Hylodes phyllodes (Amphibia, Anura, Hylodidae): nocturnal calling behavior

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Most frogs are nocturnal, but some are primarily diurnal (*e.g.,* dendrobatids, hylodids). In addition, their calling activity is known to be influenced by social interactions as well as by local environmental factors such as relative humidity, temperature, photoperiod and rainfall (Duellman and Trueb, 1986; Wells, 2007).

Hylodes phyllodes (family) is a small frog that inhabits rocky streams in the Atlantic Rain Forest of southeastern Brazil (Heyer, 1982; Heyer *et al.,* 1990). This species calls during the day (Heyer *et al.,* 1990; Hartmann *et al.,* 2006), like most species of *Hylodes* (*e.g., H. asper, H. uai, H. sazimai;* Heyer *et al.* 1990; Haddad and Pombal, 1995; Nascimento *et al.,* 2001), except for *H. perere,* which may call both during the day and night (Silva and Benmaman, 2008). Furthermore, Heyer *et al.* (1990) reported a male of *H. phyllodes* calling early at night (19:20 h) at Boracéia. Hatano *et al.* (2002) provided evidence for strictly diurnal activity of a closely related species, *H. fredi* (considered as *H. phyllodes* for many years), by demonstrating that there is a strong relationship between the time of sunrise and sunset and the starting and ending of calling activity, respectively. Here, we provide field data indicating that, although nocturnal activity may occur in *H. phyllodes,* it is an extremely rare event.



Figure 1: Male (left) and female (right) of *Hylodes phyllodes* on a rocky stream in the Atlantic Rain Forest of southeastern Brazil.

Monthly from February 2007 to December 2011, we monitored populations of *H. phyllodes* in four streams located at non-disturbed Atlantic Forest at the northern end of Parque Estadual da Serra do Mar (about 23°21'S, 44°47'W), São Paulo state, southeastern Brazil. During this monitoring program, we conducted 273 night surveys in these four streams. Our surveys started just after sunset and ended around 23:00 h to 01:00 h. During these night surveys, we never heard a call of *H. phyllodes* after sunset. The only exception occurred on 14 December 2011, at approximately 20:00 h, when we heard an individual of *H. phyllodes* emitting advertisement calls intensely. When we arrived at the site the frog was already calling. The calling site was a wet rock crevice partially covered by mosses (Fig. 1) located on the left bank of the stream, about 2 m from the streambed and 1.5 m above the water. We spent around 20 minutes at the site and when we left the frog was still calling. The advertisement calls emitted were apparently identical to those emitted during day. At the time of the observation, air humidity was 82%, temperature 21.3°C, atmospheric pressure was 999.6 mmHg, a light rain was falling, and moonlight was dim.

The next morning (15 December), around 09:00 h, we returned to the same site and observed an adult male at exactly the same spot where we found the calling male the previous night. It was calling intensely and as we approached, we spotted a female he had probably attracted and was apparently courting (Fig. 1). The male and female moved about 50 cm until they went out of sight. The morning was cloudy, air humidity was 89%, air temperature was 21.3°C, and atmospheric pressure was 1000.1 mmHg. None of the specimens were collected due to the ongoing monitoring program.

Based on numerous observations of this species during our 5-year study we believe that this species may exhibit site fidelity. Site fidelity is already known for other species of *Hylodes,* as *Hylodes dactylocinus* (Narvaes and Rodrigues, 2005) and *Hylodes cardosoi* (Lingnau *et al.,* 2008). Therefore, we infer that the male found in the same spot in the morning of 15 December was probably the same male that was calling in the previous night.

During our night surveys, it was common to find individuals of *H. phyllodes* (juveniles, adult males and females) resting on leaves along stream banks (see also Heyer *et al.,* 1990), strongly indicating the absence of activity during the night. Because we failed to observe nocturnal calling activity during the 5 years of night surveys, except for the observation reported herein, we conclude that this behaviour is extremely rare in *H. phyllodes,* in contrast to *H. perere,* that seems to call frequently at night (Silva and Benmaman, 2008). This unusual behavior could be related to courtship (as indicated by the observation in the following morning) and/or male-male competition for a female.

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Desova de *Haddadus binotatus,* Ilha da Queimada Grande, SP (Foto: F. E. Barbo).