PHOTO BY FRED KRAUS

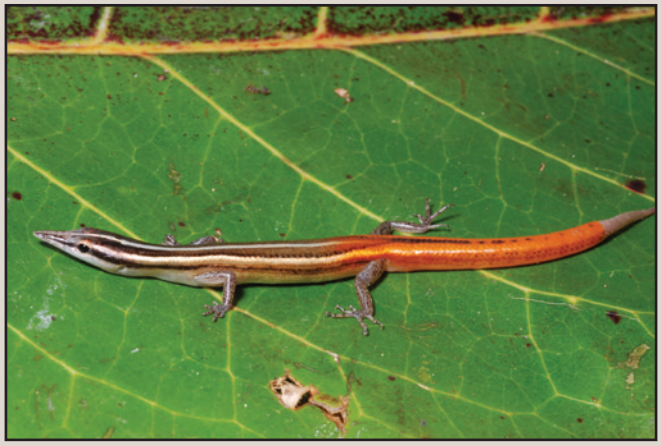

FIG. 1. *Lipinia longiceps* Woodlark Island, Milne Bay Province, Papua New Guinea, 20 October 2010.

in the vertebrate collection of the Bishop Museum (BPBM), Honolulu, Hawaii, USA. The series consisted of eight males (mean SVL = 40.6 mm ± 3.1 SD, range = 34–43 mm; Milne Bay, January: BPBM 16834, 16836 and October: BPBM 39903, 39904, 39907, 39908; East Sepik, September: BPBM 34693; Morobe, November: BPBM 19042); three females (mean SVL = 40.3 mm ± 0.58 SD, range = 40–41 mm: Milne Bay, February: BPBM 17587 and October: BPBM 39139, 39906), and three unsexed juveniles, (SVL = 26 mm, Milne Bay, January: BPBM 16835 and SVL = 20 mm , October: BPBM 39905, SVL = 17 mm, Morobe, April: BPBM 40273). Lizard were initially preserved with 10% neutral buffered formalin and later maintained in 70% ethanol. A slit was made on the abdomen and a gonad was removed from each lizard for histological examination. Gonads were embedded in paraffin, sections were cut at 5 µm and stained with Harris hematoxylin followed by eosin counterstain. All histology slides were deposited at BPBM.

All males exhibited spermiogenesis (sperm formation) in which the lumina of the seminiferous tubules were lined by rows of metamorphosing spermatids or sperm. The presence of males exhibiting spermiogenesis was found in specimens collected in January, September and October suggesting a prolonged period of spermiogenesis. The smallest reproductively active male *L. longiceps*, i.e., exhibiting spermiogenesis, measured 38 mm SVL (BPBM 19042) and was collected in November.

For females, two yolking ovarian follicles (4 mm diameter) were found in lizard BPBM 39906 (SVL = 41 mm) which represent the first clutch reported for *L. longiceps*. I did not observe embryos, so it is not known if *L. longiceps* exhibits viviparity as does the congener *L. noctua* (Goldberg and Kraus 2012. Curr. Herpetol. 31:58–60). Approximately half of the *Lipinia* species are viviparous (Rodda 2020. Lizards of the World Natural History and Taxon Accounts. Johns Hopkins University Press, Baltimore, Maryland. 801 pp.). Another female, BPBM 17587 (40 mm SVL) was undergoing yolk deposition in February, whereas BPBM 39139 (40 mm SVL) collected in October was not reproductively active. Two *L. longiceps* of presumably neonate size from widely separated months, one from April (BPBM 40273) and one from October (BPBM 39905) might suggest an extended period of egg production; and the third slightly larger subadult was from January (BPBM 16835). To my knowledge this is the first report on any aspect of the reproductive ecology of *L. longiceps* and suggests a prolonged reproductive period. This study warrants further examination in order to document monthly stages in the testicular cycle in males and elucidate the monthly distribution of stages in the ovarian cycle in females.

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***PHRYNOSOMA CORNUTUM* (Texas Horned Lizard). BEHAVIOR.** The ability for headstarted and reintroduced animals to emulate natural behaviors upon release from human care is essential for survival. In *Phrynosoma cornutum*, behaviors related to successful cold season brumation are critically important for lizards to survive through difficult winter weather conditions and extreme temperatures (Sherbrooke 2003. Introduction to Horned Lizards of North America. University of California Press, Berkeley, California. 177 pp.; Vesy et al. 2021. J. Wildl. Manage. 85:1267–1279). Therefore, headstarted and reintroduced *P. cornutum* must be able to exhibit brumation behavior in the wild. We raised 34 headstart *P. cornutum* at the Oklahoma City Zoo and Botanical Garden (OKZ) originally sourced as eggs or hatchlings in 2019 and 2020 from Tinker Air Force Base (TAFB; 35.41578°N, 97.41097°W; WGS 84; 375 m elev.) near Oklahoma City, Oklahoma, USA. While in human care, lizards were reared at stable temperatures (24°C ambient, 37°C basking) and light cycles (11:13 h day night cycle) for either one or two years depending on original collection cohort prior to reintroduction onto TAFB in June 2021. Because the husbandry conditions were constant while these *P. cornutum* were under human care, they were not exposed to natural, annual cooling periods and it is unknown if reintroduced *P. cornutum* would undergo successful brumation behaviors like their wild counterparts. In June 2021, we attached harmonic radar diodes and used a RECCO radar-emitting detector (RECCO R9 Detector; Lindholm, Sweden) to track 34 headstarted, reintroduced sub-adult and juvenile *P. cornutum* at TAFB.

On 12 October 2021, we found one of the harmonic tagged headstarted *P. cornutum* (#849-11), a sub-adult, burrowed into clay substrate, seemingly in preparation for the coming winter. We relocated this individual again on 19 October 2021 and confirmed this individual remained at the same site and in the same position (Fig. 1A). On 19 October, we located a second sub-adult (#849-1) exhibiting a similar behavior to the first, buried beneath plant litter and into clay soil (Fig. 1B). Both lizards were left undisturbed at their brumation sites, though visible tracking diodes protruding from the ground allowed for identification of each animal.

Both lizards were part of the 2019 cohort from the multi-partner collaborative reintroduction program between the OKC Zoo, TAFB, the University of Oklahoma, and the Oklahoma Department of Wildlife Conservation. They spent the first two years of their lives in human care at the OKC Zoo prior to reintroduction in June 2021. To our knowledge, this is the first reported account of headstarted, naïve, *P. cornutum* exhibiting brumation behaviors in the wild post-reintroduction. This has been an open question in *P. cornutum* conservation and headstarting programs, and our observations suggest that lizards raised in human care retain their natural proclivity to successfully enter brumation and go dormant for the winter. Our findings support the use and viability of headstarting programs as conservation tools for state imperiled *P. cornutum*

FIG. 1. Photographs of headstarted *Phrynosoma cornutum* burrowed into natural substrate for brumation through winter: A) lizard 849-11 buried in open clay substrate with attached harmonic radar diode visible; B) lizard 849-1 dormant under clay substrate and plant litter with harmonic radar diode and solar-powered CTT LifeTag (Cellular Tracking Technologies; Rio Grande, New Jersey, USA) visible above ground.

populations.

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***PHRYNOSOMA CORNUTUM* (Texas Horned Lizard). PREDATOR ATTACK SURVIVAL.** Ocular sinus squirting of systemic blood by *Phrynosoma cornutum* can clearly function as a deterrent to predation by some canid and felid mammalian predators in experiments (Middendorf and Sherbrooke 1992. Copeia 1992:519–527; Sherbrooke and Middendorf 2001. Copeia 2001:1114–1122, Sherbrooke and Middendorf 2004. Copeia 2004:652–658; Sherbrooke and Mason 2005. Southwest. Nat. 55:216–222; Sherbrooke et al. 2012. Herpetol. Rev. 43:386–391), but no clear examples of its functioning as a life-saving event in nature have been published. Field encountered deaths of *P. cornutum* (Munger 1986 Copeia 1986:820–814) and of *P. solare* (Sullivan and Sullivan 2017 Sonoran Herpetol. 30:54–57) have been attributed to coyotes but is often difficult to confirm. Here, I report on injuries to a female *Phrynosoma cornutum* (98 mm SVL, 44.2 g) collected live 11 July 1994 by Gretchen LeBuhn (1 mi north Portal Road, by San Simon [foothills] Road, Cochise County, Arizona, USA, on the Crown Dancer Ranch of John P. Caron.

The lizard was brought to an outdoor enclosure on the date of capture for feeding and care. Wounds were not examined and photographed until 23 July 1994 after rains in the outdoor enclosures cleared any dried blood and adhering debris from the wounds, or around the eyes that would have confirmed a blood-squirting defense. There were two ventral skin surface puncture wounds medial-posteriorly to both forelimb axilla, 27 mm apart from the outer edges, and 4 mm and 5 mm diameter; short tear wounds extended from the punctures towards the forelimbs. These appeared quite symmetrical and were interpreted as inflicted by ventral incisor teeth punctures of a predator. Dorsally there was a patch of hanging skin, 7 mm across at its base, in the middle of the lizard's back, exposing a healing area along the line of the middorsal white stripe. Possibly this injury resulted from grasping upper-jaw incisor teeth.

Following examination on 23 July, the lizard was released 7 September 1994 where it was captured. The following year it was recaptured near release area on 12 June 1995 and appeared in good health and all of the puncture wounds and tears were healed (Fig. 1). The lizard was preserved and deposited at the American Museum of Natural History (AMNH R-144475 [WCS 5990]) for X-ray examination, which showed no obvious damage