

New Locality Records and Echolocation Call Description of Pouched Bat (*Saccolaimus saccolaimus*) (Chiroptera: Emballonuridae) from the Philippines

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Echolocation call descriptions of local bat species in the Philippines have been published recently. However, collected reference call data has been biased towards species that can easily be captured using mist nets and harp traps, whereas acoustic data for rare and aerial species that are less frequently recorded by traditional means remain absent. Significant gaps still exist in our knowledge about the distribution, ecology, behavior, and population of most of these high-flying bats in the Philippines. In this study, we report new locality records and provide an echolocation call description for *Saccolaimus saccolaimus*, a locally rare bat species with only a few known records from the Philippines. Three localities surveyed represent new distributional records for this species in the Philippines: La Union and Bulacan in Luzon Island, and Davao City in Mindanao Island. Echolocation calls of this species are mainly characterized by pulses of long multi-harmonic calls, which are emitted at ca. 20 kHz, the lowest frequency recorded thus far among Philippine bats. Our data contributes to understanding this species' distribution and preference for modified habitats and residential areas, as well as to providing reference call data for future acoustic surveys and monitoring of this rare bat species.

Keywords: acoustic survey, bioacoustics, echolocating bats, emballonurids, Luzon Island

The pouched bat (*Saccolaimus saccolaimus*) is a widely distributed species occurring in South Asia, Melanesia, and Australia (IUCN 2023). While it is locally common in nearby Southeast Asian regions like Singapore, Malaysia, and Vietnam, this species is considered rare in the Philippines and has only been documented in seven localities (Figure 1) (Heaney *et al.* 2010, 2016). Very little is known about its ecology, behavior, and population status in the Philippines, owing in part to the difficulty in capturing this high-flying species through traditional mist net methods alone (Heaney *et al.* 2016).

Acoustic techniques offer a more feasible and effective means of detecting and monitoring the activity of this species, provided there is the accurate and comprehensive characterization of the species' echolocation call (Amberong *et al.* 2021).

Detailed descriptions of echolocation calls for some bat species have been published recently, with the goal of providing the first comprehensive bat call library for the Philippines (Amberong *et al.* 2021). Due to few available records, echolocation call recordings are still absent for *S. saccolaimus* in the Philippines. Here, we report new locality records for *S. saccolaimus* based on mist-net

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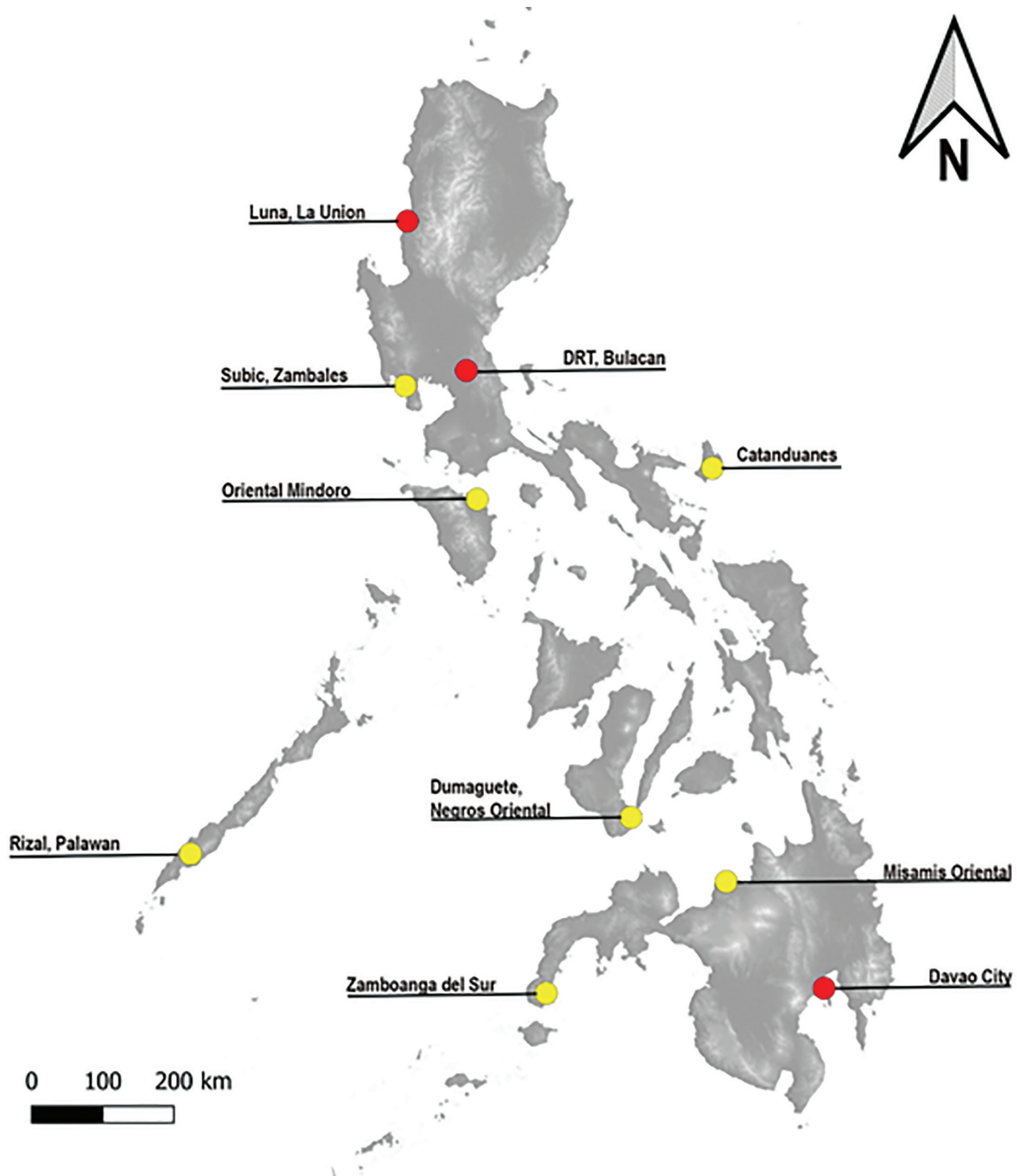


Figure 1. Distributional records of *Saccolaimus saccolaimus* in the Philippines based on published data (yellow circles) and records from this study (red circles).

captures from previous surveys in Luzon and Mindanao islands and provide the first description of its echolocation call in the Philippines.

Sampling was conducted from 2013–2017 in Luna, La Union and Doña Remedios Trinidad, Bulacan in Luzon Island and Davao City in southern Mindanao Island.

Mist nets (12 m x 2.6 m with a 36-mm mesh) set near the ground and canopy (4–10 m) were used to capture bats. Voucher specimens were collected and deposited at the University of the Philippines Diliman Institute of Biology Vertebrate Museum, Quezon City. Field sampling was covered by Wildlife Gratuitous Permit Numbers III-2013-06, RX1-2015-06, and 2016-03. Calls from *S.*



Figure 2. *Saccolaimus saccolaimus* captured from canopy nets showing diagnostic features including white spots on the dorsal pelage, pouch under the chin, and sheath tail. Upper right photo taken by C. Zafra; the rest of the photos by BRL-UPIB/ R.J. Duco and A.M. Fontanilla.

saccolaimus captures released in a 2.74 m (length) x 2.1 m (width) x 1.5 m (height) enclosure were obtained using a Pettersson Elektronik D1000x ultrasound detector and then characterized by measuring several call parameters using BatSound v. 4.2.1 (Pettersson Elektronik AB).

A total of six individuals of *S. saccolaimus* were captured during our sampling: three individuals from La Union, two from Bulacan, and one from Davao City – all of which represent new locality records for this species in the Philippines (Figure 1). Diagnostic characteristics include dark brown dorsal pelage with white flecks and a distinct chin pouch (Figure 2). All individuals were captured using canopy nets, as expected given the high-altitude flight habit of this species (Milne *et al.* 2009; Heaney *et al.* 2016). Further, all samples were captured in disturbed areas near active quarry areas, agricultural lands, and residential zones, consistent with previous records of this species being observed in perturbed environments (IUCN 2023).

S. saccolaimus calls were recorded from two individuals in Bulacan. The high-intensity calls (*i.e.* loud calls selected for call parameter measurement) were emitted at very low frequency (~ 20 kHz), the lowest emitted thus far among bat species in the Philippines. Low frequencies are typical for high-flying species that feed in open spaces to enhance detection distances while minimizing atmospheric attenuation (Rydell and Arlettaz 1994). The analyzed pulses are multi-harmonic and of long duration (28.51 ms), with most energy contained on the second and third harmonics (Figure 3). Call parameters of *S. saccolaimus* differ from the similarly-sized and co-occurring emballonurid *Taphozous melanopogon*, which has a dominant frequency of 28–30 kHz in the same area (Amberong *et al.* 2021). Frequency at maximum energy (FmaxE) from our samples (mean = 19.58 kHz) was closer to the values obtained from those in northwestern Australia (mean = 20.3 kHz) (Mckenzie and Bullen 2019) and Queensland, Australia (mean = 20.8 kHz) (Milne *et*

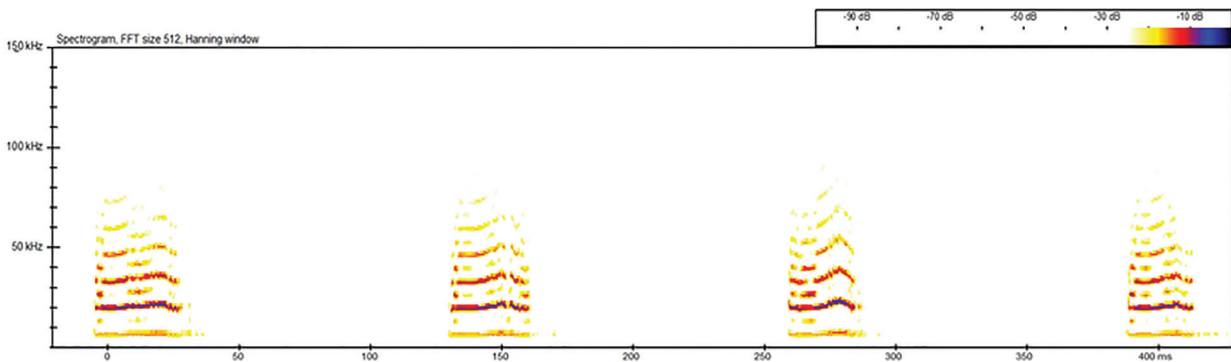


Figure 3. Spectrogram of echolocation pulses emitted by *Saccolaimus saccolaimus* inside an enclosure.

al. 2009) than in nearby regions such as Brunei (23–25 kHz) and Malaysia (23–26 kHz) (Heller 1989; Coles *et al.* 2004). As several subspecies are recognized, further genetic studies are warranted to understand their taxonomy and explain differences in their acoustic characteristics.

Given the growing significance of employing acoustic monitoring techniques to study echolocating bats in the Philippines (Amberong *et al.* 2021), this study makes a valuable addition to future studies on populations of *S. saccolaimus*, as well as to studies of other rare bat species in the Philippines.

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