

## A New Species of Torrent-Dwelling Frog (Hylidae, *Litoria*) from the Mountains of New Guinea

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**Abstract:** *Litoria megalops* sp. nov. from mountain torrents in Papua Province, Indonesia is described. It is most similar to *L. micromembrana* from which it is distinguished by its smaller size (male SVL: 24.6–27.5 vs 31.7–35.5 mm), exceptionally large and prominent eyes, and conical tubercles on the dorsum. The advertisement call of the new species is a short pulse train with 7–10 pulses per call and lasting 0.9–1.3 s. The new species was found at night on low vegetation along torrents in closed-canopy lower montane rainforest.

Key words: Hylidae; *Litoria*; New Species; Papua Province; Indonesia; New Guinea

### INTRODUCTION

Torrent-dwelling frogs of the hylid genus *Litoria* Tschudi 1838 occur throughout the Australopapuan region but reach their greatest diversity along the central mountainous spine of New Guinea. These frogs deposit large unpigmented eggs under rocks in streams, and have dorso-ventrally flattened tadpoles with large suctorial mouthparts (e.g., Menzies and Zweifel, 1974; Günther, 2006). Tyler and Davies (1978) recognized several species-groups within torrent-dwelling *Litoria*. One of these, the *L. becki* group, is distinguished from other torrent hylids by a combination of unwebbed fingers, long legs, and a rounded snout. The group currently contains three species; *L. becki* (Loveridge, 1945) known only from high

altitudes on Mt Wilhelm and Mt Giluwe (Loveridge, 1945; Richards, unpublished), and *L. micromembrana* (Tyler, 1963) and *L. modica* (Tyler, 1968) that have broad distributions in the mountains of eastern New Guinea (Tyler, 1968).

During a Rapid Assessment Program (RAP) biodiversity survey in the headwaters of the Wapoga River of Papua Province, Indonesia, specimens of an undescribed torrent-dwelling *Litoria* were obtained from lower montane forest (altitude 1070 m: Richards et al., 2000). The new species resembles *L. micromembrana* but is distinguished from that species and other torrent-dwelling *Litoria* by its extremely large and prominent eyes, its small size and its advertisement call.

### MATERIALS AND METHODS

Specimens are deposited in the Museum Zoologicum Bogoriense (MZB), Indonesia, and

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the South Australian Museum (SAMA), Australia. Measurements (to the nearest 0.1 mm) were taken with dial callipers and a stereomicroscope fitted with an ocular micrometer. They are: SVL (snout-vent length), TL (tibia length), HW (head width at tympanum, HL (head length from tip of snout to posterior edge of tympanum), EYE (horizontal eye diameter), TYM (horizontal tympanum diameter), IN (inter-narial distance), EN (distance between anterior edge of eye and posterior edge of naris), 3FD (transverse diameter of 3rd finger disc), 3FP (narrowest transverse width of penultimate phalanx), 4TD (transverse diameter of 4th toe disc), and 4TP (penultimate phalanx, as for 3rd finger).

Calls were recorded with a Sony Professional Walkman tape recorder and SMZ-200 microphone, and were analysed with the sound analysis program Avisoft SAS-Lab Pro.

### *Litoria megalops* new species

(Figs. 1–5)

#### *Holotype*

Adult male, MZB Amph.11828, 1070 m, Wapoga Alpha mineral exploration camp, Papua, Indonesia (3°08'41"S, 136°34'25"E) coll. S. J. Richards and D. T. Iskandar, 14 Apr 1998.

#### *Paratypes*

MZB Amph.11829–32, SAMA R61633–36, coll. S. J. Richards and D. T. Iskandar, 9–16 Apr 1998 from the type locality.

#### *Diagnosis*

A small *Litoria* (males 24.6–27.2 mm SVL) that can be distinguished from all congeners by the following combination of characters: 1) eyes very large (EYE/SVL 0.138–0.167), 2) canthus rostralis rounded, moderately curved, 3) fingers long, unwebbed, 4) toes 2/3 webbed, 5) conical tubercles on dorsum, concentrated on head, 6) mating call with a short pulse train lasting about 0.9–1.3 sec, and a dominant frequency of 3865–4129 Hz.



FIG. 1. Lateral view of head of *Litoria megalops*, holotype MZB Amph.11828. Scale bar=5 mm.

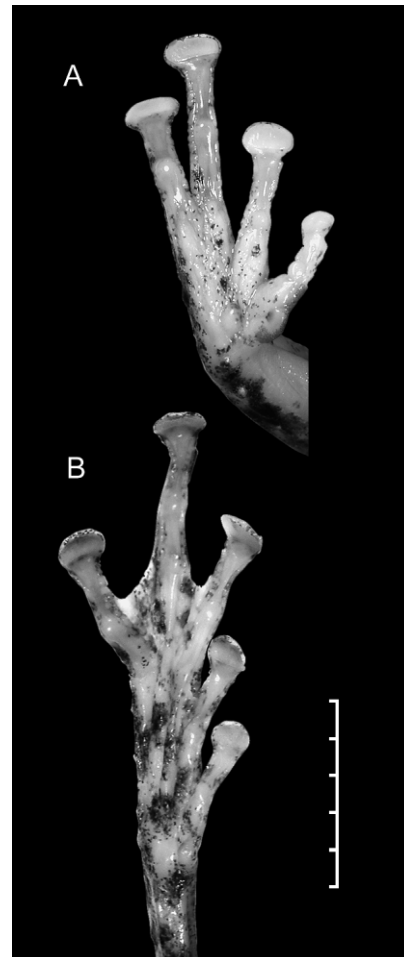


FIG. 2. Palmar (A) and plantar (B) views of *Litoria megalops*, holotype MZB Amph.11828. Scale bar=5 mm



FIG. 3. *Litoria megalops* paratype in life.

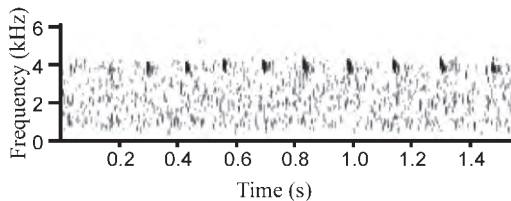


FIG. 4. Audiospectrogram of *Litoria megalops* sp. nov. (paratype SAMA R61634) advertisement call recorded at 22.2°C.

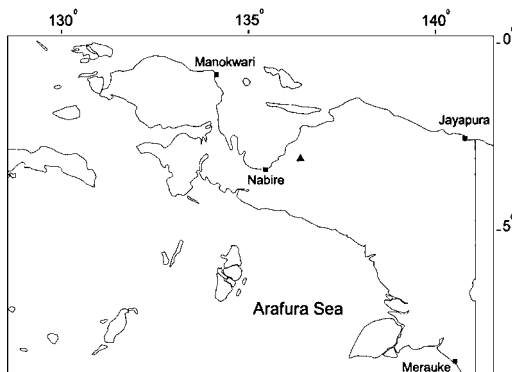


FIG. 5. Distribution of *Litoria megalops* sp. nov. (closed triangle).

#### Description of holotype

Measurements in mm: SVL 26.4, TL 17.8, HW 10.0, HL 10.1, EYE 4.2, EN 2.1, IN 3.1, TYM 1.4, 3FP 0.8, 3FD 1.7, 4TP 0.8, 4TD 1.6. Body slender, limbs long (TL/SVL 0.67). Head as long as broad (HL/HW 1.01), more than one third of snout-vent length (HL/SVL

0.38); snout broadly rounded in dorsal view, slightly projecting in lateral view. Canthus rostralis rounded, moderately curved, loreal region strongly concave. Nostrils close to tip of snout, internarial distance greater than distance between snout and naris (EN/IN 0.677). Eyes very large, prominent (EYE/SVL 0.159) (Fig. 1), pupil horizontal, eyelid without reticulations. Vomerine teeth in two small clumps between the choanae, vocal slits long, located laterally and extending anteriorly from point just anterior of angle of jaws. Tongue broadly cordiform. Tympanum clearly visible, dorsal edge obscured by prominent, curved supratympanic fold. Fingers long, unwebbed, relative lengths  $3 > 4 > 2 > 1$ , terminal discs moderately large (3FP/3FD 0.47). A narrow, elongate and finely rugose brown nuptial pad on edge of first finger extends from base of wrist to a point level with subarticular tubercle. Toes 2/3 webbed, webbing reaches to just above ultipenultimate tubercle on 4th toe, and to penultimate tubercle on toes 2, 3 and 5, relative lengths  $4 > 5 = 3 > 2 > 1$ , terminal discs moderately large (4TP/4TD 0.5) (Fig. 2). Skin smooth dorsally with raised conical tubercles on head and body; tubercles on head concentrated in two mid-dorsal rows, oriented antero-posteriorly. Throat finely granular, belly coarsely granular. A row of white-tipped tubercles on outer edge of tarsus.

In life amber dorsally, with a green interorbital bar. A patch of mottled white, tinged with green posteriorly, between eye and upper jaw. A broad green band laterally. Mottled brown and white below green lateral band, becoming translucent with white mottling ventro-laterally. Venter white. Iris gold, speckled with brown (Fig. 3). In preservative colors have faded to dull brown, green markings including lateral band have become bluish.

#### Variation

Body measurements and proportions are presented in Table 1. The type series is rather uniform. All specimens bear prominent conical tubercles on the dorsum, though in several the tubercles are concentrated mainly on the

TABLE 1. Measurements (in mm) and proportions of male torrent-dwelling frogs of the genus *Litoria* from New Guinea, presented as mean (SD), and range.

	<i>L. megalops</i> (n=9)	<i>L. micromembrana</i> (n=10)	<i>L. modica</i> (n=10)
SVL	26.4 (1.05) 24.6–27.5	33.2 (1.42) 31.7–35.5	25.3 (1.07) 24.0–27.2
TL	17.4 (0.49) 16.5–18.2	20.2 (0.92) 18.8–21.7	15.4 (0.51) 14.6–16.2
TL/SVL	0.66 0.60–0.71	0.61 0.57–0.62	0.61 0.57–0.64
HL/HW	1.06 1.01–1.10	0.95 0.89–1.01	1.06 0.96–1.08
HL/SVL	0.38 0.34–0.39	0.34 0.31–0.36	0.38 0.36–0.40
EYE/SVL	0.15 0.14–0.17	0.13 0.12–0.14	0.14 0.13–0.15
EN/IN	0.72 0.63–0.80	0.70 0.61–0.85	0.62 0.54–0.69
3FP/3FD	0.48 0.43–0.53	0.50 0.40–0.55	0.56 0.47–0.65
4FP/4FD	0.47 0.33–0.56	0.61 0.50–0.75	0.63 0.53–0.85

head. A row of white-tipped tubercles along the outer edge of the tarsus is a consistent feature. Variation is restricted to minor aspects of coloration. All specimens have a blue (green in life) lateral band but the inter-orbital bar is absent or poorly defined in several individuals. In some specimens the mottled white patch below the eye is rather indistinct.

#### Advertisement call

The advertisement call is a short pulse train lasting 0.9–1.3 s. We recorded 4 calls from male paratype SAMA R61634 at an air temperature of 22.2°C. Two calls have 7 and 9 pulses, and two calls have 10 pulses. Mean pulse rate is 6.94/s (range 6.54–7.73/s, SD 0.538, n=36 pulses) and mean pulse length is 0.014 s (range 0.011–0.021 s (SD 0.0026, n=33)). Calls have a narrow energy band with a mean dominant frequency of 3994 Hz (range 3865–4129 Hz, SD 137, n=4). A spectrograph is illustrated in Fig. 4.

#### Comparison with other species

*Litoria megalops* can be distinguished from most small to moderate-sized torrent-dwelling treefrogs including *L. brongersmai* (Loveridge, 1945), *L. longicrus* (Boulenger, 1911), *L. napaea* (Tyler, 1968), *L. rara* Günther and Richards, 2005, *L. scabra* Günther and Richards, 2005 and *L. rivicola* Günther and Richards, 2005 by its lack of finger webbing (vs distinct finger webbing) (Boulenger, 1911; Loveridge, 1945; Tyler, 1968; Günther and Richards, 2005). In its combination of moderate size, lack of finger webbing and long limbs, *L. megalops* most closely resembles *L. micromembrana* and *L. modica*. It differs from both of these species in having larger eyes (EYE/SVL 0.14–0.17 vs 0.12–0.14 in *L. micromembrana* and 0.13–0.15 in *L. modica*), and in having conical tubercles on the dorsum. It further differs from *L. micromembrana* in its smaller size (male SVL to 27.5 mm vs. 31.7–35.5 mm in *micromembrana*) and from *L. modica* in having a distinct lateral green

band (absent in *L. modica*). The call of *L. megalops* also differs from that of *L. micromembrana* and *L. modica*. Based on a male recorded at Abalgamut, Huon Peninsula (SAMA R61599) at 16C the call of *L. micromembrana* is a series of 3–5 musical, unpulsed notes produced at a rate of 0.95–1.44/s ( $n=4$ ), with each note lasting about 0.4–0.8 s (first notes in a sequence) to 0.16 s (terminal notes in a sequence), with a narrow energy band and a dominant frequency of 3671–4118 Hz. The call of *L. modica* is a short, sharp chirp, uttered singly or followed by several chattering notes (S. Richards pers obs.). A detailed comparison of measurements of these three species is presented in Table 1. Other stream-dwelling *Litoria* with unwebbed or basally webbed fingers include *L. arfakiana* (Peters and Doria, 1878), *L. wollastoni* (Boulenger, 1914) *L. spinifera* (Tyler, 1968), and *L. macki* Richards, 2001. All of these species are substantially larger than *L. megalops* (male SVL > 35 mm vs. 24.6–27.5 mm in *L. megalops*) with smaller eyes (Tyler, 1968; Menzies and Zweifel, 1974; Richards, 2001; Günther, 2006) and different advertisement calls. The call of *L. arfakiana* is a single short (50–80 ms), finely pulsed (80–110 pulses/s) musical note (Günther, 2006), and that of *L. wollastoni* is a short buzz followed by one or more ‘pips’ (Menzies and Zweifel, 1974). *Litoria spinifera* produces a very loud and finely pulsed musical note with a narrow frequency band and lasting just 0.013–0.095 s and *L. macki* produces a succession of loud bell-like notes (Richards, 2001).

#### *Distribution and ecology*

*Litoria megalops* is known only from the type locality in the headwaters of the Wapoga River, Papua Province, Indonesia (Fig. 5). Male *L. megalops* were found along steep torrents at night where they called from low vegetation (0.5–1.0 m high) adjacent to or overhanging the rushing water. The call is soft and was difficult to hear and record above the sound of the water. No females were detected but the close association of males with torrential

streams, and their absence from lentic waterbodies in the area strongly supports the notion that this species breeds in lotic environments.

Other torrent-dwelling hylid frog species occurring in micro-sympatry with *L. megalops* at the type locality were *L. brongersmai*, *L. macki*, *L. napaea*, *L. cf arfakiana* and *Nyctimystes pulcher* (Wandolleck, 1911) (Richards et al., 2000).

#### *Etymology*

The name *megalops* is a noun in apposition, and refers to the large and prominent eyes of this species.

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- tions: AMNH=American Museum of Natural History; BM=Natural History Museum, London; MCZ=Museum of Comparative Zoology, Harvard University; MSNG=Museo Civico di Storia Naturale, Genoa; MZB=Museum Zoologicum Bogoriense; SAMA=South Australian Museum; ZMB=Zoological Museum, Berlin; UP=University of Papua New Guinea Natural Sciences Collection.
- Litoria arfakiana*, MSNG 29723A, Hatam, Arfak Mountains, Papua Province, Indonesia, lectotype.
- Litoria brongersmai*, MCZ 15203 Snow Mountains, Papua Province, Indonesia, holotype; MZB 11824–27, SAMA R61630–32, Wapoga River Headwaters, northern Papua Province, Indonesia.
- Litoria dorsivena*, SAMA R7902–R7911, Telefomin, Sandaun Province, Papua New Guinea, type series.
- Litoria longicrus*, BM 1947.2.22.60–61, Wendessi, Papua Province, Indonesia, syntypes.
- Litoria macki*, MZB Amp.3870 Wapoga Alpha Mineral Exploration Camp, Papua, Indonesia (holotype); MZB Amph.3871–2, QM J75810, SAMA R55363 same locality as holotype; SAMA R55364 Lagori Landing site 21, Papua, Indonesia, all paratypes.
- Litoria micromembrana*, SAMA R4150, Mount Podamp, Papua New Guinea, holotype; SAMA R61629, SAMA R61637–40, UP 10031, Finimterre, Hindenberg Range, Western Province, Papua New Guinea; SAMA R61599–601, UP 10029, UP 10032, SAMA R61602, Abalgamut, SAMA R61603, Kikiapa, both localities on the Huon Peninsula, Papua New Guinea.
- Litoria modica*, SAMA R8108, Oruge, Papua New Guinea, paratype; SAMA R61616–19, UP 10030, Mount Akrik, Star Mountains, Western Province, Papua New Guinea; SAMA R61609–12, UP 10035–36, Mount Binnie Summit, Western Province, Papua New Guinea; SAMA R61604–07, UP 10033, Mount Sisa, Southern Highlands Province, Papua New Guinea; SAMA R61608, UP 10030, Mount Stolle, Sandaun Province, Papua New Guinea.
- Litoria napaea*, AMNH 49575 Idenburg

#### APPENDIX 1

##### *Specimens examined*

Abbreviations refer to the following institu-

River, Snow Mountains, Papua Province, Indonesia, paratype; SAMA R61620–28, MZB Amph.11833–42 Wapoga LS21, Papua Province, Indonesia.

*Litoria oenicolen*, AMNH 87922 Baiyer River, Western Highlands Province, Papua New Guinea, holotype.

*Litoria pratti*, BM 1947.2.23.54–56, Wendessi, Papua Province, Indonesia; BM 1947.2.23.57–8 Arfak Mountains, Papua, Indonesia, cotypes.

*Litoria rivicola*, ZMB 64118, holotype, 60321–8, 63982, 64113–64117 (60327–8 re-registered as SAMA R61795–6), 30 km SE of Nabire, Papua Province, Indonesia, paratypes.

*Litoria scabra*, MZB Amph.11335, headwaters of the Wapoga River, Papua Province, Indonesia, holotype. MZB Amph.11336–40,

SAMA R60706–60709, ZMB 67357–67359 from the type locality, paratypes.

*Litoria spinifera*, SAMA R6295–6301 Oruge, Western Highlands Province, Papua New Guinea, paratypes; SAMA R9167, Camp 1, Pio River, southern lowlands, Papua New Guinea; SAMA R9108A–D, Elmagale, Eastern Highlands Province, Papua New Guinea; SAMA R55357–62, UP 9963–4 Crater Mountain Wildlife Management area, 55–75 km S of Kundiawa, Eastern Highlands Province, Papua New Guinea.

*Litoria wollastoni*, BM 1947.2.23.59 Octakwa River, Papua Province, Indonesia, holotype.

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