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A NEW SPECIES OF FANGED FROG, GENUS *LIMNONECTES* (AMPHIBIA: ANURA: DICROGLOSSIDAE) FROM SOUTHEAST MINDANAO ISLAND, PHILIPPINES

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ABSTRACT: A new species of fanged frog (genus *Limnonectes*) is described from Davao Del Norte Province, eastern Mindanao Island, Philippines. The new species can be diagnosed on the basis of external morphology, with notable diagnostic features being its moderately large size (79.6 and 84.3 mm SVL for two males and 69.3 mm SVL for the single available female specimen), the possession of white-tipped dorsal asperities, arrangement of asperities into distinct circular clusters throughout the skin of the dorsum, a completely visible tympanum, fully webbed feet, and moderately large odontoid processes of the lower jaw. Discovery of the new species emphasizes the degree to which the biodiversity of the Mindanao Faunal Region currently is misunderstood.

Key words: Biodiversity; Cryptic species; Endemism; Fanged frogs; Mindanao Faunal Region; Philippines

THE FANGED frogs of Asia are a moderately species-rich group of 53 described taxa distributed across much of SE Asia (Evans et al., 2003; Inger, 1999; AmphibiaWeb, 2007: www.amphibiaweb.org). Species of the genus *Limnonectes* have been recorded from as far west as India and China, through the Malaysian Peninsula and the Sunda Shelf Islands of Indonesia, the Philippines, and as far east as the Indonesian islands of the Malukus, the Lesser Sundas, and Papua New Guinea (Daudin, 1802; Duellman, 1993; Frost, 1985; Inger, 1999; Inger and Tan, 1996; Iskandar, 1998; Iskandar and Tjan, 1996; Smith, 1927; Zhao and Adler, 1993).

Recently, many undescribed cryptic species have been identified (Evans et al., 2003), and widely distributed polytypic species complexes are commonly discussed in taxonomic and geographic summaries (Inger, 1999; Iskandar and Colijn, 2000; Iskandar and Tjan, 1996). Reviews of SE Asian biogeographical history and polytypic species groups have emphasized the complex geological history of the region (Brown and Diesmos, 2008; Hall, 1996, 1998) as a potential generator of anuran species diversity (Brown and Diesmos, 2002). In the Philippines, many studies have highlighted the impact that the formation of Pleistocene Aggregate Island Complexes (PAICs) may have had on the evolutionary process of speciation (Brown and Diesmos, 2002; Brown et al., 2000; Brown et al., 2002; Heaney, 1985). These and other studies suggest that the known diversity of Philippine fanged frogs, like that of other anuran groups in the Philippines, is underestimated (Brown et al., in press).

The few available molecular phylogenetic studies of *Limnonectes* suggest that numerous cryptic species may exist (Emerson, 1996; Emerson et al., 2000; Evans et al., 2003), especially in "widespread" species (complexes) like the *L. kuhli* and *L. blythi* groups; however, taxonomists have been reluctant to describe these taxa on the basis of molecular sequence data alone and revisionary studies have lagged far behind molecular work (Iskandar and Tjan, 1996; R. F. Inger, D. T. Iskandar, A. C. Alcala, personal communication). Nevertheless, some of the undescribed species are morphologically distinct and readily diagnosable on the basis of morphological characters.

There are five described species of *Limnonectes* on the large southern Philippine island

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of Mindanao. These include *L. magnus* and *L. leytensis*, species found throughout the Mindanao Faunal Region (Mindanao, Samar, Leyte, Dinagat, Bohol, and Siargao islands), *L. diuatus* (known only from Mindanao), and *L. parvus* known only from Mindanao and Basilan islands. Additionally, *Limnonectes micrixalus* was described from Basilan Island of the Sulu Archipelago and has been reported on the western tip of the Zamboanga Peninsula of Mindanao (Inger, 1954; Taylor, 1923).

In May 1994, J. W. Ferner and party surveyed frog diversity along the Simulaw River Drainage of Mt. Pasian in eastern Mindanao Island (Fig. 1). Three individuals of a morphologically highly distinct undescribed species of *Limnonectes* were collected. Although no additional specimens have been collected in the nearly 15 intervening years, we are compelled to take taxonomic action at this time because the new species is so distinct and because ignorance of biodiversity in part contributes to forest destruction throughout the southern Philippines.

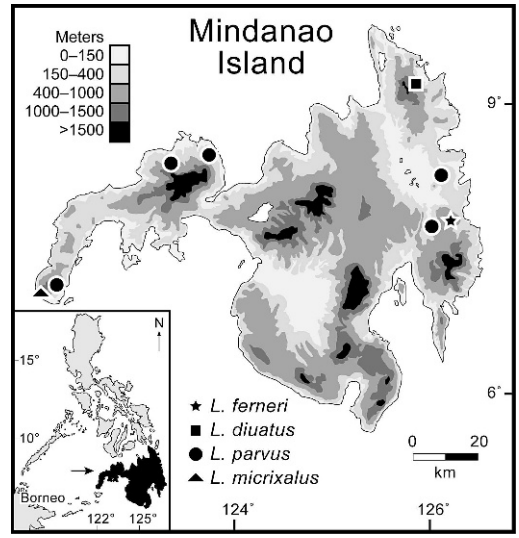

FIG. 1.—Distribution of fanged frogs on Mindanao Island, Philippines. The inset shows the location of Mindanao Island (darkly shaded) in the southern Philippines. The type locality of *L. ferneri* (Mt. Pasian, Municipality of Monkayo, Davao Del Norte Province) is indicated with a black star; the type locality of *L. diuatus* (Diwata Mountains) is indicated with a black square; known localities for *L. parvus* are indicated with black circles; the known Mindanao distribution of *L. micrixalus* is indicated with a triangle. *Limnonectes magnus* and *L. leytensis*, as currently recognized, possess wide distributions throughout the Mindanao faunal region.

MATERIALS AND METHODS

We recorded morphometric data from alcohol-preserved specimens that were originally fixed in 10% formalin (Appendix 1). Sex was determined by gonadal inspection, and measurements were taken with digital calipers to the nearest 0.1 mm. To minimize interobserver bias and other sources of potential error (Hayek et al., 2001; Lee, 1982, 1990), all measurements were scored by CDS.

Characters measured follow Matsui (1984), Brown et al. (2000), and Emerson (1994), and include: snout–vent length (SVL), head length (HL), mandible–nares length (MNL) head width (HW), eye–narial distance (END), snout length (SNL), interorbital distance (IOD), internarial distance (IND), eye diameter (ED), upper eyelid width (UEW), horizontal tympanic annulus diameter (TAD), upper arm length (UAL), forearm length (FAL), femur length (FEL), tibia length (TBL), pes length (PL), manus length (ML), and odontoid length (OPL). In the description, ranges are followed by mean ± standard deviation in parentheses. Webbing terminology follows Guayasamin et al. (2006) as modified from Savage and Heyer (1967).

RESULTS

Limnonectes **ferneri** *sp. nov.*
(Figs. 2–4)

Holotype.—PNM 9506 (Formerly CMNH 5574; collection no. JWF 94093), an adult male collected 19 May 1994 in the Simulaw River Drainage, 2.3 km N, 1.0 km E of Peak 1409, Mt. Pasian (7° 58′ 16.26″ N, 126° 17′ 50.52″ E; WGS-84), Municipality of Monkayo, Davao Del Norte Province, Mindanao Island, Philippines, by John W. Ferner.

Paratopotypes.—One male, CMNH 5572 (JWF 94091), and one female, CMNH 5573 (JWF 94094), collected by John W. Ferner on the same date and at the same locality as the holotype.

Diagnosis.—*Limnonectes ferneri* can be distinguished from other Philippine congeners and morphologically similar nonPhilippine

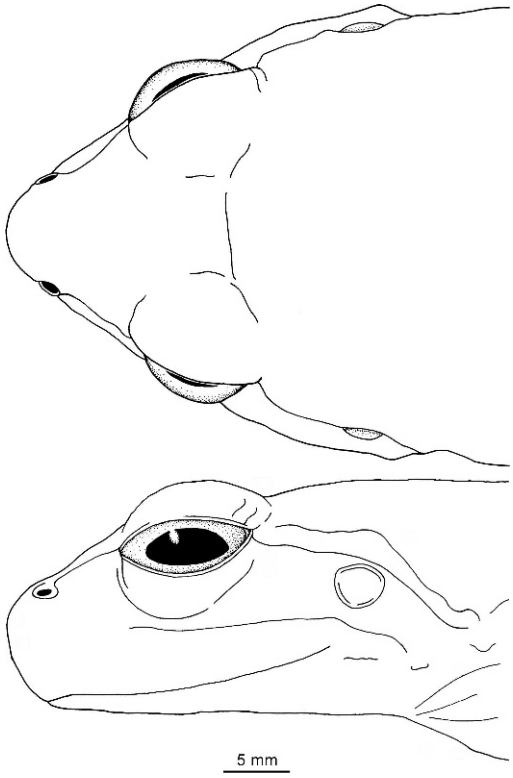

FIG. 2.—Head of male holotype of *Limnonectes ferneri* (PNM 9506) in dorsal and lateral views. Illustrations by CDS.

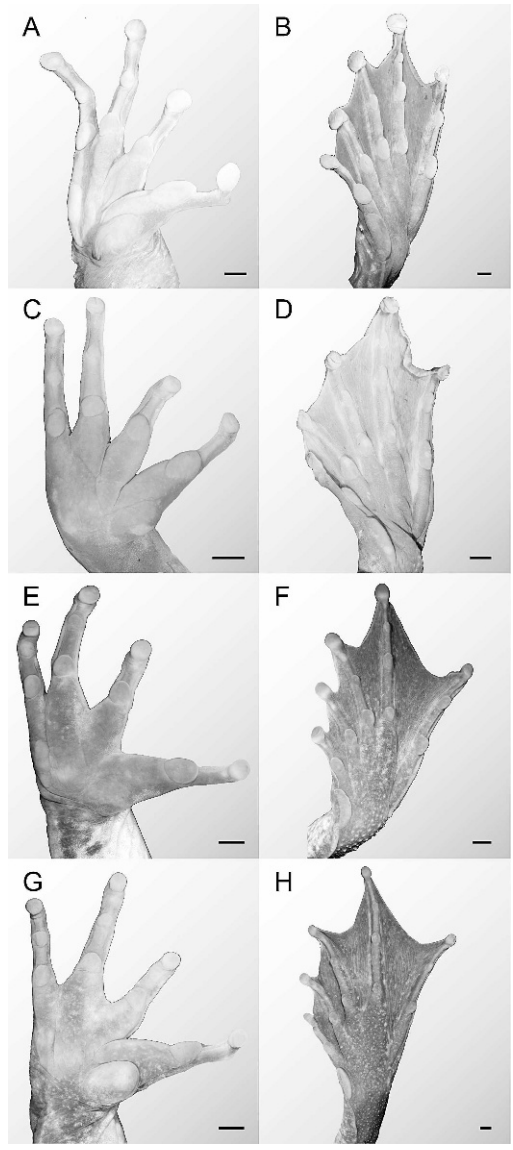

FIG. 3.—Ventral views of hand (A) and foot (B) of male holotype of *Limnonectes ferneri* [PNM 9506], hand (C) and foot (D) of male *Limnonectes diuatus* [CAS 139393], hand (E) and foot (F) of female *Limnonectes kuhlii* [TNHC 59829], and hand (G) and foot (H) of male *Limnonectes magnus* [KU 306041]. Scale bars = 2 mm.

congeners, *L. kuhlii*, and *L. asperatus* by the following combination of characters: body moderately large (79.6 and 84.3 mm SVL for two males and 69.3 mm SVL for the single available female); odontoid moderately long (2.7 mm for males, 1.1 mm for females); dorsal skin smooth to rugose; tympanum completely visible; supratympanic fold prominent, rugose; extensive foot webbing; snout rounded; Finger I > Finger II; presence of densely distributed white-tipped dorsal asperities throughout the dorsum; dorsal asperities distributed in radial clusters; dorsal folds/ridges absent (Table 1).

Comparisons.—The new species most closely resembles *Limnonectes diuatus*, a montane endemic known from NE Mindanao (Fig. 1). In their description of *L. diuatus*, Brown and Alcala (1977) proposed a taxonomic affinity between *L. diuatus* and *L. kuhlii* from Java, Indonesia, on the basis of size, dorsal color pattern, webbing, tuberculation, and habitat preferences. We compare the new species to all Philippine congeners (*L. acanthi*, *L. diuatus*, *L. leytensis*, *L. macrocephalus*, *L. magnus*, *L. micrixalus*, *L. palavanensis*, *L. parvus*, *L. visayanus*, and *L. woodworthi*), and distantly allopatric (but

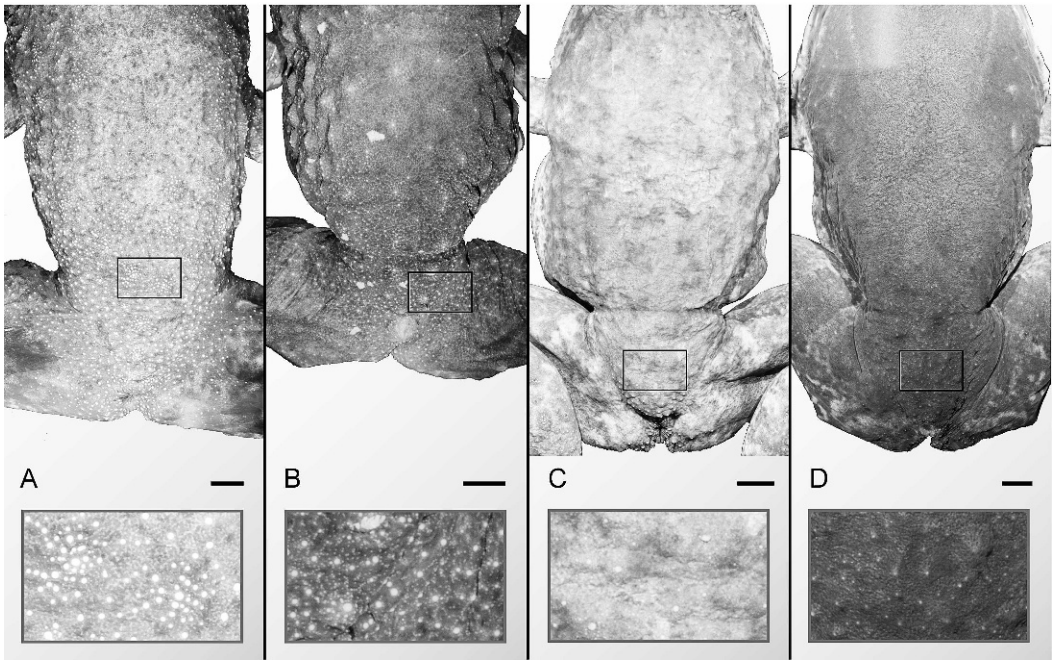

FIG. 4.—Dorsal views of (A) *Limnonectes ferneri* [PNM 9506; male, SVL 84.3 mm, Holotype], (B) *Limnonectes diuatus* [CAS 139393; male, SVL 58.4 mm], *Limnonectes kuhlii* [TNHC 59829; female, SVL 64.2 mm], and (C) *Limnonectes magnus* [KU 306041; male, SVL 85.3 mm] exhibiting the presence and absence of white dorsal asperities and white-tipped dorsal tubercles and tubercle clusters. Magnified images are denoted by black boxes and are found below dorsal views. Scale bars = 5 mm.

phenotypically similar) *L. kuhlii* and *L. asperatus*. Morphological characters of the new species are defined while character states of opposing species are shown in parentheses.

Limnonectes ferneri is easily distinguished from *L. diuatus* by a larger body size (Table 1). In addition, it has smooth to rugose dorsal skin (rugose); Finger I > II (I = II); densely distributed white-tipped dorsal asperities (sparsely); aggregate clusters of white-tipped dorsal asperities (Fig. 4; absence); round snout in dorsal aspect (acuminate); and absence of dorsal folds and ridges (presence).

Limnonectes ferneri is distinguished from the phenotypically similar nonPhilippine species of *Limnonectes* (*L. asperatus* and *L. kuhlii*) by its larger body size (Table 1); having smooth to rugose dorsal skin (smooth in *L. kuhlii* and highly rugose in *L. asperatus*); and having a completely visible tympanum (completely or partially hidden). The new species is further diagnosed from *L. kuhlii* by the presence of white-tipped dermal asperities (Fig. 4; absence), and having a prominent and rugose supratympanic fold (not prominent and smooth). From *L. asperatus*, the new species further differs by the presence of aggregate clusters of white-tipped dorsal asperities (absence); its larger odontoid process length (Table 1); having more extensive foot webbing (Table 1); having a less rugose supratympanic fold (highly rugose); having Finger I > Finger II length (=); having a rounded snout in dorsal aspect (broadly rounded); and the absence of dorsal folds and ridges (presence).

The new species is distinguished from the remaining large-bodied Philippine species of *Limnonectes* (*L. acanthi*, *L. macrocephalus*, *L. magnus*, *L. visayanus*, and *L. woodworthi*) by the presence of white-tipped dorsal dermal asperities (Table 1); the presence of aggregate clusters of white-tipped dorsal asperities (absence); having smooth to rugose dorsal skin (Table 1); and having a round snout in dorsal aspect (Table 1). From *L. macrocephalus* and *L. magnus*, *L. ferneri* is further

TABLE 1.—Summary of qualitative diagnostic characters (present, absent) in *Limnonectes ferneri*, non-Philippine (but phenotypically similar) congeners *L. kuhlii* and *L. asperatus*, and large bodied Philippine congeners. Sample size for each sex, body size, odontoid process length, and general geographical distribution (PAIC = Pleistocene Aggregate Island Complexes, sensu Brown and Diesmos, 2002) are included for reference (SVL and OL given as range over mean ± standard deviation). *L. leytensis*, *L. micrixalus*, *L. palavanensis*, and *L. parvus* were not included due to their dramatically smaller body sizes.

	ferneri (2m, 1f)	*diuatus* (1m, 1f)	*magnus* (11m, 11f)	*acanthi* (11m, 10f)	*visayanus* (10m, 10f)	*woodworthi* (3m, 10f)	*macrocephalus* (5m, 3f)	*kuhlii* (6m, 10f)	*asperatus* (2m)
SVL (male)	79.6, 84.3	58.4	71.2–164.4 (92.5 ± 33.8)	61.0–73.4 (67.8 ± 3.3)	73.9–94.2 (80.0 ± 7.4)	57.3–63.3 (59.7 ± 3.2)	78.9–144.6 (102.5 ± 25.2)	55.0–81.5 (71.5 ± 8.9)	35.1, 39.9
SVL (female)	69.3	62.3	66.3–130.8 (80.6 ± 17.5)	64.1–75.2 (70.1 ± 4.0)	75.4–89.0 (83.9 ± 4.2)	58.3–69.5 (63.7 ± 3.6)	92.2–113.3 (99.5 ± 12.0)	52.7–75.3 (63.2 ± 7.5)	—
OL (male)	2.7, 2.7	2.0	2.2–5.8 (2.8 ± 1.0)	1.5–2.2 (1.9 ± 0.2)	1.8–3.0 (2.4 ± 0.4)	1.3–1.6 (1.5 ± 0.1)	2.3–4.3 (3.4 ± 1.0)	1.4–3.4 (2.5 ± 0.7)	1.8, 1.8
OL (female)	1.1	1.5	0.7–1.6 (1.0 ± 0.2)	0.8–1.0 (0.9 ± 0.1)	1.0–2.0 (1.4 ± 0.3)	0.7–0.9 (0.8 ± 0.1)	1.1–1.4 (1.3 ± 0.1)	0.5–1.6 (1.0 ± 0.3)	—
Range	SE Mindanao Island	NE Mindanao Island	Mindanao PAIC	Palawan and Mindoro Islands	Visayan PAIC	SE Luzon Island	Luzon Island	Indonesia	Borneo
Dorsal skin rugosity	Smooth to rugose	Rugose	Smooth	Rugose	Rugose	Smooth	Rugose	Smooth	Highly rugose
Tympanum hidden	No	No	Dorsal edge	No	No	No	Dorsal/ posterior edge	All or partially	Posterior 1/3
Supratympanic fold	Prominent, rugose	Prominent, rugose	Prominent, rugose	Prominent, smooth	Prominent, smooth	Less Prominent, smooth	Prominent, smooth	Not prominent, smooth	Prominent, highly rugose
Snout shape	Round	Highly pointed	Pointed	Moderately round	Pointed	Moderately pointed	Moderately round	Round	Broadly round
Finger I L vs. II L	1 > 2	1 = 2	1 > 2	1 > 2	1 > 2	1 > 2	1 > 2	1 > 2	1 = 2
White-tipped dorsal asperities[1]	+, densely distributed	+, sparse	−	+, posterior 1/4 body	+, posterior 1/4 body	−	+, posterior 1/4 body	−	+
White-tipped dorsal asperity clusters	+	−	−	−	−	−	−	−	−
Irregular dorsal folds/ridges	−	+	−	+	+	+	+	−	+
Continuous dorsolateral folds	−	−	−	−	−	+	−	−	−
Webbing extent	I 0–0^+ II 0–0^+ III 0–0^+ IV 0^+–0^+ V	I 0^+–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0^+ V	I 0^+–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0^+ V	I 0–0^+ II 0–0^+ III 0–0^+ IV 0^+–0^+ V	I 0^+–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0^+ V	I 0^+–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0^+ V	I 0–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0 V	I 0^+–0^+ II 0^+–0^+ III 0^+–0^+ IV 0^+–0^+ V	I 0^+–1^+ II 0^+–1^+ III 1–1^- IV 1^-–0^+ V

[1] Unless otherwise stated, the presence of this character indicates its presence across the entire dorsal surface.

distinguished by its smaller body size (Table 1); and having a completely visible tympanum (dorsal and/or posterior edge hidden). The new species is distinguished from *L. acanthi*, *L. macrocephalus*, *L. visayanus*, and *L. woodworthi* by the absence of dorsal folds and ridges (presence) and by having a rugose supratympanic fold (smooth). The new species is further distinguished from *L. acanthi*, *L. visayanus*, and *L. woodworthi* by having more extensive foot webbing (Table 1). From *L. woodworthi*, the new species is distinguished by its larger body size (Table 1); the absence of continuous dorsolateral folds (presence); and the absence of dark lateral head coloration (presence).

From the small-bodied Philippines species (*L. leytensis*, *L. micrixalus*, *L. palavanensis*, and *L. parvus*), *Limnonectes ferneri* is distinguished by its larger body size (*L. ferneri* [male SVL = 79.6–84.3 mm, female SVL = 69.3 mm], *L. leytensis* [male SVL = 28.9–30.0 mm, female SVL = 25.8–34.0 mm], *L. micrixalus* [female SVL = 30.0 mm (Inger, 1954)], *L. palavanensis* [female SVL = 30.0–37.6 mm], and *L. parvus* [female SVL = 30.0 mm (Inger, 1954)]); having more extensive foot webbing (webbing formula on foot I $0–0^{+}$ II $0–0^{+}$ III $0–0^{+}$ IV $0^{+}–0^{+}$ V for *L. ferneri* I $0^{+}–1^{+}$ II $0^{+}–2^{-}$ III $0^{+}–2^{+}$ IV $2^{+}–1^{-}$ V for *L. leytensis*, I $0^{+}–2^{+}$ II $2^{+}–1^{+}$ III $1^{+}–2^{+}$ IV $2^{+}–1^{+}$ V for *L. micrixalus*, I $1^{+}–2$ II $0^{+}–2^{+}$ III $0^{+}–3^{-}$ IV $3^{-}–1^{+}$ V for *L. palavanensis*, and I $2–2^{1/2}$ II $2^{-}–3^{-}$ III $2^{1/2}–3^{2/3}$ IV $3^{1/3}–2^{+}$ V for *L. parvus*); and the presence of white-tipped dorsal dermal asperities (absence in *L. micrixalus*, *L. palavanensis*, and *L. parvus*, or presence and restricted to posterior ¼ of body in *L. leytensis*). *Limnonectes ferneri* is further distinguished from *L. leytensis* and *L. parvus* by having smooth to rugose dorsal skin (rugose in *L. leytensis*, or smooth in *L. parvus*); having a rugose supratympanic fold (smooth); and having Finger I > Finger II length (=). From *L. micrixalus*, *L. leytensis*, and *L. parvus*, the new species is distinguished by the absence of an inverted "v" shaped mark in the scapular region (presence). The new species is distinguished from *L. micrixalus* and *L. leytensis* by the absence of dorsolateral folds (presence). From *L. leytensis*, the new species is further distinguished by having a round snout in dorsal aspect (moderately pointed); the absence of irregular dorsal folds and ridges (presence); and the presence of aggregate clusters of white-tipped dorsal asperities (absence).

Description of holotype.—A mature male; habitus robust; head broader than body, head length 30.8% SVL; head length 78.3% head width; snout tip rounded in dorsal and lateral aspect (Fig. 2); upper lips moderately swollen, forming protuberant ridge posteriorly towards the angle of the jaw; interorbital region rugose; eye diameter 98.9% snout length, 1.4× eye–nares distance; pupil horizontally elliptical; canthus rostralis laterally concave in dorsal aspect; loreal region flat; nostrils oriented posterolaterally; internarial region slightly convex; tympanic annulus distinct, its diameter 0.34× eye diameter; dorsal margin of tympanic annulus in contact with supratympanic fold; fold strongly protuberant, rugose, extending from posterior corner of eye across to supra-axillary region. Tongue elongate, tapered anteriorly, with broad anterior attachment; choanae situated at anterolateral edge of palate, tear-shaped, with narrow point facing posterolaterally, widely separated by distance four to five times greater than diameter of single choana; dentigerous process of vomer distinct, with seven teeth on each side; dentigerous process angled anterolaterally, approximately at 45° incline with closest (posterior) points separated by distance approximately equal to one-third diameter of single choana, their most distant (anterior) ends separated by distance equal to 1.5 times diameter of single choana; short vocal slits at posteroventral margin of mouth; odontoid distinct, tips pointed, 2.7 mm in length.

Manus length 41.2% pes length; tibia length 70.9% pes length; tibia length 44.8% SVL; fingers robust; terminal discs slightly expanded (Fig. 3A); relative lengths of fingers: II < IV < III = I; subarticular tubercles prominent, convex; one subarticular tubercle below Digits I and II, two tubercles under Digits III and IV; supernumerary tubercles absent; thenar (inner metacarpal) and palmar (outer metacarpal) enlarged, elongate, ovoid; nuptial pads, asperities, and webbing absent; forearm musculature hypertrophied.

Tarsus folds and flaps absent; terminal discs of toes moderately expanded, with distinct circummarginal grooves; plantar surfaces of foot with well-developed, prominently rounded to pointed subarticular tubercles (Fig. 3B); relative lengths of toes: I < II < III < V < IV; webbing formula on foot I 0–0^+ II 0–0^+ III 0–0^+ IV 0^+–0^+ V; postaxial flap of skin running along entire outer edge of Toe V; inner metatarsal tubercle prominent, elongate, ovoid, with sharp spade-like ventral edge; outer metatarsal tubercle absent.

Skin of dorsal surfaces of trunk and head textured, bearing heterogeneous dermal asperities (tiny but perceptible, to large and clustered) and tubercle clusters; tubercles across dorsum consisting of single, raised tubercle, short, raised ridge, or large, irregular, raised tubercle cluster; all raised surfaces capped with round, white-tipped dermal asperities; tubercle clusters consisting of 5–28 white asperities, clusters irregularly dispersed across dorsum; dermal asperities concentrated on posterior two-thirds of dorsum, dorsal surfaces, and eye lids (Fig. 4A); dorsum covered with irregular, low ridges, none spanning entire body length, and concentrated in dorsolateral surface; ventral surfaces of head smooth; lateral and ventral surfaces of limbs smooth with dorsal surfaces tuberculate, having concentrated white dermal asperities; flanks shagreen; subarticular tubercles on manus velvety in texture; tarsus rugose on dorsolateral surface, white dermal asperities concentrated on heel, plantar surfaces of foot smooth; cloacal region wrinkled, densely covered with white dermal asperities and asperity clusters.

Coloration of holotype in preservative.—Dominant dorsal color on head, body, and limbs uniform dark chocolate-brown with distinct white dermal asperities; dorsal surfaces of limbs with transverse, irregular, light brown blotches; interorbital bar absent; center of tympanum dark brown to black; lips uniform brown; lower lip coloration interrupted by irregular light brown blotches; dark brown flanks, blending into lighter, mottled venter; dorsal surfaces of manus, pes, and digits dark brown with light brown blotches above each phalangeal articulation.

TABLE 2.—Summary of univariate morphological variation among mensural characters in the type series of *Limnonectes ferneri*.

	Female $n = 1$	Male $n = 2$
SVL	69.3	79.6, 84.3
HL	25.1	26.0, 27.0
HW	28.3	32.1, 33.1
SNL	6.8	10.2, 10.3
IND	6.2	6.9, 6.9
IOD	5.2	7.1, 7.7
ED	9.5	8.9, 10.1
END	5.4	7.3, 7.3
TAD	3.3	3.5, 3.6
MNL	22.2	25.4, 26.2
UEW	7.3	7.4, 7.7
UAL	9.9	13.0, 13.2
FAL	14.6	16.0, 16.1
ML	18.5	21.1, 21.9
FEL	32.2	37.8, 37.9
TBL	33.9	37.4, 37.8
PL	46.2	52.7, 53.3
OL	1.1	2.7, 2.7

Throat lighter than dorsum, marbled dark and light brown; light brown to tan bar across anterior portion of chest; forelimbs with light brown and tan mottled coloration, ventral surfaces with white blotches across margin between upper arm and forearm; venter mottled dark and light brown; ventral surfaces of thigh mottled light brown and tan, tibia and tarsus darker brown; palmar and plantar surfaces of hands and feet dark brown, with gray subarticular tubercles; foot webbing mottled light and dark brown; lower eyelid light brown around periphery with light blue-gray center. Color in life unrecorded.

Measurements of holotype (mm).—SVL 84.3; HL 26.0; HW 33.1; SNL 10.2; IND 6.9; IOD 7.7; ED 10.1; END 7.3; TAD 3.5; UEW 7.4; MNL 26.2; UAL 13.2; FAL 16.1; ML 21.9; FEL 37.9; TBL 37.8; PL 53.3; OPL 2.7.

Variation.—Summaries of univariate morphological variation in the series are presented in Table 2.

Distribution.—*Limnonectes ferneri* is known only from the Simulaw River Drainage, 2.3 km N, 1.0 km E of Peak 1409, Mt. Pasian (7° 52′ 6″ N, 126° 11′ 54″ E; WGS-84), Municipality of Monkayo, Davao Del Norte Province, Mindanao Island, the Philippines (Fig. 1).

Etymology.—We take great pleasure in naming the new species for our friend and colleague John W. Ferner, in recognition of his contributions to Philippine herpetology and the support and guidance he provided RMB in his formative years of working with Philippine herpetofauna. Suggested common name = Ferner's Fanged Frog.

Ecology and natural history.—The new species was collected on rocks and muddy river banks of the Simulaw River Drainage in disturbed (selectively logged) primary forest of the PICOP forest reserve. While nuptial pads or asperities are known to occur in *L. magnus*, *L. visayanus*, *L. woodworthi*, *L. macrocephalus*, and *L. kuhlii*, they were not observed in the new species. Given the sampling size of the type collection and absence of surveys spanning the breeding season of the species, it remains to be seen whether the observed absence of nuptial asperities is a character of the new species. Other anurans encountered in the area included *Ansonia muelleri*, *Kalophrynus pleurostigma*, *Limnonectes leytensis*, *L. magnus*, *L. parvus*, *Megophrys stejnegeri*, *Occidozyga laevis*, *Philautus leitensis*, *Platymantis* cf. *dorsalis*, and *Rana grandocula*.

Discussion

With the description of *Limnonectes ferneri*, the number of *Limnonectes* species climbs to 54, and the number known from the Philippines stands at 10. It is not surprising that the geographically isolated and poorly studied mountain ranges of eastern Mindanao Island contain new species of large-bodied fanged frogs. The few molecular-based studies of fanged frogs have all shown considerable genetic variation between described species and numerous genetically distinct suspected new species (Emerson, 1996; Emerson et al., 2000; Evans et al., 2003).

Limnonectes ferneri is the sixth species of fanged frog known from Mindanao Island (the other five include *L. diuatus*, *L. leytensis*, *L. magnus*, *L. micrixalus*, and *L. parvus*). The five species possess highly disparate morphologies, and with the exception of *L. magnus* and *L. leytensis*, all have geographically limited ranges.

A comprehensive phylogenetic analysis and corresponding taxonomic revision would greatly improve our understanding of diversity in Philippine *Limnonectes*. In addition to recognition of morphological characters for diagnosing species of *Limnonectes*, future studies should focus more attention on the diversity of advertisement calls and fine-scale molecular analyses. These approaches likely will reveal additional, cryptic species.

The discovery of the new species on Mindanao highlights the need for appropriate herpetological inventories throughout this geographically complex and poorly known island. Additional surveys conducted in forested regions throughout Mindanao are necessary to document fully the geographic range of this new species and to arrive at a reasonable assessment of its conservation status. At present, the new species is known only from Mt. Pasian in the southwest portion of the island. Although few individuals were initially encountered, we suspect that the new species may possess a wider geographical distribution; however, any attempt at this time of assessing the conservation status of this species would be highly speculative, and nothing should be inferred from the fact that only three specimens were encountered in a restricted range.

While efforts are underway to survey and study the Mindanao faunal region (Samar, Leyte, Biliran, Mindanao, Dinagat, Siargao, and smaller associated islands), to date, the herpetofauna of this geographically diverse region remains poorly known, understudied, and in need of comprehensive review. Much of the surrounding geographic landscape in Mindanao Island has become highly disturbed, and many species may now be restricted to the few small patches of primary forest remaining on the mountain peaks throughout the region (Siler and Brown, personal observation). However, it would be highly premature to assume that the new species is rare and/or range-restricted. Great strides could be made towards a comprehensive understanding of Mindanao faunal region amphibian biodiversity if biologists can overcome logistical obstacles to field work in this culturally complex and politically contentious region of the southern Philippines (Brown et al., 2002).

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Appendix I

Specimens Examined

Numbers in parentheses indicate the number of specimens examined for each species.

Limnonectes acanthi.—(21) **PHILIPPINES**: Palawan Island: *Palawan Province*: Puerto Princesa City: Barangay Irawan: KU 308989–90, 309049, 309051, 309056–57, 309065, 309084–85, 309140–41, 309144; Municipality of Brooke's Point: Barangay Mainit: KU 309145–46, 309149, 309154–55; Municipality of Quezon: Barangay Poblacion: KU 309157–58, 309160, 309163. ***Limnonectes asperatus***.—(2) **INDONESIA**: Borneo: *Central Kalimantan*: Mentaya Hulu District: FMNH 252416 (paratype), 259072. ***Limnonectes diuatus***.—(2) **PHILIPPINES**: Mindanao Island: *Agusan del Norte Province*: Tagibo River: south side of Mt. Hilonghilong: CAS 113431, 139393. ***Limnonectes kuhlii***.—(55) **INDONESIA**: Java Island: MNHN 4469 (syntype), RZB 4297 (two specimens: syntypes); *Jawa Barat Province*: Kecamatan Kadudampit: TNHC 59826, 59829, LSU 81895, BSI-FS 0026–0032, 0067–69, 0081–92 (uncataloged specimens, deposited at MZB); LAO PEOPLE'S REPUBLIC: *Bokeo Province*: MNHN 1997.3902, 1997.3904, 1997.3916, 1997.4104, 1997.4106; **MALAYSIA**: Sarawak: *Bintulu District*: KU 155685–86; *Kapit District*: KU 155681–84; **THAILAND**: *Chaing Mai Province*: CUMZA 2003.4–8, 2003.13, 2003.30, 2003.32–33; *Loei Province*: KU 40185, 40189–90, 40192, 40198–200. ***Limnonectes leytensis***.—(9) **PHILIPPINES**: Negros Island: *Negros Oriental Province*: Dumaguete City: KU 306006, 306008–09, 306011–12, 306014, 306016–18). ***Limnonectes macrocephalus***.—(8) **PHILIPPINES**: Polillo Island: *Quezon Province*: Municipality of Polillo: KU 303480, 303481, 307505; Luzon Island: *Kalinga Province*: Municipality of Lubuanga: KU 306049, 306053, 306056, 306058, 306059. ***Limnonectes magnus***.—(22) **PHILIPPINES**: Camiguin Sur Island: *Camiguin Province*: Municipality of Mambajao: KU 302139–40; Dinagat Island: *Suriago del Norte Province*: Municipality of Loreto: KU 306003, 306062–63, 306068–70; Samar Island: *Eastern Samar Province*: Municipality of Taft: KU 306036, 306041–42, 306077, 306082–84, 306028–30, 306033, 309272–74. ***Limnonectes palavanensis***.—(5) **PHILIPPINES**: Palawan Island: *Palawan Province*: Municipality of Brooke's Point: Barangay Mainit: KU 309133–35, 309136, 309138. ***Limnonectes parvus***.—(4) **PHILIPPINES**: Mindanao Island: *Zamboanga del Norte Province*: Mt. Malindang: Dapitan River: CAS 139445–46; *Misamis Occidental Province*: Dapitan Peak: CAS 145767–68. ***Limnonectes visayanus***.—(20) **PHILIPPINES**: Masbate Island: *Masbate Province*: Municipality of Mobo: KU 302171; Negros Island: *Negros Occidental Province*: Municipality of Cauayan: KU 302145; *Negros Oriental Province*: Municipality of Valencia: KU 302189–90, 302192, 302196, 302203–04; Panay Island: *Antique Province*: Municipality of Culasi: KU 302157–59, 302161, 302165; Municipality of Pandan: KU 302176, 302180–84; Municipality of San Remigio: KU 306816. ***Limnonectes woodworthi***.—(13) **PHILIPPINES**: Catanduanes Island: *Catanduanes Province*: Municipality of San Miguel: KU 302231, 302234; Polillo Island: *Quezon Province*: Municipality of Polillo: KU 302224, 302227, 302228, 303483–85, 307528, 307531–34.

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