Two new species of the Liolaemus elongatus-kriegeri complex (Iguania, Liolaemidae) from Andean highlands of southern Chile

Jaime Troncoso-Palacios\textsuperscript{1}, Hugo A. Díaz\textsuperscript{1,2}, Damien Esquerré\textsuperscript{3}, Felix A. Urra\textsuperscript{1,4}

\textsuperscript{1} Programa de Fisiología y Biofísica, Instituto de Ciencias Biomédicas (ICBM), Facultad de Medicina, Universidad de Chile, Independencia 1027, Santiago, Chile  \textsuperscript{2} Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Las Palmeras 3425, Santiago, Chile  \textsuperscript{3} Division of Evolution, Ecology and Genetics, Research School of Biology, The Australian National University, Canberra, ACT 0200, Australia  \textsuperscript{4} Programa de Farmacología Molecular y Clínica, Instituto de Ciencias Biomédicas (ICBM), Facultad de Medicina, Universidad de Chile, Independencia 1027, Santiago, Chile

Corresponding author: Jaime Troncoso-Palacios (jtroncosopalacios@gmail.com)

Academic editor: A. Bauer  |  Received 10 October 2014  |  Accepted 18 March 2015  |  Published 27 April 2015

http://zoobank.org/D250C8BF-532A-4767-895F-F1FA36D368B7

Citation: Troncoso-Palacios J, Díaz HA, Esquerré D, Urra FA (2015) Two new species of the Liolaemus elongatus-kriegeri complex (Iguania, Liolaemidae) from Andean highlands of southern Chile. ZooKeys 500: 83–109. doi: 10.3897/zookeys.500.8725

Abstract
The elongatus-kriegeri complex is one of the most diverse clades of the Liolaemus (sensu stricto) subgenus of lizards. There are currently 29 species recognized in this group distributed between Chile and Argentina. Based on molecular evidence, there seem to be five main clades nested within this complex: the elongatus, leopardinus, kriegeri, petrophilus and punmahuida clades. Liolaemus buergeri and L. kriegeri, both of the kriegeri clade, were believed to inhabit the surroundings of the Laja Lagoon, in the Biobío Region of Chile. Moreover, this Chilean population of L. kriegeri was recently recognized as an undescribed taxon called “Liolaemus sp. A” based on molecular phylogenetics. In this work, we studied these two populations of the Laja Lagoon and provided the morphological diagnosis to describe them as two new species: L. scorialis \textsuperscript{sp. n.} and L. zabalai \textsuperscript{sp. n.}, previously considered L. buergeri and “L. kriegeri Liolaemus sp. A” respectively. Additionally, we identified another population of L. scorialis in the vicinity of La Mula Lagoon in the Araucanía Region of Chile. Liolaemus scorialis differs from almost all of the species of the elongatus-kriegeri complex by its considerably smaller size. Nevertheless, without molecular data we cannot assign it to any particular subclade. Liolaemus zabalai belongs to the kriegeri clade based on published molecular phylogenies. Finally, we provide some natural history data on both species and we document for the first time the presence of L. neuquensis in Chile from a museum specimen from La Mula Lagoon.
Keywords
Liolaemus buergeri, Liolaemus kriegi, new species, lizard, Laja Lagoon, Biobío

Introduction

Liolaemus is a diverse genus of South American lizards, with currently 245 species (Uetz and Hošek 2014) grouped into two subgenera: Liolaemus (sensu stricto) and Eulaemus (e.g. Laurent 1985, Schulte et al. 2000). Each of these subgenera has been divided into several groups based on phylogenetic relationships (Abdala 2007, Avila et al. 2006, Fontanella et al. 2012, Lobo 2005).

The elongatus-kriegi complex Cei (1979), is one of the most diverse groups of the Liolaemus (sensu stricto) subgenus with currently 29 species distributed in Chile and Argentina. In a phylogenetic study based on three mitochondrial genes, Morando et al. (2003) found that this complex is subdivided into three clades: elongatus, kriegi and petrophilus. Later, Avila et al. (2010a) based on one mitochondrial locus, added a fourth clade: the punmahuida clade. Finally, Esquerré et al. (2014) added a fifth clade comprising only Chilean endemic species: the leopardinus clade. An alternative classification has been proposed by Lobo (2005) and updated by Lobo et al. (2010b), based mainly on morphological and lifestyle traits, which classifies these species in three groups: elongatus (which includes the capillitas subgroup), kriegi and leopardinus, with a different arrangement compared with the molecular hypothesis (Table 1 and Table 2).

Currently, the elongatus-kriegi complex (Avila et al. 2012, Esquerré et al. 2014, Morando et al. 2003) or elongatus, kriegi and leopardinus groups (Lobo 2005, Lobo et al. 2010b) includes the following species: Liolaemus antumalguen Avila et al., 2010, L. austromendocinus Cei, 1974, L. buergeri Werner 1907, L. burmeisteri Avila et al. 2012, L. carlosgarini Esquerré et al. 2013, L. capillitas Hulse, 1979, L. choique Abdala et al. 2010, L. cristiani Núñez et al. 1991, L. dicktracyi Espinoza & Lobo, 2003, L. elongatus Koslowsky, 1896, L. flavipiceps Cei & Videla, 2003, L. frassinettii Núñez, 2007, L. gununakuna Avila et al. 2004, L. heliodermis Espinoza et al. 2000, L. kriegi Müller & Hellmich, 1939, L. leopardinus Müller & Hellmich, 1932, L. parvus Quinteros et al. 2008, L. petrophilus Donoso-Barros & Cei, 1971, L. punmahuida Avila et al. 2003, L. ramonensis Müller & Hellmich, 1932, L. sibian Abdala et al. 2010, L. smaug Abdala et al. 2010, L. talampaya Avila et al. 2004, L. thermarum Videla & Cei, 1996, L. tregenzai Pincheira-Donoso & Sclaro, 2007, L. tulkas Quinteros et al. 2008, L. ubaghsi Esquerré et al. 2014, L. umbrifer Espinoza & Lobo, 2003 and L. valdesianus Hellmich, 1950.

Liolaemus buergeri, of the kriegi clade, was described from El Planchón Volcano, Maule Region, Chile (Werner 1907). This species has been traditionally believed to be widely distributed in Chile and Argentina (Cei 1986, Pincheira-Donoso 2001). However, its current wide distribution is in part due to cases of misidentification and a lumping of cryptic species (Medina et al. 2013). Donoso-Barros (1970) extended the southern distribution of L. buergeri to the Andes of Talca, Maule Region, Chile (50 km S from El Planchón Volcano).
Two new species of the *Liolaemus elongatus-kriegi* complex (Iguania, Liolaemidae)...

**Table 1.** Species of the *elongatus-kriegi* complex grouped by clades, based on mitochondrial molecular phylogenies. (1) Species included by Morando et al. (2003). (2) Species added by Avila et al. (2004). (3) Species added by Avila et al. (2010a). (4) Species added by Avila et al. (2012). (5) Species added fide Esquerré et al. (2014). *Liolaemus thermarum* is included in the *elongatus* clade by Avila et al. (2010a) but omitted by Avila et al. (2012).

| elongatus clade         | kriegi clade  | leopardinus clade | petrophilus clade | punmahuida clade |
|-------------------------|---------------|-------------------|-------------------|-----------------|
| *L. antumalguen* (3)    | *L. buergeri* (1) | *L. frassinettii* (5) | *L. austromendocinus* (1) | *L. flavipiceps* (3) |
| *L. burmeisteri* (4)    | *L. kriegi* (1)   | *L. leopardinus* (5)   | *L. capillitas* (1)    | *L. punmahuida* (3)  |
| *L. elongatus* (1)      |                | *L. ramonensis* (5)   | *L. dicktracyi* (2)   |                 |
| *L. smaug* (4)          |                | *L. ubaghsi* (5)     | *L. gununakuna* (2)   |                 |
| *L. thermarum* (3)      |                | *L. valdesianus* (5) | *L. parvus* (3)       |                 |
|                         |                |                    |                   | *L. petrophilus* (1) |
|                         |                |                    |                   | *L. talampaya* (2)  |
|                         |                |                    |                   | *L. tulkas* (3)     |
|                         |                |                    |                   | *L. umbrifer* (2)   |

**Table 2.** Species of the *elongatus-kriegi* complex by groups, based on morphological, skeletal and lifestyle traits phylogeny according to (1) Lobo (2005), (2) updated by Lobo et al. (2010b) and (3) fide Esquerré et al. (2013). The *capillitas* subgroup is nested into *elongatus* group (Lobo et al. 2010b).

| capillitas subgroup         | elongatus group         | kriegi group          | leopardinus group          |
|----------------------------|-------------------------|-----------------------|---------------------------|
| *L. capillitas* (1)        | *L. austromendocinus* (2) | *L. buergeri* (1) | *L. frassinettii* (2)     |
| *L. dicktracyi* (1)        | *L. carlosgarini* (3)   | *L. cristiani* (1)   | *L. leopardinus* (1)      |
| *L. heliodermis* (1)       | *L. elongatus* (1)      | *L. kriegi* (1)      | *L. ramonensis* (1)       |
| *L. talampaya* (2)         | *L. flavipiceps* (2)    |                       | *L. valdesianus* (1)      |
| *L. tulkas* (2)            | *L. gununakuna* (2)     |                       |                           |
| *L. umbrifer* (1)          | *L. parvus* (2)         |                       |                           |
|                           | *L. petrophilus* (2)    |                       |                           |
|                           | *L. punmahuida* (2)     |                       |                           |
|                           | *L. thermarum* (2)      |                       |                           |
|                           | *L. tregenzai* (2)      |                       |                           |

Later, Pincheira-Donoso (2001) extended the Chilean southern distribution of *L. buergeri* to the Batea-Mahuida Volcano (Araucanía Region, 240 km S from El Planchón Volcano) and pointed out that he also examined three specimens from the Laja Lagoon (Biobío Region, Chile, 150 km S from El Planchón Volcano); but Pincheira-Donoso and Núñez (2005) indicated that the specimens from Batea-Mahuida Volcano indeed correspond to *L. elongatus*, whereas the status of “*L. buergeri*” from the Laja Lagoon in Chile remains uncertain. In regards to Argentina, Cei (1986) stated that this species occurs in Mendoza and Neuquén Provinces, but Morando et al. (2003) and Medina et al. (2013), based on genetic and morphological evidence, respectively, indicated that several Argentinean populations attributed to *L. buergeri* correspond to at least three undescribed species.

*Liolaemus kriegi*, also of the *kriegi* clade, was described from Estancia El Cón- dor, Río Negro Province, Argentina (Müller and Hellmich 1939a). Later, Donoso-
Barros (1966) extended its northern distribution to the Cordillera de Curicó, Maule Region, Chile, 650 km N of Estancia El Cóndor; and to the Laja Lagoon, Biobío Region, Chile, 400 km N of Estancia El Cóndor (Donoso-Barros 1974). Morando et al. (2003), based on mitochondrial genes, found three candidate species related to *L. kriegi*, all from Argentina and previously assigned to *L. buergeri*: *Liolaemus* sp. A (from Caviahue, Neuquén Province), *Liolaemus* sp. B (from Ranquil Norte, Neuquén Province) and *Liolaemus* sp. C (from Laguna Los Barros, Neuquén Province). Medina et al. (2013), in a morphological analysis of these populations, corroborated the status of candidate species of these *Liolaemus* sp., adding new localities for *Liolaemus* sp. A, including samples from the Laja Lagoon (Chile) which corresponds to the species previously identified as *L. kriegi* by Donoso-Barros (1974). Also, Medina et al. (2013) found another candidate species from Argentina (*Liolaemus* sp. D), previously identified as *L. buergeri* by Morando et al. (2003). Recently, Medina et al. (2014) in a new phylogenetic study based on mitochondrial and nuclear genes, corroborate the previous studies and provide strong evidence for *Liolaemus* sp. A as a candidate species, also based on samples from Chile (Laja Lagoon) and Argentina (several localities of Neuquén Province).

Here, we studied the taxonomic status of the southernmost currently-recognized Chilean population of “*Liolaemus buergeri*”, from the vicinity of the Laja Lagoon, Biobío Region; and of “*L. kriegi/Liolaemus* sp. A” from the same locality. This population of “*L. buergeri*” is described as a new species which differs greatly from *L. buergeri* and almost all species of the *elongatus-kriegi* complex by its small snout-vent length (less than 70.0 mm). Additionally, specimens of this new species are recorded from La Mula Lagoon, Araucanía Region, Chile. For “*L. kriegi/Liolaemus* sp. A”, we provide a full description and diagnosis of this new species belonging to the *kriegi* clade.

**Materials and methods**

We examined specimens of almost all Chilean species currently considered as belonging to the *Liolaemus elongatus-kriegi* complex. The morphological characters were examined according to Etheridge (1995), Lobo (2005), Abdala et al. (2010) and Avila et al. (2010a, 2012). Body measurements were taken with a digital vernier caliper (0.02 mm precision). Measurements are provided as mean ± standard deviation (x ± SD). The Mann–Whitney U test was used to compare the new species and some related species. Scales were observed with different magnifying lenses and scolation and measurements were recorded on the right side of the specimen, unless otherwise indicated. Dorsal scales were counted between the occiput and the level of the anterior border of the hind limbs. Ventral scales were counted from mental scale to the anterior margin of cloacal opening. Stomach and intestinal contents were observed under a binocular microscope for one specimen of each new species. The specimens examined are listed in Appendix 1. Data for Argentinean species were taken from the literature. *Liolaemus ceii* is not accepted as valid species in this work (see discussion). Museum codes are as
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...

follow: MRC (Museo Regional de Historia Natural, Concepción), MZUC (Museo de Zoológía, Universidad de Concepción) and SSUC (Colección de Flora y Fauna Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile).

Results

**Liolaemus scorialis** sp. n.
http://zoobank.org/35B1E4BC-4EA1-4FEF-B025-B93D5C5A9CB9
Fig. 1

*Liolaemus buergeri* (in part?), Pincheira-Donoso, 2001. Not. Mens. Mus. Nac. Hist. Nat., Chile, 346: 8.

*Liolaemus buergeri* (in part?), Pincheira-Donoso & Núñez, 2005. Pub. Oc. Mus. Nac. Hist. Nat., Chile, 59: 285.

**Holotype.** SSUC Re 617 (Fig. 1). Male collected 7 km NW of the summit of the Antuco Volcano, near the Laja Lagoon, Biobío Region, Chile (37°21’S – 71°23’W, 1450 m). Collected by J. Troncoso-Palacios, F. Urra and H. Díaz. 08/01/2014.

**Paratypes.** SSUC Re 615–16 two males and 612–614 three females (Figs 1 and 3). The same data as the holotype. MRC 675, 677, 680, 682. Four males. La Mula Lagoon (37°53’S – 71°22’W), Ralco National Reserve. Unknown coll. 01/12/2001.

**Etymology.** The species name refers to the habitat, which is composed of accumulations of igneous rocks from the Antuco Volcano, called “scoria” from the Greek “skoria”. We propose the common name “Slag Lizard” in English and “Lagarto del escorial” in Spanish.

**Diagnosis.** *Liolaemus scorialis* belongs to the *elongatus-kriegi* complex, but its specific assignation to a particular subclade is currently unknown since we have no molecular data for this new species, and molecular and morphological phylogenies for the *elongatus-kriegi* complex disagree in the arrangement of this complex subgroups (see discussion).

Below a wide diagnosis is provided on aspect of all species of the complex. *Liolaemus scorialis* differs from almost all species of the *elongatus-kriegi* complex by its size (maximum SVL = 69.9 mm), smaller than *L. antumalguen* (Table 3), *L. austromendocinus* (max. SVL = 103.0 mm, Espinoza et al. 2000), *L. buergeri* (Table 3, Fig. 2), *L. burmeisteri* (Table 3), *L. capillitas* (max. SVL = 93.0 mm, Espinoza et al. 2000), *L. choique* (Table 3), *L. dicktracyi* (max. SVL = 91.0 mm, Espinoza and Lobo 2003), *L. elongatus* (max. SVL = 94.7 mm, Avila et al. 2012), *L. flavipiceus* (Table 3, Fig. 2), *L. frassinetti* (max. SVL = 91.1 mm), *L. gununakuna* (max. SVL = 97.5 mm, Avila et al. 2004), *L. kriegi* (max. SVL = 101.0 mm; Avila et al. 2003), *L. leopardinus* (max. SVL = 98.2 mm), *L. petrophilus* (max. SVL = 100.0 mm; Espinoza et al. 2000), *L. punmahuida* (Table 3), *L. ramonensis* (max. SVL = 94.9 mm), *L. sbitan* (max. SVL = 98.3 mm, Abdala et al. 2010), *L. talampaya* (max. SVL = 85.5 mm, Avila et al. 2004), *L. thermarum* (max. SVL = 85.0 mm, Videla and Cei 1996), *L. tregenzai* (Table 3),
Figure 1. Liolaemus scorialis sp. n. A, B Holotype, male C, D Paratype, female E Paratype, male F Paratype, female. All from the type locality, 7 km NW of the summit of the Antuco Volcano, near the Laja Lagoon, Biobío Region, Chile.

Liolaemus scorialis has probably been previously confused with L. buergeri (see discussion), but in addition to the size difference, L. scorialis differs from L. buergeri because the latter has a vertebral stripe on the tail, whereas the tail is ringed in L. scorialis. Moreover, L. buergeri has more midbody scales (x = 89.4 ± 5.5, n = 14) than L. scorialis (x = 82.0 ± 4.7, n = 10) (Mann–Whitney U = 20.5, P < 0.01, DF = 21) and more dorsal scales (x = 84.1 ± 4.4) than L. scorialis (x = 76.5 ± 4.3) (Mann–Whitney U = 15.0, P < 0.01, DF = 21); but L. buergeri has fewer ventral scales (x = 118.7 ± 4.7) than L. scorialis (x = 124.0 ± 6.0) (Mann–Whitney U = 36.0, P = 0.05, DF = 21).

Liolaemus scorialis is syntopic with “L. kriegi/Liolaemus sp. A”, but in addition to the size difference, the latter has more midbody scales (x = 94.3 ± 4.8, n = 8) than it (Mann–Whitney U = 1.5, P < 0.01, DF = 16). Moreover, the dorsal scale count range of L. scorialis does not overlap with the range of “L. kriegi/Liolaemus sp. A” (Table 3).
Two new species of the *Liolaemus elongatus-kriegi* complex (Iguania, Liolaemidae)...

**Table 3.** Scalation and morphological characteristics for the species of the *Liolaemus elongatus-kriegi* complex occurring near *L. scorialis* sp. n. and *L. zabalai* sp. n. distribution. Juvenile specimens examined are excluded. Source of data for not examined species are: *L. antumalguen* (Avila et al. 2010a), *L. burmeisteri* (Avila et al. 2012), *L. choique* (Abdala et al. 2010), *L. punmahuida* (Avila et al. 2004) and *L. tregenzai* (Pincheira-Donoso and Scolaro 2007). (*) Medina et al. (2013). M = males; F = females.

|                  | *L. antumalguen* (M = 5, F = 9) | *L. buergeri* (M = 6, F = 11) | *L. burmeisteri* (M = 6, F = 11) | *L. carlogarini* (M = 3, F = 10) | *L. choique* (M = 3, F = 10) | *L. flavipiceus* (M = 5, F = 10) | *L. punmahuida* sp. n. (M = 7, F = 3) | *L. scorialis* sp. n. (M = 3, F = 5) | *L. tregenzai* | *L. zabalai* sp. n. (M = 3, F = 5) |
|------------------|---------------------------------|-------------------------------|---------------------------------|---------------------------------|-------------------------------|---------------------------------|----------------------------------|--------------------------------|----------------|----------------------------------|
| Maximum SVL (mm) | 107.8                           | 96.2                          | 85.2                            | 68.8                            | 90.7                          | 95.8                            | 96.0                             | 69.9                            | 90.2                        | 92.0                             |
| Midbody scales   | 72–82                           | 80–100                        | 70–81                           | 80–95                           | 74–88                         | 68–77                           | 67–81                            | 76–90                           | 71–85                       | 90–104                           |
| Dorsal scales    | 70–78                           | 78–91                         | 76–85                           | 68–82                           | 65–81                         | 60–71                           | 70–78                            | 74–81                           | -                           | 86–96                             |
| Ventral scales   | 105–118                         | 111–125                       | 99–110                          | 112–124                         | 118–135                       | 93–105                          | -                                | 115–131                         | -                           | 116–122                           |
| Sexual dichromatism | Absent                          | Absent                        | Absent                          | Absent                          | Absent                        | Absent                          | Absent                           | Slight                          | Present                    | Slight                           |
| Cloacal region color (males) | Yellowish in some specimens but usually black | Yellowish | Yellowish | Yellowish | Yellowish | Reddish or yellowish in some specimens but usually black | Reddish or yellowish | Yellowish | - | Yellowish |
| Tail pattern     | Absent                          | Vertebral line with diffuse rings in the tail base | Weak rings | Rigns (marked or weak) | Absent | Absent or weak rings | Absent | Rings | Rings | Rings |
| Predoanal pores on males | 3–4 | 3–4 | 0–5 | 0–3 | 3–4 | 0 | 0 | 3–4 | 0 | 3–4 (3–5*) |
There is a black lateral band running from the tip of snout to the groin in “L. kriegi Liolaemus sp. A”, whereas in L. scorialis there is a dark brown lateral band running from the shoulder to the groin.

*Liolaemus scorialis* differs from similar size species of the *elongatus-kriegi* complex as follows. *Liolaemus scorialis* differs from *L. cristiani* because the males of the latter lack precloacal pores and have reddish ventral coloration, whereas males of *L. scorialis* have 3–4 precloacal pores and no reddish ventral coloration.

*Liolaemus scorialis* differs from *L. heliodermis*, because the males of the latter have a black head and sulfur-yellow dorsum (Espinoza et al. 2000), an unique feature in the *Liolaemus* subgenus. Moreover, *L. heliodermis* has 62–69 midbody scales (Espinoza et al. 2000), whereas *L. scorialis* has 76–90.

*Liolaemus scorialis* differs from *L. parvus*, because the latter has 60–77 midbody scales and 96–113 ventral scales (Quinteros et al. 2008), whereas *L. scorialis* has 76–90 midbody scales and 115–131 ventral scales. *Liolaemus scorialis* has a ringed tail, whereas *L. parvus* has weak or absent rings on the tail (Quinteros et al. 2008).

*Liolaemus scorialis* differs from *L. smaug*, because the latter has marked sexual dichromatism with white spots dispersed on the dorsum of males and absent in females (Abdala et al. 2010), whereas both males and females of *L. scorialis* have white spots on the dorsum. *Liolaemus scorialis* has ringed tail, whereas *L. smaug* has weak or no rings on the tail (Abdala et al. 2010). Males of *L. smaug* have bright golden yellow dorsal color, a trait absent in *L. scorialis*. 

---

**Figure 2.** Chilean species of the *elongatus-kriegi* complex that live near the distribution of *Liolaemus scorialis* sp. n. and *L. zabalai* sp. n. A *L. buergeri* from El Planchón (type locality, photo by J. Troncoso-Palacios) B *L. buergeri* from Altos de Lircay (photo by R. Díaz) C *L. carlosgarini* from the road to the Maule Lagoon (type locality, photo by J. Troncoso-Palacios) D *L. flavipiceus* from the Maule Lagoon (photo by C. Garín).
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...

Figure 3. Comparison of the ventral color pattern. A Liolaemus scorialis sp. n. from type locality, with immaculate gray ventral color B L. carlosgarini with light gray ventral color and dark inconspicuous spots dispersed.

*Liolaemus scorialis* differs from *L. tulkas*, because the males of the latter have 0–1 precloacal pores (Quinteros et al. 2008), whereas males of *L. scorialis* have 3–4 precloacal pores. Moreover, *L. tulkas* has 63–68 midbody scales (Quinteros et al. 2008), whereas *L. scorialis* has 76–90.

*Liolaemus scorialis* differs from *L. carlosgarini* (Fig. 2), because the males of the latter have 0–3 precloacal pores (present in 50% of the males, these are small and underdeveloped), whereas males of *L. scorialis* have 3–4 well developed precloacal pores. *Liolaemus scorialis* has more ventral scales ($x = 124 \pm 6.0, n = 10$) than *L. carlosgarini* ($x = 115 \pm 4.0, n = 17$) (Mann–Whitney $U = 11.0, P = 0.01, DF = 25$). Moreover, *L. scorialis* has brown dorsal color and immaculate gray ventral color, whereas *L. carlosgarini* has light brown-yellowish dorsal color and whitish ventral color with dark inconspicuous spots on the gular region and belly (Figs 2 and 3).

**Description of the holotype.** Adult male. SVL 62.3 mm. Tail length 101.5 mm (not autotomized). Axilla-groin length 26.3 mm. Head length (from the posterior border of the auditory meatus to the tip of the snout) 16.4 mm. Head width (distance between the two ear openings) 11.4 mm. Head height (at the level of ear openings) 6.9 mm. Forelimb length 21.1 mm. Hindlimb length 39.7 mm. Foot length 18.9 mm. Rostral scale wider
(2.5 mm) than high (1.0 mm). Two postrostrals. Four internasals. Hexagonal interparietal scale, with a central, small, and whitish spot marking the position of the parietal eye. Interparietal smaller than parietals, surrounded by six scales; nine scales between the interparietal and rostral (both excluded); 15 scales between occiput and rostral; orbital semicircle complete on the right side, formed by 13 scales, incomplete on the left side; 6-5 supraoculars (left-right); six superciliary scales. Frontal area is divided into six scales (two posterior, one in the center and three anterior); 2 scales between nasal and canthal; preocular separated from the lorilabials by one loreal scale; nasal in contact with the rostral, surrounded by seven scales. There is one row of lorilabials between the supralabials and the subocular. Seven supralabials, the fifth is curved upward without contacting the subocular. Four infralabial scales. Mental scale pentagonal, in contact with four scales; four pairs of postmental shields, the second is separated by two scales. Temporal scales are subimbricated and slightly keeled. There are ten temporal scales between the level of superciliary scales and the rictal level. Three projected scales on the anterior edge of the ear, which are small and do not cover the auditory meatus; auricular scale is wide and is restricted to the upper third of the meatus. Forty gulars between the auditory meatuses. Well developed “Y” shaped lateral neck fold and dorsolateral fold slightly developed. Antehumeral fold present. Midbody scales 88. Dorsal scales of the vertebral zone lanceolate, imbricate, keeled and without mucrons. Dorsal scales of the paravertebral fields more rounded, subimbricate, with more poorly developed keel, without mucrons and with interstitial granules between them. Dorsal scales of the vertebral zone are larger than the ventral scales. Dorsal scales of the paravertebral fields are similar in size to the ventral scales. Dorsal scales 81. Ventral scales are rhomboidal to rounded, smooth, imbricate, and without interstitial granules. Ventral scales 131. There are four precloacal pores. The suprafemoral scales are rhomboidal to rounded, imbricate, and smooth or slightly keeled. Infrafemoral scales are rounded, smooth, and imbricate. Supra-antebrachials scales are rhomboidal to rounded, imbricate, and slightly keeled or smooth. Infra-antebrachials are rounded to rhomboidal, subimbricate with few interstitial granules, and smooth. The dorsal scales of the tail are rhomboidal, imbricate, keeled and some with mucrons. The ventral scales of the tail vary from rhomboidal to triangular, and are imbricate and smooth. Lamellae of the fingers: I: 10, II: 17, III: 21, IV: 23 and V: 13. Lamellae of the toes: I: 13, II: 18, III: 22, VI: 29 and V: 20.

Color of the holotype in life. Light brown head, with dark brown lines: a “Ω” shaped line between nasal scales and supraocular area, two short stripes on the posterior supraocular areas, an incomplete “O” shaped dark brown line surrounding the interparietal scale, six dark brown short lines on the occipital area. The temporal area is brown with two dark brown horizontal stripes; the ocular area and the cheeks are light gray. Subocular area is gray with two dark brown vertical lines on the middle and posterior edge. Background color of the dorsum is brown. A wide occipital band on the dorsum, formed by twelve transverse dark brown bars; some white scales on the posterior border of these bars. Dark brown lateral band with few yellowish scales dispersed into it, running from the shoulder to the groin; some white scales between the occipital and lateral bands; below the lateral band the flanks are yellowish. Limbs
are brown with dark brown spots and some white scales dispersed. Tail is brown with some white scales dispersed and dark brown rings. Posterior third of the tail is immaculate brown. Ventrally, the throat, belly, limbs and tail are immaculate gray. Rear portion of belly and thighs are yellowish. Precloacal pores orange.

**Variation.** There is no sexual dimorphism in size. In seven males: SVL: 57.4–69.9 mm. Axilla-groin distance: 21.4–28.7 mm. Head length: 15.1–17.2 mm. Head width: 11.2–13.0 mm. Head height: 6.4–8.9 mm. Foot length: 19.7–21.1 mm. Leg length: 37.1–46.2 mm. Arm length: 20.3–26.0 mm. Tail length: 101.6–111.3 mm (n = 2; autotomized in the rest). In three females: SVL: 57.3–65.6 mm. Axilla-groin distance: 25.6–32.8 mm. Head length: 15.3–15.8 mm. Head width: 11.1–12.1 mm. Head height: 6.2–6.7 mm. Foot length: 18.7–20.0 mm. Leg length: 37.2–39.0 mm. Arm length: 21.8–22.3 mm. Tail length 88.8–103.1 mm (n = 2; autotomized in the rest).

The variation of the scalation in *Liolaemus scorialis* is as follows. Midbody scales: 76–90 (x = 82.0 ± 4.7). Dorsal scales: 74–81 (x = 76.5 ± 4.3). Ventral scales 115–131 (x = 124.0 ± 6.0). Fourth finger lamellae: 21–24 (x = 22.7 ± 1.1). Fourth toe lamellae: 28–31 (x = 29.2 ± 1.4). Supralabial scales: 6–7 (x = 6.2 ± 0.4). Infraoral scales: 4–5 (x = 4.7 ± 0.5). Precloacal pores in males: 3–4. Interparietal scale pentagonal or hexagonal, bordered by 5–9 scales (x = 6.7 ± 1.2).

There is a slight sexual dichromatism, females have no yellowish color on the rear portion of belly and thighs. Males have the same color and pattern described for the holotype with variations only in shade. Females have the same color and pattern described for the holotype, but the background color of the dorsum can be brown or gray. One female lacks a wide occipital band because the transverse dark brown bars are not fused and it has an inconspicuous vertebral stripe. Also, in this female there are no lateral bands, since it has unfused vertical bars on the flanks. The tail has dark brown rings in both sexes. Males have orange precloacal pores. The coloration and pattern of the juveniles are unknown.

**Distribution and natural history.** The northern known distribution limit of the new species is the type locality, near the Laja Lagoon, 1450 m, Biobío Region, Chile (37°21’S – 71°23’W; Fig. 4). At the type locality, this new species was found inhabiting areas composed of sandy ground and volcanic sediments, where large accumulations of different sized igneous rocks protrude from the soil (Fig. 5). These sites correspond to a slag heap of solidified lava. The vegetational cover is low, consisting mainly of high-Andean forbs with species such as *Echium vulgare* and *Verbascum thapsus*, as well as the bush *Ephedra chilensis*. It is an abundant lizard of saxicolous habits. It was observed to be active between 9h00 and 18h00, taking refuge under the volcanic rocks. Also, we observed specimens in several places near the slopes of Antuco Volcano (37°23’S – 71°23’W, 1320 m; 37°23’S – 71°23’W, 1270 m; 37°23’S – 71°25’W, 1074 m) in similar environments. Near the Laja Lagoon, at its upper altitudinal limit (1450 m), this species was found in syntopy with *Phymaturus vociferator* Pincheira-Donoso, 2004. At 1320 m, it was found in syntopy with “L. kriegii* Liolaemus* sp. A” and *Diplolaemus sexcinctus* Cei et al., 2003. At its lower altitudinal limit (1074 m), it was found in syntopy with *L. lemniscatus* Gravenhorst, 1838 and *L. tenuis* (Duméril & Bibron, 1837).
Figure 4. Distributional map for Liolaemus scoralis sp. n., L. zabalai sp. n. and the species of the elongatus-kriegi complex that inhabit in proximity of its. Asterisk: L. scoralis (red = near Laja Lagoon, type locality; orange = La Mula Lagoon). Star: L. zabalai sp. n. (light green = road to Los Barros, type locality; blue = distribution in Argentina). Purple circle: L. carlosgarini. Yellow triangle: L. flavipiceus. Green pentagon: L. buergeri. Gray octagon: L. choique. Brown hexagon: L. antumalguen. Black cross: L. punmahuida. Light pink diamond: L. burmeisteri. Pink square: L. tregenzai.
Two new species of the *Liolaemus elongatus-kriegi* complex (*Iguania, Liolaemidae*)...  

Its southern limit of distribution is in La Mula Lagoon (La Araucanía Region, Chile), 48 km South from the Antuco Volcano (37°53’S – 71°22’W), 1600 m. We have no data for vegetation or environment in La Mula Lagoon. In this location, according to the Herpetological Catalog of the Museo de Historia Natural of Concepción (unpublished), *L. scorialis* occurs in syntopy with *L. pictus* (Duméryl & Bibron, 1837). However, this report probably actually refers to *L. septentrionalis* Pincheira-Donoso & Núñez, 2005 (fide Vera-Escalona et al. 2012). The Museo de Historia Natural of Concepción also listed an unidentified species of *Liolaemus* (labeled as *Liolaemus monticola* ssp., see discussion) and the snake *Tachymenis chilensis* Schlegel, 1837, from La Mula Lagoon.

The intestinal and stomach contents were examined; plant and insect remains were found in the intestine, along with a large number of nematodes of an unidentified species. No remains were found in the stomach. At the time of capture (January) two females had three embryos each and one female had several small oocytes.

*Liolaemus zabalai* sp. n.
http://zoobank.org/063D3CC3-0606-4CC4-8216-8F6B2B38CC3C

Fig. 6

*Liolaemus kriegi*, Donoso-Barros, 1974. Bol. Soc. Biol. Concepción, 47: 287.
*Liolaemus kriegi* (in part), Cei, 1986. Mus. Reg. Scien. Nat. Torino, 4: 230.
*Liolaemus sp.*, Torres-Pérez, 1997. Not. Biol., 5(4): 146.
*Liolaemus kriegi* (in part), Pincheira-Donoso, 2001. Not. Mens. Mus. Nac. Hist. Nat., Chile, 346: 11.
*Liolaemus* sp. A, Morando et al., 2003. Syst. Biol., 52: 179.
*Liolaemus kriegi* (in part), Pincheira-Donoso & Núñez, 2005. Pub. Oc. Mus. Nac. Hist. Nat., Chile, 59: 289.
Liolaemus kriegi (in part), Mella, 2005. Guía Camp. Rep. Chil. Zon. Cent., p. 64.
Liolaemus sp. A, Medina et al. Cuad, 2013. Herp. 27(1): 27.
Liolaemus sp. A, Medina et al., 2014. Biol. J. Linnean Soc. 113: 256.

Holotype. SSUC Re 602 (Fig. 6). Near Los Barros, Laja Lagoon, Biobío Region, Chile. (37°31'S – 71°15'W, 1460 m). Collected by J. Troncoso-Palacios, F. Urra and H. Díaz. 07/01/2014.

Paratypes. SSUC Re 598. Adult male. SSUC Re 597, 599, 600–01. Four adult females. The same data as the holotype (Figs 6 and 8). MZUC 35607, 39567. One male and one female. Malleco, Antuco Volcano, Los Barros. Unknown coll.

Etymology. This species is named after Patricio Zabala, collection manager of the “Colección de Flora y Fauna Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile” (SSUC). We dedicate this species to him because of his support of herpetological research in Chile, allowing us to review and deposit material in SSUC, and especially for his friendship.

Diagnosis. Liolaemus zabalai belongs to the kriegi clade of the elongatus-kriegi complex and is closely related to some undescribed species: Liolaemus sp. C and Liolaemus sp. D; being more distant from the currently described species L. buergeri, L. kriegi and L. tregenzai (Fig. 7). According to Medina et al. (2014), in regards to the species of the kriegi clade L. zabalai is sympatric only with L. tregenzai at the Copahue Volcano.

With respect to the species of the kriegi clade, Liolaemus zabalai differs from L. tregenzai because the latter has 71–85 midbody scales and the males have no precloacal pores (Pincheira-Donoso and Scolaro 2007), whereas L. zabalai has 90–104 midbody scales and the males have 3–5 precloacal pores. In addition, the green-bluish ventral color of L. tregenzai is completely absent in L. zabalai. The uncorrected pairwise difference (cyt-b) between the species is 3.09% (Medina et al. 2014).

Liolaemus zabalai differs from L. kriegi in that the latter reaches 101.1 mm SVL, has reddish cloacal coloration in both sexes and has an unringed tail (Avila et al. 2003), whereas L. zabalai is smaller (max. SVL = 92.0 mm), has yellowish cloacal coloration in both sexes and has a ringed tail (in specimens with original tails). The uncorrected pairwise difference between these species is 3.79% (Medina et al. 2014).

Liolaemus zabalai differs from L. buergeri in that the latter has fewer dorsal scales (78–91; x = 84.1 ± 4.4, n = 14) than L. zabalai (86–96; x = 89.4 ± 3.2, n = 8) (Mann–Whitney U = 19.5; P = 0.01, DF = 20). Liolaemus zabalai has more loreal scales between the nasal and the subocular (4–6; x = 4.3 ± 0.6, n = 8) than L. buergeri (3–4; x = 3.3 ± 0.5, n = 14) (Mann–Whitney U = 11.0; P < 0.01, DF = 20). Also, L. buergeri has a vertebral stripe on the tail, whereas L. zabalai has a ringed original tail. The limbs in L. zabalai are black with dispersed light brown spots, whereas L. buergeri has brown limbs with dispersed black spots (Fig. 8). Liolaemus zabalai and L. buergeri share basically the same dorsal coloration pattern, but this is noticeably more marked and darker in L. zabalai (Fig. 8, see discussion). Based on the cyt-b locus, the uncorrected average pairwise difference between L. zabalai and L. buergeri is 2.94% (Medina et al. 2014), greater than the values reported for other Liolaemus widely accepted as valid species.
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...

Figure 6. Liolaemus zabalai sp. n. A, B Holotype, male C, D Paratype, female E Paratype, male F Paratype, female. All from the type locality, near Los Barros, Laja Lagoon, Biobío Region, Chile.

Figure 7. Phylogenetic position of Liolaemus zabalai sp. n. in the kriegi clade, based on cytochrome-b (cyt-b) locus according to Medina et al. (2014).
Figure 8. Comparison of the dorsal color pattern. A Liolaemus zabalai sp. n. with marked color pattern and B L. buergeri, diffuse color pattern.

(see discussion). Also, L. zabalai can vocalize, a feature only documented for L. chilensis in the entire genus Liolaemus (Labra et al. 2013). Finally, although the ranges overlap, males of L. buergeri have 3–4 ($x = 3.3$) precloacal pores, whereas males of L. zabalai have 3–5 ($x = 3.9$) precloacal pores (Medina et al. 2014).

Compared to the other species of the elongatus-kriegi complex that occur near the known distribution of Liolaemus zabalai, the new species may be diagnosed as follows. Males of L. zabalai have precloacal pores, whereas males of L. flavipiceus and L. pun-
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...

...mahuída lack them (Table 3). L. zabalai is larger than L. scorialis; and L. zabalai has more midbody scales than L. antumalguen, L. burmeisteri and L. choique (Table 3).

**Description of the holotype.** Adult male. SVL: 90.3 mm. Tail length: 92.3 mm (autotomized). Axilla-groin length 39.7 mm. Head length (from the posterior border of the auditory meatus to the tip of the snout) 22.2 mm. Head width (distance between the two ear openings) 16.5 mm. Head height (at the level of ear openings) 11.7 mm. Forelimb length 28.5 mm. Hindlimb length 47.1 mm. Foot length 23.4 mm. Rostral scale wider (4.5 mm) than high (2.2 mm). Two postrostrals. Four internasals. Heptagonal interparietal scale, with a central, small, and whitish central spot marking the position of the parietal eye. Interparietal smaller than right parietal, but bigger than left parietal, surrounded by eight scales: nine scales between the interparietal and the rostral; 14 scales between occiput and rostral; orbital semicircle complete on both sides (formed by 13 scales); 5 supraoculars on both sides; seven supraciliary scales. Frontal area is divided into six scales (three posterior, one anterior-left, two anterior-right); 2 scales between nasal and canthals; preocular separated from the lorilabials by one loreal scale; nasal in contact with the rostral, surrounded by six scales. There is one row of lorilabials between the supralabials and the subocular. Seven supralabials, the fourth is curved upward without contacting the subocular. Five infralabial scales. The mental scale is pentagonal and is in contact with four scales. Four pairs of postmental shields, the second is separated by two scales. Temporal scales are subimbricated and smooth or slightly keeled. Nine temporal scales between the level of supraciliary scales and the rictal level. Two projected scales on the anterior edge of the ear, which are small and do not cover the auditory meatus. There is no differentiated auricular scale. Forty-two gulars between auditory meatus. Well developed “Y” shaped lateral neck fold with antehumeral and posthumeral folds developed. Dorsolateral fold slightly developed. Midbody scales 90. Dorsal scales on the vertebral zone are lanceolate to rounded, subimbricate, keeled and without mucrons. Dorsal scales on the paravertebral fields are more rounded, subimbricate, smooth or with less developed keels, without mucrons and there are interstitial granules between them. Dorsal scales are smaller than the ventral scales. Dorsal scales 86. Ventral scales are rhomboidal, smooth, subimbricate, and with few interstitial granules. Ventral scales 122. There are three precloacal pores. The suprafemoral scales are rhomboidal, imbricate, and smooth or keeled. Infracaudal scales are lanceolate to rhomboidal, smooth, and subimbricate and with few interstitial granules. Supra-antebrachials scales are rhomboidal to rounded, subimbricate, and keeled or smooth. Infra-antebrachials are rounded to rhomboidal, subimbricate, and smooth. The dorsal scales of the tail are lanceolate to rectangular, subimbricate, keeled or smooth and with few interstitial granules. The ventral scales of the tail vary from lanceolate to triangular, and are subimbricate and smooth. Lamellae of the fingers: I: 11, II: 16, III: 20, IV: 22 and V: 15. Lamellae of the toes: I: 12, II: 16, III: 21, VI: 27 and V: 18.

**Color of the holotype in life.** Black head, with some light brown spots on the supraocular and snout areas. The scales located behind the orbital semicircles are light brown; but the interparietal scale, parietal scales and the scales in contact with the
parietal scales are black. Superciliary scales are light brown with black spots. Temporal
scales are light brown; cheeks light gray with some black spots. Subocular is gray with
a black vertical line on the middle. Background color of the dorsum is light brown.
Wide occipital band on the dorsum, formed by twelve transverse black bars. Very few
whitish scales dispersed on the dorsum. Black lateral band bearing a few dispersed
whitish scales, running from the tip of snout to the groin. Flanks below lateral band
are light brown. Limbs black with dispersed light brown spots. Tail light brown with
inconspicuous vertebral stripe in the regenerated zone; occipital black band ends in the
first fifth of the tail, remainder with some dispersed black spots and a black vertebral
stripe. Throat, belly and ventral surfaces of limbs whitish with dispersed inconspicu-
ous dark dots. Rear portion of the belly and the thighs are yellowish. Ventrally, tail is
whitish with a dark gray ventral stripe and diffuse dark gray rings from the cloaca to
the midpoint of the tail. Precloacal pores orange.

**Variation.** In three males: SVL: 72.6–90.3 mm. Axilla-groin distance: 32.7–
38.6 mm. Head length: 17.6–22.2 mm. Head width: 14.2–16.5 mm. Head height:
9.2–11.7 mm. Foot length: 21.5–23.0 mm. Leg length: 42.1–47.2 mm. Arm length:
24.6–28.5 mm. Tail length: 102.0 mm in one specimen (autotomized in the rest).
In three females: SVL: 71.8–90.2 mm. Axilla-groin distance: 32.9–42.7 mm. Head
length: 17.9–19.5 mm. Head width: 13.9–16.6 mm. Head height: 9.4–11.1 mm.
Foot length: 20.6–24.2 mm. Leg length: 41.5–48.8 mm. Arm length: 24.8–29.4 mm.
Tail length: 105–115 mm (in two specimens without autotomized tails).

The variation of the scalation in *Liolaemus zabalai* is as follows. Midbody scales:
90–104 (x = 94.3 ± 4.8). Dorsal scales: 86–96 (x = 89.4 ± 3.2). Ventral scales 116–122
(x = 119.5 ± 2.1). Fourth finger lamellae: 19–22 (x = 20.9 ± 1.0). Fourth toe lamellae:
26–27 (x = 26.8 ± 0.5). Supralabial scales: 6–7 (x = 6.6, ± 0.5). Infralabial scales: 4–5
(x = 4.6 ± 0.5). Interparietal scale pentagonal, hexagonal or heptagonal, bordered by
5–8 scales (x = 7.3 ± 1.1). Precloacal pores in males: 3–4.

There is slight sexual dichromatism; males are slightly darker than females. In general,
all specimens have the pattern and color described for the holotype. One female has rusty-
colored scales dispersed on the flanks, paravertebral fields and groin. In all specimens, the
ventral surface of the throat, belly and limbs are whitish with dark marked or inconspicu-
ous dots dispersed; there is a fragmented midventral stripe on the belly of two specimens.
Males and females have a yellowish coloration in the posterior portion of the belly and
the thighs (faint in some females). The tail has black rings, marked or diffuse, with a frag-
mented vertebral stripe in all specimens with complete original tails. Males have orange
prechacal pores. The coloration and pattern of the juveniles are unknown.

**Distribution and natural history.** To our knowledge, in Chile this species is only
found in the surroundings of the Laja Lagoon. The type locality is near Los Barros,
Laja Lagoon, Biobío Region, Chile (37°31’S – 71°15’W, 1460 m, Fig. 9); but we also
saw specimens (not collected) on the road to the Laja Lagoon at two localities (37°23’S
– 71°23’W, 1320 m; 37°23’S – 71°22’W, 1390 m). The new species was found inhab-
iting areas of sandy soil with rocks of small and medium size. The vegetational cover
is low, consisting mainly of *Ephedra chilensis*. It is an abundant lizard of saxicolous
habits. This species was observed active between 11h00 and 18h00, taking refuge in
cavities under the rocks. Near Los Barros, at its upper altitudinal limit (1460 m), this species was found in syntopy with Diplolaemus sexcinctus. At the lower altitudinal limit (1320 m), it was found in syntopy with Liolaemus scorialis, Phymaturus vociferator and D. sexcinctus. Two specimens of L. zabalai vocalized (squealed) in several occasions in response to the manipulation.

Liolaemus zabalai is also found in Argentina (where it has been called “Liolaemus sp. A”) at several localities in Neuquén Province (Morando et al. 2003, Medina et al. 2013, 2014).

An analysis of the intestinal contents performed on one specimen, showed that this species is omnivorous, but feeds mainly on plants. At the time of capture (January) the females had no embryos, but three had several small oocytes.

**Discussion**

In this work, the taxonomic status of two Chilean populations of the *Liolaemus elongatus-kriegi* complex from the Laja Lagoon have been clarified, here newly described as *L. zabalai* (previously confused with *L. kriegi* and also designed as *Liolaemus* sp. A) and *L. scorialis*. Pincheira-Donoso (2001) recorded two species of the *L. elongatus-kriegi* complex from the same location: *L. kriegi* and *L. buergeri*. Even though we did not examine the three specimens of “*L. buergeri*” listed by Pincheira-Donoso (2001), we believe that these correspond to *L. scorialis*, since the aspect of this new species resem-
bles \textit{L. buergeri} (although it is notably smaller than it) and we did not find additional species of the \textit{elongatus-kriegi} in the vicinity of Laja Lagoon. Also, Troncoso-Palacios et al. (2012) published several photographs of specimens from a population of “\textit{L. buergeri}” from Los Humos, Libertador Bernardo O’Higgins Region, Chile, but unfortunately those specimens were not collected. This population is completely isolated from other populations of \textit{L. buergeri} and some specimens exhibit a completely black ventral coloration, a feature absent in other populations of \textit{L. buergeri} (Donoso-Barros 1966, Pincheira-Donoso and Núñez 2005). A more conclusive study in regard to this population should be conducted. Besides, there is diverse evidence supporting the existence of at least three more undescribed species currently assigned to \textit{L. buergeri} in Argentina (Medina et al. 2013, 2014, Morando et al. 2003).

Assigning \textit{Liolaemus scorialis} to any of the groups (Lobo 2005, Lobo et al. 2010b) or clades (Morando et al. 2003, Avila et al. 2012) proposed for such a diverse lineage of Patagonian lizards is a difficult task, especially taking into account that the phylogenetic studies based on morphological and molecular data disagree, and unfortunately we do not have molecular data for \textit{L. scorialis}. However, it is unlikely that \textit{L. scorialis} belongs to the \textit{leopardinus} group-clade, because it completely lacks “leopard-like” dorsal spots, a distinctive feature of these lizards (Lobo 2005). Also, it is unlikely that \textit{L. scorialis} belongs to the \textit{capillitas} group, because species of this group share two synapomorphies absent in \textit{L. scorialis}: spots in the shoulder region and a red coloration in the cloacal zone (Abdala et al. 2010, Lobo 2005). The \textit{petrophilus} clade (Avila et al. 2012, Morando et al. 2003) includes all species of the \textit{capillitas} group (with the exception of \textit{L. heliodermis}, not sampled) plus \textit{L. austromendocinus}, \textit{L. gununakuna}, \textit{L. parvus} and \textit{L. petrophilus}. However, with the exception of \textit{L. petrophilus} and \textit{L. gununakuna}, all species of the \textit{petrophilus} clade have fewer than 82 midbody scales (Abdala et al. 2010, Avila et al. 2004, Espinoza and Lobo 2003, Quinteros et al. 2008), whereas \textit{L. scorialis} has 76–90 midbody scales. In regards to the \textit{punmahuida} clade (Avila et al. 2010a), included into the \textit{elongatus} group by Lobo et al. (2010b), both species of this clade (\textit{L. flavipiceus} and \textit{L. punmahuida}) have red coloration in the cloacal zone and males lack precloacal pores (Avila et al. 2003, Ceí and Videla 2003), features absent in \textit{L. scorialis}. \textit{Liolaemus scorialis} is probably related to the \textit{elongatus} or \textit{kriegi} clades, as some species of these clades occur in the vicinity or in the type locality of \textit{L. scorialis} and have similar counts of midbody, dorsal and ventral scales. Also, some of these species have white dorsal dots, rings on the tail and yellow in the cloacal zone (Abdala et al. 2010, Avila et al. 2010a, 2012, Ceí 1986) like \textit{L. scorialis}. A molecular phylogeny including \textit{L. scorialis} is required to clarify this.

In the case of \textit{Liolaemus zabalai} of the \textit{kriegi} clade, the uncorrected pairwise differences between it and other species of the \textit{kriegi} clade are 2.94–3.79%, almost at the limit of the value (3%) proposed for identify candidate species in \textit{Liolaemus} (Breitman et al. 2012). In comparison, other \textit{Liolaemus} lizards widely accepted as valid species show a lower level of differentiation for the mitochondrial gene cyt-b, for example: \textit{L. martorii} Abdala, 2003 vs. \textit{L. morenoi} Etheridge & Christie, 2003, 2.73% (Avila et al. 2010b); \textit{L. riojanus} Ceí, 1979 vs. \textit{L. multimaculatus} (Duméril & Bibron, 1837), 1.23% (Avila et al. 2009); \textit{L. chacabucoense} Núñez & Scolaro, 2009 vs. \textit{L. kingii} (Bell, 1843), 2.22% (Breitman 2013). \textit{Liolaemus zabalai} can vocalize, a trait only documented for \textit{L. chiliensis}}
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...
**Liolaemus chillanensis** was included in the *elongatus* clade by Avila et al. (2010a) and Avila et al. (2012) based on mitochondrial DNA data generated by Torres-Pérez et al. (2009), but at least part of the specimens used as vouchers were misidentified (Troncoso-Palacios, unpublished data). Therefore, in this study we do not consider *L. chillanensis* as a member of the *elongatus-kriegi* complex and we excluded it from our comparisons. Also, we examined one male of *Liolaemus monticola* ssp. (MRC 676) syntopic with *L. scorialis* in La Mula Lagoon, and identified it as *L. neuquensis* Müller & Hellmich, 1939, a species described from Copahue Volcano (Müller and Hellmich 1939b), 15 km E from La Mula Lagoon; being the first record of *L. neuquensis* in Chile.

In summary, this work describes two new species of the *elongatus-kriegi* complex lizards from the vicinity of the Laja Lagoon, in southern Chile, one probably confused with *L. buergeri*: *L. scorialis* and the other with a history of mis-identifications as *L. kriegi* or *Liolaemus* sp. A, for which we provide the formal name *L. zabalai*. Nonetheless, there is certainly still much to discover about the diversity of this group of Patagonian lizards.

**Acknowledgements**

We thank P. Zabala (Pontificia Universidad de Católica de Chile) for allowing us to review and deposit material in the collection under his care. We are grateful to the following colleagues (and museums) for allowing us to study specimens: H. Núñez (Museo Nacional de Historia Natural), M. Lamborot (Laboratorio de Citogenética, Facultad de Ciencias, Universidad de Chile), J.F. Troncoso (Museo de Historia Natural de Concepción), J. Artigas and J.C. Ortiz (Museo de Zoología de la Universidad de Concepción). F. Lobo, C. Roman, L.J. Avila, F. Tillack, C. Garín and A. Laspiur for sending literature. C.F. Garín and R. Díaz for providing photographs. J. Troncoso-Palacios thanks M. Penna for his support. HAD thanks CONICYT for the support with the master’s fellowship FAU thanks the PhD fellowship from CONICYT. D. Esquerré is supported by a Becas Chile-CONICYT scholarship. Two anonymous reviewers greatly improved the work. Thanks to the Servicio Agrícola y Ganadero (SAG) for the collecting permit (N°4468/2014).

**References**

Abdala CS (2007) Phylogeny of the *boulengeri* group (Iguania: Liolaemidae, *Liolaemus*). Zootaxa 1538: 1–84.

Abdala CS, Quinteros AS, Scrocchi GJ, Stazzonelli JC (2010) Three new species of the *Liolaemus elongatus* group (Iguania: Liolaemidae) from Argentina. Cuadernos de Herpetología 24: 93–109.

Avila LJ, Morando M, Pérez DR, Sites JW Jr (2004) Phylogenetic relationships of lizard of the *Liolaemus petrophilus* group (Squamata: Liolaemidae), with description of two new species from western Argentina. Herpetologica 60: 187–203. doi: 10.1655/03-04
Avila LJ, Morando M, Pérez DR, Sites JW Jr (2009) A new species of Liolaemus from Añeló sand dunes, northern Patagonia, Neuquén, Argentina, and molecular phylogenetic relationships of the Liolaemus wiegmanni species group (Squamata, Iguania, Liolaemini). Zootaxa 2234: 39–55.

Avila LJ, Morando M, Pérez DR, Sites JW Jr (2010a) A new species of the Liolaemus elongatus clade (Reptilia: Iguania: Liolaemini) from Cordillera del Viento, northwestern Patagonia, Neuquén, Argentina. Zootaxa 2667: 28–42.

Avila LJ, Morando M, Sites JW Jr (2006) Congeneric phylogeography: hypothesizing species limits and evolutionary processes in Patagonian lizards of the Liolaemus boulengeri group (Squamata: Liolaemini). Biological Journal of the Linnean Society 89: 241–275. doi: 10.1111/j.1095-8312.2006.00666.x

Avila LJ, Pérez CHF, Medina CD, Sites JW Jr, Morando M (2012) A new species of lizard of the Liolaemus elongatus clade (Reptilia: Iguania: Liolaemini) from Curi Leuvu River Valley, northern Patagonia, Neuquén, Argentina. Zootaxa 3325: 37–52.

Avila LJ, Pérez CHF, Morando M (2003) A new species of Liolaemus (Squamata: Iguania: Liolaemidae) from northwestern Patagonia (Neuquén, Argentina). Herpetologica 59: 532–543. doi: 10.1655/02-67

Avila LJ, Pérez CHF, Morando M, Sites JW Jr (2010b) A new species of Liolaemus (Reptilia: Squamata) from southwestern Rio Negro province, northern Patagonia, Argentina. Zootaxa 2434: 47–59.

Breitman MF (2013) Filogenia, filogeografía y patrones de diversificación en la sección Liolaemus lineomaculatus (Iguania: Squamata: Liolaemini) de América del Sur austral (Patagonia). Pd.D. Dissertation, National University of Cordoba, Argentina.

Breitman MF, Avila LJ, Parra M, Sites JW Jr, Morando M (2012) How lizards survived blizzards: phylogeography of the Liolaemus lineomaculatus group (Liolaemidae) reveals multiple breaks and refugia in southern Patagonia, and their concordance with other co-distributed taxa. Molecular Ecology 21: 6068–6085. doi: 10.1111/mec.12075

Cei JM (1979) The Patagonian Herpetofauna. In: Duellman WE (Ed.) The South American Herpetofauna: Its origin, evolution, and dispersal. Lawrence, Kansas, 309–329.

Cei JM (1986) Reptiles del centro, centro-oeste y sur de la Argentina. Museo Regionale di Scienze Naturali di Torino, Monografie 4: 1–527.

Cei JM, Videla F (2003) A new species of Liolaemus lacking precloacal pores in males from the Andean south-eastern mountains of Mendoza Province, Argentina. (Liolaemidae, Iguania, Lacertilia, Reptilia). Bollettino del Museo Regionale di Scienze Naturali, Torino 20: 275–290.

Donoso-Barros R (1966) Reptiles de Chile. Ediciones de la Universidad de Chile, Santiago, cxliv + 458 pp.

Donoso-Barros R (1970) Catálogo herpetológico chileno. Boletín del Museo Nacional Historia Natural, Chile 31: 49–124.

Donoso-Barros R (1971) A new Liolaemus from Neuquén (Argentina). Herpetologica 27: 49–51.

Donoso-Barros R (1974) Notas Herpetológicas. Boletín Sociedad de Biología de Concepción, Chile 47: 285–287.
Espinoza RE, Lobo F (2003) Two new species of *Liolaemus* from northwestern Argentina: speciation within the northern subclade of the *elongatus* group (Iguania: Liolaemidae). Herpetologica 59: 89–105. doi: 10.1655/0018-0831(2003)059[0089:TNSOLL]2.0.CO;2

Espinoza RE, Lobo F, Cruz FB (2000) *Liolaemus heliodermis*, a new lizard from northwestern Argentina with remarks on the content of the *elongatus* group (Iguania: Tropiduridae). Herpetologica 56: 507–516.

Esquerré D, Núñez H, Scolaro JA (2013) *Liolaemus carlosgarini* and *Liolaemus riodamas* (Squamata: Liolaemidae), two new species of lizards lacking precloacal pores, from Andean areas of central Chile. Zootaxa 3619(4): 428–452. doi: 10.11646/zootaxa.3619.4.2

Esquerré D, Troncoso-Palacios J, Garín CF, Núñez H (2014) The missing leopard lizard: *Liolaemus ubaghsi* sp. nov., a new species of the *leopardinus* clade (Reptilia: Squamata: Liolaemidae) from the Andes of the O’Higgins Region in Chile. Zootaxa 3815(4): 507–525. doi: 10.11646/zootaxa.3815.4.3

Etheridge R (1995) Redescription of *Ctenoblepharys adspersa* Tschudi, 1845, and the Taxonomy of Liolaeminae (Reptilia: Squamata: Liolaemidae). American Museum Novitates 3142: 1–34.

Fontanella FM, Olave M, Avila LJ, Sites JW Jr, Morando M (2012) Molecular dating and diversification of the South American lizard genus *Liolaemus* (subgenus *Eulaemus*) based on nuclear and mitochondrial DNA sequences. Zoological Journal of the Linnean Society 164: 825–835. doi: 10.1111/j.1096-3642.2011.00786.x

Labra A, Silva G, Norambuena F, Velásquez N, Penna M (2013) Acoustic Features of the weeping lizard’s distress call. Copeia 2013(2): 206–212. doi: 10.1643/CE-12-026

Laurent RF (1985) Segunda contribución al conocimiento de la estructura taxonómica del género *Liolaemus* Wiegmann (Iguanidae). Cuadernos de Herpetología 1: 1–37.

Lobo F (2005) Las relaciones filogenéticas dentro del grupo *chilensis* (Iguania: Liolaemidae: *Liolaemus*): sumando nuevos caracteres y taxones. Acta Zoológica Lilloana 49: 67–89.

Lobo F, Abdala C, Valdecantos S (2010a) Taxonomic studies of the genus *Phymaturus* (Iguania: Liolaemidae): description of four new species. South American Jounal of Herpetology 5(2): 102–126. doi: 10.2994/057.005.0205

Lobo F, Espinoza RE, Quinteros S (2010b) A critical review and systematic discussion of recent classification proposals for liolaemid lizards. Zootaxa 2549: 1–30.

Medina CD, Avila LJ, Morando M (2013) Hacia una Taxonomía Integral: poniendo a prueba especies candidatas relacionadas a *Liolaemus buergeri* Werner 1907 (Iguania: Liolaemini) mediante análisis morfológicos. Cuadernos de Herpetología 27(1): 27–34.

Medina CD, Avila LJ, Sites JW Jr, Morando M (2014) Multilocus phylogeography of the Patagonian lizard complex *Liolaemus kriegi* (Iguania: Liolaemini). Biological Journal of the Linnean Society 113: 256–269. doi: 10.1111/bij.12285

Mella JE (2005) In: Peñaloza APG, Novoa F, Contreras M (Eds) Guía de Campo Reptiles de Chile: Zona Central. Ediciones del Centro de Ecología Aplicada Ltda.

Morando M, Avila LJ, Sites JW Jr (2003) Sampling strategies for delimiting species: genes, individuals, and populations in the *Liolaemus elongatus-kriegi* complex (Squamata: Liolaemidae) in Andean-Patagonian South America. Systematic Biology 52: 159–185. doi: 10.1080/10635150390192717
Müller L, Hellmich W (1939a) Liolaemus-Arten aus dem westlichen Argentinien. Zoologischer Anzeiger 127: 44–47.
Müller L, Hellmich W (1939b) Liolaemus-Arten aus dem westlichen Argentinien II. Über eine neue Liolaemus altissimus - Rasse vom Volcán Copahue. Zoologischer Anzeiger 125: 113–119.
Pincheira-Donoso D (2001) Distribución geográfica de Liolaemus buergeri Werner, 1907 (Reptilia-Tropiduridae) en Chile y Argentina nuevos datos y comentarios. Noticiero Mensual del Museo Nacional de Historia Natural, Chile 346: 8–11.
Pincheira-Donoso D, Núñez H (2005) Las especies chilenas del género Liolaemus Wiegmann, 1834 (Iguania: Tropiduridae: Liolaeminae). Taxonomía, sistemática y evolución. Publicación Ocasional del Museo Nacional de Historia Natural, Chile 59: 1–486.
Pincheira-Donoso D, Scolaro JA (2007) Iguanian species-richness in the Andes of boreal Patagonia: evidence for an additional new Liolaemus lizard from Argentina lacking precloacal glands (Iguania: Liolaeminae). Zootaxa 1452: 55–68.
Quinteros AS, Abdala CS, Díaz Gómez JM, Scrocchi GJ (2008) Two new species of Liolaemus (Iguania: Liolaemidae) of central west Argentina. South American Journal of Herpetology 3: 101–111. doi: 10.2994/1808-9798(2008)3[101:TNSOLI]2.0.CO;2
Schulte JA II, Macey JR, Espinoza RE, Larson A (2000) Phylogenetic relationships in the iguanid lizard genus Liolaemus: multiple origins of viviparous reproduction and evidence for recurring Andean vicariance and dispersal. Biological Journal of Linnean Society 69: 75–120. doi: 10.1006/bijl.1999.0346
Torres-Pérez F (1997) Antecedentes para dos nuevas formas de saurios del Parque Nacional Laguna del Laja (VIII Región). Noticiero de Biología 5(4): 146.
Torres-Pérez F, Mendez MA, Benavides E, Moreno RA, Lamborot M, Palma RE, Ortiz JC (2009) Systematics and evolutionary relationships of the mountain lizard Liolaemus monticola (Liolaemini): how morphological and molecular evidence contributes to reveal hidden species diversity. Biological Journal of the Linnean Society 96: 635–650. doi: 10.1111/j.1095-8312.2008.01140.x
Troncoso-Palacios J, Silva R, Terán D (2012) Nuevos registros para dos especies de lagartos (Liolaemus) en la zona Central de Chile. La Chiricoca 13: 9–13.
Uetz P, Hošek J (2014) The Reptile Database. http://www.reptile-database.org [accessed December, 22, 2014]
Vera-Escalona I, D’Elía G, Gouin N, Fontanella FM, Muñoz-Mendoza C, Sites JW Jr, Victoriaño PF (2012) Lizards on ice: evidence for multiple refugia in Liolaemus pictus (Liolaemidae) during the last glacial maximum in the southern Andean beech forests. PLoS ONE 7(11): 1–17. doi: 10.1371/journal.pone.0048358
Videla F, Cei JM (1996) A new peculiar Liolaemus species of the “chiliensis” phyletic group from the volcanic Cordilleran landscapes of southern Mendoza Province, Argentina (Iguania, Lacertilia, Reptilia). Bolletino del Museo Regionale di Scienze Naturali, Torino 14: 505–516.
Werner F (1907) Sobre algunos lagartos nuevos clasificados i descritos por el Doctor E. Werner de Viena. In: Bürger O. Estudios sobre reptiles chilenos. Anales de la Universidad de Chile 121:149–155.
Appendix I

Specimens examined. Museum codes are as follow: LCUC (Laboratorio de Citogenética, Facultad de Ciencias, Universidad de Chile), MNHN-CL (Museo Nacional de Historia Natural, Chile), MRC (Museo de Historia Natural de Concepción), MZUC (Museo de Zoológia de la Universidad de Concepción) and SSUC (Colección de Flora y Fauna Patricio Sánchez Reyes, Pontificia Universidad Católica de Chile).

Liolaemus buergeri. LCUC 2311. El Planchón, 2370 m. M. Lamborot & M.E. Manzur colls. 07/01/1996. SSUC Re 434–37. El Planchón, road to Teno Lagoon. J. Troncoso-Palacios, L. Negrete & R. Barros colls. January, 2012. SSUC Re 171–180. Maule Lagoon. F. Ferri coll. 20/02/2011.

Liolaemus carlosgarini. MNHN-CL 4531–67. Road to Maule Lagoon. C. Garín coll. 22/02/2008. SSUC Re 181–189, 349. Road to Maule Lagoon. F. Ferri coll. 20/02/2011.

Liolaemus cristiani. SSUC Re 537. El Peine. J. Troncoso-Palacios coll. 28/11/2011.

Liolaemus flavipiceus. MNHN-CL 2118, 2120. Maule Lagoon. C. Veloso & S. Silva colls. MNHN-CL 2167, 2170. Maule Lagoon. J.C. Torres-Mura & H. Núñez. MNHN-CL 4399–07. Laguna del Maule, aguas abajo, 2153 m. C. Garín & G. Lobos colls. 03/03/2008. SSUC Re 169–70. Maule Lagoon. F. Ferri coll. 20/02/2011.

Liolaemus frassinettii. LCUC 800–01. Cantillana. Unknown coll. 14/04/1983. SSUC Re 80. Altos de Cantillana. F. Torres coll.

Liolaemus leopardinus. MNHN-CL 3437–3439. El Colorado. H. Núñez, C. Garín, V. Mergigio, S. Fox & S. Perea colls. 06/01/2001. MNHN-CL 4025, 4027–28. Farellones. C. Veloso coll. 11/01/1988. MNHN-CL 4890–91. El Colorado. D. Esquerré, M. Palma, S. Fox & E. Santoyo colls. February, 2012. SSUC Re 364. Farellones. F. Ferri coll. 12/10/2010. SSUC Re 365. Farellones. F. Ferri coll. 13/02/2011. SSUC Re 366–67. Farellones. F. Ferri, M.L. Carrevedo & J. Troncoso-Palacios colls. 25/01/2012.

Liolaemus neuquensis. MRC 676. La Mula Lagoon, Araucanía Region, Chile. Unknown coll.

Liolaemus ramonensis. MNHN-CL 4007–08, 4012, 4015–17. Quebrada de Macul. C. Veloso & P. Espejo colls. 06/03/1987.

Liolaemus scorialis. SSUC Re SSUC Re 612-17. 7 km NW of the summit of the Antuco Volcano, near the Laja Lagoon, Biobío Region, Chile. J. Troncoso-Palacios, F. Urra & H. Díaz colls. 08/01/2014. MRC 675, 677, 680, 682. La Mula Lagoon, Ralco National Reserve. Unknown coll. 01/12/2001.

Liolaemus ubaghsi. MNHN-CL 3808–16. Chapa Verde. H. Núñez, C. Garín & D. Pincheira-Donoso colls. 22–23/05/2003. MNHN-CL 1601. Chapa Verde. M. Elgueta coll. SSUC Re 491–92. Tranque Barahona, O’Higgins Region, Chile. R. Thomsom & G. Ugalde colls. 15/04/2008.
Two new species of the Liolaemus elongatus-kriegi complex (Iguania, Liolaemidae)...

*Liolaemus valdesianus.* SSUC Re 129. Cajón del Maipo. Unknown coll. SSUC Re 363. Lo Valdés. F. Ferri coll. 10/01/2011. SSUC Re 559. El Yeso. C. Garín coll. 20/02/2013.

*Liolaemus zabalai.* SSUC Re 597–602. Near Los Barros, Laja Lagoon, Biobío Region, Chile. Collected by J. Troncoso-Palacios, F. Urra and H. Díaz. 07/01/2014. MZUC 35607, 39567. Malleco, Volcán Antuco, Los Barros. Unknown coll.