



## The tadpole of the Madagascar Bullfrog, *Laliostoma labrosum*

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The anuran genus *Laliostoma* Glaw, Vences & Böhme forms, together with *Aglyptodactylus* Boulenger, the subfamily Laliostominae in the endemic Malagasy-Comoran family Mantellidae. *Laliostoma labrosum* (Cope) is the sole representative of the genus. This stout, terrestrial frog is widely distributed in open areas of western and central Madagascar and breeds in lentic waters. It is the only mantellid without intercalary elements between terminal and subterminal phalanges of fingers and toes (Glaw & Vences 2006) and has an important potential to understand the evolution of mantellid frogs (Glaw *et al.* 2006).

The tadpoles of *L. labrosum* have briefly been described by Cope (1868) and Glaw & Vences (1994), with additional detailed measurements and data on natural history published by Glos & Linsenmair (2004). As a contribution to provide reliable and detailed larval descriptions of all Malagasy frog species we here update the previous descriptions based on newly collected *Laliostoma* tadpoles identified by DNA barcoding (Thomas *et al.* 2005).

Tadpoles were collected in Toliara, south-western Madagascar on 7 February 2003 in a warm puddle within the limits of the town. They were preserved in buffered formalin and deposited in the Zoologische Staatssammlung München, Germany (ZSM 914/2007; nine specimens; field number FG/MV 2002.1724). The Genbank accession number of a fragment of the mitochondrial 16S rRNA gene amplified and sequenced from one voucher specimen of the series is EU717877. Terminology and measurements follows Altig & McDiarmid (1999). Measurements were taken using a digital caliper and a Zeiss Stereo Discovery microscope system: BL, body length; BH, maximum body height; BW, maximum body width; TL, total length; TAL, tail length; ED, eye diameter; IOD, inter-orbital distance; IND, inter-narial distance; ESD, distance between eye and spiraculum; LTRF, labial tooth row formula; LTD, labial tooth density (number of teeth per millimetre in second upper tooth row A2); LTN, labial tooth number in A2; PN, oral papilla number; TMH, tail muscle height; TMW, tail muscle width; MTH, maximum tail height; DF, height of dorsal fin at midlength of tail; TMHM, height of tail muscle at midlength of tail; VF, height of ventral fin at midlength of tail; ODW, oral disc width. Drawings and descriptions are based on the DNA voucher unless otherwise stated.

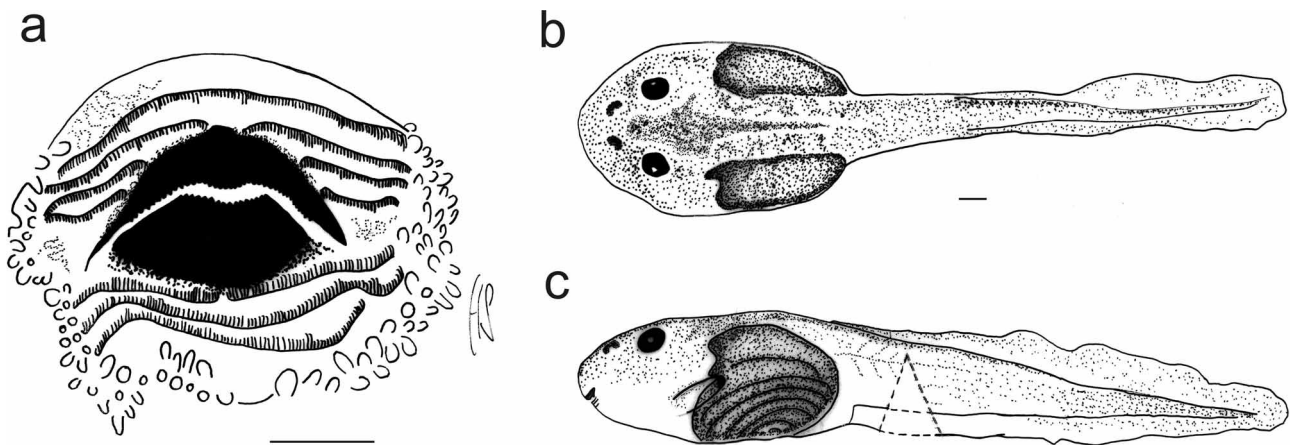
**Description.** Tadpole in Gosner developmental stage 29 and fairly good state of preservation. In preservative, transparent to fawn with a yellowish shade. Small, rounded brown spots on the body. Ventral caudal fin and belly transparent, fawn, lacking these spots. In dorsal view, body shape ovoid. In lateral view, body ovoid and not depressed, BW 1.29 of BH and no flattening of body shape toward snout. Nostrils directed dorsolaterally, round, not protuberant, rimmed with a mediadorsal projection giving them a bean shape, positioned slightly closer to the eyes than to the tip of snout, IND 0.41 of IOD. Eyes positioned dorsally, oriented dorsolaterally, moderately sized, not visible in ventral view, ED 0.07 of BL. Snout rounded in lateral and dorsal view. Spiracle sinistral, closely attached to the body wall (but at the tip the inner wall is free from body), not visible in dorsal view. Spiracular opening oval, oriented posteriorly, upper margin situated at a considerably deeper level than lower margin of eye, slightly closer to the end of the body than to the tip of snout, ESD 0.28 of BL. Intestinal spiral well visible in lateral and ventral view. Short, flattened vent tube, dextral, right wall displaced dorsally. Caudal musculature well developed, TMH 0.84 of BH and 0.94 of MTH; in lateral view, visible behind the end of the body. Dorsal fin originating slightly behind the base of caudal muscle, increasing in height at the proximal part of the tail (MTH 0.9 of BH), and maintaining equal height over the distal half of the tail (with some undulation due to the curly shape of the dorsal fin in the preserved specimen), slightly diminishing to finely rounded tip. Only dorsal fin is slightly convex in outline, not equally sized, margins of ventral fin nearly parallel with the margins of the tail muscle. Oral disc small, generalized, ODW 0.35 of BL and 0.71 of BW, transversely elliptical, directed anteroventrally, laterally slightly emarginated, not visible in dorsal view, but margins visible in lateral view. Lower labium with two discontinuous rows of papillae, rounded, with a small gap in the middle of both lower papillae rows. Upper labium with two rows of papillae, some with pointed tip, separated by a wide dorsal gap. LTRF 4(2–4)/3(1), LTD

about 37 teeth per mm, LTN about 116. Beak well developed and fully keratinised, black. Both jaw sheaths equally sized. Upper jaw sheath M-shaped, lower sheath V-shaped.

*Measurements (in mm)*. BL 12.3, BH 4.8, BW 6.2, TL 29.3, TAL 17.0, ED 1.0, IOD 3.7, IND 1.5, ESD 3.5, TMH 4.0, TMW 2.2, MTH 4.3, DF 1.2, TMHM 2.4, VF 1.4, ODW 4.4. *Teeth and papillae counts*. LTD 37, PN 82.

*Variation*. Seven tadpoles in developmental stages 25–30, including the DNA voucher specimen: BW 1.16–2.12 of BH, IND 0.13–1.04 of IOD, ED 0.07–0.13 of BL, ESD 0.26–0.35 of BL, TMH 0.61–0.92 of BH, TMH 0.64–1.13 of MTH, MTH 0.80–1.05 of BH, ODW 0.34–0.42 of BL, ODW 0.40–0.72 of BW, TAL 1.19–1.64 of BL, BL 0.38–0.46 of TL, TAL 0.54–0.62 of TL. LTRF variation: 5(2–5)/3; 5(2–5)/3(1); 4(2–4)/3; 4(2–4)/3(1). LTD 33–41, PN 63–85. Two tadpoles in stages 36–37: BW 0.82–1.3 of BH, IND 0.33–0.34 of IOD, ED 0.10–0.11 of BL, ESD 0.22 of BL, TMH 0.78–0.80 of BH, TMH 0.85–0.69 of MTH, MTH 0.93–1.16 of BH, ODW 0.27–0.28 of BL, ODW 0.54 of BW, TAL 1.46–1.78 of BL, BL 0.36–0.41 of TL, TAL 0.59–0.64 of TL. LTRF 5(2–5)/3 [5(2–5)/3(3) in one individual, probably due to an artefact]. LTD 36, PN 76–85.

The nine tadpoles examined agree in general body proportions and colour, independent of their developmental stage. Some larvae in earlier stages had four instead of five upper labial tooth rows. Size increase was notable: BL was 9.2–13.2 mm in stages 26–30 and 16–17 mm in stages 36–37. A distinctive feature of *Laliostoma labrosum* tadpoles is the small ventral gap in the center of both lower papillae rows which was observed in all specimens but seems to be absent in *Aglyptodactylus* (Glos & Linsenmair 2004). Observations by Glaw & Vences (1994) report a silvery grey colour in life, with a silvery belly, and agree with our description except for a slightly different LTRF of 6(2–6)/3. Our description largely agrees with the morphometric data and LTRF provided by Glos & Linsenmair (2004) who report *Laliostoma* tadpoles to be facultatively carnivorous.



**FIGURE 1.** Drawings of the preserved voucher tadpole of *Laliostoma labrosum* (stage 29), series ZSM 914/2004; (A) oral disc, (B) dorsal view, (C) lateral view. The dashed triangle in the tail indicates the tissue sample used for DNA sequencing.

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