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ORIGINAL ARTICLE

Second capture of *Promops centralis* (Chiroptera) in French Guiana after 28 years of mist-netting and description of its echolocation and distress calls

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ABSTRACT

The Amazonian basin harbours some of the most bat-diverse ecosystems worldwide. Yet, information on elusive, high-flying bat species such as Molossidae is scarce or virtually missing in the literature, which hampers conservation efforts both locally and globally. The recent advent of new technologies specifically designed to survey bats, such as passive ultrasound detectors and acoustic lures, has significantly increased understanding of bat ecology and distribution, and has allowed researchers to gather new and valuable information which was impossible to collect in the past. We undertook a rapid bat diversity assessment in French Guiana using acoustic lures to aid in capturing high-flying insectivorous bat species. Here we report the second and third capture record of *Promops centralis* (Chiroptera, Molossidae) for French Guiana, captured after 28 years since the first and only captures so far in the county. One individual was a post-lactating female and represents the first record of breeding *P. centralis* in French Guiana. We provide (i) morphometric and acoustic data (including the species' distress calls) as well as detail photography to aid in species identification; and (ii) COI and CytB sequences of the two individuals (first mitochondrial sequences for French Guiana).
KEYWORDS: Amazon, bats, bioacoustics, Molossidae, mitochondrial sequences

Segunda captura de *Promops centralis* (Chiroptera) en la Guayana Francesa después de 28 años de muestreos con redes y descripción de su ecolocalización y sus llamadas de alarma

RESUMEN

La cuenca amazónica alberga algunos de los ecosistemas más diversos en fauna quiropterológica del mundo. Sin embargo, en la literatura científica no encontramos información muy detallada sobre especies de murciélago esquivas como las de la família Molossidae. Esta carencia condiciona y obstaculiza los esfuerzos de conservación tanto a escala local como global. El desarrollo reciente de nuevas tecnologías diseñadas específicamente para muestrear quirópteros, como los detectores de ultrasonidos pasivos o los reclamos acústicos mediante el uso de llamadas de alta frecuencia, ha incrementado nuestro conocimiento sobre su ecología y distribución. Además, ha permitido a los investigadores obtener nuevos datos que eran prácticamente imposibles de conseguir en el pasado. Llevamos a cabo una evaluación rápida de diversidad quiropterológica en la Guayana Francesa, utilizando reclamos acústicos con el objetivo de capturar especies insectívoras de vuelo alto. En este estudio, aportamos la segunda y tercera captura de *Promops centralis* (Chiroptera, Molossidae) para Guayana Francesa después de 28 años desde sus primeras y únicas capturas hasta ahora. Uno de los indivíduos capturados fue una hembra poslactante, el primer registro de reproducción de la especie. Aportamos (i) datos morfométricos, bioacústicos (incluyendo las llamadas de alarma típicas de la especie) y fotografías de detalles para facilitar su identificación; y (ii) las secuencias de COI y CytB de los dos individuos (las primeras secuencias mitocondriales para la Guayana Francesa).
PALABRAS CLAVE: Amazonas, bioacústica, murciélagos, Molossidae, secuencias mitocondriales

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INTRODUCTION

Harbouring a rich diversity of habitats, including the tropical Amazonian forest, French Guiana represents a hotspot of bat diversity. Currently, 106 bat species from nine families are listed in this county (Catzeflis *et al.* 2013; Moratelli *et al.* 2015; Rufray 2015). The advent of new techniques for surveying bats such as the use of bioacoustics is currently pushing forward our understanding of bat ecology and distribution (Britzke *et al.* 2013; Gibb *et al.* 2019), allowing the discovery of new species and opening ecological research questions and fields that were entirely inaccessible in the past.

The most common survey technique in bat studies used in the tropics is the ground mist-netting, followed by canopy netting, and direct roost search (MacSwiney *et al.* 2008). Nevertheless, the use of acoustic studies is increasing in the Neotropics (Barataud *et al.* 2013) due to the technological advances in new affordable detectors and automatic classifiers (Hill *et al.* 2019). While mist-netting has been proved to be highly efficient for phyllostomid bats, bioacoustics seem to be more appropriate for aerial insectivorous bats such as molossids or emballonurids (MacSwiney *et al.* 2008). More recently, the development of ultrasonic acoustic lures to attract bats to the mist-nets has gained momentum amongst bat researchers and naturalists (Quackenbush *et al.* 2016; Samoray *et al.* 2019), especially for targeting elusive insectivorous species. Although their effectiveness has been proven in different contexts and for several species (Hill and Greenaway 2005; Lintott *et al.* 2013; Quackenbush et al. 2016), acoustic lures have been rarely used in the tropics (Chaverri *et al.* 2018).

Amongst all bat families that occur in the Neotropics, Molossidae is one of the least known, probably due to the difficulty of capturing molossids using traditional sampling methods (Kalko *et al.* 2008). These species roost in relatively inaccessible crevices or cavities and forage at high altitudes above forest canopies, in open areas and over aquatic habitats, where mist-netting is either impossible or inefficient (López-Baucells *et al.* 2018; Torrent *et al.* 2018). As a result, natural history data for these species are generally scarce or virtually missing in the literature. Among molossids, the big crested mastiff bat, *Promops centralis* is one of the most elusive and less studied species (Hintze *et al.* 2019). As many other molossids, *P. centralis* seems to be a habitat-opportunist, having been reported in a wide range of environments such as forests, wetlands, deserts, and urban areas (Gregorin and Taddei 2000; Lim and Engstrom 2001; Jung and Kalko 2010, 2011; Fischer *et al.* 2015; González-Terrazas *et al.* 2016; Hintze *et al.* 2019). In terms of echolocation, *P. centralis* is easily recognizable, with alternate concave-convex pairs of pulses produced at ~30 and ~35 kHz, respectively (López-Baucells *et al.* 2016; Arias-Aguilar *et al.* 2018).

We undertook a rapid bat diversity assessment in French Guiana using mist nets and acoustic lures, with the main aim of improving the natural history understanding of molossid bats. Here we report the second and third capture records of *P. centralis* for French Guiana, captured after 28 years since the first and only captures in the county so far by Simmons and Voss (1998). We present data on the morphology, echolocation (including distress calls), and mitochondrial cytochrome oxidase I (COI) and cytochrome b (CytB) gene sequences of *P. centralis* from French Guiana.

MATERIAL AND METHODS

Sampling design

We performed a total of 14 consecutive nights of bat trapping with mist nets between the 8 and 21 November 2019 at 14 sites (Figure 1; see details in the Supplementary Material, Table S1). At each site, we installed between two and five nets of 12 m length and 2.5 m height (Ecotone, Gdynia, Poland), and trapping took place from sunset for four hours. Each survey night, three mist nets were equipped with an acoustic lure (Bat Lure, Apodemus, Wageningen, The Netherlands) broadcasting social and distress calls (see Chaverri *et al.* 2018) of bats from four different families: Phyllostomidae, Vespertillionidae, Molossidae and Emballonuridae.

Morphological, acoustic and genetic analyses

Mist nets were checked every 20 min, and bats were removed from the nets as soon as possible. Species were identified using identification keys from López-Baucells *et al.* (2016) and Charles-Dominique *et al.* (2001). Information on sex, age (juvenile or adult), reproductive status (not reproductively active, reproductively active, lactating female, or pregnant female), body mass, and forearm length were taken for all captured individuals. Sex and reproductive status were assessed by inspecting genitalia, while age was determined by trans-retro-illuminating wing joints (Anthony 1988). Bat capture and handling were conducted following guidelines approved by the American Society of Mammalogists (Sikes and Gannon 2011). To confirm species identification of individuals with ambiguous morphological criteria, one to two wing punches were taken per individual and were subsequently processed and analysed to obtain mitochondrial genetic classification (hereafter referred as DNA barcoding). When the acoustic repertoire of a species was poorly described in the literature, we recorded echolocation calls while releasing individuals, either during the night if the acoustic activity of free-flying bats was very low, or at sunrise of the same night to avoid the simultaneous presence of other individuals. Different ultrasound microphones were used for the recordings: M500-384 (Pettersson, Uppsala, Sweden) and Echo Meter Touch Pro (Wildlife Acoustics, Maynard, USA). Releases were performed in open environments (forest clearings or wide roads). We also recorded distress calls when an individual was handled. Lactating females were always released at night.

Figure 1. Locations records of *Promops centralis* in French Guiana (acoustic records and capture sites, including the two new capture locations reported in here). Sampling sites where the species has not been recorded in our study are also shown. Locations of previously known acoustic records have been retrieved from Faune Guyane (www.faune-guyane.fr). Blue lines represent the main river systems. © Layers: Institut National de l'Information Géographique et Forestière 2017. This figure is in color in the electronic version.

Echolocation and distress calls of the two *P. centralis* individuals captured were analysed using Kaleidoscope (Wildlife Acoustics, USA) with a 512-Hanning FFT window. For each individual, we measured the frequency of maximum energy of ten good-quality echolocation calls. The first series of pulses recorded during the release were discarded as they were not truly representative calls. Distress calls were only recorded from the male while handled. Measurements such as call duration and frequency of maximum energy of harmonics were conducted on 19 good-quality calls.

Genetic analyses were conducted at the Department of Microbiology and Immunology at KU Leuven (Leuven, Belgium). Mitochondrial DNA from both individuals was extracted from muscular tissue (wing punches) using total nucleic acid extraction with RNAeasy mini kit (Cat No. 74104, Qiagen, USA), following specification from the manufacturer. Both COI and CytB sequences were amplified using One-Step RT-PCR kit (Cat No. 210210, Qiagen, Germany), following specifications from the manufacturer. Primers Molcit-F AATGACATGAAAAATCACCGTTGT and MVZ-16 AAATAGGAARTATCAYTCTGGTTTRAT were used to amplify CytB (Ibáñez *et al.* 2006) and UTyr 5'-ACCYCTGTCYTTAGATTTACAGTC-3' and C1L705 5'-ACTTCDGGGTGNCCRAARAATCA-3' COI (Hassanin *et al.* 2012). Thermocycling was conducted as follows: 15 min at 94°C, 30 sec at 94°C, 30 sec at 55 °C, 1 min at 72 °C and 10 min at 72°C. Molecules were amplified for 40 cycles (a cycle corresponding to a repetition of the underlined temperatures and times). Amplicons for both individuals were purified using ExoSAP-IT (Cat No. 78201.1, Thermo Fisher Scientific, USA) and sequenced by Sanger sequencing (Macrogen Europe, Meibergdreef, Amsterdam-Zuidoost). Chromatograms were assembled with UGENE v1.31.0 and manually corrected. Sequences are deposited in GenBank as follows: MT350796 and MT350797 for the female individual and MT350798 and MT350799 for the male indiviudal (CytB and COI, respectivley).

RESULTS

We captured 450 individuals belonging to 40 bat species (overall results of the survey are available in www.faune-guyane.fr), including two individuals of *Promops centralis*. The identification was primarily based on morphological features, and was subsequently confirmed with acoustic and genetic analyses. The first individual was captured on 8 November at 18:25 in a net placed along a swimming pool located in a private garden of Remire-Montjoly (Figure 1). It was a non-reproductively active male with a forearm length of 51.8 mm, for which no other morphological features were measured. It was released at the same location. We captured the second individual on 21 November around 20:20, 131 km away from the first location, in a net placed over a shallow water body located near a secondary road westward of Iracoubo (Figure 1). This individual was captured in front of a bat lure playing distress and social calls of several molossid species, including distress calls recorded from the first *P. centralis* we captured. The individual was a post-lactating female and therefore represents the first report of breeding *P. centralis* in French Guiana (Figure 2). All the external morphological measurements have been included in Table 1.

Regarding their echolocation, both individuals presented the typical acoustic features of *P. centralis,* with alternate concave-convex pairs of modulated pulses. When hand-

Table 1. External morphological measurements of the (i) post-lactating female of *Promops centralis* captured near Iracoubo and (ii) two females captured by Simmons and Voss (1998) near Paracou, French Guiana. Values for the two females are the mean (observed range).

External morphological measurement	Present study (one female)	Simmons and Voss 1998 (two females)
Body weight (g)	21.5	22.9 (22.8-30.0)
Body length (mm)	67.2	-
Hindfoot (mm)	10.3	13.0 (13.0-13.0)
Calcar (mm)	24.9	-
Tail (mm)	58.4	56.0 (46.0-66.0)
Ear length (mm)	13	14.5 (14.0-15.0)
Tragus width (mm)	4.9	-
Tragus height (mm)	6.1	-
Forearm (mm)	51.8	52.8 (52.0-53.5)
Thumb (mm)	4.6	-
Fifth metacarpal bone (mm)	31.5	-
Fifth phalanx 1 (mm)	14.7	-
Fifth phalanx 2 (mm)	8.8	-
Fourth metacarpal bone (mm)	50.5	-
Fourth phalanx 1 (mm)	20.6	-
Fourth phalanx 2 (mm)	4.0	-
Third metacarpal bone (mm)	53.2	-
Third phalanx 1 (mm)	24.3	-
Third phalanx 2 (mm)	20.2	-
Third phalanx 3 (mm)	5.9	-
Second metacarpal bone (mm)	51.4	-

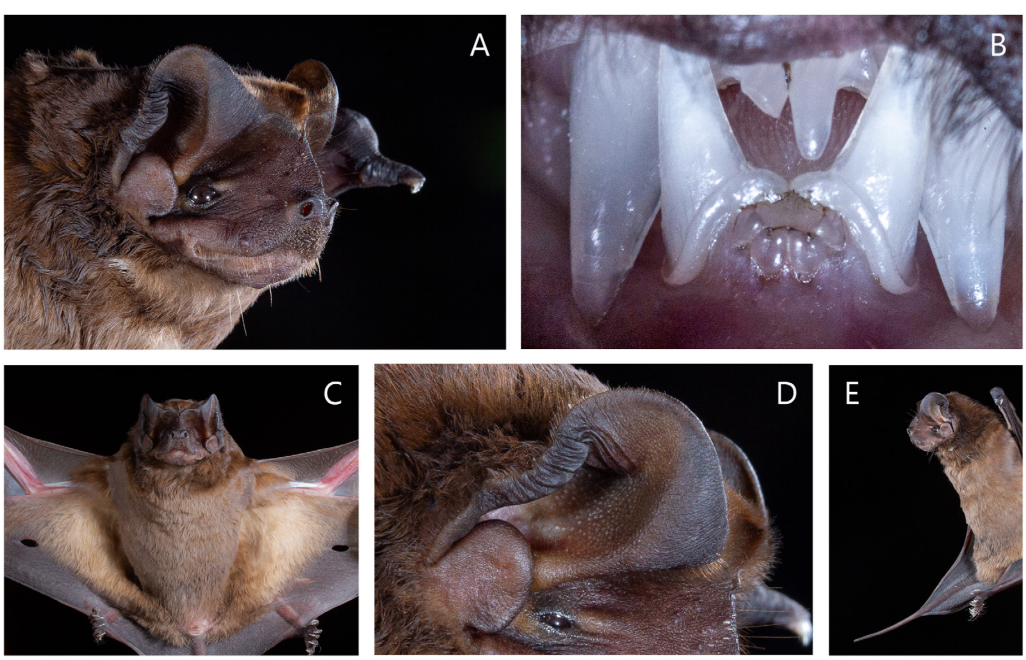

Figure 2. External diagnostic morphological traits of the female *Promops centralis*. A – strong ridge on the nose; B – 4 lower incissors; C – extended fur across the lower part of the wings; D – yellowish tone of the skin around the eyes; E – global aspect of *P. centralis.* This figure is in color in the electronic version.

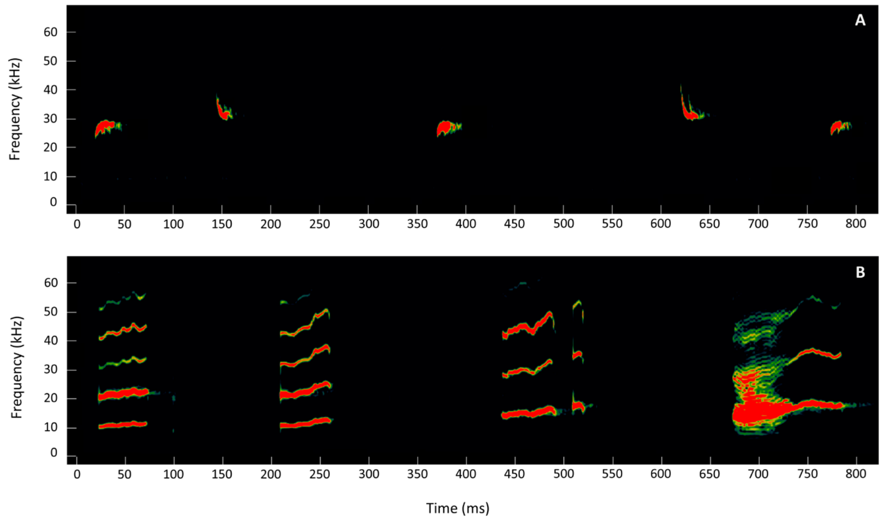

Figure 3. Sonograms of A – echolocation calls recorded when the animals were hand released; and B – most common distress calls recorded while the animal was handled. Sonograms were produced using Kaleidoscope (Wildlife Acoustics, USA) with a 512-Hanning FFT window. This figure is in color in the electronic version.

released, the male and female emitted concave calls with the frequency of maximum energy at 29.2 kHz (range: 27.8-29.8) and 27.4 kHz (26.9-27.8), respectively, and convex calls at 34.3 kHz (33.1-35.2) and 31.7 kHz (31.4-32.2), respectively (Figure 3; available at https://sonotheque.mnhn.fr/sounds/MNHN/SO/2020-192 and https://sonotheque.mnhn.fr/sounds/mnhn/so/2020-174). The most common distress calls of *P. centralis* consisted of long frequency-modulated calls (mean ± SD: 114.5 ± 52.5 ms; 19 calls), with several harmonics with mean frequency of maximum energy at 15.8 (SD 2.9), 30.7 (SD 5.5), 44.3 (SD 4.4) and 53.6 (SD 6.2) kHz (Figure 3; sample MNHN-SO-2020-193 available at https://sonotheque.mnhn.fr/sounds/MNHN/SO/2020-193). These structures are described by Nagel (2006) as tonal calls, more specifically trills (> 3 frequency modulations, with irregular patterns), and could appear noisy.

Reconstruction of both COI and CytB sequences of the two individuals from DNA barcoding yielded in two diagnostic sequences of 655 and 784 nucleotides, respectively. All four sequences were analysed with BLAST (Mega-Blast) (Camacho *et al.* 2009) using the complete NCBI nucleotide database (accessed on April 2020). All sequences were affiliated to *Promops centralis* with an average nucleotide identity > 99% (Table 2). Controversially, the COI sequence from the female individual (GenBank accession number MT350797) had *Promops davisoni* as one of its closest references (GenBank accession number MH185193.1). Detailed inspection of secondary hits of MT350797 against NCBI Blast database showed comparable identities with *Promops centralis*. However, the CytB sequence from the same individual (GenBank accession number MT350796) was classified as *Promops centralis* (closest reference as GenBank accession number MG029508.1). Based on similarity results from CytB and COI sequences, it can be assumed that both individuals belong to the *Promops centralis*, concording with our previous assessment (Table 2).

Table 2. Summary of taxonomy affiliation of both *Promops centralis* individuals captured in French Guiana, based on genetic barcoding.

Individual	Location	Gene	GenBank entry	Closest reference	Identity percentage
Male	Remire-Montjoly	COI	MT350799	JF449067.1	99.24%
		CytB	MT350798	MH058091.1	98.98%
Female	Iracoubo	COI	MT350797	MH185193.1	99.23%
		CytB	MT350796	MG029508.1	99.11%

DISCUSSION

Using an integrative approach combining morphological, acoustic and genetic data, we confirmed the presence of *Promops centralis* in French Guiana, adding the second and third capture records for this county after more than 28 years from the first captures of this species (Simmons and Voss 1998). We captured one male and one post-lactating female in two sites located 131 km apart and situated > 80 and > 45 km away, respectively, from the site where the first capture of *P. centralis* was made. Our capture records contribute to improve current knowledge of *P. centralis* distribution in French Guiana. At a larger scale, our records fall into the potential but poorly known distribution range of *P. centralis* in South America recently modelled by Hintze *et al.* (2019).

Mist-net surveys have been intensively conducted in French Guiana since the 1990s, especially by Charles-Dominique *et al.* (2001) and through numerous research projects (e.g. Thoisy *et al.* 2014; Moratelli *et al.* 2015; Catzeflis *et al.* 2016; Lavergne *et al.* 2016; Filippi-Codaccioni *et al.* 2018). Yet it was only from 2011, with the advent of bioacoustics, that *P. centralis* was registered again using bat detectors (e.g. Barataud *et al.* 2013). The 25 acoustic records so far suggest that *P. centralis* is well distributed in French Guiana (Figure 1; www.faune-guyane.fr) and present in many habitats, from tropical rainforest to marshes and lowland wetlands. Nevertheless, despite the relatively high capture effort and, more recently, the use of new capture techniques (e.g. canopy nets) the enigmatic and poorly studied *P. centralis* has remained uncaught in French Guiana for nearly three decades.

Our results are of great interest considering the rarity of the mentions of this species in French Guiana and the difficulties of capturing high-flying foragers. It is likely, albeit not evidence-based, that the second *P. centralis* was attracted to the net due to the distress calls of the first individual, that were broadcasted by the acoustic lure. We provide the first recordings of distress calls for this species and make them available on open access, so other researchers can use them in the field. Comprehensive bat call libraries are essential to improve bat sampling efficacy and will probably drive the future of both acoustic and mist-netting bat surveys worldwide (Waters and Gannon 2004; López-Baucells *et al.* 2019). Further work is needed to confirm whether distress calls of *P. centralis* indeed attract conspecifics, as observed in other species (Chaverri *et al.* 2018).

Promops centralis may be more common than previously expected in Central and South America (Hintze *et al.* 2019), and several factors can explain the lack of records in the literature. Firstly, this species is difficult to capture using ground-nets due to its foraging behaviour. Optimizing net configuration and location may, however, help in increasing the capture rate (Trevelin *et al.* 2017). In this study, the two individuals of *P. centralis* were captured in nets placed across a shallow water body in open spaces. While high-flying species are adapted to foraging above canopy levels, they descend to drink, and setting mist-nets across water bodies located in open space represents a better option than setting-up nets above the canopy. Besides, few acoustic surveys are conducted in the tropics, especially in the Amazon (MacSwiney *et al.* 2008; López-Baucells *et al.* 2016). More information about the species distribution range could easily be gained by deploying more detectors in suitable habitats. Moreover, it is likely that the species is commonly confused by bat researchers and naturalists with other widespread molossid species that present similar morphology, such as *Molossus rufus* (Simmons and Voss 1998). It is therefore of utmost importance to generate high-quality taxonomic affiliation of unique captures, as was achieved in this study.

CONCLUSIONS

Our reports of *P. centralis* constitute the most updated information for the species in French Guiana. We present morphological, acoustic, and genetic baseline information that will hopefully optimize the output of future bat research in the Neotropics – including genetic mitochondrial sequences and raw acoustic data – all of them usually scarce in the literature. The lack of genetic and acoustic references still represents an important obstacle that hinders bat research and conservation in the tropics. Further research is needed to understand the potential of acoustic lures to attract and capture elusive, high-flying bat species.

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SUPPLEMENTARY MATERIAL (only available in the electronic version)

Froidevaux *et al*. Second capture of *Promops centralis* (Chiroptera) in French Guiana after 28 years of mist-netting and description of its echolocation and distress calls

Table S1. Information on the mist net survey for a rapid bat diversity assessment conducted in French Guyana (France) in November 2019. NA = data not available.

Date	Location	Observers	Mistnet	Coordinate_X	Coordinate_Y	Habitat_ category	Habitat_details
20191108	Private Garden, Cayenne	JF/ALB/CL/CR/VR	1	-52.2782783	4.9231093	Garden	Garden; under mango tree
20191108	Private Garden, Cayenne	JF/ALB/CL/CR/VR	2	-52.2784071	4.9230387	Garden	Garden; open
20191108	Private Garden, Cayenne	JF/ALB/CL/CR/VR	3	-52.2780916	4.9228976	Garden	Garden; next to swimming pool
20191109	Water treatment plant, Cayenne	JF/ALB/CL/CR/VR	1	-52.3319610	4.9254240	Open	Swamp; open
20191109	Water treatment plant, Cayenne	JF/ALB/CL/CR/VR	2	-52.3330810	4.9261300	Forest edge	Perpendicular to mangrove edge
20191109	Water treatment plant, Cayenne	JF/ALB/CL/CR/VR	3	-52.3332470	4.9262810	Forest	In tall mangrove
20191109	Water treatment plant, Cayenne	JF/ALB/CL/CR/VR	4	-52.3334160	4.9264390	Forest	In tall mangrove
20191110	Kanawa near Carbet, Saül	JF/ALB/CL/CR	1	-53.1745750	3.6088510	Forest	In forest on path
20191110	Kanawa near Carbet, Saül	JF/ALB/CL/CR	2	-53.1742590	3.6085980	River in forest	Crossing river in forest
20191110	Kanawa near Carbet, Saül	JF/ALB/CL/CR	3	-53.1743290	3.6080530	Forest	In forest on path
20191111	Kanawa near Carbet 2, Saül	JF/ALB/CL/CR/VR	1	-53.1746890	3.6094090	River in forest	Crossing river in open
20191111	Kanawa near Carbet 2, Saül	JF/ALB/CL/CR/VR	2	-53.1750000	3.6110000	Forest	In forest on path
20191111	Kanawa near Carbet 2, Saül	JF/ALB/CL/CR/VR	3	-53.1749000	3.6092900	Garden	Garden
20191111	Kanawa near Carbet 2, Saül	JF/ALB/CL/CR/VR	4	-53.1749000	3.6092900	Garden	Garden
20191111	Kanawa near Carbet 2, Saül	JF/ALB/CL/CR/VR	5	NA	NA	Forest	4x12m in forest on path
20191112	Popotte, Saül	JF/ALB/CL/CR/VR	1	-53.1745360	3.6116950	River in open	Crossing river in open
20191112	Popotte, Saül	JF/ALB/CL/CR/VR	3	-53.1745970	3.6113800	River in open	Crossing river in open
20191112	Popotte, Saül	JF/ALB/CL/CR/VR	4	-53.1751950	3.6125180	Forest	In forest
20191112	Popotte, Saül	JF/ALB/CL/CR/VR	5	NA	NA	Forest	4x12m in forest on path
20191113	Roche Bateau, Saül	JF/ALB/CL/CR	1	-53.1848030	3.5948040	Forest	In forest on path
20191113	Roche Bateau, Saül	JF/ALB/CL/CR	2	-53.1833880	3.5941970	Forest	In forest on path
20191113	Roche Bateau, Saül	JF/ALB/CL/CR	3	-53.1841580	3.5948090	Riverbank	Riverbank; parallel to river
20191113	Roche Bateau, Saül	JF/ALB/CL/CR	4	-53.1842110	3.5948200	River in forest	Crossing river in semi-open forest
20191113	Roche Bateau, Saül	JF/ALB/CL/CR	5	-53.1841580	3.5948090	Riverbank	In forest on path; parallel to river
20191114	Angouleme, Mana	JF/ALB/CL/CR	1	-53.6563085	5.4104042	Riverbank	Riverside; parallel to river
20191114	Angouleme, Mana	JF/ALB/CL/CR	2	-53.6553510	5.4110030	Garden	Garden
20191115	Organabo	JF/ALB/CL/CR	1	-53.4680118	5.5512150	River in open	River bridge; crossing river
20191115	Organabo	JF/ALB/CL/CR	2	-53.4676906	5.5519449	Forest	In forest on path
20191115	Organabo	JF/ALB/CL/CR	3	-53.4673274	5.5534811	Forest	In forest on path

Table S1. Continued.

Date	Location	Observers	Mistnet	Coordinate_X	Coordinate_Y	Habitat_category	Habitat_details
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	1	-53.5549430	5.4071570	River in open	River bridge; crossing river
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	2	-53.5559580	5.4065390	Open	In the middle of forest clearing
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	3	-53.5546840	5.4083870	Riverbank	Riparian forest
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	4	-53.5547280	5.4079500	Forest	In forest on path
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	7	-53.5545890	5.4075440	River in open	Crossing river in open
20191116	Carbet ONF, Montagne de fer	JF/ALB/CL/CR/SU/QU	8	-53.5562840	5.4059670	Forest road	Crossing forest road
20191117	Croassroad, Montagne de fer	JF/ALB/CL/CR	1	-53.5591880	5.4008630	Forest road	Forest road
20191117	Croassroad, Montagne de fer	JF/ALB/CL/CR	2	-53.5600350	5.4006520	Forest road	Forest road
20191117	Croassroad, Montagne de fer	JF/ALB/CL/CR	3	-53.5601260	5.4002990	Forest	In forest
20191117	Croassroad, Montagne de fer	JF/ALB/CL/CR	4	-53.5598050	5.3999430	Forest road	Forest road
20191117	Croassroad, Montagne de fer	JF/ALB/CL/CR	5	-53.5614750	5.4018220	Forest road	Forest road
20191118	Angouleme River, Mana	JF/ALB/CL/CR/SU/QU	1	-53.6553816	5.4106978	Garden	Garden
20191118	Angouleme River, Mana	JF/ALB/CL/CR/SU/QU	2	-53.6562313	5.4100057	River in open	Crossing part of large river
20191118	Angouleme River, Mana	JF/ALB/CL/CR/SU/QU	3	-53.6557748	5.4098170	Garden	Garden
20191118	Angouleme River, Mana	JF/ALB/CL/CR/SU/QU	4	-53.6549111	5.4101595	River in forest	Crossing small river under tall tree
20191118	Angouleme River, Mana	JF/ALB/CL/CR/SU/QU	5	-53.6563717	5.4104462	Riverbank	Riverside; parallel to river (6x12m)
20191119	Reserve de Mana, Mana	JF/ALB/CL/CR/SU/QU	1	-53.9354050	5.7458750	Forest	In forest on path
20191119	Reserve de Mana, Mana	JF/ALB/CL/CR/SU/QU	2	-53.9350420	5.7460210	Forest	In forest on path
20191119	Reserve de Mana, Mana	JF/ALB/CL/CR/SU/QU	3	-53.9356790	5.7462540	Forest edge	Crossing large corridor parallel to coast
20191119	Reserve de Mana, Mana	JF/ALB/CL/CR/SU/QU	4	-53.9354380	5.7453360	Garden	Next to building with Molossids roost
20191120	Crique Morpio	JF/ALB/CL/CR/QU	1	-53.3041920	5.4902290	Open	In the middle of forest clearing
20191120	Crique Morpio	JF/ALB/CL/CR/QU	2	-53.3037110	5.4898580	Riverbank	Riverbank; parallel to river
20191120	Crique Morpio	JF/ALB/CL/CR/QU	3	-53.3037250	5.4902270	River in open	Crossing river in open
20191120	Crique Morpio	JF/ALB/CL/CR/QU	4	-53.3034570	5.4904250	River in open	Crossing river in open
20191121	Montagne de Kaw	JF/ALB/CL/CR/SU/QU	1	-52.2996980	4.6439390	Open	Open
20191121	Montagne de Kaw	JF/ALB/CL/CR/SU/QU	2	-52.2995390	4.6436640	Forest road	Semi-open path
20191121	Montagne de Kaw	JF/ALB/CL/CR/SU/QU	3	-52.2997970	4.6435020	Forest road	Semi-open path
20191121	Montagne de Kaw	JF/ALB/CL/CR/SU/QU	4	-52.2992010	4.6436660	River in forest	Crossing a pond