

## SHORT NOTE

HERPETOLOGICAL JOURNAL, Vol. 10, pp.41-44 (2000)

**ADVERTISEMENT CALLS OF *BUFO CAMERUNENSIS*, *CHIROMANTIS RUFESCENS*, *DIMORPHOGNATHUS AFRICANUS* AND *PHRYNOBATRACHUS AURITUS*, FROM EQUATORIAL GUINEA (CENTRAL AFRICA)**

RAFAEL MÁRQUEZ<sup>1,2</sup>, IGNACIO DE LA RIVA<sup>1</sup>, AND JAIME BOSCH<sup>1</sup>

<sup>1</sup> Museo Nacional de Ciencias Naturales, CSIC, José Gutiérrez Abascal 2, 28006 Madrid, Spain

<sup>2</sup> Centro de Biologia Ambiental, Faculdade de Ciências, Universidade de Lisboa, P-1700 Portugal

*Key words:* vocalisation, African frogs, behaviour

The comparison of anuran advertisement calls is a powerful tool for the anuran taxonomist and the call itself is an important characteristic, often omitted in early descriptions of the species. Considerable effort has already been devoted to the description and comparison of anuran calls around the world. In Africa, studies have been completed on northern populations (e.g. Schneider, Tunner & Hodl, 1979; Akef & Schneider, 1993), and with populations from South Africa (e.g. Passmore & Carruthers, 1995). With noted exceptions (Amiet, 1976; Schiøtz, 1999), calls of African species from tropical areas have received much less attention. In particular, the more than fifty species that compose the anuran fauna of Equatorial Guinea have only recently been studied by the scientific community (De la Riva, 1994). As it is, this fauna remains among the least known, especially when compared to those of other countries in West Africa. In this paper we contribute to the knowledge of the anuran fauna of Central Africa by providing a quantitative description of the calls of four species of anurans two of which were previously undescribed.

Recordings were obtained by the second author in 1993, in the vicinity of Moka (01°40' N, 10°17' E), Monte Alén National Park, Centro-Sur province, District of Niefang, Equatorial Guinea. Recording equipment included either a Sony WM D6C or a Sanyo M1120 tape recorder, and a Sennheiser Me 80 directional microphone. We present a characteristic audiospectrogram and oscillogram for a selected 2.5 sec. recording segment for each species. A longer recording (14-73 secs.) from a characteristic single male

of each species was analysed to generate numerical information on the spectral and temporal characteristics of the sounds.

Recordings were processed with a digital signal analysis system based on an Apple Macintosh. The sounds were digitized and edited at a sampling frequency of 44.1 kHz and at 16 bit resolution, with Sound Tools hardware and software. Signalyze software was used to obtain numerical information and to generate audiospectrograms and oscillograms. Frequency information was obtained through fast Fourier transform (FFT; width, 1024 points). The terminology used for the description of the advertisement calls follows Heyer *et al.* (1990). Unless specified, classification and nomenclature of the species follow Frost (1985).

Thirteen different call characteristics were recorded. The variables considered were: call duration, note duration, number of pulses per note, pulse rate (pulses per second), pulse duration/pulse period (T/P), fundamental frequency, dominant frequency, other frequencies with energy (in addition to dominant and fundamental frequencies), frequency range (difference between the highest and lowest frequencies with energy), and change in dominant frequency (dominant frequency at the end of the note minus dominant frequency at the beginning of the note), frequency bandwidth (highest frequency with energy in the call minus lowest frequency with energy), notes per minute (within call), and calls per minute. Collected individuals were deposited in the Centro de Estudios Tropicales, Sevilla, Spain.

The numerical parameters of the calls are shown in Table 1. In all cases, data from a single individual per species are reported.

*Bufo camerunensis* Parker. This bufonid was relatively common throughout Monte Alén. Advertisement calls were recorded on 2 September 1993. Males called at night from the ground, immediately adjacent to the shores of shallow ponds (less than 0.5 m deep) on the roadside, mixed with a large chorus of *Afrixalus paradorsalis* and *Afrixalus fulvovittatus*. Occasionally, other males could be heard throughout the year forming small choruses on the ground in forest clearings, in the absence of bodies of water. Recordings were obtained on the road between Niefang and Moka, at approximately 600 m.a.s.l. Air temperature near the recording site was 18 °C. The call is a typical *Bufo* call: a long (602-843 ms.) sequence of 25-53 pulses, with increasing pulse rate, emphasized frequencies at 854 Hz and 1658 Hz. (dominant frequency), and a wide frequency band (787-1716 Hz; Fig 1A). Pulse structure was type I after the classification of *Bufo* calls of Martin (1972). The call was repeated at relatively regular intervals (mean calling rate 38.2. calls per minute). Amiet (1976) describes the call of *B. camerunensis* from Ototomo (Cameroun). Although the audiospectrogram published is difficult to read, the only numerical information provided by Amiet (54

TABLE 1. Numerical characteristics of the advertisement calls: mean±SD, and range [in brackets].

	<i>N</i> (no tests)	Call duration (msec.)	Note duration (msec.)	Pulses/ note	Pulses/ second	T/P
<i>Bufo camerunensis</i>	13	718.6±69 [602.8-843.1]	718.6±69 [602.8-843.1]	38.5±6.6 [25-53]	53.4±5.5 [41.5-66.2]	0.008±0.002 [0.006-0.012]
<i>Chiromantis rufescens</i> isolated pulses	17	4644.5±899.9 [4008.2-5280.8]	10.1±1.8 [6.6-13.7]	8.5±3.5 6-11	- -	- -
<i>Chiromantis rufescens</i> pulse train	2	-	312.7±49.4 [277.8-347.6]	11.5±2.1 [10-13]	37±1 [36-37.4]	0.279±0.023 [0.263-0.295]
<i>Dimorphognathus africanus</i>	2	365.2±26.8 [346.2-384.1]	356.2±26.8 [346.2-384.1]	62±4.2 [59-65]	169.8±0.8 [169.2-170.4]	0.639±0.0162 [0.394-0.872]
<i>Phrynobatrachus auritus</i>	6	276.1±29.6 [245.6-322.4]	276.1±29.6 [245.6-322.4]	16.8±2.2 [15-20]	60.4±1.5 [58.3-62]	0.589±0.176 [0.4-0.774]

TABLE 1. (continued...)

	Fundamental frequency(Hz)	Dominant freq.(Hz)	Other freq.(Hz)	Change in freq.(Hz)	Frequency range(Hz)	Notes/ minute	Calls/ minute
<i>Bufo camerunensis</i>	854±24 [787-868]	1659±49 [1555-1716]	-	152±54 [61-222]	1604±241 [1191-2019]	38.2±4.7 [28.5-47.9]	38.2±4.7 [28.5-47.9]
<i>Chiromantis rufescens</i> isolated pulses	852±180 [167-1010]	852±180 [167-1010]	1777±180 1479-1979	-	545±20 [525-565]	242.8±63.4 [120.2-327.1]	6.9
<i>Chiromantis rufescens</i> pulse train	1484±14 [1474-1494]	1484±14 [1474-1494.2]	-	50±71 [0-101]	838±43 [808-868]	-	-
<i>Dimorphognathus africanus</i>	1151±57 [1111-1191]	2615±71 [2564-2665]	-	30±14 [20-40]	1918±114 [1837-1999]	3.6	3.6
<i>Phrynobatrachus auritus</i>	1622±168 [1494-1959]	1622±168 [1494-1959]	-	84±100 [-101-162]	1595±378 [1050-2100]	51.5±14.1 [32.8-71.5]	51.5±14.1 [32.8-71.5]

pulses per second) coincides with our recordings (range 41-66.2). In addition, most energy from the call of the toads from Cameroun is concentrated slightly below 2000 Hz, which is also true for our recordings. Overall, we can state that there are substantial similarities between the calls which do not suggest potential taxonomic differences.

*Chiromantis rufescens* (Günther). This racophorid frog was moderately rare in Monte Alén. Males called at night, perched on the vegetation (< 1.5 m high) in primary and secondary forests, during the rainy season (September- November). Recordings were obtained on 30 September 1993. *Afrivalus paradoxalis* and *A. fulvovittatus* could be heard simultaneously. Air temperature near the recording site was 18 °C.

The call includes two parts, a first part in which 6-11 isolated pulses are emitted at regular intervals (calling rate 120-327 calls/min), and a second part which is composed of a relatively longer pulse train (277-347

ms) of 10 to 13 pulses (Fig 1B). The isolated pulses have a low mean dominant frequency of 1484 Hz. and have an additional emphasized frequency at 1777 Hz. The frequency width (range) of the pulse is (525-565 Hz). The resulting sound is similar to a knock on wood. The second part has an emphasized frequency of about 700 Hz and a dominant frequency which increases slightly but gradually towards the end of the call (from 1474 Hz to 1494 Hz). Schiøtz (1967) described the calls of *Chiromantis rufescens* from Iperin, Nigeria. The calls are described as having two motifs. The first motif has similar temporal and spectral characteristics to the isolated pulses in our recordings. The second motif, however, has a similar overall structure to our pulse train, but the reported number of pulses (30 pulses per call in Schiøtz 1967) was substantially higher than ours, and the pulse repetition rate (45 pulses per second, in Schiøtz, 1967) was also higher than in our recordings. Given the overall similarity of the calls,

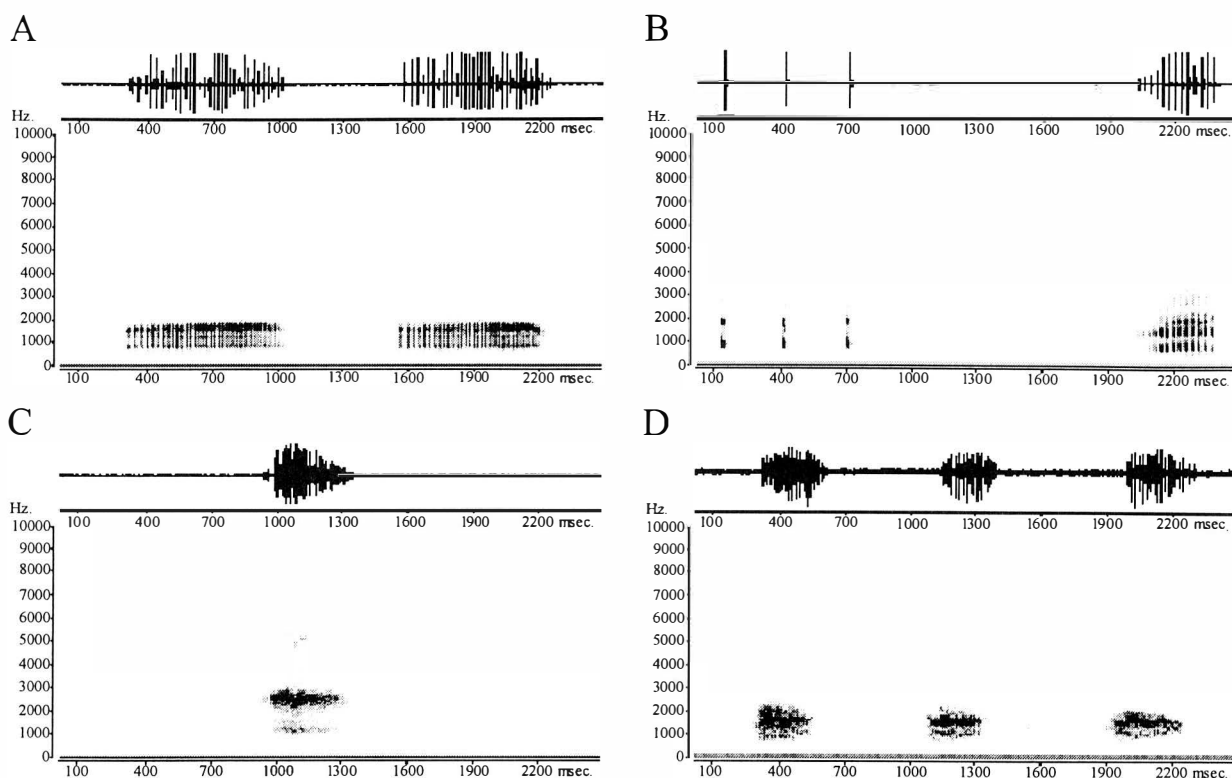


FIG. 1. Characteristic oscillogram (top) and audiospectrogram (bottom) of an advertisement call (A) *Bufo camerunensis*, two calls from two different males; (B) *Chiromantis rufescens*, call showing the last three isolated pulses of a sequence of 11 pulses followed by the pulse train; (C) *Dimorphognathus africanus*; (D) *Phrynobatrachus auritus*.

the differences observed are likely to be a consequence of differences in the recording temperature or motivational state of the males.

*Dimorphognathus africanus* (Hallowell). This ranid frog was moderately common in Monte Alén. Males called continuously during the day, in the vicinity of streams in the forest, throughout the year. They were secretive, calling from small caves in the bank of the river. Recordings were obtained on 22 October, at an air temperature of approximately 24 °C. No other anuran species could be heard simultaneously. The call is a short trill (346-384 ms.) with an irregular temporal structure (T/P is highly variable) which results in a noisy spectrum (Fig. 1C). The mean dominant frequency is at 2614 Hz, but the emphasized frequency range is wide. The call has a fast raise time and a longer fall time. At the beginning of one of the recorded calls the animal emitted 4-8 isolated pulses (28 ms long) with very low power and with a frequency similar to the rest of the call. To the best of our knowledge there are no previous descriptions of the advertisement call of this species.

*Phrynobatrachus auritus* Boulenger. This ranid frog was extremely common in Monte Alén. Calls could be heard during the rainy seasons (March to May and September to December). Males called from the ground or

from rocks, at the edges of ponds or calm streams, occasionally in the water. They generally called at night, but they could also be heard during the day, particularly in the morning. They may form large choruses, occasionally with *Bufo gracilipes*. Recordings were obtained on the afternoon of 26 May 1993. Air temperature near the recording site was 20 °C. The call is composed of a sequence of 15-20 pulses emitted at regular intervals (pulse rate: 58-62 pulses/second), forming a raucous trill with a mean dominant frequency of 1622 Hz (Fig 1d). To the best of our knowledge, there have been no previous descriptions of the advertisement call of this species.

#### ACKNOWLEDGEMENTS

Field-work in Equatorial Guinea by the second author was funded by the program ECOFAC (DGVIII, EU) through AGRECO-CIRAD and the Asociación de Amigos de Doñana, Spain. J. L. Amiet was extremely kind in helping with species identification. J. Bosch was the recipient of a post-doctoral fellowship from the Ministerio de Educación y Cultura of Spain. Partial funding for the first author was provided by the Portuguese grants PRAXIS XXI, BCC/ 11965/97 and PRAXIS XXI 2/2.1/BIA/194/94 (Principal Investigator, E. G. Crespo).

## REFERENCES

- Akef, M. S. A. & Schneider, H. (1993). Reproductive behaviour and mating call pattern in Degen's toad, *Bufo vittatus*, in Egypt (Bufonidae, Amphibia). *J. Afr. Zool.* **107**, 97-104.
- Amiet, J.-L. (1976). Voix d'amphibiens camerounais. V Bufonidae: genres *Bufo*, *Werneria* et *Nectophryne*. *Ann. Faculté des Sciences du Cameroun.* **21/22**, 139-157.
- De La Riva, I. (1994). Anfibios anuros del Parque Nacional de Monte Alén, Río Muni, Guinea Ecuatorial. *Rev. Esp. Herp.* **8**, 123-139.
- Frost, D. R. (1985). *Amphibian species of the world. A taxonomic and geographical reference*. Lawrence, Kansas, U.S.A.: Allen Press Inc. & The Association of Systematics Collections.
- Heyer, W. R., Rand, A. S., Goncalves da Cruz, C. A., Peixoto, O. L. & Nelson, C. E. (1990). Frogs of Boraceiá. *Arq. Zool. S. Paulo* **31**, 237-410.
- Martin, W. F. (1972). Evolution of vocalization in the toad genus *Bufo*. In *Evolution in the genus Bufo*, 279-309. Blair, W. F. (Ed). Austin: University of Texas Press.
- Passmore, N. I. & Carruthers, V. C. (1995). *South African frogs. A complete guide*. Southern Book Publishers & Witwatersrand University Press, Johannesburg.
- Schiøtz, A. (1967). The tree frogs (Rhacophoridae) of West Africa. *Spolia Zool. Mus. haun.* **25**, 1-346.
- Schiøtz, A. (1999). *Treefrogs of Africa*. Edition Chimaira. Frankfurt am Main.
- Schneider, H., Tunner, H. G. & Hodl, W. (1979). Beitrag zur kenntnis des paarungsrufes von *Rana lessonae* Camerano, 1882 (Anura Amphibia). *Zool. Anz.* **202**, 20-28.

Accepted: 10.9.99