Western North American Naturalist

Volume 64 | Number 1 Article 19

2-20-2004

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Western North American Naturalist 64(1), ©2004, pp. 141–143

REPRODUCTIVE CYCLE OF SMITH'S BLACK-HEADED SNAKE, *TANTILLA HOBARTSMITHI* (SERPENTES: COLUBRIDAE), IN ARIZONA

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Key words: reproduction, Tantilla hobartsmithi, *Smith's black-headed snake.*

Smith's black-headed snake, *Tantilla hobartsmithi,* occurs in Arizona, southern California, western Colorado, southern Nevada, southern New Mexico, southwestern Texas, southern Utah, and in the Mexican states of Chihuahua, Coahuila, and Sonora (Cole and Hardy 1981). Most individuals are found beneath rocks, mainly in riparian, grassland, chaparral, and woodland communities (Cole and Hardy 1983). Information on clutch sizes and time of oviposition for *T. hobartsmithi* was given by Stebbins (1985) and Degenhardt et al. (1996). Force (1935) provided detailed information on reproduction in the congener *Tantilla gracilis* from northeastern Oklahoma as did Aldridge and Semlitsch (1992a, 1992b) for *Tantilla coronata* from South Carolina. This note's purpose is to provide information on the reproductive cycle of *T. hobartsmithi* in Arizona based on a histological examination of gonadal tissue from museum specimens.

Data are presented from 74 sexually mature *T. hobartsmithi* (40 females, mean snout-vent length [SVL] = 175 mm ± 18 [*s*], range = 141–222 mm; 34 males, mean SVL = 161 mm ± 12 [*s*], range = 138–185 mm) examined from the herpetology collections of Arizona State University (ASU), Tempe; Carnegie Museum (CM), Pittsburgh; Museum of Northern Arizona (MNA), Flagstaff; Natural History Museum of Los Angeles County (LACM), Los Angeles; Museum of Southwestern Biology (MSB), at the University of New Mexico, Albuquerque; and University of Arizona (UAZ), Tucson (Appendix). Data from 2 gravid females provided by P. Rosen (personal communication) were also included, but ovaries from these specimens were not sectioned. Counts were made of oviductal eggs and enlarged ovarian follicles. I examined tissues from 37 ovaries, 34 testes, and 20 vasa deferentia from specimens collected between 1948 and 2001. The left ovary was removed from females and the left testis and vas deferens were removed from males for histological examination. Tissues were embedded in paraffin, cut into 5-µm sections, mounted on glass slides, and stained with Harris' hematoxylin followed by eosin counterstain. Slides were examined to determine the stage of the testicular cycle and the presence of yolk deposition (secondary vitellogenesis *sensu* Aldridge 1979). Vasa deferentia were examined for sperm.

Testicular histology was similar to that reported by Goldberg and Parker (1975) for the colubrid snakes *Masticophis taeniatus* and *Pituophis catenifer.* In regressed testes seminiferous tubules contained spermatogonia and Sertoli cells embedded in a Sertoli syncytium. In recrudescent testes I noted a renewal of spermatogenic cells characterized by spermatogonial divisions. Primary and secondary spermatocytes and occasional spermatids were present. In testes undergoing spermiogenesis, metamorphosing spermatids and mature sperm were present.

Because males from June were not examined, the testicular cycle cannot be completely described. Nevertheless, the presence of males with testes in regression or recrudescence in spring (Table 1) and all males undergoing spermiogenesis in August and September suggests that *T. hobartsmithi* has an aestival spermatogenesis *(sensu* Saint Girons 1982) with multiplication of spermatogonia in spring and spermiogenesis ending in October. This pattern also occurs in the congener *T. coronata* in South Carolina (Aldridge and Semlitsch 1992b).

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TABLE 1. Monthly distribution of reproductive stages in the seasonal testicular cycle of 34 *Tantilla hobartsmithi* from Arizona. Values shown are the number of males exhibiting each of the 3 conditions.

Month	*n*	Regression	Recrudescence	Spermiogenesis
March	8	7	1	0
April	14	8	6	0
May	4	2	2	0
July	1	0	1	0
August	5	0	0	5
September	2	0	0	2

TABLE 2. Monthly distribution of reproductive stages in the seasonal ovarian cycle of 40 *Tantilla hobartsmithi* from Arizona including 2 gravid females* from P. Rosen (personal communication). Values shown are the number of females exhibiting each of the 4 conditions.

Month	*n*	Inactive	Early yolk deposition	Enlarged follicles (18 mm length)	Oviductal eggs
January	1	1	0	0	0
March	6	6	0	0	0
April	16	15	1	0	0
May	4	3	0	0	1*
July	5	4	0	0	1
August	6	5	0	1*	0
October	2	2	0	0	0

All vasa deferentia of *T. hobartsmithi* from the following dates contained sperm: 4 March, 10 April, 2 May, 2 August, 2 September. Force (1935) suggested that *Tantilla gracilis* mated during May in Oklahoma. Aldridge and Semlitsch (1992b) reported that *T. coronata* mates during spring and summer in South Carolina. Most species of *Tantilla* are thought to mate in the spring (Rossi and Rossi 1995). *Tantilla hobartsmithi* may similarly mate in the spring utilizing sperm stored in the vasa deferentia from autumn spermiogenesis; however, the possibility that fall mating may occur cannot be dismissed.

As was reported for other species of *Tantilla* by Clark (1970), female *T. hobartsmithi* lack a functional left oviduct. A female *T. hobartsmithi* (Table 2) from April was undergoing early yolk deposition with basophilic yolk granules in the ovarian follicles (SVL 190 mm, UAZ 32948), while 1 from May (SVL 208, LACM 20472) contained 2 oviductal eggs. P. Rosen (personal communication) supplied information on the following 2 gravid *T. hobartsmithi.* A female from 25 July (SVL 190 mm, Cochise County) contained 1 oviductal egg, and 1 female from 2 August (SVL 222 mm, Pima County) contained 2 enlarged eggs (18 mm length). Thus, for *T. hobartsmithi* in Arizona, clutch sizes ($n = 3$) range between 1 and 2. The remainder of the *T. hobartsmithi* females examined were not reproductively active. The presence of 27/31 (87%) reproductively inactive females during April, May, July, and August may suggest that only a portion of the female population produces eggs annually. This is typical for other colubrid snakes from the southwestern United States (see, for example, Goldberg 2000, 2001). However, examination of a large sample of *T. hobartsmithi* females during the months of reproduction from the same population and year are needed before this can be known. Aldridge and Semlitsch (1992a) reported an ovarian cycle for *T. coronata* similar to that of *T. hobartsmithi* in which vitellogenesis occurs in the spring, with ovulation occurring in June and egg deposition in June and early July. In Oklahoma, *T. gracilis* egg deposition (2–3 eggs most commonly) occurred from the middle of June to the middle of July (Force 1935). The period of egg deposition may be later for *T. hobartsmithi* in Arizona and could be timed to coincide with the summer monsoon period and resultant moisture. However, examination of additional gravid females will be needed to ascertain the time of oviposition for *T. hobartsmithi.*

Previous reports on reproduction in *T. hobartsmithi* include clutches of 1–3 eggs laid in June, July, and perhaps August (Stebbins 1954, 1985). Additional data on clutch size in *T. hobartsmithi* are from females collected in Big Bend National Park, Brewster County, Texas. These include 3 reports of clutches of 1 egg each from *T. hobartsmithi* (= *T. atriceps*) deposited 23 June, 28 July, and 4 August (Easterla 1975); 1 female with a single egg ready to be deposited 1 June (Minton 1958 [1959]); and a clutch of 3 eggs deposited 19 June (Degenhardt et al. 1996). Field observation and subsequent collection of gravid females will improve our understanding of the reproductive biology of this species.

I thank G. Bradley (UAZ), J. Gillette (MNA), A. Holycross (ASU), D. Kizirian (LACM), C. Painter (MSB), and J. Wiens (CM) for permission to examine specimens and K. Beaman (LACM) for helpful comments on the manuscript. P. Rosen (UAZ) provided information on clutch sizes.

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Received 19 August 2002
Accepted 21 January 2003

APPENDIX. Specimens examined from the herpetology collections of Arizona State University (ASU), Carnegie Museum (CM), Museum of Northern Arizona (MNA), Museum of Southwestern Biology (MSB), Natural History Museum of Los Angeles County (LACM) and University of Arizona (UAZ).

LOCALITY.—**Cochise Co.**: CM 40413–41415; MSB 57234; UAZ 40061, 43941, 47192, 50656, 50743. **Coconino Co.**: UAZ 28042. **Gila Co.**: UAZ 42685. **Graham Co.**: UAZ 43884, 43887. **Greenlee Co.**: ASU 30456, 30458; UAZ 42784. **Maricopa Co.**: LACM 20472, 103725, 103726, 125277, 125449, 125450; UAZ 26392, 26417, 37454, 37457, 43779. **Pima Co.**: MNA 27.777, 27.779, 27.790, 27.791, 27.793; UAZ 26403, 26414, 26416, 26419, 26422, 26428, 26433, 26434, 28552, 30474, 30757, 31985, 32948, 32949, 35630, 36426, 39862, 40406, 40458, 42018, 42360, 42496, 44350, 47180, 50373, 50602, 53402. **Pinal Co.**: UAZ 26399–26401, 26405, 26420, 26423, 26432, 30335, 43882, 43883, 44022, 47486. **Yavapai Co.**: UAZ 49929.

DISTRIBUTION.—Arizona.