

***ELEUTHERODACTYLUS RICHMONDI* STEJNEGER (ANURA: LEPTODACTYLIDAE): COMPARISON OF THEIR CALLS IN TWO MOUNTAIN LOCALITIES OF PUERTO RICO.**

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Introduction

Eleutherodactylus richmondi Stejneger is one of the 16 species of the genus *Eleutherodactylus* from Puerto Rico. It was originally described based on collected samples from El Yunque Sierra de Luquillo. It is also known in different mountain locations of the Cordillera Central or central mountain range, Sierra de Cayey, and Sierra de Luquillo. Its altitudinal distribution varies between 40 and 1,150 m of elevation (Fig. 1). It has not been included in the list of endangered species by the Department of Environmental Resources in spite of the numerous recommendations that point out its progressive decline in the last decades (Joglar, 1998).

The most well known populations are, undoubtedly, the ones in Sierra Luquillo. However, in the past few years, there have no sightings or acoustic activity in most of the localities of El Yunque (Joglar, 1998; L. Villanueva, personal communication). Other isolated populations in different mountain localities on the island are under constant monitoring, as is the case of the population located in the Carite State Forest and another one located in the Maricao State Forest. The purpose of this research is the characterization and comparison of the voices of individuals from two populations: El Pico El Yunque, Sierra de Luquillo, and the Carite Forest in Sierra de Cayey.

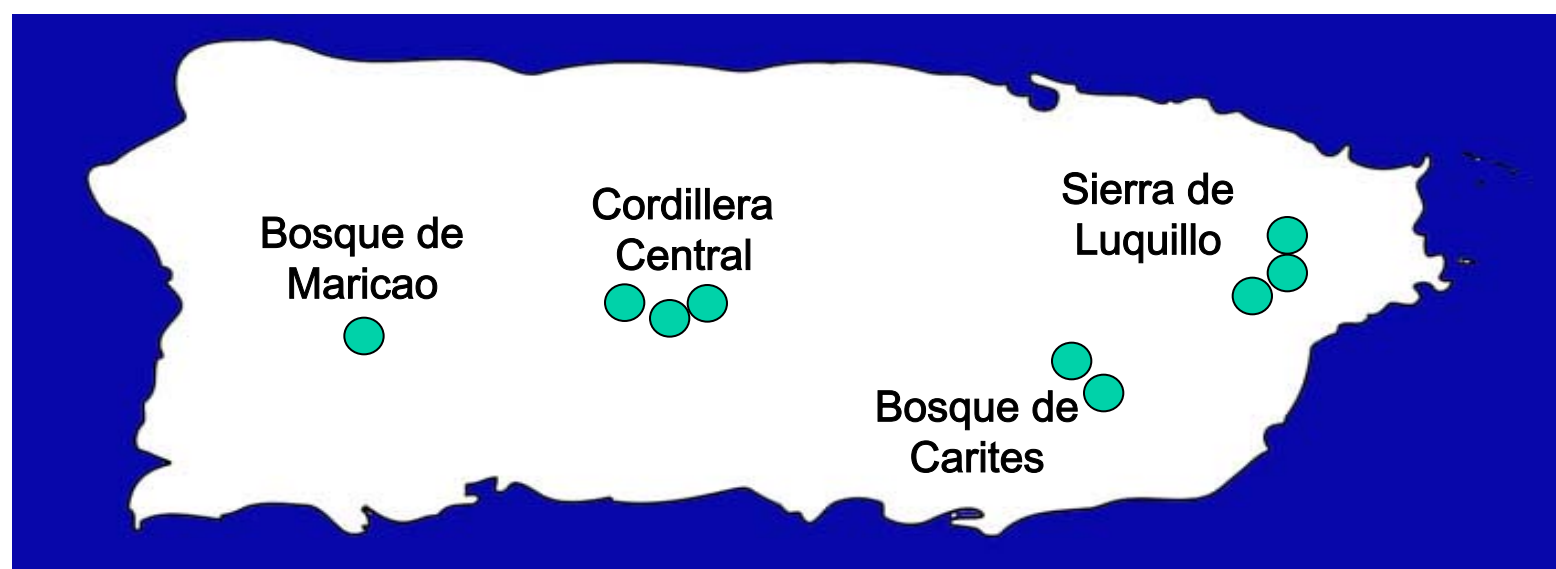


Figure 1. Geographic distribution of *Eleutherodactylus richmondi*

Materials and Methods

Recordings made at El Pico El Yunque by Dr. S. B. Hedges at 665 m of elevation in 1987 were used, as well as recordings made by us at Carite in the year 2000 at 715-720 m of elevation (Fig. 1) The recordings, in both cases, were made with a recorder model TCM 400 and omnidirectional microphones. The acoustic registers were digitalized using MacRecorder equipment and an Apple Macintosh IICI computer with the aid of the SoundEdit 2.0 program. The temporal and spectral analyses were made using the program Canary 1.2.4 (Fig. 2). At least 10 calls per individual were recorded in both localities, and there were at least recordings of 10 different individuals. The comparisons were made using a t-test with a significance level of 95%.

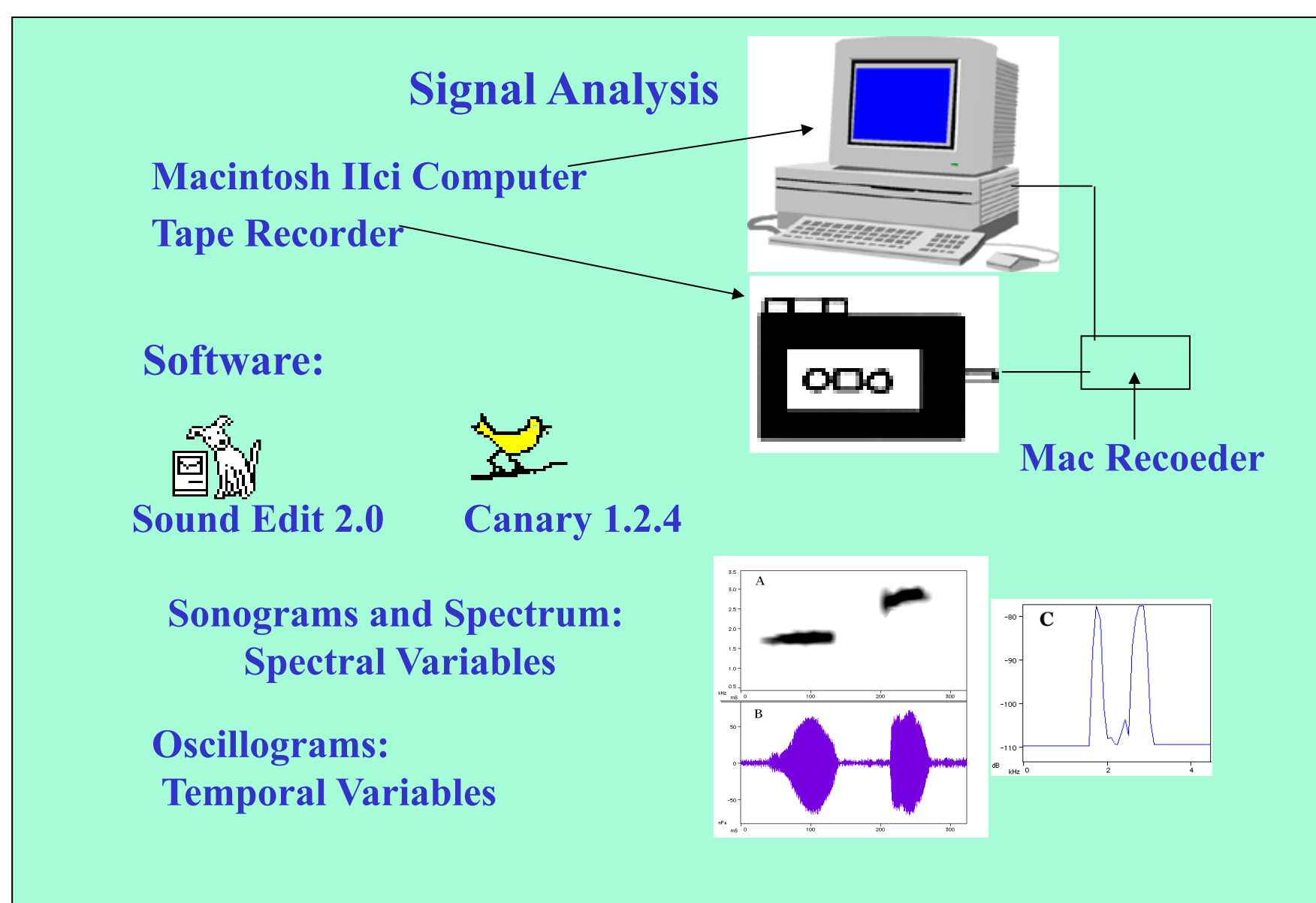


Figure2. Signal analysis

Results and Discussion

According to the literature, the voice of this species is made up of simple or double notes, and the calls have only one type of note with a duration that varies between 30 and 70 mS, with a dominant frequency of 3 to 5 kHz (Drewry and Rand, 1983). The frequency, duration of the calls and notes, and the amount of calls per minute in each locality were compared to detect differences between individuals. We did not find significant differences between individuals at the same locality. The results of the present study indicate significant differences between the temporal and spectral characteristics of the calls at the two localities studied. In the case of the recordings obtained at El Yunque, the duration of the notes and the call was greater than in Carite, and it was found that 30% of the calls at El Yunque had double notes. The average dominant frequency was greater in the calls in Carite, with a smaller number of calls per minute. The results are summarized in Table 1. Figures 3 present the oscillograms, sonograms, and spectra of two calls from an individual in each locality. Comparison of the spectral and temporal characteristics of two individuals of *E. richmondi* from El Yunque and the Carite Forest.

Table 1. Comparison of the spectral and temporal characteristics of two individuals of *E. richmondi* from El Yunque and the Carite Forest.

	Yunque	Carite	t	df	P
Average Dominant Frequency	3.7 kHz	4.8 kHz	131.1	9	P<<<0.01 ***
Note Duration	136.2 mS	12.0	2.83	9	P<<<0.01 ***
Call / Minute	13.1	9.4		9	P=0.01*
Note/Call	1 - 2	1			
Elevation	665 m	715-720 m			

The sonogram pattern is similar in both localities: pulse modulation is present as series of spaced lines more or less symmetric above and below the dominant frequency. The side bands secondary peaks of frequency appear in spectrum too.

The differences found in the voices of *E. richmondi* in these two localities could have been related to different climatic factors, the habitat, and the community of amphibians in each locality: air temperature, relative humidity, type of vegetation, and the ensemble of sympatric species of *Eleutherodactylus* that emit their calls in the same period of acoustic activity. It is also important to compare very carefully the morphological characteristics of the individuals in the different localities.



Eleutherodactylus richmondi Photo R.L.Joglar

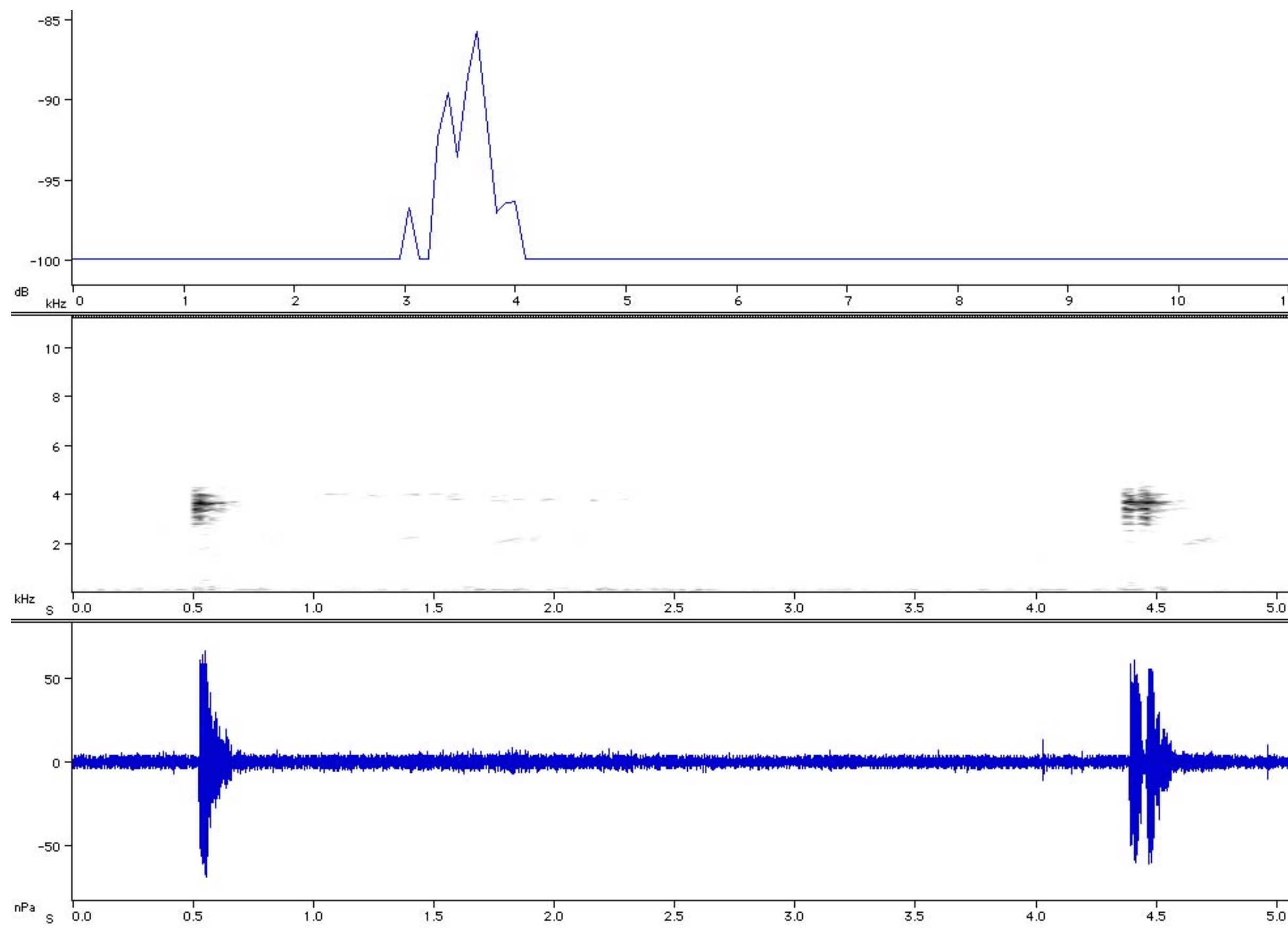
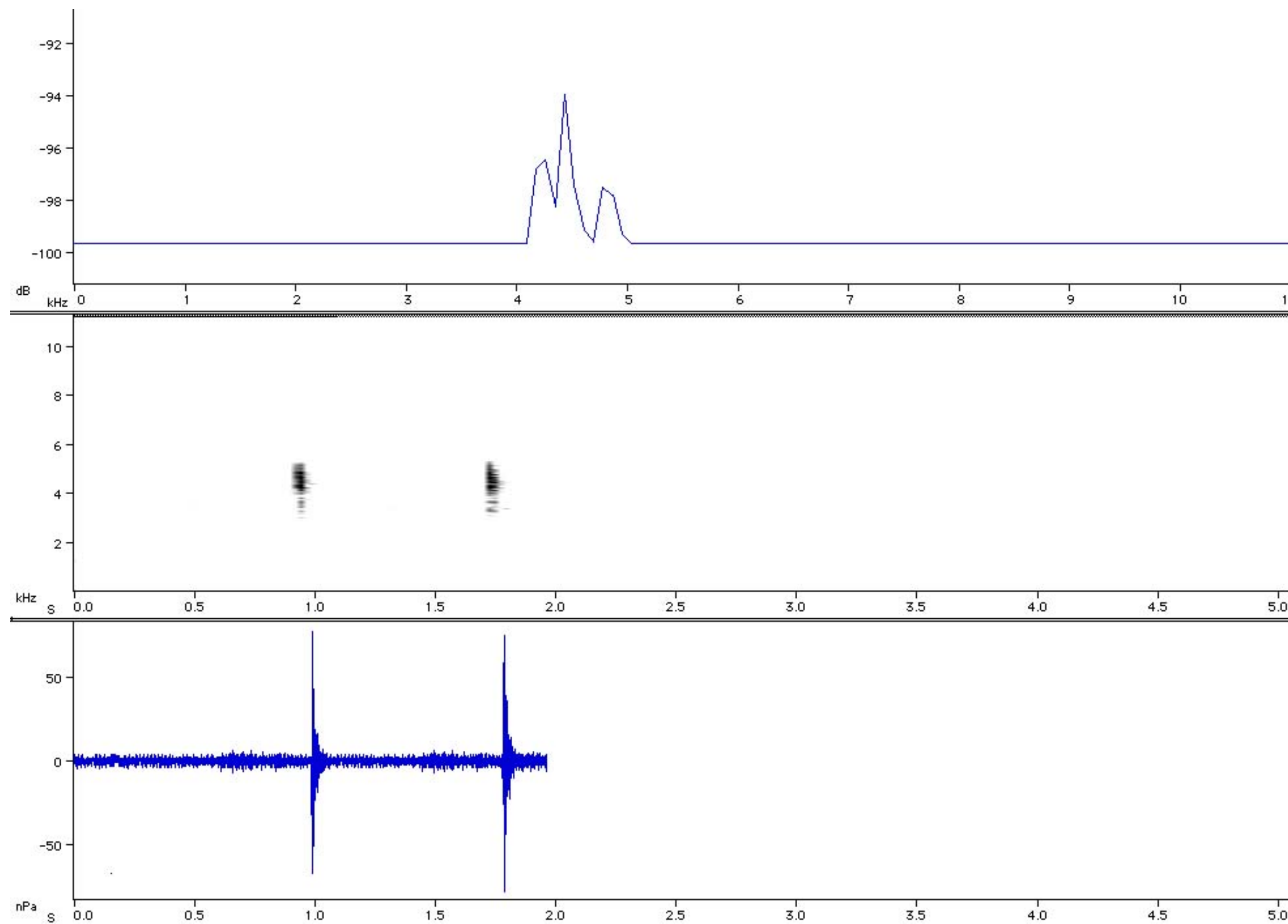
A**B**

Figure 3. Spectrum (above), sonogram (middle) and oscillograms(below) A. Tow *E.leutherodactylus richmondi*' s calls (left: one note, right: double note) from El Yunque, 665 m. B. Two *E. richmondi*' s calls from Carites State Forest Rte. 7740 km 6.9.

References

Drewry, G. E. and A. Stanley Rand. 1983. Characteristics of an Acoustic Community: Puerto Rican Frogs of the Genus *Eleutherodactylus*. *Copeia*. 4:914-953.

Joglar, R. L. 1998. Los Coquíes de Puerto Rico, su Historia Natural y Conservación. Editorial de la Universidad de Puerto Rico.232pp.

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