



Re-description of the tadpole of *Pleurodema somuncurensis* (Ceï, 1969) (Amphibia: Anura)

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The monotypic genus *Somuncuria* was erected by Lynch (1978) on the basis of external morphology and osteology of the adults of *Telmatobius somuncurensis* Ceï, 1969. In addition, Lynch remarked a general resemblance between *Somuncuria* and *Pleurodema*. The recent phylogenetic analysis by Faivovich *et al.* (2012) recovered *Somuncuria* nested into *Pleurodema* and closely related to *Pleurodema bufoninum*. According to Faivovich *et al.* (2012), these species have nearly identical sequences and additional study is required to establish populations identity. *Pleurodema somuncurensis* inhabits thermal springs at mid altitudes (500–800 m a.s.l.) in a restricted geographic range at Meseta de Somuncurá, Río Negro Province, Argentina (Ceï, 1969).

The external larval morphology of *Pleurodema somuncurensis* was briefly described by Ceï (1970) in the context of a larval morphology account of the genus *Telmatobius*. Later, Lavilla & Scrocchi (1986) and Lavilla (1988) provided additional information of external larval features of *P. somuncurensis*, but in the context of the patagonian genera formerly referred as “Lower Telmatobiinae”.

Recently, we studied a sample of larvae of *Pleurodema somuncurensis* and noticed some inconsistencies with the description by Ceï (1970), mainly in regard to the oral disc configuration. The present work describes in detail the external larval morphology of *P. somuncurensis* and discusses its morphological traits in the context of the recently proposed phylogeny of the genus by Faivovich *et al.* (2012).

Tadpoles of *Pleurodema somuncurensis* were collected at Estancia el Rincón, Río Negro Province, Argentina (4059'27.00"S, 6640'36.30"W – 594 m a.s.l.), fixed in 10% formalin and housed at the herpetological collection of the Centro Nacional Patagónico (CNP). Comparison with *P. bufoninum* tadpole is made throughout the description of *P. somuncurensis* tadpole given their need for additional diagnostic traits (see Faivovich *et al.*, 2012). The tadpoles of other species of the genus *Pleurodema* are compared in the subsequent discussion. Tadpoles of *P. bufoninum* used for comparison were collected near Road N° 12, 50 Km northeast from Gobernador Gregores, Santa Cruz Province, Argentina (4830'30.0"S, 6940'44.6"W – 616 m a.s.l.), fixed in 10% formalin and housed at the herpetological collection of Museo de La Plata (MLP). Ten tadpoles of *P. somuncurensis* (CNP.A-1980) and five of *P. bufoninum* (MLP.A-5261) between Stages 36–39 (Gosner, 1960) were employed to study larval morphology and take morphometric measurements. To compare the eyes features, we used additional tadpoles and adults of *P. somuncurensis* and *P. bufoninum* deposited at CNP collection (detailed in Fig. 1). Tadpoles of both species were reared until metamorphosis and species identification were made by the morphology of lumbar glands. Measurements were taken under a Zeiss Stemi SV11 stereomicroscope with measuring equipment (to the nearest 0.1 mm). Morphological terminology mainly follows that of Altig & McDiarmid (1999). We recorded 24 external morphology measurements: total length (TL), body length (BL), tail length (TaL), maximum tail height (MTH), tail muscle height (TMH), tail muscle width (TMW), internarial distance (IND, with modifications: measured between the internal edges of narial apertures), interorbital distance (IOD, with modifications: measured between the external edges of pupils) (all them from Altig & McDiarmid, 1999); body maximum width (BMW), body width at nostrils (BWN), body width at eye level (BWE), body maximum height (BMH), rostro-spiracular distance (RSD, measured horizontally from the tip of the snout to the posterior edge of the spiracular tube), fronto-nasal distance (FN, from the tip of the snout to the anterior edge of nostrils), eye-nostril distance (END, from the posterior edge of nares to the anterior edge of eyes), nostril major axis (N), eye diameter (E), extra nasal distance (EN, distance between external edges of nares), intraocular distance (IO, distance between interior edges of eyes), oral disc width (OD), and dorsal gap length (DG) (following Lavilla & Scrocchi, 1986); dorsal fin height (DFH) and ventral fin height (VFH), both measured at a position coincident with MTH (after Kolenc *et al.*, 2009) and finally, a variable introduced by

us, the snout-dorsal fin origin distance (SDF, measured in lateral view from the tip of the snout to the anterior edge of dorsal fin). In the description of tadpole of *P. somuncurensis* most measures were expressed as proportions with their corresponding mean, SD, and range. Each proportion of *P. somuncurensis* measures were compared with those of *P. bufoninum* with the Student's *t*-test ($P < 0.01$). In *P. bufoninum* were only show those significant differences. Measures of *P. bufoninum* are not presented as they were included in a previous work (Barrasso *et al.* 2012).

Tadpoles of *Pleurodema somuncurensis* (Fig. 1) have a total length about 51.57 mm (48.12–55.76), body ovoid, slightly depressed (BMH/BMW = 0.90 ± 0.02 ; 0.86–0.94), body length about 38% of total length (44% in *P. bufoninum*), body shape is oval in dorsal view with a constriction behind the cephalic region, and the maximum width is placed at the posterior portion of the head or sometimes at the abdominal region (BMW = 11.6 ± 0.66 ; 10.63–12.51). Snout rounded in dorsal and lateral profiles. Eyes with notable upper and lower meniscus (*sensu* Cei, 1969; 1970) (Fig. 1E), diameter ($E = 2.07 \pm 0.1$; 1.92–2.21) is about 20% of body width at eye level, they are dorsally located and smaller than interorbital distance: IOD/E = 3.09 ± 0.17 ; 2.83–3.39 (IOD/E = 2.62 ± 0.28 ; 2.32–3.06 in *P. bufoninum*). Interorbital distance accounts 60% of body width at eye level: IOD/BWE = 0.63 ± 0.02 ; 0.58–0.65 (IOD/BWE = 0.5 ± 0.03 ; 0.46–0.55 about 50% in *P. bufoninum*). Nostrils circular and dorsal (0.33 ± 0.05 ; 0.27–0.44). Fronto-nasal distance a little larger than eye-nostril distance (FN/END = 1.18 ± 0.16 ; 0.97–1.47). Internarial distance smaller than interorbital distance (IND/IOD = 0.30 ± 0.02 ; 0.28–0.33). Extra nasal distance smaller than interocular distance (EN/IO = 0.72 ± 0.04 ; 0.63–0.77). Spiracle sinistral, inner wall is fused to body wall except for the very distal end which folds to delimit the spiracle opening. Spiracular tube projected backwards, slightly curved towards the dorsum and laterally opened, opening rounded, being its diameter smaller than the tube diameter (Fig. 1A). Rostro-spiracular distance about 57% of body length. Vent tube medial, attached to the ventral fin. Tip of tube overpasses the free margin of the ventral fin; opens to the left in 70% of the examined specimens and to the right in the others. A medium-sized saccular transparent structure encloses the vent tube in both species, as described for *P. bibroni* and *P. kriegi* by Kolenc *et al.* (2009). The tail size represents 62% of total length (56% in *P. bufoninum*). The maximum tail height occurs in the middle third and both fins are higher than the body height: MTH/BMH = 1.23 ± 0.06 ; 1.19–1.38 (MTH/BMH = 0.99 ± 0.14 ; 0.86–1.22; almost equal to body height in *P. bufoninum*). Both fins have regularly convex margins and the dorsal fin height is the greatest (DFH/VFH = 1.30 ± 0.20 ; 1.05–1.61). The dorsal fin extends a bit onto the body (SDF/BL = 0.69 ± 0.02 ; 0.64–0.77). The tail axis is straight, and the tail smoothly stretches towards the tip in its last half, ending rounded. Caudal musculature width is almost equal than the caudal musculature height at the beginning of the tail: TMW/TMH = 1.07 ± 0.07 ; 0.96–1.18 (wider in *P. bufoninum*, TMW/TMH = 1.32 ± 0.11 ; 1.20–1.50). Myomeres are noticeable but are slightly obscured by pigmentation, mostly in the posterior ones.

Oral disc subterminal, ventrally positioned, not visible dorsally, and emarginated. Width of disc about one third of maximum body width: OD/BMW = 0.33 ± 0.02 ; 0.29–0.36 (OD/BMW = 0.26 ± 0.02 ; 0.23–0.29 in *P. bufoninum*). The marginal papillae arranged into two or three rows at lateral and mental regions. Ventral gap absent and rostral gap present (DG/OD = 0.63 ± 0.06 ; 0.53–0.72). Infraangular lateral papillae are present in 80% of examined specimens. One specimen presented additional supra-angular papillae. Intramarginal papillae absent in 20% of specimens. Keratodonts numerous, arranged in a tooth row formula LTRF 2(2)/3(1); A2 gap wide; P1 gap narrow. The relative lengths of the rows are $A2 \geq A1$ and $P1 \geq P2 > P3$. Both, arch-shaped upper jaw and V-shaped lower jaw sheaths are robust and bear marginal serrations (Fig. 1D).

The coloration in life (Fig. 1) is brownish-gold, with gray and dark gray spots on dorsum and lateral portions of the body, continuing onto the dorsum of caudal musculature. In a few larvae a clear vertebral line is seen from the eyes to the end of the body or ends just midway (fuzzy in preserved specimens). In ventral view the gular region is scarcely pigmented anteriorly, the branchial region has golden and reddish blotches, the abdomen presents a black background and gold spots; internal organs scarcely visible. Caudal musculature with light background, some dark blotches on lateral view, absent in ventral view. The dorsal and ventral fins are almost transparent. Iris golden.

In preservative, the dorsum of the body is brown irregularly scattered with dark-brown blotches; the flanks are of the same color as the dorsal region. The ventral skin lacks pigment allowing the visualization of the hyobranchial apparatus, heart and intestine. The lateral and ventral views of the tail muscle show no pigment except for a few dark blotches; the dorsal body pattern continues onto the dorsal musculature of the tail. The dorsal and ventral fins are mostly transparent scattered with brown blotches. Iris dark gray to black.

Measurements (mm; $n = 10$) of *Pleurodema somuncurensis* larvae (mean, standard deviation, and range between parentheses): BL = 19.12 ± 1.05 (17.68–21.47); BMH = 10.41 ± 0.64 (9.41–11.64); BMW = 11.6 ± 0.66 (10.63–12.51); BWE = 10.21 ± 0.4 (9.63–10.77); BWN = 7.57 ± 0.54 (6.81–8.56); DFH = 4.96 ± 0.58 (4.34–5.83); DG = 2.44 ± 0.29 (2.11–3.0); E = 2.07 ± 0.1 (1.92–2.21); EN = 2.64 ± 0.15 (2.39–2.94); END = 1.99 ± 0.19 (1.74–2.15); FN = 2.33 ± 0.14 (2.13–2.56); IND = 1.94 ± 0.14 (1.7–2.16); IO = 3.68 ± 0.3 (3.44–4.4); IOD = 6.40 ± 0.36 (5.94–6.99); MTH = 12.85 ± 0.86 (11.36–

13.9); $N = 0.33 \pm 0.05$ (0.27–0.44); $OD = 3.86 \pm 0.16$ (3.66–4.17); $RSD = 11.13 \pm 0.66$ (10.14–12.37); $SDF = 13.38 \pm 1.15$ (12.65–16.56); $TaL = 32.16 \pm 2.35$ (29.13–35.64); $TMH = 6.04 \pm 0.6$ (5.13–6.95); $TMW = 5.76 \pm 0.4$ (5.22–6.51); $TL = 51.57 \pm 3.06$ (48.12–55.76); $VFH = 3.89 \pm 0.65$ (2.9–4.54).

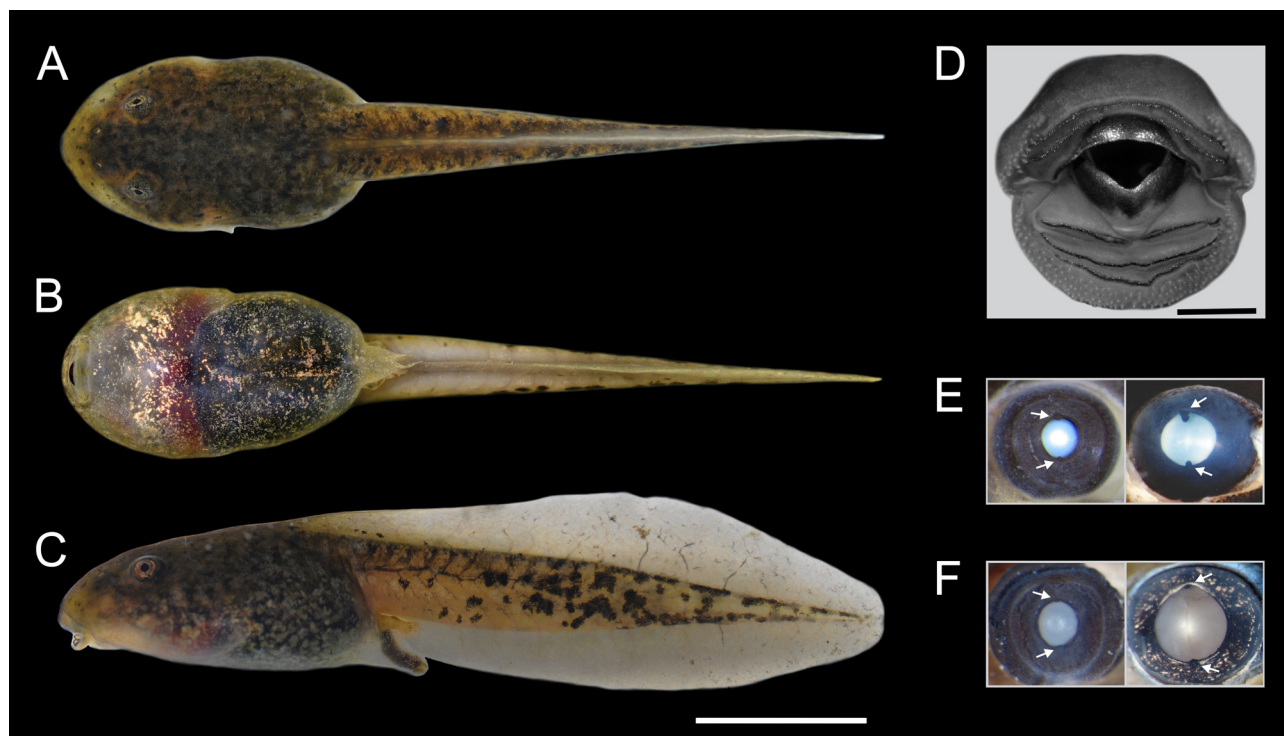


FIGURE 1. External morphology and live coloration of a Stage 36 tadpole of *Pleurodema somuncurensis* (CNP.A-1980). (A) Dorsal, (B) ventral, and (C) lateral views (scale bar = 10 mm). (D) Oral disc (scale bar = 1 mm). (E) From left to right, eye of a Stage 38 tadpole and adult of *P. somuncurensis* showing the upper and lower meniscus (arrows) (CNP.A-1980 and CNP.A-1990, respectively). (F) From left to right, eye of a Stage 38 tadpole and adult of *P. bufoninum* showing the upper and lower meniscus (arrows) (CNP.A-1991 and CNP.A-1996, respectively).

In general, the external morphology of *Pleurodema somuncurensis* larvae is similar to the description first provided by Cei (1970). The main differences were observed in the oral disc. None of the specimens examined by us showed ventral gap in the marginal papillae as illustrated by Cei (1970). Lavilla (1988) neither confirmed nor neglected presence of ventral gap in the marginal papillae of the species. The ventral gap was proposed as synapomorphy of Bufonidae (Haas, 2003), but it is also present in larvae of many non-bufonid anurans (e.g., many leptodactylids: see Vera Candioti *et al.*, 2011). The species of *Pleurodema* have marginal papillae usually arranged into single to multiple rows with only a dorsal gap (Kolenc *et al.*, 2009; Barrasso *et al.*, 2012; Galvani *et al.*, 2012; Otero *et al.*, 2013; present work), except *P. marmoratum* for which presence of ventral gap was reported by Cei (1980). According to Vera Candioti *et al.* (2011), presence of a short ventral gap in some specimens of *Pleurodema* is probably explained by a developmental arrest on the ontogeny of the marginal papillae. However, the history of the distribution of this character still needs further data. Most of the specimens of *P. somuncurensis* we examined presented two rows of marginal papillae in the dorsolateral region of the disc and three (sometimes two) rows of marginal papillae in ventral region. The keratodont formula presents two alternative configurations within *Pleurodema*: LTRF 2(2)/2 in *P. guayapae*, *P. nebulosum* and *P. tucumanum* (*P. nebulosum* and part of the *P. brachyops* clade *sensu* Faivovich *et al.*, 2012), and LTRF 2(2)/3[1] in the remaining species. Within the second LTRF configuration, the gap in P1 may be absent (*P. cinereum*, *P. marmoratum*), present (*P. borellii*, *P. bibroni*, *P. cordobae*, *P. dipolister*, *P. kriegi*, *P. somuncurensis*, *P. thaul*), or may be present/absent within the same species (*P. brachyops*, *P. bufoninum*) (Kolenc *et al.*, 2009 and references therein; Barrasso *et al.*, 2012; Galvani *et al.*, 2012; Otero *et al.*, 2013; present work). Thus, taking into account that the marginal papillae of *P. somuncurensis* may be arranged on two or three rows and that the P1 gap of *P. bufoninum* may be present or absent, these features are not useful for distinguishing these species.

Cei (1969; 1970) remarked the presence of an upper and lower “meniscus” in the iris of *P. somuncurensis*. The term meniscus was coined by Miranda-Ribeiro (1926) to describe an upper contractile projection from iris to pupil of adults of the genus *Cycloramphus*. Such meniscus was also found by Lutz (1943) for adults of *Zachaenus parvulus* and by Basso

(1998) for the lower border of the iris of adults of *Atelognathus ceii*. We found that presence of both upper and lower meniscus occurs from the larval to the adult stages in *P. somuncuriensis*. Although the same occurs in *P. bufoninum*, the meniscus is more conspicuous in *P. somuncurensis* (Fig. 1E-F). The presence of this morphological feature is shared between these sister taxa (Faivovich *et al.*, 2012) and it was not reported for other species of the genus. Nevertheless, the so called “meniscus” requires a more precise definition and a detailed study at different taxonomic levels.

In summary, the larvae of *Pleurodema somuncurensis* and *P. bufoninum* are quite similar and share a unique character for the genus: the presence of “meniscus” in the iris. These larvae could be differentiated only by certain morphometric variations: tadpoles of *P. somuncurensis* presented a relatively higher tail, a longer and more robust tail musculature, eyes slightly more separated, and a wider dorsal gap on the oral disc.

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