Catalogue of American Amphibians and Reptiles.

Hunt, L.E. 2008. *Anniella geronimensis*.

Anniella geronimensis Shaw
Baja California Legless Lizard

Anniella pulchra Gray 1852:437. Type-locality, "California", restricted to "San Diego, California" in error by Smith and Taylor (1950a), subsequently restricted to the "vicinity of Bahia de San Quintin, Baja California Norte, Mexico" by Hunt (1983). Holotype, British Museum (Natural History) (BMNH) 1946 8.29.32 (original number BMNH 1852.4.12.3), an adult female containing a single, near-term embryo, collected by J.O. Goodridge in October 1846 (examined by author).

Anniella geronimensis Shaw 1940:225. Type-locality "San Geronimo Island, Lower California, Mexico." Holotype, San Diego Natural History Museum (SDNHM) 7543 (L.M. Klauber collection), an adult female collected by M. Bancroft on March 28, 1932 (examined by author).

• **CONTENT**. No subspecies are currently recognized.

• **DEFINITION**. The head is strongly depressed and the rostrum is wedge-shaped in profile. Maximum SVL is 142 mm, maximum tail length is 65 mm, with tail length comprising 26%–31% of total length. There are 72–86 dorsal scales along the vertebral line of the tail, 24–28 scale rows around the mid-body, 14–16 scale rows around the anterior portion of the tail, 5–7 (usually 6) supralabials, with the fourth supralabial typically the largest. The vertebral stripe is usually distinct and 2–3 scale rows separate it from the first lateral stripe. There are 4 or more black or brown lateral stripes along the sides of the body between the scale rows, which continue as longitudinal stripes on the ventral surface. This species displays significant geographic variation in body size, color, and other morphological and chromatic features (Hunt 1984). Adult dorsal color varies from copper to silver-grey, with a prominent brown or black vertebral stripe. Young resemble adults in dorsal coloration. Ventral color is typically a dark grey-violet and there is a smooth transition between dorsal and ventral coloration. The preanal scales are cream-colored or white against a dark background.

FIGURE 1. *Anniella geronimensis* from El Socorro, Baja California del Norte, Mexico. Photograph courtesy Gary Nafis and CaliforniaHerps.com.

• **DESCRIPTIONS**. Shaw (1940) described the holotype. Hunt (1983) gave a detailed description of the holotype of *Anniella pulchra* Gray 1852, which represents this species. Bezy et al. (1977) describe the karyotype (2n = 36) and Hunt (1984) analyzed morphological variation throughout the known range of this species.

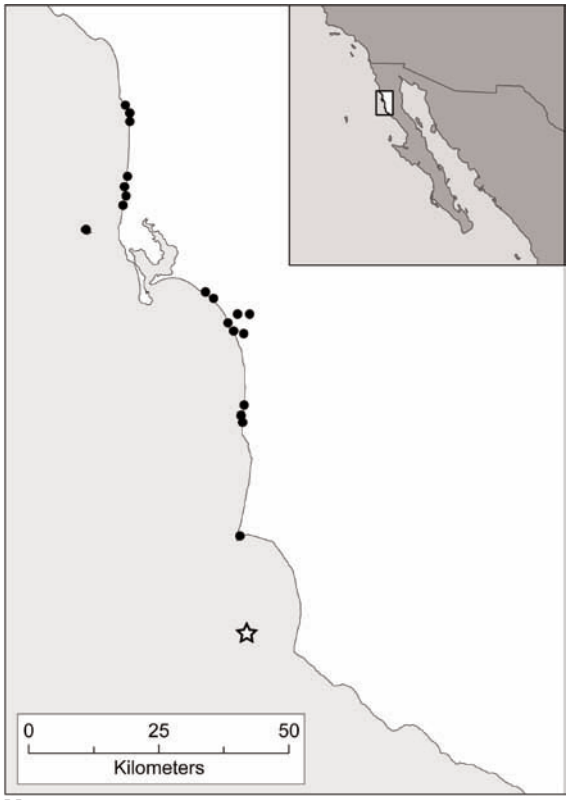
• **ILLUSTRATIONS**. Line drawings and/or color illustrations of this species are found in Shaw (1940) and Hunt (1983, 1984). Black-and-white and/or color photographs are found in Bezy et al. (1977), Grismer (1994), McPeak (2000), and Stebbins (2003).

FIGURE 2. Habitat of *Anniella geronimensis* at El Socorro, Baja California del Norte, Mexico. Photograph courtesy Gary Nafis and CaliforniaHerps.com.

• **DISTRIBUTION**. This lizard is endemic to the Pacific coast of northwestern Baja California Norte, Mexico, where it is restricted to wind-blown sand dunes fringing the coastline from Colonia Guerrero southward to Punta Baja (a latitudinal distance of approximately 90 kilometers) and extending no more than a few kilometers inland. Insular populations are known from Isla San Geronimo and Isla San Martin. Populations of *Anniella geronimensis* are sympatric and parapatric with *Anniella pulchra* north and south of Bahia de San Quintin, respectively (see **Comment**).

• **FOSSIL RECORD**. None.

• **PERTINENT LITERATURE**. The life history of this species is poorly known. The following sources provide information on **anatomy and morphology** (Hunt 1983, 1984; Shaw 1940, 1949, 1953; Wiens and Slingluff 2001), **biogeography** (Grismer 1994, 2002; Murphy 1976, 1983; Savage 1960, 1967; Welsh 1988), **checklists, keys, and field guides** (Frank and Ramus 1995; Liner 1994, 2007; Loomis et al. 1974; McPeak 2000; Pregill and Berrian 1984; Savage 1952; Smith and Smith 1976; Smith and Taylor 1950a,b; Stebbins 2003), **ecology, natural history, and geographic distribution** (Barrett et al. 2003; Bettelheim 2005; Bostic 1975; Grismer 2002; Hunt 1983; Klauber 1932; Mellink 2002; Sanchez-Pacheco and Mellink 2001; Shaw 1949, 1953; Van Denburgh 1922; Van Denburgh and Slevin 1914), **genetics** (Bezy et al. 1977; Macey et al. 1997, 1999; Pearse



MAP. Distribution of *Anniella geronimensis*. The star indicates the type-locality and dots other records.

and Pogson 2000), **nomenclature** (Hunt 1983), and **reproduction** (Fitch 1981; Shaw 1953).

• **ETYMOLOGY**. The name *geronimensis* refers to the type-locality.

• **COMMENT**. *Anniella* was considered a monotypic genus for 88 years despite the possibility that Gray (1852), Richardson (1852), and Boulenger (1885) may have had specimens of both species at their disposal (Hunt 1983). Similarly, Van Denburgh and Slevin (1914), Van Denburgh (1922), and Klauber (1932) described finding *Anniella pulchra* on Isla San Geronimo well before Shaw (1940) described legless lizards from this island, and subsequently from the mainland (Shaw 1949), as a distinct species.

This lizard has one of the most restricted geographic distributions of any North American lizard, with a known range of less than 300 km^2. Although locally common, it apparently is restricted to wind-blown sand deposits, which are disjunct and highly vulnerable to disturbance. Threats to the existence of this species probably include habitat fragmentation and local extirpation caused by development (e.g. Munoz et al. 2000), grazing, sand mining, agriculture, motor vehicles, foot traffic, non-native invasive plants, and wave action. Conservation measures should focus on habitat preservation and restoration, especially in the low dunes along the northwestern edge of the intensely cultivated Valle de San Quintin, where *Anniella pulchra* and *Anniella geronimensis* are narrowly sympatric. Parapatric contact zones between the two species occur to the southeast and are also highly susceptible to land use changes that could destroy these interesting distributional patterns.

ACKNOWLEDGMENTS. I thank S. Sweet for reviewing the manuscript, and A.H. Price and P. Collins for bibliographic assistance.

LITERATURE CITED

Barrett, K., D.A. Wait, and W.B. Anderson. 2003. Small island biogeography in the Gulf of California: lizards, the subsidized island biogeography hypothesis, and the small island effect. J. Biogeogr. 30:1575–1581.

Bettelheim, M.P. 2005. The California Legless Lizard (*Anniella pulchra*) and the Baja California Legless Lizard (*Anniella geronimensis*): a natural history of the species. Nature Booklets Volunteer Project, Walnut Creek, California.

Bezy, R.L., G.C. Gorman, Y.J. Kim, and J.W. Wright. 1977. Chromosomal and genetic divergence in the fossorial lizards of the family Anniellidae. Syst. Zool. 26:57–71.

Bostic, D.L. 1975. A Natural History Guide to the Pacific Coast of North Central Baja California and Adjacent Islands. Biological Educational Expeditions, Vista, California.

Boulenger, G.A. 1885. Catalogue of the Lizards in the British Museum (Natural History). 2nd ed., Vol. 2. Trustees of the British Museum (Nat. Hist.), London.

Fitch, H.S. 1981. Sexual size differences in reptiles. Misc. Publ. Mus. Nat. Hist. Univ. Kansas. (70):1–72.

Frank, N. and E. Ramus. 1995. A complete guide to scientific and common names of reptiles and amphibians of the world. N G Publ., Inc., Pottsville, Pennsylvania.

Gray, J.E. 1852. Descriptions of several new genera of reptiles, principally from the collection of H.M.S. Herald. Ann. Mag. Nat. Hist., Ser. 2, 10: 437–440.

Grismer, L.L. 1994. Ecogeography of the peninsular herpetofauna of Baja California, México and its utility in historical biogeography, p. 89–125. *In* P.R. Brown and J.W. Wright (eds.), Herpetology of the North American Deserts: Proceedings of a Symposium. Southwest. Herpetol. Soc. Spec. Publ. (5).

–. 2002. Amphibians and Reptiles of Baja California, including its Pacific Islands and the Islands in the Sea of Cortés. Univ. California Press, Berkeley.

Hunt, L.E. 1983. A nomenclatural rearrangement of the genus *Anniella* (Sauria: Anniellidae). Copeia 1983:79–89.

–. 1984. Morphological variation in the fossorial lizard *Anniella*. M.A. Thesis, Univ. Kansas, Lawrence.

Klauber, L.M. 1932. Notes on the Silvery Footless Lizard, *Anniella pulchra*. Copeia 1932:4–6.

Liner, E.A. 1994. Scientific and common names for the amphibians and reptiles of Mexico in English and Spanish. Nombres científicos y comunes en

Inglés y Español de los anfibios y reptiles de México. SSAR Herpetol. Circ. (23):v + 113 p.
–. 2007. A checklist of the amphibians and reptiles of México. Occ. Pap. Mus. Nat. Sci. Louisiana St. Univ. (80):1–60.
Loomis, R.B., S.G. Bennett, S.R. Sanborn, C.H. Barbour, and H. Wiener. 1974. A handlist of the herpetofauna of Baja California, Mexico and adjacent islands. Privately printed, California St. Univ., Long Beach.
Macey, J.R., A. Larson, N.B. Ananjeva, and T.J. Papenfuss. 1997. Replication slippage may cause parallel evolution in the secondary structures of mitochondrial transfer RNAs. Mol. Biol. Evol. 14: 30–39.
–, J.A. Schulte, II, A. Larson, B.S. Tuniyev, N. Orlov, and T.J. Papenfuss. 1999. Molecular phylogenetics, tRNA evolution, and historical biogeography in anguid lizards and related taxonomic families. Mol. Phylo. Evol. 12:250–272.
McPeak, R.H. 2000. Amphibians and Reptiles of Baja California. Sea Challengers, Monterey, California.
Mellink, E. 2002. El límite sur de la región Mediterránea de Baja California, con base en sus tetrápodos endémicos. Acta Zool. Mex. (n.s.) 85: 11–23.
Munoz, A.A., H. de la Cueva, I. Espejel, E.R. Vizcaino, M. Gutierrez Lacayo, A. Harper, S.I. Obando, L. Ojeda, E. Palacios, J.A. Stallcup, L. Vera, and M.D. White. 2000. Analysis of the environmental impact statement for the tourist project: "Proyecto de Cabo San Quintin en Ensenada, Baja California", to be located in San Quintin Bay, Baja California, Mexico. Prep. by Proesteros, Ensenada, Baja California, Mexico.
Murphy, R.W. 1976. The evolution of a peninsular and insular herpetofauna: a drift-based alternate hypothesis. M.S. Thesis. San Francisco St. Univ., San Francisco, California.
–. 1983. Paleobiogeography and genetic differentiation of the Baja California herpetofauna. Occ. Pap. Calif. Acad. Sci. (137):1–48.
Pearse, D.E. and G.H. Pogson. 2000. Parallel evolution of the melanic form of the California Legless Lizard, *Anniella pulchra*, inferred from mitochondrial DNA sequence variation. Evolution 54:1041–1046.
Pregill, G.K. and J.E. Berrian. 1984. Type specimens of amphibians and reptiles in the San Diego Natural History Museum. Trans. San Diego Soc. Nat. Hist. 20:151-164.
Richardson, J. 1852. Reptiles, Part 1, p. 143–156 + x–xi, errata, pls. 25-28. *In* E. Forbes (ed.), The Zoology of the Voyage of H.M.S. Herald, under the command of Captain Henry Kellett, R.N., C.B., during the years 1845–1851. Reeve and Co., London.
Sánchez-Pacheco, J.A. and E. Mellink. 2001. Geographic distribution: *Anniella geronimensis* (Baja California Legless Lizard). Herpetol. Rev. 32:192.
Savage, J.M. 1952. A preliminary checklist to the herpetofauna of the islands adjacent to Baja California, Mexico. Mimeograph.
–. 1960. Evolution of a peninsular herpetofauna. Syst. Zool. 9:184–212.
–. 1967. Evolution of the insular herpetofaunas, p. 219–227. *In* R.N. Philbrick (ed.), Proceedings of the Symposium on the Biology of the California Islands. Santa Barbara Botanic Garden, Santa Barbara, California.
Shaw, C.E. 1940. A new species of Legless Lizard from San Geronimo Island, Lower California, Mexico. Trans. San Diego Soc. Nat. Hist. 9:225–228.
–. 1949. *Anniella geronimensis* on the Baja California peninsula. Herpetologica 5:27–28.
–. 1953. *Anniella pulchra* and *A. geronimensis*: sympatric species. Herpetologica 8:167–170.
Smith, H.M. and E.H. Taylor. 1950a. Type localities of Mexican reptiles and amphibians. Univ. Kansas Sci. Bull. 33:313–380.
– and –. 1950. An annotated checklist and key to the reptiles of Mexico exclusive of the snakes. Bull. U.S. Natl. Mus. (199):v + 253 p.
– and R.B. Smith. 1976. Synopsis of the Herpetofauna of Mexico. Source Analysis and Index for Mexican Reptiles. Vol. III. John Johnson, North Bennington, Vermont.
Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts.
Van Denburgh, J. 1922. The reptiles of western North America. Vol. I. Lizards. Occ. Pap. California Acad. Sci. (10):1–611.
– and J.R. Slevin. 1914. Reptiles and amphibians of the islands of the West Coast of North America. Proc. California Acad. Sci., 4th Ser., 4:129–152.
Welsh, H.H., Jr. 1988. An ecogeographic analysis of the herpetofauna of the Sierra San Pedro Martir Region, Baja California, with a contribution to the biogeography of the Baja California herpetofauna. Proc. California Acad. Sci. 46:1–72.
Wiens, J.J. and J.L. Slingluff. 2001. How lizards turn into snakes: a phylogenetic analysis of body-form evolution in anguid lizards. Evolution 55:2303–2318.

Lawrence E. Hunt, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, California 93106 (anniella@silcom.com).

Primary editor for this account, Andrew H. Price.

Published 30 April 2008 and Copyright © 2008 by the Society for the Study of Amphibians and Reptiles.