

A revised geographical range for *Liolaemus elongatus* Koslowsky, 1896 (Squamata: Liolaemini) in Argentina: review of reported and new-data based distribution with new localities

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Abstract. Estimating the effective geographical ranges of species is central to species-oriented conservation and management. In this paper, we review the geographical distribution of *Liolaemus elongatus* Koslowsky, 1896 with three new records for northern Chubut and southern Río Negro provinces, Argentina. Based on detailed locality records pooled from multiple data sources, including new records obtained for this study, we revise the range of *L. elongatus sensu stricto* and provide geographical distribution maps comparing the previously recognized range to that proposed herein. Our results show that *L. elongatus* possesses a much more limited geographic distribution than previously thought, being restricted to areas south of 38°S latitude; the newly proposed range is merely half the species formerly recognized geographical distribution.

Keywords. Lizards, Geographical range size, *Liolaemus*, Biogeography, Patagonia, Argentina.

The accurate estimation of the geographical range of a species is central to species-oriented conservation policy. Nevertheless, species occurrence data are often biased, due to their opportunistic origin (Newbold, 2010): in fact, they tend to be pooled around specific areas depending on the nature of collecting campaigns and/or the accessibility of sampled areas (Katzner et al., 2011; Feeley and Silman, 2011). In this general context, when widespread and diverse taxa are involved (e.g., Liolaemidae; Pincheira-Donoso et al., 2008), the combination of a large sampling area with the uncertainty of taxonomic assignments may lead to possible overestimation or underestimation of the real distribution of the species under investigation, with obvious drawbacks, not only from the conservation point of view. The genus *Liolaemus* may be a good example of such a problem.

Liolaemus is a South American genus of lizards with

more than 230 described species (Breitman et al., 2011; Abdala et al., 2012), some of which are widely distributed in Argentina. Whereas recent work has resulted in changes in the systematic status of several *Liolaemus* species (e.g., Abdala et al., 2012; Avila et al., 2012), herpetologists have not adequately updated species geographical distributions. One such lizard is *Liolaemus elongatus* Koslowsky (1896), a viviparous, insectivorous, medium-sized lizard (85 mm maximum snout-vent length, SVL) which typically inhabits rocky outcrops of western Patagonia steppe environments (Ceï, 1986). *Liolaemus elongatus* was originally described from rocky outcrops of western Chubut (“...el territorio del Chubut, cerca de las Cordilleras, donde vive en las grietas de las rocas...”; Koslowsky, 1896). Since the 1970s, this species has been considered widely distributed over Patagonia, reaching northwestern areas of Argentina including Altoandina

environments (Ceï, 1974, 1986; Avila and Lobo, 1999; Avila et al., 2000).

Phylogeographical analyses showed that southernmost populations from the Agrio River Basin (Neuquén Province) are genetically clustered and spatially separated from northern populations (Morando et al., 2003). Based on mitochondrial data, some northern *L. elongatus* populations appear more closely related to the *Liolaemus petrophilus* complex (Morando et al., 2003), while others, although being closely related to *L. elongatus*, maintain some degree of difference (Medina pers. comm.). Several of the northernmost populations considered by Morando et al. (2003) to represent new candidate species were later described as new species (e.g., *L. parvus* and *L. tulkas*; Quinteros, et al., 2008; *L. smaug* and *L. choique*; Abdala et al., 2012; *L. burmeisteri*; Avila et al., 2012). However, the knowledge of the geographical distribution of *L. elongatus* and related taxa remains fragmented and a detailed review of the geographical range of these species is lacking. This, along with other unknown aspects of the natural history of *Liolaemus elongatus*, led Avila et al. (2000) to consider its conservation status as “insufficiently known”. Here, we evaluate the reported distribution of *L. elongatus* by reviewing all populations previously allocated to this species and comparing them with new geographical records of populations allocated to *L. elongatus sensu stricto* (Morando et al., 2003; Medina pers. comm.) in the Río Negro, Chubut and southern Neuquén provinces.

Between February 1998 and March 2010, we collected specimens of *Liolaemus elongatus* by hand, snore or forked stick, following visual survey from a vehicle along unpaved roads or walking transects. We recorded latitude, longitude and elevation for each locality, as determined by a Garmin GPS 12™ Global Position Device. Taxonomic identity was established for each collected specimen based on morphological analyses with a classical morphological approach (using scale counts, morphometry, and color pattern), taking into consideration the original species description of *Liolaemus elongatus* Koslowsky 1896 and comparison with syntypes deposited in Museo de La Plata collection (Ferraro and Williams, 2006). Additionally, results of phylogeographic studies based on three mitochondrial genes (Morando et al., 2003) and two mitochondrial and four nuclear genes (Medina pers. comm.) were also considered for taxa identification. After capture, lizards were euthanized by a pericardial injection of sodium thiopentotal Pentovet®, fixed in 10-20% formalin and later transferred to 70% ethanol (Simmons, 2002). Voucher specimens from these collections were deposited in the herpetological collection (LJAMM-CNP; <http://www.cenpat.edu.ar/colecciones03.html>) located in Centro Nacional Patagónico (CENPAT-CONICET), Puerto Madryn, Argentina. We followed animal handling procedures suggested by Simmons (2002) and in agreement with regulations detailed in the Argentinean National law #14346. Each provincial fauna authority regulates collection permits, which are included in acknowledgments.

We made updated geographical range maps based on LJAMM-CNP collections records and a review of museum and literature data associated with vouchered specimens, in order to compare our new records with the distribution previously reported for this species. Using the results of phylogeographic and phylogenetic studies (Morando et al., 2003; Avila et al., 2004; Medina pers. comm.), morphological comparisons of sampled specimens with syntypes, and results of ongoing morphological studies to establish species limits (Medina, pers. comm.), we considered as *Liolaemus elongatus sensu stricto* all records located south of 38°S latitude. We georeferenced all records for *L. elongatus* obtained from published studies without geographical coordinates, but with an accurate locality description. All records in the resulting database were mapped using the program gvSIG® version 1.11.

From our review of published literature and museum data, we obtained 202 records distributed in 70 localities of *Liolaemus elongatus* (Fig. 1A; Suppl. Mat. Table T1 and Appendix A1). This set of data points supported a wide geographical range for this species, spanning from southern Catamarca Province southward along a narrow strip limited to the Andes Mountains of Neuquén Province, through Río Negro, and continuing south of Chubut Province (Ceï, 1974, 1986; Avila and Lobo, 1999; Scolaro, 2005). The database obtained from our collection campaigns, consisted on 294 records from 75 localities (Fig. 1B; Suppl. Mat. Table T1 and Appendix A1). Three localities included in the 25 de Mayo Department (Río Negro Province) and Telsen Department (Chubut Province) represent new geographic records; in detail: five specimens (LJAMM-CNP 6227-6228, 6235-6237) from Provincial Route 5, 22 km NW El Cain (41°35'48.9" S, 68°22'11.3" W; 1165 m a.s.l.), 25 de Mayo Department; three individuals (LJAMM-CNP 10974-6) from Provincial Route 67, 11.2 km S Río Negro-Chubut border (42°04'34.45" S, 68°09'43.11" W; 1407 m a.s.l.); one specimen captured (LJAMM-CNP 7514) from Provincial Route 67, on the road to Talagapa, 53.1 km N of Gan Gan City (42°13'50.8" S, 68°14'23.8" W; 1402 m a.s.l.), Telsen Department.

By reviewing distributional data available for *Liolaemus elongatus* from previous systematic studies, and adding localities from recent phylogeography studies as well as new records from recent field collections, our results

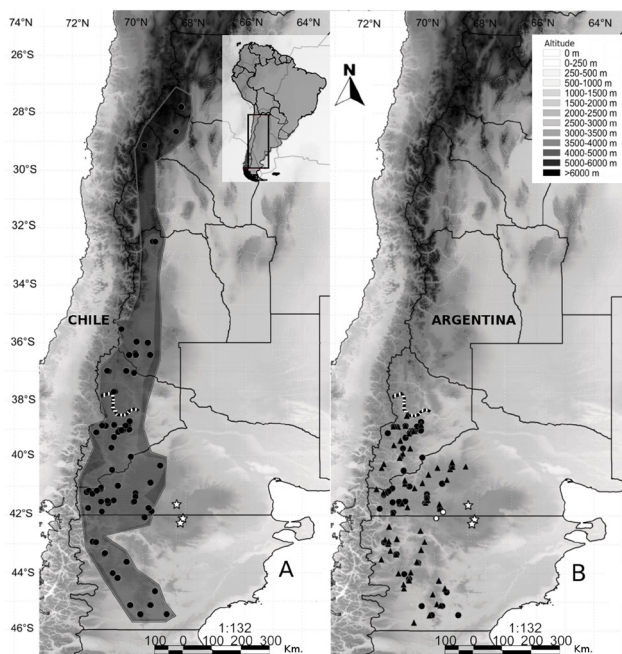


Fig. 1. A) Distributional range in Argentina of *Liolaemus elongatus* (*sensu lato*) from literature and museum review. Black dots: literature and museum records; white stars: Río Negro and Chubut provinces new records; grey light shaded area: range from Scolaro (2005); grey strong shaded area: range from Cei (1986). B) New proposal for current geographic distribution in Argentina of *Liolaemus elongatus*. Black triangles: LJAMM-CNP database collection records; white stars: Río Negro and Chubut provinces new records; white circles: closest known population of Sierra Añueque; dashed black and white line: Agrio River.

allows redefining the geographical distribution of *L. elongatus* in Argentina. The geographical range assigned by previous publications for this species covers a much broader area than that supported by our data. Since the 1970s, *L. elongatus* was thought to range from Catamarca Province (Avila and Lobo, 1999; Avila et al., 2000) to southern Chubut Province (Cei 1974, 1986). In contrast, our results show that the current distribution of *L. elongatus sensu stricto* ranges from south of Agrio River Basin (Neuquén) to southern Chubut province and includes several new sites providing a more detailed description of the distribution of the species within Neuquén, Río Negro and Chubut (Fig. 1B). The updated range is only one-half of the species formerly recognized geographical distribution. This discrepancy is partly due to the taxonomic review of the species assignments, and partly due to the discovery of new occurrence sites. Indeed, records from new localities represent the easternmost geographical points for this species, respectively located (straight line distance) at about 79 km, 93 km and 92 km from the closest known populations of Sierra Añueque (Cei, 1986;

Cei and Avila, 1998; Fig. 1B). These records are particularly significant, because they represent the first ones about this species from the Somuncurá Plateau and related volcanic outcrops.

Precise geographical distribution studies are important (Feeley and Silman, 2011) as they provide basic information for systematic (Debandi et al., 2011), biogeographic (Corbalán and Debandi, 2008; Vera-Escalona et al., 2010) and conservation (Corbalán et al., 2011; Katzner et al., 2011) studies. Recently, analyses of museum-based collections data demonstrated numerous cases of lizard population extinctions worldwide (Sinervo et al., 2010). The information presented in the present study will make a useful contribution to similar broad-scale analyses in the future and should facilitate more rapid development of conservation plans for *L. elongatus*, if necessary.

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SUPPLEMENTARY MATERIAL

Table T1. Summary of georeferenced locality records for *Liolaemus elongatus*.

Appendix A1. Detailed localities of all the records obtained for *Liolaemus elongatus*.