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Updating the distributions of four Uruguayan hylids (Anura: Hylidae): recent expansions or lack of sampling effort?

[1,2]Gabriel Laufer, [1,3]Noelia Gobel, [1,4]Nadia Kacevas, [1]Ignacio Lado, [1,5]Sofía Cortizas, [2]Magdalena Carabio, [6]Diego Arrieta, [6]Carlos Prigioni, [6]Claudio Borteiro, and [6,]*Francisco Kolenc

[1]*Área Biodiversidad y Conservación, Museo Nacional de Historia Natural, MEC, Miguelete 1825, 11800 Montevideo, URUGUAY* [2]*Vida Silvestre Uruguay, Canelones 1198, 11100 Montevideo, URUGUAY* [3]*Sistema Nacional de Áreas Protegidas, DINAMA-MVOTMA, Galicia 1133, 11100 Montevideo, URUGUAY* [4]*Departamento de Ecología y Biología Evolutiva, Departamento de Biodiversidad y Genética, Instituto de Investigaciones Biológicas Clemente Estable, Av. Italia 3318, 11600 Montevideo, URUGUAY* [5]*Instituto Tecnológico Regional Centro Sur, Universidad Tecnológica del Uruguay, Francisco Antonio Maciel s/n, 97000 Durazno, URUGUAY* [6]*Sección Herpetología, Museo Nacional de Historia Natural, MEC, Miguelete 1825, 11800 Montevideo, URUGUAY*

***Abstract*.—This study reviews the geographic distributions of four hylid frogs native to Uruguay: *Dendropsophus nanus*, *D. minutus*, *Lysapsus limellum*, and *Scinax nasicus*. Their current conservation status in Uruguay, according to the IUCN red listing criteria, is Endangered, as few locality records were available and published in the herpetological literature to date. Herein, new field data and observations from citizen science were gathered to review their occurrence in Uruguay more comprehensively. New records are provided that significantly expand their distribution ranges and the numbers of known populations. This information, along with the apparent tolerance of these species to habitat disturbance associated with agriculture, allowed us to reconsider their conservation status in Uruguay. Recent southward range expansions in this country were observed for *D. minutus* and *S. nasicus*, and similar phenomena are discussed for *Physalaemus riograndensis* and *Scinax fuscovarius*. According to new new data presented here, we recommend considering *D. nanus*, *D. minutus*, and *S. nasicus*, as Least Concern species locally, given their large distribution areas and many locality records in different environments. We also recommend downgrading *L. limellum* to the Vulnerable category, as it is currently known from less than ten localities in Uruguay. These examples emphasize the importance of fieldwork and citizen science for considering the conservation status of poorly known taxa, and the potential impacts of climate change scenarios.**

Keywords. Climate change, IUCN conservation status, *Dendropsophus nanus*, *Dendropsophus minutus*, *Lysapsus limellum*, range expansion, *Scinax nasicus*

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Introduction

The Neotropical Region is characterized by its high diversity of amphibians, especially anurans. This large biogeographic region has important numbers of endemic species and families (Duellman 1999). The herpetofauna of Uruguay, in the southern region of the Neotropics, is mainly composed of species associated with the Pampas biome, which comprises Uruguay, part of northeastern Argentina, and the extreme south of Brazil (Achkar et al. 2016). However, some taxa occurring in northern Uruguay are widely distributed in central South America, associated with other adjacent biomes (i.e., Espinal, Chaco, and Atlantic Forest), reaching the southern boundaries of their distributions in Uruguay. Examples include the anuran hylids *Dendropsophus minutus*, *Dendropsophus nanus*, *Lysapsus limellum*, and *Scinax nasicus*. These frogs are conspicuous and abundant species throughout their geographic ranges, but the categorization of their conservation status in Uruguay has been controversial. For instance, González (2001) did not consider them as imperiled species based on field observations, but Canavero et al. (2010) indicated that *L. limellum* would be endangered because of a restricted

Correspondence. **fkolenc@gmail.com*

distribution range. Coincidently, Arrieta et al. (2013) only listed the last species as being of conservation priority at the national level because of the scarcity of available information at that time. In contrast, these four species were recently considered as Endangered in Uruguay according to the IUCN categorization scheme because of their restricted geographic distributions, relatively low numbers of known populations, and the possible threat of intensive land use for agriculture (Carreira and Maneyro 2019).

It must be noted that scarce and geographically biased field survey efforts for amphibians have been carried out historically in Uruguay, which is made evident by the relatively recent discovery of unknown populations of several poorly known species, e.g., *Julianus uruguayus* by Kolenc et al. (2003), *Pleurodema bibroni* by Kolenc et al. (2009), and *Ololygon aromothyella* by Laufer et al. (2009). The distributions of some of these poorly known and putatively endangered amphibians in Uruguay have been underestimated, and for this reason, this work reviews the local occurrence of *D. minutus*, *D. nanus*, *L. limellum*, and *S. nasicus*. Fieldwork and citizen science observations over the last 20 years have allowed us to become familiar with these species in their habitats, collect new data that extend their national ranges, increase the numbers of known populations, estimate the impacts of land use and modification on them, and reconsider the local conservation status of these frogs. Based on this data, the possibility that some of these species may be experiencing a recent and rapid southward expansion of their geographic distributions is also discussed.

Materials and Methods

The field surveys consisted of night encounters for the detection of adult amphibians, by direct sighting and/or listening to nuptial calls (Dodd 2010). Some voucher specimens were collected, euthanized with an overdose of Eugenol or intracoelomic injection of lidocaine, fixed in formalin, and deposited in the herpetological collections of the Departamento de Zoología Vertebrados (ZVCB), Facultad de Ciencias, and Museo Nacional de Historia Natural (MNHN), Montevideo, Uruguay. Although this communication is based on our own fieldwork data, complementary information was obtained from the Uruguayan Biodiversidata database (available from https://biodiversidata.org) and the iNaturalist citizen science database (available from https://www.inaturalist.org). Biodiversidata is an open database, managed by experts from national and international institutions working on biodiversity (Grattarola et al. 2019). The iNaturalist database includes images and sound records from community-based surveys, which are added to the iNaturalist website, and confirmed by international specialists. When a record reaches confirmation by at least two specialists, it is classified as being of "Research Grade" (Van Horn et al. 2018). All records of the studied species included here are ones that presented this qualification. In addition, previously published records were included, such as those in regional publications not widely available, and in online literature databases.

The records were mapped for each of the four species, and their extent of occurrence in Uruguay were obtained by joining the most peripheral record points in a polygon. For records located very close to the country borders, these limits were considered in building the polygon. The resulting distributions were used for a reassessment of the species conservation status at the national level using the *IUCN Red List of Threatened Species* criteria (IUCN 2012).

With the objective of evaluating whether any of these four hylids specialized in habitat use, information about the environment was collected whenever possible. Three main types of environments were considered for this attribute: Crops (rainfed crops, rice, and *Eucalyptus* and/or *Pinus* afforestation), Natural (grasslands, wetlands, and native forests with low anthropic influence including extensive cattle farms), and Urban (urbanized and peri-urban areas, routes or industrial facilities). In this way, the percentages of records corresponding to each one of these characteristic environments were calculated. The Chi-square test (χ^2) was used to assess whether the records for each species were evenly distributed among the three environment types (Rayat 2018). Data analyses were done in R open software, and $\alpha < 0.05$ was the criterion for achieving significance (R Core Team 2019).

Results and Discussion

New Records

For better visualization of new geographical data and the discussion of conservation status, the updated distributions of the studied taxa in Uruguay are pictured considering previously published records of accessions in herpetological collections (Fig. 1). The new species records are as listed here, where NV indicates non-vouchered specimens represented by call and/or visual records in the surveys.

Dendropsophus minutus. Departamento de Cerro Largo: Aceguá (NV, 11 July 2011; NV, 22 October 2012; MNHN 9551, 6 February 2013; NV, 23 November 2018); Paso de la Mina (NV, 11 November 2017); Isidoro Noblía (NV, 19 December 2016); Paso Centurión (Biodiversidata, 2015, day and month not available); Melo (MNHN 9922, 22 October 2003); Melo, National Route 8, 2 km southeast from Melo (Biodiversidata, 23 October 2003); Surroundings of Río Branco city (Biodiversidata, 22 January 2014). Departamento de Treinta y Tres: access to the protected area Quebrada de los Cuervos (MNHN 9925, 2 December 2001); Quebrada de los Cuervos (MNHN 9923, 1 October 2001; MNHN 9304, 9 November 2002; MNHN 8503 and MNHN

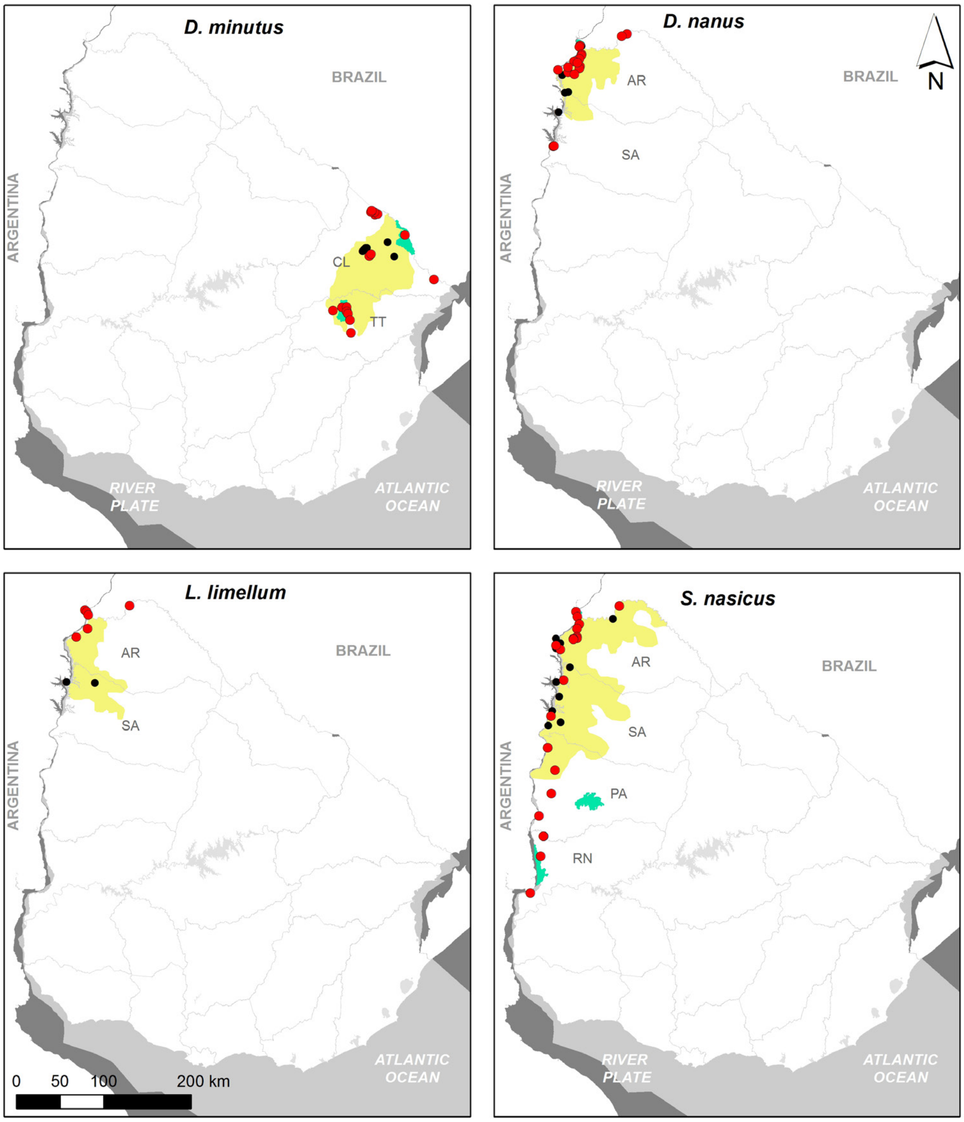

Fig. 1. Distribution of *Dendropsophus minutus*, *D. nanus*, *Lysapsus limellum*, and *Scinax nasicus* in Uruguay. Shaded areas correspond to estimated distributions according to Carreira and Maneyro (2019, yellow), and the closest national protected areas (green). Black dots indicate previous literature records from Gudynas and Rudolf (1983), Langone and Basso (1987), Olmos et al. (1997), Kolenc et al. (2003), Núñez et al. (2004), and Prigioni et al. (2011). New records in the present study are indicated in red. Department names are indicated as follows: AR, Departamento de Artigas; SA, Departamento de Salto; PA, Departamento de Paysandú; RN, Departamento de Río Negro; CL, Departamento de Cerro Largo; and TT, Departamento de Treinta y Tres.

8068, 2 March 2009; MNHN 9933, 25 November 2014; NV, 5 March 2015); National Route 8, 5 km northward from Ciudad de Treinta y Tres (NV, 15 January 2020); National Route 8, 20 km northward from Ciudad de Treinta y Tres (MNHN 9924, 2 November 2009); Route 98, ca. 7 km northward from Isla Patrulla (MNHN 9926, 2 November 2009).

Dendropsophus nanus. Departamento de Artigas: ALUR, ponds on roadsides of industrial facilities (MNHN 9929–9930, 15 January 2004); Arroyo Falso Mandiyú at National Route 3, artificial pond for irrigation of sugarcane (NV, 12 March 2002); Arroyo Itacumbú, marshes satellite to main course (NV, 11 March 2002); Arroyo Lenguazo, CALPICA, dam on main stream (NV, 12 February 2003); Arroyo Yacaré, close to Río Cuareim (ZVCB 8281–8282, 15 January 1999); Bella Unión, pond in urban area (MNHN 9428–9430, 9 February 2011); CAINSA, National Route 3 km 615, pond on the roadside (MNHN 9931, 13 January 2003); CALVINOR, artificial pond for irrigation of intensive crops (NV, 13 January 2001); Colonia Viñar, National Route 30 km 5, artificial dam on creek for irrigation of sugar cane (MNHN 9927 and ZVCB 10248, 19 January 2002); COPCABU, close to the Uruguay River, dammed creek for irrigation of rice (MNHN 9928, 13 January 2003); Establecimiento Amorós, National Route 3 km 609 (ZVCB 10246, 13 December 2001); Paso del León (MNHN 9480 and MNHN 9481, 5 December 2012). Departamento de Salto: pools for wastewater treatment and lagoon edge, Salto Grande Dam (MNHN 9934, 16 November 2019); surrounding area of Salto Grande Dam

(Biodiversidata, 15 February 2013).

Lysapsus limellum. Departamento de Artigas: Bella Unión, outskirts of urban area (NV, February 2001); Bella Unión, Los Pinos, cattle pond (MNHN 9919, 10 February 2011); CAINSA, National Route 3 km 615, artificial pond (NV, 25 March 2019); COPCABU, close to Uruguay River, artificial pond for rice irrigation (MNHN 9920, 13 January 2003); Paso del León (MNHN 9482–9484, 4 December 2012, and Biodiversidata); Rincón de Franquía, marshes (NV, February 2011).

Scinax nasicus. Departamento de Artigas: ALUR, ponds on roadsides of industrial facilities (MNHN 9914, 14 December 2001); Arrocera Conti, human habitation and rice crops area (MNHN 9126, MNHN 9128–9133, MNHN 9137–9138, 13 October 1981; MNHN 9235–9236, 28 November 1981); Arroyo Ñaquiñá, los Espinillos farm, dammed creek for cattle and irrigation of rice (NV, 9 January 2003); Arroyo Tigre when joining the Uruguay River (MNHN 9921, 6 March 2004); Bella Unión, Parque Rivera, on roadside ponds (MNHN 9917, 8 January 2001); Bella Unión, Los Pinos (MNHN 9916, 10 February 2011); CAINSA, National Route 3 km 615, artificial pond (NV, 15 January 2004); Colonia Viñar, National Route 30 km 5, artificial dam on creek for irrigation of rice (MNHN 9913, 19 January 2002); National Route 3 km 596 (MNHN 9918, 13 March 2002); National Route 30 km 4, artificial pond for livestock (MNHN 9915, 18 March 2002); Paso del León (Biodiversidata, 4 December 2012). Departamento de Salto: Arroyo Boicuá, gallery forest (MNHN 9349); surrounding area of Salto Grande Dam (Biodiversidata, 15 February 2013). Departamento de Paysandú: Paysandú city (iNaturalist, 9 January 2020); Río Queguay, close to Lorenzo Geyres (MNHN 9912, January 1989); surroundings of Meseta de Artigas, natural forest (iNaturalist, 14 February 2020); Termas de Guaviyú (MNHN 8213, December 1998). Departamento de Río Negro: Route 24, south of Arroyo Negro (iNaturalist, 22 December 2019); Route 24, south of Arroyo Negro (iNaturalist, 2 February 2020); crops surrounding Esteros de Farrapos e Islas del Río Uruguay National Park (MNHN 9932, 3 November 2018); M´Bopicuá (NV, 18 November 2002).

Species Distributions

Dendropsophus minutus was first included in the Uruguayan herpetofauna by Olmos and collaborators (1997), who found it at a few localities in Cerro Largo Department in 1996. Previous citations of this species from Uruguay correspond to specimens of *Julianus uruguayus*, when the two taxa were considered synonymous (i.e., Braun and Braun 1974, as *Hyla minuta*). More recently, new records of *D. minutus* were available from the protected area Quebrada de los Cuervos y Sierras del Yerbal, in Treinta y Tres Department, where the species occupies natural and artificial lentic water bodies (Kolenc et al. 2003; Prigioni et al. 2011). It is noteworthy that *D. minutus* was reported quite recently from northeastern Uruguay, given its current abundance, high population density, and the fact that it can be easily identified and detected by its conspicuous advertisement call. Furthermore, males can be heard vocalizing for an extended period during the entire spring and summer (Prigioni et al. 2011). This frog was not detected during inventory systematic surveys of vertebrates in the protected area Quebrada de los Cuervos y Sierras del Yerbal, held between October 1988 and January 1991 (Simó et al. 1994). However, the species was established in the area at least since the early 2000s, being one of the most common amphibians during night acoustic surveys in the warmest periods of the year (e.g., Prigioni et al. 2011; Laufer et al. 2015). Currently, *D. minutus* can be found farther south. These historical and new observations suggest that *D. minutus* is expanding its geographic range in Uruguay, in a southward direction. This expansion first occurred over hilly landscapes of the ecoregion Serranías del Este, but more recently in adjacent lowland areas close to Treinta y Tres city. This range expansion may have been aided by climate change and/or the ability of the species to colonize both natural and artificial ponds constructed for cattle, and also altered areas such as those with exotic forest plantations of *Pinus* and *Eucalyptus* (G. Laufer, pers. obs.) (Fig. 2). The same phenomenon has possibly occurred with the hylid *Scinax fuscovarius* which is associated with the hilly landscapes of northern Uruguay. Examples of this species were not known in the country until the early 1990s (see Arrieta and Maneyro 1999), but currently it is a fairly common and abundant frog in much of Rivera, eastern Artigas, and northern Tacuarembó Departments (C. Borteiro and F. Kolenc, pers. obs.). Although this area was not thoroughly surveyed historically, it is unlikely that this relatively

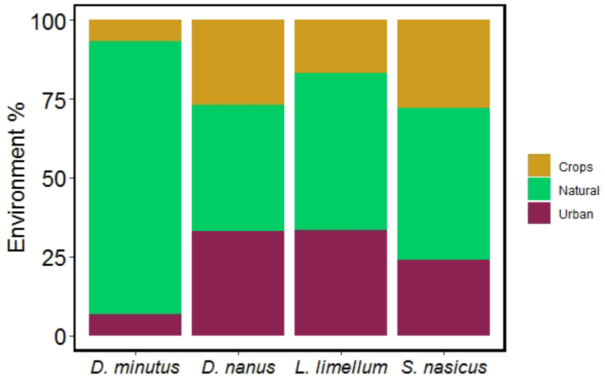

Fig. 2. Occurrence of *Dendropsophus minutus* (n = 15), *D. nanus* (n = 15), *Lysapsus limellum* (n = 6), and *Scinax nasicus* (n = 21) in different types of environments. Crops include rainfed crops, rice, sugar cane, and *Eucalyptus* and/or *Pinus* afforestations; Natural includes the grasslands, wetlands, and native forests with low anthropic influence (i.e., extensive livestock farming); and Urban refers to urban and peri-urban areas, routes, or industrial plants.

large, conspicuous, and common peri-domiciliary hylid, if present, would have passed uncollected. Monitoring of the distributions of these hylid frogs in Uruguay merit future studies.

Another frog that apparently underwent a significant range expansion in Uruguay is the leptodactylid *Physalaemus riograndensis*. This small and noisy species, whose advertisement call can be heard mostly during the summer months, was first cited for northern Uruguay by Cei and Roig (1961). This was later corroborated by the observations of Prigioni and Langone (1983), who also listed specimens from the east (Plácido Rosas, Cerro Largo), collected in 1982. Later, Prigioni and García Sánchez (2002) described the tadpole of *P. riograndensis* based on specimens collected in 1988, ca. 130 km farther south at La Coronilla, Rocha Department. The species is currently a conspicuous component of wetlands of the Laguna Merín basin in much of eastern Uruguay, and over sandy habitats of the Atlantic coast of Rocha in the southeast from the locality Barra de Valizas to the border with Brazil (Borteiro and Kolenc 2007; Prigioni et al. 2011). Barra de Valizas (its southernmost known locality; Borteiro and Kolenc 2007) was thoroughly surveyed by one of the authors (F. Kolenc) during the second half of the 1980s and the species was not present there at that time (see also Vaz-Ferreira et al. 1966). These historical records and surveys by the authors suggest a range expansion of *P. riograndensis* over the wetlands in the eastern plains of Uruguay, at least since the 1980s.

Three additional species of amphibians recently known from only a few specimens collected in less than five localities in northern Uruguay, are widely distributed in adjacent areas of Brazil and Argentina: *Boana albopunctata*, *Leptodactylus furnarius*, and *Physalaemus cuvieri* (Canavero et al. 2001; Kwet et al. 2002; Maneyro and Beheregaray 2007). In these cases, it is difficult to assess whether a range expansion took place or, alternatively, if those findings are just evidence of a lack of sampling effort close to the border with Brazil.

Three of the species studied here, *D. nanus*, *L. limellum*, and *S. nasicus,* are widely distributed in association with the Chaco and Espinal biomes, and they marginally reach northwestern Uruguay in a narrow lowland area of grasslands adjacent to the Uruguay River, and westward from the hilly formation Cuchilla de Haedo.

The presence of *D. nanus* in this country was first communicated by Langone and Basso (1987) through evidence of two localities in the northern Artigas Department, at Barra del Arroyo Yacuí, and 6 km NW from Belén. It was recently categorized as Endangered because of its limited distribution, agricultural land use, and the construction of the Salto Grande hydroelectric dam in the Uruguay River (Carreira and Maneyro 2019). However, it is fairly abundant at the several localities cited above for the Artigas and Salto Departments and also in their surroundings. This frog is almost invariably present in cattle ponds and the shallow areas in hundreds of medium to large artificial lagoons used for agriculture, which are produced by dams built on creeks and streams, that range from a few to hundreds of ha in area (Uruguay 2000; Fig. 2). Besides, it is commonly found in the water bodies which are satellites to the main lake of the Salto Grande Dam (G. Laufer and N. Gobel, pers. obs.).

Gudynas and Rudolf (1983) were the first to report the collection of a specimen of *L. limellum* in northwestern Uruguay, at Termas del Arapey in 1973, and the species has been viewed as a rarity in the Uruguayan herpetofauna since then. We observed during field surveys that this frog mostly inhabits vegetated man-made water bodies. It colonizes cattle ponds and small dams built as water reservoirs for the irrigation of rice and sugarcane (Fig. 2). Large choruses were detected in shallow waters, and up to approximately 2 m depth, in rice crop water reservoirs. Specimens of *L. limellum* were reported to disperse from the Paraná River system in Argentina across the De la Plata River in large masses of floating vegetation, mainly composed of water hyacinths (*Eichhornia crassipes*) that occasionally aggregate in southern Uruguay (Achaval et al. 1979), but we do not know of any successfully established populations near the De la Plata River shores in Uruguay.

The new locality reported in this work for *S. nasicus* at M´Bopicuá, is about 193 km (straight-line distance) south from the previous southernmost record in Uruguay by Núñez and collaborators (2004, Fig. 1). Other encounters south from the previously known distribution are also reported here. The behavioral ecology of *S. nasicus* in northern Uruguay suggests wide plasticity in habitat use, as also observed elsewhere (Kacoliris et al. 2006; Entiauspe-Neto et al. 2016). Our data indicate that it is frequent and abundant in northwestern Uruguay, inhabiting natural water bodies but also anthropized and urban areas, even inside human habitations (Fig. 2). This was expected considering its latitudinal distribution in Argentina, on the other side of the Uruguay River (Agostini et al. 2016).

Conservation Status and Threat Considerations

The conservation assessment of Uruguayan amphibians has rarely been based on systematic field surveys (i.e., Kolenc et al. 2009), but has relied mostly on previous records in herpetological collections or a researcher's perception of species status (Carreira and Maneyro 2019). In this case study, the several new records for each of the four studied species significantly extend their ranges and known populations. These records were obtained from a wide diversity of environments, such as urbanized areas, human habitations, backyards, grasslands, the edges of native forests, and areas of intensive agriculture and cattle production (Fig. 2). In fact, in most cases, the records were distributed approximately evenly among the environments. The distributions of *D. nanus* (χ^2 = 0.2, df = 2, P = 0.9), *L. limellum* (χ^2 = 0.5, df = 2, P

= 0.8), and *S. nasicus* (χ^2 = 0.9, df = 2, *P* = 0.6), were equiprobable among the three different environment types. The greatest difference appears for *D. minutus*, for which the records corresponded mostly to the Natural environment type (χ^2 = 8.9, df = 2, *P* = 0.01; Fig. 2). The distribution of this species is mainly associated with Serranías del Este, an ecoregion characterized by a low grade of urbanization and extent of intensive agriculture (Evia and Gudynas 2000).

The lack of previous data does not allow the differentiation between episodes of recent dispersal and low sampling effort, at least in *D. nanus* and *L. limellum*. In the case of *S. nasicus,* its presence in southern Paysandú and Río Negro Departments seems to be recent. In any case, they are each common and abundant species. Their distributions in Uruguay largely overlap with those of the toad *Rhinella diptycha* and the frog *Lepatodactylus chaquensis* (Núñez et al. 2004), species currently not considered as Endangered, and that eventually may face similar threats due to habitat alterations.

It should be noted that for all the studied species, the potential threats to their conservation are mainly related to habitat alteration and biological invasions. Another significant potential hazard for amphibians in northwestern Uruguay is the strong and increasing advance of intensive agriculture, especially soybean crops and *Eucalyptus* plantations (Brazeiro et al. 2020; Soutullo et al. 2020). In fact, there is already evidence that agrochemicals and the eutrophication of lentic systems (breeding sites) negatively affect individual fitness, with empirical regional evidence in *S. nasicus* (Peltzer et al. 2008), *L. limellum* (Attademo et al. 2015), *D. nanus* (Suarez et al. 2016), and *D. minutus* (Gonçalves et al. 2015). However, the widespread construction of ponds and dams for cattle and irrigation of rice and sugarcane crops have favored the persistence of these and several other amphibian species and reptiles in agricultural areas with intensive land use, including those studied herein (Borteiro 2005; Borteiro et al. 2008). Furthermore, like other congeners (i.e., *S. granulatus* and *S. fuscovarius*), *S. nasicus* is commonly found in peridomestic environments and breeds in artificial water bodies as we observed in the study area. Carreira and Maneyro (2019) indicated that the Salto Grande Dam constitutes a threat to local populations of amphibians, particularly *D. nanus* and *S. nasicus*. However, the construction of that dam produced minimal habitat loss as compared to total potential habitat of the studied species in northwestern Uruguay. In addition, studies on the possible impact following the construction of the dam indicated the use of its available new habitats by some amphibian species, such as *Leptodactylus luctator*, *Melanophryniscus atroluteus*, *Rhinella diptycha*, and *R. dorbignyi*, also as breeding sites (Vaz-Ferreira et al. 1981, 1982).

Another major threat to the studied species is the invasive American Bullfrog (*Lithobates catesbeianus*), that is rapidly expanding in Uruguay (Laufer et al. 2018). Although there are records of this invader near the coast of the Uruguay River, its greatest expansion was recorded in the east. In Cerro Largo Department, *D. minutus* is present at sites that are being colonized by this invasive anuran (Laufer and Gobel 2017).

The new records indicate that the studied species are present in larger extents of occurrence than previously considered in Uruguay (*D. minutus* 7,685 km^2, *D. nanus* 3,046 km^2, *L. limellum* 3,116 km^2, and *S. nasicus* 7,329 km^2), with each one occurring in more than ten different localities (except for *L. limellum*), and showing plasticity in habitat use, which merit reconsiderations of their current local conservation status levels. Additionally, there is no evidence of reductions in the number of populations or range retractions for any of them. None of these four species qualify for their currently assigned categories in the *IUCN Red List of Threatened Species* at our national level. We consider that *D. minutus*, *D. nanus*, and *Scinax nasicus* should be considered locally as Least Concern, and only *L. limellum* as Vulnerable, due to its restricted distribution in a few localities in northern Uruguay. These assumptions are reinforced by the fact that the studied species were identified in several national SNAP protected areas (Sistema Nacional de Áreas Protegidas): Rincón de Franquía (Artigas Department, except for *D. minutus*), Esteros de Farrapos e Islas del Río Uruguay (Río Negro Department, *S. nasicus*), Esteros y Algarrobales del Río Uruguay and probably in Montes del Queguay (Paysandú Department, *S. nasicus*), the projected protected area Humedales e Islas del Hum (Soriano and Río Negro Departments, *S. nasicus*), and Quebrada de los Cuervos y Sierras del Yerbal, and Paso Centurión y Sierra de Ríos (Cerro Largo and Treinta y Tres Departments, *D. minutus*). These areas have great potential for the conservation of many of the poorly known components of the native herpetofauna in Uruguay.

Niche modelling projections under presumed future climate change scenarios show that the four hylid species studied in this work, and also *S. fuscovarius* and *P. riograndensis,* show potential range expansions at a 50-year time projection (Toranza 2011). According to our field observations, we believe that this range expansion has already been happening over the past 20–30 years, at least for some of these species.

Conclusions

This work underscores the need for continuing amphibian monitoring surveys in much of northern and eastern Uruguay. Despite the small size of this country, there is still a strong geographical bias in the knowledge of its biodiversity (Grattarola et al. 2019). We conclude that although it is laborious, the extensive collection of fieldwork data and collaborative work among herpetologists is mandatory for accurate assessments of the conservation needs of our native amphibians.

We also reinforce the importance of open biological databases and citizen science projects to increase the scientific knowledge and awareness to conserve native biodiversity.

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Gabriel Laufer has a Ph.D. in Ecology from the University of the Republic, Uruguay (UdelaR). Gabriel is currently an Adscript Researcher at the National Natural History Museum (MNHN) in Montevideo, Uruguay, works for the NGO Vida Silvestre Uruguay (VSUy) in conservation biology, and is a member of the Uruguayan National System of Researchers (SNI). Gabriel has authored several articles in international journals on the ecology and natural history of vertebrates. His research interests are in biodiversity conservation, biological invasions, protected areas, and amphibian ecology.

Noelia Gobel is a Ph.D. student in Ecology at the UdelaR and an honorary researcher of the National Natural History Museum (MNHN) in Montevideo, Uruguay. Her topics of interest and studies focus on the conservation of biodiversity and the effects of global change, community ecology, and food webs. Noelia has authored several publications on these topics.

Nadia Kacevas is a postgraduate student at the UdelaR, currently working as a Research Assistant in the Instituto de Investigaciones Biológicas Clemente Estable (IIBCE), and as an honorary collaborator at the MNHN. Her interests are focused on behavior, ecology, genetics, and contributing to the development of conservation strategies for the biodiversity of Uruguay through multidisciplinary approaches.

Ignacio Lado is a postgraduate student of the UdelaR. His interests are related to biodiversity conservation, biological invasions, geographic information systems, and biodiversity monitoring. Ignacio currently works as a biodiversity consultant for wind farms.

Sofía Cortizas is a Professor at the Technological University of Uruguay (UTEC) and she has an M.Sc. in Biodiversity Conservation from the University of Barcelona, Spain. Sofia has been participating in several projects on biological invasions, in which she has been working to understand the American Bullfrog's trophic niche and how it overlaps with those of native amphibian species.

Magdalena Carabio works in conservation biology at the NGO Vida Silvestre Uruguay (VSUy) and in environmental education at the NGO Julana. Magdalena has an M.Sc. in Environmental Sciences from the UdelaR. She has worked on projects related to anuran ecology, conservation management, conservation status indicators, environmental education, and citizen science, and she leads a private land protection program.

Diego Arrieta is currently working as the herpetological curator in the National Natural History Museum (MNHN) in Montevideo, Uruguay. Diego was trained in the Faculty of Sciences, UdelaR, in vertebrate biology. With a keen interest in the natural history of the amphibians of Uruguay, he has authored several articles in international journals and book chapters on this topic.

Carlos Prigioni worked in the Vertebrate Zoology Section of the Faculty of Sciences, UdelaR; in the Technical Department of Fauna of the Ministry of Livestock, Agriculture and Fisheries; in the Fisheries Management Group, National Directorate of Aquatic Resources of the same ministry; and as a Zoological Technician of the National Natural History Museum (MNHN) in Montevideo, Uruguay. He is currently retired and is an Associate Researcher at the MNHN in Uruguay. With his biological training, Carlos is the author of more than 170 works on vertebrate zoology, published in national and international journals. His interests are in the taxonomy, distribution, and biology of vertebrates, especially amphibians.

Claudio Borteiro is an Adscript Researcher in Herpetology at National Natural History Museum (MNHN) in Montevideo, Uruguay. He graduated as a Veterinarian from the Veterinary Faculty of UdelaR, working mainly as a small animal and exotic pet veterinary practitioner. He obtained a Ph.D. in Zoology at the Faculty of Sciences, and is currently a member of the National System of Researchers (SNI). With broad research interests in the natural history of Neotropical amphibians and reptiles, his scientific works focus mainly on systematics, taxonomy, conservation, and amphibian diseases.

Francisco Kolenc is currently an Adscript Researcher in the Herpetology Department of the National Natural History Museum (MNHN) in Montevideo, Uruguay, and a member of the National System of Researchers (SNI) of Uruguay. Francisco has authored several articles in international journals on Neotropical amphibians and reptiles. His main research interests are in the natural history, systematics, taxonomy, evolution, and larval forms of Neotropical amphibians.