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Release calls of female *Bombina bombina* (Anura: Bombinatoridae)

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Abstract. Release calls of a female fire-bellied toad, *Bombina bombina*, were recorded in the field while handling the toad. Duration and structure of these calls are similar to release calls of male *B. bombina*.

Keywords. *Bombina bombina,* female, vocalisation.

The vocal repertoire of the fire-bellied toad, *Bombina bombina* (Linnaeus, 1761) was described by Lörcher (1969) and Schneider (2005). These authors distinguished several call types of males (mating call, release call, territorial call, contact call) and stated that females do not emit calls. Release calls of females were observed, however, in the related species *Bombina variegata* (Savage, 1932; Vasara et al., 1991; Gollmann and Gollmann, 2002) and *Bombina orientalis* (Akef and Schneider, 1985). Release calls in *Bombina* are emitted when an individual is clasped by another toad and are also often produced when toads are gently grasped by a human. Here we analyse vocalizations of a female *B. bombina* which were uttered while the toad was held in the hand immediately after capture in the field.

The call series was recorded with an AKG 140 D microphone connected to an Uher Report 4000 tape recorder at an air temperature of 18.5 °C near Marchegg (Lower Austria) on 4th May 1984. The female toad (48 mm snout-vent length) was held at a distance of 10 cm from the microphone. The weak signals of the female are clearly distinguishable from the background sound consisting mainly of advertisement calls of male *B. bombina*. Frequency analysis and spectrograms of eleven calls were generated with the S_Tools_STx program package, a development of the Acoustics Research Institute of the Austrian Academy of Sciences (http://www.kfs.oeaw.ac.at). Spectrograms were obtained at an fft size of 160 samples, a frequency between 0 and 5000 Hz, with analysis bandwidth 440 Hz and an amplitude range of -60 dB to 30 dB. The spectrogram frame had a length of 46 ms with an overlap of 75%.

Call duration ranged from 35 to 76 ms (mean = 57 ms, ± 13 SD, n = 11). All calls show a slight downward frequency modulation and a harmonic structure with a mean

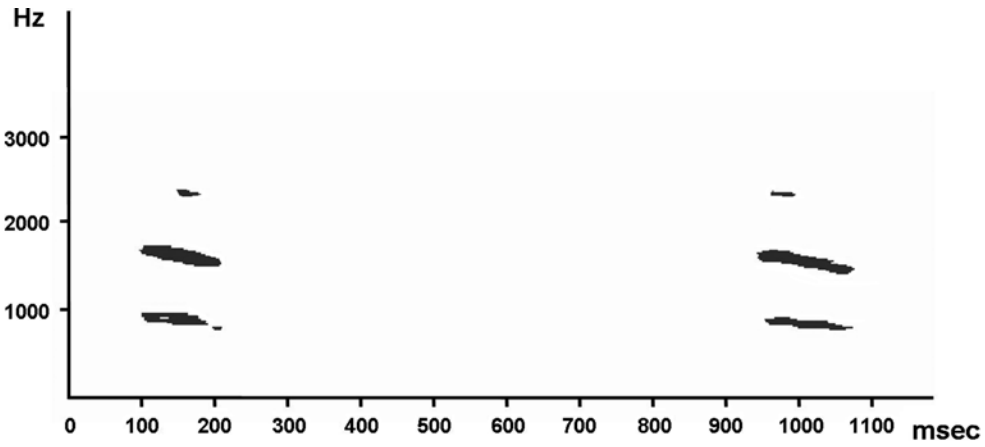

Fig. 1. Spectrogram of two release calls of a female *Bombina bombina* (calls four and five out of a series of eleven calls).

fundamental frequency of 800 Hz, with much energy in a second harmonic around 1600 Hz and a third harmonic around 2400 Hz (Fig. 1).

The release calls of the female are similar to the release calls of male *B. bombina* in duration (mean 62 ms, Lörcher, 1969) and general structure. Fundamental frequency is higher than values reported for males (500 Hz, Lörcher, 1969; 600 Hz, Schneider, 2005). Harmonic structure and weak frequency modulation match the release calls illustrated by Schneider (2005) and those of *B. variegata* shown by Lörcher (1969), whereas the release calls of *B. bombina* males presented by Lörcher (1969) have a higher number of harmonics and upward frequency modulation.

This is the first analysis of vocalizations of females in *Bombina*, which so far had only been described verbally. Female release calls are known from other families of anurans; usually, their structure is similar to the release calls of males (Brzoska et al., 1977), whereas differences in frequency and amplitude are probably caused by sexual dimorphism of the laryngeal apparatus (Wells, 2007: 271). Release calls of female *B. bombina* are frequently uttered after capture (e.g., by three of five toads handled for photography on 8th August 2007 in Untere Lobau, Vienna, Austria; G.G. unpubl. data). The vocalizations of female fire-bellied toads may have escaped notice of observers in the field because the louder calls of the males usually drown them during behavioural interactions.

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