

Project Update: February 2015

Expedition period

The field trip was developed from Thursday, February 12 to Sunday, February 15. This first field trip was dedicated to form alliances with the technical staff from the Park and explore the cave in which the target species (*Natalus primus*) inhabits: cave La Barca.

Developed Activities

On this field trip we were dedicated mainly to make a full recognition of the cave to set the areas in which the sound recordings will be made during the upcoming field expeditions. Cave La Barca has an approximate extension of 500 metres, including 5 main galleries and a heat trap. We are interested in the cave entrances, which are multiple in this cave, and the cave galleries inhabited by *N. primus*.

Amount of data collected

We used two types of recording devices to collect the echolocation calls from bat species inhabiting cave La Barca: Song Meters units, that will be referred as Automatic Recording Units (ARU) (Wildlife Acoustics, USA) and Avisoft USGH (Avisoft Bioacoustics, Berlin, Germany). Places inside the cave in which these recording devices were used, were marked in a plane from Cave La Barca (Fig. 1), published previously (Tejedor et al., 2005) and constituted our guide.

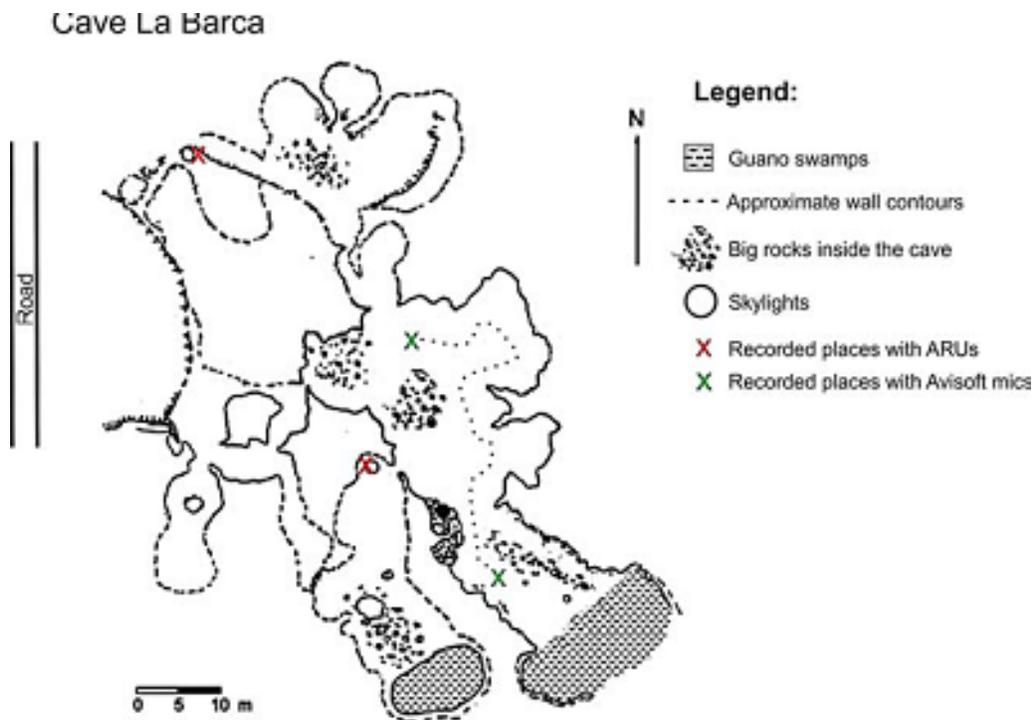


Figure 1. Map from Cave La Barca, modify from Tejedor *et al.* (2005) signalling the recorded places inside of it. Dot lines represent transect surveyed with the Avisoft recording system.

Individuals from *N. primus* were seen in the inner most galleries from cave La Barca. Five individuals from this species were collected using mist nets installed in the communication routes between the cave galleries and checked every 15 minutes. All the animals collected were flying very close to the wall, according to the position in which they fall off in the mist net.

We used a microphone array to record flight paths from the individuals collected. The microphone array consisted of four condenser ultrasound Avisoft microphones (CM16/CPMA; 10-200 kHz, ± 3 dB) arranged in t shape, with 50 cm between each microphone. This microphone array allowed to determine the bat's position per call emitted, taking into account the time of arrival differences between calls perceived by each one of the four microphones. Animals were allowed to fly in an enclosed space in one of the cave galleries not visited by bats (to avoid unwanted echolocation calls from other bats in our records). One single flight path was obtained per individual.

ARUs were put in two skylights of the cave to determine which species were using these skylights during the night exodus. ARUs were scheduled to record 1minute sound files from 6:00 pm to 6:30 am using the Song Meter Configuration Utility software (Fig. 2)

These sound recordings will allow us to build *spectrograms templates* from *N. primus* echolocation calls to recognize their individuals within the sound files recorded during the night exodus at the cave entrances. Within the aims of our project we do not pretend to collect individuals from this species, taking into account their endangered condition. This 5 individuals were collected to identify the species and have an acoustical and morphological reference from them, due to last individuals captured, according to scientific articles published, were in 1993 and those individuals were sacrificed. Data collected from these individuals were the forearm length, weight, sex and reproduction status. Forearm length and weight agreed with those published previously for the species (Tejedor, 2011; Tejedor et al., 2004).

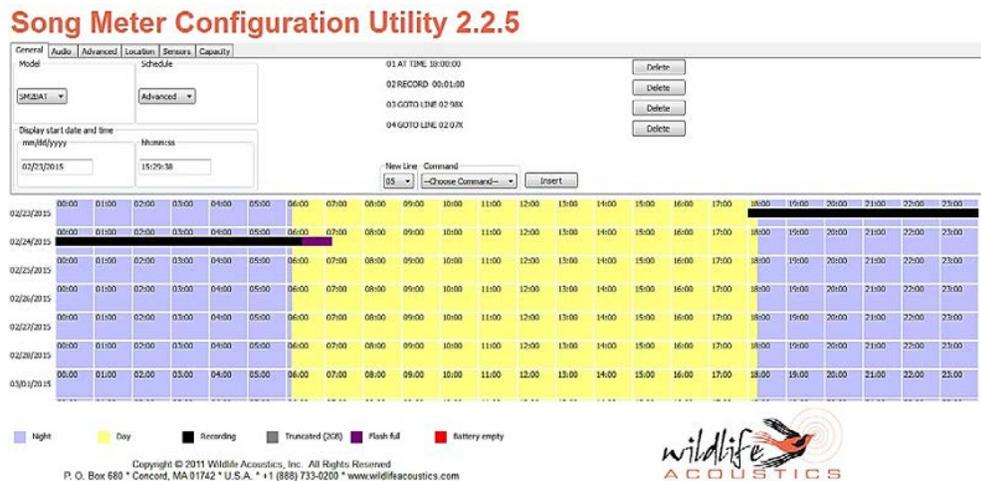


Figure 2. Schedule made for the Song Meter units used to record bat vocalizations emitted during the night exodus from two different skylights in Cave La Barca through the Song Meter Configuration Utility software.

Obtained results

From the flight paths recorded, we obtained 10 sound files from *N. primus*, extracting from these, 170 echolocation calls. Flight trajectories were obtained up to 5 meters away from the microphones (Fig. 3 A) and the channel with the highest amplitude was used as a reference to build these flight paths in every sound file. From the echolocation calls contained in every flight path we analysed some call variables (Figure 4) such as: duration (ms), peak frequency (kHz), minimum and maximum frequency (kHz), bandwidth (kHz) and number of harmonics, useful to the acoustic identification of the species. These spectra and temporal variables of echolocation calls were automatically measured using Avisoft-SASLab Pro software, from 256 Fast Fourier Transforms, with a 98.43% overlap. Signals were characterized -10 dB from the maximum amplitude peak in the power spectrum of each signal. Measurements of all parameters were in the mean spectra of each call.

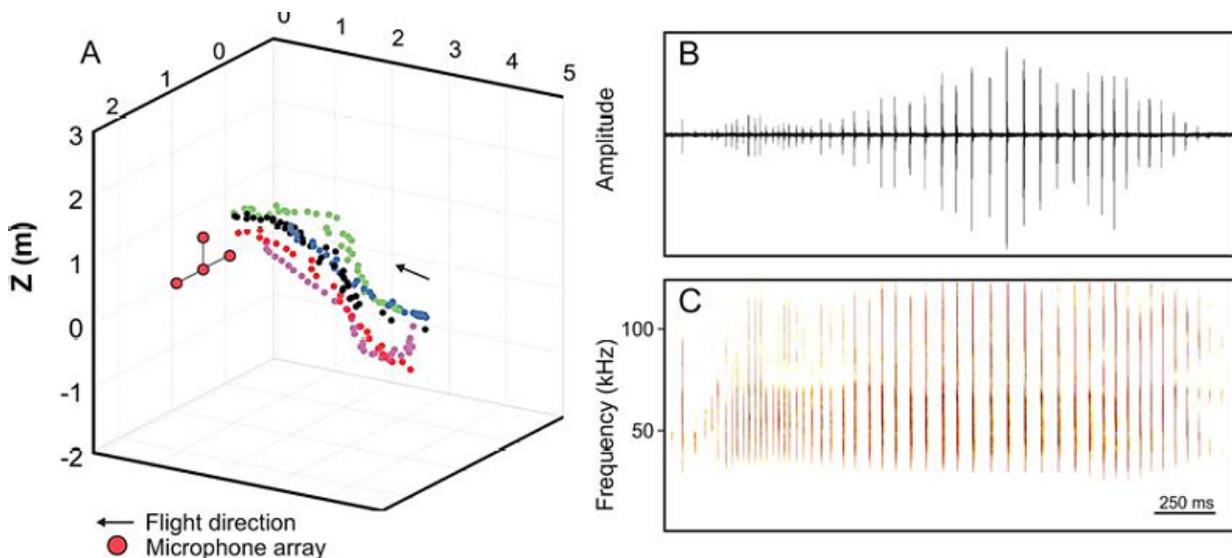


Figure 3. Flight paths from five individuals of *Natalus primus* during their approach to the array of microphones (A). Each color represents each one of the flight paths from the collected individual from *N. primus*. Waveform and spectrogram from one flight path represented

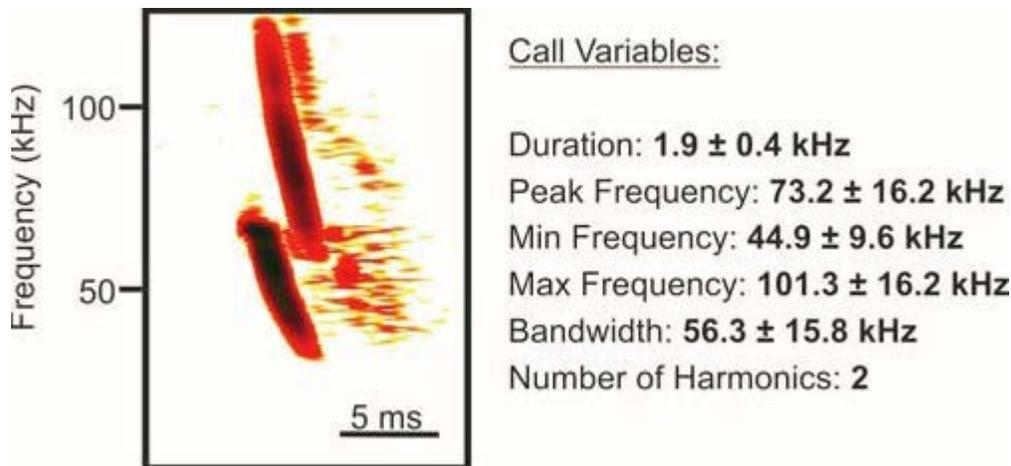


Figure 4. Spectrogram from an echolocation call from *Natalus primus* and call variables extracted from 170 calls. Mean and standard deviation are given for these variables.

More than 40 sound files from different bat species were recorded in different galleries inside the cave using Avisoft and 1524 files were obtained from ARUs located in the skylights from a single night of recording.

Educational/Scientific materials made in this period

We created a tabloid to identify bat species inhabiting cave La Barca and nearest localities (See attached) in Guanahacabibes National Park. This tabloid includes general information about bats: useful for specialized personal and people non familiar with bats. We included also the threat status of these Cuban bats, grouping them in four categories (Mancina et al., 2007) and a couple of curiosities about bats. We made also posters relating bat conservation issues and from our target species (See attached).

Next Steps

- In our next field trip, we will be giving our first talk to the technical staff from the Park, we will explain the aims of the project and how they will be essential to keep a long term monitoring on this bat species and the other bats as well.
- From the sound records obtained in this first field trip, we would be able to start run the *spectrograms templates* from *N. primus* over the more than 1574 sound files obtained from ARUs and Avisoft.
- Taking into account that the vocal repertoire of *N. primus* is not describe so far (one of outcome of the project) and we have recorded the species in one single context (flying in an enclosed space); we count with a rich repertoire from the other bat species inhabiting cave La Barca, we will create also *spectrograms templates* for these species to make a better discrimination in the sound files obtained so far.

Additional comments

We were very well welcomed by the authorities of the Guanahacabibes National Park, they are very interested on the work with bats and they recognize the importance of having cave La Barca inside of this Park, one of the most specious caves in Cuba, inhabiting 13 species of

bats! The technical staff from the Park would be very interested on have a feedback from every field trip made during this year, so they could have also the data collected from the cave and other information regarding bats from La Barca.

References:

Mancina, C. A., Echenique-Díaz, L. M., Tejedor, A., García, L., Daniel-Álvarez, Á., and Ortega-Huerta, M. A., 2007, Endemics under threat: an assessment of the conservation status of Cuban bats: *Hystrix It. J. Mamm.*, v. 18, no. 1, p. 3-15.

Tejedor, A., 2011, Systematics of funnel-eared bats (Chiroptera: Natalidae), *in* History, A. M. o. N., ed.: New York.

Tejedor, A., Silva, G., and Rodríguez-Hernández, D., 2004, Discovery of extant *Natalus major* (Chiroptera: Natalidae) in Cuba: *Mammalian Biology*, v. 69, no. 3, p. 153-162.

Tejedor, A., Tavares, V. d. C., and Rodríguez-Hernández, D., 2005, New records of hot-cave bats from Cuba and the Dominican Republic: *Boletín de Sociedad Venezolana Espeleología*, v. 39, p. 10-15.