

New species of *Hypsiboas* (Anura: Hylidae) in the *pulchellus* group from southern Brazil

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Abstract. A new species of *Hypsiboas* in the *pulchellus* group is described from central Rio Grande do Sul, Brazil. To date, this species is only known from the southern slopes of the Araucaria plateau, where it occurs from about 200–600 m a.s.l. in semideciduous forests near small permanent and temporary streams. It is a medium-sized to moderately large-sized hylid in the *semiguttatus* clade (mean SVL in males 46.6 mm) with robust body, hypertrophied forearms and prominent prepollex in males. It is characterized by a coffee-brown to beige dorsal colouration with numerous small dark spots and vermiculations; by a dark brown dorso-lateral stripe extending from the eye to the inguinal region bordered above by a thin yellowish stripe; by dark brown flanks with bright yellow spots; by hidden areas of thighs being dark with small yellow spots; and by a broad, irregularly shaped, dark stripe on outer margins of forearms and hind limbs, bordered whitish above. It is distinguished from all other species in the *semiguttatus* clade by its unique body coloration and its advertisement call.

Key words. Anura, Hylidae, *Hypsiboas*, new species, *semiguttatus* clade, vocalization, Rio Grande do Sul, Brazil.

Introduction

The Neotropical hylid genus *Hypsiboas* currently contains 74 species (FROST 2007). This genus was revalidated and subdivided into seven species groups by FAIVOVICH et al. (2005). The largest and taxonomically most problematic group is the *H. pulchellus* clade comprising more than 30 taxa (see also DUELLEMAN et al. 1997, FAIVOVICH et al. 2004). Within the *pulchellus* group, FAIVOVICH et al. (2004, 2005) recognized a *polytaenius* clade containing nine species that are characterized by a distinct striped dorsal pattern. As sister group of the *polytaenius* clade, FAIVOVICH et al. (2004, 2005) and GARCIA et al. (2007) proposed a small clade of several species in southern Brazil (states of Rio Grande do Sul, Santa Catarina and Paraná) and in the Argentinean province Misiones being composed of *H. semiguttatus*, *H. joaquina*, the recently described *H. curupi*, and at least one or two undescribed species which were formerly referred to *H. semiguttatus* (e.g., in STRANECK et al. 1993, KWET & DI BERNARDO

1999). Although morphological synapomorphies supporting the monophyly of this clade are still lacking, all these species seem to be closely related and the study of these forms is still in progress. During field work in central Rio Grande do Sul, we found another different species in this clade which is morphologically most similar to the new species from Misiones formerly treated as *H. semiguttatus* (see GARCIA et al. 2007). However, it differs in advertisement call and external characteristics, as body size and colouration, and occurs in a distance of more than 300 km from the Argentinean locality. This species of *Hypsiboas* is here described as new.

Material and methods

The type material was collected in the municipality of Sinimbu, central Rio Grande do Sul, Brazil, approximately 15 km north of the city of Sinimbu, located at the southern slope of the Araucaria plateau. Specimens were fixed and stored in 70% ethanol

and are deposited in the Museu de Ciências e Tecnologia da PUCRS, Porto Alegre, Brazil (MCP). For comparisons, material housed in the collections of the Staatliches Museum für Naturkunde Stuttgart (SMNS) and the Zoological Museum Hamburg (ZMH) was examined. The following measurements were taken to the nearest 0.1 mm with dial calipers: snout-vent length (SVL); head length (HL); head width (HW); horizontal eye diameter (ED); horizontal tympanum diameter (TD); eye-nostril distance, from center of the nostril to the anterior edge of eye (EN); interorbital distance between anterior edges of eyes (IO); internarial distance between centers of nostrils (IN); thigh length (THL); tibia length (TIL); foot length, from proximal edge of inner metatarsal elevation to tip of fourth toe (FL). The webbing formulae follow SAVAGE & HEYER (1967, 1997).

Call recordings were obtained with a Sony WM-D6C tape recorder and a Sennheiser microphone system K6 with ME66 module. Acoustic analysis was performed using Cool Edit analysis software at a sampling frequency rate of 44.1 kHz. A total of 33 advertisement calls from four males were analyzed. The call voucher specimens are contained in part of the type series deposited in the MCP collection. Measurements of the following acoustic parameters were taken: call duration (note length), pulse length, pulses per note, interpulse interval, pulse repetition rate, dominant frequency range, and other frequencies with perceptible energy (harmonics). Temporal parameters are given in seconds (s) and spectral parameters in Hertz (Hz).

Results

Hypsiboas stellae sp. nov.

(Figs. 1-2)

Holotype: MCP 5621, adult male, from a small unnamed forest stream (confluent of Rio Pardinho which is a confluent of Rio Pardo; both streams are tributaries of Rio Jacuí), at the southern slope of the South Brazilian

Araucaria plateau, at about 500 m a.s.l., about 15 km N of Sinimbu, 52°36'W, 29°34'S, Municipality of Sinimbu, State of Rio Grande do Sul, Brazil, collected on 07 January 2002 at 23:50 h by Axel Kwet and Marcos Di Bernardo.

Paratypes: MCP 5620, adult male collected on 07 January 2002 together with the holotype. MCP 6529-6531 collected on 27 October 2002, and MCP 7556-7559 collected on 17 October 2003; these paratypes are adult males from three nearby small forest streams (also confluents of Rio Pardinho in the Municipality of Sinimbu).

Diagnosis: A medium to moderately large-sized species of *Hypsiboas* (males 40.7-49.9 mm, mean 46.56 mm SVL) with robust body, hypertrophied forearms and prominent prepollex in males. The new species belongs to the *Hypsiboas semiguttatus* clade within the *pulchellus* group. It has a unique advertisement call and is characterised by a dorsal colour pattern consisting of fine dark mottling on brownish ground; by a distinct, broad, dark dorsolateral stripe which is yellowish bordered above extending from the tip of the snout to the inguinal region; and by several distinct, small yellow blotches on the dark brown flank. Compared to other taxa in the *pulchellus* group, the new species is promptly differentiated from all species in the *polytaenius* clade, i.e. *H. beckeri*, *H. buriti*, *H. cipoensis*, *H. goianus*, *H. latistriatus*, *H. leptolineatus*, *H. phaeopleura*, *H. polytaenius*, and *H. stenocephalus*, by lacking a distinct dorsal pattern of longitudinal stripes; from *H. freicanecae* by lacking a bright triangular spot on the snout; from *H. balzani*, *H. callipleura*, and *H. marianitae* by presenting a well defined, dark dorsolateral stripe, whitish bordered above (not present in these species); from *H. ericae* by a much larger size and by hypertrophied forearms in males; from *H. guentheri*, *H. marginatus*, *H. melanopleura*, and *H. palastes* by bearing distinct yellowish blotches on the flank; and from most other species

in the *pulchellus* group, i.e., *H. alboniger*, *H. andinus*, *H. bischoffi*, *H. caingua*, *H. cordobae*, *H. cymbalum*, *H. prasinus*, *H. pulchellus*, *H. riojanus*, and *H. secedens*, by the absence of dark bars or blotches on the hidden surfaces of the thighs.

Hypsiboas stellae is most similar to the species belonging to the *semiguttatus* clade defined by GARCIA et al. (2007), to which the new taxon probably belongs. Compared to these species, the equally sized *H. joaquina* (mean SVL of males 47.8 mm, $n = 36$; versus 46.6 mm in *H. stellae*) inhabits open grassland (*H. stellae* is a forest dweller), presents metallic white or whitish blotches on the dorsal surfaces of thighs, tarsus, and foot (GARCIA et al. 2003) which are absent in *H. stellae*, and has a very different advertisement call with much more pulses (29–55 pulses versus 5–14 pulses in *H. stellae*). *Hypsiboas semiguttatus* and a closely related taxon from Misiones, Argentina, formerly assigned to *H. semiguttatus* (see discussion) and recently described as *H. curupi* by GARCIA et al. (2007), are considerably smaller (mean SVL of males 40.6 mm in *H. semiguttatus*, $n = 17$; and 35.6 mm in *H. curupi* from Misiones, $n = 57$; versus 46.6 mm in *H. stellae*) having different advertisement calls with shorter notes (note length 0.10–0.92 s in *H. semiguttatus* and 0.13–0.28 s in *H. curupi* versus 0.64–1.85 s in *H. stellae*) and many more pulses (19–45 pulses in *H. semiguttatus* and 18–45 pulses in *H. curupi* versus 5–14 pulses in *H. stellae*). Another species in this clade from northeastern Rio Grande do Sul, which is not yet described, was preliminarily named “*Hyla semiguttata* small form” in KWET & DI BERNARDO (1999) and KWET (2001) or *Hypsiboas* sp. (aff. *joaquina*) in GARCIA et al. (2007). This undescribed species differs by its much smaller size (mean SVL of males 34.2 mm, $n = 18$, see KWET 2001; versus 46.6 mm in *H. stellae*), completely different colour pattern, and different bioacoustic parameters (20–105 pulses with a dominant frequency of 2200 Hz; versus 5–14 pulses and a dominant frequency of 1650 Hz in *H. stellae*).

Description of the holotype: Adult male, MCP 5621 (Figs. 1A–E). Robust, relatively large-sized hyloid with the following measurements (in mm): SVL 47.3; HL 14.5; HW 15.6; ED 4.4; TD 2.4; EN 3.5; IO 8.8; IN 3.9; THL 25.9; TIL 24.7; FL 21.6. Head approximately as long as wide, HL 30.7% of SVL, HL 95% of HW; snout rounded to slightly truncate in dorsal view and rounded in lateral view, nostrils directed dorsally. Canthus rostralis distinct, loreal region concave and steep. Eyes moderately sized, pupil round; tympanum distinct with its diameter slightly larger than half the eye-diameter; supratympanic fold distinct and prominent, extending from behind the eyelid over the dorsal margin of the tympanum to insertion of arm. Tongue large and cordiform, notched posteriorly. Large vocal slits under the tongue, and a single, median, subgular vocal sac. Two distinct, slightly transverse median rows of vomerine teeth posterior to choanae. Dorsal skin texture smooth (Figs. 1A, B, D); ventral surfaces distinctly granular (Fig. 1C).

Hypertrophied forearms; fingers slightly fringed with moderately sized, prominent terminal discs; disc on first finger (thumb) slightly smaller than other finger discs (Fig. 1E); enlarged prepollex with sharp, bony spine; relative finger length $I < II = IV < III$; hand webbing formula $I - II \ 2 - 3 \ III \ 3 - 2^+ \ IV$; inner and outer metacarpal tubercles low and poorly defined; each finger with a single, prominent, subarticular tubercle and several small but also prominent supernumerary tubercles. Long legs; tibia slightly shorter than thigh (TBL 95.4% THL) and somewhat longer than half of SVL (TBL 52.2% SVL); poorly developed inner tarsal fold extending from the inner metatarsal tubercle to the tibio-tarsal articulation. Toes long, robust and fringed, with well developed terminal discs (Fig. 1F); ovoid inner metatarsal tubercle distinct and prominent, outer metatarsal tubercle absent; small single subarticular tubercles and small but distinct supernumerary tarsal tubercles on each toe; relative toe length $I < II < V < III < IV$; foot webbing formula $I \ 2^- - 2 \ II \ 1 - 2 \ III \ 2^- - 3 \ IV \ 2 - 1^+ \ V$.



Fig. 1. *Hypsiboas stellae* sp. nov., holotype MCP 5621, adult male; (A) dorsal view; (B) lateral view; (C) ventral view; (D) dorsolateral view of living holotype; (E) ventral view of left hand; (F) ventral view of left foot. Scale bars in (E) and (F) = 5 mm.



Fig. 2. *Hypsiboas stellae* sp. nov., dorsal variation in male paratypes; (A) MCP 5620; (B) MCP 7557 (note the high number of dorsal scars, due to intraspecific male combats); (C) MCP 7559 (unusual dark specimen); (D) MCP 7556 (calling male); (E) MCP 6531 (light specimen, left) and MCP 6530 (specimen with distinct dorsal pattern, right); (F) ventral views of MCP 6531 (light gular region) and MCP 6530 (dark gular region); (G) type locality, an unnamed small forest stream; (H) egg clutch.

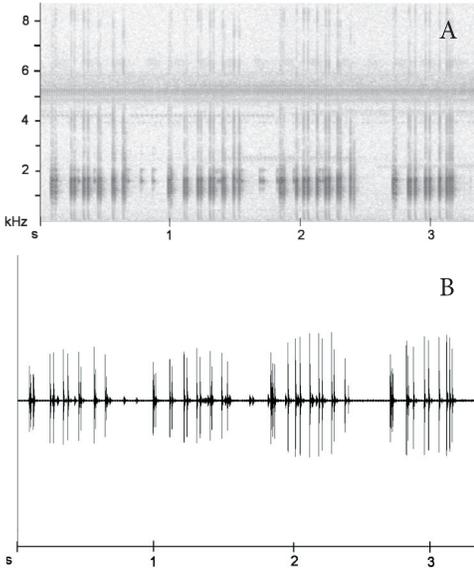


Fig. 3. Audiospectrogram (A) and waveform (B) of the advertisement call of *Hypsiboas stellae* sp. nov.; four consecutive notes from within a call sequence of 20 notes (recording AK12B14); air temperature 19.8 °C, voucher specimen MCP 5620.

In life, dorsum and dorsal surfaces of arms and legs coffee-brown or dark beige anteriorly merging into lighter tones (tan). Numerous small dark spots and vermiculations are distributed over the whole dorsal surface (Fig. 1D). Iris golden or copper, lighter in the upper portion. A white labial stripe extends from the tip of the snout to the arm insertion being most intense below the tympanum. A dark brown canthal stripe runs from the tip of the snout over the nostril to the eye. Dorsolaterally from behind the eyes, there is a broad, dark brown stripe passing the tympanum and reaching up to the inguinal region. This nearly black stripe is bordered above by a thin yellow or yellowish stripe and below by dark brown flanks with about 10-20 yellow spots or small elongated blotches. Outer margins of forearms, hind limbs, and cloacal region with a broad, dark brown stripe being yellowish bordered above. These stripes are irregularly shaped and often partly bro-

ken into several dark blotches surrounded by whitish lines. Hidden areas of thighs dark brown with small yellow spots, more densely distributed close to the cloacal region. Palmar and plantar surfaces dark brown. Ventral surface creamy yellow, gular region dark brown and finely spotted with small yellow granules.

In preservative, dorsum dark brown to greyish-brown with dark mottling (Figs. 1A-B). The yellow spots became cream or whitish, the dark coloration on gular region and ventral surfaces of hand and foot changed into lighter brown (Fig. 1C).

Variation: Measurements and proportions of the paratypes are very similar to the holotype (Table 1), except MCP 7556, which is considerably smaller than all other males (40.7 mm versus 44.3-49.9 mm). The dorsal coloration varies markedly among the specimens from tan, coffee-brown, greenish brown or dark beige to dark brown. Most specimens exhibit a faint dorsal pattern of small dark spots and vermiculations, but sometimes this pattern is hardly visible, i.e. in MCP 7559, which presents an unusual dark coloration on the dorsal surfaces. MCP 6530 is unusual in presenting a row of several small, dark middorsal blotches and some oval flecks above the dorsolateral stripe on the right posterior portion of the body. MCP 6529 presents similar flecks on both posterior sides of the body but it lacks the middorsal blotches present in MCP 6530. The flanks of all specimens present a varying number of bright yellow or yellowish blotches of variable size and shape ranging from spots to small elongated blotches. The variation in dorsal and ventral patterns in the type series is illustrated in Figs. 2A-F.

Advertisement call: The following advertisement calls from four males were analyzed (Table 2): (1) recording AK12B13, 07 January 2002 at 23.40 h, air temperature 19.7 °C, voucher specimen MCP 5621 (holotype), n = 3 calls; (2) recording AK12B14, 08 January 2002 at 01.05 h, air temperature 19.8 °C,

New species in the *Hypsiboas pulchellus* group

Tab. 1. Measurements (in mm) of *Hypsiboas stellae* sp. nov., type series (n = 9 males) including holotype MCP 5621.

	5621	5620	6529	6530	6531	7556	7557	7558	7559	Range	Mean	SD
SVL	47.3	45.8	46.2	44.3	46.3	40.7	49.6	49.9	48.9	40.7-49.9	46.56	2.89
HL	14.5	14.1	1.4	13.3	13.4	12.0	15.0	14.3	14.3	12.0-15.0	13.88	0.88
HW	15.6	15.1	14.7	14.9	15.0	13.1	16.2	15.9	16.0	13.1-16.2	15.17	0.94
ED	4.4	4.2	4.3	4.2	4.3	4.3	4.7	4.5	4.5	4.2-4.7	4.38	0.16
TD	2.4	2.4	2.5	2.5	2.6	2.2	2.7	2.4	2.5	2.2-2.7	2.47	0.14
EN	3.5	3.7	3.6	3.5	3.7	3.4	4.1	3.6	4.1	3.4-4.1	3.69	0.25
IO	8.8	9.2	8.5	8.7	8.8	7.4	8.9	9.0	9.1	7.4-9.2	8.71	0.53
IN	3.9	4.3	4.0	3.5	3.7	3.2	3.8	3.9	3.9	3.2-4.3	3.80	0.31
THL	25.9	26.0	25.4	24.9	25.2	23.1	28.3	28.3	26.6	23.1-28.3	26.00	1.64
TIL	24.7	24.2	23.9	24.3	23.0	22.4	27.8	26.5	25.0	22.4-27.8	24.64	1.66
FL	21.6	20.8	20.9	20.7	19.9	18.7	23.5	23.6	23.2	18.7-23.6	21.43	1.70

Tab. 2. Acoustic parameters for the advertisement calls of four males of *Hypsiboas stellae* sp. nov. (mean, numbers in brackets are ranges).

	MCP 5621 07 January 2002	MCP 5620 08 January 2002	MCP 6529-31 28 October 2002	MCP 7556 17 October 2003
Air temperature (°C)	19.7	19.8	17.0	19.5
Number of notes analyzed	3	22 (series of notes)	5	3
Note length (s)	1.28 (1.01-1.63)	0.64 (0.42-1.26)	1.64 (1.12-1.85)	1.13 (0.42-1.53)
Pulse length (s)	0.01	0.01	0.01	0.01
Pulses per note	6-11	9-14	9-12	5-14
Inter-pulse interval (s)	0.09 (0.03-0.17)	0.04 (0.01-0.13)	0.15 (0.01-0.22)	0.08 (0.01-0.18)
Pulse repetition rate (pulses/s)	6-8	9-21	7-11	9-14
Dominant frequency range (Hz)	1640 (1100-1800)	1660 (1100-1800)	1650 (1300-1800)	1660 (1400-1900)
Other frequencies with perceptible energy (Hz)	-	3900-4200	4500-4800	4700-4900

voucher specimen MCP 5620, n = 22 calls; (3) recording AK16B02, 28 October 2002 at 01.20 h, air temperature 17.0 °C, voucher specimen in the series MCP 6529-31, n = 5 calls; (4) recording AK17A12, 17 October 2003 at 22.45 h, 19.5 °C air temperature, voucher specimen MCP 7556, n = 3 calls. The advertisement call is a simple, rasping note that is irregularly repeated; generally in intervals of several minutes. Due to this very sparse and sporadic calling, only a few calls are available for the

analysis. However, one male (MCP 5620) was observed emitting a sequence of 20 consecutive notes. A series of four consecutive notes from this call sequence is illustrated in Fig. 2. These notes were separated by small inter-note intervals of about 0.3 s, each note lasted 0.42-1.85 s and consisted of 5-14 pulses. The inter-pulse intervals varied between 0.01 s (in cases, when two or three pulses were emitted in quick succession jointly) and 0.22 s (in the case of single pulses). Due to this difference,



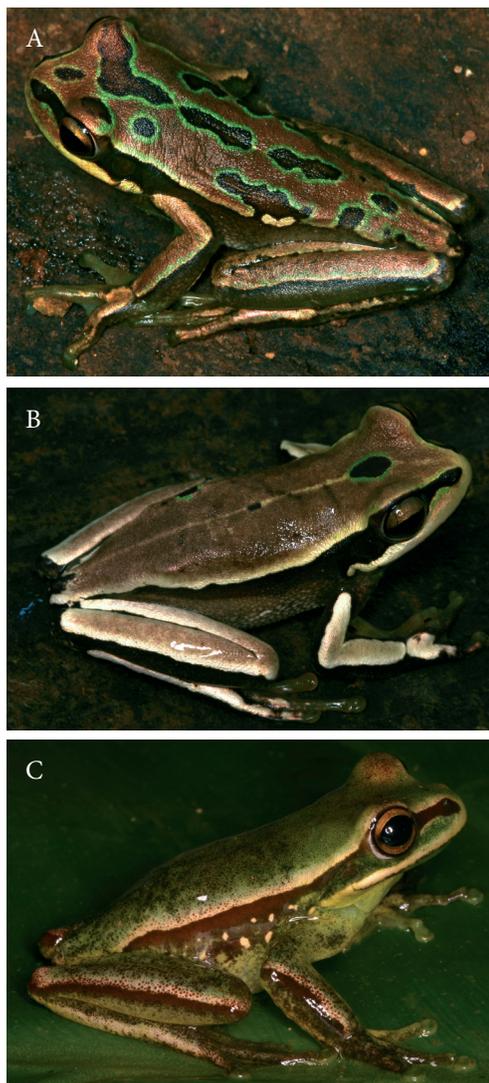


Fig. 4 (left page). Species closely related to *Hypsiboas stellae* sp. nov.: (A, B) males of *Hypsiboas curupi* from Itá, Santa Catarina; (C, D) males of *Hypsiboas* sp. aff. *joaquina* from São Francisco de Paula, Rio Grande do Sul; (E, F) males of *Hypsiboas joaquina* from Urubici, Santa Catarina; (G, H) males of *Hypsiboas* cf. *joaquina* from Cambará do Sul, Rio Grande do Sul.

Fig. 5. Species closely related to *Hypsiboas stellae* sp. nov.: (A, B) *Hypsiboas* cf. *curupi* from Lebon Regis, Santa Catarina; (C, D) *Hypsiboas* sp. 1 from Santo Amaro da Imperatriz, Santa Catarina; (E, F) *Hypsiboas* sp. 2 from Blumenau, Santa Catarina.

the pulse repetition rate was usually 6-14 pulses/s, but this rate was somewhat higher in notes from within the call sequence reaching up to 21 pulses/s. The dominant frequency spectrum ranged between 1100 and 1900 Hz, with maximum energy at about 1650 Hz. Another frequency band with perceptible energy (second harmonic) was present between 3900-4900 Hz.

The four closely related, above mentioned species in the *H. semiguttatus* clade differ in advertisement calls. The call of *H. joaquina* (GARCIA et al. 2003) consists of shorter notes (note length 0.67-1.00 s) with much more pulses (29-55 pulses). The notes of *H. semiguttatus* described by GARCIA et al. (2007) are shorter at average (note length 0.10-0.92 s), consist of more pulses (14-45 pulses) and have a much higher dominant frequency range (2100-2900 Hz). The call of the morphologically similar *H. curupi* from Misiones described as the call of *H. semiguttatus* by STRANECK et al. (1993; see GARCIA et al. 2007) differs in much shorter notes (note length 0.13-0.28 s), containing greater number of pulses (18-45 pulses), whereas the call of *H. sp. aff. joaquina* from northeastern Rio Grande do Sul (described as the call of "*Hyla semiguttata* small form" in KWET 2001) has considerably greater number of pulses (20-105 pulses) and a higher dominant frequency (about 2200 Hz).

Etymology: The species is dedicated to the company "Stellae Limited" in recognition of its contribution to conserving biodiversity by aiding the reduction of greenhouse gases produced by the UK further education sector. The specific name is treated as a noun in apposition.

Distribution: The new species is distributed in dense semideciduous forests at the southern slope of the Araucaria Plateau in central Rio Grande do Sul, where it was found from about 200-600 m a.s.l. at small mountain streams which are all confluents of Rio Pardinho (which is, on the other hand, a

confluent of Rio Pardo and a tributary of Rio Jacuí). To date, *H. stellae* is known only from the municipality of Sinimbu, but it may also occur in some neighbouring municipalities, where the same habitat type is present. A somewhat divergent population found at Perau de Janeiro, Municipality of Arvorezinha (MCP 8136, 8707), about 50 km to the north, is preliminary named *H. cf. stellae* (see discussion). Until more distributional data become available, *H. stellae* should be classified as "Data Deficient" according to the criteria established for the Global Amphibian Assessment.

Natural history: *Hypsiboas stellae* is a strict forest dweller living along small permanent and temporary mountain streams (Fig. 2G). The holotype (MCP 5621), a calling male, was found on 7 January 2002 at night near a small mountain stream, perched on a small branch at about 80 cm height. A second male (paratype MCP 5620) was found 2 m from the same stream on a small branch at 50 cm height. In rocky pools with slowly flowing water many tadpoles in different stages and a small egg clutch containing about 200 eggs were observed. The eggs were surrounded by large, transparent capsules (2-3 mm in diameter; Fig. 2H). On 6 January 2002, many tadpoles and several egg clumps fixed to submerged plant stems and foliage were observed in fast running water of a nearby streamlet presumably belonging to the new species. On 27 October 2002 three males (MCP 6529-6531) calling from about 20-50 cm high on rocks and six tadpoles (MCP 6543) in advanced stages (shortly before metamorphosis) were collected from another stream in the same region. Unfortunately, these larvae died in the collection jar before preservation and, due to their very poor condition, they could not be used for tadpole description. On 17 October 2003, four adult males (MCP 7556-7559) and four very small larvae (MCP 7601, also not useful for description) were collected at night from two additional streams in the same region. Three of these males were calling on rocks or

small branches; one male was found resting under a large stone. The only additional species occurring at this locality was *Proceratophrys bigibbosa*. All collected males of *H. stellae* presented distinct marks on their dorsum which are probably scars resulting from the use of the prepollical spines in intraspecific territorial male-male combats as also known for *H. marginatus* (KWET 2001).

Discussion

GARCIA et al. (2001) critically discussed the *Hyla pulchella* group sensu DUELLMAN et al. (1997) and proposed a new subgroup including *Hypsiboas marginatus* (as *Hyla marginata*), *H. joaquinii* (as *H. pulchella joaquinii*), *H. semiguttatus* (as *H. semiguttata*), *H. ericae*, and several populations of presumably undescribed species from southern Brazil (see Figs. 4, 5). GARCIA et al. (2001) provided a redescription of *Hypsiboas marginatus* and, as already proposed by KWET & DI-BERNARDO (1999), confirmed the full species level of this taxon which was previously considered a synonym of *H. semiguttatus* (LANGONE 1993). The new subgroup is characterized by the absence of dark bars or blotches on the hidden surfaces of the thighs (present in most members of the *H. pulchellus* group), by the vocalization consisting of long multi-pulsed notes, and by reproduction in streams. However, GARCIA et al. (2001) pointed out the need for additional studies to support the presumed monophyly of this clade.

Based on the type material and new specimens collected near the type locality São Joaquim in Santa Catarina, GARCIA et al. (2003) redescribed *Hypsiboas joaquinii* (as *Hyla joaquinii*). They elevated this taxon from the former subspecific status of *H. pulchellus* (as *Hyla pulchella joaquinii*) and confirmed that *H. joaquinii* is more similar and seemingly more closely related to *H. semiguttatus* than to *H. pulchellus*. However, whereas *H. semiguttatus* lives in forests of the southern portion of the Serra do Mar, in southeastern

Paraná and northeastern Santa Catarina, *H. joaquinii* (Figs. 4E, F) occurs in open, montane meadow formation on the Araucaria plateau of southeastern Santa Catarina and perhaps in adjacent Rio Grande do Sul. Morphologically similar populations from the municipalities Bom Jesus, Cambará do Sul, and São José dos Ausentes in Rio Grande do Sul (Figs. 4G, H) which were named "*Hyla semiguttata* large form" in KWET & DI-BERNARDO (1999) are now preliminarily referred to *Hypsiboas* cf. *joaquinii* (see GARCIA et al. 2007).

The original description of *Hypsiboas semiguttatus* by LUTZ (1925) was based on a single specimen from São Bento do Sul, northeastern Santa Catarina. As this description is very short and not adequate for species recognition, the taxon was redescribed by GARCIA et al. (2007). As already suggested by GARCIA et al. (2003), the new findings confirm the previous assumption that more than one species is covered by the name *Hyla semiguttata*. As mentioned above, the "true" *H. semiguttatus* is a strict forest dweller in Paraná and northeastern Santa Catarina being ecologically well separated from two morphologically similar populations in open or semi-open areas on the volcanic plateau in northeastern Rio Grande do Sul which were formerly assigned to *H. semiguttatus*, i.e. by LUTZ (1973), BRAUN & BRAUN (1980), KWET & DI-BERNARDO (1999) and KWET (2001). Instead, both these grassland populations in Rio Grande do Sul belong to two extremely variable taxa: "*Hyla semiguttata* large form" from the border region to Santa Catarina, which is possibly conspecific with *Hypsiboas joaquinii* (preliminarily called *Hypsiboas* cf. *joaquinii*), and another species named "*Hyla semiguttata* small form" (from the surroundings of São Francisco de Paula) by KWET & DI-BERNARDO (1999) and KWET (2001). The latter distinct species (Figs. 4C, D) is not yet described and preliminarily named *Hypsiboas* sp. (aff. *joaquinii*) by GARCIA et al. (2007).

In addition, GARCIA et al. (2007) recently described differing populations of *Hypsiboas*

from Misiones province, northeastern Argentina, as a new species (*Hypsiboas curupi*) formerly referred to *Hyla semiguttata* (e.g., by CEI & ROIG 1961, CEI 1980, 1987, CARRIZO 1991, STRANECK et al. 1993, FAIVOVICH 1996). Based on the molecular evidence provided by FAIVOVICH et al. (2004, 2005), GARCIA et al. (2007) also confirmed a monophyletic *Hypsiboas semiguttatus* clade as the sister group of a *H. polytaeniatus* clade within the large *pulchellus* group. *Hypsiboas stellae*, described in the present paper, is morphologically most similar to this recently described species from Misiones. According to GARCIA et al. (2007), *H. curupi* might be distributed also in extreme north-western Rio Grande do Sul (municipality of Planalto) and south-western Paraná. Another morphologically similar population currently observed near Lebon Régis, Santa Catarina (Figs. 5A, B) is here referred to *H. cf. curupi*, although there are also similarities to *H. joaquina* and *H. semiguttatus* (RODRIGO LINGNAU, pers. commun.). Recently, we collected three specimens in the municipality of Itá (MCP 8130, 8671-72; Figs. 4A, B) which seem to be conspecific with this new taxon; this means *H. curupi* may be also distributed in western Santa Catarina. Summarizing, *H. stellae*, *H. semiguttatus*, *H. joaquina* and both *H. curupi* from Misiones and *H. sp. aff. joaquina* from northeastern Rio Grande do Sul belong to the *semiguttatus* clade sensu GARCIA et al. (2007).

About 50 km airline distance north of the type locality of *Hypsiboas stellae*, at a small stream at Perau de Janeiro (52°81'89"W, 28°85'19"S), municipality of Arvorezinha, we collected a single hylid morphologically similar to *H. stellae* but considerably different in size. This individual (MCP 8631), presumably a subadult, is much smaller (SVL 34.7 mm) than all known specimens of *H. stellae*. Five tadpoles (MCP 8710) collected from this locality showed a variable labial tooth formula (2-3(1,3)/3-5(1-2,5) similar to that of the tadpole of *H. curupi* from Misiones (see GARCIA et al. 2007) originally described as that of *Hyla semiguttata* by FAIVOVICH (1996).

However, the tadpoles from Misiones present distinct marginal papillae completely bordering the oral disc, whereas in all larvae from Arvorezinha the marginal papillae exhibit a large distinct anterior gap arguing for the presence of two different species. Pending further studies, the population from Arvorezinha is referred here to *Hypsiboas cf. stellae*. *Hypsiboas stellae* seems to be restricted to a very small geographic range in the extreme southern part of the Araucaria plateau. Given this presumed restricted range, the new species faces high potential extinction risks, and its survival may depend on the conservation of the original forest and on the development of a specific in situ conservation policy.

Finally, it might be interesting to mention here that there are at least two additional species of *Hypsiboas* occurring along mountain streams in the Atlantic Rain Forest of Santa Catarina, which are morphologically similar to the above mentioned taxa in the *semiguttatus* clade and/or to *H. marginatus* (unpublished data; see Figs. 5C-F). However, these populations from Serra de Tabuleiro near Santo Amaro da Imperatriz (MCP 8116-17, 8122-24; Figs. 5C, D) and from the surroundings of Blumenau (MCP 8721-22; Figs. 5E, F) are very distinct in colouration and bioacoustic characteristics and clearly belong to two additional taxa to be described in the future. All these data reveal southern Brazil to be a specific hotspot for medium-sized hylids in the *pulchellus* group and claim for the need of future studies. Molecular studies are probably necessary to understand the evolutionary history of, and for delimiting species boundaries in, this group.

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Appendix

Additional specimens examined

Hypsiboas cf. *stellae*: Brazil: Rio Grande do Sul: Arvorezinha: Perau de Janeiro: MCP 8631; 8707 (larvae).

Hypsiboas joaquinii: Brazil: Santa Catarina: São Joaquim: MCP 8217, Urubici: MCP 8245-47.

Hypsiboas cf. *joaquinii* (= "*Hypsiboas semiguttatus* large Form" in KWET & DI BERNARDO 1999): Brazil: Rio Grande do Sul: Bom Jesus: SMNS 9214; ZMH A03393; Camará do Sul: MCP 3294-96; SMNS 9215; ZMH A03390.

Hypsiboas marginatus: Brazil: Rio Grande do Sul: São Francisco de Paula: Pró-Mata: MCP 1763-

64, 2415-18, 3226, 3413, 3441, 3448, 3724-25; SMNS 9002:1-3, 9261, 9678:1-2; ZMH A03314.

Hypsiboas cf. *curupi*: Brazil: Santa Catarina: Itá: MCP 8130, 8671-72, 8710 (larvae), Lebon Regis: MCP 9028.

Hypsiboas sp. aff. *joaquinii* (= "*Hypsiboas semiguttatus* small Form" in KWET & DI BERNARDO 1999): Brazil: Rio Grande do Sul: São Francisco de Paula: MCP 2454-57, 2486, 3210-12, 3227, 3263, 3266, 3270, 3292-93, 3297, 3303, 3419, 3431, 3439, 3509-13, 3639; SMNS 9172, 9214, 9220-21, 9263; ZMH A03391-92.

Hypsiboas sp. 1 – Brazil: Santa Catarina: Santo Amaro da Imperatriz: MCP 8116-17; 8122-24.

Hypsiboas sp. 2 – Brazil: Santa Catarina: Blumenau: MCP 8721-22.

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