

A NEW SPECIES OF THE *HYPYSIBOAS BENITEZI* GROUP FROM THE WESTERN AMAZON BASIN (AMPHIBIA: ANURA: HYLIDAE)

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ABSTRACT: A new species of the *Hypsiboas benitezi* group is described from the western Amazon Basin. The new species is characterized by its medium size (SVL 24.4–31.2 mm in adult males, 26.0–36.0 mm in adult females), absence of nuptial excrescences, palpebral membrane lacking golden reticulation, and a mental gland in males. The dorsal surfaces of living frogs are bright yellowish green to tan, and frequently bear an X-shaped mark; the parietal peritoneum, pericardium and sclera are covered by guanophores. The new species differs from other members of the *Hypsiboas benitezi* group (*H. benitezi*, *H. lemai*, *H. microderma*, *H. pulidoi*, *H. rhythmicus*, and *H. roraima*), by the combination of a dorsal X-shaped marking, absence of golden reticulation on palpebral membrane, and central portion of abdominal parietal peritoneum, pericardium, and sclera covered by guanophores. The new species has been confused with *Hyloscirtus albopunctulatus* (as *Hyla albopunctulata*) in the past, but the study of the type series of the latter indicates that they represent different species. *Hypsiboas hutchinsi* is excluded from the *H. benitezi* group and transferred to the *H. semilineatus* group, as it shares with *H. geographicus* and *H. semilineatus* the absence of a projecting spine in the prepollex (the only known species of *Hypsiboas* with this character state), presence of pigmented nuptial excrescences, reticulated palpebral membrane, and finely tuberculated skin.

Key words: Amphibia; Anura; Hylidae; *Hypsiboas nympha*; New species; Western Amazon Basin

THE WESTERN Amazon Basin of Colombia, Ecuador and Peru holds a remarkably high biological diversity with regard to amphibians. For example, 112 frogs have been recorded from the Iquitos region, northeastern Peru (Rodríguez and Duellman, 1994) and 120 amphibian species from a single site, the Tiputini Biodiversity Station, in Amazonian Ecuador (Cisneros-Heredia, 2003). Recent fieldwork in these regions and the study of collections led to the discovery of a new species of *Hypsiboas*.

This new species was included in the recent analysis and taxonomic revision of the family Hylidae by Faivovich et al. (2005), whose most parsimonious trees showed it to be nested within a group of western amazonian and Guayana highland species (*Hypsiboas benitezi*, *H. lemai*, *H. microderma*, *H. roraima*, and other undescribed species). This clade was named the *Hypsiboas benitezi* group, and is supported mainly by molecular data, and by the presence of what was termed a “flat” mental gland.

Besides the already mentioned species, Faivovich et al. (2005) tentatively included *H. hutchinsi*, *H. pulidoi*, and *H. rhythmicus* in this group.

Goals of this paper include (1) the description of the new species, (2) a discussion of differences between the new species and *Hyloscirtus albopunctulatus*, a species of the *H. bogotensis* group (Faivovich et al., 2005) with which it had been confused in the past, and (3) briefly discuss the composition of the *Hypsiboas benitezi* group, as further study indicates that *H. hutchinsi* should be excluded from it.

MATERIALS AND METHODS

Thirty-one specimens of the new species were examined, along additional material that is listed in the Appendix. Snout dorsal outlines follow Heyer et al.'s (1990) standards. Webbing formulae follow Savage and Heyer's (1967) convention as subsequently modified by Myers and Duellman (1982). All other terminology is that of Duellman (1970). Abbreviations used throughout the text are: DF3,

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width of disc on third finger; EN, eye to nostril distance; ED, horizontal eye diameter; FL, foot length as the distance from the proximal edge of the inner metatarsal tubercle to the tip of the fourth toe; HL, head length as the straight line distance from the posterior mouth corner to the tip of the snout; HW, head width at the level of mouth corners; IOD, interorbital distance, taken between the anterior margins of the orbits; IN, internarial distance; SVL, snout-vent length; TL, tibia length; and, TYD, tympanum diameter. All measurements (in mm) were taken using a dissecting microscope and electronic digital calipers (0.05 mm accuracy and rounded to the nearest 0.1 mm); all measurements were taken by the same person (DFCH), and each measurement was taken at least three times. Sex was determined by presence or absence of secondary sexual characters (prepollical spine and mental gland) or by direct observation of the gonads. Relative lengths of digits were determined by adpressing adjacent digits to one another. Color pattern in life was taken from field notes and color photographs. Internal soft anatomy was examined by dissection of preserved specimens. Drawings were made with the aid of a stereomicroscope with a drawing tube attachment and photographs were used to document eye coloration.

Classification of vegetation formations follows Sierra (1999). Geographic position and elevation of collection localities were determined using collectors' field notes and the 2000 physical map of the Republic of Ecuador 1:1,000,000 distributed by the Instituto Geográfico Militar, and NIMA (2003).

Throughout this paper we adopt the taxonomic changes recently introduced by Faivovich et al. (2005), that resulted in the partition of the formerly paraphyletic *Hyla* into 15 genera, and the redefinition of several of its former species groups, particularly within *Hypsiboas*. The literature on hylid frogs mentioned in this paper other than Faivovich et al. (2005) included all referred species in *Hyla*.

Institutional abbreviations used are as follows: AMNH—American Museum of Natural History, New York; BMNH—British Museum of Natural History, London; DFCH-USFQ—Universidad San Francisco de Quito, Quito; EPN—Departamento de Biología, Escuela



FIG. 1.—Living male holotype of *Hypsiboas nympha* sp. nov. (DFCH-USFQ 0355).

Politécnica Nacional, Quito; FHGO-USFQ—Fundación Herpetológica G. Orcés collection deposited at Universidad San Francisco de Quito, Quito; ICN—Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá; KU—Natural History Museum at the University of Kansas, Lawrence; MCZ—Museum of Comparative Zoology, Harvard University, Cambridge; NHMG, Naturhistoriska Museet, Göteborg, Sweden; NMP6V—National Museum, Prague; QCAZ—Museo de Zoología, Universidad Católica del Ecuador, Quito; ROM—Royal Ontario Museum, Toronto; USNM—National Museum of Natural History, Smithsonian Institution, Washington, DC; ZFMK—Zoologisches Forschungsmuseum Alexander Koenig, Bonn.

SPECIES ACCOUNT

Hypsiboas nympha sp. nov.

Hyla albopunctulata—Duellman and Mendelson, 1995:339; Cisneros-Heredia, 2003:17.

Hyla sp.—Moravec et al., 2002:36.

Hyla sp. 2—Faivovich et al., 2005:11.

Hypsiboas sp. 2—Faivovich et al., 2005:122.

Holotype.—DFCH-USFQ 0355, an adult male (Fig. 1) from Ecuador: Provincia de Sucumbíos: Reserva de Producción Faunística Cuyabeno, (00° 05' 02" S, 76° 12' 54" W, 290 m a.s.l.), ca. 3.3 km E of the Lago Agrio—Tarapoa-Puerto El Carmen Road (remarks), collected on 19 July 2000 by D. F. Cisneros-Heredia, M. Brandt, A. León, C. Ponce, and T. Sugahara.

Paratypes.—AMNH 88088, 94193, 94196, 94198, ZFMK 82884 (females): Ecuador: Provincia de Morona-Santiago: Cusuime, Río

Cusuime (02° 40' S, 77° 42' W), 60 km airline SE Macas, collected between May and July 1971 by B. Malkin. KU 221637 (female): Provincia de Sucumbíos: San Pablo de Kantesiya (00° 15' S, 76° 25' W), collected on 9 February 1988 by J. M. Touzet. DFCH-USFQ 1012 (male) and 1122 (female): Provincia de Orellana: Tiputini Biodiversity Station (00° 37' S, 76° 10' W, 190–270 m), collected on 10 August 1999 and 22 May 2001 by D. F. Cisneros-Heredia, A. Chiriboga, and T. Sugahara. QCAZ 14841 (male): Parque Nacional Yasuní (00° 40' S, 76° 24' W, ca. 300 m), collected on 21 July 1997 by S. Ron. QCAZ 18805 (male): same locality as before, collected on 23 January 2002 by S. Padilla. QCAZ 8907 (female): Provincia de Pastaza: Lorocachi (01° 37' S, 75° 57' W, 220 m), collected on 19 February 1996 by O. Torres et al. NMP6V 71202/1 (male), and 71202/2 (female): Peru: Departamento de Loreto: ca. 5 km NW of the village of Tarapoto, ca. 19 km SW of Iquitos (03° 47' 12" S, 73° 25' 43" W, ca. 120 m), collected on 26 March 2001 by J. Moravec and I. Arista Tuanama. AMNH 96237 (male), 96238 (female): Yagua Indian village, headwaters of Río Loretoyacu: ca. 100 km NW Leticia (Colombia), collected between 22 April–2 May 1970 by B. Malkin. KU 221849 (male): San Jacinto (02° 18' 44.8" S, 75° 51' 46.0" W), collected on 1 July 1993 by N. Woodman.

Referred material.—AMNH 94192, 94194, 94198 (juveniles): Ecuador: Provincia de Morona-Santiago: Cusuime, Río Cusuime (02° 40' S, 77° 42' W), 60 km airline SE Macas, collected between May and July 1971 by B. Malkin. QCAZ 14706 (male): 2 km E de Santiago (03° 02' S, 78° 02' W, 220 m), collected on 28 December 2000. QCAZ 8092 (male): Provincia de Orellana: Carretera Pompeya Sur-Iro km 38 (00° 30' S, 76° 40' W, ca. 300 m): collected on 21 January 1995. EPN 1562: Cotapino (00° 42' S, 77° 28' W, 600 m) (unknown sex, dehydrated specimen), collected by the Olalla brothers, unknown date. QCAZ 9685 (male): Parque Nacional Yasuní (ca. 300 m), collected on 11 May 1996; FHGO-USFQ 3674 (female): same locality as before, collected on 04 September 2002. FHGO-USFQ 2694 (male): Bataburo Lodge, Río Tigiino, collected on 03 September 2001. EPN 8950: Provincia de Pastaza: Unknown locality (unknown sex,

poorly preserved adult), collected by A. Almendáriz. DFCH-USFQ 0390 (juvenile): Provincia de Sucumbíos: collected at the type locality. QCAZ 16327 (unknown sex, poorly preserved adult): Singue (00° 14' N, 76° 18' W, ca. 280 m). QCAZ without number: Puerto Bolívar, Cuyabeno (0° 05' 19" S, 76° 08' 31" W, 240 m) collected on August 2003. ICN 47270 (male): Colombia: Departamento de Amazonas: Vía Tarapaca km. 9, Comunidad Monilla-Amena, collected between 2 and 14 November 2001.

Diagnosis.—A medium-sized member of the *Hypsiboas benitezi* group, (SVL 24.4–31.2 in adult males, 26.0–36.0 in adult females), and defined by the following combination of characters: slender body, head wider than body; snout truncate in dorsal view and protruding in lateral view because of strongly protuberant nostrils; large prominent eyes; palpebral membrane lacking golden reticulations; small tympanum; limbs long and slender; axillary membrane absent; bifid distal subarticular tubercles on fingers I, III, and IV; enlarged prepollex with slender slightly projecting bony spine in males; nuptial excrescences absent in males; mental gland in males; hands one-fourth webbed, feet three-fifths webbed; no inner tarsal fold, tarsal tubercles absent; heel tubercles and calcars absent; cloacal sheath absent or very short; in life, dorsal surfaces bright yellowish green to tan, ventral surfaces translucent bluish or greenish white, iris creamy golden with black periphery, bones green, parietal peritoneum, pericardium and sclera covered by guanophores.

Comparisons.—A prepollical spine is present in all species of *Bokermannohyla* and most *Hypsiboas* (Duellman et al., 1997; Faivovich et al., 2004, 2005). *Hypsiboas nympha* is easily distinguished from members of most species groups of these genera by the mental gland in males. Exceptions are other members of the *H. benitezi* group (*H. benitezi*, *H. lemai*, *H. microderma*, and *H. roraima*; character state unknown in *H. pulidoi*, and *H. rhythmicus*), *H. albopunctatus* group (*H. heilprini*), and *H. punctatus* group (*H. granosus* and *H. punctatus*). The absence of a leaf-green dorsal coloration in life distinguishes *H. nympha* from *H. granosus* and *H. punctatus*. *Hypsiboas nympha* differs from *H. heilprini* for its smaller size, much more slender body, less-developed

prepollical spine, and absence of saclike folds around the cloaca; furthermore, the mental gland in *H. heilprini* is conspicuously thicker. *Hypsiboas nympa* differs from all species in the *H. benitezi* group for lacking a calcar (present in *H. microderma* and *H. roraima*), absence of golden reticulation on the palpebral membrane (present in *H. microderma* and *H. roraima*), absence of any pattern on the thighs (brown markings on hidden surfaces of thighs in *H. roraima*), frequent occurrence of X-shaped dorsal marking (absent in all other species), guanophores present on peritoneum and pericardium (absent in *H. benitezi*, *H. microderma*, and *H. roraima*; character state unknown in *H. pulidoi* and *H. rhythmicus*), lavender or purple coloration in preserved specimens (brownish or grayish in all other species).

Juveniles of *Hypsiboas nympa* could be confused with the syntopic *Dendropsophus miyatai*. However, *D. miyatai* has red markings on a metallic yellow to pink dorsum, a pink venter and a pinkish-tan iris, whereas juveniles of *D. nympa* have green markings on a bright yellow dorsum, a greenish venter and a greenish-tan iris with black periphery.

Description of holotype.—Adult male; SVL 29.8; body slender; head wider than body, slightly wider than long, HW/HL = 1.02, widest below eyes; snout truncate in dorsal view, slightly protruding in lateral profile because of the prominent nostrils; eye-nostril distance slightly longer than diameter of eye, EN/ED = 1.13; canthus rostralis curved, slightly rounded in section; loreal region concave; lips thin, slightly flared; internarial region distinctly depressed; nostrils strongly protuberant, directed dorsolaterally. Interorbital area flat, IOD/ED = 1.90, IOD/HW = 0.57; eyes large and protuberant, ED/HL = 0.30, ED/HW = 0.30; upper eyelid width, 3.2. Palpebral membrane translucent, lacking golden reticulations. Supratympanic fold poorly developed, semi-circular in outline, obscuring uppermost part of annulus, extending up to insertion of the arm; tympanum small, distinct, directed dorsolaterally, separated from eye by a distance slightly longer than tympanum diameter; tympanum diameter slightly larger than DF3. Arm slender, not hypertrophied, lacking an axillary membrane; a row of barely developed ulnar tubercles appearing as an

indistinct fold; fingers moderately long, bearing moderately large, round discs, diameter of disc on Finger III slightly wider than tympanum; relative length of fingers I < II < IV < III; subarticular tubercles small, round, distal one of Fingers I, III, and IV bifid, most prominent on Finger I; supernumerary tubercles absent; carpal tubercles barely noticeable; inner metacarpal tubercle small, flat, round; outer metacarpal tubercle flat, large, elongate; nuptial excrescences absent; prepollex enlarged, slender bony spine slightly projecting at tip; webbing basal between fingers one and two; webbing formula **II** 2⁺—3⁺ **III** 3⁻—3⁻ **IV**. Hind limb long and slender; TL/SVL = 0.51; heels overlapping when hind limbs flexed perpendicular to axis of body; no tarsal fold; calcars and heel tubercles absent; toes moderately long, bearing round discs, slightly smaller than those on fingers; relative lengths of toes I < II < III < V < IV; subarticular tubercles moderately large, round, elevated; supernumerary tubercles absent; outer metatarsal tubercle absent; inner metatarsal tubercle ovoid, flat, indistinct; webbing formula **I** 2—2½ **II** 2—3⁺ **III** 2—3 **IV** 3—2 **V**. Skin on dorsum, head, and dorsal surfaces of forearms and thighs finely shagreen; skin on flanks smooth; skin on belly and ventral surfaces of thighs granular; oval mental gland. Cloacal opening directed posteriorly at upper level of thighs; cloacal sheath absent; cloacal tubercles present, scattered, extending to midlevel of thighs. Tongue ovoid, barely free behind; vomerine odontophores prominent, in two fairly straight series, each bearing 12 teeth, and with the inner margins angled and converging medially; choanae large, elongate; vocal slits moderately long, extending from midlateral base of tongue, almost reaching to angle of jaws; vocal sac single, median, subgular.

In life, dorsal surfaces light yellowish green, with distinct X-shaped gray marking on dorsum, gray horizontal line in sacral region, and gray interocular line; dark canthal stripe; dark anterior lateral stripe between the dorsum and the flanks; melanophores forming weakly defined, irregular transversal bars on dorsal surfaces of limbs; throat greenish cream, venter and ventral surfaces of limbs translucent greenish white, central portion of abdominal parietal peritoneum white, visible

TABLE 1.—Variation of measurements (in mm) of adult *Hypsiboas nympha*. See text for abbreviations.

| Measurement | Males | | | Females | | |
|-------------|----------------|-----------|----------|----------------|-------------|----------|
| | Mean \pm SD | Range | <i>n</i> | Mean \pm SD | Range | <i>n</i> |
| SVL | 29.4 \pm 2.0 | 24.4–31.2 | 10 | 32.7 \pm 2.8 | 26.0–36.0 | 10 |
| HL | 10.9 \pm 1.1 | 8.2–11.9 | 10 | 11.5 \pm 1.3 | 8.7–13.0 | 10 |
| HW | 10.5 \pm 0.8 | 8.8–11.2 | 9 | 11.5 \pm 0.9 | 9.5–13.0 | 10 |
| TYD | 1.5 \pm 0.1 | 1.4–1.7 | 5 | 1.5 \pm 0.3 | 1.3–1.9 | 8 |
| ED | 3.2 \pm 0.4 | 2.5–3.7 | 9 | 3.9 \pm 0.4 | 3.3–4.4 | 9 |
| DF3 | 1.3 \pm 0.2 | 1.2–1.5 | 5 | 1.4 \pm 0.3 | 1.0–1.8 | 8 |
| EN | 3.8 \pm 0.4 | 3.1–4.3 | 10 | 4.0 \pm 0.5 | 3.2–5.0 | 10 |
| IN | 2.2 \pm 0.3 | 1.8–2.5 | 10 | 2.3 \pm 0.3 | 1.8–3.0 | 10 |
| IOD | 5.9 \pm 0.5 | 4.6–6.3 | 9 | 6.2 \pm 0.5 | 5.2–7.0 | 10 |
| TL | 15.6 \pm 0.9 | 13.5–16.7 | 10 | 17.3 \pm 1.4 | 14.6.0–19.4 | 10 |
| FL | 10.7 \pm 0.9 | 9.8–12.0 | 9 | 11.5 \pm 0.9 | 9.4–12.5 | 9 |

through ventral skin; webbing and discs transparent white; iris creamy golden, with broad black periphery, and sclera covered with guanophores; bones green (from D. F. Cisneros-Heredia and M. Brandt field notes, 19 July 2000; and color transparencies).

In alcohol, dorsal surfaces lavender to purplish gray with scattered melanophores. Faint brownish-purple lines on dorsum, extending from scapular region to midlevel of body, forming an indistinct X-shaped marking. Faint brownish purple horizontal line in the interocular region, and other in sacral region. Loreal region, lips and lateral sides of the head pale white with scattered melanophores; dark canthal stripe extending from eye to nostril, larger melanophores scattered around nostrils. Upper half of flanks pale white with dark melanophores, forming an indistinct lateral stripe, lower half of flanks pale white; venter and throat cream; anterior, posterior, and ventral surfaces of limbs and thighs cream;

dorsal surfaces of limbs and thighs purplish gray with densely scattered melanophores; discs and ventral surfaces of hands and feet creamy white; cloacal region with scattered melanophores, cloacal tubercles enameled.

Measurements: SVL 29.8, HL 11.0, HW 11.1, ED 3.3, EN 3.8, IOD 6.3, TYD 1.5, DF3 1.2, NN 2.2, TL 15.3, FL 12.0.

Variation.—Variation of measurements and body proportions is given in Tables 1 and 2. A photograph of the paratype NMP6V 71202/1 is shown in Fig. 2; dorsal and lateral aspects of the head, and the ventral aspects of the hand and foot of the same specimen are depicted in Fig. 3. The vomerine odontophores occur either in straight series anteriorly convergent (NMP6V 71202/1), or with the inner margins angled, converging medially (holotype, AMNH 94193, and, DFCH-USFQ 1012). Also, in the females AMNH 88088, DFCH-USFQ 1122,

TABLE 2.—Variation of proportions of adult *Hypsiboas nympha*. See text for abbreviations.

| Proportion | Males | | Females | |
|------------|-----------|----------|-----------|----------|
| | Range | <i>n</i> | Range | <i>n</i> |
| TL/SVL | 0.49–0.55 | 10 | 0.49–0.56 | 10 |
| FL/SVL | 0.32–0.40 | 10 | 0.34–0.39 | 9 |
| HL/SVL | 0.34–0.40 | 10 | 0.33–0.39 | 10 |
| HW/SVL | 0.31–0.38 | 9 | 0.33–0.37 | 10 |
| IOD/HW | 0.52–0.63 | 9 | 0.52–0.56 | 10 |
| HW/HL | 0.82–1.07 | 9 | 0.90–1.14 | 10 |
| EN/ED | 1.01–1.46 | 9 | 0.92–1.25 | 9 |
| IOD/ED | 1.66–2.10 | 9 | 1.40–1.68 | 10 |
| ED/HL | 0.25–0.33 | 9 | 0.30–0.39 | 9 |
| ED/HW | 0.25–0.38 | 9 | 0.29–0.40 | 9 |
| TY/ED | 0.44–0.51 | 4 | 0.33–0.51 | 7 |

FIG. 2.—Living male paratype of *Hypsiboas nympha* sp. nov. (NMP6V 71202/1).

KU 221637, and ZFMK 82884, the vomerine odontophores are slightly S-shaped. A somewhat intermediate condition is exhibited by AMNH 94195. Number of vomerine teeth varies in some paratypes as follows: males ($n = 4$) 7–11 ($\bar{X} = 8.75$) / 9–10 ($\bar{X} = 9.75$); females ($n = 8$) 9–15 ($\bar{X} = 11.25$) / 10–17 ($\bar{X} = 12.63$). The development of the supratympanic fold is indistinct or diffuse in some specimens (AMNH 96237–238), probably as a result of fixation artifacts. The toe-webbing formulae vary as follow: **I** (2–2⁺)—(2–2^{1/2}) **II** (1^{1/2}–2)—(3–3⁺) **III** (1–2)—(2^{1/2}–3) **IV** (3–3)—(1^{1/2}–2) **V**. The size of the mental gland is variable. In the paratype AMNH 96237 the glandular tissue covers approximately the distal third of the gular area, whereas in NMP6V 71202/1 the glandular tissue extends posteriorly to the anterior margin of the distended vocal sac, covering approximately two thirds of the gular region (Fig. 4A); the size of the gland in KU 221849 is intermediate between the latter (Fig. 4B).

The partially dissected male paratype KU 221849 has ovoid, unpigmented testes, the lengths (1.8 mm) of which are about 30% of kidney length; wolffian ducts are not convoluted.

Overall dorsal coloration in preservative varies from lavender/purple (DFCH-USFQ 0335, 1012, NMP6V 71202/1–2, AMNH 94193, 14841, QCAZ 18805), pinkish purple (AMNH 88088, 94192, 94194–195, 94198, DFCH-USFQ 1122, KU 221637, 221849, QCAZ 8907, ZFMK 82884) to cream (AMNH 96237–238). Dorsal pattern varies mostly regarding presence and distinctiveness of the dark gray interocular band, dorsal X-shaped marking, and the lateral stripe. The X-shaped marking is present in most specimens, with the exception of AMNH 94193 and KU 221849. On NMP6V 71202/1 and DFCH-USFQ 1122 the marking is barely visible, but was very distinct in life (photo in Moravec et al., 2002: Figs. 1, 2). The canthal stripe is less marked in AMNH 88088 and DFCH-USFQ 1122. The lateral stripe is absent in NMP6V 71202/1 (color photographs of this specimen published by Moravec et al., 2002) and AMNH 96238. In juveniles, the lines that make up the marking are broader than in adults which exhibit less prominent narrow lines.

Duellman and Mendelson (1995) described the coloration in life of male paratype KU

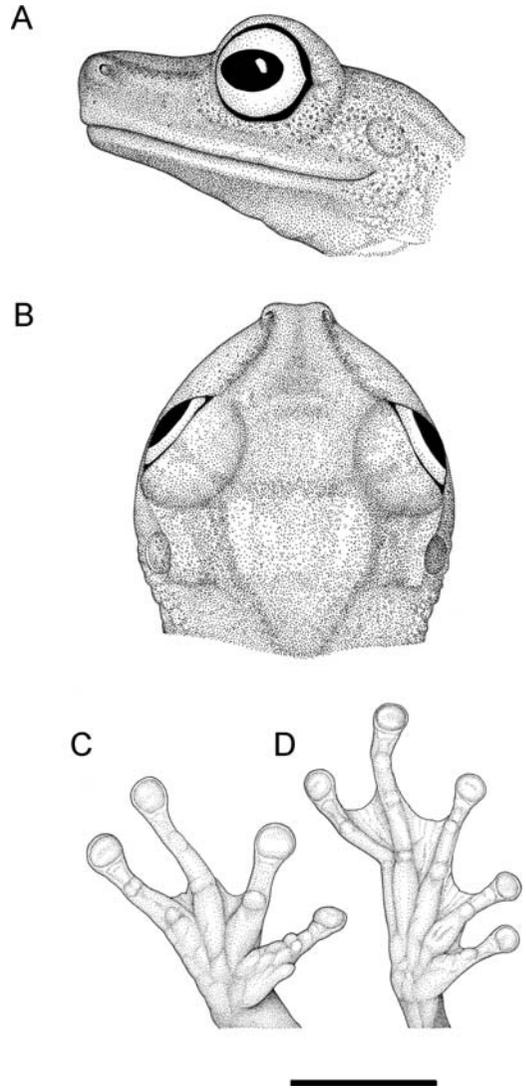


FIG. 3.—Male paratype of *Hypsiboas nymppha* sp. nov. (NMP6V 71202/1). (A) Dorsal, and (B) lateral views of the head, (C) palmar, and (D) plantar view of right hand and foot. Scale bar equals 5 mm.

221849 (using the name *Hyla albopunctulata*) as “At night, pale purple; by day, pale dull green changing to dull tan on dorsum; pale purple on venter and hidden surfaces of limbs; peritoneum white; iris silvery bronze.” The color in life of a juvenile (DFCH-USFQ 0390, SVL 15.5) was “bright yellow dorsum with green stripes, greenish tan iris with black periphery, translucent lemon green thighs with yellow marks, translucent lemon yellow



FIG. 4.—Gular region showing the structure of the mental gland and its variation in males of (A) *Hysiboas nympha* sp. nov. (paratype KU 221849), (B) *Hysiboas nympha* sp. nov. (paratype NMP6V 71202/1), (C) *Hysiboas lemai* (KU 166831), (D) *Hyloscirtus colymba* (AMNH 98365), (E) *Hyloscirtus palmeri* (ICN 20087), (F) *Hyloscirtus albopunctulatus* (syntype BMNH 1880.12.5.159). Scale bar equals 5 mm.

venter, some internal organs visible [liver and intestines]" (from D. F. Cisneros-Heredia and M. Brandt field notes, 20 July 2000). Gross morphological features are fairly invariant, with the exception of NMP6V 71202/2 and DFCH-USFQ 0390, which have a subacuminate snout in dorsal view instead of rounded. The density of the guanophores covering the abdominal portion of the parietal peritoneum

is fairly variable, and they could be partially or totally lost in badly preserved or dehydrated specimens.

Distribution and ecology.—*Hysiboas nympha* is distributed in the western Amazon Basin (Fig. 5). Specimens recorded herein originate from the northern and southern regions of eastern lowland Ecuador and from northeastern Peru at elevations below 600 m, and from

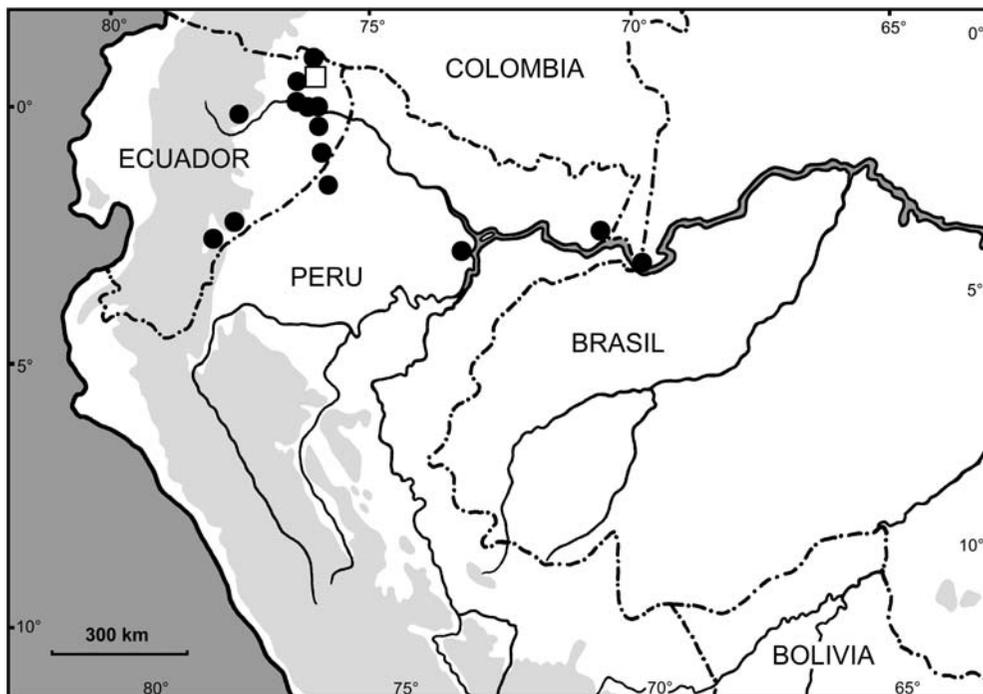


FIG. 5.—Schematic map showing the known distribution of *Hypsiboas nympha* sp. nov. Square indicates the type locality. Shaded areas indicate elevations above 500 m a.s.l.

lowlands of Colombia around Leticia. The northernmost locality of *H. nympha* is “Singue,” province of Sucumbíos, Ecuador (QCAZ 16327), whereas the southernmost record is Leticia, Colombia (K.-H. Jungfer, personal communication May 2004; and referred specimen ICN 47270). The species probably also occurs in adjacent western Brazil.

Hypsiboas nympha seems to prefer the primary Amazonian Lowland Evergreen forests flooded by white waters (varzea) and black waters (igapo), and is found only occasionally in Lowland Evergreen nonflooded forests (terra-firme forest). The type locality is a swampy area (water depth 5–20 cm), approximately 50 m distance from a stream. The arboreal vegetation at the type locality includes species of the families Verbenaceae, Lauraceae, Arecaceae, Bombacaceae, Actinidiaceae, and Rubiaceae, with stem diameters up to 450 mm; the herbaceous coverage was poor, the average canopy height was between 12–23 m (emergent trees up to 40 m). The general topography of the type locality consists of low hills with flat or slightly rounded tops and

slightly convex slopes; the lowermost areas (where the holotype was collected) were flooded. The soils at the type locality are lixiviated, acid, brownish-red typical dystropepts. The holotype was collected at night (2200 h) sitting on a leaf ca. 40 cm above water. Moravec et al. (2002) reported two specimens of *H. nympha* (as *Hyla* sp.) collected “in a swampy area of primary forest with abundant epiphytes and vines and dense growth of herbaceous plants, low palms...perched on the same plant ca. 10 cm beside each other, ca. 130 cm above ground.” One female paratype (DFCH-USFQ 1122) contains approximately 70 unpigmented oviductal eggs of ca. 2 mm. The advertisement call and larvae are unknown.

Other hylids collected at the type locality of *Hypsiboas nympha* are *Dendropsophus leucophyllatus*, *D. marmoratus*, *D. miyatai*, *Hypsiboas boans*, *H. calcaratus*, *H. fasciatus*, *H. geographicus*, *H. granosus*, *H. lanciformis*, *Osteocephalus cabrerai*, *O. planiceps*, *O. taurinus*, *O. yasuni*, *Scinax ruber*, and *Sphaenorhynchus lacteus*.



FIG. 6.—Dorsal view of two syntypes of *Hyloscirtus albopunctulatus*. (A) BMNH 1880.12.5.160, (B) BMNH 1880.12.5.159.

Etymology.—The specific name is derived from the Greek *nymphaē* and in allusion to the beautiful goddesses in Greek mythology that lived in woods and marshes. The name is used here as an invariable noun in apposition.

Remarks.—The type locality was reached by way of a 3320 m transect cut into the primary rainforest of the Cuyabeno Reserve; this transect was made during the environmental survey of the Ñanpaz foundation (a NGO partner in 2000 of City Investing Company, now part of EnCana Corp.). The transect had its initial point at the southeastern border of the “Cielito Lindo” farm, on the Lago Agrio-Tarapoa-Puerto El Carmen road (ca. km 85), at 00° 05′ 04″ S, 76° 14′ 46″ W, and runs eastwards. Two paratypes (NMP6V 71202/1–2) come from “ca. 5 km NW of the village of Tarapoto” in the department of Loreto, Peru. This locality must not be confused with the much better known town of Tarapoto in the department of San Martín. The locality “Cusuime, Río Cusuime” where Boris Malkin collected some paratypes of *Hypsiboas nympha* (AMNH 88088, 94192–195, 94198, ZFMK 82884) is called “Cusuimi, Río Cushuimi” in the physical map of the Republic of Ecuador 1:1,000,000. Also the locality San Pablo de Kantesiya where Jean-Marc Touzet collected one paratype (KU 221637) is called “San Pablo de Kantesiya” in the physical map of the Republic of Ecuador and in Touzet (1986).

DISCUSSION

Throughout this paper we employ the term “mental gland” to describe the glandular tissue

present in the mental area of males of several species of the *Hypsiboas benitezi* group. Unlike the morphology commonly seen in the *Hyloscirtus bogotensis* group, in which the tissue forms a conspicuous, thick, glandular mass of tightly packed glandular units (Fig. 4D–F), the tissue described for species of the *Hypsiboas benitezi* group is a thinner layer composed of looser glandular units (Fig. 4A–C) (for this reason it was termed “flat” mental gland by Faivovich et al., 2005). In the context of the phylogenetic hypothesis of Hylineae advanced by Faivovich et al. (2005), the mental glands present in the *Hypsiboas benitezi* group, in the *H. granosus* + *H. punctatus* clade, in *H. heilprini*, and in the *Hyloscirtus bogotensis* group arose independently. Detailed histological work is necessary to more appropriately characterize the mental gland present in the aforementioned species of *Hypsiboas* and to compare it with that present in the *Hyloscirtus bogotensis* group (Romero de Pérez and Ruiz-Carranza, 1996). Additional research is also needed to better understand morphological and perhaps physiological variation of the gland within the *H. bogotensis* group, as Ruiz-Carranza and Ardila-Robayo (1991) noticed that the mental gland of *H. lynchi* is not apparent externally, but visible through dissections, a different condition from that noticed in the species of *Hyloscirtus* examined in the present study.

Duellman and Mendelson (1995) referred two specimens (KU 221637, 221849), here designated paratypes of *Hypsiboas nympha*, to *Hyloscirtus albopunctulatus*, and used one of them for a detailed redescription of the species. The allocation of that specimen to *H. albopunctulatus* was based on the original description by Boulenger (1882) as well as notes and pictures of the type series taken in 1969 (Duellman and Mendelson, 1995). However, our recent examination of the syntypes of *Hyloscirtus albopunctulatus* revealed several differences between the latter and *Hypsiboas nympha*. As correctly mentioned by Duellman and Mendelson (1995), only one syntype (formerly untagged, now BMNH 80.12.5.160) has white spots on the dorsum (Fig. 6A), whereas in the others the dorsum is uniform pale brown with small, scattered melanophores (Fig. 6B). However, all syntypes have wide fringes on fingers and toes (a putative synapomorphy of

Hyloscirtus; Faivovich et al., 2005), a thicker mental gland (putative synapomorphy of the *Hyloscirtus bogotensis* group; Duellman, 1972), a relatively robust body, short and robust limbs, a well-developed supratympanic fold, a white supraclacal ridge, a white ridge on the arm, and a white ridge on the heel extending along the tarsus, and the outer edge of the fifth toe. These distinctive characters are absent in *Hypsiboas nympha*, suggesting an incorrect allocation of these specimens to *Hyloscirtus albopunctulatus* by Duellman and Mendelson (1995).

Specimens of *Hypsiboas nympha* commonly have been confused in collections, having been identified either as *Hyloscirtus albopunctulatus* or centrolenids. The unique lavender or pinkish dorsal coloration of some preserved specimens of *Hypsiboas nympha* is similar to the coloration found in some species of *Centrolene* and *Cochranella* (Centrolenidae), and is very different from that of most other hylids; the only other case we are aware of is the *Dendropsophus rubicundulus* group (Napoli and Caramaschi, 1998). Both *H. nympha* and species of *Centrolene* (e.g., *C. prosoblepon*, *C. grandisonae*) or *Cochranella* (e.g., *C. cochranae*, *C. megacheira*) have a greenish dorsal coloration in life, which, after a short time in preservative, turns to lavender, pink, or even cream (variation probably related with the preservation methods or time in preservative). Starrett and Savage (1973) discussed the dorsal color patterns in Costa Rican centrolenids and termed the pigment that turns purple after preservation "pigment A," tentatively identifying it as guanine. Possibly, the pigment in the skin of *H. nympha* that changes from green to lavender is the same found in centrolenids. In addition, *H. nympha* has a parietal peritoneum, pericardium, and sclera covered by guanophores, a feature also present in centrolenids and other Hyliinae (e.g., *Hyloscirtus bogotensis* group; Ruiz-Carranza and Lynch, 1991).

In the analysis of Faivovich et al. (2005), *Hypsiboas nympha* (as *Hypsiboas* sp. 2) is recovered as the sister taxon of *H. microderma*. These two taxa are the only species of the *H. benitezi* group that have a western Amazonian distribution, while the other species are restricted to the Guayana Highlands. Current knowledge of the biology of species of the

H. benitezi group is quite poor. Males are reported to call along fast flowing streams in *H. benitezi* (Donnelly and Myers, 1991; Heyer, 1994; Myers and Donnelly, 1997), *H. lemai* (Duellman, 1997), and *H. rhythmicus* (Señaris and Ayarzagüena, 2002). Males of *H. roraima* call from bromeliads, very close to small streams (D. B. Means, personal communication). In *H. microderma*, however, males are reported to call in swampy areas (Pyburn, 1977; Moravec et al., 2002). As reported earlier, males of *H. nympha* were observed in swampy areas, in one case close to a stream. J. D. Lynch (personal communication) reports to have seen this species in Leticia, Colombia, calling along streams.

Relatively large (diameter \approx 2.0–2.5 mm), unpigmented eggs have been reported for *Hypsiboas lemai* (Duellman, 1997) and *H. nympha* (this paper); eggs of *H. roraima* are also large (diameter \approx 2.0–2.2 mm) and mostly unpigmented, with the exception of a small light brown area in the animal pole (J. Faivovich, personal observation on ROM 35189). Duellman (1997) reported that an amplexant pair of *H. lemai* kept in a plastic bag deposited eggs on a leaf. Based on this, and occurrence of calling males on vegetation above a stream, he suggested that eggs are normally deposited on vegetation overhanging streams in which the tadpoles develop. The occurrence of similar eggs in the other species could be taken to suggest a similar reproductive mode.

Hypsiboas hutchinsi was tentatively placed in the *H. benitezi* group by Faivovich et al. (2005) based on its overall similarity, as perceived from the description of Pyburn and Hall (1984). Examination of the holotype suggests that this allocation was incorrect, as the male holotype lacks a mental gland, so far the only putative morphological synapomorphy of the group. Also, unlike species with known eggs in the *H. benitezi* group (see above), *H. hutchinsi* has small (diameter $<$ 1 mm) and pigmented eggs (Pyburn and Hall, 1984).

There is some evidence to associate *Hypsiboas hutchinsi* with the *H. semilineatus* group, as it shares with *H. geographicus* and *H. semilineatus* the prepollex not modified into a projecting spine (as far as we are aware, the only species of *Hypsiboas* where this character

state occurs), the presence of pigmented nuptial excrescences (otherwise apparently present only in *H. melanopleura* of the *H. pulchellus* group; Duellman et al., 1997, but see Lehr and May, 2004), reticulated palpebral membrane (shared with *H. boans*, and *H. wavrini*, two other species of the *H. semilineatus* group; otherwise present in *H. microderma*, and *H. roraima*; Duellman and Hoogmoed, 1992; Pyburn, 1977), and the finely granular dorsal skin texture of *H. geographicus* and *H. semilineatus* (present as well in *H. microderma* according with Pyburn, 1977; not visible in preserved holotype).

Other evidence in potential conflict with a relationship of *Hypsiboas hutchinsi* with the *H. semilineatus* group is that larvae of *H. hutchinsi* have the oral disc completely surrounded with marginal papillae and a 4/7 labial tooth row formula (Pyburn and Hall, 1984). Larvae of species currently included in the *H. semilineatus* group have an anterior gap in the marginal papillae and a 2/3, 2/4, 2/5, or 3/5 labial tooth row formula (Duellman, 1978; D'Heursel and de Sá, 1999; Martins and Moreira, 1991). Within *Hypsiboas*, the larvae known to have the oral disc completely surrounded with marginal papillae are the ones tentatively assigned to *H. benitezi* (Myers and Donnelly, 1997), *H. heilprini* (Noble, 1927), and those of a still undescribed species of *Hypsiboas* that was called *H. semiguttatus* by Faivovich (1996). Labial tooth row formulae approaching the reported 4/7 of *H. hutchinsi* are known to occur in *Hypsiboas* in the larvae tentatively assigned to *H. benitezi*, with 4/8 (Myers and Donnelly, 1997), and in *H. heilprini*, with 6/9 (Noble, 1927). Note that in the context of the results of Faivovich et al. (2005), the oral disc completely surrounded with marginal papillae in the tadpole of *H. benitezi* is more parsimoniously interpreted as a plesiomorphy, as this character state occurs in *Aplastodiscus*, most *Bokermannohyla*, *Hylascirtus*, and *Myersiohyla*.

Based on the previous discussion, we find that the four putative synapomorphies shared by *Hypsiboas hutchinsi*, *H. geographicus*, and *H. semilineatus* outweigh the alternative hypotheses of relationships of *H. hutchinsi* with other *Hypsiboas*. For this reason, we advance the hypothesis that *H. hutchinsi* is a member of the *H. semilineatus* group.

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APPENDIX I

Specimens Examined

Bokermannohyla alvarengai. BRAZIL: Minas Gerais: Serra do Cipó: AMNH 88644, 89373.

Bokermannohyla circumdata. BRAZIL: São Paulo: Boracéia: AMNH 54522–54524.

Bokermannohyla pseudopseudis. **BRAZIL**: Goiás: Chapada dos Veadeiros: AMNH 90194

Dendropsophus miyatai. **ECUADOR**: Orellana: Tiputini Biodiversity Station: DFCH-USFQ 231–235; **PERU**: Loreto: Anguilla: NMP6V 71259.

Hyloscirtus albopunctulatus. **ECUADOR**: BMNH 80.12.5.159–162 (syntypes); Sarayacu: BMNH 80.12.5.230 (syntype).

Hyloscirtus alytolylax. **ECUADOR**: Cotopaxi: Las Pampas: ZFMK 46394–403.

Hyloscirtus colymba. **PANAMA**: Chiriqui: Valle de la Sierpe: ZFMK 38445–448. Coclé: Cont. Div. N. El Copé, 600 m: AMNH 98364–365.

Hyloscirtus palmeri. **COLOMBIA**: Valle del Cauca: Jimenez: BMNH 1947.2.13.32–33 (syntypes); Antioquia: Frontino: Vereda Venados, Parque Nacional Natural Las Orquideas, quebrada El Retiro, 850 m: ICN 20087.

Hyloscirtus phyllognathus. **PERU**: Roque: NHMG 474 (holotype).

Hyloscirtus torrenticola. **ECUADOR**: Napo: Cascada San Rafael, on Rio Quijos, at km 102, INECEL station, 1350 m: USNM 286399.

Hypsiboas albomarginatus. **BRAZIL**: 20 km N Rio de Janeiro: ZFMK 38801–802, 39495–496.

Hypsiboas albopunctatus. **BOLIVIA**: Santa Cruz: P.N. Noel Kempff Mercado: ZFMK 67049, 72698.

Hypsiboas benitezi. **VENEZUELA**: Bolívar: North side of Cerro Guaiquinima: AMNH 133843–133848; Amazonas: Mt. Duida, 2300 ft.: USNM 291067.

Hypsiboas boans. **BOLIVIA**: Santa Cruz: P.N. Noel Kempff Mercado: ZFMK 67046; **GUYANA**: Tableau Pond, 4 mi. (by Rd.) NW Dubulay Ranch house: AMNH 141014–14017; **PERU**: Loreto: Anguilla: NMP6V 71249; Madre de Dios: Puerto Maldonado: ZFMK 35909.

Hypsiboas calcaratus. **ECUADOR**: Orellana: Tiputini Biodiversity Station; DFCH-USFQ 206, 208–10; **PERU**: Loreto: km 31 on road Iquitos–Nauta: NMP6V 71250.

Hypsiboas dentei. **BRAZIL**: Amapá: Vila Nova: AMNH 140755; Serra do Navio: AMNH 140756.

Hypsiboas fasciatus. **BOLIVIA**: Pando: Cobija: ZFMK 67143–144; **ECUADOR**: Orellana: Tiputini Biodiversity Station: DFCH-USFQ 207; **PERU**: Loreto: 20–30 km SW of Iquitos: NMP6V 71149, 71251/1–2; Aguajito: ZFMK 41407.

Hypsiboas geographicus. **BOLIVIA**: Beni: Río Cheveje-cure: ZFMK 62829; Santa Cruz: P.N. Noel Kempff Mercado: ZFMK 67047, 72690; **ECUADOR**: Orellana: Tiputini Biodiversity Station: DFCH-USFQ 109, 147–8; Sucumbíos: Reserva de Producción Faunística Cuyabeno: DFCH-USFQ 377; **PERU**: Loreto: Anguilla: NMP6V 71252/1–2; **GUYANA**: Berbice River Camp, at ca. 18 mi.

(linear) SW Kwakwa (ca. 2 mi. downriver from Kurundi River confluence): AMNH 166146–157.

Hypsiboas granosus. **BOLIVIA**: Pando: Cobija: ZFMK 66820; **ECUADOR**: Napo: near Tena: DFCH-USFQ 712–13; **GUYANA**: Roraima area: ZFMK 47694–695; **PERU**: Loreto: Iquitos region: NMP6V 71185–86, 71255.

Hypsiboas heilprini. **DOMINICAN REPUBLIC**: Provincia Duarte: Los Bracitos: AMNH 11401 (holotype); 31297–300; 31305–07; 37477–78 (paratypes).

Hypsiboas hutchinsi. **COLOMBIA**: Vaupés: ca. 2 km SW Umuñapito: UTA 24819 (holotype).

Hypsiboas lanciformis. **BOLIVIA**: Pando: Cobija: ZFMK 66776–777; **BRAZIL**: Acre: km 29 Rio Branco-Puerto Acre Rd.: AMNH 139307–308.

Hypsiboas lemai. **GUYANA**: Mount Ayangana: ROM 39569, 39570. **VENEZUELA**: km 112 road El Dorado–Santa Elena de Uairén: KU 166831.

Hypsiboas lundii. **BRAZIL**: Minas Gerais: Serra do Cipó, km 110: AMNH 89374.

Hypsiboas microderma. **COLOMBIA**: Vaupés: Yapima: UTA 5012 (holotype); **PERU**: Loreto: Puerto Almendras, 17 km SW Iquitos: NMP6V 71258/1; Anguilla, 50 km W Iquitos: NMP6V 71258/2.

Hypsiboas multifasciatus. **BOLIVIA**: Santa Cruz: P.N. Noel Kempff Mercado: ZFMK 67048.

Hypsiboas ornatissimus. **SURINAM**: Marowijne: Loe Creek: 54 km (air) S. Oelemari: AMNH 90790.

Hypsiboas pellucens. **ECUADOR**: Pichincha: Santo Domingo de los Colorados (650 m): AMNH 89690–89695.

Hypsiboas picturatus. **ECUADOR**: Pichincha: San Vicente de Andoas: DFCH-USFQ 0BM5; **COLOMBIA**: Nariño: Guayaquina (500 m): AMNH 87921.

Hypsiboas polytaeniis. **BRAZIL**: Petropolis: ZFMK 38807.

Hypsiboas punctatus. **BOLIVIA**: Pando: Cobija: ZFMK 66813; Santa Cruz: La Florida: ZFMK 60367–373; San Ramon: ZFMK 60393–394; **PARAGUAY**: vicinity of Asunción: ZFMK 55249–250; **PERU**: Loreto: Puerto Almendras: NMP6V 71188/1–3; Andoas: ZFMK 39319–322.

Hypsiboas pulidoi. **VENEZUELA**: Territorio Amazonas: Monte Duida, 2000 pies: MCZ 72499 (holotype).

Hypsiboas raniceps. **PARAGUAY**: Canendiyu: AMNH 155921–922.

Hypsiboas roraima. **GUYANA**: Mount Ayangana: ROM 39611, 39616, 39623–624.

Hypsiboas rufitelus. **COSTA RICA**: between Limon and Cahuita: ZFMK 42112; La Selva: ZFMK 56550; **PANAMA**: Bocas del Toro: Rambala: ZFMK 47788–791.

Hypsiboas semilineatus. **BRAZIL**: Espiritito Santo: Sooretama, Linhares: USNM 164162–163.

Hypsiboas sibleszi. **GUYANA**: Mount Ayangana: ROM 39553, 39554, 39556, 39558.