

Attempted predation of the toad *Rhinella marina* (Linnaeus, 1758) (Amphibia: Bufonidae) by *Leptodactylus rhodonotus* (Günther, 1868) (Amphibia: Leptodactylidae) in southeast Peru

Mark Thomas^{1,*}, Christopher Beirne^{1,2}, Elizabeth Bailey¹ and Andrew Whitworth^{1,3}

Leptodactylus rhodonotus (Günther, 1868), the white-lipped frog, is a large *Leptodactylid* frog, of the *L. pentadactylus* group (Heyer 1979, 2005). This species has been recorded along the Andean slopes and the lowlands of the upper Amazon Basin of Bolivia and Peru (200–2050m elevation); and is likely to exist in adjacent Colombia and Brazil (Frost, 2016). Parmelee (1999) reported that *L. rhodonotus* consumed 26 different species of prey, ranging from snails to millipedes and unusually a crab, suggesting that the dietary diversity of *L. rhodonotus* is ‘unique’ compared with other species of *Leptodactylus*. Where studied, other species from the genus *Leptodactylus* are known to have opportunistic and generalist dietary habits, principally feeding on ants, termites, beetles, annelids and spiders (Sugai, 2012; Camera, 2014; Pires & Vogt, 2015), and rarely on other anurans (Teixeira & Vrcibradic, 2003; Duellman, 2005).

The predation event reported here occurred at the Manu Learning Centre, on the Mascoitania reserve (-12.789403°S; -71.391126°W, 460 m a.s.l., WGS 84), in Amazonian southeast Peru. It is an 643 ha private reserve, which has been protected since 2002, it holds a research station and lodge, situated along the Alto Madre de Dios River, in the buffer zone of Manu National Park. The forest has been subject to varying human

disturbance over the last ~50 years through agriculture and logging. (see, Whitworth et al., 2016; Villacampa et al., 2016; Whitworth et al., 2017).

On 2 October 2015 at 19:12 h, an adult individual of *L. rhodonotus* was found within the cleared areas of the research station with a juvenile *Rhinella marina* (Linnaeus, 1758) being swallowed headfirst (Fig. 1A). The individual was removed (Fig. 1B) and both were weighed and measured. *L. rhodonotus* was 75 mm SVL and weighed 33 g, and *R. marina* was 34 mm SVL and weighed 3 g. The *R. marina* showed no obvious sign of injury after its removal, and both were released after measurements and photos were taken.

The Cane toad naturally occurs from northwestern Mexico to central Brazil, whereas introduced populations have been reported in the Caribbean and Pacific regions (Eastal, 1981), northwest Australia and Papua New Guinea (Lampo & DeLeo, 1998). When threatened, *R. marina* reacts by inflating their body and priming the parotoid glands. When the predator attacks, the glands are triggered which results in the delivery of toxins directly to the predators mouth (Jared et al., 2011). Whilst the effect of the toxins has been known to end in mortality for species in Australia (such as crocodiles, elapid snakes, and varanid lizards; see Beckmann et al., 2011), many Neotropical native species are known to predate on *R. marina* and their tadpoles (including caiman, snakes, & opossums; e.g. Zug & Zug, 1979; Garrett, 1993).

Here we report the presumed first known predation event of *L. rhodonotus* on *R. marina* or any other anuran species as far as we are aware. This highlights *L. rhodonotus* as a novel predator of *R. marina* and documents its potential insensitivity to *R. marina* toxins. Parmelee (1999) reviewed the dietary tracts of the *Leptodactylus* genus, and concluded that because of the quantity of snails and millipedes (uncommon prey)

¹ The Crees Foundation. Urb. Mariscal Gamarra, B-5, Zona-1, 2da Etapa-Cusco, Perú

² Centre for Ecology and Conservation, University of Exeter, Penryn Campus, Cornwall TR10 9EZ, UK

³ Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UK

* Corresponding author e-mail: travelmark85@gmail.com



Figure 1. A) *Leptodactylus rhodonotus* in the act of consuming the juvenile *R. marina*, B) liberated *Rhinella marina* in the foreground. Photographs by Andrew Whitworth.

found, this makes *L. rhodonotus* unique in comparison to other *Leptodactylus* species. This finding provides additional support to Parmelee (1999) suggesting that *L. rhodonotus* does exhibit a ‘unique’ dietary composition.

Acknowledgments. We would like to thank The Crees Foundation (www.crees-manu.org) and its director, Quinn Meyer, for supporting the herpetological research at the Manu Learning Centre. Thanks to the Ministerio de Agricultura de Peru for providing the permit to conduct research (Permit number: 25397; Authorisation number 904-2012-AG-DGFFS-DGEFFS). Finally, special thanks to Rudolf von May for providing the pre-review of this manuscript and providing helpful comments.

References

Beckmann, C., Crossland, M.R., Shine, R. (2011): Responses of Australian Wading Birds to a Novel Toxic Prey Type, the Invasive Cane Toad *Rhinella Marina*. *Biological Invasions* **13**: 2925–2934.

- Camera, B.F., Krinski, D., Calvo, I.A. (2014): Diet of the Neotropical Frog *Leptodactylus Mystaceus* (Anura: Leptodactylidae). *Herpetology Notes* **7** (0): 31–36.
- Duellman, W. (2005): *Cusco Amazonico: The Lives of Amphibians and Reptiles in an Amazonian Rainforest*. ITHACA and London: Comstock Publishing Associates.
- Easteal, S. (1981): The History of Introductions of *Bufo Marinus* (Amphibia: Anura); a Natural Experiment in Evolution. *Biological Journal of the Linnean Society* **16**: 95–113.
- Frost, D.R. (2016): *Amphibian Species of the World: An Online Reference*. v. 2016.6.0. Available at: <http://research.amnh.org/herpetology/amphibia/index.html>. Accessed on 13 August 2016.
- Garrett, C. M., Boyer, D.M. (1993): *Bufo Marinus* (Cane Toad) Predation. *Herpetological Review* **24** (148).
- Jared, C., Antoniazzi, M.M., Verdade, V.K., Toledo, L.F., Rodrigues, M.T. (2011): The Amazonian Toad *Rhaebo guttatus* Is Able to Voluntarily Squirt Poison from the Paratoid Macroglands. *Amphibia-Reptilia* **32** (4): 546–549.
- Lampo, M., DeLeo, G.A. (1998): The Invasion Ecology of the Toad *Bufo Marinus*: From South America To Australia. *Ecological Applications* **8** (2): 388–396.
- Parmelee, J.R. (1999): Trophic Ecology of a Tropical Anuran Assemblage. *Scientific Papers Natural History Museum the University of Kansas* **11** (1094): 1–59.
- Pires, D., Vogt, R.C. (2015): *Leptodactylus Knudseni* (Pepper Frog). Diet. *Herpetological Review* **46** (December).
- Sugai, J.L.M.M., Terra, J.S., Ferreira, V.L. (2012): Diet of *Leptodactylus Fuscus* (Amphibia : Anura : Leptodactylidae) in the Pantanal of Miranda River, Brazil. *Biota Neotropical*. **12** (1): 99–104.
- Teixeira, R. L., Vrcibradic, D. (2003): Diet of *Leptodactylus Ocellatus* (Anura ; Leptodactylidae) From Coastal Lagoons of. *Cuadernos de Herpetologia* **17**: 11–118.
- Villacampa, J., Serrano-Rojas, S. & Whitworth, A. (2016) *Amphibians of the Manu Learning Centre and other areas of the Manu region*. The Crees Foundation. Cusco, Peru. 279 pp.
- Whitworth, A., Downie, R., von May, R., Villacampa, J., MacLeod, R. (2016): How Much Potential Biodiversity and Conservation Value Can a Regenerating Rainforest Provide? A ‘Best - Case Scenario’ Approach from the Peruvian Amazon . *Tropical Conservation Science* **9** (1): 224–245.
- Whitworth, A., Villacampa, J., Rojas, S.J.S., Downie, R. and MacLeod, R., (2017). Methods matter: Different biodiversity survey methodologies identify contrasting biodiversity patterns in a human modified rainforest—A case study with amphibians. *Ecological Indicators*, **72**, 821-832.
- Zug, G.R., Zug, P.B. (1979): The Marine Toad, *Bufo Marinus* : A Natural History Resumé of Native Populations. *Smithsonian Contributions to Zoology* 1979 **284**: 1–58.

Accepted by Simon Maddock