Western Wildlife 12:19–22 • 2025
Submitted: 28 March 2025; Accepted: 8 June 2025.

Notes

Record Maximum Snout-Vent Lengths of the Endangered Blunt-nosed Leopard Lizard (*Gambelia sila*)

Erin N. Tennant[1,3], David J. Germano[2], and Reagen O'Leary[1]

[1]California Department of Fish and Wildlife, Central Region, Lands Unit, 1234 East Shaw Avenue, Fresno, California 93710
[2]Department of Biology, 9001 Stockdale Highway, California State University, Bakersfield, California 93311-1022
[3]Corresponding author, e-mail: erin.tennant@wildlife.ca.gov

***Abstract.*—Large size of individuals in an animal population can confer selective advantages over smaller members. The Blunt-nosed Leopard Lizard (*Gambelia sila*) is an endangered species of the San Joaquin Desert for which the maximum snout-vent length (SVL) of lizards in the 1960s was reported to be 123 mm. Since then, population studies have not reported lizards greater than this maximum size. Here we report record maximum SVL of males in two populations.**

Key Words.—California; lizards; mass; San Joaquin Desert; snout-vent length; SVL.

The size of animals can be an important factor affecting survival and reproduction. For many vertebrates, larger females produce more or larger offspring than smaller individuals (in den Bosch et al. 1998; Germano and Williams 2005; Fokidis et al. 2007; Goncalves et al. 2011). Body size of males can also lead to selective advantages. Large size can benefit territorial males by conferring an advantage defending their territories against other males, which can lead to larger territories and therefore access to more females (Fox et al. 1983; Shine et al. 2000; Candolin and Voigt 2001). In some lizards, larger males have significantly greater bite force in their jaws than smaller females (Verwaijen et al. 2002; Brecko et al. 2008), and bite force was greater for lizards with larger body size than smaller lizards (Donihue et al. 2016). Differences in bite force could allow larger individuals to access more and a wider variety of resources than smaller individuals.

Blunt-nosed Leopard Lizards (*Gambelia sila*) are predators, mainly on arthropods and occasionally small lizards (Montanucci 1965; Tollestrup 1979; Germano et al. 2007). Male *G. sila* are territorial (Montanucci 1965; Tollestrup 1983) and a large male could potentially defend their territory better against smaller males because of its larger size, thereby having greater reproductive success. Larger size, particularly a larger head, may allow *G. sila* a competitive advantage over smaller individuals because of the ability to seize and swallow larger prey. Although *G. sila* has been studied for over 60 y (Montanucci 1965, 1967), the maximum size of 123 mm snout-vent length (SVL) for adult lizards has not been reported to differ from these earliest publications. Here we report record SVLs for male *G. sila* from two populations in the San Joaquin Desert. We use SVL as our measure of size because weight in these lizards and most small animals, especially reptiles, can fluctuate depending on size and type of their last prey, when they last defecated, or if females are gravid.

From 2015 to 2017 we intensively surveyed three sites in the San Joaquin Desert for *G. sila* during the adult and hatchling seasons (April to October) by completing walking surveys on permanent grids approximately two days a week to study demographics and population size. Grids were 300 × 300 m and were either previously established or newly created at Pixley National Wildlife Refuge (Pixley NWR; Tulare County, California), Northern Semitropic Ridge Ecological Reserve (hereafter called Semitropic Ecological Reserve; Kern County, California), and Lokern Ecological Reserve (Kern County, California). From 2018–2024, we scaled back our efforts and conducted 10-d censuses during both the adult (April-July) and hatchling seasons (August-October) on the grids at Semitropic and Lokern Ecological Reserves. At Pixley NWR, 10-d censuses were only completed in 2019 and 2022. At Pixley in 2021 and 2024, only three survey days were completed. No surveys were completed at Pixley in 2023. These demographic censuses were supplemented by a radio-telemetry study at the Lokern site and a nearby oil field study site in 2015 and 2016 (Germano et al. 2024), and additional work at Semitropic Ecological Reserve and Pixley NWR during the same period (unpubl. data). For the demographic study (unpubl. data), we and personnel from the Central Region Lands Unit of the California Department of Fish and Wildlife and the Kern and Pixley NWR of the U.S. Fish and Wildlife Service caught *G. sila* using a modified fishing pole with a loop at the end made from dental floss (Stebbins 1954). We permanently marked each individual adult with a Passive Integrated Transponder (PIT) subdermally or intra-abdominally (Germano and Williams 1993). We collected demographic data, which included measuring their mass (± 0.5 g) and snout-vent length (SVL; ± 1 mm). In line with previous studies by the second author (Germano and Williams 2005; Germano et al. 2024; Germano 2025), SVL was precisely measured using a clear plastic millimeter ruler

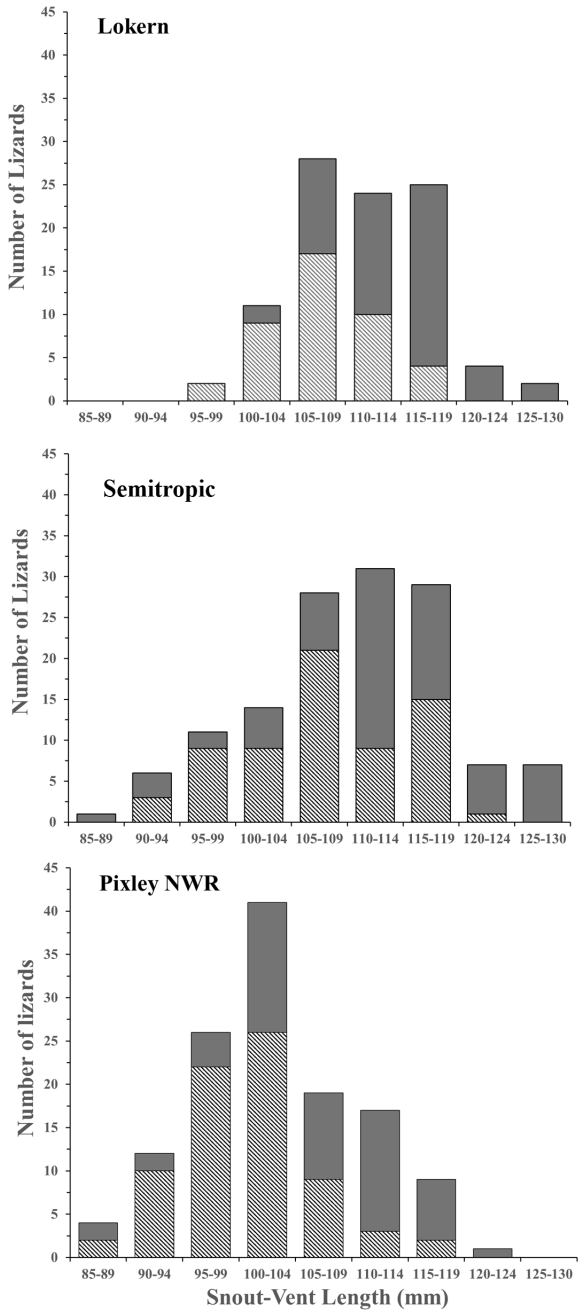

Figure 1. Distribution of the longest snout-vent lengths (mm) of female (light grey) and male (dark grey) Blunt-nosed Leopard Lizards (*Gambelia sila*) caught 2015–2024 at Lokern and Semitropic Ecological Reserves in Kern County, California, and at Pixley National Wildlife Refuge (NWR) in Tulare County, California.

in which the lizard was held against and its body gently stretched to eliminate the lizard from bending its body, thereby shortening its overall length. Our experience suggested that by not straightening lizards, the SVL can be reduced by several millimeters. Mass was recorded using spring scales and taken to either a whole number or to 0.5 decimal when the mark was approximately halfway between whole values. We used the largest size an individual attained, if that individual was recaptured over the study period, to determine the distribution of adult SVLs for each site and the maximum SVLs and mass at each study site.

Of the 54 individual adult male *G. sila* caught 2015–2024 on the Lokern Ecological Reserve, the maximum SVLs measured varied from 102–127 mm (Fig. 1). At Semitropic Ecological Reserve, the SVLs of 67 adult males varied from 89–128 mm, and for 55 males at Pixley NWR, SVLs varied from 86–121 mm (Fig. 1). Based on past studies that reported measurements of *G. sila* (Table 1), the maximum SVLs of the largest males we caught at both the Lokern and Semitropic Ecological Reserves are larger than any previously published data. Prior to our study, the largest male SVL reported in the literature was 123 mm (Montanucci 1965, 1967), and a recent study from Germano (2025) did not change this. The 123 mm SVL male Germano (2025) caught was found during the Lokern grazing study (Germano et al. 2012) on the Lokern Triangle (northwest of Hwy 58 and East of Hwy 33) and weighed 54.9 g, but the largest weight for a male at this site was 63 g for a 116 mm SVL individual (Table 1). The largest SVL of *G. sila* reported by Montanucci (1965) was 123 mm, but he did not give the sex of the lizard obtaining this size. Likely this size was for a male. Both Jennings (1995) and McGuire (1996) also report the largest SVL of *G. sila* as 123 mm, but no attribution is given, and this seems to be taken from the Montanucci (1965) dataset. Using 123 mm SVL as the benchmark, at the Lokern Ecological Reserve, we found two males ≥ 123 mm SVL: one male 125 mm SVL (58 g) and one male 127 mm SVL (51 g). At the Semitropic Ecological Reserve, we found 10 males ≥ 123 mm SVL; two 123 mm (45, 58.5 g); one 124 mm (44 g); three 126 mm (50, 51, 53 g); one 127 mm (56 g); and three 128 mm (48, 51, 59 g). The largest male found at Pixley NWR was 121 mm SVL and it was also the heaviest male at that site weighing 55 g (Table 1). In a recent study on the Elkhorn Plain by Weaver et al. (2024), the greatest SVL for a male *G. sila* was 122 mm and the heaviest male was 56 g (Table 1). Previous demographic work by Germano and Williams (2005) on the Elkhorn Plain found the greatest male SVL to be 118 mm, and the heaviest male was 60 g (Table 1).

Of the 42 individual female *G. sila* we caught 2015–2024 on the Lokern Ecological Reserve (Fig. 1), the largest SVL was from a gravid female that measured 118 mm and weighed 42.5 g. The heaviest non-gravid females at the Lokern Ecological Reserve were two lizards at 37 g (one 113 mm SVL and one 105 mm SVL; Table 1). At the Semitropic Ecological Reserve, we caught 67 individual female *G. sila* 2015–2024, and three females were 118 mm SVL (one non-gravid female weighed 45 g), one was 119 mm SVL (non-gravid: 38 g), and one gravid at 122 mm SVL. The heaviest non-gravid female was the 45 g, 118 mm SVL individual reported above (Table 1). From 2015–2024 we caught 75 individual female *G. sila* at Pixley NWR, and the largest was 118 mm SVL (Fig. 1), was non-gravid, and weighed 33 g.

Table 1. Comparison of the longest snout-vent lengths (SVL) and greatest mass (g) by sex of Blunt-nosed Leopard Lizards (*Gambelia sila*) reported in published studies from the San Joaquin Desert. Montanucci (1965) did not give sizes by sex and only stated longest adult SVL (123 mm). Weaver et al. (2024) and Germano and Williams (2005) worked on the Elkhorn Plain. Weaver et al. (2024) did not differentiate in mass data whether females were gravid, so we excluded female mass data from the table. Data for Germano (2025) were gathered during a livestock grazing study (Germano et al. 2012) at the Lokern Natural Area. Mass values for the longest females are for those not carrying eggs. The longest SVL and greatest mass were not for the same animal, except those marked with an asterisk (*).

	Females		Males	
Reference	SVL (mm)	Mass (g)	SVL (mm)	Mass (g)
Tollestrup (1982)	111	—	120	—
Germano and Williams (2005)	116	47	118	60
Weaver et al. (2024)	114	—	122	56
Germano (2025)	121	58	123	63
This Study - Lokern	118	37	127	58
This Study - Semitropic	122	45	128*	59*
This Study - Pixley	118	36	121*	55*

The heaviest females at Pixley were three females at 36 g (103 mm, 104 mm, 104 mm SVL). Of published records for female *G. sila* (Table 1), the largest SVL at Pixley NWR was 111 mm (Tollestrup 1982). For the Elkhorn Plain, the largest SVL for females from two studies were 114 mm (Weaver et al. 2024) and 116 mm (Germano and Williams 2005). Tollestrup (1982) did not give mass values, but on the Elkhorn Plain, the heaviest non-gravid female was 47 g (Germano and Williams 2005; Table 1). Weaver et al. (2024) did not differentiate whether females were gravid, so we excluded mass values from that study. The largest female recorded on the Lokern grazing study (Germano 2025; at the Lokern triangle mentioned previously) was 121 mm SVL weighing 44.7 g, but the heaviest non-gravid female was 58.1 g with a SVL of 116 mm (Table 1).

We found the largest male *G. sila* at our Lokern and Semitropic Ecological Reserves to be 4–5 mm larger, respectively, than the largest size (123 mm) previously reported by Montanucci (1965) and Germano (2025). Two males at Lokern Ecological Reserve and eight males at Semitropic Ecological Reserve were > 123 mm SVL (Fig. 1). We also found larger females at all sites than past studies (up to this year) that specifically reported female SVLs. Germano (2025) found the largest female at a different part of the Lokern area with an SVL of 121 mm, which is only 1 mm shorter than the largest female we found at Semitropic (Table 1). Weights of both male and female *G. sila* at our survey sites, however, were not unusually large compared to previous reported weights.

We do not know if environmental conditions have changed in the range of *G. sila* that has led to longer individuals or if the method of measuring SVL has contributed to this difference. We are confident that our method of measuring individuals against a clear plastic ruler, while making sure the body is straight, is an accurate method for measuring SVL in lizards. We also know that the distribution of large lizards at Lokern and Semitropic were not specific to a certain field technician or year but distributed throughout the study period. We believe there may be environmental conditions at Lokern and Semitropic that allowed lizards to grow larger than at other sites, but exactly what these conditions might be are unknown. Understanding demographic characteristics of *G. sila* populations throughout their range could help to develop better conservation measures for the species. This may be especially useful for translocation/reintroduction plans, as it is typically recommended to keep similar population groups together.

Acknowledgments.—We were supported during the first three years of this study (2015–2017) by funding from a Section 6 grant from the U.S. Fish and Wildlife Service to the California Department of Fish and Wildlife. H. Scott Butterfield of The Nature Conservancy, Michael Westphal of the U.S. Bureau of Land Management, and Joseph Stewart at U.C. Santa Cruz helped with funding and study design during the first three years of the Section 6 funding. We thank Larry Saslaw for help with initial study design, building grids, and catching lizards. We also thank Geoff Grisdale, Miguel Jimenez, Kathyrn Jimenez, and Audrey Mahinan from the Kern and Pixley National Wildlife Refuges of the U.S. Fish and Wildlife Service and John Battistoni, Jacklyn Mohay, Shana Carey, Christina Anderson, Lori Werner, Abigail Gwinn, Jessica Mead, Kira Ganbin, Javier Mendez, Jaime Marquez, Monica Wheeler, and Ezekiel Currier from the Central Region Lands Unit of the California Department of Fish and Wildlife for assisting with demographic data collection.

Literature Cited

Candolin, U., and H.R. Voigt. 2001. Correlation between male size and territory quality: consequence of male competition or predator susceptibility? Oikos 95:225–230.

Brecko, J., K. Hutghe, B. Vanhooydonck, A. Herrel, I. Grbac, and R. Van Damme. 2008. Functional and ecological relevance of variation in body size and shape in the lizard *Podarcis melisellensis* (Lacertidae). Biological Journal of the Linnean Society 94:251–264.

Donihue, C.M., K.M. Brock, J. Foufopoulos, and A. Herrel. 2016. Feed or flight: testing the impact of food availability on the functional ecology of an island lizard. Functional Ecology 30:566–575.

Fokidis, H.B., T.S. Risch, and T.C. Glenn. 2007. Reproductive and resource benefits to larger female body size in a mammal with female-biased sexual size dimorphism. Animal Behaviour 73:479–488.

Fox, S.F. 1983. Fitness, home range quality, and social rank in *Uta stansburiana*, Pp. 149–168 *in* Lizard Ecology: Studies of a Model Organism. Huey, R.B., E.R. Pianka, and T.W. Schoener (Eds.). Harvard University Press, Cambridge, Massachusetts.

Germano, D.J. 2025. Population structure and reproduction of Blunt-nosed Leopard Lizards in mid-elevation bajada habitat. Herpetological Conservation and Biology 20:1–11.

Germano, D.J., and D.F. Williams. 1993. Field evaluation of using passive integrated transponder (PIT) tags to permanently mark lizards. Herpetological Review 23:54–56.

Germano, D.J., and D.F. Williams. 2005. Population ecology of blunt-nosed leopard lizards in high elevation foothill habitat. Journal of Herpetology 39:1–18.

Germano, D.J., G.B. Rathbun, and L.R. Saslaw. 2012. Effects of grazing and invasive grasses on desert vertebrates in California. Journal of Wildlife Management 76:670–682.

Germano, D.J., L.R. Saslaw, and E.N. Tennant. 2024. The effect of oil field activity on home range, movements, and rates of predation of Blunt-nosed Leopard Lizards (*Gambelia sila*). Journal of Herpetology 58:135–147.

Goncalves, I.B, I. Ahnesjö, and C. Kvarnemo. 2011. The relationship between female body size and egg size in pipefishes. Journal of Fish Biology 78:1847–1854.

in den Bosch, H.A.J., and R.G. Bout. 1998. Relationship between maternal size, eggs size, clutch size, and hatchling size in European lacertid lizards. Journal of Herpetology 32:410–417.

Jennings, M.R. 1995. *Gambelia sila* (Stejneger). Blunt-nosed Leopard Lizard. Catalogue of American Amphibians and Reptiles 612:1–4.

McGuire, J.A. 1996. Phylogenetic systematics of crotaphytid lizards (Reptilia, Iguania, Crotaphytidae). Bulletin of the Carnegie Museum of Natural History 32:1–143.

Montanucci, R.R. 1965. Observations of the San Joaquin Leopard Lizard, *Crotaphytus wislizenii silus* Stejneger. Herpetologica 21:270–283.

Montanucci, R.R. 1967. Further studies on leopard lizards, *Crotaphytus wislizenii*. Herpetologica 23:119–125.

Shine, R., M.M. Olsson, I.T. Moore, M.P. LeMaster, M. Greene, and R.T. Mason. 2000. Body size enhances mating success in male garter snakes. Animal Behaviour 59:F4–F11.

Stebbins, R.C. 1954. Amphibians and Reptiles of Western North America. McGraw Hill Book Co. New York, New York.

Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co., Boston, Massachusetts.

Tollestrup, K. 1979. The ecology, social structure, and foraging behavior of two closely related species of leopard lizards, *Gambelia silus* and *Gambelia wislizenii*. Ph.D. Dissertation, University of California, Berkeley. 146 p.

Tollestrup, K. 1982. Growth and reproduction in two closely related species of leopard lizards, *Gambelia silus* and *Gambelia wislizenii*. American Midland Naturalist 108:1–20.

Tollestrup, K. 1983. The social behavior of two species of closely related leopard lizards, *Gambelia silus* and *Gambelia wislizenii*. Zeitschrift fur Tierpyschologie 62:307–320.

Verwaijen, D., R. Van Damme, and A. Herrel. 2002. Relationship between head size, bite force, prey handling efficiency and diet in two sympatric lacertid lizards. Functional Ecology 16:842–850.

Weaver, S.J., I.J. Axsom, L. Peria, T. McIntyre, J. Chung, R.S. Telemeco, M.F. Westphal, E.N. Taylor. 2024. Hydric physiology and ecology of a federally endangered desert lizard. Conservation Physiology 12: https://doi.org/10.1093/conphys/coae019.