

# *Insuetophrynus acarpicus* Barrio, 1970 (Anura: Rhinodermatidae): new distribution record at the edge of the Valdivian coastal range, southern Chile

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**Abstract:** We report a new locality record for the Mehuín Green Frog, *Insuetophrynus acarpicus* Barrio, 1970, a Critically Endangered species from southern Chile. The new locality is about 90 km southeast of the type locality and expands the known geographical distribution 40 km to the southeast. The new record confirms the presence of *I. acarpicus* south of the Lingue and Valdivia rivers. Our documentation demonstrates a discontinuous distribution of this frog in the Valdivian Coastal Range of Chile and intensifies the need to implement effective strategies for its conservation.

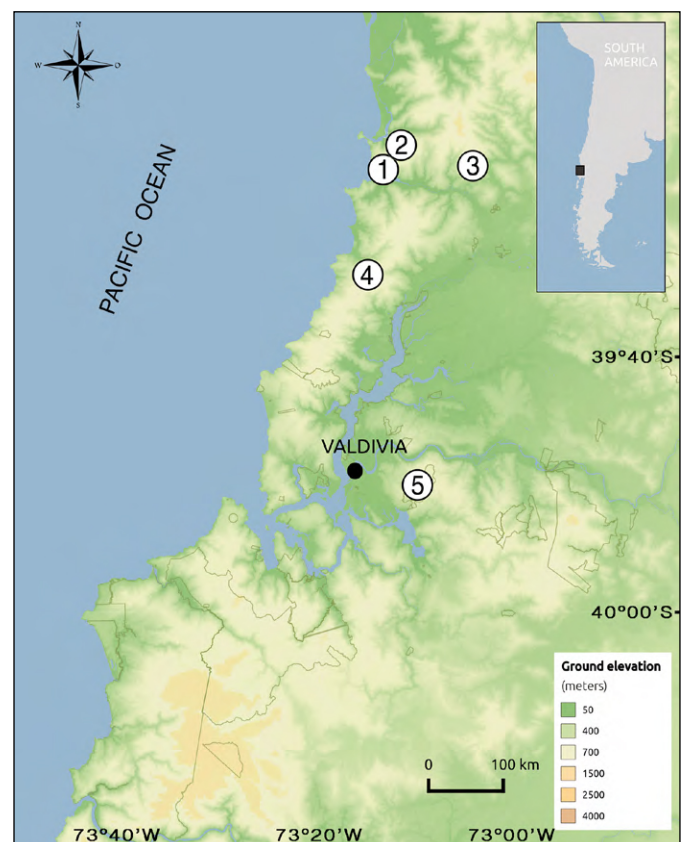
**Key words:** Amphibia, Critically Endangered, Mehuin Green Frog

*Insuetophrynus* is a genus of frog that has only one known representative, *Insuetophrynus acarpicus* Barrio, 1970, which is endemic to the temperate rainforests of Chile (FORMAS 1979). Since its description, this species has been recorded in only four places (BARRIO 1970; SOTO et al. 2002; MÉNDEZ et al. 2005; RABANAL & NUÑEZ 2012), but none of these localities are more than 20 km from the type locality. In ecological terms, this species is strongly aquatic and restricted to coastal streams on 19° to 38° slopes (DÍAZ et al. 1983; RABANAL & NUÑEZ 2012).

The type locality of *I. acarpicus* is a stream within a coastal drainage system. The stream has a sand and rock bottom with fast-flowing, clear water (DÍAZ & VALENCIA 1985). The dominant riparian vegetation includes *Luzuriaga radicans* Ruiz & Pav., *Blechnum blechnoides* (Bory) Keyserl., *Hipopterigium* sp., *Lophosoria quadripinnata* (J.F.Gmel.) C.Chr., *Hymenophyllum plicatum* Kaulf., and *H. caudiculatum* Mart.

Larval development of this species can take from 10 to 12 months, and recently metamorphosed individuals were found mainly in January (RABANAL & FORMAS 2009).

Currently, *I. acarpicus* is considered Critically Endangered by the IUCN (2016). This status is mainly due to small existing populations, rapid environmental deterioration, extremely



**Figure 1.** Distribution map depicting the known localities of *Insuetophrynus acarpicus* based on the new locality reported herein and literature records: (1) Mehuín (type locality); (2) Queule; (3) Colegual Alto; (4) Chan-chán; (5) new record of *Insuetophrynus acarpicus* in the Llancahue watershed.



**Figure 2.** An adult male *Insuetophrynus acarpicus* from Llancahue.

narrow distribution, and aquatic habitat specialization.

During a field survey on 15 December 2014, in Llancahue ca. 10 km southeast of the city of Valdivia (39°50' S, 073°10' W), Los Ríos region, Chile (Figure 1), we found one specimen of *I. acarpicus* in a small stream. In accordance with our permit (720/2016) issued by the Servicio Agrícola y Ganadero, we returned to the stream and found five specimens, of which, two were collected. The specimens were identified by one of us (J.J. Nuñez) by comparison to the original description (BARRIO 1970). One specimen was cleared and stained, following the methods of HANKEN & WASSERSUG (1981), to confirm the determination according to the cranial and carpal osteology. Both specimens were deposited in the Herpetological Collection of the Instituto de Ciencias Marinas y Limnológicas (ICMLH), Universidad Austral de Chile, Valdivia.

Both specimens presented the key characters of the species, which are the distinctive cranial features and toe webbing formula, as described in the original description (BARRIO 1970). Furthermore, cranial and carpal osteology of one specimen confirmed the identification. In dorsal view, live specimens presented granular or slightly warty bodies; the ventral region was also granular, and the gular region was smooth. Pectoral nuptial patches were slightly visible on one of the specimens (ICMLH006). In life, the dorsal pigmentation was greenish brown with small white granulations. The hind legs included a pattern of transverse dark bands (Figure 2).

The specimens were measured using a dial caliper (0.01 mm accuracy). Snout–vent length ranged between 28.08 and 33.26 mm (Table 1). The cleared specimen showed the

diagnostic characters reported by LYNCH (1978), which are composed of a firmisternal pectoral girdle and carpal elements without ossification. Other sympatric amphibian species observed during the survey of the area were *Eupsophus roseus* (Duméril & Bibron, 1841), *E. vertebralis* Grandison, 1961, *Alsodes valdiviensis* Formas, Cuevas & Brieva, 2002, *Pleurodema thaul* (Lesson, 1826), and *Batrachyla antartandica* Barrio, 1967.

The Llancahue watershed (1270 ha) provides important ecosystem services to the local human population, including biodiversity protection, a park for recreation, clean water, as well as an average 60% of the water supply for the city of Valdivia. Within this watershed is a native temperate forest fragment (ca. 700 ha) in a natural reserve, which is the nearest such natural reserve to the city of Valdivia. It represents part of a biodiversity hotspot and a threatened ecosystem (MOORMAN et al. 2013). These forests are mainly formed by Ulmo (*Eucryphia cordifolia*

**Table 1.** Quantitative external measurements (mm) of two *Insuetophrynus acarpicus* from Llancahue.

Character	ICMLH006	ICMLH007
Snout–vent length	33.26	28.08
Head length	10.38	9.06
Head width	12.22	9.69
Interorbital distance	7.68	5.20
Nostril–eye distance	3.56	2.58
Eye diameter	3.20	3.80
Femoral length	16.96	13.16
Foot length	24.68	20.12
Arm length	7.60	6.46
Hand length	8.46	6.40





**Figure 3.** The habitat of *Insuetophrynus acarpicus* in Llancahue.

Cav.), Tapa (*Laureliopsis philippiana* (Looser) R.Schodde), Olivillo (*Aextoxicon punctatum* Ruiz & Pav.), and Canelo (*Drimys winteri* G.R. Forst. & G. Forst.) among the canopy species, and sometimes Coihue (*Nothofagus dombeyi* Mirb. Oerst.) in emergent positions. Also growing at this locality are ferns such as Pesebre (*Megalastrum spectabile* (Kaulf.) A.R.Sm. & R.C. Moran), Ampe (*Lophosoria quadripinnata*), and *Hymenophyllum* sp. Climbing plants are represented by Voqui (*Boquila trifoliolata* (DC.) Decne.), Quilineja (*Luzuriaga radicans*), Botellita (*Mitraria coccinea* Cav.). Herbaceous plants include Coral Bead (*Nertera granadensis* (Mutis ex L.f.) Druce), and among shrubs and understory species the dominants include the bamboo Quila (*Chusquea quila* Kunth; in gaps and more open conditions), Arrayán (*Raphythamnius spinosum* (A.L. Juss.) Mold.) and Fuinque (*Lomatia ferruginea* (Cav.) R.Br.). We observed a moss at the site, *Hypopterygium arbuscular* Brid. The aquatic habitat and environment of *I. acarpicus* in Llancahue is shown in the Figure 3.

**Table 2.** List of frog species present in the Llancahue watershed. Conservation status according to the IUCN (2016).

Species	Conservation status
<i>Alsodes valdiviensis</i>	Data Deficient
<i>Batrachyla taeniata</i>	Least Concern
<i>Batrachyla leptopus</i>	Least Concern
<i>Batrachyla antartandica</i>	Least Concern
<i>Eupsophus roseus</i>	Near Threatened
<i>Eupsophus vertebralis</i>	Near Threatened
<i>Insuetophrynus acarpicus</i>	Critically Endangered
<i>Pleurodema thaul</i>	Least Concern
<i>Rhinoderma darwinii</i>	Vulnerable
<i>Telmatobufo australis</i>	Vulnerable

Until now there were nine frog species reported from the Llancahue watershed (Table 2). Two anurans from this forest are classified as Vulnerable (*Rhinoderma darwinii* (Duméril & Bibron, 1841), *Telmatobufo australis* Formas, 1972), and one was recently proposed as Endangered (*Alsodes valdiviensis*; OLIVARES et al. 2014). In the context of the distribution of amphibians in Los Ríos region, the presence of *I. acarpicus* in Llancahue watershed provides an occurrence record at the edge of the Coastal Range where it contacts the Intermediate Depression of Chile. This occurrence record extends the known distribution of *I. acarpicus* southeast of the type locality by about 90 km (in straight line) (Figure 1). This is the southernmost known record for the species and the first record south of the Valdivia River. Currently, we are not able to advance a specific biogeographical hypothesis about this new record, but nevertheless, the presence of *I. acarpicus* in the Llancahue watershed is evidence that this species once occurred more widely than was originally thought.

From a conservation point of view, the high level of fragmentation observed in some localities containing this habitat type, mainly Chan-chán and Colegual Alto, illustrates the importance of protecting what remains of local habitats. No doubt, habitat deterioration could negatively affect genetic diversity in *I. acarpicus*, as well as make this species more susceptible to stochastic environmental changes, and localized extinction. In fact, MÉNDEZ et al. (2006) reported low levels of genetic diversity at three localities. This suggests that these populations could be in decline, possibly due to inbreeding depression. Thus, the presence of *I. acarpicus* in Llancahue intensifies the need to implement effective conservation strategies in this area.

## ACKNOWLEDGEMENTS

We thank Seremi del Medio Ambiente of Región de Los Ríos, DID-UACH 2014-16, the Association of Zoos and Aquariums and their Conservation Endowment Fund (grant No. 08-809), the Sophie Danforth Conservation Biology Fund, the George and Mary Rabb Foundation, the Chicago Board of Trade Endangered Species Fund, the San Antonio Zoo, and the Shared Earth Foundation for support of our ongoing fieldwork. We thank also William W. Lamar and Tim Paine for assistance in the field. This is a contribution of Núcleo Transdisciplinario en Estrategias Socio-Ecológicas para la Sostenibilidad de los Bosques Australes (TESES).

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**Authors' contributions:** DPE, APO, DF, and JJJ carried out fieldwork that resulted in the collection of the new specimens. DPE measured the specimens, and prepared the cleared specimens. JJJ conducted morphological analyses to verify the taxonomic determination. DPE, DF, APO, and JJJ together wrote the text.

**Received:** 5 March 2016

**Accepted:** 31 December 2016

**Academic editor:** Ivan Nunes