

Presence or absence of humeral spine

The humeral spine is the ventrolateral extension of the *crista ventralis* (a prominent ridge in the humerus) and is present only in a few anuran species, most of them belonging to the family Centrolenidae. Its presence or absence is of taxonomic importance and helps, for example, to identify glass frog genera (Fig. 57).

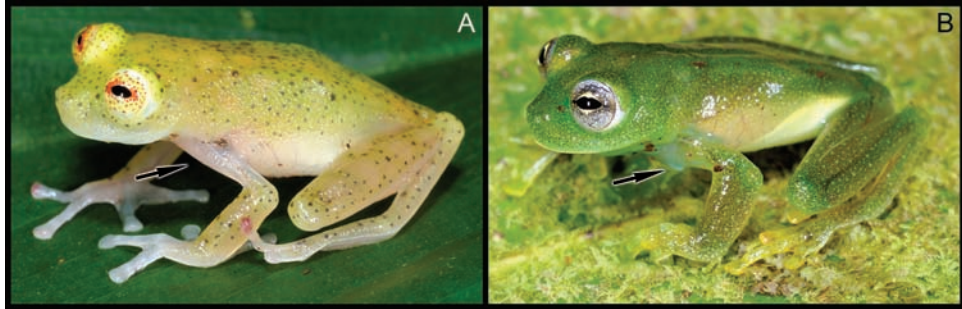


Fig. 57. Humeral spine in anurans. A. Absent (e.g. in *Hyalinobatrachium*, here *H. crurifasciatum*); B. Present (e.g. in *Centrolene*, here *C. gorzulae*). (Photos by P. J. R. Kok).

Condition of nuptial pads

Nuptial pads are horny or thickened structures of various sizes and shapes usually located on the male's thumb (Fig. 58). Testicular hormones influence their development and they are especially prominent during the breeding season. Condition of nuptial pads is of taxonomic importance and is useful to distinguish species.

Presence or absence of keratinized prepollical spines

Keratinized prepollical spines (= thumb spines, Fig. 58) are nuptial excrescences found in several anuran species. In some species the thumb bears a single developed spine, while in other taxa there may be two developed spines or no spine at all. The presence or absence of spines may help to distinguish similar taxa, although there is some intraspecific variation in this character.

Presence or absence of a fleshy proboscis

In some species males have a shovel-shaped projecting snout probably used to excavate underground nesting chambers (Fig. 58).

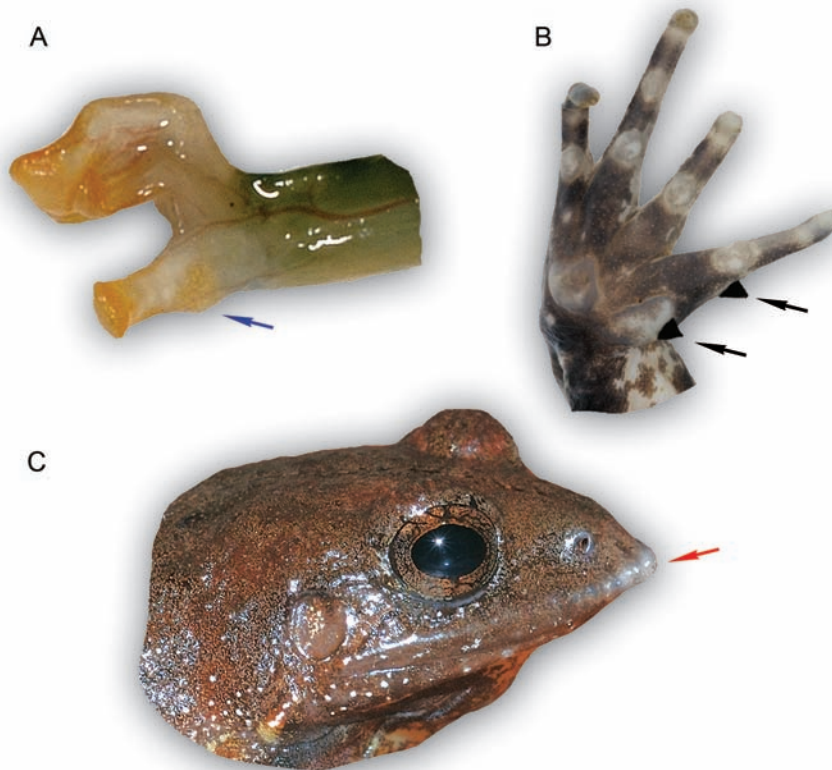


Fig. 58. Some male appendages in anurans. A. Nuptial pad on Finger I (here in *Hyalinobatrachium taylori*, Centrolenidae); B. Keratinized spines on thumb (here in *Leptodactylus petersii*, Leptodactylidae); C. Fleshy proboscis in *Leptodactylus lutzi*, Leptodactylidae. (Photos by P. J. R. Kok).

4.2.2. Field key to the anuran genera of Kaieteur National Park

The only purpose of the following dichotomous key is to help the reader to identify in the field the anurans of Kaieteur National Park to the genus level. It will guide the reader to a specific generic account by reference to a page number. A key to the species is provided in each of the generic accounts.

This key is not infallible and the reader should always verify any identification made by using the key through detailed comparison with the descriptions and illustrations in the species accounts. Do also note that only a few subjective characters are used in the key and that these characters are not sufficient for genus or species identification.

1. Tongue absent, pupil circular (Fig. 42C), no disc on the tip of digits but four small lobes (Fig. 51E), body distinctly flattened *Pipa* (p. 234)

1'.	Not as above	2
2.	Pair of dermal scutelike flaps on dorsal surface of each disc (Fig. 51F)	Anomaloglossus (p. 114)
2'.	Not as above	3
3.	Fingers lacking expanded terminal discs (Fig. 51A, D)	4
3'.	Fingers with expanded terminal discs (Fig. 51B-C)	9
4.	Parotoid glands present (Fig. 47A)	5
4'.	Parotoid glands absent	6
5.	Parotoid glands ovoid, small to large (Fig. 47A), cranial crests absent or weakly developed	Rhaebo (p. 124)
5'.	Parotoid glands trianguloid, very large, cranial crests well developed (Fig. 41)	Rhinella (p. 130)
6.	Terminal disc on digits with pointed tip (Fig. 51D), digits flattened, subdigital pads rather than subarticular tubercles, very small size	Adelophryne (p. 148)
6'.	Not as above	7
7.	Tympanum distinct (Fig. 43A)	Leptodactylus (p. 212)
7'.	Tympanum indistinct or absent (Fig. 43B, C)	8
8.	Dorsum black with yellow reticulation, toes webbed	Atelopus (p. 120)
8'.	Dorsum brown without reticulation, body ovoid, toes unwebbed	Synapturanus (p. 230)
9.	Pupil vertically elliptical (Fig. 42B), fingers and toes opposable	Phyllomedusa (p. 190)
9'.	Pupil horizontally elliptical (Fig. 42A), fingers and toes not opposable	10
10.	First finger shorter than second	11
10'.	First finger equal or longer than second	18
11.	Toes no more than basally webbed (Fig. 49A)	Pristimantis (p. 238)
11'.	Toes at least one-third webbed (Fig. 49B, C, D)	12

12. Head very small, triangular, terminal disc on digits truncate (Fig. 51C), throat black with white spots ***Allophryne*** (p. 110)
- 12'. Not as above **13**
13. Web between Toes I-II absent or reduced (does not reach the subarticular tubercle of Toe II) and webbing on fingers absent or much reduced (Fig. 49), skin smooth to shagreened (Fig. 44A, B), dorsal ground colour not green **14**
- 13'. Web between Toes I-II usually extends beyond the subarticular tubercle of Toe II and webbing on fingers usually present (Fig. 49) [except in *Hypsiboas liliae*, in which the dorsal skin is granular (Fig. 44C), and the dorsal ground colour green] **15**
14. Dorsal outline of snout truncate (Fig. 40A), snout not protruding beyond lower jaw, inner metatarsal tubercle projecting ***Tepuihyla*** (p. 202)
- 14'. Dorsal outline of snout rounded (Fig. 40A), snout protruding beyond lower jaw, inner metatarsal tubercle not projecting ***Scinax*** (p. 196)
15. Axillary membrane extensive (more than 1/2 upper arm length), orange or yellow with black spots (Fig. 45B) ***Dendropsophus*** (p. 158)
- 15'. Axillary membrane usually absent or indistinct (Fig. 45A), when present (Fig. 45B) small (no more than 1/2 upper arm length), never orange **16**
16. Bones green and skin on dorsum thick and glandular ***Trachycephalus*** (p. 206)
- 16'. Not as above **17**
17. Skin of head fused to skull, males usually with paired vocal sacs (Fig. 56C-D) and dorsal skin distinctly tuberculate or spiculate (Fig. 44D-E) (smooth in females, Fig. 44A) [Except in *O. exophthalmus* and *O. oophagus*] ***Osteocephalus*** (p. 178)
- 17'. Skin of head not fused to skull, males with subgular vocal sac (Fig. 56A), dorsal skin not sexually dimorphic ***Hypsiboas*** (p. 162)
18. Venter not transparent, internal organs not visible ***Stefania*** (p. 152)
- 18'. Venter transparent, internal organs visible **19**

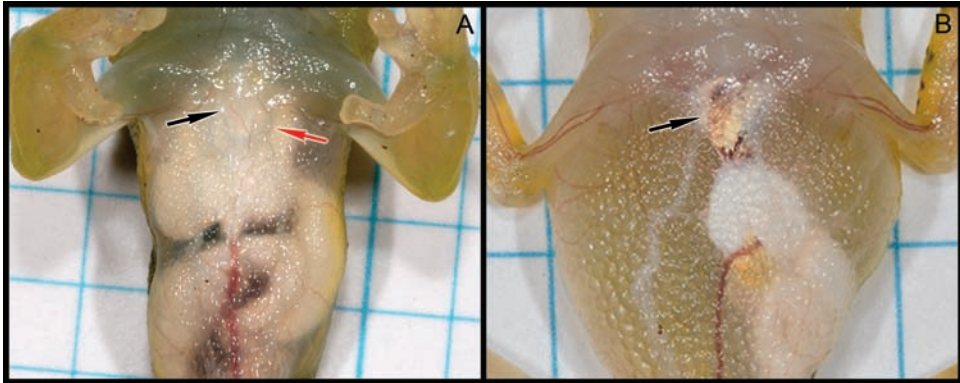


Fig. 59. Condition of the parietal peritoneum in glass frogs (Centrolenidae). A. White (indicated by a red arrow), heart not visible (black arrow) (here in *Cochranella helenae*); B. Transparent, heart visible (indicated by a black arrow) (here in *Hyalinobatrachium crurifasciatum*). (Photos by P. J. R. Kok).

- 19. Anterior third of parietal peritoneum white, heart not visible (Fig. 59A) **Cochranella** (p. 138)
- 19'. Parietal peritoneum transparent, heart at least partially visible (Fig. 59B) **20**

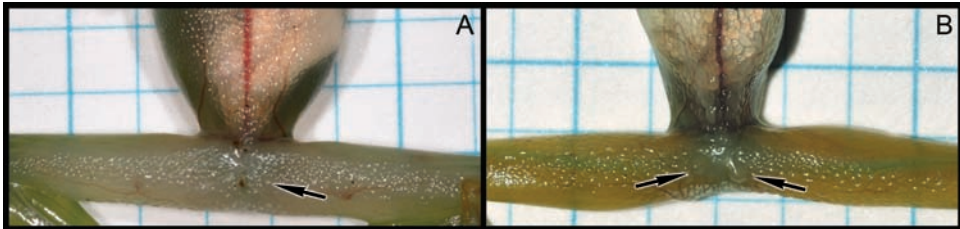


Fig. 60. Ventral view of the area between the legs showing absence/presence of enlarged tubercles below vent in glass frogs (Centrolenidae). A. Absent (here in *Hyalinobatrachium taylori*); B. Present (here in *Centrolene gorzulae*). (Photos by P. J. R. Kok).

- 20. Distinctly enlarged round tubercles below vent (Fig. 60B), prepollical spine projecting, humeral spine present in adult males (Fig. 57B) **Centrolene** (p. 134)
- 20'. No distinctly enlarged round tubercles below vent (Fig. 60A), prepollical spine not projecting, humeral spine absent in adult males (Fig. 57A) **Hyalinobatrachium** (p. 142)

4.2.3. Tadpoles identification: key features

Characteristics of anuran larvae (= tadpoles) are often used in taxonomic descriptions. In some taxa adults may be problematic to identify even though their tadpoles are very distinctive. Reversely (and surprisingly) some fairly different species may have extremely similar larvae.

Tadpoles show a great diversity in morphological types and are perfectly adapted to the many different environments in which they are found (from ponds and streams to bromeliads and tree holes); their morphology also reflects phylogenetic relationships.

Gosner's (1960) staging system subdivides tadpole development in 46 stages, those below 25 being of little use for identification. Ideally tadpoles should be in stages 26 to 38 to be accurately identified. Hence it is important to rear some larvae in the field and preserve tadpoles at different developmental stages.

The Gosner (1960) staging system is recommended for use with exotroph tadpoles. Figure 61 illustrates Gosner stages from 23 to 41, which are briefly explained below [see Gosner (1960) and McDiarmid & Altig (1999)]. Before stage 23 larvae are non-feeding and mostly immobile.

Stage 23: oral disc distinct, external gills very distinct on both sides.

Stage 24: oral disc distinct, external gills atrophied, operculum closes on right.

Stage 25: oral disc obvious, external gills absent, spiracle forms on left.

Stage 26: hind limb development begins, length of hind limb bud inferior to 50% of its height.

Stage 27: length of hind limb bud superior or equal to 50% of its height.

Stage 28: length of hind limb bud superior or equal to its height.

Stage 29: length of hind limb bud inferior or equal to 150% of its height.

Stage 30: length of hind limb bud equal to 200% of its height.

Stage 31: foot paddle visible.

Stage 32: indentation between the fourth and the fifth toes visible.

Stage 33: indentation between the third and the fourth toes visible.

Stage 34: indentation between the second and the third toes visible.

Stage 35: indentation between the first and the second toes visible.

Stage 36: Toes III-V separated.

Stage 37: all toes separated.

Stage 38: inner metatarsal tubercle appears.

Stage 39: subarticular patches visible.

Stage 40: outer metatarsal tubercle and foot subarticular tubercles visible, vent tube still present.

Stage 41: forelimbs bud visible, vent tube absent.

From stage 41 the larval mouthparts disappear and are replaced by adult jaws, tail is resorbed and limbs become functional. Stage 46 corresponds to complete metamorphosis.

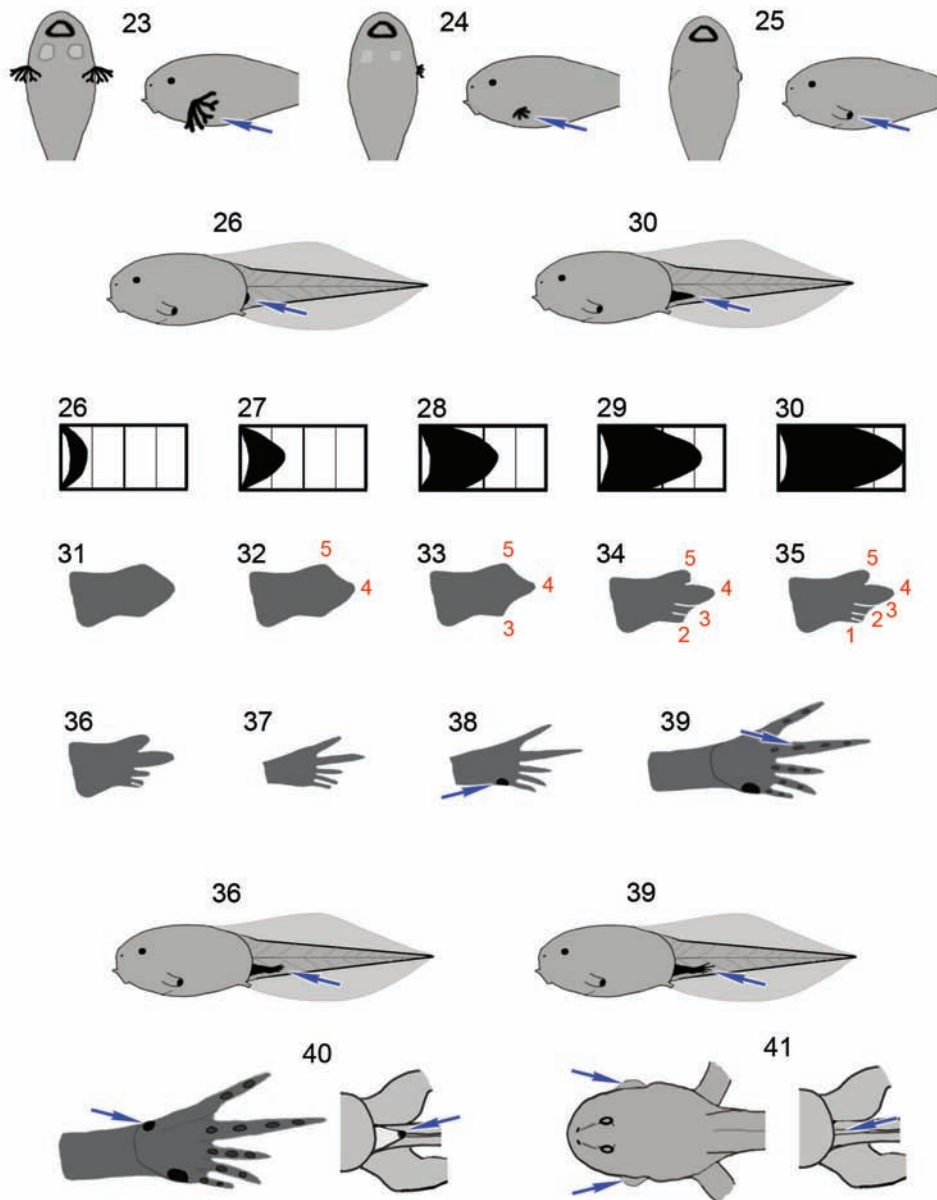


Fig. 61. Gosner (1960) developmental staging system, from stage 23 to stage 41. Modified from McDiarmid & Altig (1999).

The principal structural features of anuran larvae are illustrated below (Fig. 62).

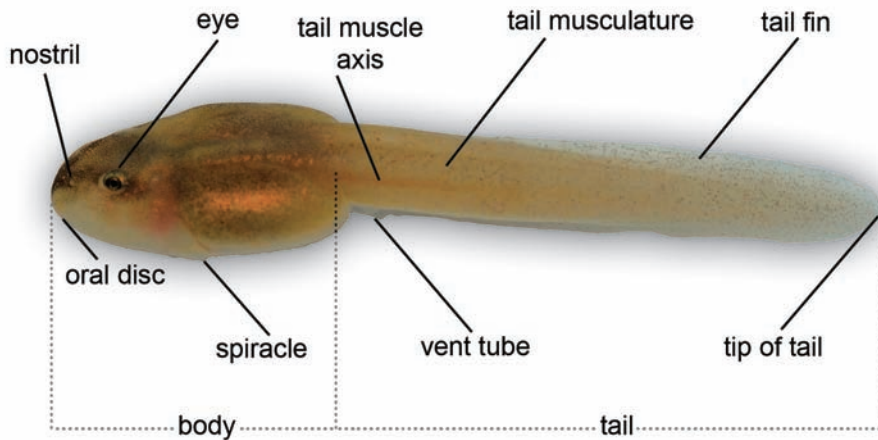


Fig. 62. Principal structural features of anuran larvae (here the arboreal tadpole of *Anomaloglossus beebei*, Aromobatidae). (Photo by P. J. R. Kok).

Shape and position of several structural characters are of taxonomic importance in tadpoles. The spiracle, for example, may be single and sinistral with a short spiracular tube (as illustrated in Fig. 62); single and sinistral with a long spiracular tube; dual and lateral; dual and lateroventral; single and posterior ventral; single and midventral. As for the eyes, they may be lateral or dorsal; the tail tip may be pointed or ending by a filament; the body may be adpressed or not; the tail fin may be extensive or not (compare Figs 62 & 63); the vent tube may be dextral or medial; etc. The development of the lateral line system is also variable. See McDiarmid & Altig, 1999 and Altig, 2007 for extensive descriptions of these structural characters.

Colour and pattern are also helpful for identification and are usually not very variable intraspecifically (although they may change during development, hence the importance to compare larvae of the same developmental stage).

As in adults, comparisons of morphometrics and measurement ratios are helpful to distinguish similar species. Grosjean (2005) recommends tadpoles between stages 32-40 for best morphological intra- and interspecific comparisons.

Principal landmarks are indicated in figure 63 and are explained below:

- **Total length (TL):** from the tip of the snout to the tip of the tail.
- **Body length (BL):** from the tip of the snout to the junction of the posterior body and the tail musculature.
- **Tail length (TAL):** from the junction of the posterior body and the tail musculature to the tip of the tail.
- **Body width (BW):** the highest width of the body.

- **Body height (BH)**: the highest height of the body.
- **Head width at level of eyes (HW)**: self-explanatory.
- **Tail muscle height at base of tail (TMH)**: self-explanatory.
- **Upper tail fin height (UTF)**: the highest height of the upper fin, from the upper margin of the tail musculature to the upper margin of the upper fin.
- **Lower tail fin height (LTF)**: the highest height of the lower fin, from the lower margin of the lower fin to the lower margin of the tail musculature.
- **Tail muscle width at base of tail (TMW)**: self-explanatory.
- **Maximum height of tail (MTH)**: the highest height of the tail.
- **Eye-naris distance (END)**: from the anterior corner of the eye to the posterior margin of the naris (nostril).
- **Naris-snout distance (NSD)**: from the anterior margin of the naris to the tip of the snout.
- **Snout-spiracle distance (SSD)**: from the tip of the snout to the posterior margin of the spiracle.
- **Internarial distance (IND)**: the distance between the median margins of the nares.
- **Interorbital distance (IOD)**: the distance between the median margins of the orbits.
- **Eye diameter (ED)**: the greatest length of the orbit from the anterior margin to the posterior margin of the eye.

Note that measurements are accurately compared only when they involve the same landmarks and tadpoles of the same developmental stages!

Some authors suggest that measurements between structures should be taken from the centre of these structures (*e.g.* internarial distance measured between the centre of the nares). As the centre of a structure is not a fixed point, we find this method too subjective and prefer taking measurements between anterior or posterior margins of structures.

See also aforementioned remark in “Morphometrics”.

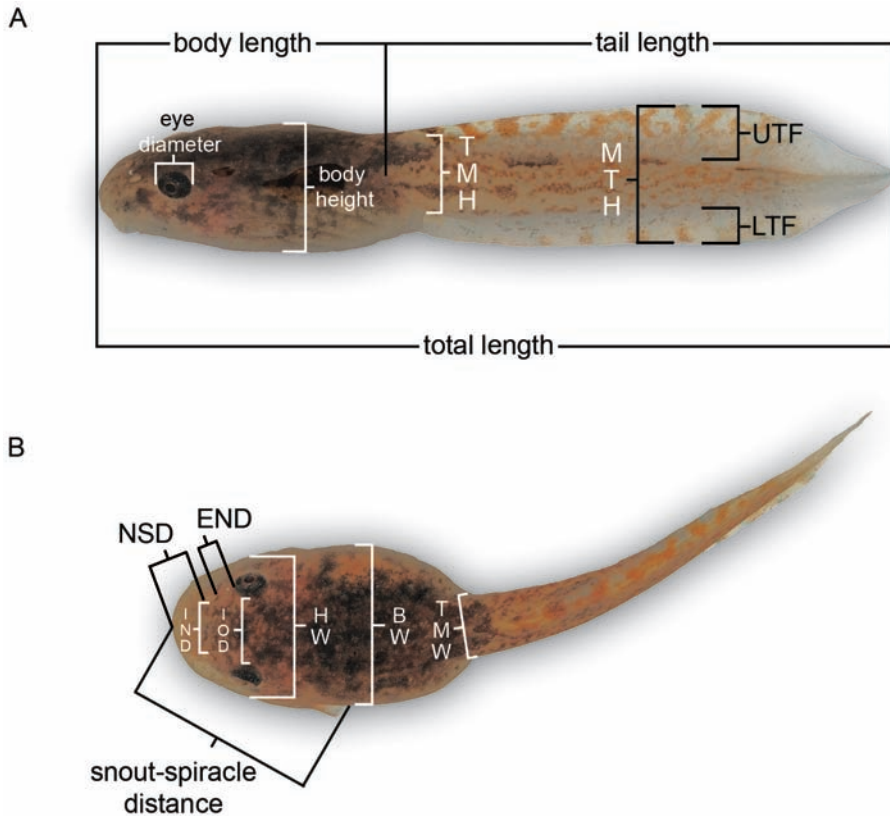


Fig. 63. Principal landmarks in anuran larvae (here a benthic tadpole of a still undetermined species). A. Lateral view; B. Dorsal view. Abbreviations are explained in the text. (Photos by P. J. R. Kok).

Shape and location of the oral disc are also very characteristic (see McDiarmid & Altig, 1999 for further details) and are usually related to the feeding habit of the larva (which may feed on detritus, dead invertebrates, other tadpoles, conspecific or heterospecific eggs, etc.). Figure 64 shows principal terminologies used in oral disc description, which are briefly explained below (see McDiarmid & Altig, 1999 and Altig, 2007 for extensive details):

- **A-1, A-2, etc.:** anterior tooth rows (= rows of labial teeth), which are numbered from the anterior margin of the upper labium toward the mouth.
- **Dorsal gap in marginal papillae and A-2 gap:** the term “gap” is used to indicate that there is a space (usually medially) that is free of papillae or labial teeth. There is often a medial gap in marginal papillae on the upper labium and sometimes a gap in the second anterior tooth row. Medial gaps may also occur elsewhere (in P-1 for example). They should not be confused with “artificial” gaps due to the loss of labial teeth or papillae. Number and location of gaps are of taxonomic importance; the size of the gap may vary with developmental stage.

- **P-1, P-2, P-3**, etc.: posterior tooth rows, which are numbered from the mouth toward the posterior margin of the lower labium.
- **Marginal papillae**: they are found on the edges of the oral disc. They may completely encircle the disc, or be interrupted by gaps. Marginal papillae may be laterally indented (= emarginated). The number of papillae rows and the length and shape of papillae vary among taxa and are helpful for identification.
- **Upper and lower jaw sheath**: they form what is sometimes called the tadpole “beak”. Shape of jaw sheath is of some taxonomic importance.
- **Jaw sheath serration**: they are the keratinized projections of various sizes and shapes occurring on the cutting edge of the jaw sheaths.

The LTRF (abbreviation of Labial Tooth Rows Formula) is very useful for comparison. It is expressed as a fractional notation in which the numerator equals the number of anterior tooth rows and the denominator equals the number of posterior tooth rows. Natural gaps are noted between parentheses [e.g. LTRF of the tadpole illustrated in Fig. 64 (*Anomaloglossus kaiei*, Aromobatidae) is 2(2)/3)]. Numbers in bracket indicate variation in the presence of a medial gap.

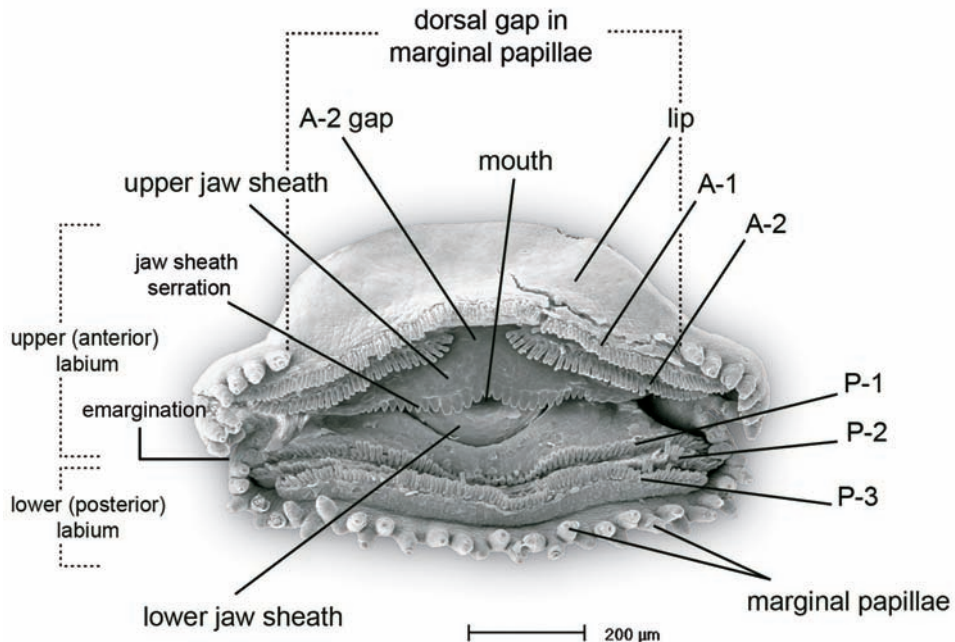


Fig. 64. Oral disc of an anuran larvae (*Anomaloglossus kaiei*, Aromobatidae) showing principal terminologies. Abbreviations are explained in the text. (Scanning electron micrograph by J. Cillis & P. J. R. Kok).

4.2.4. Preparation of tadpole oral disc for electronic microscopy

Observation of the tadpole oral disc using scanning electron microscopy (SEM) is very effective to distinguish very small features that are of taxonomic importance (variation in labial teeth for example).

The oral disc must first be carefully dissected under a stereomicroscope and transferred to 100% ethanol. The sample will then be “critical-point dried”. Critical point drying is a technique of drying soft, naturally hydrated, tissues without deforming their structure. This technique is mostly used for examination under high vacuum conditions, as in the case of a scanning electron microscope. Allowing the oral disc to dry under high vacuum conditions would damage it due to the surface tension that occurs when changing from the liquid to the gaseous phase.

Within the critical-point drier apparatus, the ethanol (called the intermediate fluid) is exchanged for the transition fluid (CO₂) and the “critical point” at which the density of the liquid and the gas is the same is achieved by controlling pressure and temperature within the instrument. Once the CO₂ is fully converted to gas the specimen is dry.

Because freshly dried specimens are highly hygroscopic (which means they readily absorb water), they must be quickly coated with a thin layer of conductive metal (usually gold).

After gold coating the oral disc is carefully positioned on a small stand with a sticky surface and is ready to be examined.

4.2.5. Call analysis

Although sound emission is reported in some caecilians (see Duellman & Trueb, 1986), only anurans produce sounds to attract conspecific females, defend their territory and communicate stress. Call analysis is a valuable tool in species identification: the advertisement call is an important mate recognition character and anuran advertisement calls are species-specific.

Vocal communication in anurans and call analysis are rather complex matters and we only provide here a brief introduction to the very basics of frog call analysis, *i.e.* the principal terms used in call analysis, their meaning, and the way to obtain essential information from your recordings through the sound analysis software.

The sound analysis software

There are several software programs available on the market; some of them may be downloaded for free from the Internet. We use *Raven Pro* (version 1.3) from the Cornell Lab of Ornithology, thus the appearance of the oscillograms and spectrograms provided below (and the calculation methods) may change according to the software you will use.

Acquiring input

This depends on the software you use. Connect your recorder to the audio input device on your computer and follow the software user guide.

Types of calls and terminology

There are four types of calls in anurans:

- **The advertisement call:** is produced by males and has two principal functions: attracting conspecific females, and announcing to other males (both conspecific and heterospecific) that the territory is occupied.
- **The reciprocation (or response) call:** is emitted by receptive females in response to conspecific males advertisement call (currently known only in a very few species).
- **The release call:** is produced by males and unreceptive females in response to a tentative amplexus. Often accompanied by body vibrations.
- **The distress call:** is emitted by several species in response to severe disturbance. Usually explosive and very loud (Fig. 65).

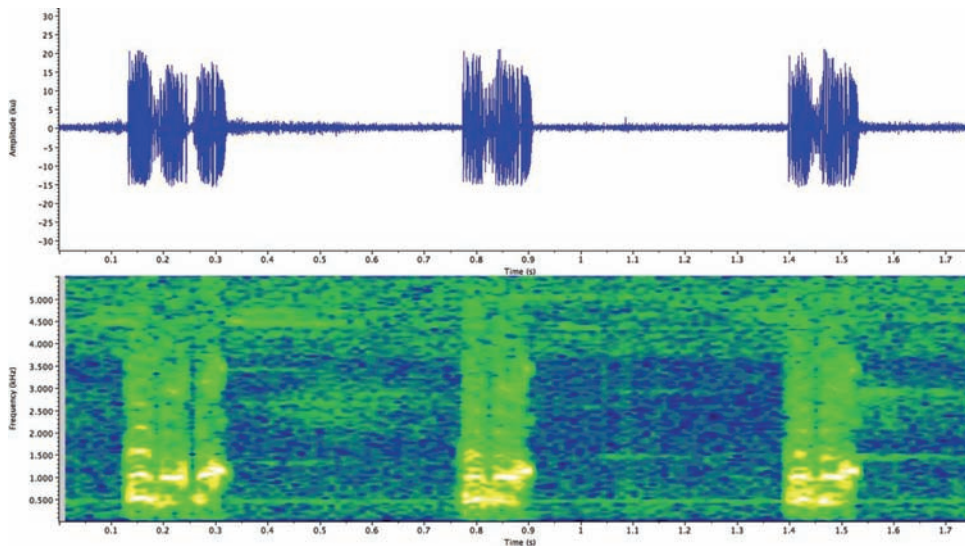


Fig. 65. Distress call of *Rhaebo guttatus*, Bufonidae. Compare with advertisement call in figure 86.

We focus here on the advertisement call, the most commonly heard call that is widely used in species identification.

The advertisement call is the assemblage of one or more acoustic signals (called the notes) produced in a given time sequence. The notes are nothing else than sound waves transmitted through the air (most of the time) or through water (in some species, e.g. *Pipa aspera*, Pipidae).

The characteristics of a sound wave (Fig. 66) are:

- **The amplitude:** usually measured in decibels (dB), the amplitude is the loudness of the sound. Variation of amplitude is visible on an oscillogram (also called the waveform).

- **The frequency:** measured in Hertz (Hz) or kilohertz (kHz), the frequency is the pitch of the sound, which depends on the number of vibrations imposed on the air per second. Variation of frequency is visible on a spectrogram (= audiospectrogram).

Acoustic components of the call are well visible on a spectrogram (Fig. 66) and are:

- **The note:** the smallest unit of the call. The advertisement call may be a single note (Fig. 67), or a series of similar or different notes (Figs 68-70).

The notes may be unpulsed, meaning that there is no extreme change in the amplitude over time (Fig. 71A), or pulsed, meaning that there is severe change(s) in amplitude over time (Fig. 71B). This phenomenon is called the amplitude modulation. Notes may contain one or several pulses of various intensities.

The frequency (= pitch) of the note may be unmodulated, meaning that there is no variation in the pitch over time (Fig. 72A), or distinctly modulated, meaning that there are conspicuous changes in frequency over time (Fig. 72B). This phenomenon is called the frequency modulation. Frequency modulation may have different patterns (e.g. upwards, downwards, up-down, etc.).

- **The fundamental frequency:** the lowest (= first) frequency harmonic.
- **The dominant frequency:** the frequency harmonic within which the greatest amount of sound energy is concentrated; also called the main harmonic. In some cases, the dominant frequency is the fundamental frequency (see Fig. 68 for example).
- **The harmonics:** the separated, evenly spaced frequencies that are multiples of the fundamental frequency.

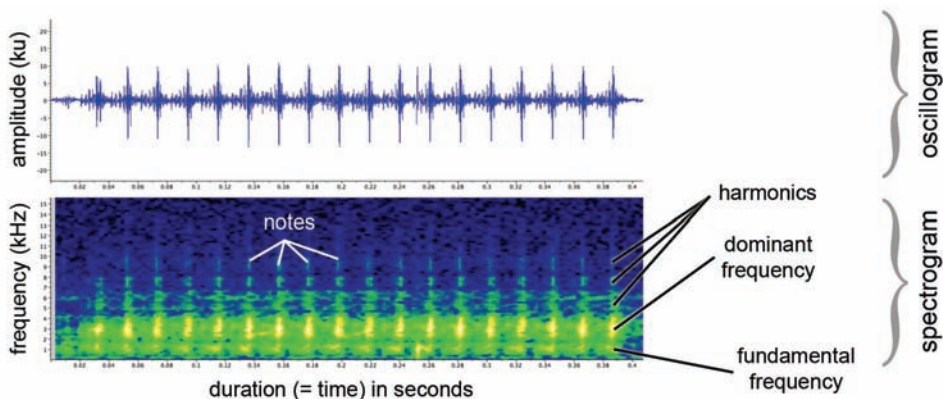


Fig. 66. Oscillogram and spectrogram of the call of *Scinax boesemani* (Hylidae) showing acoustic components.

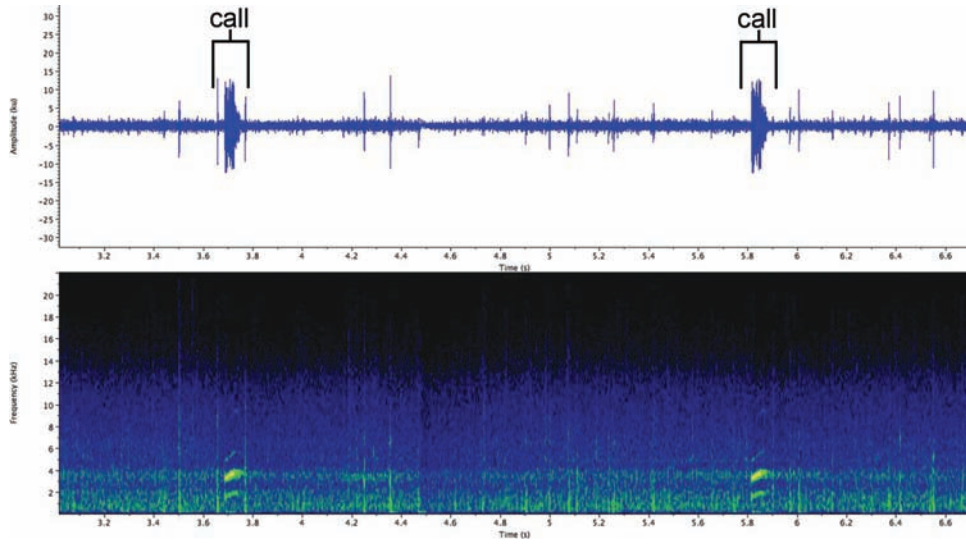


Fig. 67. Oscillogram and spectrogram of the call of *Leptodactylus lutzi* (Leptodactylidae) illustrating a call composed of a single note.

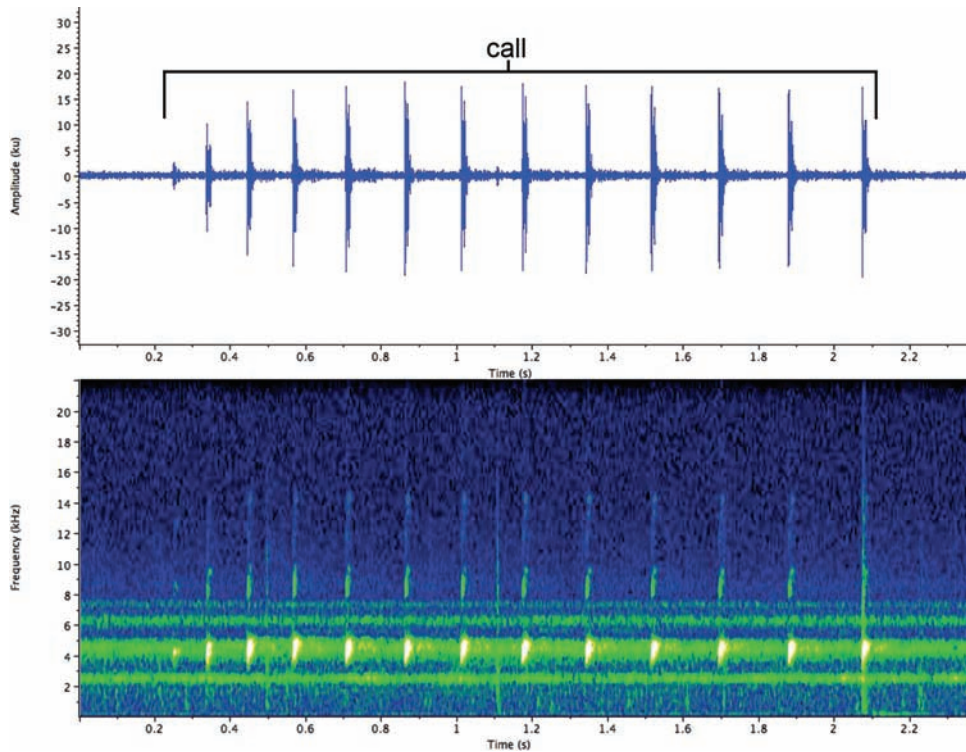


Fig. 68. Oscillogram and spectrogram of the call of *Adelophryne gutturosa* (Eleutherodactylidae) illustrating a call composed of a series of notes (here 13 notes).

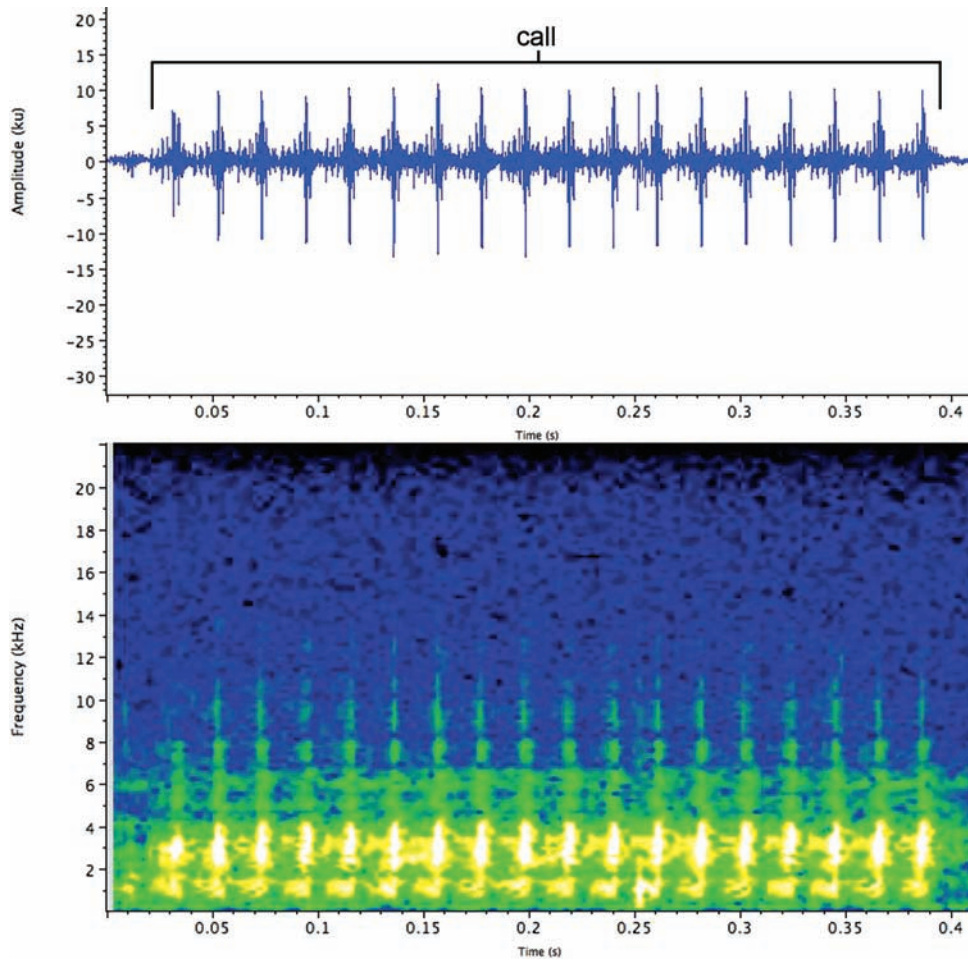


Fig. 69. Oscillogram and spectrogram of the call of *Scinax boesemani* (Hylidae) illustrating a call composed of a series of identical notes (here 18 notes) produced in a very short period of time. This kind of call is named a trill. In this case the entire call is given in less than half a second; compare with figure 68 in which the call is given in about 2s.

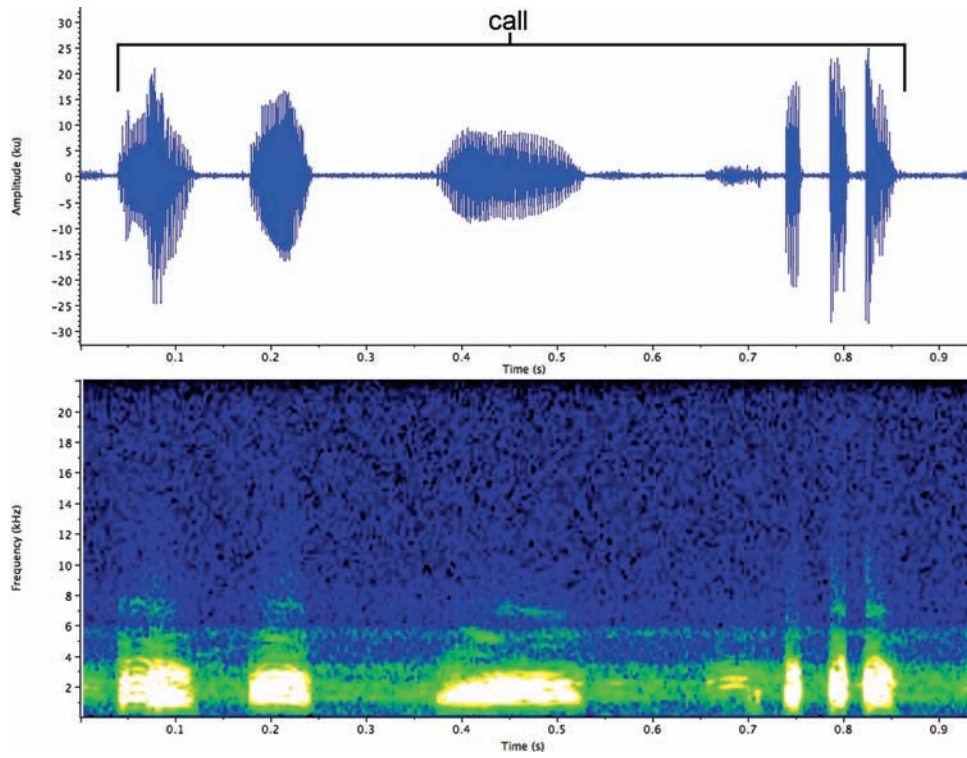


Fig. 70. Oscillogram and spectrogram of the call of *Osteocephalus lepriurii* (Hylidae) illustrating a complex call composed of a series of very different notes.

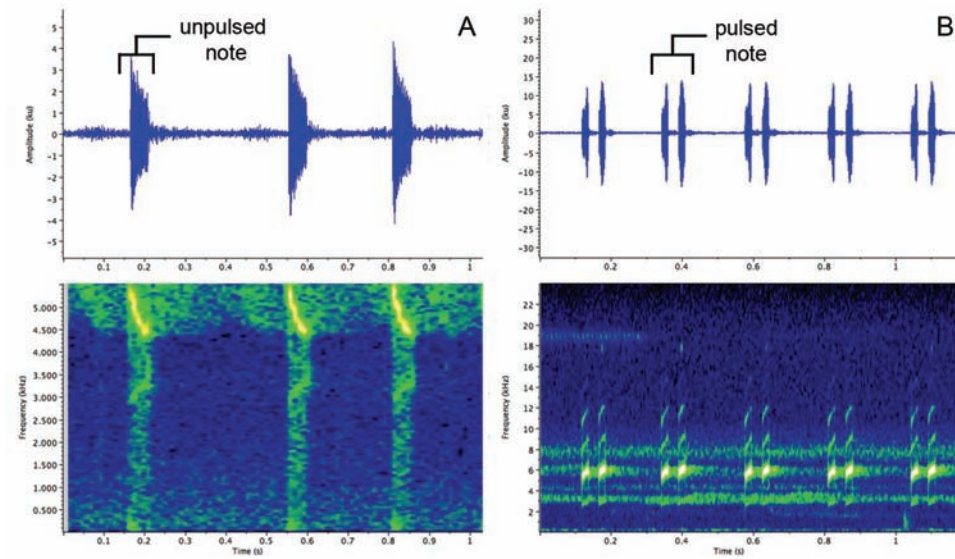


Fig. 71. Oscillograms and spectrograms illustrating amplitude modulation. A. An unpulsed note [*Allobates spumaponens* (Aromobatidae)]; B. A pulsed note [*Allobates granti* (Aromobatidae)]. None of these species occur in KNP.

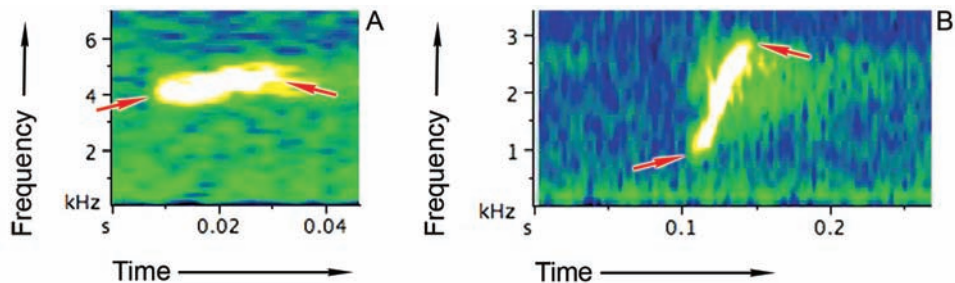


Fig. 72. Spectrograms illustrating frequency modulation. A. Dominant frequency of the call of *Centrolene gorzulae* (Centrolenidae), mostly unmodulated; B. Dominant frequency of the call of *Leptodactylus longirostris* (Leptodactylidae), distinctly modulated (upwards). Red arrows highlight the change of frequency between the beginning of the note (on the left) and the end of the note (on the right).

The following principal temporal variables and parameters are usually considered in the call analysis and allow comparisons between calls:

- **The call duration:** measured in seconds (s), from the beginning of the first to the end of the last note.
- **The note duration:** measured in seconds (s), from the beginning of the note to the end of the note.
- **The inter-call interval:** measured in seconds (s), from the beginning of one call to the beginning of the next.
- **The number of notes:** the number of notes within the call.

- **The inter-note interval:** measured in seconds (s), from the end of one note to the beginning of the next.
- **The note period:** measured in seconds (s), from the beginning of one note to the beginning of the next.
- **The call rate:** the rate at which entire calls are produced, expressed in calls/min.
- **The note repetition rate:** the rate at which notes are produced, expressed in notes/s. The note repetition rate is obtained by measuring the time between the beginning of the first note and the beginning of the last note, and dividing the number of notes included within this period by the time in seconds. Equivalent to the call rate when the call is composed of a single note.
- **The dominant frequency:** generally measured from a spectral slice taken through the portion of the note with the highest amplitude, expressed in Hertz (Hz).

Acquisition of the data

Open your sound using the sound analysis software. Calls and notes are usually not well visible (Fig. 73A) and you will need to zoom in the recording to see the calls and the notes closer (Fig. 73B-C). Play with the contrast if needed and use the software tools to calculate the data you need.

Figure 74 illustrates how to calculate the call duration using the selection borders in *Raven Pro*. The same method is applied for other temporal variables.

Figure 75 shows calculation of the dominant frequency from a spectral slice in *Raven Pro*. Placing the cursor at the top of the first peak will provide the frequency at the bottom of the display.

Remarks:

- Descriptive data are always obtained from multiple measurements of different calls from an individual (ideally from as many individuals as possible).
- As we saw above (in “Recording of advertisement calls”), temperature notably influences some attributes of the acoustic signals (e.g. frequency, note repetition and note repetition rate) and comparisons between calls recorded at different temperatures may lead to misinterpretations.

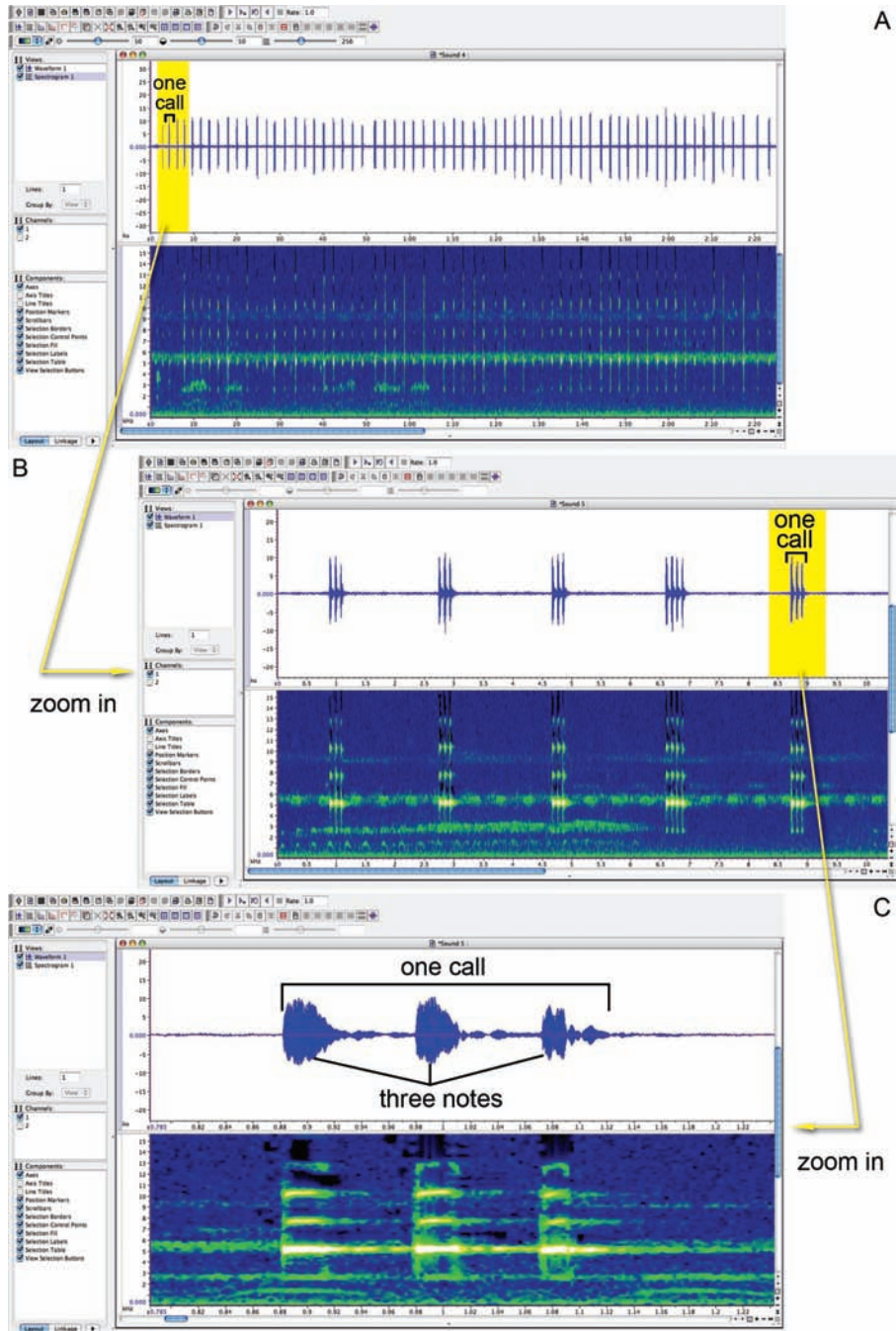


Fig. 73. Zoom in the sound recording to identify calls and notes (here the call of *Anomaloglossus beebeyi*, Aromobatidae). A. Calls are difficult to detect and details are not discernible; we zoom in the area highlighted yellow; B. After zooming, five calls are well visible and the number of notes is discernible; we zoom again in the area highlighted in yellow; C. After zooming, one call composed of three notes is isolated.

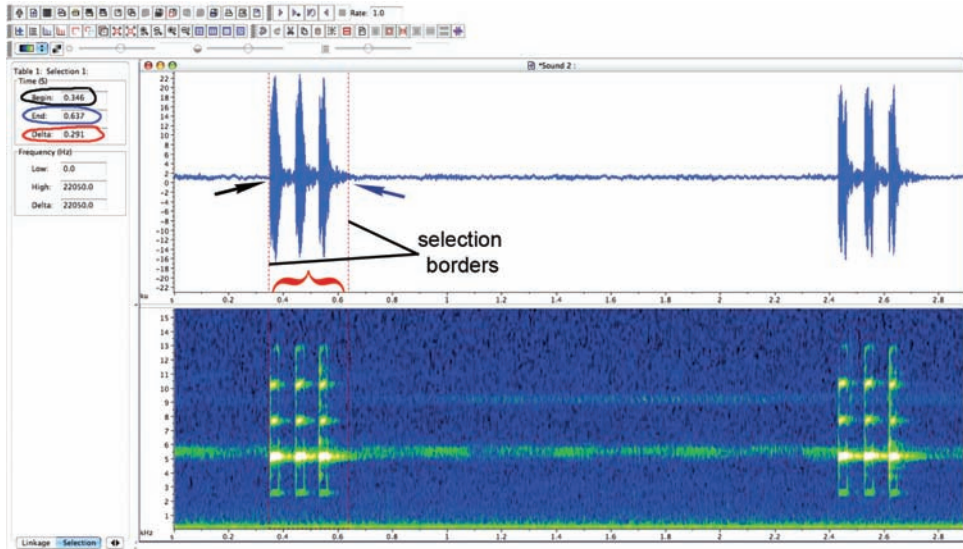


Fig. 74. Example of calculation of a temporal variable: estimation of the call duration of *Anomaloglossus beebeyi*, Aromobatidae. The call is pinpointed between the selection borders. The black arrow indicates the beginning of the call (= time at the beginning - in seconds, which is encircled in black in the left column); the blue arrow indicates the end of the call (= time at the end - in seconds, which is encircled in blue in the left column). The difference (delta) between these two times (which is encircled in red in the left column and shown by a red curly bracket on the oscillogram) is the call duration (0.291 s in this case).

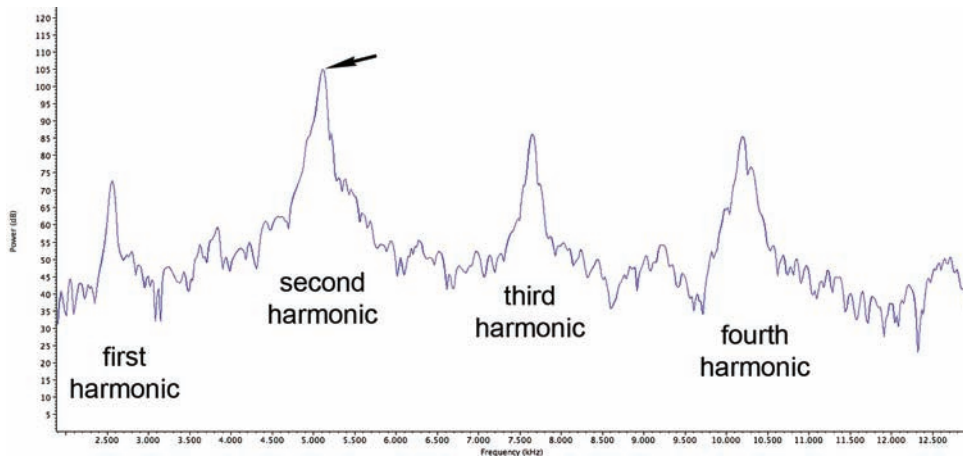


Fig. 75. Spectral slice of the first note of the first call illustrated in figure 74 (*Anomaloglossus beebeyi*, Aromobatidae). The first harmonic is the fundamental harmonic. In this case, the dominant frequency is the second harmonic. The black arrow indicates the peak at which the dominant frequency is measured.

5. Identification guide, and how to use it

The main goal of this identification guide is to allow for a quick and easy identification of the species of amphibians currently known from Kaieteur National Park.

Most of the time, collection and handling of the animal will be necessary for examining discrete structures and hidden colour patterns. Always handle amphibians with wet hands, as their skin may be fragile. Additionally, you should never handle an amphibian if you have insect repellent on your hands, as it would kill it. No “poison frogs” (family Dendrobatidae) are currently recorded from the Park, but some species secrete large amounts of toxins (e.g. large *Leptodactylus*, *Rhaebo* and *Rhinella*) that can irritate your skin and mucous membranes, or even kill other amphibian species if they are in contact with the secretions. Always rinse your hands thoroughly after handling an amphibian.

Genera and species are treated alphabetically within each family. Each species is illustrated by at least a dorsolateral view in life and a ventral view (in life or in preservative). Whenever possible the colour variation is illustrated. Illustration of hand and foot, peculiar morphological characters that may help the identification, and an oscillogram and spectrogram of the call (if known and when relevant) are provided as well. Whenever possible, oscillograms and spectrograms were generated from recordings made in Kaieteur National Park. When adequate recordings were not available we prepared audiospectrograms from recordings made outside the Park. This was the case for the following species: *Allophryne ruthveni*, *Rhinella marina*, *Hypsiboas calcaratus*, *H. boans*, *H. geographicus*, *Osteocephalus leprieurii*, *O. taurinus*, *Phyllomedusa bicolor*, *Trachycephalus coriaceus* (species recorded in French Guiana, calls courtesy of C. Marty and P. Gaucher), *Atelopus hoogmoedi*, *Rhaebo guttatus*, *Trachycephalus resinifictrix*, *Leptodactylus mystaceus*, *L. rhodomystax*, *Pristimantis* cf. *marmoratus* (species recorded at Mabura Hill Forest Reserve, Guyana, calls courtesy of R. Ernst), *Dendropsophus marmoratus* (specimen recorded in Ecuador, Napo, Jatun Sacha, call courtesy of K. H. Jungfer), *Phyllomedusa vaillantii* (specimen recorded in Peru, Panguana, call courtesy of A. Schlüter), and *Leptodactylus lineatus* (specimen recorded in Peru, Tambopata, call courtesy of A. Schlüter).

You can use the field keys provided on p. 64 (caecilians) and p. 87 (anurans) to identify the genus, and then use the field keys provided under each generic account to identify your specimen up to the species. You also may wish to first consult the colour figures that illustrate the species and check the diagnostic characters given in the accounts. Both methods should allow for fast identification. If you experience problems in identifying a specimen you can contact one of the authors (see the beginning of the manual for contact information), as it is possible that you have found a species not previously reported from the Park or even an undescribed taxon.

In addition to the field key for species, each generic account provides basic information on the genus, some external morphological characters that may be useful for identification, and, when necessary, briefly mentions species of possible occurrence in the Park that were not collected during our surveys. Do

note that morphological characters provided for each genus are not always discriminant because no morphological synapomorphies have currently been detected in some genera (e.g. *Dendropsophus*, *Hypsiboas*).

The taxonomy of a few specimens collected in the Park remains too unclear and so these possible new taxa were voluntarily excluded from this guide. The elucidation of the taxonomy of these specimens will be dealt with later, once more material becomes available.

Cryptic species are distinct taxa that are not, or hardly distinguishable on a morphological basis (see for example *Hypsiboas cinerascens* and *Hypsiboas* sp. on p. 168 and 176, respectively). Some widespread species might in fact be complexes of cryptic taxa (Fouquet *et al.*, 2007) and many of those species probably remain to be described. This suggests that current estimates of amphibian species richness are too low, but also that the taxonomic status and/or the distribution of some species treated in this manual could be re-evaluated in the future.

Each species account is provided as follows:

- **Scientific name of the species** (Genus and species) followed by authorship and date of publication.
Year and page of the original description + references to original illustrations (when relevant) are also given.
- **Pictograms** illustrate the size of the animal and its nycthemeral activity pattern (Fig. 76). This may be useful for quick identification and comparison without reading the text.

Diurnal species are active during the day (whatever the meteorological conditions). Nocturnal species are primarily active by night, or near dawn or dusk (or both), but some may be found during the day when cloudy and/or heavily raining.

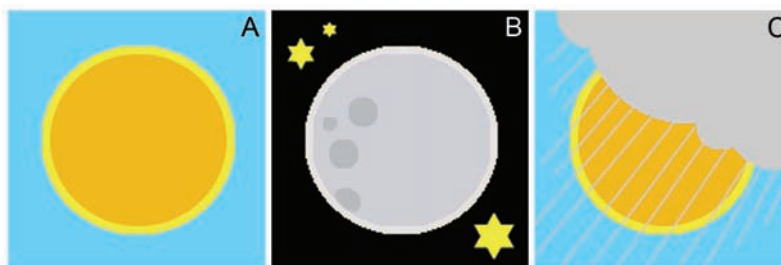


Fig. 76. Pictograms illustrating the nycthemeral activity patterns. A. Diurnal. B. Nocturnal. C. Used for nocturnal species that may be found during cloudy days and/or heavy rains.

- **English name:** the most commonly used English name(s). We usually propose an English name if none is currently available.
- **Local name:** the name of the species in Patamona dialect, when known.

- **Type locality:** the geographical location where the holotype (= the original preserved specimen designated for naming and describing the species) or the lectotype (= a specimen serving the function of a holotype when no holotype was designated in the original description) was collected.
- **Selected references:** a maximum of three important references that should be consulted by the reader.
- **Field identification:** this section provides the maximum theoretical size (SVL) in males and females (*i.e.* the maximum size reported in the literature, not the maximum size reported from KNP). If examination of specimens collected in Kaieteur National Park resulted in increases in the known maximum size for a species, this is indicated by an asterisk (*). Eight to nine characters that are easily observable in the field, even for people having little knowledge in amphibian taxonomy, are emphasized. The reader should refer to the previous chapters of this manual for more details about diagnostic characters. We tried to deal with the same characters for each species of a same genus in order to facilitate comparisons. Colour arrows refer to these characters in the identification section and pinpoint them in the corresponding figures.
- **Life history:** this section provides basic information on the biology of the species.
- **Call:** this section provides reference to the first description of the advertisement call (when relevant), and a brief description.
- **Tadpole:** this section provides reference to the first description of the tadpole (when relevant), a brief description as well as its ecomorphological guild (see McDiarmid & Altig, 1999 for details).
- **Abundance and distribution in KNP:** this section provides a subjective estimation of the abundance of the species in the Park, which is expressed as very common (occurs in considerable numbers and easily observed every day), common (commonly seen, easily observed every week), rare (not usually observed more than once every few month), or very rare (seen very occasionally, sometimes known from a single specimen). Note that a species may be rare in some parts of the Park, but locally abundant due to adequate habitat, environmental conditions, etc. (this is especially true for species like *Anomaloglossus beebei* and *Leptodactylus lineatus*). Some species may be locally abundant only during a very short period of time (*e.g.* explosive breeders) and otherwise be seen only very occasionally. Main sampling localities where the species was recorded in KNP are provided as well (refer to Fig. 3 to locate sampling localities on a map).
- **Geographic range:** the general distribution of the species.
- **Taxonomic comments:** when necessary, this section provides some important remarks on the taxonomy of the species.
- **Remark:** when necessary, this section mentions if some photos used to illustrate the species have been taken outside the Park.

Allophryne Gaige, 1926

“TUKEIT HILL FROGS”



Fig. 77. *Allophryne ruthveni*, the only described species in the genus. (Photo by P. J. R. Kok).

- ⇒ Small size
- ⇒ Head small, triangular
- ⇒ Snout short
- ⇒ Maxillary teeth absent
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum smooth with unevenly distributed spicules (Fig. 44A, E)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Fingers basally webbed
- ⇒ Finger I < II when fingers adpressed
- ⇒ Toes half-webbed
- ⇒ Finger discs truncate, wider than digits (Fig. 51C)

The genus is monotypic, but more species probably await description (see below).

Generic and specific characteristics are illustrated together in the species account of the only currently described taxon, *Allophryne ruthveni* (p. 112).

Tukeit Hill frogs are nocturnal, mostly arboreal, and inhabit primary forest where they are mainly found in the close vicinity of streams. They are explosive breeders, having apparently short breeding periods during the rainy season.

The genus *Allophryne* is taxonomically challenging with a long history of controversy, sharing many characteristics with Centrolenidae. There is still some debate regarding the family ranking of the genus. Frost *et al.* (2006) formerly ranked *Allophryne* in the family Centrolenidae, but Guayasamin *et al.* (2008) argued to maintain the use of Allophrynidae, pointing out a sister-group relationship between *Allophryne* and glass frogs (Centrolenidae).

Sexual dimorphism

Females of the only described species have more white spots on the black throat and less spicules on the dorsum. Males have a whitish central area visible through the skin on the chest and the belly.

Eggs

Deposited on a leaf overhanging water.

Tadpoles

Not formally described yet. Exotroph (possibly benthic, or fossorial like those of centrolenids).

Distribution

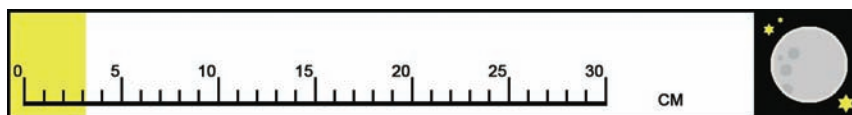
The genus *Allophryne* is currently reported throughout the Guiana Shield and in the states of Pará, Maranhão, and Rondônia in Brazil (Frost, 2008).

Allophryne ruthveni is expected in Bolivia according to De la Riva *et al.* (2000).

A putative new species of *Allophryne* has been reported from Peru (Rodríguez & Knell, 2003), which would suggest that the genus is more widespread than previously thought. However no description appeared since the discovery of the putative new species.

Allophryne ruthveni Gaige, 1926

1926: 1, pl. 1.



ENGLISH NAME: Tukeit Hill frog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "Tukeit Hill, below Kaiteur [sic] Falls, British Guiana".

SELECTED REFERENCES: Lynch & Freeman, 1966 (expanded description, in English); Hoogmoed, 1969 (additional data on natural history and colouration, B&W photos, in English); Caldwell & Hoogmoed, 1998 (extended account, colour photo, in English).

Field identification - Males reach 24.7 mm SVL, females 31.0 mm.

- Dorsal ground colour and pattern variable, ranging from greyish-brown to creamish bronze with dark irregular spots and/or reticulum; often a conspicuous cream spot on posterior face of upper arm; skin on dorsum smooth, covered with horny spicules (larger and more extensive in males).
- Ventral surface thickly areolate, translucent dark grey, with a whitish central area visible through the skin in males.
- Throat black with white spots (more extensive in females).
- Head very small, triangular, broader than long.
- Iris dark reddish brown.
- Fingers basally webbed, with lateral fringes.
- Tip of fingers and toes truncate.
- Toes moderately webbed, with lateral fringes.

Life history - Nocturnal, arboreal. Found in primary forest, often in the vicinity of creeks. Males call from 1-3 m above the ground. Eggs are deposited on a leaf overhanging water, from which tadpoles will fall into the water as they hatch; tadpoles probably feed on detritus.

Call - First described by Caldwell & Hoogmoed (1998: 666.2), who provided a spectrogram. It consists of a short, low, raspy trill produced at a rate of ca. 30 calls/min.

Tadpole - Not formally described. Lescure & Marty (2001) reported it as brownish grey, mottled with black, dorsoventrally flattened with a gradually tapering tail.

Abundance and distribution in KNP - Rare, collected only around main sampling localities # 2 and 5 (see Fig. 3), but the species is probably more widespread in the Park.

Geographic range - Has been reported throughout the Guiana Shield and in the states of Pará, Maranhão, and Rondônia in Brazil. Expected in Bolivia according to De la Riva *et al.* (2000).

Taxonomic comments – See generic account (p. 110).

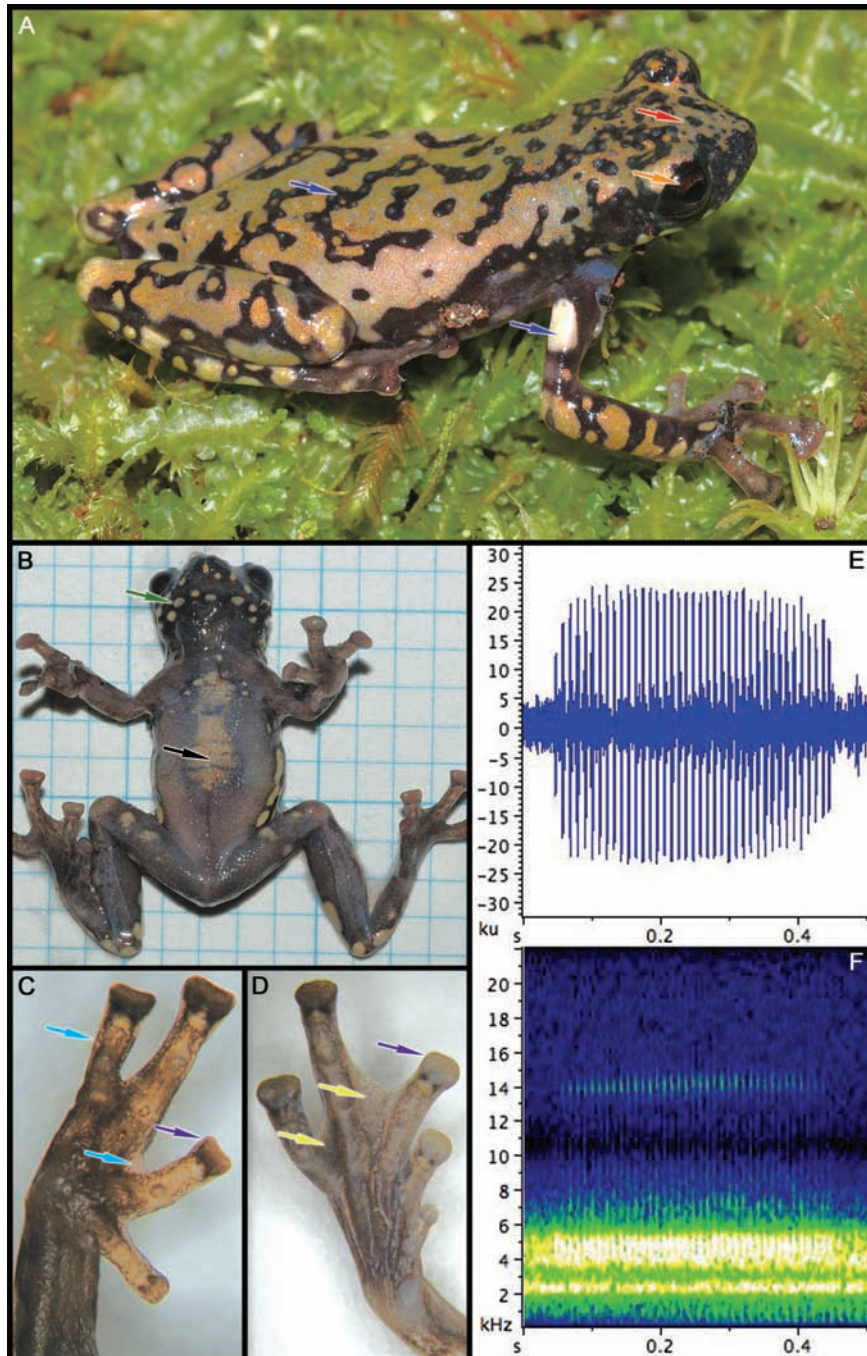


Fig. 78. *Allophryne ruthveni* Gaige, 1926. A. Dorsolateral view. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

***Anomaloglossus* Grant, Frost, Caldwell, Gagliardo,
Haddad, Kok, Means, Noonan, Schargel & Wheeler, 2006**

“ROCKET FROGS”



Fig. 79. *Anomaloglossus kaiei*, one of the 20 currently described species in the genus. Here a male carrying tadpoles. (Photo by P. J. R. Kok).

- ⇒ Small to medium size
- ⇒ Maxillary teeth present
- ⇒ Presence of a median lingual process (Fig. 80)
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum smooth to slightly granular (Fig. 44 A-C, H)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Fingers unwebbed
- ⇒ Finger I < = > II when fingers adpressed
- ⇒ Dorsal surface of finger disc with two scutelike flaps (Fig. 51F)

The genus currently contains 20 species, but many still await description. Rocket frogs are diurnal, mostly terrestrial (some, like *A. kaiei* are forest-dwellers, some, like *A. beebei*, are bromeliad-dwellers, others like *A. degranvillei* are stream-dwellers), and inhabit a wide range of habitats, from savannah to tepui summits.

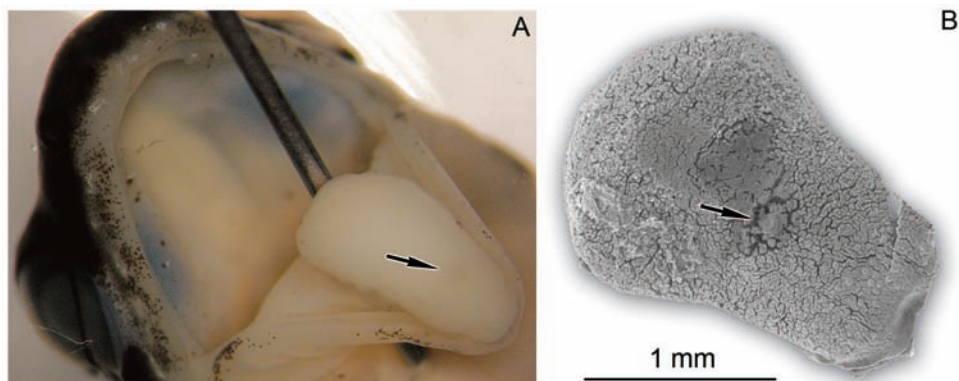


Fig. 80. The median lingual process (here in *Anomaloglossus kaiei*). (Photo A by P. J. R. Kok; scanning electron micrograph B by J. Cillis & P. J. R. Kok).

Sexual dimorphism

Not present in all species. Males of some species have the third finger or all fingers swollen, and/or a darker throat than females.

Eggs

Terrestrial, deposited on the ground, or on leaves of bromeliads (= phytotelmata).

Tadpoles

Extotroph (benthic or arboreal), or endotroph.

Distribution

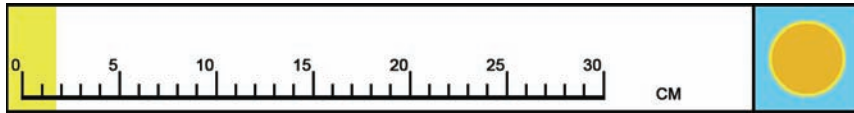
The genus *Anomaloglossus* is currently reported from the northern and eastern Amazon Basin, the Guiana Shield, and the Pacific slopes of the Andes in Colombia and Ecuador (Grant *et al.*, 2006).

Field key to the *Anomaloglossus* species of Kaieteur National Park

1. Finger I distinctly shorter than Finger II; lateral fringes present on Fingers II & III; palm yellow; digits without small sky blue spots; hindlimbs without dark brown bars; dorsal colour usually yellow, and pattern usually absent or inconspicuous ***A. beebei*** (p. 116)
- 1'. Finger I and II equal in length; lateral fringes present on all fingers; palm dark brown or black; digits with sky blue spots; hindlimbs usually with distinct dark brown bars; dorsal colour brown, and pattern usually conspicuous
 ***A. kaiei*** (p. 118)

Anomaloglossus beebei (Noble, 1923)

1923: 289, figs 1-4.



ENGLISH NAME: Golden rocket frog, Beebe rocket frog.

LOCAL NAME (PATAMONA): Kayatik.

TYPE LOCALITY: "Near Kaieteur Falls, British Guiana".

SELECTED REFERENCES: Bourne, 2001 (colour pattern, natural history, in English); Bourne *et al.*, 2001 (vocal communication, reproductive behaviour, in English); Kok *et al.*, 2006b (redescription, call description, tadpole description, colour photos, natural history, distribution, in English).

Field identification - Males reach 16.8 mm SVL, females 18.7 mm.

➤ Dorsal ground colour very variable (at least five different colour patterns), ranging from bright yellow to pale brown, with dorsolateral stripes (sometimes inconspicuous), with or without dark brown markings, juveniles greenish/yellowish white; skin on dorsum slightly granular.

➔ Ventral surface granular, immaculate yellow to yellowish orange in both sexes (fades to white in preservative).

➤ Throat immaculate in both sexes.

➤ When addressed, Finger I shorter than II; Finger III not swollen in males.

➤ Subarticular tubercles small, single.

➤ Fingers unwebbed, lateral fringes present on Fingers II and III.

➤ Toes moderately webbed.

➤ Discs on digits larger than adjacent phalange, with distinct dorsal scutes.

Life history - Diurnal. Found exclusively in large terrestrial bromeliads (*Brocchinia micrantha*). Males call from bromeliads. Eggs are deposited on the leaves of the bromeliad and tadpoles live in the water-filled phytotelm where they feed on detritus, insect larvae, other tadpoles, and unfertilized eggs deposited by the female.

Call - First described by Kok *et al.* (2006b: 60), who provided a spectrogram. It consists of 3-4 notes (high-pitch chirps) repeated at a rate of 44-51 calls/min.

Tadpole - First described by Kok *et al.* (2006b: 59). Exotroph, arboreal; yellow with dark mottling; LTRF = 2(2)/3.

Abundance and distribution in KNP - Very common locally in suitable habitat. Collected only around main sampling localities # 1 and 11 (see Fig. 3), but possibly more widespread in the Park in suitable habitats.

Geographic range - Reported only from Guyana, in KNP and on Mt Ayanganna.

Taxonomic comments - Identification of specimens from Mt Ayanganna needs formal confirmation, notably by call and tadpole comparisons.

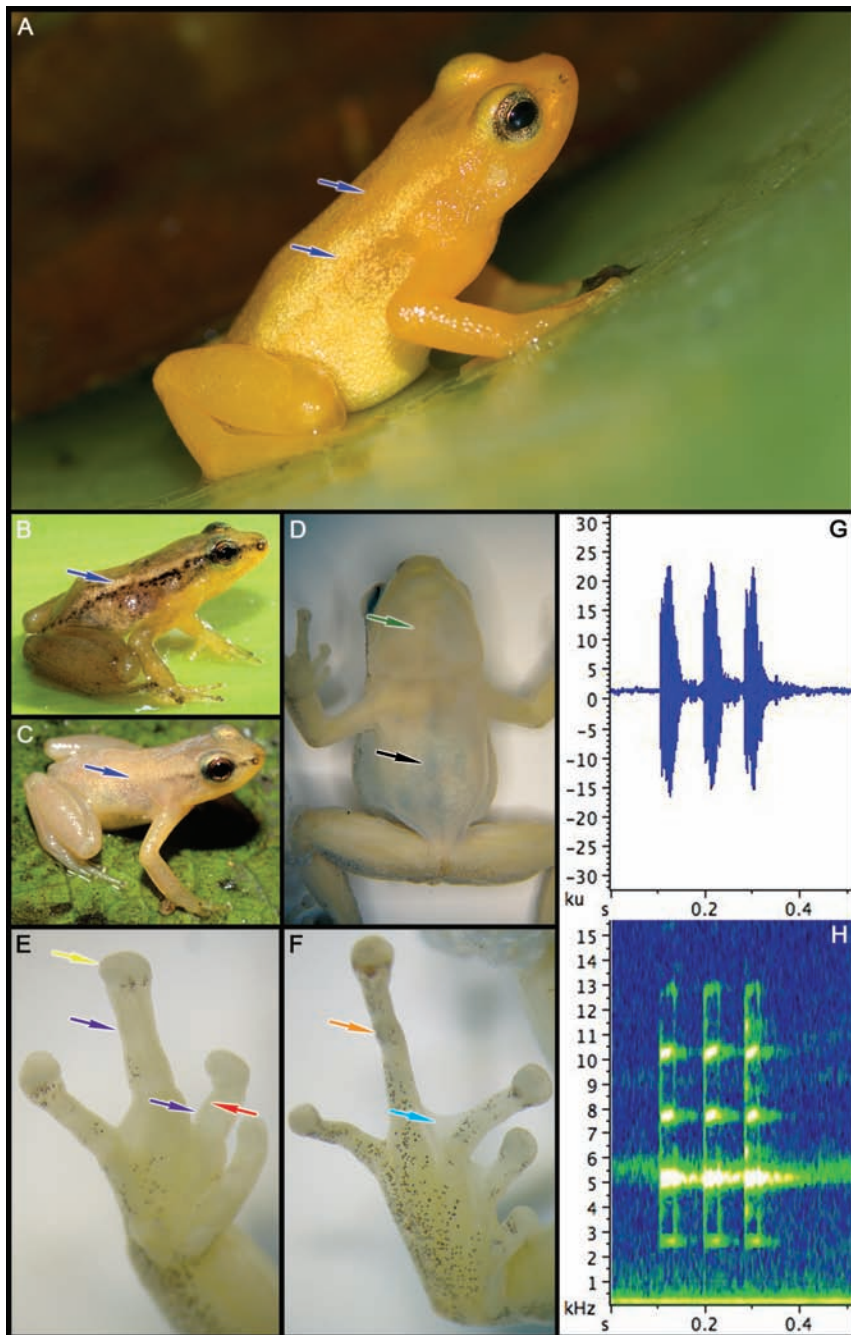
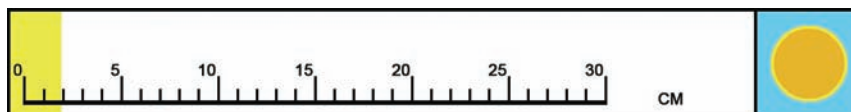


Fig. 81. *Anomaloglossus beebei* (Noble, 1923). A. Bright yellow morph. B. Brown morph. C. Juvenile. D. Ventral surface in preservative. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

***Anomaloglossus kaiei* (Kok, Sambhu, Roopsind, Lenglet & Bourne, 2006)**

2006a: 38, figs 1-8.



ENGLISH NAME: None; we propose “Kaie rocket frog”.

LOCAL NAME (PATAMONA): Kokonbasli.

TYPE LOCALITY: “Kaieteur National Park, along Tukeit trail, Guyana, 5°11'06”N, 59°28'51”W, elevation ca. 400 m”.

SELECTED REFERENCE: Kok *et al.*, 2006a (original description, call description, tadpole description, colour photos, natural history, distribution, in English).

Field identification - Males reach 18.9 mm SVL, females 19.8 mm.

➤ Dorsal ground colour variable, ranging from medium to reddish brown, with thin to inconspicuous dorsolateral line from eye to vent, and a wide black band from tip of snout laterally around body and above vent; skin on dorsum smooth to shagreened, posteriorly granular.

➤ Ventral surface smooth, immaculate orangish yellow in females, cream in males.

➤ Throat light greyish pink with dark spotting in males, immaculate yellow in females.

➤ When adpressed, Fingers I and II equal in length; all fingers slightly swollen in males.

➤ Subarticular tubercles small, single.

➤ Rudimentary webbing between Fingers II and III, lateral fringes present on all fingers.

➤ Toes moderately webbed.

➤ Discs on digits larger than adjacent phalanx, with distinct dorsal scutes.

Life history - Diurnal, terrestrial. Mostly found in primary forest, but also occurs in disturbed areas. Males call from over or under dead leaves on the ground. Eggs are probably laid in the leaf litter; tadpoles are usually carried by the male (rarely the female) and are deposited in very small pools where they feed on detritus, and sometimes on unfertilized eggs that are deposited by the female.

Call - First described by Kok *et al.* (2006a: 51), who provided a spectrogram. It consists of 1-2 notes (cricket-like chirps) repeated at a rate of 22-33 calls/min.

Tadpole - First described by Kok *et al.* (2006a: 47). Exotroph, benthic; dark brown with minute light dots; LTRF = 2(2)/3.

Abundance and distribution in KNP - Very common locally. Collected around all main sampling localities (see Fig. 3).

Geographic range - Reported only from Guyana, in KNP, but the species is widespread in the Pakaraima Mountains of Guyana (Kok, unpublished data).

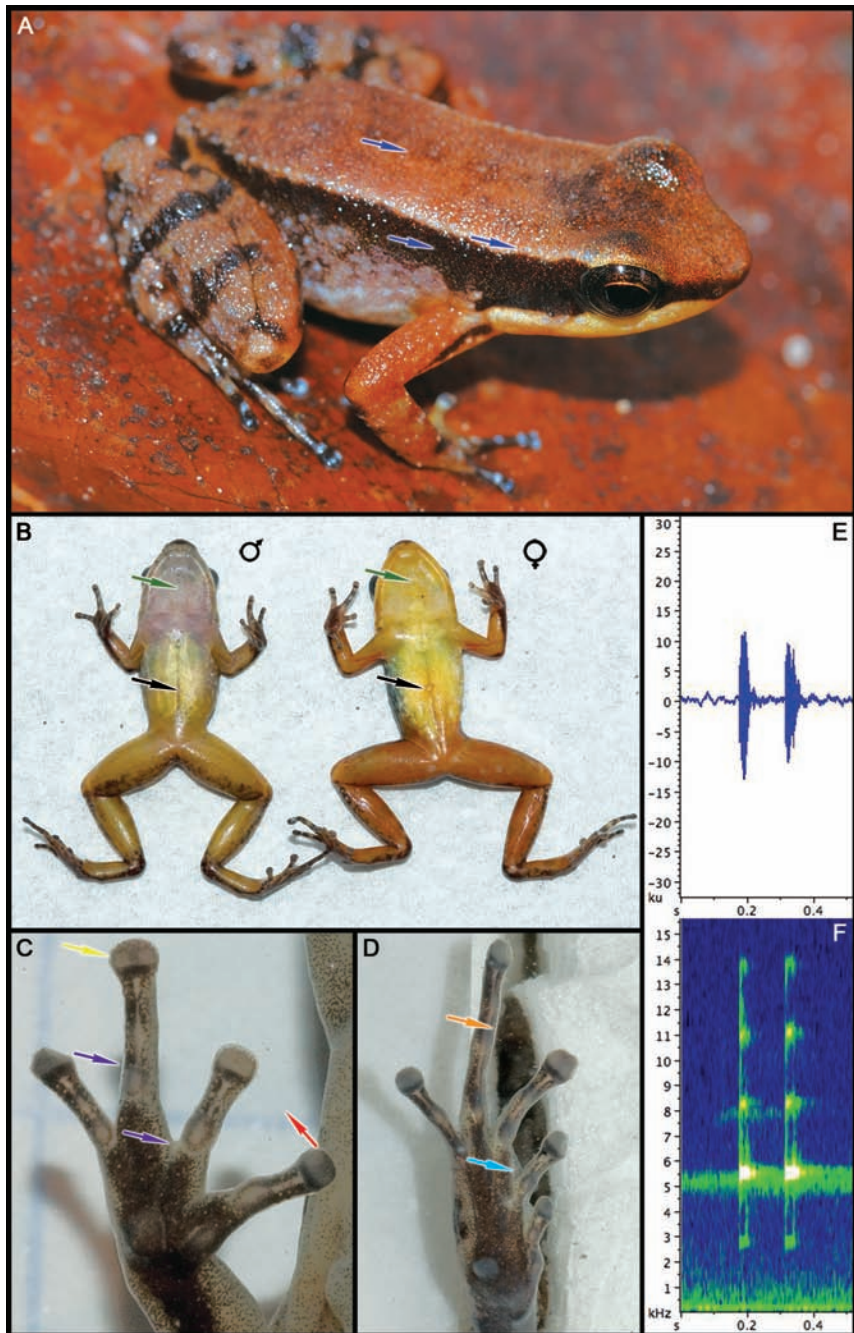


Fig. 82. *Anomaloglossus kaiei* (Kok, Sambhu, Roopsind, Lenglet & Bourne, 2006). A. Dorsolateral view of a female. B. Ventral surfaces of male and female in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Atelopus Duméril & Bibron, 1841

“HARLEQUIN TOADS”



Fig. 83. *Atelopus hoogmoedi*, one of the ca. 83 currently described species in the genus. (Photo by P. J. R. Kok).

- ⇒ Small to medium size
- ⇒ Maxillary teeth absent
- ⇒ Usually brightly coloured with contrasting pattern
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum usually smooth (Fig. 44A), but shagreened to warty in some species (Fig. 44B-F)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I < II; first finger and toe very short; finger webbing at least between Fingers I-II, toes webbed
- ⇒ Finger discs unexpanded (Fig. 51A)
- ⇒ Tympanum absent (Fig. 43C)

The genus currently contains 83 species, although the taxonomic status of some of its members needs verification. Harlequin toads are diurnal and mostly terrestrial. Many species are stream-dwellers (meaning that they inhabit stream banks), but individuals may be found far from water. Several different toxins have been reported in a number of *Atelopus* species (e.g. tetrodotoxin).

Many populations of *Atelopus* recently drastically declined, and the genus appears to be very sensitive to the chytrid fungus *Batrachochytrium dendrobatidis*, which is one of the putative causes of the global amphibian decline.

Sexual dimorphism

Females are larger than males. Forearm in males is thicker proximally than distally, and Finger I has nuptial excrescences.

Eggs

Aquatic, deposited in gelatinous strings in streams or small adjacent pools, sometimes attached to submerged rocks.

Tadpoles

Exotroph (gastromyzophorous).

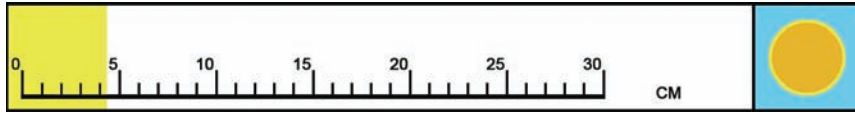
Distribution

The genus *Atelopus* is widespread and reported in Central and South America, from Costa Rica to Bolivia (Frost, 2008).

Only *Atelopus hoogmoedi* (p. 122) is currently recorded from Kaieteur National Park, where several healthy populations occur.

***Atelopus hoogmoedi* Lescure, 1974**

1974: 998, figs 1-2.



ENGLISH NAME: None; we propose “Hoogmoed harlequin toad”.

LOCAL NAME (PATAMONA): Patakàlàlàk.

TYPE LOCALITY: “monts Atachi-Bacca (Guyane française)”

SELECTED REFERENCES: Lescure, 1974 (original description - under *A. pulcher hoogmoedi* – B&W photo, in French); Lescure & Marty, 2001 (brief description - under *A. spumarius hoogmoedi* - distribution, colour photo, in French); Lötters *et al.*, 2005 (brief description, colour photo, in French, English and Dutch).

Field identification - Males reach 31.8 mm SVL, females 42.8* mm.

- Dorsal ground colour dark brown to black, with variable pattern consisting of broad irregular yellow dorsolateral bands and markings, in which black spots are usually present; skin on dorsum smooth.
- Ventral surface smooth, yellow, orange or pinkish, usually with irregular black markings.
- Throat yellow, orange or pinkish, usually with irregular black markings.
- Tympanum absent.
- Arms and legs slender.
- First finger reduced, when adpressed Finger I much shorter than II, fingers unwebbed.
- Toes I-II much reduced included in a pad-like web, toes moderately webbed.
- Disc on fingers and toes unexpanded.

Life history - Diurnal, terrestrial. Found on the leaf litter in primary forest, often near streams. Individuals may be found sleeping on low vegetation at night. Males call from the ground, close to small streams. Eggs are deposited in gelatinous strings in streams or in small adjacent pools.

Call - First described by Lescure (1981a: 900), who provided a spectrogram. It consists of a series of pulses increasing in pulse rate from the beginning to the end of the call and produced in about one second.

Tadpole - Unknown. Very likely exotroph, gastromyzophorous, like in other species of the genus.

Abundance and distribution in KNP - Rare, but may be locally common. Collected only around main sampling localities # 4 and 11 (see Fig. 3).

Geographic range - Reported only from the Guianas (French Guiana, Suriname and Guyana) and adjacent northern Brazil (states of Roraima, Pará and Amapá).

Taxonomic comments - Often reported as *Atelopus spumarius hoogmoedi* in the literature. Probably a complex of species that deserves a thorough revision.

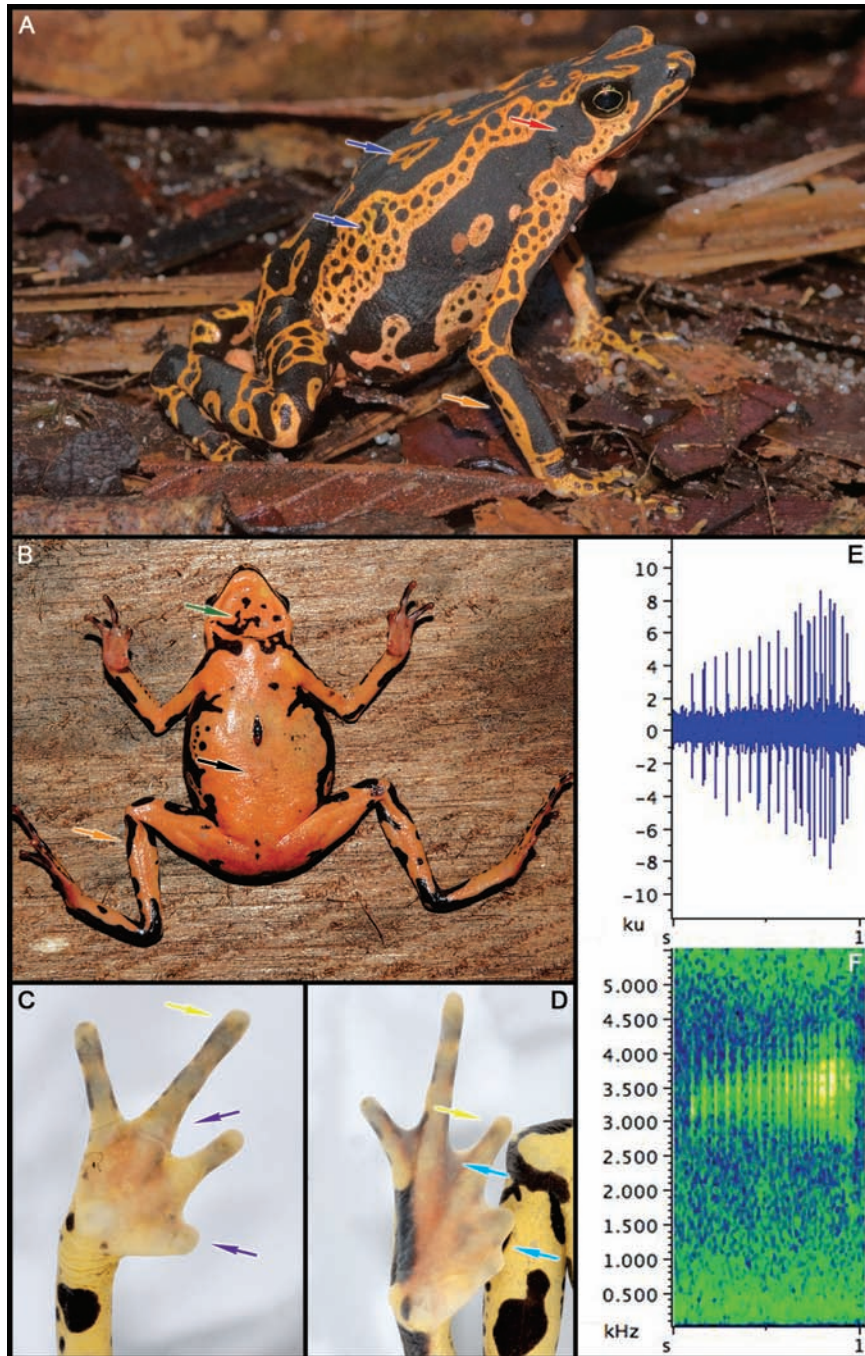


Fig. 84. *Atelopus hoogmoedi* Lescure, 1974. A. Dorsolateral view of a female. B. Ventral surface of a female in life. C. Palm (preserved female specimen). D. Sole (preserved female specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Rhaebo Cope, 1862

“COPE TOADS”



Fig. 85. *Rhaebo guttatus*, one of the eight currently described species in the genus.
(Photo by P. J. R. Kok).

- ⇒ Medium to very large size
- ⇒ Maxillary teeth absent
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum smooth, tuberculate or spiculate (Fig. 44A, D-E)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Fingers unwebbed to basally webbed
- ⇒ Finger I < = > II when fingers adpressed
- ⇒ Finger discs unexpanded (Fig. 51A)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)
- ⇒ Parotoid glands present, ovoid to elongate (Fig. 47A)
- ⇒ Cranial crests absent or weakly developed

The genus currently contains eight species and includes the species formerly assigned to the *Bufo guttatus* species group.

Cope toads are diurnal or nocturnal, strictly terrestrial. They mainly inhabit tropical rainforest where they are often found along rivers and streams; some species are also found in open areas.

Sexual dimorphism

Males are usually smaller than females, in some species throat colour may vary between sexes (e.g. black in male vs. dark brown with white spots in female).

Eggs

Aquatic, deposited in long strings in temporary or permanent pools, sometimes close to streams, and possibly in slow-moving water.

Tadpoles

Unknown for several species. Exotroph (benthic); Lescure & Marty (2001) suggested a possible rheophilous tadpole in *Rhaebo guttatus*.

Distribution

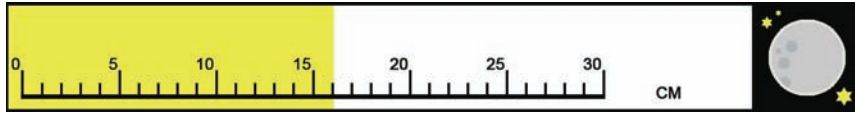
The genus *Rhaebo* is widespread and currently reported from eastern Honduras to Ecuador west of the Andes, and from the Guiana Shield to the upper Amazon Basin (Frost, 2008).

Field key to the *Rhaebo* species of Kaieteur National Park

1. Skin on dorsum tuberculate (Fig. 44D); parotoid glands large, well visible (Fig. 47A); snout truncate in profile (Fig. 40B), not distinctly projecting beyond mouth; upper eyelid not laterally projecting beyond the eye; tympanum well distinct (Fig. 43A). ***R. guttatus*** (p. 126)
- 1'. Skin on dorsum spiculate (Fig. 44E); parotoid glands small to moderately large; snout acute in profile (Fig. 40B), distinctly projecting beyond the mouth; upper eyelid laterally projecting beyond the eye; tympanum barely distinct (Fig. 43B). ***R. nasicus*** (p. 128)

Rhaebo guttatus (Schneider, 1799)

1799: 218.



ENGLISH NAME: Spotted toad.

LOCAL NAME (PATAMONA): Walà.

TYPE LOCALITY: "India Orientali" [restricted to Suriname by Rivero, 1961]

SELECTED REFERENCES: Duellman, 1997 (brief description, colour photo, in English); Lescure & Marty, 2001 (brief description, distribution, colour photo, in French); Duellman, 2005 (brief description, tadpole description, call description and colour photo, in English).

Field identification - Males reach 137.8 mm SVL, females 177.0 mm.

- Dorsal ground colour orange tan to greyish brown, with no distinct pattern, but some large tubercles may be orange, reddish brown or dark brown; skin on dorsum tuberculate, sometimes spiculate, but always smooth on head.
- Ventral surface smooth to finely granular, orangish brown, pale grey or greyish brown with cream spots.
- Flanks dark reddish brown to dark brown, highly contrasting with the dorsal colour.
- Lower lip with creamy spots.
- Cranial crests absent, but presence of a canthal and a short preorbital ridge.
- Parotoid glands large, ovoid.
- When adpressed Finger I much longer than II, fingers unwebbed.
- Disc on fingers and toes unexpanded.

Life history - Nocturnal, terrestrial. Found in primary forest, near streams and rivers. Individuals may be found in very rocky areas (*i.e.* along the Potaro River at the base of Kaieteur Falls) and in caves. Males call from the ground, usually at the edge of streams or rivers. Eggs are deposited in gelatinous strings in streams or in small adjacent pools.

Call - The first comprehensive description seems to be that of Duellman (2005: 183), who provided a spectrogram. It consists of a series of loud notes (a plaintive mewling diminishing in frequency and loudness) repeated at a rate of about 75 notes/min.

Tadpole - The first detailed description is apparently that of Duellman (2005: 183), who provided a description of a stage-37 tadpole resulting from captive breeding. Exotroph, benthic, possibly rheophilous according to Lescure & Marty (2001); dark brown; LTRF = 2(1)/3.

Abundance and distribution in KNP - Common. Collected around main sampling localities # 1, 2, 6, 7, 10 and 12 (see Fig. 3). Probably widespread in the Park.

Geographic range - Widespread in the Amazon Basin, found from eastern Ecuador and Peru to the Guiana Shield and from Venezuela and Colombia to northern Bolivia.

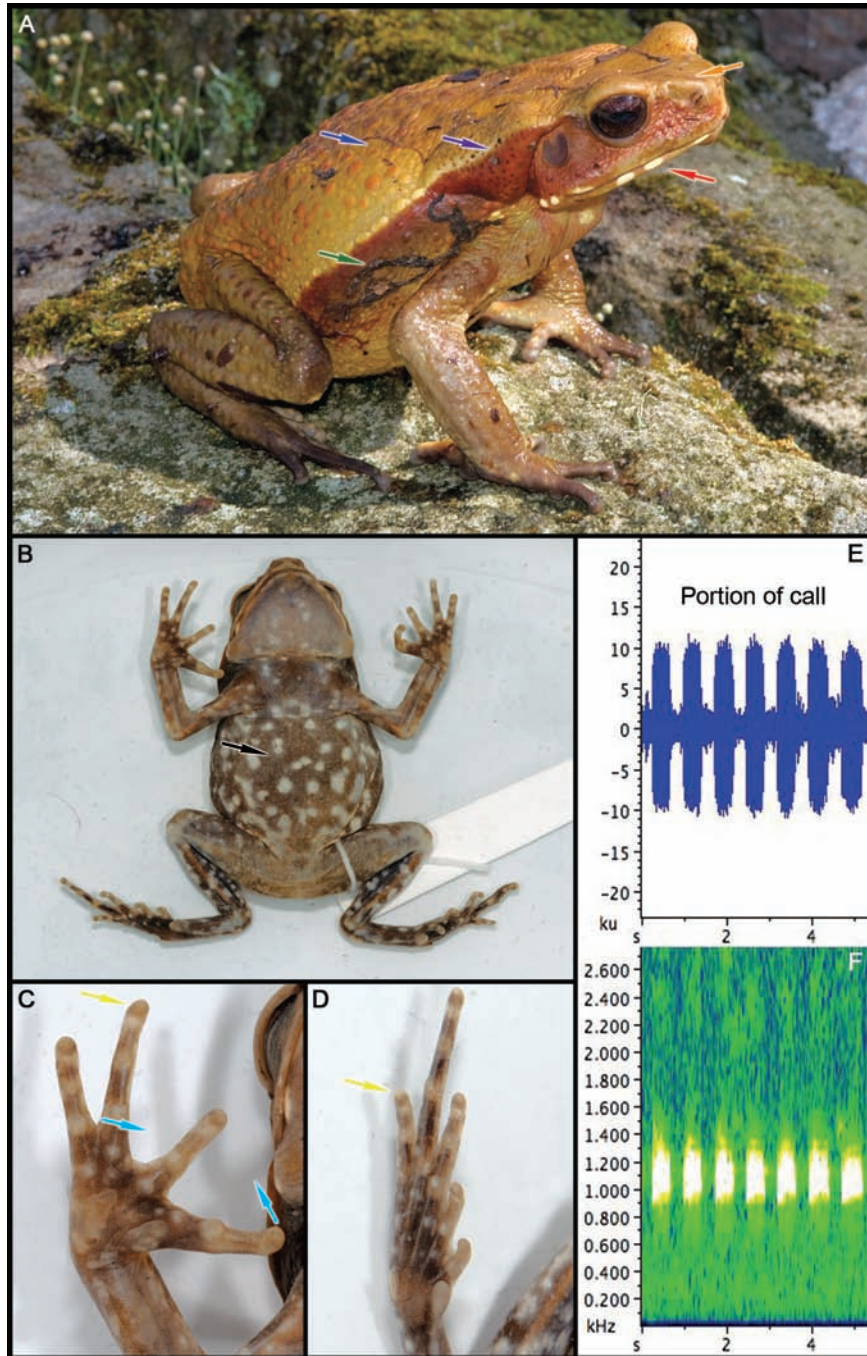
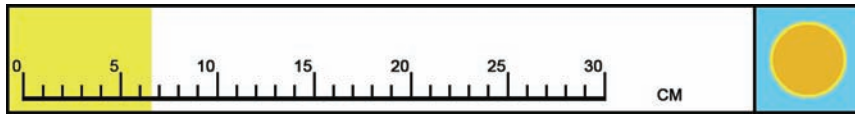


Fig. 86. *Rhaebo guttatus* (Schneider, 1799). A. Dorsolateral view of a female. B. Ventral surface of a preserved juvenile. C. Palm (preserved juvenile specimen). D. Sole (preserved juvenile specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

***Rhaebo nasicus* (Werner, 1903)**

1903: 252.



ENGLISH NAME: Werner's toad.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: Unknown, restricted to "South America, probably along the Atlantic drainage" by Smith & Laurent (1950).

SELECTED REFERENCE: Hoogmoed, 1977 (description, habitat, distribution, B&W photos, in English).

Field identification - Males reach 47.2* mm SVL, females 68.5* mm.

- ➔ Dorsal ground colour very variable: medium brown, or greyish brown to reddish brown, sometimes with small greyish blue to sky blue spots (often present on flanks), and usually with a distinct pattern consisting of a black inverted triangle between the eyes connected further down on the back to a black "hour-glass" marking; in some specimens (especially juveniles) the dorsum only has one or more small dark spot; skin on dorsum spiculate.
- ➔ Ventral surface granular, dirty white with more or less extensive brown mottling.
- ➔ Upper eyelid laterally projecting beyond the eye.
- ➔ Snout acute in profile, distinctly projecting beyond the mouth.
- ➔ Cranial crests present, but low and not very distinct.
- ➔ Parotoid glands small to moderately large, elongate.
- ➔ When adpressed Finger I much longer than II, fingers unwebbed.
- ➔ Disc on fingers and toes unexpanded.

Life history - Diurnal, terrestrial. Found in primary forest only. Individuals are usually observed on the forest floor among leaf litter, sometimes far from water. Nothing is known about the reproductive behaviour of the species, but males probably call from the ground at the edge of small pools or slow-moving streams. Eggs are probably deposited in gelatinous strings in small water bodies or in slow-moving streams.

Call - Unknown.

Tadpole - Unknown. High probably exotroph, benthic, like in other species of the genus.

Abundance and distribution in KNP - Rare. Observed around main sampling localities # 6, 10 and 11 (see Fig. 3). Probably widespread in the Park.

Geographic range - Restricted to eastern Venezuela and Guyana.

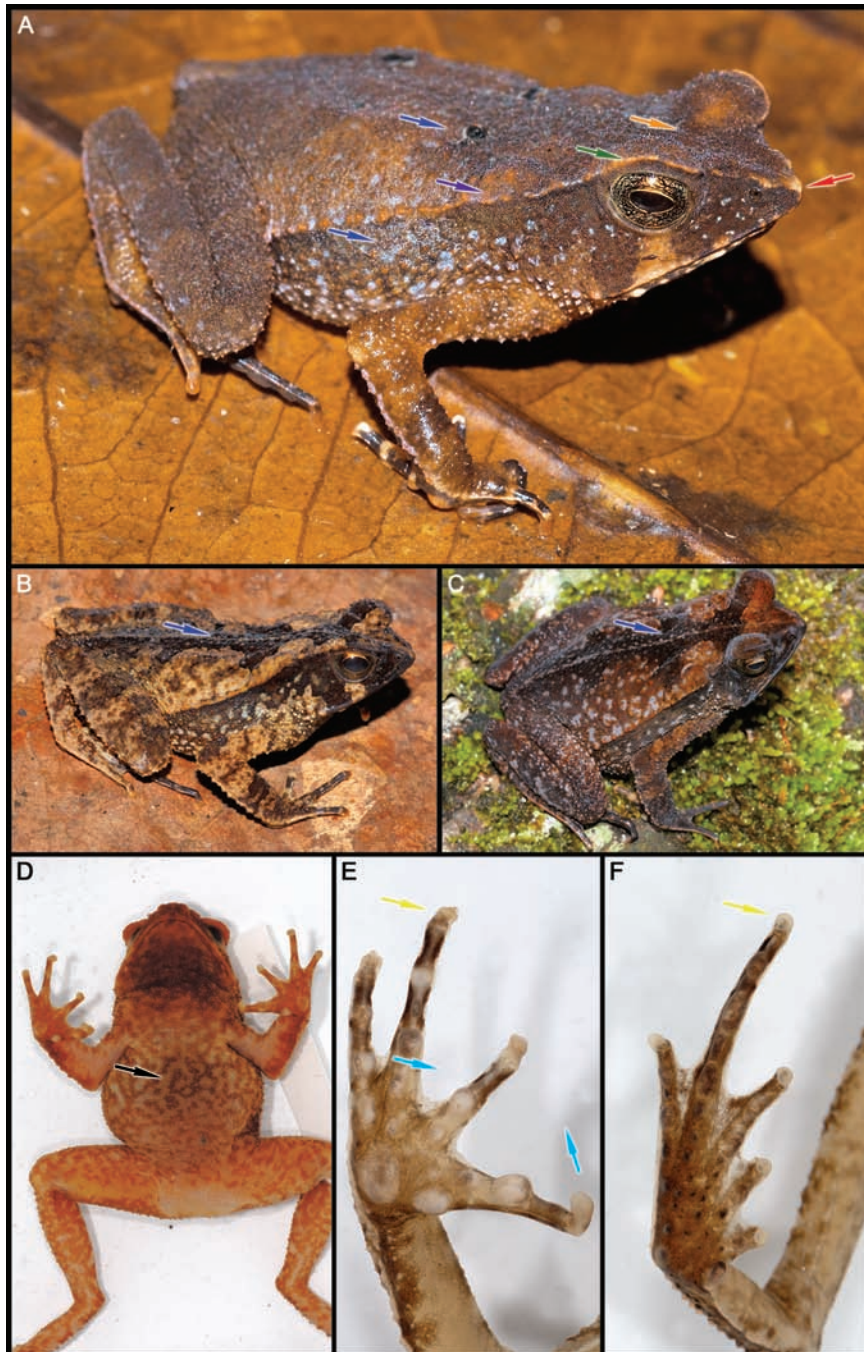


Fig. 87. *Rhaebo nasicus* (Werner, 1903). A. Dorsolateral view of a male. B, C. Dorsolateral views of males. D. Ventral surface of a preserved male. E. Palm (preserved male specimen). F. Sole (preserved male specimen). (Photos by P. J. R. Kok).

Rhinella Fitzinger, 1826

“SOUTH AMERICAN TOADS”



Fig. 88. Amplectant pair of *Rhinella marina* photographed in French Guiana. (Photo by P. J. R. Kok).

- ⇒ Medium to very large size
- ⇒ Maxillary teeth absent
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum rarely smooth, usually tuberculate to warty (Fig. 44A, D-F)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I < = > II when fingers adpressed
- ⇒ Finger discs unexpanded (Fig. 51A)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)
- ⇒ Parotoid glands present, round, ovoid, trianguloid, or elongate (Fig. 47A)
- ⇒ Cranial crests absent or present (from weakly developed to hypertrophied)

This large genus currently contains 77 species and includes all the former South American *Bufo* species, excluding those of the *Bufo guttatus* species group (now *Rhaebo*), the *B. valliceps* species group (now *Incilius*), and the *B. variegatus* species group (now *Nannophryne*).

South American toads are diurnal or nocturnal; some species are terrestrial, while others are arboreal. They inhabit a wide range of habitats, from savannah to cloud forest.

Sexual dimorphism

Males are usually smaller than females; males of many species have keratinous nuptial excrescences on first finger(s). In some species females develop hypertrophied supratympanic crests (*i.e.* *Rhinella margaritifera*).

Eggs

Aquatic, deposited in long strings in temporary or permanent pools, also in slow-moving and fast-moving water. Clutch deposition site is unknown in several species.

Tadpoles

Unknown in several species. Exotroph (benthic or gastromyzophorous).

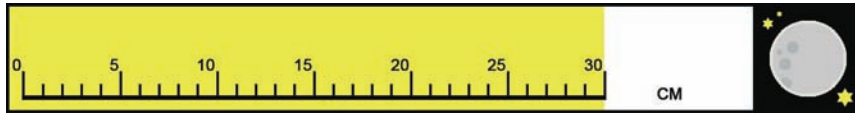
Distribution

The genus *Rhinella* is widespread and currently reported from southern Texas (USA) to southern South America, including Trinidad and Tobago (Frost, 2008). *Rhinella marina* has been introduced widely and is now considered as a major threat for local fauna in many parts of the world (*e.g.* Australia).

Only *Rhinella marina* (p. 132) is currently reported from Kaieteur National Park.

Rhinella marina (Linnaeus, 1758)

1758: 211.



ENGLISH NAME: Giant toad.

LOCAL NAME (PATAMONA): Wāla or Pālātuku.

TYPE LOCALITY: "America".

SELECTED REFERENCES: Duellman, 1978 (brief description, tadpole description, B&W photo, in English); Easteal, 1986 (definition, distribution, pertinent literature, call spectrogram); Duellman, 2005 (brief description, tadpole description, call description and colour photo, in English).

Field identification - Males reach at least 140.0 mm SVL, females may exceptionally reach about 300.0 mm; most specimens range in size from 150 to 200 mm.

- ➔ Dorsal ground colour brown to greyish or reddish brown, with or without dark brown or black mottling and/or cream spots; skin on dorsum warty.
- ➔ Ventral surface granular, creamy white, with or without a distinct pattern consisting in greyish brown, dark brown or black spots and/or mottling.
- ➔ Flanks similar to dorsum, not contrasting with the dorsal colour.
- ➔ Lower lip without creamy spots.
- ➔ Cranial crests present and distinct.
- ➔ Parotoid glands very large, trianguloid.
- ➔ When adpressed Finger I longer than II, fingers unwebbed.
- ➔ Disc on fingers and toes unexpanded.

Life history - Nocturnal (although juveniles may sometimes be found by day), terrestrial. Occurs in a wide range of habitats, from savannah to primary forest, and is highly anthropophilic. Individuals prefer open areas and are usually found in disturbed habitats, in large clearings in secondary forest, more rarely in primary forest (where the largest specimens seem to occur). Males call from the ground, usually at the edge of slow-moving streams, rivers, or in swampy areas. Eggs are deposited in gelatinous strings in slow-moving water, rocky pools, ponds, lakes, swamps, etc.; always in open areas that receive high amount of sunlight during the day.

Call - First described by Blair (1956: 96), who provided a spectrogram. Easteal (1986: 2) provided a spectrogram, but no description; see also Duellman (2005: 185), who provided a short description and a spectrogram and oscillogram. It consists of a long low-pitched rattling trill repeated at a rate of about 4 calls/min.

Tadpole - The first description is apparently that of Ruthven (1919: 7), but see also that of Breder (1946: 395) and Savage (1960: 233). Exotroph, benthic, black; LTRF = 2(2)/3.

Abundance and distribution in KNP - Very common locally. Observed around all main sampling localities (see Fig. 3).

Geographic range - Widespread from southern Texas to central Brazil. Introduced worldwide.

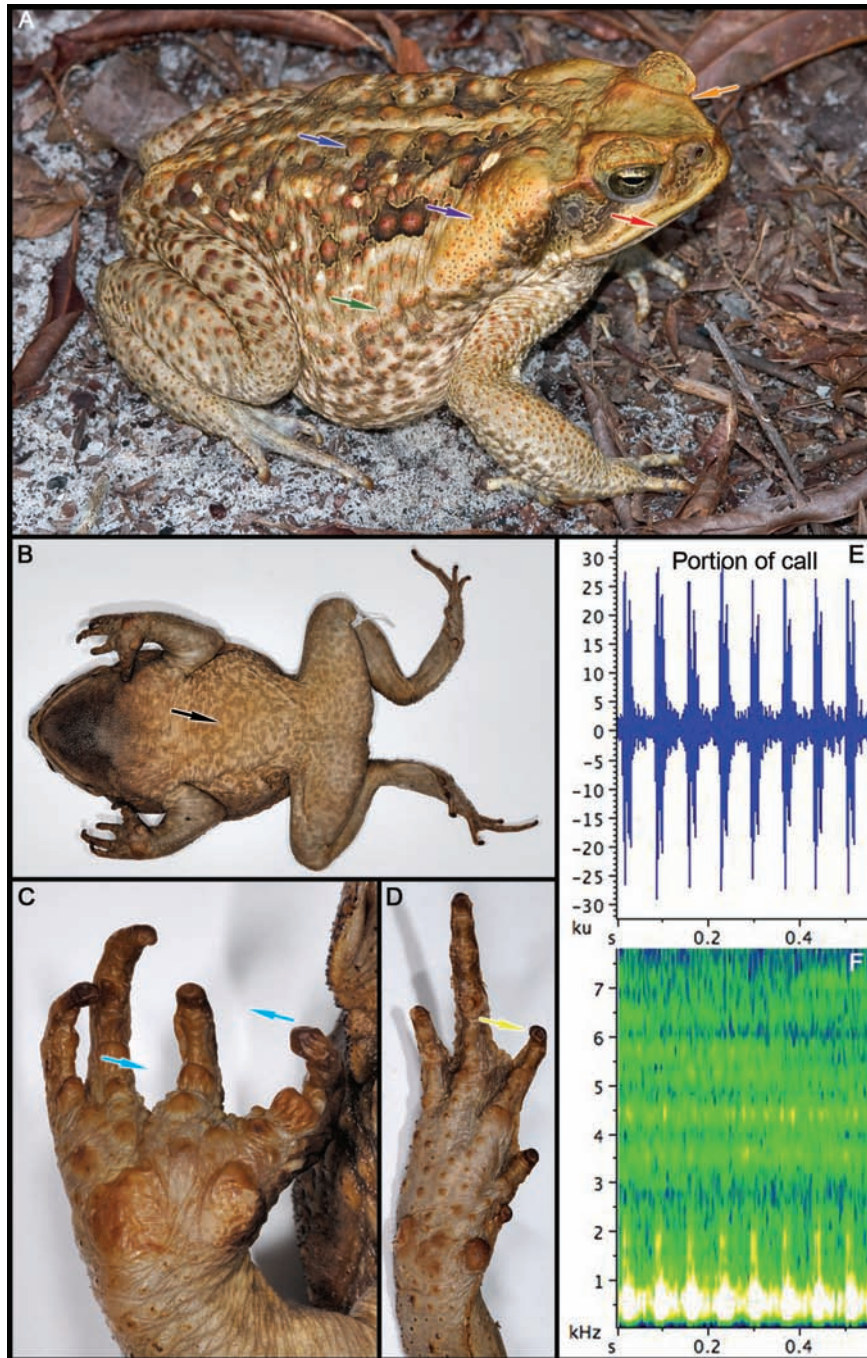


Fig. 89. *Rhinella marina* (Linnaeus, 1758). A. Dorsolateral view of a female. B. Ventral surface of a preserved male. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Centrolene Jiménez de la Espada, 1872

“GIANT GLASS FROGS”



Fig. 90. *Centrolene gorzulae*, the only *Centrolene* reported from Kaieteur National Park. (Photo by P. J. R. Kok).

- ⇒ Small to medium size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Humeral spine in adult males (Fig. 57B)
- ⇒ Skin on dorsum smooth or shagreened to finely granular (Fig. 44A-C)
- ⇒ Ventral skin transparent, internal organs visible (Fig. 59)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I \leq II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B-C)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)

The genus *Centrolene* currently contains 42 species.

Frogs of the genus *Centrolene* are nocturnal and mostly arboreal. They inhabit tropical rainforest and are usually found along streams or rivers.

Centrolene was found to be paraphyletic with regards to *Cochranella* by Frost *et al.* (2006) [see also taxonomic comments by Cisneros-Heredia & McDiarmid (2007) and Guayasamin *et al.* (2008)].

Sexual dimorphism

Males have a humeral spine and nuptial excrescences on fingers or along flanks. In most species males are smaller than females, except in *Centrolene geckoidum*.

Eggs

Egg masses are deposited outside of water, usually on leaves overhanging lotic water, but some species occasionally place them over lentic water. *Centrolene gorzulae* was found to deposit egg masses in moss on branches overhanging the water (Fig. 91), or between two leaves (P. Kok, pers. obs.), and *C. buckleyi* might deposit eggs in bromeliads (Lynch & Duellman, 1973).



Fig. 91. Egg mass of *Centrolene gorzulae* (Photo by P. J. R. Kok)

Tadpoles

Exotroph (fossorial).

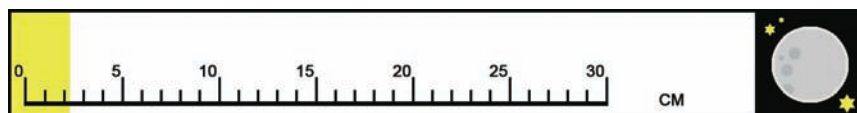
Distribution

Species belonging to the genus *Centrolene* are found from Honduras to Panama, along the Andes from Venezuela to Peru, on the Cordillera de la Costa of Venezuela and in the western part of the Guiana Shield (Cisneros-Heredia & McDiarmid, 2007).

Only *Centrolene gorzulae* (p. 136) is currently reported from Kaieteur National Park.

***Centrolene gorzulae* (Ayarzagüena, 1992)**

1992: 19, figs 3e, 4.



ENGLISH NAMES: Bolívar giant glassfrog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "Cerro Auyantepuy-Cento, Edo. Bolívar, Venezuela (5°56'N, 62°34'W), 1.850 msnm".

SELECTED REFERENCES: Noonan & Harvey, 2000 (description of the synonym *C. papillahallicum*, B&W photo and drawings, in English); Señaris & Ayarzagüena, 2005 (description, natural history, call description, tadpole description, B&W drawings, distribution, in Spanish); Kok & Castroviejo-Fisher, 2008 (description, synonymy, natural history, colour photos, distribution, in English).

Field identification - Males reach 22.5 mm SVL, females 22.0 mm.

- Dorsal ground colour dark green with scattered minute paler flecks, upper lip yellowish white; iris metallic copper with black reticulations; skin on dorsum finely shagreened.
- Ventral surface strongly granular, translucent green, internal organs visible through the skin: parietal peritoneum mostly transparent, pericardial peritoneum white, hepatic and visceral peritonea white.
- Bones green, visible through the skin.
- Humeral spine in adult males.
- Prepollical spine projecting.
- When adpressed, Fingers I and II equal in length.
- Enameled fringes present on postaxial edges of Finger IV and Toe V.
- Enlarged round tubercles below vent.

Life history - Nocturnal, arboreal. Exclusively found in primary forest. Males call from the upper surface of leaves above or along small streams, usually 1.0-1.5 m above the ground, but the species can be found as high as 4 m above the forest floor. Gelatinous masses of eggs are deposited on mosses overhanging water, from which tadpoles will fall into the water as they hatch; tadpoles probably feed on detritus.

Call - First described by Señaris & Ayarzagüena (2005: 83), who provided a spectrogram. It consists of a single short pulsed note repeated at a rate of about 10 notes/min.

Tadpole - Still undescribed, description by Kok in progress. Exotroph, fossorial; greenish brown; LTRF = 0/0 (Kok, unpublished data).

Abundance and distribution in KNP - Locally common. Collected only around main sampling localities # 4 and 11 (see Fig. 3), but the species is certainly more widespread in the Park.

Geographic range - Known from Auyantepui and neighbouring localities in Bolívar State, Venezuela, and from the Pakaraima Mountains in Guyana.

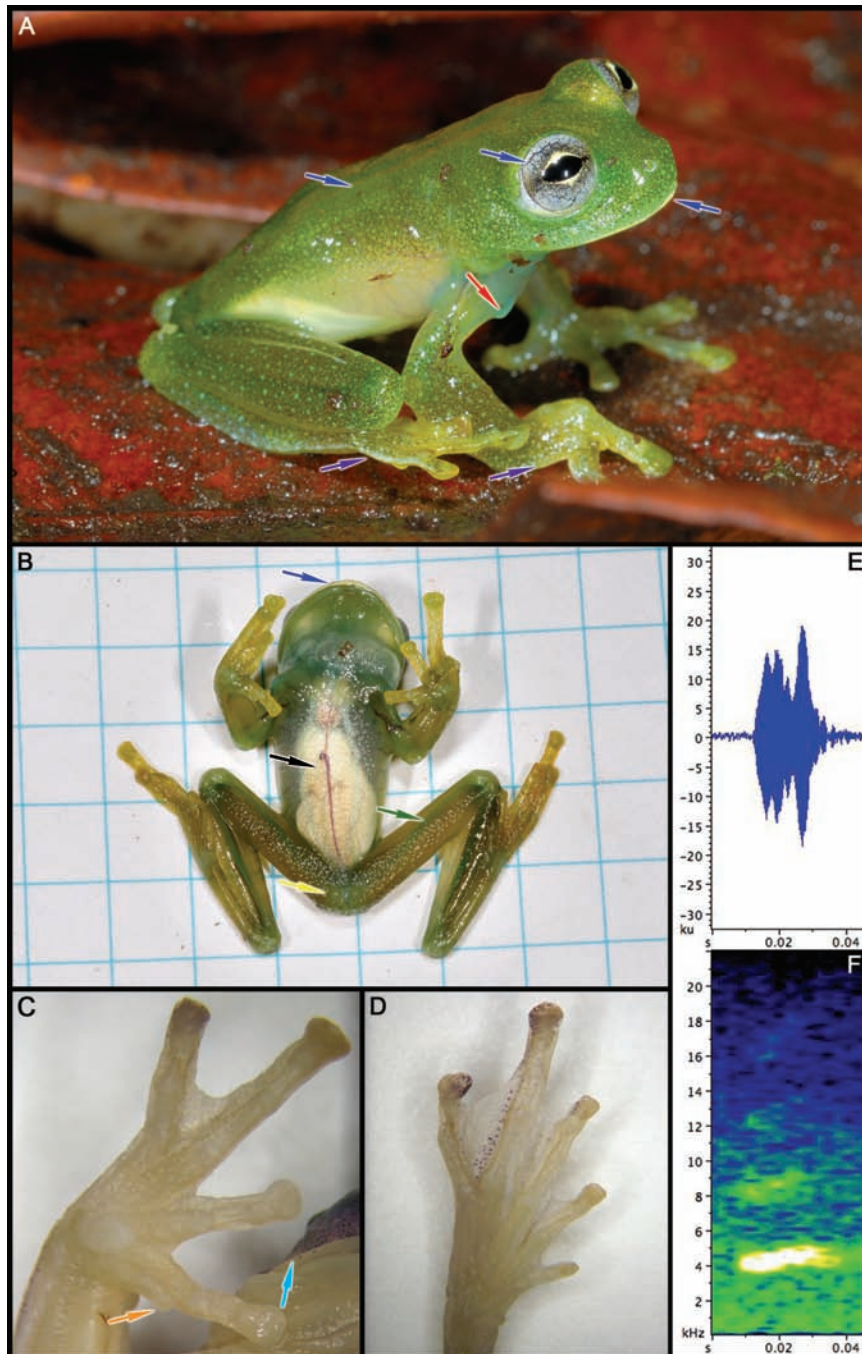


Fig. 92. *Centrolene gorzulae* (Ayarzagüena, 1992). A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Cochranella Taylor, 1951

“COCHRAN FROGS”



Fig. 93. Portrait of *Cochranella helenae*, the only *Cochranella* species currently reported from Kaieteur National Park. (Photo by P. J. R. Kok).

- ⇒ Small size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Humeral spine absent in adult males (Fig. 57A)
- ⇒ Skin on dorsum smooth or shagreened to granular (Fig. 44A-C)
- ⇒ Ventral skin transparent, internal organs visible (Fig. 59)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I < = > II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B-C)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)

The genus *Cochranella* currently contains 42 species.

Frogs of the genus *Cochranella* are nocturnal and mostly arboreal. They inhabit tropical rainforest and are usually found along streams or rivers.

The genus is diagnosed only on the basis of a plesiomorphic character (the absence of a humeral spine in males) and the taxonomy of *Cochranella* needs revision (see comments in Cisneros-Heredia & McDiarmid, 2007, and Guayasamin *et al.*, 2008).

Sexual dimorphism

Males have nuptial excrescences on fingers. In most species males are smaller than females.

Eggs

Egg masses are deposited outside of water, usually on leaves overhanging lotic water, but some species occasionally place them over lentic water. Some taxa (*e.g.* *Cochranella euhystrix* from Peru, *C. nola* from Bolivia) attach egg masses to rocks in the spray zone of waterfalls or in streams (Cadle & McDiarmid, 1990; Lötters & Köhler, 2000).

Tadpoles

Exotroph (fossorial).

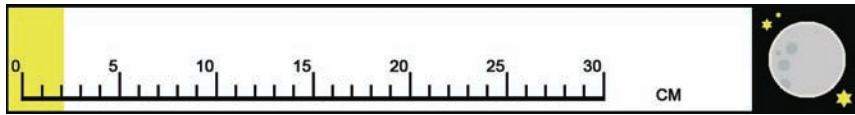
Distribution

Species belonging to the genus *Cochranella* are found from Nicaragua to Amazonian Brazil, in the Guiana Shield, Ecuador, Peru and Bolivia (Frost, 2008).

Only *Cochranella helenae* (p. 140) is currently reported from Kaieteur National Park.

***Cochranella helenae* (Ayarzagüena, 1992)**

1992: 21, figs 3d, 4.



ENGLISH NAME: Venezuela Cochran frog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "Quebrada Jaspe, San Ignacio de Yuruaní, Edo Bolívar, Venezuela".

SELECTED REFERENCES: Ayarzagüena, 1992 (original description, B&W photo, in Spanish); Señaris & Ayarzagüena, 2005 (description, natural history, call description, tadpole description, colour photo, distribution, in Spanish); Kok & Castroviejo-Fisher, 2008 (description, synonymy, natural history, colour photos, distribution, in English).

Field identification - Males reach 20.4 mm SVL, female not known.

➔ Dorsal ground colour pale lime green to greenish yellow with scattered dark brown flecks, iris yellow speckled with minute dark brown punctuations; skin on dorsum shagreened.

➔ Ventral surface granular, transparent, internal organs visible through the skin: parietal peritoneum white, pericardial peritoneum white, hepatic and visceral peritonea white.

➔ Bones pale green, visible through the skin.

➔ Humeral spine absent in adult males.

➔ Prepollical spine not projecting.

➔ When adpressed, Fingers I and II almost equal in length.

➔ Fringes on postaxial edges of Finger IV and Toe V (first phalange only) not enameled.

➔ Paired enlarged round tubercles below vent.

Life history - Nocturnal, arboreal. Exclusively found in primary forest. Males call from the upper surface of leaves above or along streams (typically large streams or rivers, but sometimes small streams), usually 3.0-4.0 m above the ground, but the species can be found as high as 10 m above the forest floor. Gelatinous masses of eggs are deposited on leaves overhanging water, from which tadpoles will fall into the water as they hatch; tadpoles probably feed on detritus.

Call - First described by Señaris & Ayarzagüena (2005: 119), who provided a spectrogram. It consists of two or three short-pulsed notes repeated at a rate of about 4-6 calls/min.

Tadpole - First described by Señaris & Ayarzagüena (2005: 120). Exotroph, fossorial; light green; LTRF = 1/3.

Abundance and distribution in KNP - Rare. Observed and heard calling only around main sampling localities # 2, 5 and 12 (see Fig. 3), but the species is probably more widespread in the park.

Geographic range - Known from the type locality and Salto Karuay, Bolívar State, Venezuela, and from KNP in Guyana.

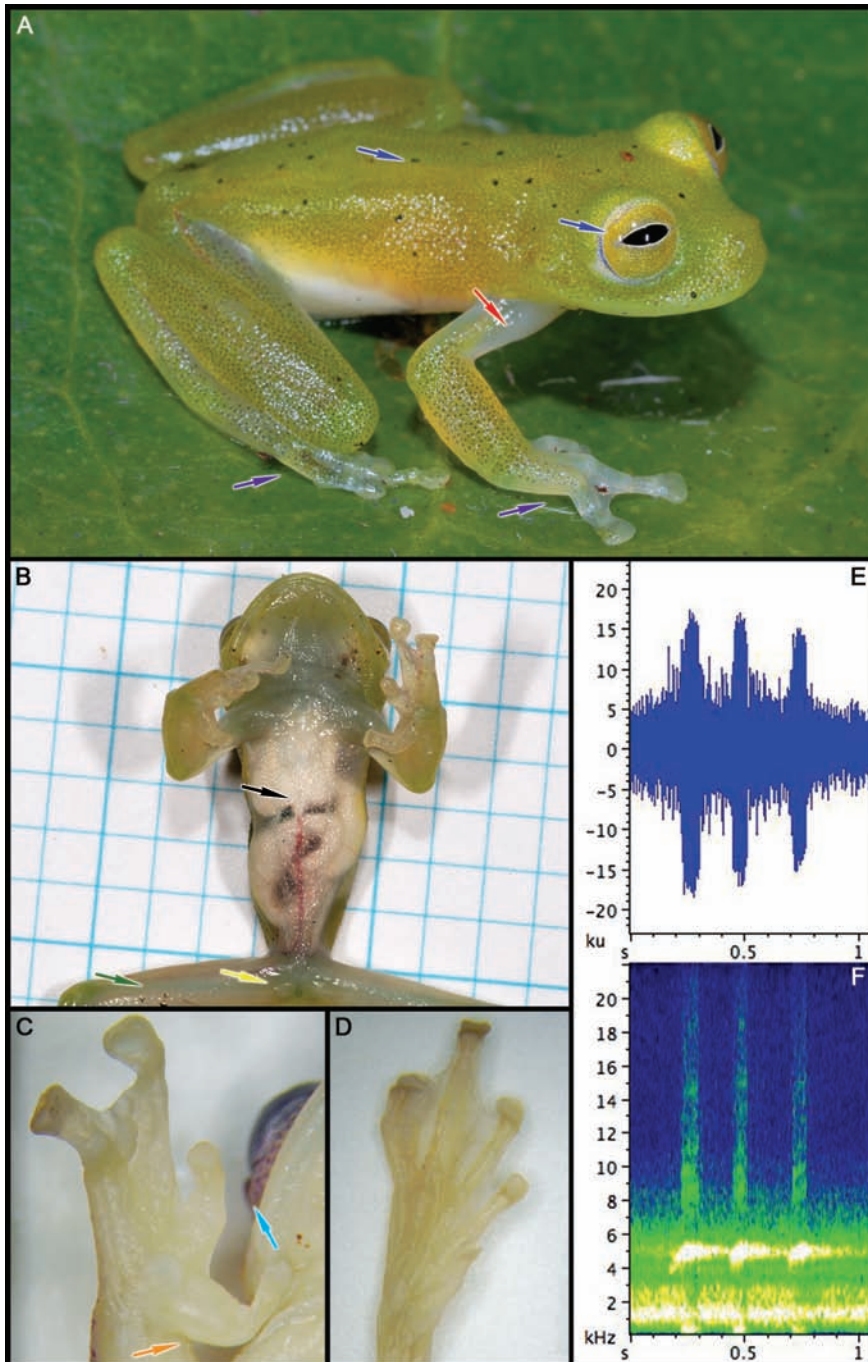


Fig. 94. *Cochranella helenae* (Ayarzagüena, 1992). A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Hyalinobatrachium Ruiz-Carranza & Lynch, 1991

“GLASS FROGS”



Fig. 95. *Hyalinobatrachium taylori*, one of the ca. 31 described species in the genus.
(Photo by P. J. R. Kok).

- ⇒ Small size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Humeral spine absent in adult males (Fig. 57A)
- ⇒ Skin on dorsum smooth or shagreened to granular (Fig. 44A-C)
- ⇒ Ventral skin transparent, internal organs visible (Fig. 59)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I < = > II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B-C)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)

The genus *Hyalinobatrachium* currently contains 31 species, although the taxonomic status of several of its members needs clarification.

Hyalinobatrachium species are nocturnal and mostly arboreal. They inhabit tropical rainforest and are usually found along streams or rivers.

The genus is diagnosed on the basis of a character shared by *Centrolene* and *Cochranella* [a bulbous liver (*i.e.* not tri- or tetralobate) with white hepatic peritoneum] and requires a taxonomic revision (see comments in Cisneros-Heredia & McDiarmid, 2007, and Guayasamin *et al.*, 2008).

Sexual dimorphism

Males have nuptial excrescences on fingers. In most species males are smaller than females.

Eggs

Egg masses are deposited outside of water, on the upper side or on the underside of leaves (Fig. 96), overhanging lotic water, but some species occasionally place them over lentic water.



Fig. 96. Egg mass of *Hyalinobatrachium crurifasciatum*. (Photo by P. J. R. Kok).

Tadpoles

Exotroph (fossorial).

Distribution

Species belonging to the genus *Hyalinobatrachium* are found from Nicaragua to Amazonian Brazil, in Tobago, in the Guiana Shield, Ecuador, Peru and Bolivia (Frost, 2008).

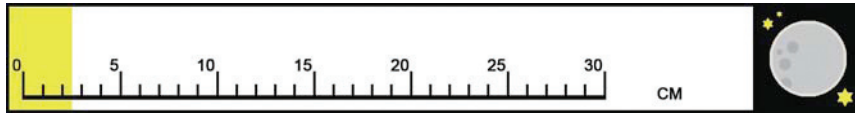
Field key to the *Hyalinobatrachium* species of Kaieteur National Park

1. Snout truncate in profile (Fig. 40B); dorsum light green with pale yellowish spots; iris yellowish with small brown flecks and usually a reddish ring around pupil; bones translucent green (visible through skin) ***H. crurifasciatum*** (p. 144)
- 1'. Snout slightly sloping in profile (Fig. 40B); dorsum dark green with pale green spots, usually bearing a white fleck in their centre; iris metallic lavender with dark brown reticulations; bones white (visible through skin) ***H. taylori*** (p. 146)

Remark: the presence of *Hyalinobatrachium mondolfii* in KNP is probable (Kok & Castroviejo-Fisher, 2008). See Señaris & Ayarzagüena (2005: 273) for a colour photo of that species.

Hyalinobatrachium crurifasciatum Myers & Donnelly, 1997

1997: 9, figs 7-10.



ENGLISH NAME: None; we propose "Banded limb glassfrog".

LOCAL NAME (PATAMONA): Pakak.

TYPE LOCALITY: "north base of Pico Tamacuari, 1160-1200 m elevation, Sierra Tapirapeco, Amazonas, Venezuela (1°13'N, 64°42'W)".

SELECTED REFERENCES: Myers & Donnelly, 1997 (original description, call description, tadpole description, in English); Noonan & Bonett, 2003 (description and tadpole description as *H. ignioculus*, in English); Señaris & Ayarzagüena, 2005 (description, osteology, natural history, call description, tadpole description, distribution, in Spanish).

Field identification - Males reach 24.0 mm SVL, females 22.8 mm.

➤ Dorsal ground colour light green with scattered dark green to dark brown flecks and pale yellowish spots; iris variable, yellowish with small brown flecks and usually a reddish ring around pupil (complete or incomplete); skin on dorsum shagreened to slightly granular.

➔ Ventral surface strongly granular, transparent, internal organs visible through the skin: parietal peritoneum transparent, pericardial peritoneum partly white, hepatic and visceral peritonea white.

➤ Bones white, visible through the skin.

➤ Humeral spine absent in adult males.

➤ Prepollical spine not projecting.

➤ When adpressed, Finger I longer than II.

➤ Enameled fringes present on postaxial edges of Finger IV and Toe V, and on metacarpal, ulnar, metatarsal and tarsal folds.

➤ No distinctly enlarged round tubercles below vent.

Life history - Nocturnal, arboreal. Exclusively found in primary forest. Males call from the lower surface of leaves above or along streams, usually 2.0-4.0 m above the ground (up to 15 m). Gelatinous masses of eggs are deposited on the lower surface of leaves overhanging water, from which tadpoles will fall into the water as they hatch; tadpoles probably feed on detritus.

Call - First described by Myers & Donnelly (1997: 13), who provided a spectrogram. It consists of a single pulsed note repeated at a rate of about 20 notes/min.

Tadpole - First described by Myers & Donnelly (1997: 13); see also Noonan & Bonett (2003: 95, as *H. ignioculus*). Exotroph, fossorial; tan peppered with melanophores; LTRF = 2(2)/2(1).

Abundance and distribution in KNP - Rare. Heard calling only around main sampling locality # 5 (see Fig. 3), but the species is certainly more widespread in the park.

Geographic range - Known from Amazonas and Bolívar states in Venezuela, Guyana, Suriname and French Guiana.

Taxonomic comments - The taxonomic status of this species is under review by S. Castroviejo-Fisher and colleagues.

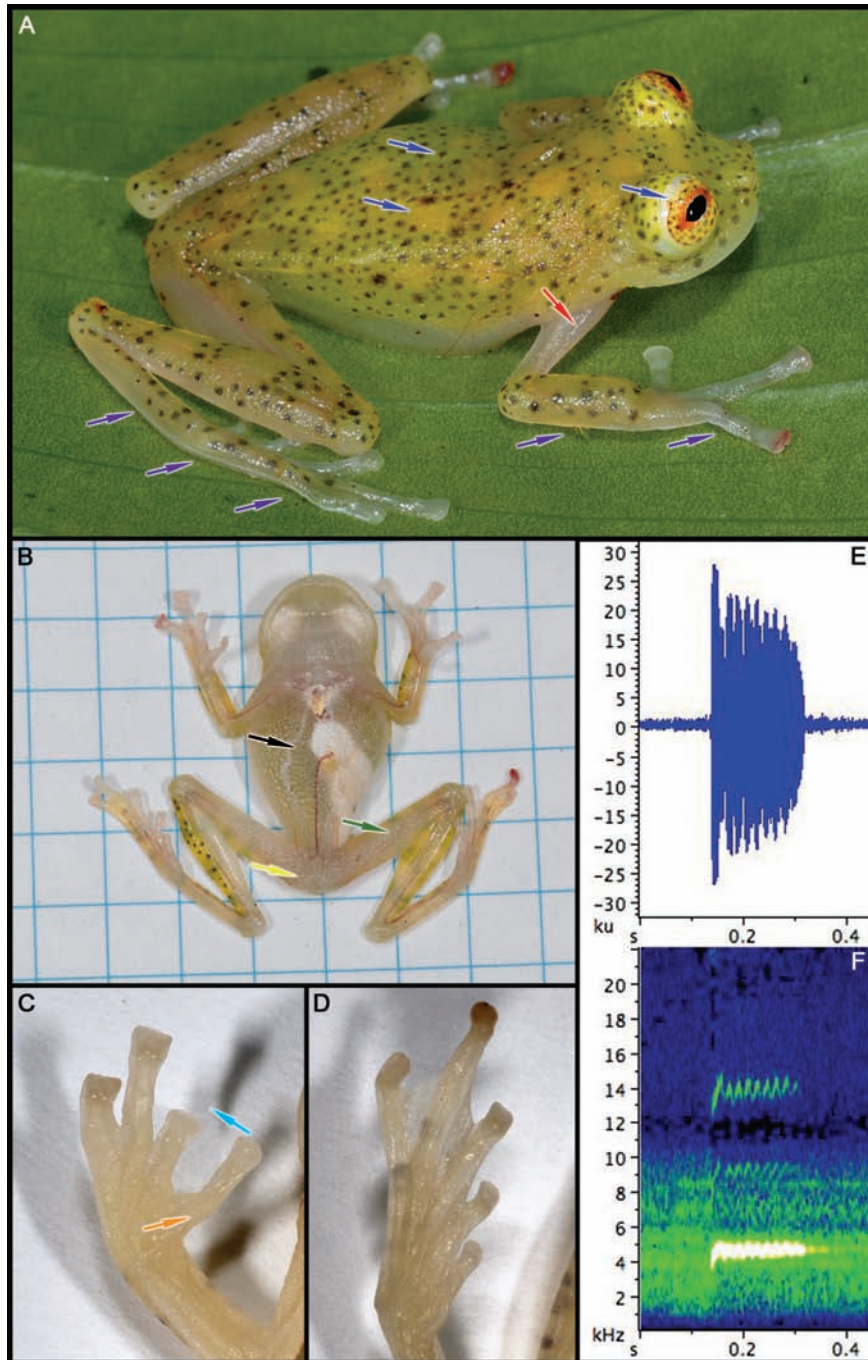
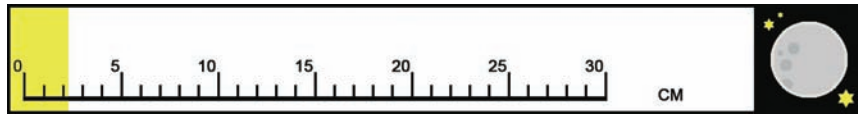


Fig. 97. *Hyalinobatrachium crurifasciatum* Myers & Donnelly, 1997. A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Hyalinobatrachium taylori (Goin, 1968)

1968: 115, fig. 1.



ENGLISH NAME: Taylor's glassfrog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "at an elevation of 750 ft. along the New River, Guyana".

SELECTED REFERENCES: Goin, 1968 (original description, in English); Señaris & Ayarzagüena, 2005 (description, osteology, natural history, call description, tadpole description, distribution, colour photo, in Spanish); Kok & Castroviejo-Fisher, 2008 (description, synonymy, natural history, colour photos, distribution, in English).

Field identification - Males reach 20.5 mm SVL, females 21.5 mm.

➔ Dorsal ground colour dark green with pale green spots, usually bearing a white fleck in their centre, bronze flecks/lines sometimes present on dorsal surfaces; iris metallic lavender with dark brown reticulations; skin on dorsum smooth to finely shagreened.

➔ Ventral surface granular, transparent, internal organs visible through the skin: parietal peritoneum transparent, pericardial peritoneum partly white, hepatic and visceral peritonea white.

➔ Bones translucent green, visible through the skin.

➔ Humeral spine absent in adult males.

➔ Prepollical spine not projecting.

➔ When adpressed, Finger I longer than II.

➔ Enamelled fringes present on postaxial edges of Finger IV and Toe V, and on metacarpal, ulnar, metatarsal and tarsal folds.

➔ No distinctly enlarged round tubercles below vent.

Life history - Nocturnal, arboreal. Exclusively found in primary forest. Males call from the upper surface of leaves above or along large streams and rivers, usually 1.0-10.0 m above the ground. Gelatinous masses of eggs are deposited on the lower surface of leaves overhanging water, from which tadpoles will fall into the water as they hatch; tadpoles probably feed on detritus.

Call - First described by Señaris & Ayarzagüena (2005: 228), who provided a spectrogram. Typically, the call consists of five to eight short notes given in very quick succession and repeated at a rate of about 1-3 calls/min.

Tadpole - First described by Señaris & Ayarzagüena (2005: 229). Exotroph, fossorial; light green; LTRF = 1/3.

Abundance and distribution in KNP - Locally common. Heard calling around main sampling localities # 5, 12 and 13 (see Fig. 3), but the species is certainly more widespread in the park.

Geographic range - Known from French Guiana, through Suriname and Guyana, to Bolívar and Amazonas states in Venezuela.

Taxonomic comments - *Hyalinobatrachium taylori* has been confused with *H. crurifasciatum* by several authors.

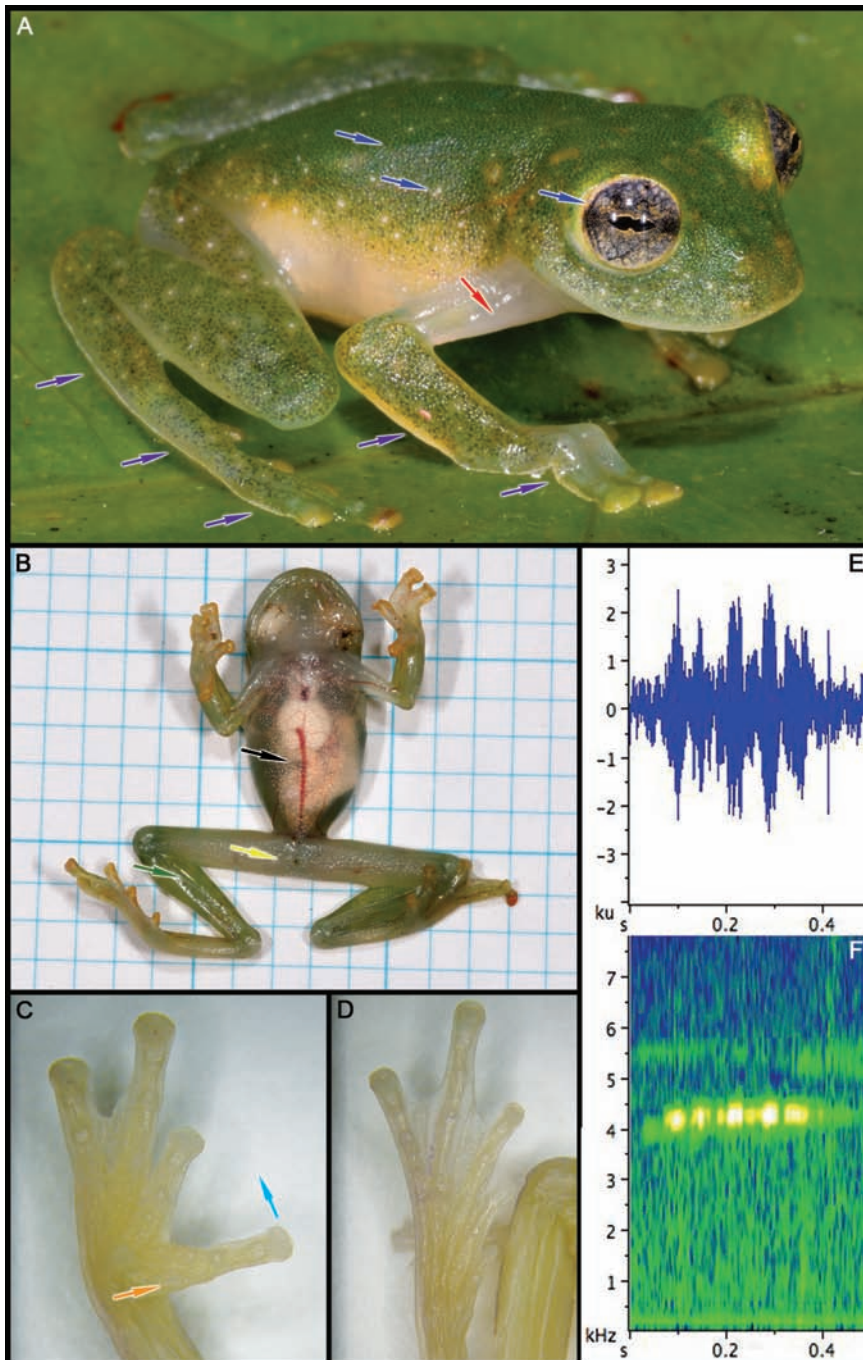


Fig. 98. *Hyalinobatrachium taylori* (Goin, 1968). A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Adelophryne Hoogmoed & Lescure, 1984

“SHIELD FROGS”



Fig. 99. The recently described *Adelophryne patamona*, a species that does not occur in Kaieteur National Park; here from Mt. Maringma. (Photo by P. J. R. Kok).

- ⇒ Very small to small size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum smooth or shagreened to granular (Fig. 44A-C)
- ⇒ Digits flattened with subdigital pads rather than subarticular tubercles
- ⇒ Finger IV reduced in size with single subdigital pad
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Finger I < II when fingers adpressed
- ⇒ Discs with pointed tips (Fig. 51D) and lateral fringes (Fig. 46E)
- ⇒ Tympanum present, distinct (Fig. 43A)

The genus *Adelophryne* currently contains six species.

Frogs of the genus *Adelophryne* are strictly terrestrial, mainly nocturnal, but some species are also active by day (especially during heavy rains). They are cryptic inhabitants of the leaf litter in tropical rainforest and are not dependent on water bodies for reproduction (see below).

Sexual dimorphism

There is no evident sexual dimorphism or dichromatism. Males have a large subgular vocal sac and are usually slightly larger than females.

Eggs

Very little is known about the reproductive biology of *Adelophryne* species. Our observations in Kaieteur National Park indicate that in *A. gutturosa*, one large egg is laid among plant roots or in the leaf litter. The large vitellin reserve strongly suggests direct development in this species (see MacCulloch *et al.*, 2008), and probably in other *Adelophryne* as well.



Fig. 100. Terrestrial egg that was laid among leaf litter by a female *Adelophryne gutturosa*. (Photo by P. J. R. Kok).

Tadpoles

Endotroph (direct developer).

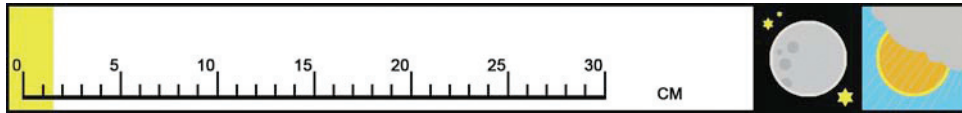
Distribution

Adelophryne species are found in northern South America, east of the Andes (Frost, 2008).

Only *Adelophryne gutturosa* (p. 150) is currently reported from Kaieteur National Park.

Adelophryne gutturosa Hoogmoed & Lescure, 1984

1984: 101, figs 4, 8-11.



ENGLISH NAME: Guiana Shield frog.

PATAMONA NAME: Unknown.

TYPE LOCALITY: "Between camp IV and V, northern slopes of Mount Roraima, Guyana (60°46'W 5°17'N), 3000 feet (914 m)".

SELECTED REFERENCES: Hoogmoed & Lescure, 1984 (original description, B&W drawings, in English); Hoogmoed *et al.*, 1994 (B&W photos, description refined, in English); MacCulloch *et al.*, 2008 (description, colour variation, colour photos, natural history, call description, in English).

Field identification - Males reach 14.7 mm SVL, females 16.0 mm.

- Dorsal ground colour variable, medium brown to grey with numerous small sky blue dots and scattered dark markings, a middorsal black "((" usually present; skin on dorsum smooth to slightly shagreened.
- Ventral surface smooth, brown to grey with small irregular sky blue dots.
- Upper arm orange.
- Iris copper with a red ring around pupil.
- When addressed, Finger I slightly shorter than II, fingers unwebbed.
- Tips of fingers pointed, discs absent.
- Tips of toes dilated into small narrow discs.
- Inner and outer metacarpal tubercle large, flat.

Life history - Diurnal and nocturnal, terrestrial. Found exclusively in primary forest, usually hidden in the leaf litter or among the rootlets at the base of plants. Males call from the base of plants, among rootlets or dead leaves. In KNP the species is often closely associated with the plant *Monotagma spicatum* (Marantaceae). Probably no more than one large egg is laid on the ground, among rootlets at the base of plants, froglets directly hatched from egg capsule.

Call - First described by MacCulloch *et al.* (2008: 46). It consists of a group of 2-15 short notes produced in quick succession with the interval between notes increasing progressively from the beginning to the end of the call.

Tadpole - Eggs of *Adelophryne* species undergo direct development and hatch as tiny frogs. Endotroph, direct developer.

Abundance and distribution in KNP - Very common, but difficult to spot. Collected or heard around all main sampling localities (see Fig. 3).

Geographic range - Widespread in the Guiana Shield from Bolívar State in Venezuela to Amapá, Brazil.

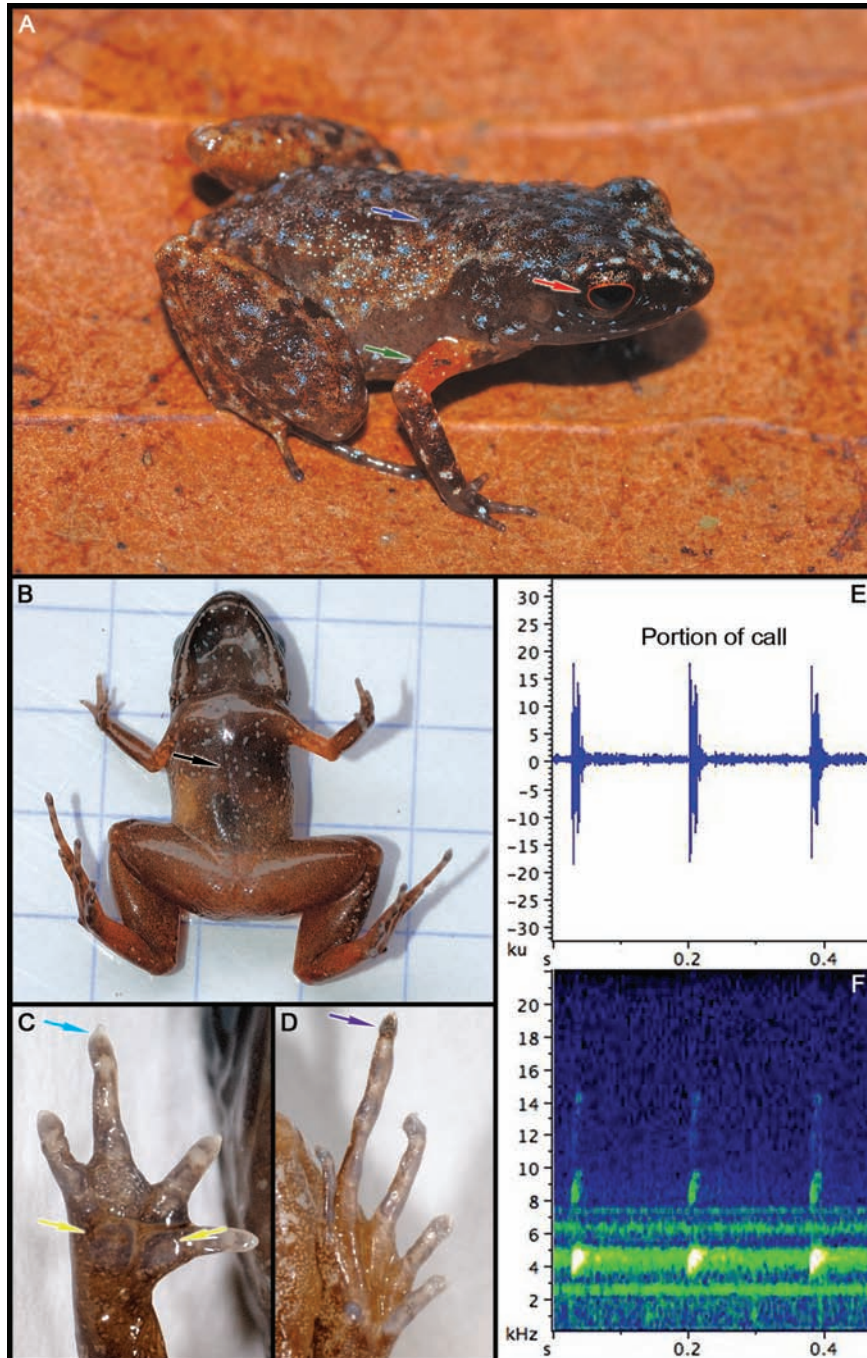


Fig. 101. *Adelophryne gutturosa* Hoogmoed & Lescure, 1984. A. Dorsolateral view of male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Stefania Rivero, 1968

“STEFANIAS”



Fig. 102. *Stefania roraimae*, a species that does not occur in Kaieteur National Park; here from Mt Maringma. (Photo by P. J. R. Kok).

- ⇒ Medium to large size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Skin on dorsum smooth, shagreened, granular or tuberculate (Fig. 44A-D)
- ⇒ Vocal sac absent (no vocal slits, Fig. 53)
- ⇒ Fingers unwebbed
- ⇒ Finger discs expanded (Fig. 51B)
- ⇒ Finger I > II when fingers adpressed
- ⇒ Toe V > III when toes adpressed
- ⇒ Tympanum present, distinct (Fig. 43A)
- ⇒ Frontoparietal and supratympanic crests absent or present (Fig. 41)

The genus currently contains 18 species assigned to two different species groups: the *Stefania evansi* group (“narrow-headed”) and the *S. goini* group (“broad-headed”).

Stefanias are nocturnal, terrestrial or arboreal. They inhabit tropical rainforest, high-tepui forest and tepui bog.

Sexual dimorphism

Males are distinctly smaller than females; there is no other evident sexual dimorphism or dichromatism.

Eggs

Eggs and neonates are carried on the back of the female, adhering to a mucus layer. A female of *Stefania evansi* with 30 near-term juveniles on the back has been reported (Kok & Benjamin, 2007) (see the frontispiece of the manual).

Tadpoles

Endotroph (paraviviparous).

Distribution

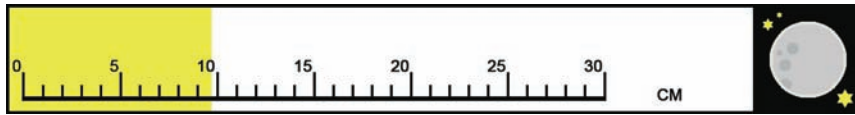
The genus *Stefania* is endemic to the Guiana Shield (Frost, 2008).

Field key to the *Stefania* species of Kaieteur National Park

1. Snout elongated, head noticeably longer than wide; tympanum separated from eye by a distance equal or slightly greater than tympanum diameter; toes extensively webbed; outer metatarsal tubercle indistinct (Fig. 50) ***S. evansi*** (p. 154)
- 1'. Snout not elongated, head as long as, or slightly longer than wide; tympanum separated from eye by a distance lower than tympanum diameter; toes basally webbed; outer metatarsal tubercle distinct (Fig. 50) ***S. woodleyi*** (p. 156)

***Stefania evansi* (Boulenger, 1904)**

1904: 106, pl. 5.



ENGLISH NAME: Evan's Stefania.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "Groete Creek, Essequibo, British Guiana".

SELECTED REFERENCES: Duellman & Hoogmoed, 1984 (description, habitat, distribution, B&W drawings, in English); MacCulloch & Lathrop, 2006a (description, distribution, colour photos); MacCulloch *et al.* 2006 (description, colour photo, in English).

Field identification - Males reach 53.0 mm SVL, females 97.5 mm.

- ➔ Dorsal ground colour very variable, ranging from pale greenish brown, medium brown or dark brown to greyish or reddish brown, with or without dark brown mottling, chevrons, and/or interorbital stripe and dorsolateral stripes; skin on dorsum shagreened.
- ➔ Ventral surface granular, dirty white to cream, usually with more or less extensive dark brown mottling, sometimes in an anastomotic pattern, throat dirty white, cream or pale reddish brown, with more or less extensive dark brown mottling, often with pale median ill-defined longitudinal stripe.
- ➔ Snout elongated, head noticeably longer than wide.
- ➔ Tympanum separated from eye by a distance equal or slightly greater than tympanum diameter.
- ➔ Prominent tubercles in temporal and post-tympanic region.
- ➔ When adpressed, Finger I longer than II, fingers unwebbed with large discs.
- ➔ Toes extensively webbed.
- ➔ Outer metatarsal tubercle indistinct.

Life history - Nocturnal, mainly arboreal, but sometimes observed on the ground (especially large females carrying eggs or juveniles). Found exclusively in primary forest, usually on rocks or low vegetation along streams and rivers. Reproductive biology poorly known, call and calling site undescribed (but see below), females carry eggs and neonates (up to 30) exposed on their back, adhering to a mucus layer; juveniles leave the mother's back at about 17-19 mm SVL.

Call - Unknown, but note that Sinsch & Juraske (2006: 159) described the call of a specimen from La Escalera, Venezuela. Since *Stefania evansi* does not occur in that area, the call described is probably that of *Stefani scalae*.

Tadpole - No tadpole stage, completely developed froglets hatched from egg capsule. Endotroph, paraviviparous.

Abundance and distribution in KNP - Very common. Collected around all main sampling localities (see Fig. 3).

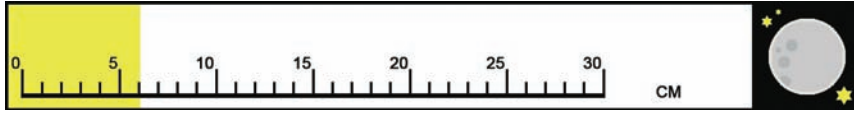
Geographic range - Known only from west-central Guyana.



Fig. 103. *Stefania evansi* (Boulenger, 1904). A. Dorsolateral view of a female carrying eggs. B. Ventral surface in life. C. Plain morph (colour morph A of Duellman & Hoogmoed, 1984). D. Striped morph (colour morph B of Duellman & Hoogmoed, 1984). E. Sole (preserved specimen). (Photos by P. J. R. Kok).

Stefania woodleyi Rivero, 1968

1968: 146, pl. 2, fig. 2.



ENGLISH NAME: Woodley's *Stefania*

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: "slope Mt. Kanaima, nr. Potaro R. Brit. Guiana".

SELECTED REFERENCES: Duellman & Hoogmoed, 1984 (description, habitat, distribution, B&W drawings and photo, in English); MacCulloch & Lathrop, 2006b (description, distribution, colour photos); MacCulloch *et al.* 2006 (description, colour photo, in English).

Field identification - Males reach 46.0 mm SVL, females 60.0 mm.

- ➔ Dorsal ground colour variable, ochre to dark brown with dark brown to black spots and irregular markings, yellowish interorbital bar often present, a pair of distinct or ill-defined dorsolateral yellowish stripes present in some specimens; skin on dorsum shagreened to granular.
- ➔ Ventral surface shagreened to granular, medium brown to cream with irregular dark brown or ochre mottling, throat medium brown with cream to ochre mottling, no trace of pale median longitudinal stripe on throat.
- ➔ Snout not elongated, head as long as, or slightly longer than wide.
- ➔ Tympanum separated from eye by a distance less than tympanum diameter.
- ➔ Rounded warts in temporal and post-tympanic region.
- ➔ When adpressed, Finger I longer than II, fingers unwebbed with large discs.
- ➔ Toes basally webbed.
- ➔ Outer metatarsal tubercle distinct.

Life history - Nocturnal, mostly terrestrial. Found exclusively in primary forest, often on the ground, on rocks or very low vegetation along streams and rivers, but several specimens were found far from water. Some individuals emit a distress call and attempt to bite when captured. Reproductive biology unknown, call and calling site undescribed, females expected to carry eggs and neonates exposed on their back, adhering to a mucus layer, like in other species of the genus.

Call - Unknown, see above.

Tadpole - Likely no tadpole stage, with completely developed froglets hatching from egg capsule on the back of the female like in other species of the genus. Expected to be endotroph, paraviviparous.

Abundance and distribution in KNP - Uncommon. Collected around main sampling localities # 5, 10, and 11 (see Fig. 3).

Geographic range - Known only from western Guyana, in the eastern portion of the Pakaraima Mountains.



Fig. 104. *Stefania woodleyi* Rivero, 1968. A. Dorsolateral view. B. Ventral surface in life. C. Specimen with ill-defined dorsolateral stripes. D. Specimen with distinct dorsolateral stripes. E. Sole (preserved specimen). (Photos by P. J. R. Kok).

Dendropsophus Fitzinger, 1843

“FITZINGER NEOTROPICAL TREEFROGS”



Fig. 105. *Dendropsophus minutus*, a species that could be present in Kaieteur National Park; here from the vicinity of Philipi village. (Photo by P. J. R. Kok).

- ⇒ Very small to medium size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Axillary membrane absent or extensive (Fig. 45)
- ⇒ No pigmented reticulation on palpebral membrane (Fig. 42D)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Skin on dorsum smooth, shagreened, tuberculate, or finely spiculate (Fig. 44A-B, D-E)
- ⇒ Fingers webbed
- ⇒ Finger I < II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)

The genus *Dendropsophus* currently contains 90 species.

Frogs of the genus *Dendropsophus* are nocturnal and mostly arboreal. They mainly inhabit tropical rainforest, but are also found in forest-edge situations, clearings, and other open areas like savannah; *Dendropsophus* species are often associated with water bodies and flooded areas.

The genus was resurrected by Faivovich *et al.* (2005) on the basis of unique DNA sequences, and contains all species formerly assigned to the genus *Hyla* believed to have 30 chromosomes. However, no strict morphological synapomorphies have currently been detected. Most *Dendropsophus* species are allocated to several different species groups, a few remain unassigned to any group.

Sexual dimorphism

Males often have different throat pigmentation than females, and are usually smaller. A few species exhibit sexually dichromatic dorsal colouration, with females having dorsolateral bands that are lacking in males (e.g. *Dendropsophus subocularis*). In some species males become yellow during the breeding season.

Eggs

Egg masses are usually deposited outside of water, on leaves, grasses, and other vegetation material overhanging or emerging from lentic water, although some species are reported to deposit eggs as a film on the water surface (e.g. *Dendropsophus koechlini*) or in clumps in the water (e.g. *D. melanargyreus*).

Tadpoles

Exotroph (benthic, nektonic, carnivorous, macrophagous).

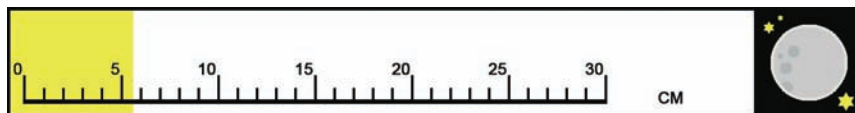
Distribution

Species belonging to the genus *Dendropsophus* are found from southern Mexico, through tropical Central and South America to northern Argentina and Uruguay, including Trinidad and Tobago (Frost, 2008).

Only *Dendropsophus marmoratus* (p. 160) is currently reported from Kaieteur National Park, but we suspect the presence of other species like *D. minutus*. Several tadpoles collected in small forested water bodies could belong to an undetermined *Dendropsophus* species.

Dendropsophus marmoratus (Laurenti, 1768)

1768: 29.



ENGLISH NAME: Marbled treefrog.

LOCAL NAME (PATAMONA): Ambak.

TYPE LOCALITY: "Surinami".

SELECTED REFERENCES: Bokermann, 1964 (description, B&W photos, in English); Duellman, 1978 (description, call description, tadpole description, natural history, in English); Lescure & Marty 2001 (description, distribution, colour photo, in French).

Identification - Males reach 44.0 mm SVL, females 56.0 mm.

➔ Dorsal ground colour variable, ranging from brown or brownish grey to grey, with a network of dark lines and markings that resemble lichens or bird droppings; colour varies significantly with light intensity; skin on dorsum weakly tuberculate.

➔ Ventral surface granular, usually white centrally, orange on the periphery, with black spots or mottling (may be completely white or pale yellow with black spots or mottling).

➔ Snout short and blunt.

➔ Axillary membrane extensive, orange or yellow with black spots.

➔ Scalloped white dermal folds on limbs.

➔ Small tubercles on lower lip.

➔ Fingers and toes extensively webbed.

➔ Discs on digits large and round, larger than adjacent phalange.

Life history - Nocturnal, highly arboreal. Mostly found in primary forest, but also occurs in disturbed forest. Males call during heavy rains, from the ground, grasses or bushes around temporary ponds, usually in clearings. Eggs are deposited as a surface film on the water; tadpoles probably feed on detritus.

Call - First described by Duellman (1978: 155). It consists of 1-3 low-pitched notes repeated at a rate of ca. 20 notes/min.

Tadpole - First described by Duellman (1978: 154). Exotroph, carnivorous; olive green with brown markings; LTRF = 0/0.

Abundance and distribution in KNP - Very rare. Collected only around main sampling locality # 1 (see Fig. 3), but the species is certainly more widespread in the park.

Geographic range - Widespread: occurs in the Guiana Shield and the Amazon Basin in Brazil, Colombia, Ecuador, Peru and Bolivia.

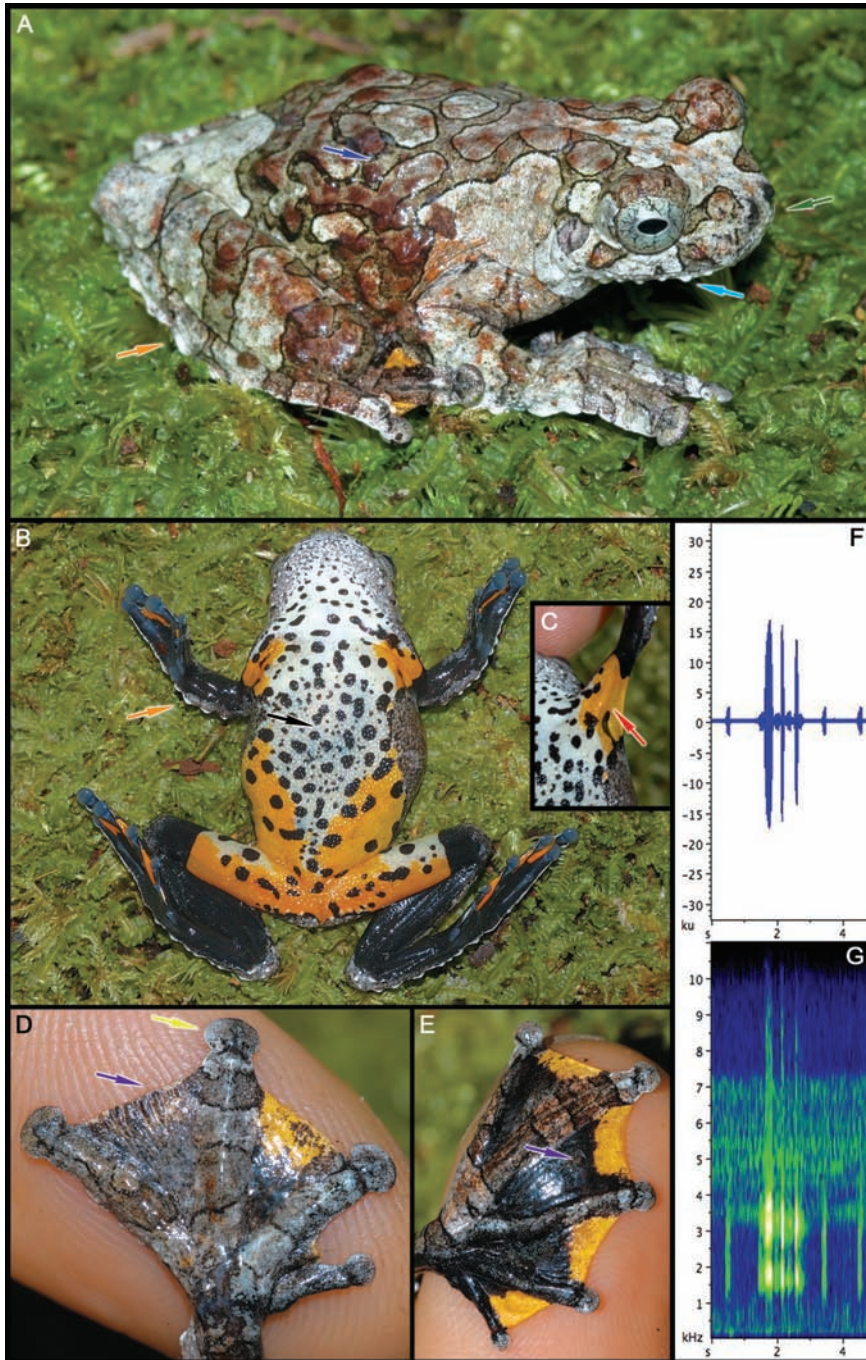


Fig. 106. *Dendropsophus marmoratus* (Laurenti, 1768). A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Detail of extensive axillary membrane. D. Top of hand of a living specimen. E. Top of foot of a living specimen. F. Call, oscillogram. G. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas Wagler, 1830

“WAGLER NEOTROPICAL TREEFROGS”



Fig. 107. *Hypsiboas ornatissimus*, a species currently not reported from Kaieteur National Park; here from the vicinity of Wayalayeng village. (Photo by P. J. R. Kok).

- ⇒ Medium to large size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Pigmented reticulation on palpebral membrane absent or present (Fig. 42D)
- ⇒ Vocal sac single, subgular (Fig. 56A)
- ⇒ Skin on dorsum smooth or shagreened to granular (Fig. 44A-C)
- ⇒ Fingers unwebbed to extensively webbed
- ⇒ Finger I < II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B)
- ⇒ Tympanum present, distinct or indistinct (Fig. 43A-B)

The genus *Hypsiboas* currently contains 79 species, which are nocturnal and mostly arboreal. They mainly inhabit tropical rainforest.

The genus was resurrected by Faivovich *et al.* (2005) on the basis of unique DNA sequences, and contains species formerly assigned to the genus *Hyla*. However, no strict morphological synapomorphies have currently been detected.

Sexual dimorphism

Males often have an enlarged prepollex and/or nuptial excrescences on the first finger. In most species males are smaller than females and in some species they have different throat pigmentation.

Eggs

Eggs are deposited in lentic or lotic water, in natural or constructed basins in some species. Some *Hypsiboas* species lay eggs as gelatinous masses, while others deposit eggs as a gelatinous film on the water surface.

Tadpoles

Exotroph (benthic).

Distribution

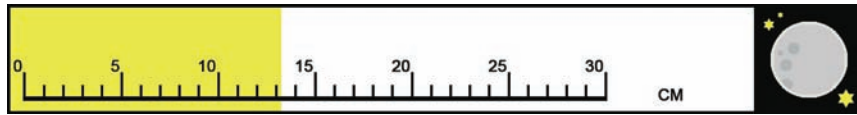
Species belonging to the genus *Hypsiboas* are found in tropical Central and South America, from Nicaragua to Argentina, including Trinidad and Tobago (Frost, 2008).

Field key to the *Hypsiboas* species of Kaieteur National Park

1. Dorsal colouration mostly brown **2**
- 1'. Dorsal colouration mostly green **3**
2. Palpebral membrane not reticulated. *H. calcaratus* (p. 166)
- 2'. Palpebral membrane reticulated (Fig. 42D). **4**
3. Dorsal skin smooth (Fig. 44A) *H. sibleszi* (p. 174)
- 3'. Dorsal skin granular (Fig. 44C). **5**
4. Fingers fully webbed *H. boans* (p. 164)
- 4'. Fingers not fully webbed *H. geographicus* (p. 170)
5. Snout truncate in profile (Fig. 40B); webbing not reaching subarticular tubercle on Finger IV; no prepollical spine in males *H. liliae* (p. 172)
- 5'. Snout rounded in profile (Fig. 40B); webbing reaching subarticular tubercle on Finger IV; prepollical spine in males (Fig. 48) **6**
6. Iris reddish orange, all fingers green *H. cinerascens* (p. 168)
- 6'. Iris silver, Fingers I-II whitish *H. sp.* (p. 176)

***Hypsiboas boans* (Linnaeus, 1758)**

1758: 213.



ENGLISH NAME: Giant gladiator treefrog.

LOCAL NAME (PATAMONA): Wàl-oma.

TYPE LOCALITY: "America".

SELECTED REFERENCES: Duellman, 1970 (description, tadpole description, call description, natural history, B&W drawings, colour drawings, in English); Duellman, 1978 (description, call description, natural history, B&W photo, in English); Hoogmoed, 1990 (comparison with *Hypsiboas wavrini*, B&W photos and drawings, in English).

Field identification - Males reach 132.0 mm SVL, females 118.0 mm.

- ➔ Dorsal ground colour variable, ranging from tan to greyish or dark brown, often with darker markings (spots or blotches), occasionally with scattered white spots and/or a middorsal line; skin on dorsum smooth.
- ➔ Ventral surface granular, white to greenish white, throat white to greenish white in females, greyish in males.
- ➔ Flanks whitish or greyish tan with diffuse dark brown vertical marks.
- ➔ Small triangular calcar on heel.
- ➔ Iris bronze, lower eyelid reticulated with silvery gold.
- ➔ Fingers with extensive brown webbing.
- ➔ Curved projecting prepollical spine in males.
- ➔ Toes with extensive brown webbing.

Life history - Nocturnal, arboreal. Found in primary and secondary forest, also occurs in open areas. Males call mainly on low vegetation along slow-moving rivers or streams, sometimes from the margin of small shallow natural basins or basin-like nests that they construct in sand or mud near water. Males usually defend egg-laying sites. Eggs are deposited as a film on the water surface of the nest basin from where the tadpoles will be washed into the stream; tadpoles feed on detritus.

Call - First described by Duellman (1970: 260), who provided a spectrogram. It consists of a series of 3-10 loud notes produced at a rate of 21-82 notes/min.

Tadpole - First described by Kenny (1969: 4, under *Hyla maxima*); see also Hero (1990: 228). Exotroph, benthic; transparent olive brown; LTRF = 2(1-2)/3-4(1).

Abundance and distribution in KNP - Common, observed around main sampling localities # 1, 2 and 5 (see Fig. 3), probably widespread in the Park

Geographic range - Widespread in lowland and upland tropical forests of South America, found also in eastern Panama, northern Colombia, and Trinidad.

Taxonomic comment - Duellman (1997) stated that the "*Hyla boans*" from Gran Sabana, Venezuela, could be specifically distinct from the widespread *H. boans* in the lowlands. Apparently specimens from Gran Sabana do not construct basin-like nests, but breed in small permanent streams. Interestingly, we never found constructed basin-like nests in KNP, but found eggs and tadpoles of *H. boans* in rocky streams.

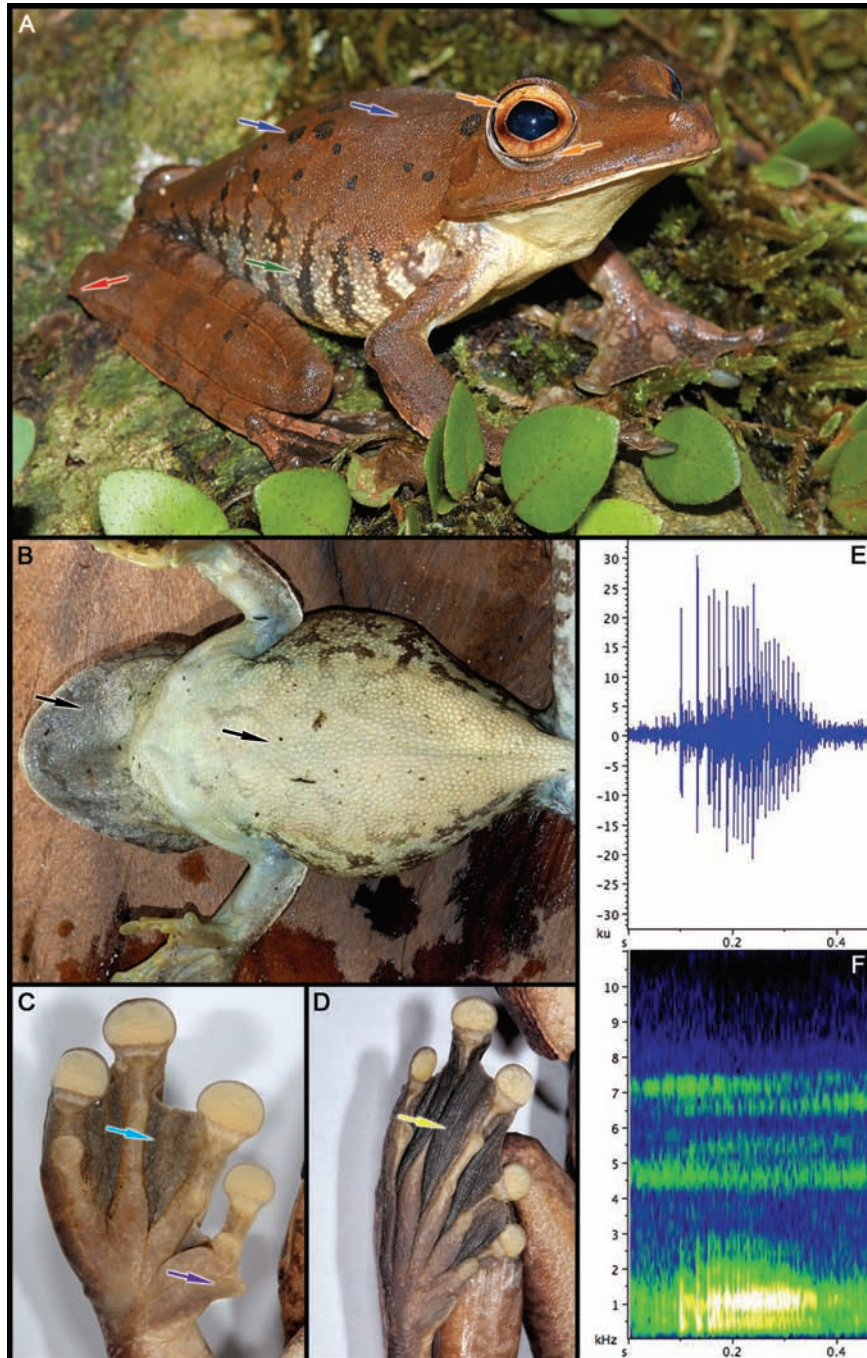
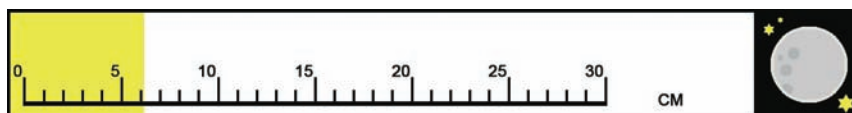


Fig. 108. *Hypsiboas boans* (Linnaeus, 1758). A. Dorsolateral view of a female. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas calcaratus (Troschel, 1848)

1848: 660.



ENGLISH NAME: Troschel's treefrog, Blue flanked treefrog.

LOCAL NAME (PATAMONA): Kon kon yun.

TYPE LOCALITY: "Britisch-Guiana".

SELECTED REFERENCES: Duellman, 1973 (description, call description, variation, natural history, B&W photos, in English), Lutz, 1973 (description, variation, in English), Duellman, 1978 (description, call description, tadpole description, natural history, B&W photo, in English).

Field identification - Males reach 41.0 mm SVL, females 61.0 mm.

➤ Dorsal ground colour variable, ranging from pale yellowish tan to brown, greyish brown or reddish brown, sometimes with darker markings (e.g. broad transverse marks, narrow transverse lines), often with a dark brown middorsal line.

➤ Ventral surface granular, white.

➤ Flanks and hidden surfaces of thighs bluish white to blue, with bold black markings (usually in the form of vertical bars).

➤ Large, elongate triangular calcar on heel.

➤ Eyelid without reticulations.

➤ Fingers with basal webbing.

➤ No prepollical spine in males.

➤ Supernumerary palmar and plantar tubercles present.

Life history - Nocturnal, arboreal. Found in primary and secondary forests. Males call from low vegetation along, or over, slow-moving streams and ponds. Eggs are deposited as a film on the water surface of slow-moving streams, swamps, or small ponds; tadpoles feed on detritus.

Call - First described by Duellman (1973: 518), it consists of one to three low-pitched rattling notes produced at a rate of ca. 8 notes/min.

Tadpole - First described by Duellman (1978: 138). Exotroph, benthic; dark brown with tan mottling and a tan interorbital bar; LTRF = 2(2)/3.

Abundance and distribution in KNP - Locally common, observed only around main sampling localities # 4 and 5 (see Fig. 3), but probably widespread in the Park.

Geographic range - Widespread in tropical South America, east of the Andes.

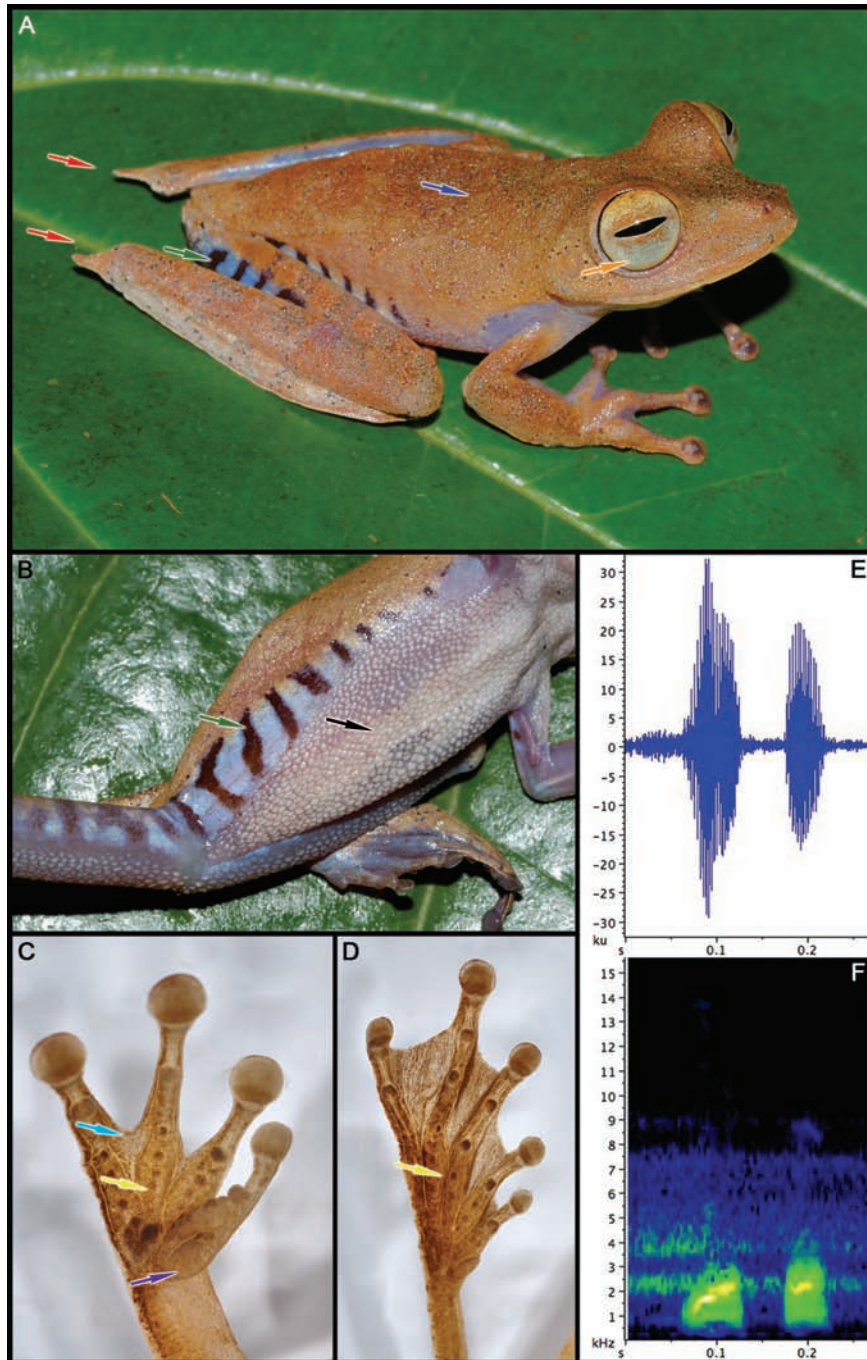
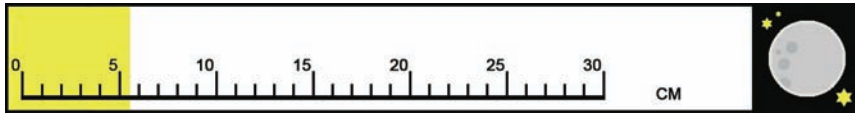


Fig. 109. *Hypsiboas calcaratus* (Troschel, 1848). A. Dorsolateral view of a female. B. Ventral surface of a female in life. C. Palm (preserved male specimen). D. Sole (preserved male specimen). E. Call, oscillogram. F. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas cinerascens (Spix, 1824)

1824: 35, pl. 8, fig. 4.



ENGLISH NAME: Demerara Falls treefrog.

LOCAL NAME (PATAMONA): Unknown, but green treefrogs are generally called "Pakoko" (pron. Pa-go-go).

TYPE LOCALITY: "Ecgá prope flumen Tefé" [= Ega, Rio Tefé, Brazil].

SELECTED REFERENCES: Duellman, 1978 (description, B&W photo, tadpole description, call description, in English [in part, under *Hyla granosa*]); Hoogmoed, 1979 (extensive description, distribution, B&W photos, call spectrogram, in English [in part, under *Hyla granosa*]); Schlüter 2005 (brief description, colour photos, call spectrogram, in German [in part, under *Hyla granosa*]). See taxonomic comments.

Field identification - Males reach 54.0 mm SVL, females 44.0 mm.

- ➔ Dorsal colour yellowish green to grass green with yellow dots, sometimes with reddish flecks/dots, and/or reddish interorbital bar; skin on dorsum finely granular.
- ➔ Ventral surface coarsely granular, pale green to bluish green, translucent in the central portion of abdomen (internal organs visible).
- ➔ Outer edge of upper eyelid yellow.
- ➔ All fingers yellowish green to green.
- ➔ Iris light orange to reddish orange.
- ➔ Outer fingers about 1/3 webbed, other fingers basally webbed.
- ➔ Prepollex enlarged, with small prepollical spine in breeding males.
- ➔ Toes about 2/3 webbed.

Life history - Nocturnal, arboreal. Found in primary forest along slow-moving streams and rivers. Males call from low vegetation, usually not far from the water surface. Eggs are deposited in slow flowing rivers and streams, as a film on the water surface; tadpoles feed on detritus.

Call - Apparently first described by Duellman (1978: 150), but see also Schlüter (1979: 216), who provided a spectrogram. It consists of a series of two to three loud, unpulsed, notes ("hoot-hoot-hoot"), which are produced at a rate of about 30-60 notes/min.

Tadpole - First described by Duellman (1978: 149); see also Hero (1990: 230). Exotroph, benthic; pale green to olive brown; LTRF = 2(1, 2)/3-4(1)[2].

Abundance and distribution in KNP - Rare, observed only around main sampling locality # 5, but probably more widespread in the Park.

Geographic range - Exact distribution is unclear due to the confusion between at least two species (see *Hypsiboas* sp., p. 176). Probably widespread in the Amazon Basin from eastern Ecuador, Peru, northern Bolivia to northeastern Brazil and the Guiana Shield.

Taxonomic comments - A complex of at least two sympatric species (see Kok, 2006). Descriptions of tadpoles and calls in the literature did not discriminate between the similar but distinct taxa, and might thus involve more than one species. Re-evaluation of the taxonomic status of these very similar species is in progress by Kok and colleagues.

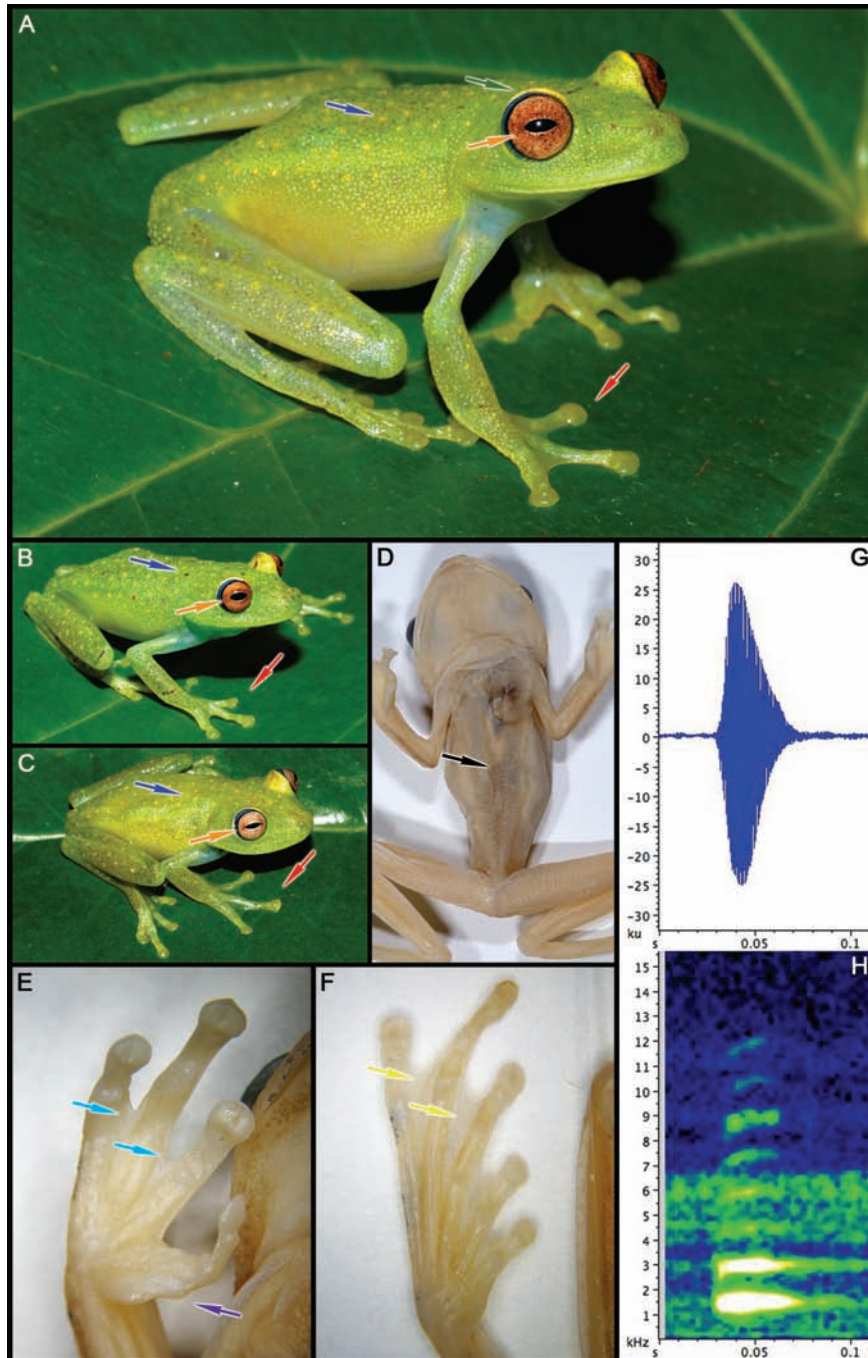
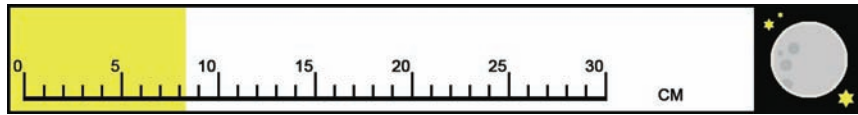


Fig. 110. *Hypsiboas cinerascens* (Spix, 1824). A-B. Dorsolateral views of males. C. Dorsolateral view of a female. D. Ventral surface of a preserved male. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

***Hypsiboas geographicus* (Spix, 1824)**

1824: 39, pl. 11, figs 1-2.



ENGLISH NAME: Map treefrog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: “*flumen Tefé*” [Rio Tefé, Brazil].

SELECTED REFERENCES: Duellman, 1973 (description, call description, ontogenetic change in colour pattern, variation, natural history, B&W photos and drawings, in English); Lutz, 1973 (description, variation, in English); Duellman, 1978 (description, call description, tadpole description, natural history, B&W photo, in English).

Field identification - Males reach 62.0 mm SVL, females 83.0 mm.

➔ Dorsal ground colour very variable and depending on light intensity, ranging from brown or greyish brown to yellowish tan or orangish brown, often with darker markings (e.g. X-shaped mark on scapular region, irregular transverse bars, black flecks) and/or middorsal line extending to varying lengths on body, but usually more conspicuous on head, occasionally with few irregular white spots; in juveniles dorsum cream with many small black dots, flanks black (not illustrated); skin on dorsum smooth.

➔ Ventral surface granular, orangish yellow to orange, excepted on throat and chest, which are white to creamy yellow (females), or whitish, with some creamy yellow laterally and posteriorly (males).

➔ Flanks bluish with white flecks.

➔ Small triangular calcar on heel.

➔ Iris orangish bronze, lower eyelid reticulated with gold.

➔ Fingers with moderate, orange webbing (finely pigmented in preservative).

➔ No prepollical spine in males.

➔ Toes with moderate, orange webbing (finely pigmented in preservative).

Life history - Nocturnal, arboreal. Found mainly in secondary forest and disturbed vegetation, also occurs in primary forest and in open areas. Males call from low vegetation along, or over, slow-moving streams and ponds. Eggs are deposited as a film on the water surface of slow-moving streams or ponds; tadpoles feed on detritus.

Call - First described by Duellman (1973: 518), who provided a spectrogram; see also Duellman (1978: 148). Complex and highly variable, consisting of a series of short chuckles and/or a long groan, notes are produced at a rate of 2-60 notes/min.

Tadpole - First described by Kenny (1969: 36); see also Hero (1990: 229). Exotroph, benthic; black; LTRF = 2-3[1] (3)/3-5[1].

Abundance and distribution in KNP - Locally common, observed around main sampling localities # 5, 9, 10 and 11 (see Fig. 3).

Geographic range - Widespread in tropical South America, east of the Andes.

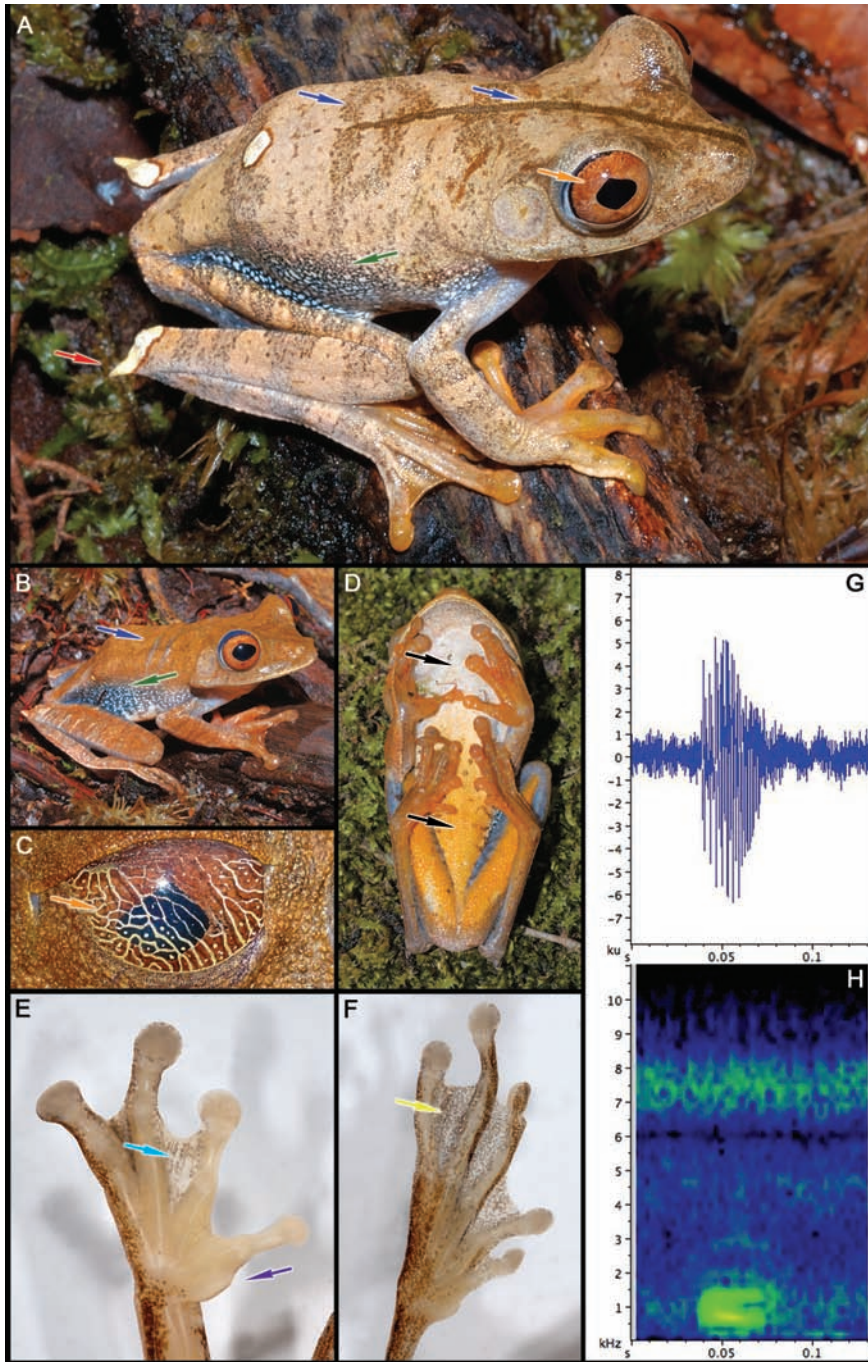
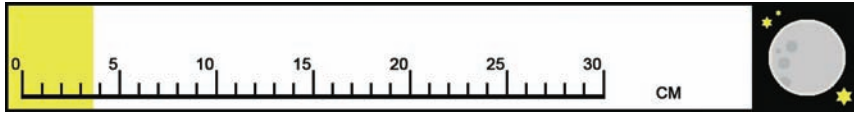


Fig. 111. *Hypsiboas geographicus* (Spix, 1824). A-B. Dorsolateral views. C. Lower eyelid. D. Ventral surface of a female in life. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas liliae Kok, 2006

2006: 191, figs 1-4.



ENGLISH NAME: None; we propose "Lili treefrog".

LOCAL NAME (PATAMONA): Unknown, but green treefrogs are generally called "Pakoko" (pron. Pa-go-go).

TYPE LOCALITY: "Between Boy Scout View and Johnson View on the Kaieteur Plateau (5°10'51"N, 59°28'57"W), ca. 400 m elevation, Kaieteur National Park, Potaro-Siparuni district, Guyana".

SELECTED REFERENCE: Kok, 2006 (original description, call description, colour photos, B&W drawings and photos, in English).

Field identification - Males reach 37.1 mm SVL, female not known.

- Dorsal colour and pattern strongly dependent on light intensity, from bright green to bright yellowish green during the day, to greenish brown at night; skin on dorsum thickly granular.
- Ventral surface thickly granular, blue, translucent in the central portion of abdomen (internal organs visible).
- Snout truncate in dorsal view, with strongly protuberant nostrils.
- Ulnar fold distinct.
- Iris silver with black periphery during the day, bronze at night.
- All fingers unwebbed.
- Prepollex enlarged, without prepollical spine.
- Toes extensively webbed.

Life history - Nocturnal, arboreal. Primary forest and forest-edged situations. Males call from the water-filled phytotelm of large terrestrial bromeliads (e.g. *Brocchinia micrantha*) or at high elevation in trees (> 10 m above the ground). Reproductive biology is totally unknown.

Call - First described by Kok (2006: 196), who provided a spectrogram. It consists of a long series of loud percussive notes ("tuk-tuk-tuk-tuk...") gradually increasing in speed and loudness; the duration of the entire call is about 50 s.

Tadpole - Unknown.

Abundance and distribution in KNP - Rare, observed only around main sampling localities # 1 and 11.

Geographic range - Reported only from Guyana, in KNP. We heard the species calling on the slopes of Mt Maringma at the Guyana-Brazil border (Kok, unpublished data); the species is probably widespread in the Pakaraima Mountains of Guyana.

Taxonomic comments - Lack of known morphological synapomorphies for the genus *Hypsiboas* (Faivovich *et al.*, 2005) precludes definite generic allocation for this species; generic allocation of *H. liliae* remains thus uncertain (J. Faivovich, pers. comm.).

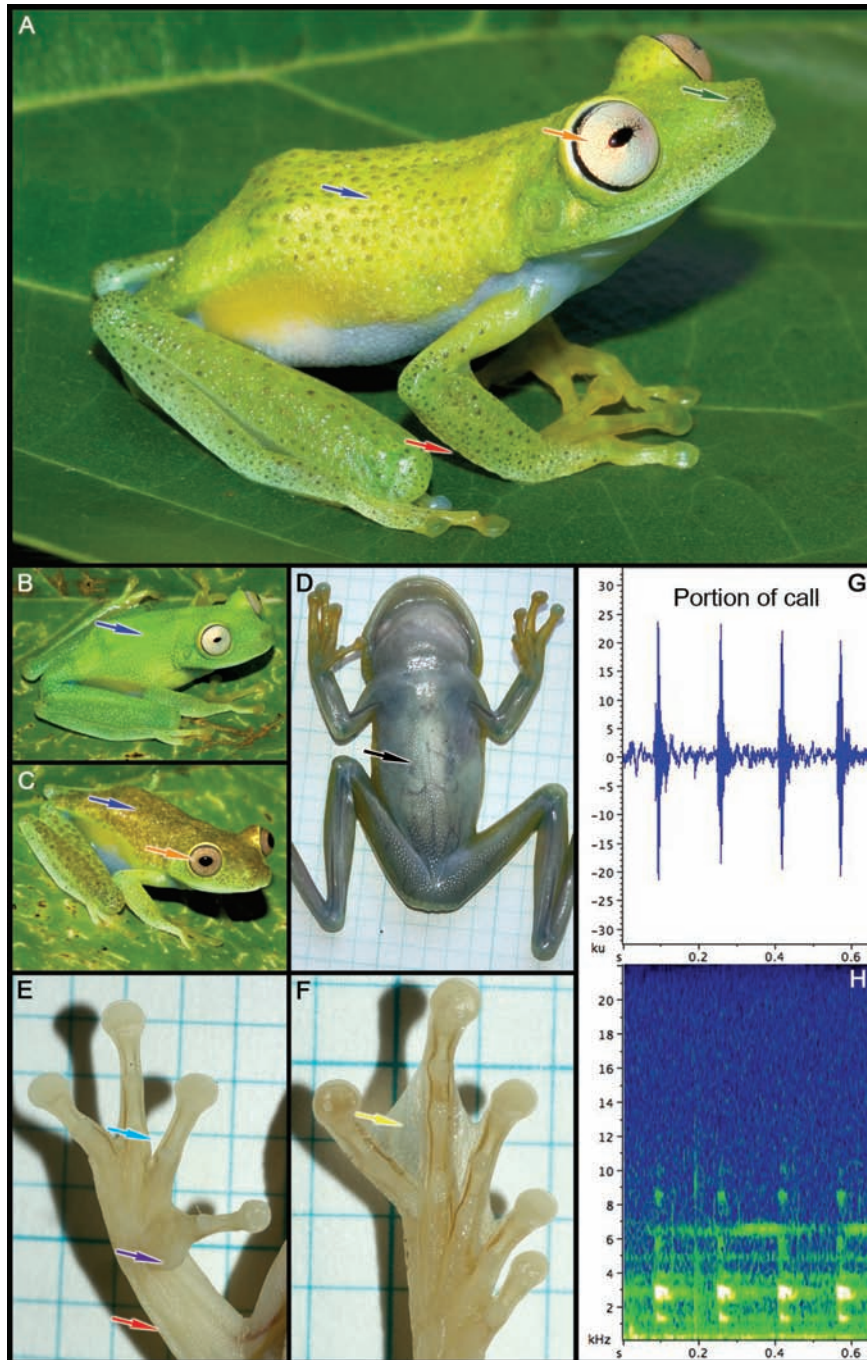
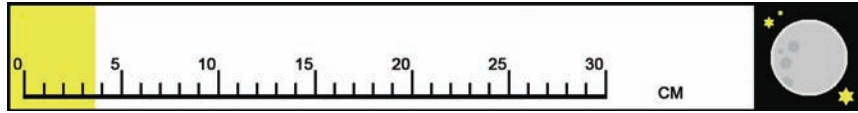


Fig. 112. *Hypsiboas liliae* Kok, 2006. A-B. Dorsolateral views of two males by day. C. Dorsolateral view of a male (same than A) by night. D. Ventral surface of a male in life. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas sibleszi (Rivero, 1972)

1972 "1971": 182, fig. B.



ENGLISH NAME: La Escalera treefrog.

LOCAL NAME (PATAMONA): Unknown, but green treefrogs are generally called "Pakoko" (pron. Pa-go-go).

TYPE LOCALITY: "Paso del Danto, La Escalera, entre El Dorado y Sta. Elena de Uiarén, 1300-1400 m; Serranía de Lema, Edo. Bolívar, Venezuela"

SELECTED REFERENCES: Rivero, 1972 (original description, B&W photos, call spectrogram, in Spanish); Hoogmoed, 1979 (extensive description, distribution, B&W photos, call spectrogram, in English); Señaris & Ayarzagüena, 2006 (description, call description, osteology, distribution, in English).

Field identification - Males reach 39.0 mm SVL, females 38.0 mm.

- Dorsal colour variable: yellowish green to pale lime-green, with or without reddish brown and/or white or yellow flecks/spots, yellow dorsolateral and interorbital stripes may be present; skin on dorsum smooth.
- Ventral surface coarsely granular, pale green to bluish green, translucent in the central portion of abdomen (internal organs visible).
- Discs of fingers and toes orange.
- Outer edge of upper eyelid not yellow, unless presence of yellow dorsolateral stripes.
- Iris yellowish bronze with black flecks.
- Outer fingers about 1/3 webbed, other fingers basally webbed.
- Prepollex enlarged, with large protruding prepollical spine in breeding males.
- Toes about 2/3 webbed.

Life history - Nocturnal, mostly arboreal. Found in primary forest along slow-moving streams or ponds. Males call from low vegetation, usually not far from the ground or the water surface, sometimes partly submerged in the water. Eggs are deposited in slow-flowing streams or ponds, as a film on the water surface; tadpoles feed on detritus.

Call - Rivero (1972: 188) and Hoogmoed (1979: plate 5) provided spectrograms, but no formal description. Señaris & Ayarzagüena (2006: 315) provided a brief description and a spectrogram. The call consists of one or two "chucks", which are produced at a rate of about 10-15 notes/min.

Tadpole - First described by Hoogmoed (1979: 27). Exotroph, benthic; grey with dark grey spots; LTRF = 2(2)/4(1).

Abundance and distribution in KNP - Rare, observed only around main sampling locality # 4, but could be more widespread in the Park.

Geographic range - Restricted to the uplands and highlands of eastern Venezuela and western Guyana.

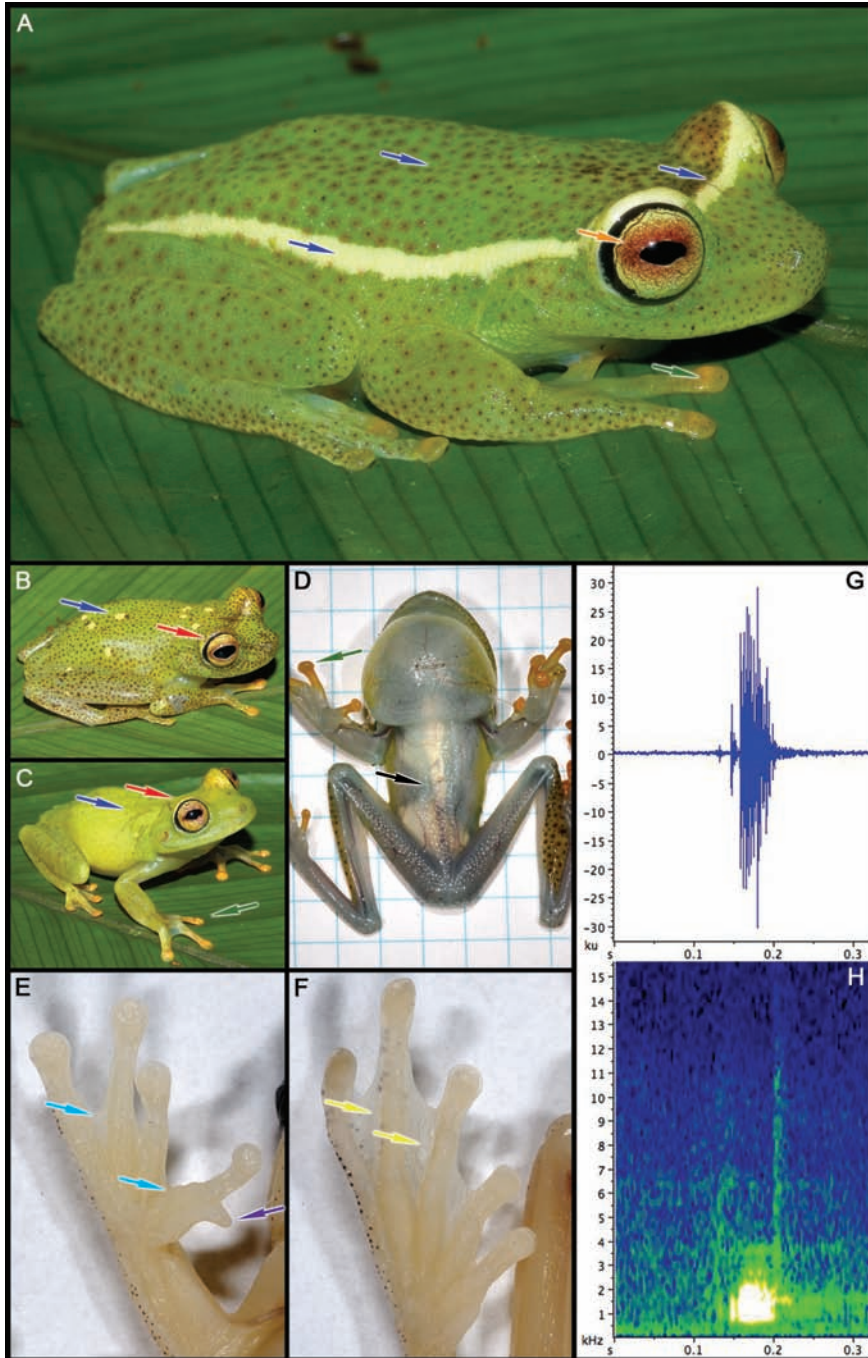
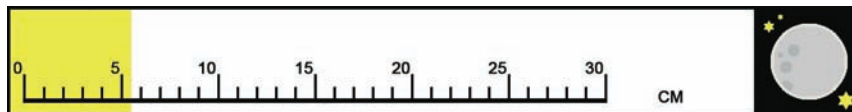


Fig. 113. *Hypsiboas sibleszi* (Rivero, 1972). A-C. Dorsolateral views of males. D. Ventral surface of a male in life. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

Hypsiboas sp.



ENGLISH NAME: "Demerara Falls treefrog" (confused with *Hypsiboas cinerascens*).

LOCAL NAME (PATAMONA): Unknown, but green treefrogs are generally called "Pakoko" (pron. Pa-go-go).

TYPE LOCALITY: -

SELECTED REFERENCES: Duellman, 1978 (description, B&W photo, tadpole description, call description, in English [in part, under *Hyla granosa*]); Hoogmoed, 1979 (extensive description, distribution, B&W photos, call spectrogram, in English [in part, under *Hyla granosa*]); Schlüter 2005 (brief description, colour photos, call spectrogram, in German [in part, under *Hyla granosa*]). See taxonomic comments.

Field identification - Males reach 54.0 mm SVL, females 44.0 mm (but see taxonomic comments).

- Dorsal colour yellowish green to grass green with yellow dots, often with reddish flecks/dots, and/or reddish interorbital bar; skin on dorsum finely granular.
- Ventral surface coarsely granular, pale green to bluish green, translucent in the central portion of abdomen (internal organs visible).
- Outer edge of upper eyelid yellow.
- Fingers I-II unpigmented, whitish, other fingers yellowish green to green.
- Iris silver, may become light brown or brown in certain light condition.
- Outer fingers about 1/3 webbed, other fingers basally webbed.
- Prepollex enlarged, with small prepollical spine in breeding males.
- Toes about 2/3 webbed.

Life history - Nocturnal, arboreal. Found exclusively in open areas (e.g. forest-edge situations, savannah), along streams or small ponds. Males call from small bushes and trees, up to 4 m above the ground, sometimes from rocks along streams. Eggs are deposited in streams and small ponds, as a film on the water surface; tadpoles feed on detritus.

Call - See *Hypsiboas cinerascens* (p. 168), with which it is confused in the literature, see also taxonomic comments. It consists of a loud, metallic, pulsed "cluck", which is produced at a rate of about 10-60 notes/min.

Tadpole - Exotroph, benthic. See *Hypsiboas cinerascens* (p. 168), with which it is confused in the literature, see also taxonomic comments.

Abundance and distribution in KNP - Locally very common, observed around main sampling localities # 2, 3, 4 and 12, probably widespread in the Park in adequate habitats.

Geographic range - Exact distribution is unclear due to the confusion with *Hypsiboas cinerascens* (see p. 168). Might be widespread in the Amazon Basin from eastern Ecuador, Peru, and northern Bolivia to northeastern Brazil and the Guiana Shield.

Taxonomic comments - Confused with *Hypsiboas cinerascens*, which is a complex of at least two sympatric species (see Kok, 2006). Re-evaluation of the taxonomy of these morphologically very similar species is in progress by Kok and colleagues.

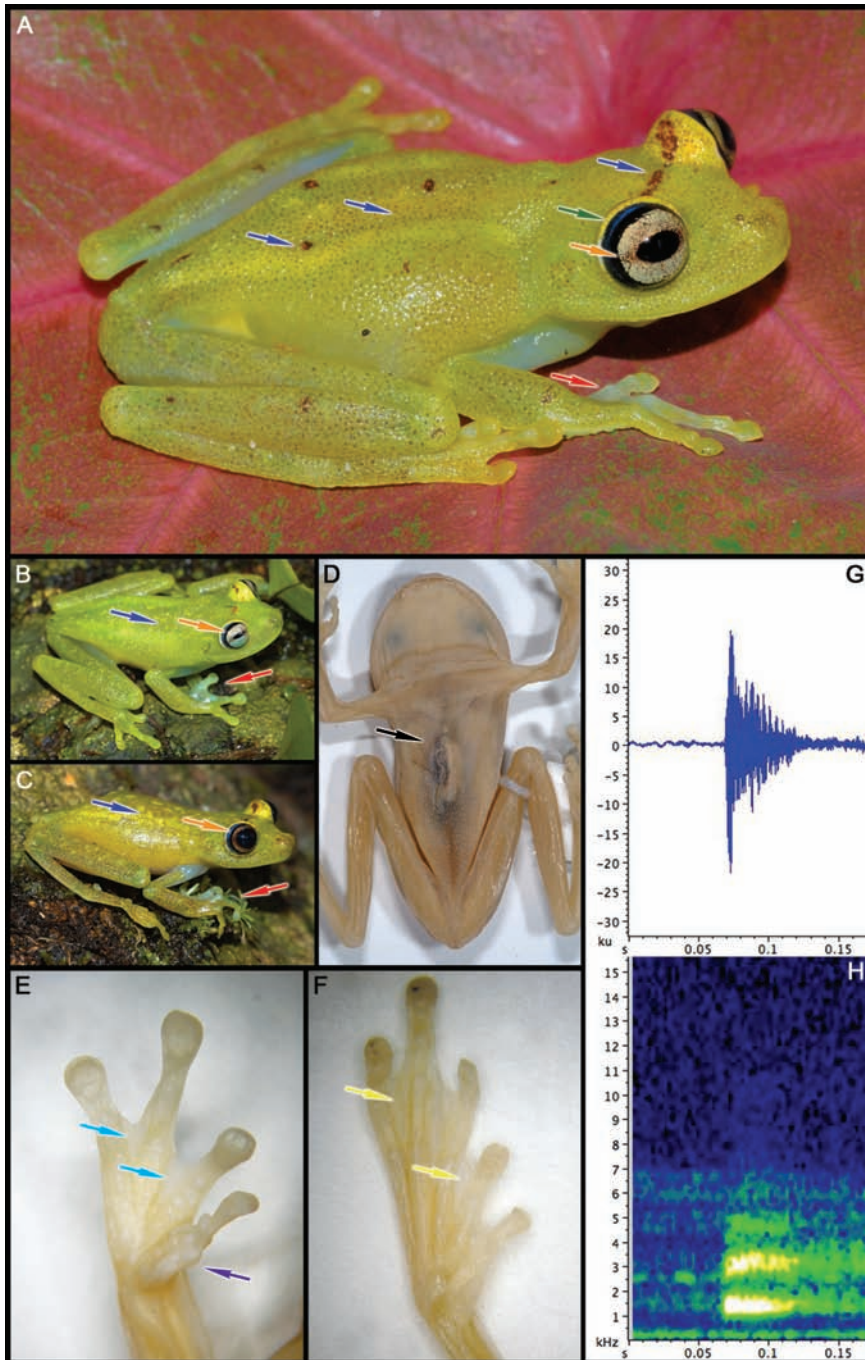


Fig. 114. *Hypsiboas* sp. A-C. Dorsolateral views of males. D. Ventral surface of a preserved male. E. Palm (preserved male specimen). F. Sole (preserved male specimen). G. Call, oscillogram. H. Call, spectrogram. (Photos by P. J. R. Kok).

Osteocephalus Steindachner, 1862

“SLENDER-LEGGED TREEFROGS”



Fig. 115. *Osteocephalus mutabor*, a species that does not occur in the Park (compare with *O. lepreurii*); here from Volcan Sumaco, Ecuador. (Photo by K. H. Jungfer).

- ⇒ Medium to large size
- ⇒ Maxillary teeth present
- ⇒ Pupil horizontally elliptical (Fig. 42A)
- ⇒ Usually exostosed skulls (skin attached to the skull bone)
- ⇒ Vocal sacs paired, lateral/subgular or both in most species (Fig. 56C-D) or vocal sac single, subgular (e.g. *O. oophagus*) (Fig. 56A)
- ⇒ Skin on dorsum often, but not always, sexually dimorphic: smooth or shagreened in females (Fig. 44A-B), smooth, but usually tuberculate or spiculate in males (Fig. 44A, D-E)
- ⇒ Fingers unwebbed to basally webbed
- ⇒ Finger I < II when fingers adpressed
- ⇒ Finger discs expanded (Fig. 51B)
- ⇒ Tympanum present, distinct (Fig. 43A)

The genus *Osteocephalus* currently contains 20 species, which are nocturnal and arboreal. They mainly inhabit tropical rainforest.

Some species (e.g. *Osteocephalus buckleyi*) might be complexes of distinct taxa and a taxonomic revision of the genus is needed. Two additional undetermined *Osteocephalus* species have been collected in KNP and are not treated here.

Sexual dimorphism

Males are smaller than females and often have the skin on dorsum tuberculate or spiculate (variable among species, dorsal skin not sexually dimorphic in some taxa), while females have smooth or shagreened dorsal skin. Breeding males yellow and/or with nuptial excrescences on prepollex reported in several species.

Eggs

Eggs are laid in lentic or lotic water, as a film on the water surface, or as a gelatinous mass. Some species lay eggs in the canopy (up to 30 m high), in water-filled bromeliads or treeholes (e.g. *Osteocephalus oophagus*).

Tadpoles

Exotroph (benthic, arboreal).

Distribution

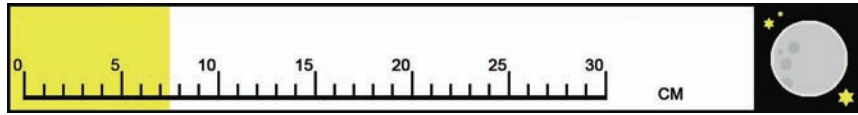
The Guiana Shield and the Amazon Basin (Frost, 2008).

Field key to the *Osteocephalus* species of Kaieteur National Park

1. Iris with conspicuous radiating black lines **2**
- 1'. Iris lacking conspicuous radiating lines **3**
2. Vocal sac single, subgular (Fig. 56A); frontoparietal ridges indistinct; toes not fully webbed; when leg extended, tibio-tarsal articulation does not reach snout-tip. ***O. oophagus*** (p. 186)
- 2'. Vocal sacs paired, lateral (Fig. 56D); frontoparietal ridges prominent; toes almost fully webbed; when leg extended, tibio-tarsal articulation reaches snout-tip or beyond ***O. taurinus*** (p. 188)
3. Dorsal colour primarily greenish; tarsal tubercles very prominent ***O. buckleyi*** (p. 180)
- 3'. Dorsal colour primarily brownish or greyish; tarsal tubercles absent or few and not very prominent **4**
4. Vocal sac single, subgular (Fig. 56A); ventral surface greyish with dark flecks; foot webbing blackish brown; distal tubercle on Finger IV single (Fig. 52B) ***O. exophthalmus*** (p. 182)
- 4'. Vocal sacs paired, subgular (Fig. 56C); ventral surface whitish or yellow, immaculate; foot webbing tan, orange or red; distal tubercle on Finger IV bifid (Fig. 52C) ***O. lepreurii*** (p. 184)

Osteocephalus buckleyi (Boulenger, 1882)

1882: 362, pl. 25, fig. 1.



ENGLISH NAME: Buckley's slender-legged treefrog.

LOCAL NAME (PATAMONA): Unknown.

TYPE LOCALITY: restricted to "Canelos, Provincia Pastaza, Ecuador" by Cochran & Goin (1970).

SELECTED REFERENCES: Trueb & Duellman, 1971 (description, B&W drawings, distribution, in English); Duellman, 1978 (description, tadpole description, natural history, B&W photo, in English); Lima *et al.*, 2006 (brief description, colour photos, in English).

Field identification - Males reach 50.0 mm SVL, females 75.1 mm.

- ➔ Dorsal ground colour variable, from greenish brown to green, with dark brown markings often in the shape of a black inverted triangle between the eyes followed on the back by a) (or a X and two large dark lumbar spots; skin on dorsum tuberculate/spiculate, especially in males.
- ➔ Ventral surface granular, greyish white, with brown blotches located mainly on throat, chest, and sides of belly; ventral surface sometimes entirely covered by brown flecks.
- ➔ Broad, irregular, green subocular spot.
- ➔ Frontoparietal ridges absent.
- ➔ Iris greenish bronze to gold without radiating black lines, but with irregular black vermiculations.
- ➔ Flanks areolate, inguinal region and inner thigh blue.
- ➔ Tarsal tubercles very prominent.
- ➔ Toes about 2/3 webbed.

Life history - Nocturnal, arboreal. Found in primary forest, usually near streams and ponds. Males call from low vegetation along streams or ponds. Eggs are deposited as a film on the water surface of streams and ponds; tadpoles feed on detritus.

Call - Probably still undescribed due to confusion with other species (see *Osteocephalus oophagus*, p. 186).

Tadpole - First described by Hero (1990: 236). Exotroph, benthic; dark blue; LTRF = 2(2)/3-8 [1].

Abundance and distribution in KNP - Rare, observed only around main sampling locality # 11 (see Fig. 3), but probably more widespread in the Park.

Geographic range - Occurs in the Amazon Basin, from eastern Ecuador and Peru, and northern and central Bolivia to northeastern Brazil and the Guiana Shield.

Taxonomic comments - Some data suggest that this taxon holds several cryptic species (K.-H. Jungfer, pers. comm.; P. Kok, unpubl. data).

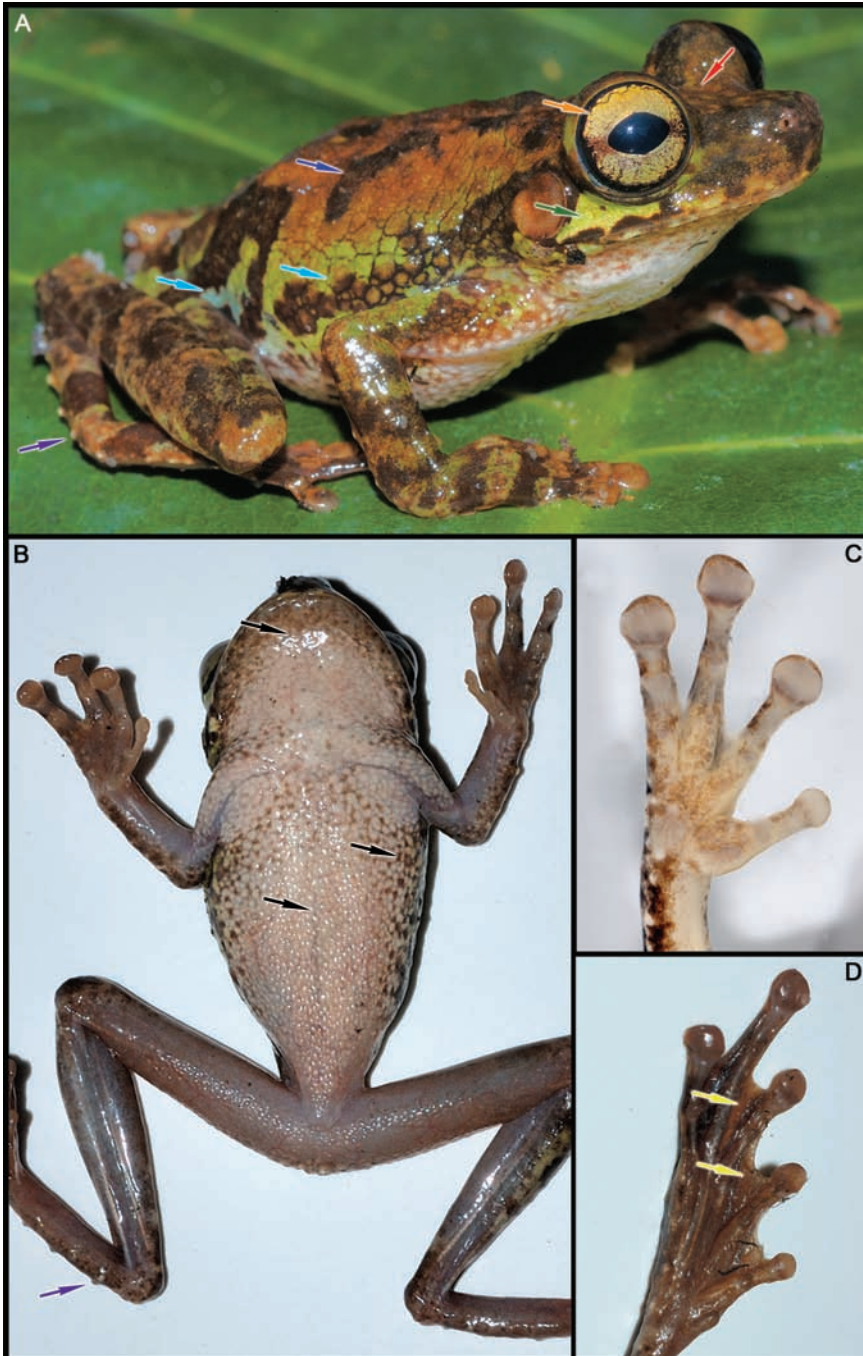


Fig. 116. *Osteocephalus buckleyi* (Boulenger, 1882). A. Dorsolateral view of a male. B. Ventral surface of a male in life. C. Palm (preserved male specimen). D. Sole (female specimen in life). (Photos by P. J. R. Kok).