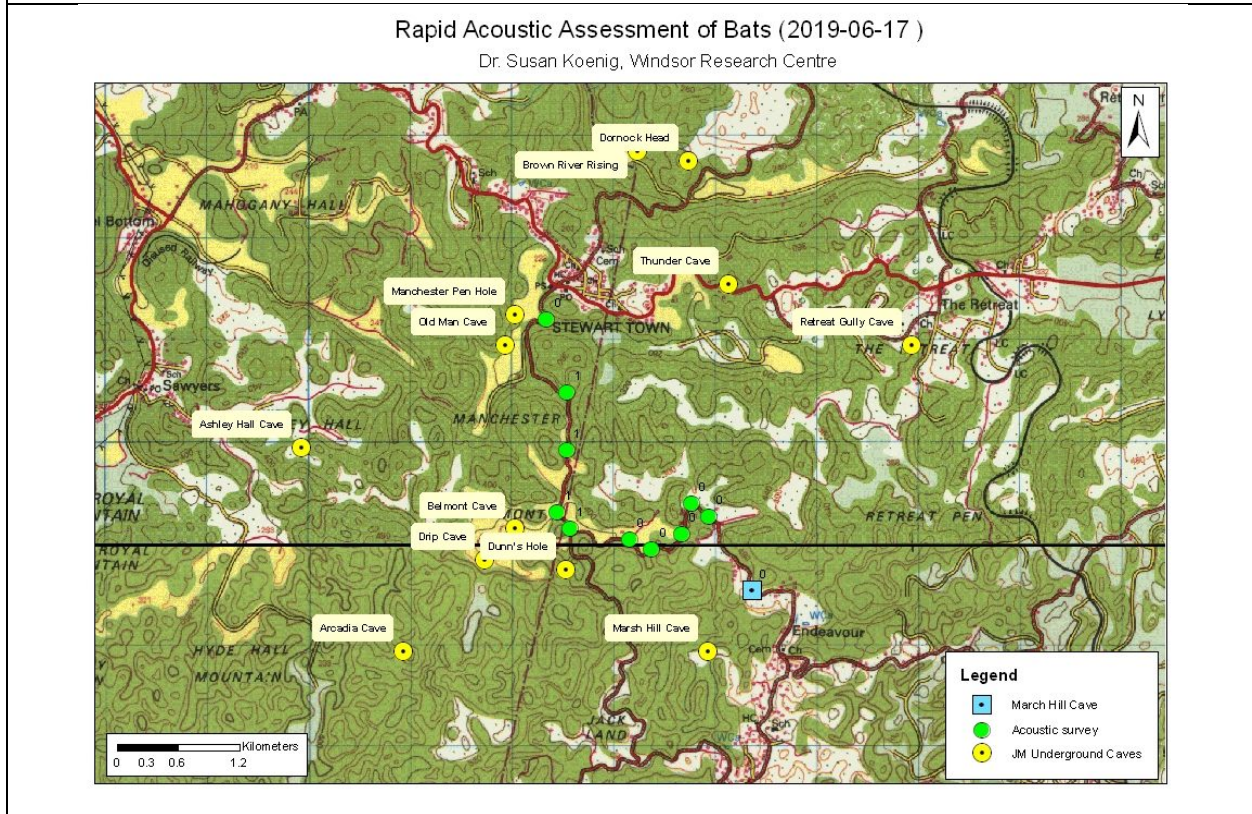
Equipment:

Ultrasonic Bat Detectors

- SM2-BAT 384 kHz Song Meter with SMX-US omni-directional microphone (Wildlife Acoustics, Inc. Massachusetts, USA) attached to 2.5 m aluminum pole and extended at a 45⁰ degree angle from the bed of a 4WD Nissan Frontier;
- Echo Meter EM3+ with built-in directional microphone (Wildlife Acoustics, Inc. Massachusetts, USA);
- Sampling rates: both detectors were programmed for 384 kHz sampling rates, for a maximum sonogram frequency of 192 kHz. Recording was broadband (full spectrum), with a lower cut-off range set for 12 kHz;
- Most-recent calibration date of microphones using Wildlife Acoustic's 40 kHz Ultrasonic Calibrator: 11th April 2018: both performed to factory specifications;
- Recording patterns:
 - a. The Song Meter was programmed to start recording 45 minutes before sunset and manually stopped at 21:15, at the end of the driving transect. The device recorded at intervals of "1-minute record" and "1-minute pause", for 50% recording of the survey; files were saved as compressed WAC0 (lossless compression format) and converted to uncompressed *.WAV files for analysis.
 - b. The Echo Meter EM3+ was used as a hand-held backup to the Song Meter. It was manually activated at the flagged survey points along the transect, allowed to record for 3-5 minutes and then turned off before driving to the next point.

Headlights were required during the driving portions of the transect; they were turned off for stationary point recording sessions. The vehicle's diesel engine, which was confirmed prior to the survey not to produce ultrasonic interference noise, was left running throughout.

Figure 1. Driving transect and waypoints along the unpaved road between Endeavour and Stewart Town. The cave reported as “Marsh Hill Cave” in *Jamaica Underground* (Fincham 1997) is approximately 770 m southwest of the cave identified as “March Hill Cave” by local community members on 17 June 2019.



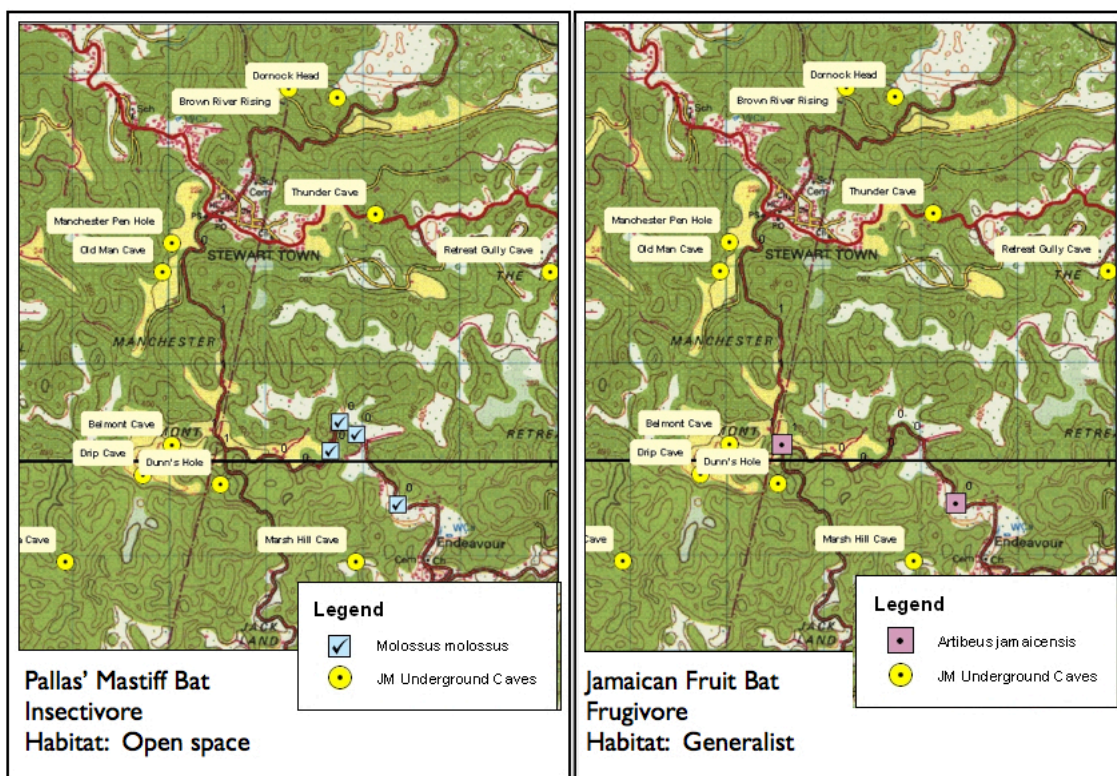
3. RESULTS

Five bat species were detected, representing 3 of the 4 foraging guilds on Jamaica and spanning the range-of-tolerance for deforestation and habitat fragmentation (Table 1; Figures 2a & 2b).

Common Name	Scientific Name	Foraging Guild	Acoustic Niche	March Hill Cave
Parnell’s Mustached Bat	<i>Pteronotus parnellii</i>	Insectivore	Highly-cluttered space	Yes
Macleay’s Mustached Bat	<i>Pteronotus macleayii</i>	Insectivore	Background cluttered	No
Jamaican Fruit Bat	<i>Artibeus jamaicensis</i>	Frugivore	Background cluttered	Yes
Pallas’ Long-tongued Bat*	<i>Glossophaga soricina</i>	Nectarivore	Background cluttered	Yes
Pallas’ Mastiff Bat	<i>Molossus molossus</i>	Insectivore	Open space	No

* A small, buffy –coloured Phyllostomidae nectarivore was seen hanging at one of the openings of March Hill Cave. I believe it was *Glossophaga soricina*, but in the absence of a photograph or acoustic recording, *Monophyllus redmani* cannot be fully discounted.

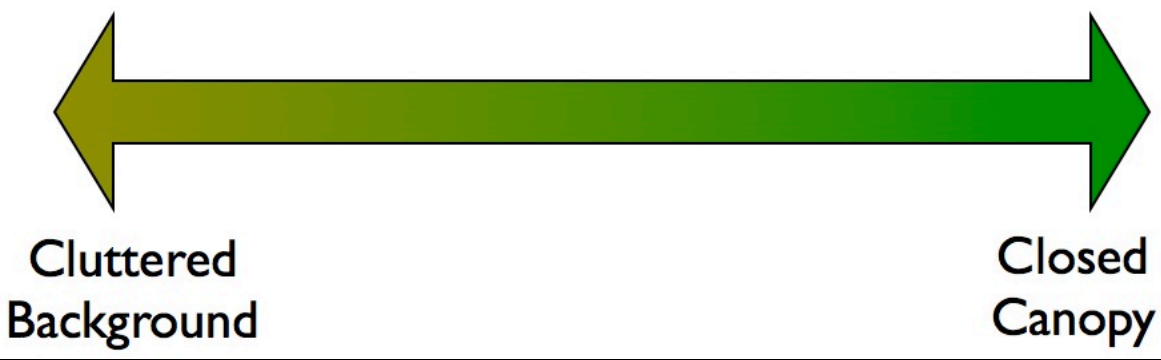
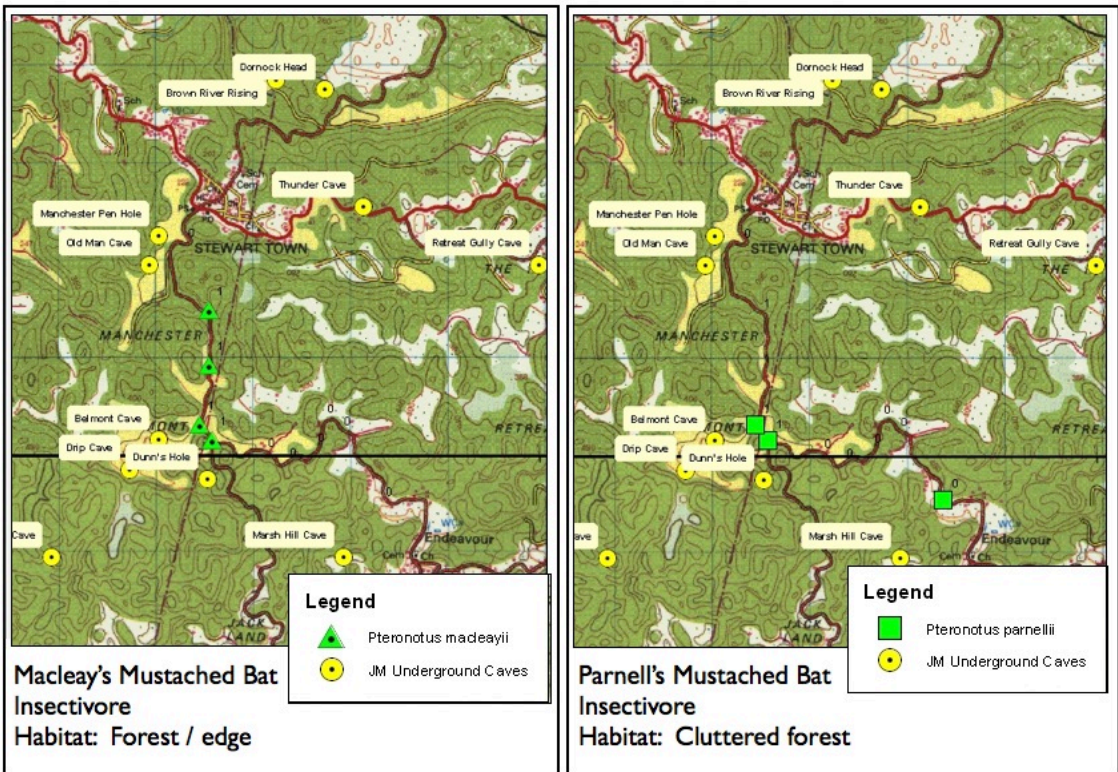
Figure 2a. Spatial detection patterns of *Molossus molossus*, an insectivore which prefers to fly and hunt in open air space, and *Artibeus jamaicensis*. The latter roosts in March Hill Cave and was detected twice along the forested unpaved road within 900m of Drip / Belmont Cave. It belongs to the family Phyllostomidae, commonly called “Whispering Bats”: acoustic detection is typically limited to within 10m of a bat detector. *Molossus molossus*, which can be detected out to at least 30m, was actively hunting during the survey, as revealed by “hunting buzzes” in sonograms.



Open Space
No Canopy

Cluttered
Background

Figure 2b. Spatial detection patterns of *Pteronotus macleayii* and *Pteronotus parnellii*. In addition to being reported as roosting in Belmont / Drip Cave by Fincham (1997), *P. parnellii* was confirmed during this survey to roost in March Hill Cave. Acoustic detection of this “cluttered space” species is less than 15-m from a bat detector. The soundscape of *Pteronotus macleayii* is identified as a “forested edge species” (Emerich *et al.* 2013): it can tolerate more forest disturbance than *P. parnellii*, but still requires a matrix of forested habitat for its prey base. Detection of *P. macleayii* is believed to be less than 10-m from a bat detector.



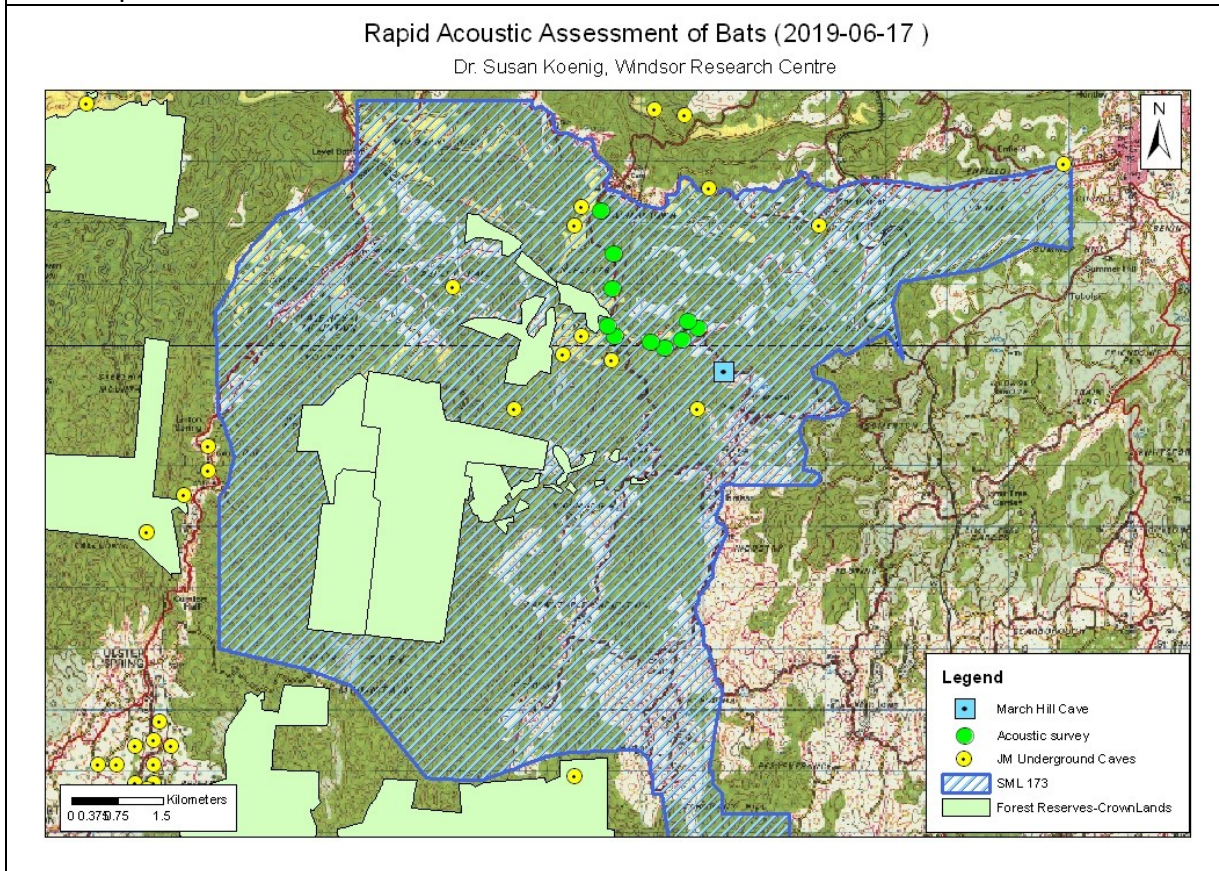
4. RECOMMENDATIONS

SML-173

Based on this “enjoyable amble along an unpaved road”, systematic and quantifiable bat surveys are needed for all caves and for the forested landscape. These are need to:

- Confirm the positions of all caves reported in *Jamaica Underground*;
- Identify new caves known by local community members;
- Identify all bat roosts and confirm species composition;
- Establish baseline bat activity indices in order to evaluate the effects of current and future human activities in the landscape;
- Ensure that connectivity between cave roosts and terrestrial forest is not compromised or destroyed;
- Ensure that forested habitats (Forest Reserves, Crown Lands, private land [Figure 3]), are managed and protected at an appropriate landscape scale for bats;
- Identify flight-line habitat corridors used by *Pteronotus parnellii* as they travel to “further afield” feeding areas across the wider landscape.

Figure 3. The spatial relationship of Forest Reserves and Crown Lands to caves in the landscape of the Endeavour-to-Stewart Town bat assessment.



5. REFERENCES

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END SUMMARY

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