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NEW PREY ITEM IN THE DIET OF THE CALIFORNIA RED-LEGGED FROG (*RANA DRAYTONII*) FROM BAJA CALIFORNIA, MEXICO

NUEVA PRESA EN LA DIETA DE LA RANA DE PATAS ROJAS DE CALIFORNIA (*RANA DRAYTONII*) DE BAJA CALIFORNIA, MÉXICO

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Resumen.– Para proteger especies amenazadas como la rana de patas rojas de California (*Rana draytonii*), es importante conocer su historia natural, incluyendo las relaciones de la red alimenticia. Reportamos las primeras observaciones de *R. draytonii* comiendo e intentando comer avispas caza tarántulas (*Pepsis* sp.) en los matorrales montanos xerofíticos de Baja California.

Palabras clave.– Avispa caza tarántulas, depredación, dieta, rana.

Abstract.– To protect threatened species such as the California red-legged frog (*Rana draytonii*) it is important to understand their natural history, including food web relationships. We report the first observations of *R. draytonii* eating and attempting to eat tarantula hawk wasps (*Pepsis* sp.), based on observations from the xerophytic montane shrublands of Baja California.

Keywords.– Diet, frog, predation, tarantula hawk wasp.

The California red-legged frog (*Rana draytonii*) is distributed from central California, USA, to northwestern Baja California, Mexico, and is the largest native frog in western North America (Linsdale, 1940; Reaser, 2003; Backlin et al., 2017). It is an endangered species in Mexico (Peralta-García et al., 2016), and its habitat (Reis, 1999; Fellers & Kleeman, 2007; Halstead et al., 2018) and reasons for population decline (Kiesecker & Blaustein, 1997; Gilliland, 2010; Alcala et al., 2019) have been comparatively well documented. The species is known to have a broad and variable diet (Bishop, 2011), with adults largely feeding on invertebrates but also taking other amphibians and small mammals (Hayes & Tennant, 1985; Ford et al., 2013; Bishop et al., 2014). Nonetheless, knowledge gaps still exist concerning the feeding habits of *R. draytonii*. Here we report the first observation of *Rana draytonii* as a predator of tarantula hawk wasps (*Pepsis* sp.).

On October 29, 2023 at 10:42 h, at Rancho Meling, Sierra San Pedro Mártir, Municipality of Ensenada, Baja California, Mexico (30.9756° N, 115.7444° W; datum WGS 84; 640 m a.s.l.), while doing pond maintenance focused on improving habitat for *R. draytonii*, we observed a tarantula hawk wasp (*Pepsis* sp.) active on leaf litter at the pond edge. An adult *R. draytonii* resting in shallow water moved toward the wasp, grasped it by its anterior end, and then returned to the pond edge whereupon it swallowed the wasp (Fig. 1). A couple of minutes later, another tarantula hawk wasp appeared, and a different adult *R. draytonii* repeatedly struck this second wasp. In its second strike, the frog caught the wasp from the posterior end but the wasp immediately stung the frog on the tongue, causing the frog to expel it (Fig. 2). The frog scratched its mouth with its front legs before returning to the water. We suspect that the successful predation of the first *Pepsis* individual was due to it being a male, which lack stingers (Salman, 1930; Schmidt, 2016). The second predation attempt was clearly unsuccessful due to the wasp being a female.

Among frogs, only the American bullfrog (*Rana catesbeiana*) has been verified to eat members of the genus *Pepsis* (Krupa, 2002; Akmentins et al., 2009). A single record does exist of remains of an unidentified wasp from the Pompilidae family (to which *Pepsis* belongs) being recovered from the stomach of

Figura 1. An adult *Rana draytonii* successfully eating a tarantula hawk wasp (*Pepsis* sp.), with the wasp's abdomen and hindlegs still visible in the frog's mouth. Photo: David Mora Giles.

Figure 1. Ejemplar adulto de *Rana draytonii* comiendo exitosamente a una avispa caza tarántulas (*Pepsis* sp.), con el abdomen y las patas traseras de la avispa aún visibles en la boca de la rana. Foto: David Mora Giles.

a *R. draytonii* (Bishop et al., 2014). However, the observations reported in this contribution are the first confirmed records of predation or attempted predation of *Pepsis* by *R. draytonii*.

Insects have developed various strategies to deter predation (Feldhaar, 2011; Lindstedt, et al., 2019), but *Pepsis* sp. wasps largely rely on aposematism (metallic blue bodies and orange wings) to alert potential predators to the venomous sting possessed by females (Schmidt, 2004; Schmidt, 2016). Our observations confirm that aposematism can fail to deter predation by *R. draytonii*. This might be related to frogs' feeding response being generally stimulated by the presence of any potential prey entering their field of vision (Schulte, 2012), and aposematism has been shown to delay but not necessarily prevent attacks on solitary prey in another frog species (Hatle & Salazar, 2001).

Figura 2. Photo sequence (A–D) of a second adult *Rana draytonii* unsuccessfully attempting to eat a tarantula hawk wasp (*Pepsis* sp.). Photo: David Mora Giles.

Figure 2. Secuencia de fotos (A–D) de segundo adulto de *Rana draytonii* intentado comerse sin éxito una avispa caza tarántulas (*Pepsis* sp.) (A–D). Foto: David Mora Giles.

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https://www.youtube.com/watch?v=I98NIfVh-RQ

CITED LITERATURE

Alcala, N., A.E. Launer, M.F. Westphal, R. Seymour, E.M. Cole, & N.A. Rosenberg. 2019. Use of stochastic patch occupancy models in the California red-legged frog for Bayesian inference regarding past events and future persistence. Conservation Biology 33: 685-696.

Akmentins, M., L. Pereyra & J. 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.

AmphibiaWeb. 2024. https://amphibiaweb.org. University of California, Berkeley, California, USA. [Consultado en septiembre 2024]

Backlin, A.R., J.Q. Richmond, E.A. Gallegos, C.K. Christensen, & R.N. Fisher. 2017. An extirpated lineage of a threatened frog species resurfaces in southern California. Oryx 52:718–722.

Bishop, M. 2011. Diet, foraging activity, and food webs of the California red-legged frog. M.S. Thesis. San Francisco State University, San Francisco, California, USA.

Bishop, M.R., R.C. Drewes & V.T. Vredenburg. 2014. Food web linkages demonstrate importance of terrestrial prey for the threatened California red-legged frog. Journal of Herpetology 48:137-143.

Feldhaar, H. 2011. Predators as prey: Top-down effects on predatory hymenoptera. Pp. 217–245 In: C. Polidori (Eds.). Predation in the Hymenoptera: An Evolutionary Perspective. Transworld Research Network, Kerala, India.

Fellers, G.M., & P.M. Kleeman. 2007. California red-legged frog (*Rana draytonii*) movement and habitat use: Implication for Conservation. Journal of Herpetology 41:276–286.

Ford, L., P.A. Van Hoorn, D.R. Rao, N.J. Scott, P.C. Trenham & J.W. Bartolome. 2013. Managing Rangelands to Benefit California Red-Legged Frogs & California Tiger Salamanders. Alameda County Resource Conservation District. California, USA.

Gilliland, K.L. 2010. The presence of (largemouth bass) influences the population of *Rana draytonii* (California red-legged frog) and *Pseudacris regilla* (Pacific tree frog) in two ponds in Santa Barbara County, California. Master's Thesis, Humboldt States University, Arcata, California.

Halstead, B.J., P.M. Kleeman, C.S. Goldberg, M. Bedwell, R.B. Douglas & D.W. Ulrich. 2018. Occurrence of California red-legged (*Rana draytonii*) and northern red-legged (*Rana aurora*) frogs in timberlands of Mendocino County, California, examined with environmental DNA. Northwest Naturalist 99:9–20.

Hatle, J.D. & B.A. Salazar. 2001. Aposematic coloration of gregarious insects can delay predation by an ambush predator. Environmental Entomology 30:51-54.

Hayes, M.P. & M.R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). The Southwestern Naturalist 30:601-605.

Kiesecker, J.M. & A.R. Blaustein. 1997. Effects of introduced bullfrogs and smallmouth bass on microhabitat use, growth, and survival of native red-legged frogs (*Rana aurora*). Conservation Biology 12:776-787.

Krupa, J.J. 2002. Temporal shift in diet in a population of American bullfrog (*Rana catesbeiana*) in Carlsbad Caverns National Park. The Southwestern Naturalist 47:461-467.

Linsdale, J.M. 1940. Amphibians and reptiles in Nevada. Proceeding of the American Academy of Arts and Sciences 73:197-257.

Lindstedt, C., L. Murphy & J. Mappes. 2019. Antipredator strategies of pupae: how to avoid predation in an immobile life stage? Philosophical Transactions of the Royal Society B: Biological Sciences 374:20190069.

Peralta-García, A., B.D. Hollingsworth, J.Q. Richmond, J.H. Valdez-Villavicencio, G. Ruiz-Campos, R.N. Fisher, P. Cruz-Hernandez & P. Galina-Tessaro. 2016. Status of the California red-legged frog (*Rana draytonii*) in the state of Baja California, México. Herpetological Conservation and Biology 11:168-180.

Reaser, J.K. 2003. Occurrence of the California red-legged frog (*Rana aurora draytonii*) in Nevada, USA. Western North American Naturalist 63:400–401

Reis, D.K. 1999. Habitat characteristics of California red-legged frogs (*Rana aurora draytonii*): ecological differences between eggs, tadpoles, and adults in coastal brackish and freshwater systems. Master's Thesis, San Jose State University, San Jose, California, USA.

Salman, K. A. 1930. Studies in the genus *Pepsis*: (Hymenoptera: Psammocharidae). PhD Dissertation. Massachusetts Agricultural College, Amherst, Massachusetts, USA.

Schmidt, J.O. 2004. Venom and the good life in tarantula hawks (Hymenoptera: Pompilidae): how to eat, not be eaten, and live long. Journal of the Kansas Entomological Society 77:402-413.

Schmidt, J.O. 2016. Tarantula hawks and solitary wasps. Pp. 123–163. In: The Sting of the Wild. Johns Hopkins University Press, Baltimore, Maryland, USA.