HERPETOCULTURE

HERPETOCULTURE NOTES

CAUDATA — SALAMANDERS

EURYCEA RATHBUNI (Texas Blind Salamander). OOPHAGY AND CANNIBALISM OF LARVAE. Eurycea rathbuni is a troglobitic spelerpine salamander endemic to the San Marcos Springs of the Edwards Aquifer in Hays County, Texas, USA (Hammerson and Chippindale 2004. IUCN Red List of Threatened Species 2004: e.T39262A10173274). Because of its occurrence in waterfilled subterranean caverns, field observations on the behavior and habits of E. rathbuni have been limited (e.g., Uhlenhuth 1921. Biol. Bull. 40:73-104), and much of what is known about the species' biology has come from observations of individuals maintained in captivity (e.g., Norman 1900. Amer. Nat. 34:179-183; Uhlenhuth, op. cit.; Maruska 1982. Proceeding of the 5th Annual Reptile Symposium on Captive Propagation and Husbandry 5:151-161; Bechler 1986. Proceedings of the 9th International Congress of Speleology 5:120-122; Bechler 1988. Southwest. Nat. 33:124-126).

Audubon Zoo has maintained a captive colony of *E. rathbuni* since 2001 and has been successfully reproducing this species since 2004. An adult breeding group comprised of 10 individuals of unknown sexes is maintained on public display in a 190-L aquarium at the zoo's Reptile Encounter building. Round river stones of varying sizes cover the floor of the exhibit as a substrate and provide potential sites for egg deposition. To facilitate public viewing, fluorescent lighting illuminates the exhibit on a 10-h photoperiod. Water parameters, photoperiod, and feeding frequency remain constant throughout the year.

Eggs are periodically produced throughout the year, although it is unclear which individual or individuals produce them. Eggs from clutches ranging from around 20–60 eggs are usually adhered singly or in small clusters to the surfaces of submerged rocks during each laying event. Eggs have typically been removed from the exhibit as soon as they are discovered and set up in a separate aquarium for hatching and development, but on several occasions, adult *E. rathbuni* were observed predating the eggs before keeper staff could retrieve them. Additionally, on rare occasions when undetected eggs hatched on exhibit, some adults were observed predating the larvae. Due to a lack of discernable physical features to facilitate visual identification, it is also unclear which individual or individuals have been observed consuming eggs or larvae.

The most recent observed case of oophagy by an adult *E. rathbuni* was closely monitored by one of us (RWM) and recorded with video. A clutch of around 20 eggs was laid on 10 February 2018 but could not be retrieved by keepers until two days later. On the morning of 12 February, one of the adults was observed directly above an egg that was adhered to the side of a rock (Fig. 1a). Using suction to detach the egg from the rock, the animal drew the egg into its mouth and then proceeded to reposition the egg inside its mouth for several seconds using chewing-like jaw movements before exuding a large cloud of opaque liquid (presumably the albumin escaping from the ruptured egg; Fig. 1b). The remaining eggs were quickly retrieved and moved to a separate rearing tank to prevent further predation.

Like other troglobitic species of *Eurycea, E. rathbuni* is believed to feed on aquatic subterranean invertebrates including crustaceans and snails (Goriki et al. 2012. *In* White and Culver [eds.], Encyclopedia of Caves, pp. 665–676. Elsevier, Waltham). Captive specimens have been reported to accept *Ambystoma* larvae (Uhlenhuth, *op. cit.*), strips of muscle from the tail of crayfish (Norman, *op. cit.*), and *Artemia* shrimp (Maruska, *op. cit.*; RWM et



FIG. 1. Oophagy in *Eurycea rathbuni* in a captive setting.

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al., unpubl). Oophagy and cannibalism have been documented in several species of plethodontid salamanders (Petranka 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington, D.C. 587 pp.; Chavez. 2017. Herpetol. Rev. 48:791–793) including oophagy in the spring-dwelling *E. sosorum* in captivity (Chavez, *op. cit.*). Given the paucity of available information on the ecology of *E. rathbuni*, it is unclear whether the feeding observations described here for *E. rathbuni* might represent natural elements of its diet and behavioral repertoire or an artifact of captivity. It might not be unreasonable, however, to suspect that *E. rathbuni* might occasionally take such opportunistic food items in nature where prey diversity and availability in aquatic subterranean environments might be limited.

These observations also have important implications for the management and breeding of *E. rathbuni* in captivity. As a vulnerable species with an extremely restricted range that has seen dramatic population declines over the past several decades (Hammerson and Chippendale, *op. cit.*), future conservation measures for *E. rathbuni* may rely on captive-breeding and repatriation as a way to bolster or restore diminished wild populations. If oophagy and cannibalism of larvae by adults pose a significant threat to captive breeding efforts, such behavior may dictate how individuals are grouped and housed to maximize egg and larval survivorship and reproductive success.

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TESTUDINES — **TURTLES**

CUORA BOURRETI (Bourret's Box Turtle). BRUMATION, OVIPOSITION AND INCUBATION. *Cuora bourreti* is listed as critically endangered (McCormack and Stuart 2016. The IUCN Red List of Threatened Species 2016: e.T163447A115303472; accessed 14 Jul 2018) and populations continue to experience declines in the wild. Recommendations to develop globally integrated captive breeding colonies have been prioritized as a conservation measure for *C. bourreti* (Horne et al. [compilers] 2012. Conservation of Asian Tortoises and Freshwater Turtles: Setting Priorities for the Next Ten Years. Wildlife Conservation Society Singapore Ltd, Singapore. 28 pp.). In North America, the captive zoo population of *C. bourreti* is managed by a Species Survival Plan (SSP) of the Association of Zoos and Aquariums (AZA), with a current population of 83 individuals held in both zoological parks and private collections.

The Smithsonian's National Zoological Park (NZP) maintains a breeding group of *C. bourreti* comprised of two males and one female. All three animals are wild-caught in origin and have been in captivity for over ten years. NZP acquired the female in late 2012, one male in 2013, and the second male in 2014. The *C. bourreti* at NZP are cycled annually by providing seasonal changes in diet, photoperiod, humidity and temperature. During the months of June, July and August, the animals are provided with fourteen hours of daylight, fed three times a week, and misted daily. These parameters are then gradually reduced to eight hours of daylight, mistings once a week, and no feedings during the winter months of December, January, and February. Captives were initially cooled indoors from an ambient temperature of 28° to 18°C in the winters of 2013 and 2014. In the winters of 2015 and 2016, they were brumated in an outdoor greenhouse and cooled below the goal temperature of 10°C, reaching minimum temperatures of 4°C and 7°C, respectively. During brumation, animals were housed individually in 113.5-liter aquaria with large, shallow water bowls (ca. 50 cm in diameter and 5 cm deep), and a PVC hide buried in deep soil and leaf litter substrate for refugia. From March through October, the animals were housed individually in large enclosures (males: $105.4 \times 28.5 \times 63.5$ cm; female: $165.1 \times 88.9 \times 30.5$ cm) with peat moss and soil substrate. Each enclosure had a basking spot providing an 8–10°C gradient within the enclosure, multiple water features, leaf litter, and several refugia. The female was introduced into both male enclosures for breeding two to four times a week during this period.

Nesting occurred as early as February and the female laid two to three clutches of one to two eggs annually (Table 1). The female excavates a shallow ca. 2-cm deep divot in the substrate for oviposition and covers the eggs with leaf litter using her rear limbs. Although this female laid eggs in 2013, hatchlings were not produced from this breeding group until 2017. In 2013, 2014, and 2015, eggs never showed banding or other signs of development. They were incubated in the following methods: inside a small plastic container (ca. $21 \times 15 \times 8$ cm) where the eggs were partially buried in a mixture of moist vermiculite at a 6:5 ratio to water by weight; and in a small (ca. $20 \times 17 \times 12$ cm) suspended incubation container (S.I.M. containers; Squamata Concepts®, Staten Island, New York, USA) with the eggs suspended over saturated vermiculite. In 2016, three eggs banded, but two embryos died within the first month and the third died after 82 days of incubation. The third embryo appeared fully developed and a cause of death was not determined. The successful development of eggs in 2016 and 2017 might be the result of lower brumation temperatures experienced during those winters than in previous years.

In 2017, eggs were incubated using three different methods. One egg from the first clutch, laid in March, was incubated in a large (ca. $33 \times 23 \times 15$ cm) suspended incubation container (S.I.M. Containers; Squamata Concepts, *opt. cit.*) suspended over saturated vermiculite. The second egg from this clutch was incubated in a small plastic container (ca. $21 \times 15 \times 8$ cm) and partially buried in a mixture of moist vermiculite at a 6:5 ratio to water by weight. A second clutch of two eggs laid in April was incubated in the substrate taken from the enclosure where they were laid (peat and soil mixture) inside a small plastic container (ca. $21 \times 15 \times 8$ cm).

Relatively little has been documented on the reproduction of turtles in the genus Cuora. The first reported hatchings of C. bourreti occurred in 1998 and 1999 and documented eggs (N = 5) from three different females averaging 5.54×3.0 cm and incubating for 85-117 days at 24-30°C (Fiebig and Lehr 2000. Salamandra 36:147–156). Here, we document a single female C. bourreti producing 19 eggs between 2013 and 2017, including five eggs produced in three different clutches in 2015 (Table 1). Although two other *Cuora* species have been reported to triple-clutch: C. flavomarginata (Connor and Wheeler 1998. Tortuga Gazette 34:1-7) and C. amboinensis (Ernst et al. 2000. World Biodiversity Database, CD-ROM Series. Springer-Verlag, Berlin), to our knowledge this is the first record of C. bourreti triple clutching in a single breeding season. Published accounts on egg production in C. bourreti note one or two clutches comprised of one to four eggs annually (McCormack et al.

TABLE 1. Egg and hatchling data from a single female Cuora bourreti housed at the Smithsonian's National Zoo over a four-year period.									
Year	Date	Weight (g)	Length (cm)	Width (cm)	Egg banding?	Incubation temperature (°C)	Results	Hatchling weight (g)	
2017	21 March	37.6	6.59	3.17	Y	26–27	Hatched: 83 days incubation	24.4	
	21 March	34.5	6.44	3.09	Y	26-27	Hatched: 83 days incubation	22.7	
	29 April	31.51	5.73	3.09	Y	27	Hatched: 88 days incubation	23.7	
	29 April	32.13	5.68	3.08	Y	27	Hatched: 89 days incubation	19.5	
2016	20 April	33.4	6.08	3.06	Y	28-29	Died early in development	-	
	20 April	31.21	5.65	3.02	Y	28-29	Died late in development-82 days incubation	1 –	
	11 July	30.62	6.03	3.06	Y	28-29	Died early in development	-	
2015	17 April	40.45	6.51	3.18	Ν	28-29	Never developed	-	
	19 May	35.78	3.16	5.88	Ν	28-29	No development	-	
	19 May	35.47	3.19	5.86	Ν	28-29	No development	-	
	26 June	32.12	5.85	3.11	Ν	28-29	No development	-	
	26 June	30.86	5.6	3.04	Ν	28-29	No development	-	
2014	26 April	33.7	3.17	6.28	Ν	28-29	No development	-	
	16 June	32.9	5.88	3.11	Ν	28-29	No development	-	
	16 June	33.5	6.07	3.05	Ν	28-29	No development	-	
2013	20 May	30	5.75	3.07	Ν	28-29	No development	-	
	19 June	29.2	5.74	3.08	Ν	28-29	No development	-	
	19 June	28.8	5.51	3.05	Ν	28-29	No development	-	
	23 August	27.6	5.77	2.81	Ν	28–29	No development	-	

2010. Asian Turtle Program [ATP], Hanoi, Vietnam 35; Fiebig and Lehr 2000, *op. cit.*; Heuberger and Heuberger 2008. Reptilia 61:20–26).

Despite efforts to protect wild *C. bourreti*, populations are continuing to decline. An increased understanding of the reproductive biology of species in the genus *Cuora* is needed to develop and refine conservation efforts through captive propagation. The hatching of the four *C. bourreti* at NZP represents an important step towards the development of a sustainable captive breeding population in North America.

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CUORA FLAVOMARGINATA (Yellow-margined Box Turtle). LONGEVITY AND MACROCEPHALY. Cuora flavomarginata is a small (to 190 mm carapace length) geoemydid turtle native to portions of southeastern mainland China, Taiwan, and the southern Ryuku Islands of Japan (Ota et al. 2009. In Rhodin et al. [eds.], Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs 5:035.1-035.10). This turtle is considered Endangered, and is probably Critically Endangered in the mainland portion of its range (Asian Turtle Trade Working Group 2000. [errata version published in 2016]. The IUCN Red List of Threatened Species 2000: http://dx.doi.org/10.2305/IUCN. UK.2000.RLTS.T5960A11965283.en; accessed 5 June 2018). The potential longevity of C. flavomarginata is poorly known; a commonly published maximum known lifespan is 19 years, 1 month for a captive female (Snider and Bowler 1992. Longevity of Reptiles and Amphibians in North American Collections, 2nd Ed. SSAR. 40 pp.). This note documents a considerably longer lifespan for two captive individuals.



Fig. 1. A) Male *Cuora flavomarginata*, obtained in 1974, displaying macrocephaly. B) Close-up image of head.

Three presumably wild-caught *Cuora flavomarginata*, two males and one female, were obtained in 1974 from a commercial source. These specimens appeared to be fully mature at this time, though no initial measurements are available. This group produced numerous fertile eggs and healthy hatchlings each year, until the female died accidentally several years ago. The two males are still alive and healthy at this writing (June 2018). The age of sexual maturation in this species has been estimated as six or seven years for wild individuals (Ota et al., *op. cit.*); thus a conservative estimate of age for the two males discussed here would be 50 years. Given that these turtles appeared to be fully mature when obtained, they could be several years older than this estimate.

One of the two living male *C. flavomarginata* reported here has developed very noticeable macrocephaly (Fig. 1), with the postocular dorsal musculature greatly hypertrophied. Although this species is considered relatively "big-headed" within its genus, and males are noted to have broader heads than females (Ota et al., *op. cit.*), true macrocephaly has apparently not been described in this species. Based on observations of numerous captive specimens and on published photographs of others (e.g., Vetter and van Dijk 2006. Terralog: Turtles of the World Vol. 4: East and South Asia. Edition Chimaira, Frankfurt am Main. 160 pp.), the male specimen described here appears to display exceptional head development.

We thank James Harding for technical assistance in preparation of this note.

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RHINOCLEMMYS PUNCTULARIA (Spot-legged Turtle). DOU-**BLE-CLUTCHING.** The reproductive biology of *Rhinoclemmys* punctularia is not well known. It has been reported that females deposit one or two eggs per clutch in March and April (Vogt 2008. Amazon Turtles. Gráfica Biblos, Lima. 104 pp.), and nesting was also recently reported in a captive specimen in July (Soares et al. 2017. Herpetol. Rev. 48:85-86). Other species of this genus have varied reproductive strategies. Because of the lack of specific published data on how many times per year species of Rhinoclemmys nest, it is important to document cases of individual turtles nesting in a single season so that more accurate estimates of annual reproductive potential for these species can be calculated (Páez 2012. In Páez et al. [eds.], Biologia y Conservacion de las Tortugas Continentales de Colombia, pp. 189-203. Serie Editorial Recursos Hidrobiologicos y Pesqueros Continentales de Colombia,. Instituto de Investigacion de Recursos Biologicos Alexander von Humboldt, Bogotá).

In Colombia, *Rhinoclemmys annulata, R. diademata, R. melanosterna*, and *R. nasuta* nest year-round (Páez, *op. cit.*). However, with the exception of *R. diademata*, which nests every two months and has an estimated reproductive potential of 6–18 eggs per year, it is unclear how many times per year individual females of these species will nest. *Rhinoclemmys nasuta* has been reported to nest twice a year, while *R. funeria* and *R. pulcherrima* nest up to four times a year, and *R. puncutlaria* nests year-round (Bonin et al. 2006. Turtles of the World. Johns Hopkins University Press, Baltimore, Maryland. 416 pp.); however, no citations were provided for these data. In Mexico, Legler and Vogt (2013. Turtles of Mexico: Land and Freshwater Land Forms. University of California Press, Berkeley, California. 416 pp.) noted that *R. areolata* lays up to five clutches annually and *R. pulcherrima* up to four clutches per year, whereas the number of clutches laid by *R. rubida* is unknown.

A captive female *R. punctularia* maintained at the Centro de Estudos de Quelônios da Amazônia - CEQUA, of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil, was observed nesting on 8 July 2016 at 1430 h and then again at 0930 h on 22 August 2016, representing an inter-nesting interval of 45 days. The first clutch consisted of one egg (38 g; 71×31 mm) (Soares et al. op. cit.); the second clutch was comprised of two eggs measuring 66×28 mm and 42 g, and 60×26 mm and 36g, respectively. The female, which measured 235 mm in straight line carapace length and 2085 g after oviposition, is part of a colony of six males and eight females originally collected from the Manaus area of Brazil that have been maintained in captivity for 22 months. The indoor terrarium housing the colony measures 10×10 m, features six ponds each measuring 1 m in diameter and 20 cm deep, and is maintained on natural light and temperature cycles, with two 2×4 m windows allowing natural light to enter the structure. One nest was constructed adjacent to a palm tree trunk and the second nest at the base of a small palm tree, both in silica sand. The nesting female was positively identified during both nesting events by its PIT tag number. This is the first record of double-clutching from direct nesting observations of captive R. punctularia.

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SQUAMATA — LIZARDS

ANOLIS GARMANI (Jamaican Giant Anole). HERMAPHRODIT-ISM. Hermaphroditism, a condition in which both male and female reproductive organs are expressed in an individual, is rare among higher vertebrates. Some cases have been reported in the Reptilia (e.g., Risley 1941. J. Morphol. 68:101–121), and in lizards, documented cases appear to be limited to lacertids: *Lacerta viridis* (Tayler 1918. Proc. Zool. Soc. Lond. 88:223–230), *Darevskia saxicola* (Lantz 1923. Bull. Soc. Zool. France 48:289–290; Darevsky 1966. J. Ohio Herpetol. Soc. 1966:115–152); anguids: *Hyalosaurus koellikeri* (Bons and Bons 1969. Compt. Rend. l'Acad. Sci 268:695–696); varanids: *Varanus exanthematicus* (Frye et al. 1999. Proc. Assoc. Reptil. Amphib. Vet. 1999:59–62), *V. acanthurus* (Brown 2008. Biawak 2:87–88); and phrynosomatids: *Sceloporus occidentalis* (Goldberg 1989. Copeia 1989:486–488).

In November 2015, a captive-bred adult *Anolis garmani* maintained at Audubon Zoo was presented to veterinary staff due to lethargy, inappetence, and overall decline in health, and subsequently euthanized due to concerns over quality of life. Upon gross necropsy and histopathological analysis, this animal, a suspected female, was determined to be hermaphroditic with both male and female reproductive organs that showed signs of active folliculogenesis and spermatogenesis.

Upon its arrival in mid-2010, this animal was originally housed together with an adult male *A. garmani*. Together, this pair produced more than 30 eggs (most of which were non-viable) over the course of one year, resulting in at least two live offspring and several mid-term and full-term embryos that died during incubation. From mid-2011 onward, this animal was periodically transferred between enclosures housing additional *A. garmani* of both sexes. Although eggs continued to be laid in these enclosures over the next several years, it was unclear which animals produced them. Eggs were also received when this hermaphroditic individual was housed with up to seven female *A. garmani*; however, since no attempts were made to incubate these eggs, it is unclear whether this individual was also capable of successfully reproducing in a male capacity. Post-mortem histopathological analysis of the animal noted some follicular degeneration with yolk resorption, suggesting full female reproductive capabilities at the time of death.

As far as it can be determined, this represents the first documented case of hermaphroditism in a dactyloid iguanian. This case highlights the importance of necropsy examinations and post-mortem histopathological analyses for detecting internal anatomical and developmental aberrations that would otherwise go unnoticed in living specimens.

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LIOLAEMUS CHALTIN. **PREFERRED AND CRITICAL THER-MAL TEMPERATURES.** *Liolaemus chaltin* is distributed in northwestern Argentina and southern Bolivia between 3400– 3750 m elev. in the Puna ecoregion (Lobo and Espinoza 2004. Copeia 2004:850–867; Quinteros 2012. Herpetologica 68:100–120). Lobo and Espinoza (*op. cit.*) report that these lizards seek refuge in grasses (*Festuca* sp.) and thorny shrubs (*Adesmia* sp.), feed on arthropods, and lay 4–5 eggs from September to November. The average field body temperature (T_b) recorded by these authors in January 1995 and 1996, between 1000 and 1800 h was 31.3 ± 2.7 °C (range 25.3–36.9; N = 40). This note aims to provide additional information on the thermal biology of *L. chaltin*.

Five *L. chaltin* (4 adult males and 1 juvenile female) were collected 30 km N of Villazón, Potosí, Bolivia (21.83°S, 65.62°W, WGS 84; 3551 m elev.) on 5 October 2015. Lizards were transported in cloth bags to the laboratory of the Colección Boliviana de Fauna (CBF) in La Paz, Bolivia. They were kept in a terrarium measuring $60 \times 30 \times 35$ cm (length × width × height) and acclimatized twoweeks prior to laboratory thermal data collection. The terrarium was set in direct sun as a heat source and lizards had access to places to hide and bask. They were fed crickets and mealworms

three times a week, and had free access to water. Individuals were held in captivity for two months before being deposited as voucher specimens (CBF 4301–4305). No specimens died and no injuries were observed during or after laboratory tests. Individual snout-vent lengths (SVL) were measured with a vernier caliper (0.05 mm), and weights (W) were taken with a CM 60-2N Kern Electronic Pocket Balance (\pm 0.01 g) before starting data collection.

Preferred temperature (T_{pref}) is an estimate of the optimal temperature a lizard would attain without biotic and abiotic constraints, generally measured in a thermal gradient (Hertz et al. 1993. Am. Nat. 142:796-818). A thermal gradient was created in a glass terrarium $(120 \times 40 \times 40 \text{ cm})$ that was divided internally into four 10-cm wide lanes separated by 10-cm high opaque walls. A 100-watt incandescent bulb was placed on the same end of each lane, registering substrate temperatures from 15 to 80°C. A 42-watt fluorescent bulb was suspended in the middle of the terrarium to standardize ambient lighting. Light bulbs were turned on at 0730 h, and specimens were placed in the middle of the thermal gradient at 0800 h. Preferred temperatures of individuals were measured every hour from 0900 to 1700 h for two days, obtaining 18 records per individual. To determine body temperatures, the tip of the thermocouple connected to a digital thermometer (Fluke 52-II, Everett, Washington, USA) was inserted up to 0.5 cm into the cloaca of each individual. For calculating set point preferred temperatures, central 50% interquartile observations were considered (sensu Hertz et al., op. cit.).

The thermal limits at which physiological functions of lizards do not operate correctly are given by critical thermal temperatures (Cowles and Bogert 1944. Bull. Am. Mus. Nat. Hist. 83:265–296; Angilletta et al. 2002. J. Therm. Biol. 27:249–268). Measurements for critical thermal data were performed three weeks after T_{pref} data collection. Critical thermal minimum (CT_{Min}) was taken exposing individuals to a $10 \times 10 \times 5$ cm empty plastic container within a $40 \times 30 \times 20$ cm plastic container filled with ice. Experimental voluntary maximum temperature (T_{vol}), panting temperature (T_{pant}) and critical thermal maximum (CT_{Max}) were taken simultaneously under a 100-watts bulb placed 10 cm above the individuals. After critical thermal records, lizards were placed immediately in another $10 \times 10 \times 5$ cm plastic container at room

TABLE 1. Voucher number code of the Colección Boliviana de Fauna (CBF), sex, snout–vent length (SVL), weight (W), individual preferred temperature (T_{pref} mean ± standard deviation, and range in parenthesis), lower and upper set-point preferred temperature values, critical thermal minimum (CT_{Min}), experimental voluntary maximum temperature (T_{vol}), panting temperature (T_{pant}), critical thermal maximum (CT_{Min}) and thermal tolerance range (TTR) for *Liolaemus chaltin* from Potosí, Bolivia.

CBF	Sex	SVL (mm)	W (g)	T _{pref} mean range (°C)	Lower set point (°C)	Upper set point (°C)	CT _{Min} (°C)	T _{vol} (°C)	T _{pant} (°C)	CT _{Max} (°C)	TTR
4301	Ŷ	36.5	1.15	34.98 ± 0.73 (32.20–37.70)	33.73	35.78	6.30	38.90	39.20	43.50	37.20
4302	ð	52.9	4.22	36.13 ± 1.00 (33.50–37.30)	35.95	36.80	4.80	37.70	41.50	43.60	38.80
4303	ð	53.2	3.91	35.16 ± 1.38 (33.00–36.60)	34.70	35.88	5.90	37.60	40.60	43.50	37.60
4304	ð	51.3	3.65	36.23 ± 1.61 (35.20–37.60)	35.65	36.65	5.40	38.60	40.30	42.50	37.10
4305	8	52.8	3.03	34.66 ± 1.11 (32.10–38.20)	33.40	35.93	6.30	38.50	40.90	43.10	36.80

temperature (20°C), to warm them in the case of CT_{Min} test, or to cool them in the case of CT_{Max} test. Thermal tolerance range (TTR) was estimated as CT_{Max} - CT_{Min} , according to Moreno-Azócar et al. (2013. Oecologia 171:773–788).

Results are shown in Table 1. Mean SVL was 49.30 mm (± 0.72, range: 36.50–53.20 mm), and mean weight (W) was 3.10 g (± 1.25, range: 1.15–4.22 g). Mean T_{pref} was 35.38°C (± 1.38, range: 32.10–38.20°C). The 25% and 75% interquartiles of T_{pref} were 34.69°C and 36.21°C, respectively. Mean value for CT_{Min} was 5.70°C (± 0.64), for T_{vol} was 38.30°C (± 0.58), for T_{pant} was 40.50°C (± 0.85) and for CT_{Max} was 42.77°C (± 1.88). Mean thermal tolerance range (TTR) was 37.50°C (± 0.78).

Our T_{pref} was 4°C lower than the T_b of *L. chaltin*, obtained by Lobo and Espinoza (op. cit.); this might suggest that the accuracy of thermoregulation (d_b) could be constrained in the wild. Field body temperature in the L. alticolor-bibronii group (Abdala 2015. South Amer. J. Herpetol. 10:104-115) is generally less than reported T_{pref} (see Labra et al. 2009. Am. Nat. 174:204–220; Medina et al. 2012. J. Therm. Biol. 37:579-586; Valdecantos et al. 2013. J. Therm. Biol. 38:126-134), settling the suggestion that higher altitude thermal environments present in Puna habitats keep *Liolaemus* species from reaching their T_{pref} (e.g., Marquet et al. Oecologia 81:16-20); although cases with high accuracy of T_b are reported, as in *L. yanalcu*, a related viviparous species (d_b= 1.16±1.46; Valdecantos et al. 2013, op. cit.). On the other hand, reported T_{pref}, CT_{min}, T_{vol}, T_{pant}, CT_{max} and TTR values for L. chaltin fall within known records for several species of Liolaemus (see Carothers et al. 1997. Rev. Chil. Hist. Nat. 70:297-309; Labra et al. 2009, op. cit.; Bonino et al. 2011. J. Exp. Zool. 315:495-503; Moreno-Azócar et al. 2013, op. cit.; Cruz et al. 2014. Ecosistemas 23:37-45; Bonino et al. 2015. Zoology 118:281-290).

Obtained physiological temperatures can give us information to forecast to what extent thermo-environmental deviations caused by habitat modification and climate change could affect species (Clusella-Trullas and Chown 2014. J. Therm. Biol. 184:5– 21), but future research must also broaden the information available on species thermoregulatory efficiency in the field.

We thank Alvaro Aguilar-Kirigin and Cristian Abdala for their collaboration on the identification of material, Soledad Valdecantos and Frida Gustaffson for their contributions to the manuscript, and Marita Paredes, Daniel Gómez, Daline Ríos and Roberto Osina for the care of specimens.

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SCELOPORUS TORQUATUS (Torquate Lizard). SELECTED BODY TEMPERATURE. Selected body temperatures under laboratory conditions have become one of the most important traits studied in the thermal biology of ectotherms (Sinervo et al. 2010. Science 328:894–899). Selected temperatures represent the range of core temperatures within which ectotherms are comfortable while performing their behaviors (IUPS Thermal Commission 2003. J. Therm. Biol. 28:75–106). The lizard *Sceloporus torquatus* is endemic to central Mexico, where it lives in rocky areas. Several reports on this species' biology have been published, describing its hematological traits (González-Morales et al. 2015. Can. J. Zool. 93:377–388), muscle contractions (Quintana et al. 2014. Acta Zool. 95:264–271), and reproduction (Guillete and Méndezde la Cruz. J. Herpetol. 27:168–174). However, the selected body temperature of *S. torquatus* has not yet been documented. Here, we describe the thermal preferences of *S. torquatus* under laboratory conditions.

During September 2016, we captured 17 adult *S. torquatus* by noose or hand (> 87 mm SVL: 7 males and 10 females) in Texcalyacac, State of Mexico (19.12694°N, 99.49472°W; 2500 m elev.). The capture site was a rocky area dominated by pine (*Pinus* spp.).

In the laboratory, the lizards were separated by sex, maintained at 25°C in plastic containers with soil and stones, and hydrated by periodically spraying the cages with water. Laboratory experiments were conducted two days after the lizards were captured. We used a thermal gradient made from a polycarbonate box $(150 \times 150 \times 70 \text{ cm [length x width x height]})$ divided into ten tracks each measuring 15 cm in length, to prevent interactions between the lizards. The box was located in a room with a controlled temperature of 20°C. Six 100-W lamps distributed along the box generated a thermal gradient ranging from 20–50°C. Body temperature data was collected manually using a digital thermometer with a probe inserted into the lizard's cloaca every two hours between 0900 and 1930 h. We used a Mann-Whitney U test to compare selected body temperatures between the sexes.

Males and females did not differ significantly in selected temperature (U = 1175.00, p = 0.66) or measurement of temperature (H₅ = 7.63, p = 0.178). Mean preferred body temperature among all lizards measured was 33.21° C (SD = 2.82, range = 22.40–33.70°C). The 25% and 75% quartiles were 31.95°C and 35.20°C, respectively. These results suggest that *S. torquatus* can be considered a eurythermic species, due to its wide range of preferred temperatures. These data can be used as a reference for future studies that evaluate traits in this species that may depend on temperature, such as color measurements and performance.

We thank the Consejo Nacional de Ciencia y Tecnología for funding (grant 178723) and scolarship for JCGM and JRR.

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SQUAMATA — SNAKES

LYCODON JARA (Twin Spotted Wolf Snake). FEEDING. *Lycodon jara* is a small snake found in varied habitats including forests, open areas with bushes and scattered trees, and agricultural areas (Das 2002. A Photographic Guide to Snakes and Other Reptiles of India. New Holland Publishers UK Ltd, Garfield. 38 pp.). It is distributed in northeastern India, Bangladesh, Nepal, Bhutan, and Myanmar (Chaudhuri et al. 2015. Hamadryad 37:95–103). Little is known about the natural history and behavior of this snake, although it has been reported to feed on geckos (Whitaker and Captain 2004. Snakes of India. Macmillan India Limited, New Delhi. 196 pp.).

On 23 June 2012 at 2130 h, we came across a *L. jara*, (snout-vent length = 31.75 cm; tail length = 7.62 cm) in a cowshed in Nadia District, West Bengal, India (22.96503°N, 88.52388°E, WGS 84;



FIG. 1. Lycodon jara feeding on Lygosoma albopunctata.

16 m elev.). It was collected and housed indoors for observations in a small plastic container measuring $24 \times 18 \times 10$ cm (L × W × H) with ambient fluorescent room lighting. Thirty minutes after the snake's capture, it was offered a House Gecko (*Hemidactylus flaviviridis*) measuring approximately 7 cm in total length (TL). The gecko was kept with the snake in the container for the next two hours, but the snake showed no interest in feeding. At 0030 h a skink (*Lygosoma albopunctata*) measuring ca. 9 cm TL was introduced to the container, replacing the gecko. The snake immediately seized the skink and held on to its head while throwing a loose coil around its prey to get a better grip. It swallowed the skink within 5 min. Four days later, we introduced another *H. flaviviridis* measuring ca 6 cm TL and replaced it after one hour with another gecko species (*H. frenatus*) that measured ca. 5 cm TL. In both cases the snake showed no interest in feeding on the geckos. Thirty minutes after introducing the second gecko, it was replaced by another similarly sized *L. albopunctata*, as before. As soon as the skink was introduced, the *L. jara* showed the same predatory behavior and swallowed the skink within approximately 5 min. The snake was released back in the same habitat where it was found the following evening.

From these observations of a recently captured individual, it appears that *L. jara* may prefer skinks over geckos and may have a skink-specific dietary interest. Further investigations into the dietary habits of this species are needed to understand its feeding habits.

We thank Saurav Dutta for his help.

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