

2), ten *B. fonsecai* neonates were euthanized and fixed in 10% formaldehyde and preserved in 70% alcohol, labeled and deposited in CHUFJF-Reptiles. The only reported neonatal data for *B. fonsecai* is from a single adult female (SVL = 810 mm and TL = 100 mm) from Serra do Mar in Cunha (23.16944°S, 44.92416°W; 1120 m elev.) that was necropsied and contained 14 developed embryos (SVL = 217.7 ± 5.9 mm, TL = 36 ± 3.5 mm; Sazima and Manzani 1998. *Herpetol. Rev.* 29:103). This study reports the live birth along with data on body size and body mass of *B. fonsecai* neonates.

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PITUOPHIS RUTHVENI (Louisiana Pine Snake). TWINNING. *Pituophis ruthveni* is an endangered species historically known from a relatively small area in west-central Louisiana and east-central Texas (Gibbons 2017. *Snakes of the Eastern United States*. University of Georgia Press, Athens. 416 pp.). This species is known for its relatively low fecundity with the average clutch size being the smallest of any snake species in the USA, while also having the largest eggs of any species native to the USA (Gibbons, *op. cit.*). *Pituophis ruthveni* is managed by a Species Survival Program through the Association of Zoos and Aquariums (AZA) with a captive population of 50 males and 51 females according to the most recent AZA population viability analysis (Johnson et al. 2017. Louisiana Pine

Snake [*Pituophis ruthveni*] AZA Animal Program Population Viability Analysis Report. Lincoln Park Zoo, Chicago, Illinois).

As part of the Species Survival Program, Zoo Atlanta has maintained two male/female pairs of *P. ruthveni* for breeding purposes since 2014. On 27 May 2017, one of the females produced a clutch of seven eggs. Of these seven, only four eggs made it full term to hatching. Upon pipping on 28 July 2017, it was discovered that one egg contained two fully formed neonates (Fig. 1). One twin exited the egg completely on 29 July and the other on 30 July. Upon fully exiting the egg, the mass of each twin snake was 32.2 g (Twin 1) and 32.4 g (Twin 2). At hatching, each neonate twin was less than half the mass of their siblings (Table 1). Despite the size difference, both twins appeared outwardly normal with no notable birth defects at the time of hatching. At the time of this writing (July 2018), both twins have thrived and surpassed their siblings in overall mass (Table 1).

Twins have been reported for some North American snake species (e.g., *Opheodrys aestivus* [Curtis 1950. *Copeia* 1950:232]; *Pantherophis guttata* [Marion 1980. *Trans. Kansas Acad. Sci.* 83:98–100]). Although the phenomenon of incomplete twinning has been documented in *Pituophis catenifer* (Wallach 2007. *Bull. Maryland Herpetol. Soc.* 43:57–95; see also Piriou et al. 2015. *Herpetol. Notes* 8:507–509) and at the time of this writing a living example of an incompletely twinned (bicephalic) *P. catenifer* is held in the herpetology collection of Audubon Zoo (R. W. Mendyk, pers. comm.), we are unable to find published reports of full twins hatching from the same egg for the genus *Pituophis*.

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TABLE 1. Mass of captive-bred *Pituophis ruthveni* at the time of hatching and current to the time of writing (July 2018).

Hatchling #	Mass at hatching (g) July 2017	Mass as of July 2018 (g)
1	68.4	358.9
2 (Twin 1)	32.2	385.8
3 (Twin 2)	32.4	392.7
4	67.9	251.8
5	71.5	300.2

THAMNOPHIS EQUUS MEGALOPS (Northern Mexican Garter-snake). REPRODUCTION. It has been inferred that female reproductive frequency for most *Thamnophis* species is once per season, although more northern species might not reproduce in sequential years (Rossman et al. 1996. *The Garter Snakes: Evolution and Ecology*. University of Oklahoma Press, Norman, Oklahoma. 332 pp.; Larsen et al. 1993. *Am. Midl. Nat.* 129:336–345; Tuttle and Gregory 2013. *Copeia* 2014:130–135). It has also been suggested that southern species may produce multiple clutches per year due to extended breeding seasons, but this has not yet been observed in the wild (Ford and Karges 1987. *Southwest. Nat.* 32:93–101; Rossman et al., *op. cit.*). Herein we report two instances of the production of two clutches within a single season by a captive female *T. equus*. *Thamnophis equus* is a federally threatened species (U.S. Fish and Wildlife Service 2014. Federal Register 79:38678–38746), and to aid its recovery Arizona Game and Fish Department established two captive populations when little was known about husbandry and propagation of this species.

Snakes for this captive breeding effort were collected under authority of the Arizona Game and Fish Department from Bubbling Ponds Fish Hatchery, Cornville, Arizona. On 21 and 22 July 2012, a female (114 mm SVL) and male (168 mm SVL), both neonates, were collected from the wild. The snakes were housed individually for the first year in captivity, after which they were housed together continuously, except during feeding events. Snakes were fed live fish and appropriately sized, frozen-thawed mice once every 7–14 days. We did not measure SVL during this period. We first implemented brumation from 27 November 2015 to 8 January 2016, and the snakes were kept in a non-heated room at ambient temperatures (range 9–25°C). The

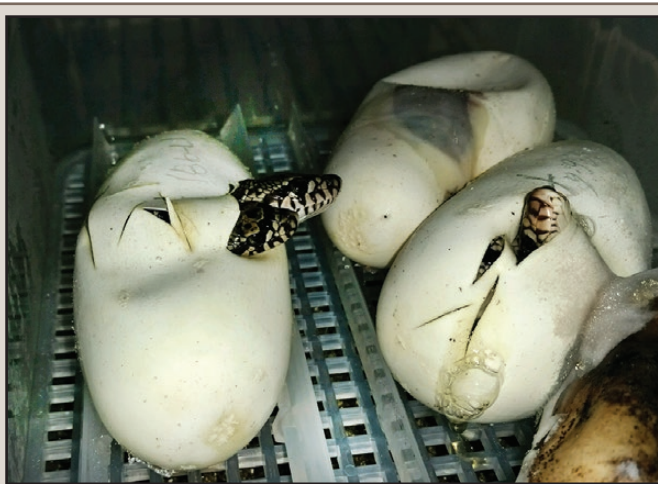


FIG. 1. Single egg twins and normal *Pituophis ruthveni* pipping at Zoo Atlanta.

PHOTO BY R. HILL

snakes have gone through the same brumation cycle annually since that time.

We observed the first successful copulation event on 28 August 2015 (i.e., before the first brumation cycle), and the female (no SVL available) produced two young on 1 June 2016 (no measurements recorded). In May 2017, the female measured 575 mm SVL and the male 460 mm SVL, and on 4 June 2017 the female gave birth to two offspring (one male, one female; neither was measured at birth). On 12 September 2017, 124 d later, the female gave birth to a litter of eight neonates; seven males, one female (mean SVL = 174.3 mm, range 165–181 mm; mean mass = 2.5 g, range 1.0–3.0 g). In 2018, no copulation was observed, but on 29 May 2018 the female produced a litter of six neonates: three males and three females (mean SVL = 194.5 mm, range 181–204 mm; mean mass = 4.0 g, range 3.0–5.0 g; recorded on 6 August). On 23 August 2018, 87 d later, a second litter of four neonates was stillborn.

To our knowledge these are the first reported instances of any *Thamnophis* species producing multiple clutches in a single breeding season (e.g., Rossman et al., *op. cit.*). The size of this female at first reproduction (575 mm SVL) is consistent with estimates of sexual maturity in *T. eques* occurring at about 550 mm SVL (Rosen and Schwalbe, 1988. Report from Arizona Game and Fish Department to U.S. Fish and Wildlife Service, Albuquerque, New Mexico; Degenhardt et al. 1996. *Amphibians and Reptiles of New Mexico*. University of New Mexico Press, Albuquerque, New Mexico). The larger of the two clutches is within the range (7–26) reported by Rosen and Schwalbe (*op. cit.*), but both are smaller than that of two other wild *T. eques* broods from Bubbling Ponds,

N = 38 (Nowak and Boyarski 2012. *Herpetol. Rev.* 43:351–352) and N = 32 (Boyarski et al. 2018. Arizona Game and Fish Department Nongame and Endangered Wildlife Program Technical Report 316). Mean offspring SVL ranged from 165–181 mm (Rosen and Schwalbe, *op. cit.*, Boyarski et al., *op. cit.*) and our observations fit into these wild observations. Both clutch size and offspring size are often correlated with female body length (King 1993. *J. Herpetol.* 27:175–185; Halstead et al. 2011. *Southwest. Nat.* 56:29–34), and this has been seen in *T. eques* from Mexico (Manjarrez and San-Roman-Apolonio 2015. *Herpetologica* 71:12–18). The relatively small size and young age of the female in this report may explain the below average clutch and offspring size compared to reported wild observations (Shine and Seigel. 1996. *Funct. Ecol.* 239:209–223), but might also be due to the snake producing two clutches in one season.

Despite being an observation from a captive animal, this finding is intriguing and confirms the possibility of *Thamnophis* being able to produce multiple clutches in a single season. Further studies using telemetry or mark-recapture may confirm whether this phenomenon occurs in wild snakes. Furthermore, this observation may have conservation implications that can be applied to captive breeding programs for this federally threatened species.

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