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A Survey of Gravid Snakes at Several Sites in Southern Wisconsin

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Photographs by the author except where indicated.

Fitch (1987a) indicated that morphological measurements, particularly measures of snout-to-vent length (SVL), provide some of the most useful information that can be obtained from field-based research on snakes. Unfortunately, published research that focuses on natural history, which includes morphological data such as snake size, has declined sharply in recent years (Henderson and Powell 2009, McCallum and McCallum 2006). In some cases, natural history observations considered "anecdotal" are even treated with scorn by researchers. As Fitch (1987b) suggested, such reactions to life history studies are unfortunate, and information that may be considered anecdotal still has a valuable role in increasing the understanding of many species' ecological needs. Therefore, this information should be published.

Considerable data have been published on the ecology and life history of several natricine snake species, particularly the Common Garter Snakes (*Thamnophis sirtalis*; e.g., Fitch 1965, 1999, 2001). These include information on aspects of their morphology, such as size (SVL) and weight. However, certain small fossorial species, such as members of the genus *Storeria* have received less attention. In addition, although the size of "mature" females has been reported for several species at some locations in the upper midwestern United States (e.g., Ohio and Michigan), such information is rare from populations in Wisconsin. Furthermore, few if any data from Wisconsin have been published, with the possible exception of technical reports that are not easily obtained. Such information is valuable for determining numerous aspects of the biology of these species, such as size at sexual maturity and morphological characteristics of regional

An example of typical Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) habitat in Wisconsin.

Grassland habitat is often preferred by Brown Snakes (*Storeria dekayi*) in Wisconsin.

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Brown Snakes (*Storeria dekayi*) were found at only one of the survey locations.

Table 1. Sample sizes, mean snout-vent-length (SVL) in mm for each species captured per survey location.

Species	Site Name	Wisconsin County	Sample Size	Mean SVL ± SD (range)
S. dekayi	Mud Lake	Dodge	21	264 ± 25 (241–295)
S. occipitomaculata	Westford	Dodge	2	231 ± 22 (215–248)
S. occipitomaculata	French Creek	Marquette	1	196
S. occipitomaculata	Horicon	Dodge	2	225 ± 16 (214–237)
T. sirtalis	Cedarburg	Ozaukee	11	471 ± 72 (356–620)
T. sirtalis	Horicon	Dodge	10	546 ± 53 (469–603)
T. sirtalis	Mud Lake	Dodge	5	562 ± 36 (524–609)
T. sirtalis	Westford	Dodge	4	492 ± 39 (450–533)

populations. Therefore, my objective was to survey for gravid natricines at several sites in southern Wisconsin, with particular interest in the understudied members of the genus *Storeria,* to determine if the sizes of gravid snakes encountered conformed to previously published reports of adult female size or size at maturity. In addition, the goal of these surveys was to provide baseline natural history data that may have current and future value to herpetologists, ecologists, and conservation biologists.

I conducted surveys for gravid females at five sites across three counties in southern Wisconsin during the late spring-summer of 2009. I chose this period to conduct my surveys because it is within the season during which Wisconsin species are gravid. Although sites varied in area, ratio of wetland to upland, and plant community complexity, all survey locations possessed open shallow marsh habitats with associated open upland habitats (primarily grassland or fallow grassland). Each site was surveyed via artificial cover objects (Fitch 1987a) in the form of ¾-inch plywood cut in 3 x 4-ft sheets. Boards were placed opportunistically in areas that appeared suitable for natricine snakes, with a particular focus on species of *Thamnophis*, *Storeria*, and *Nerodia*. Boards were checked after 1700 h only on days that had been partly sunny to sunny. This insured that the microclimate under each board would be warm enough to attract gravid females, but not so warm as to be unsuitable. Gravidity was determined by palpation of the lower third of the snake to check for the presence of formed embryos. I measured the SVL of gravid snakes by gently, but firmly, stretching them along a tape measure as described in Fitch (1999).

Due to resource limitations, the survey effort at each site varied. At some locations, cover objects were deployed several years prior to initiation of the study, whereas at other locations, boards were deployed in late spring 2009, immediately prior to initiation of surveys. In addition, each site was not surveyed the same number of times, and an equal number of cover objects was not implemented equally across sites. Mud Lake and Westford, for example, each had ten cover objects and were visited six times throughout the late spring and summer. Cedarburg, on the other hand, had 15 cover boards and was surveyed four times. French Creek had 10 boards and was surveyed four times, whereas Horicon had 20 boards divided among four locations and was surveyed nine times. However, because the objective of these studies (i.e., to sample gravid females on-site and measure their SVL) did not depend upon equitable survey efforts across sites, these variations were deemed acceptable.

Throughout the course of these surveys, I encountered adult gravid females of three natricine species: Northern Brown Snake (*Storeria dekayi dekayi*), Redbelly Snake (*Storeria occipitomaculata occipitomaculata*), and Eastern Garter Snake (*Thamnophis sirtalis sirtalis*; Table 1). However, I did not find all three species at every survey location. Gravid snakes also were found at all survey locations. For example, at the French Creek site, I found only one gravid Redbelly Snake and no gravid females of other species. Brown Snakes were encountered only at the Mud Lake site, whereas gravid Eastern Garter Snakes were found at all sites except French Creek (Table 1). Overall, gravid Eastern Garter Snakes were the most frequently encountered snakes across all sites (n = 30). These were followed by Northern Brown Snakes (n = 21) and Redbelly Snakes (n = 5). Because I did not mark individuals, I may have collected and measured the same snake on more than one occasion.

Table 2. Size comparisons of adult female snakes encountered during this study and past published reports. Measurements of snakes reported to be gravid are indicated with a single asterisk (*); publications reporting estimated size at sexual maturity are indicated with a double asterisk (**).

Species	Source	Location of Study	Sample Size	Average SVL (mm)
S. dekayi	This study	Wisconsin	21	264*
S. dekayi	Wilson and Dorcas (2004)	North Carolina	9	245
S. dekayi	Minton (2001)	Indiana	21	266
S. dekayi	Fitch (1999)	Kansas	22	256*
S. dekayi	King (1997)	Ontario/Ohio	NA	230**
S. dekayi	Kofron (1979)	Louisiana	30	170–175**
S. occipitomaculata	This study	Wisconsin	5	222*
S. occipitomaculata	Wilson & Dorcas (2004)	North Carolina	7	181
S. occipitomaculata	Minton (2001)	Indiana	10	198
S. occipitomaculata	Brodie & Ducey (1989)	New York	42	209*
S. occipitomaculata	Semlitsch & Moran (1984)	South Carolina	37	157
S. occipitomaculata	Blanchard (1937)	Michigan	71	194
T. sirtalis	This study	Wisconsin	30	514*
T. sirtalis	Minton (2001)	Indiana	30	531
T. sirtalis	Fitch (1999)	Kansas	1592	639
T. sirtalis	Rossman et al. (1996)	Various	NA	420–550**
T. sirtalis	Mitchell (1994)	Virginia	—	515
T. sirtalis	Larsen et al. (1993)	Canada	23	745*
T. sirtalis	King (1989)	Lake Erie Islands	345	683
T. sirtalis	Hebard (1950)	Washington	32	408

In general, the SVL of gravid females of all species encountered did not vary greatly from past reports (Table 2). On average, gravid Brown Snakes were 264 ± 25 mm in SVL with little variation in individual SVL. This species has been reported to show significant geographic variation in SVL (King 1997), which also has been noted for *Thamnophis sirtalis* (King 1989). Gravid Redbelly Snakes were slightly smaller than Brown Snakes on average, but sizes varied little (222 ± 20 mm). The average SVL of gravid Eastern Garter Snakes captured during my surveys was 514 mm, making them the largest snake encountered. Unlike the other two species, however, considerable variation in SVL was observed in this species (SD = 67 mm).

Although Redbelly Snake SVLs reported from past studies are smaller than the average I recorded for individuals in Wisconsin, my sample size was

Redbelly Snakes (*Storeria occipitomaculata*) were found in habitat such as this during surveys.

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Redbelly Snakes (*Storeria occipitomaculata*) were encountered at more sites than Brown Snakes (*S. dekayi*), but in lower densities.

The Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) was the most frequently observed snake during surveys.

small (n = 5), and I recommend caution when interpreting this. However, to my knowledge, few published reports have large sample-sizes of this species. For example, Wilson and Dorcas (2004) reported capturing seven females over five years of surveys in North Carolina; Brodie and Ducey (1989) reported a sample of 42 gravid females captured over two years in New York; Semlitsch and Moran (1984) captured 37 females; and Blanchard (1937), who commented specifically on how infrequently they are encountered, analyzed 71 females for which he had acquired data over 12 years. In addition, although my samples were small, despite being spread across three sites in two counties, little variation was observed in SVL (SD = 20 mm).

Rossman et al. (1996) reported that female *Thamnophis sirtalis* mature at 420–550 mm and all of the average SVLs that I observed per site fit within this range (Table 2). At one location (Cedarburg), I examined two gravid individuals that were below this threshold (397 mm and 356 mm). Fitch (1999) reported that the smallest gravid female, among the hundreds that he analyzed over 50 years at a site in Kansas, measured 490 mm in SVL. At least ten gravid individuals that I encountered at all survey locations were shorter than this.

In summary, the gravid snakes of all species encountered during my surveys were similar in SVL to previously published reports. Unfortunately, the small sample sizes and relatively short survey period (i.e., one season) of this work limits comparisons with other studies. More data are necessary to make definitive conclusions about the sizes of gravid snakes in this region of North America.

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