



Research note

A new record for American Bullfrog (*Lithobates catesbeianus*) in San Juan, Argentina

Nuevo registro de rana toro americana (*Lithobates catesbeianus*) en San Juan, Argentina

Eduardo Sanabria^{1*}, Yanina Ripoll^{1,2}, Marcelo Jordan^{1,2}, Lorena Quiroga¹, Mariano Ariza², María Guillemain², Mauricio Pérez² and Héctor Chávez²

¹Departamento de Biología, Facultad de Ciencias Exactas Físicas y Naturales, Universidad Nacional de San Juan. Av. Ignacio de la Roza y Meglioli. 5400 San Juan, Argentina.

²Subsecretaría de Medio Ambiente, Gobierno de la Provincia de San Juan. Av. Ignacio de la Roza y España. 5400 San Juan, Argentina.

*Correspondent: sanabria.eduardoa@gmail.com

Abstract. We report a new record of *Lithobates catesbeianus* (American bullfrog) from Argentina. *L. catesbeianus* was first introduced to San Juan Province 11 years ago in Calingasta Department, where the habitat is pre-cordilleran. The new record is for Zonda Department, San Juan Province, in the Monte desert region. Here, *L. catesbeianus* uses artificial ponds for reproduction and tadpole development. These ponds receive water from an irrigation system that connects the whole agriculture land in the region. The tadpoles use the irrigation canals to move among ponds. We suggest that legislation should be established to prevent future invasions and to achieve sustainable management of the wild American bullfrog populations in San Juan. Prevention of future invasion and management of established populations of this species requires the cooperation of numerous stake holders.

Key words: *Lithobates catesbeianus*, invasion, alien species, Monte desert, Argentina.

Resumen. Se presenta un nuevo registro de *Lithobates catesbeianus* (rana toro americana) en Argentina. *L. catesbeianus* fue introducida por primera vez a la provincia de San Juan hace 11 años en el Departamento Calingasta, donde el hábitat es pre-cordillerano. El nuevo registro es para el Departamento Zonda en la provincia de San Juan, en el desierto del Monte. En este sitio, *L. catesbeianus* usa estanques artificiales para la reproducción y desarrollo del renacuajo. Los estanques reciben agua de un sistema de riego que conecta todas las tierras de la agricultura en la región. Los renacuajos utilizan los canales de riego para moverse entre los estanques. Sugerimos que se establezcan leyes para prevenir invasiones futuras y para lograr un manejo integrado de las poblaciones silvestres de rana toro que se encuentran en San Juan. La prevención de futuras invasiones y el manejo de las poblaciones establecidas de esta especie requieren la cooperación de numerosas entidades tanto gubernamentales como privadas.

Palabras clave: *Lithobates catesbeianus*, invasión, especie exótica, desierto del Monte, Argentina.

The direct and indirect introduction of non-native species by humans is a growing biological concern. The reasons for such introductions are varied and include biological control, human consumption, pet trade, and others (Kraus, 2009). The consequences of these introductions can be destructive to native species and the environment (Begon et al., 2006). Impacts include the extinction or extirpation of natives, biotic homogenization, disruption of food webs, changes in primary productivity of ecosystem, changes in soil formation, and vectors of disease (Kraus, 2009). *Lithobates catesbeianus* can act as a vector for microorganisms, especially *Batrachochytrium*

dendrobatidis, the pathogen that causes chytridiomycosis in amphibians, which is the principal cause of global amphibian mass mortalities (Berger et al., 1998; Longcore et al., 1999; Ron and Merino, 2000; Daszak et al., 2003).

L. catesbeianus has been widely introduced around the world. In South America, it has been introduced to Brazil (Borges-Martins et al., 2002), Chile (Lever, 2003), Colombia (Rueda Almonacid, 2000), Ecuador (Cisneros-Heredia, 2004), Guayana (Rueda-Almonacid, 1999), Paraguay (Frost, 2009), Perú (Rueda-Almonacid, 1999), Uruguay (Laufer et al., 2008), and Venezuela (Hanselmann et al. 2004). Populations of *L. catesbeianus* have recently been reported from Argentina in the provinces of San Juan (Sanabria et al., 2005), Misiones (Pereyra et al., 2006),

Buenos Aires (Barrasso et al., 2009), Córdoba (Akmentins et al., 2009), and Salta (Akmentins and Cardozo, 2009). Here we report a new population of *L. catesbeianus* from San Juan Province, Argentina.

We discovered this new population in an agricultural area in Cerro Blanco, Zonda Department, San Juan Province, Argentina (31° 55' S, 68° 70' W; 650 m). The region is part of the phytogeographic province of Monte, which has an arid climate and a mean annual temperature of 17.3 °C (mean annual minimum and maximum: 10.4 and 25.7 °C, respectively) and a mean annual rainfall of 89 mm, which falls mainly in summer (Cabrera, 1994). The dominant native vegetation out of the agricultural region includes *Prosopis* sp., *Larrea* sp., *Opuntia* sp., *Trichocereus* sp. (Warner, 2004). There are artificial irrigation reservoirs within agricultural lands in this area. Interconnected irrigation canals transfer water from the principal irrigation channel, which is controlled by the provincial Departamento de Hidráulica.

We surveyed the area on 25 March 2009, and searched for reservoirs. At night, we visited 2 artificial ponds, looking for frogs for 2 hours in each one. Tadpoles were collected by hand, euthanized using an overdose of 2% xilocaine, fixed in 10% formalin, and preserved in 70% ethanol.

We captured 12 tadpoles representing various stages of development (6 at stage 25, 5 at stage 40, 1 at stage 42; Gosner, 1960). Five adult males and 7 juveniles were identified but not collected, due to the difficulty in access to the 5 m deep ponds. Males were singing at the time of sighting.

These specimens represent the second report of American bullfrogs in San Juan Province. The first record was for Calingasta Department in the pre-cordilleran environment at 1 500 m (Sanabria et al., 2005). The new record is 130 km east of Calingasta and represents an invasion of this species into the more xeric habitat of the Monte desert. In Zonda Department, the system of irrigation channels and artificial ponds connects all agriculture land. We observed tadpoles of *L. catesbeianus* in the channels and artificial ponds, which provide suitable habitat for the tadpoles to complete their development and for adults to mate. Akmentins and Cardozo (2009) reported the capture of American bullfrogs in ponds and irrigation channels, which the frogs apparently utilize as way of dispersion.

The native range of *L. catesbeianus* is eastern Canada and the United States to northeastern México (Frost, 2009). Ecologically, the American bullfrog is a highly adaptable species, which has led to its success invading several environments from deserts to tropics (Adams and Pearl, 2007). The ecological impacts of bullfrogs include competition with or even direct consumption of native

frogs. Their large size and voracious habits mean that they can decimate often vulnerable populations of myriad aquatic animals (Kraus, 2009). In central Argentina, *L. catesbeianus* has been reported to feed on amphibians, snakes, mammals, and invertebrates (Akmentins et al., 2009). The reproductive potential, trophic ecology, and prevalence of the parasitic fungus *B. dendrobatidis* are unknown for introduced populations of bullfrogs. Studies are needed to understand the impacts of this invasive species in San Juan Province and in other regions of Argentina. The American bullfrog was introduced in Argentina for 2 ways. First, by intentional or incidental releases from captive breeding. Second, by home range expansion of a population primarily localized in Rio Grande do Sul, Brazil (Pereyra et al., 2006; Akmentins and Cardozo, 2009). In San Juan, the species was first introduced at least 11 years ago. The lack of government regulation or control over illegal captive-breeding enterprises caused the establishment of numerous wild populations.

This type of finding is important because it provides vital information to determine the distribution of invasive species. Likewise, knowledge about the location of this species allows us to define the territories colonized by American bullfrog and propose control and management of these populations. Also, we suggest that current regulations should be reformed in order to prevent the establishment of additional populations of *L. catesbeianus* in Argentina. Furthermore, application of control measures and management of previously established populations of *L. catesbeianus* should employ various control measures while involving local residents and stakeholders as well as academic and governmental institutions.

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Literature cited

- Adams, M. J. and C. A. Pearl. 2007. Problems and opportunities managing invasive bullfrogs. Is there any hope? In *Biological invaders in inland waters: profiles, distribution and threats*, F. Gherardi (ed.). Springer, Dordrecht. p. 679-693.
- Akmentins, M. S. and D. E. Cardozo. 2009. American Bullfrog *Lithobates catesbeianus* (Shaw, 1802) invasion in Argentina. *Biological Invasions*, Doi: 10.1007/s10530-009-9515-3.
- Akmentins, M. S., L. C. Pereyra and J. N. Lescano. 2009. Primer registro de una población asilvestrada de rana toro (*Lithobates catesbeianus*) en la provincia de Córdoba, Argentina. *Notas sobre la biología de la especie. Cuadernos de Herpetología* 23:25-32.
- Barrasso, D. A., R. Cajade, S. J. Nenda, G. Baloriani and R.

- Herrera. 2009. Introduction of the American bullfrog *Lithobates catesbeianus* (Anura: Ranidae) in natural and modified environments: an increasing conservation problem in Argentina. *Shout American Journal of Herpetology* 4:69-75.
- Begon, M., C. Townsend and L. Harper. 2006. *Ecology from individuals to ecosystems*. Blackwell Publications, United Kingdom. 714p.
- Berger, L., R. Speare, P. Daszak, D.E. Green, A.A. Cunningham, C.L. Goggin, R. Slocombe, M.A. Ragan, A.D. Hyatt, K.P., McDonald, H.B. Hines, K.R., Lips, G. Marantelli and H. Parkes. 1998. Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. *Proceedings of the National Academy of Science* 95:9031-9036.
- Borges-Martins M., M. Di-Bernardo, G. Vinciprova and J. Measey. 2002. Geographic distribution. *Rana catesbeiana*. *Herpetological Review* 33:319.
- Cabrera, A. L. 1994. *Enciclopedia Argentina de Agricultura y Jardinería, Tomo II, Regiones Fitogeográficas Argentinas*, Editorial ACME S.A.C.I., Argentina. 85 p.
- Cisneros-Heredia, D. F. 2004. Geographic distribution: *Rana catesbeiana*. *Herpetological Review* 35:406.
- Daszak, P., A. A. Cunningham and A. D. Hyatt. 2003. Infectious disease and amphibian population declines. *Diversity Distribution* 9:141-150.
- Frost, D. R. 2009. *Amphibian species of the world: an online reference*. Version 5.3 (12 February 2009). Electronic Database accessible at <http://research.amnh.org/herpetology/amphibia/>. Accessed: 01.IX.2009.
- Gosner, K. L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* 16:183-190.
- Hanselmann, R., A. Rodríguez, M. Lampo, L. Fajardo-Ramos, A. Aguirre, A. Kilpatrick, J. P. Rodríguez and P. Daszak. 2004. Presence of an emerging pathogen of amphibians in introduced bullfrogs *Rana catesbeiana* in Venezuela. *Biological Conservation* 120:115-119.
- Kraus, F. 2009. *Alien reptiles and amphibian. A scientific compendium and analysis*. *Invading nature: Springer series in invasion ecology* 4, USA. 555p.
- Laufer, G., A. Canavero, D. Nuñez and R. Maneyro. 2008. Bullfrog (*Lithobates catesbeianus*) invasion in Uruguay. *Biological Invasions* 10:1183-1189.
- Lever, C. 2003. *Naturalized amphibians and reptiles of the world*. Oxford University Press, New York. 338p.
- Longcore, J. E., A. P. Pessier and D. K. Nichols. 1999. *Batrachochytrium dendrobatidis* gen. et sp. nov., a chytrid pathogenic to amphibians. *Mycologia* 91:219-227.
- Pereyra, M. O., D. Baldo and E. R. Krauczuc. 2006. La "rana toro" en la Selva Atlántica Interior Argentina: un nuevo problema de conservación. *Cuadernos de Herpetología* 20:37-40.
- Ron, S. R. and A. Merino. 2000. Amphibian declines in Ecuador: overview and first report of chytridiomycosis from South America. *Froglog* 42:2-3.
- Rueda Almonacid, J. V. 2000. Situación actual y problemática generada por la introducción de "rana toro" a Colombia. *Revista de la Academia Colombiana de Ciencias* 23 (suplemento especial):367-393.
- Sanabria, E. A., L. B. Quiroga and J. C. Acosta. 2005. Introducción de *Rana catesbeiana* (rana toro), en ambientes pre-cordilleranos de la provincia de San Juan, Argentina. *Multequina* 14:65-68.
- Warner, T. T. 2004. *Desert meteorology*. Cambridge University Press, New York. 595p.

