BRIEF NOTE

Small Litter Sizes and Relative Clutch Mass of Northern Watersnakes (*Nerodia sipedon sipedon*) in Southwestern Ohio

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Abstract. Relative clutch mass (RCM), the ratio of total mass of a clutch to the postpartum body mass of the female, is considered by many a life history trait that indirectly quantifies reproductive effort in snakes. The Northern Watersnake (*Nerodia sipedon sipedon*) is one of the most abundant and widespread species of snake within Ohio. Litter sizes of *N. s. sipedon* have been reported to range between four and 99 and RCM values typically fall between 0.20 and 0.38. Two gravid *N. s. sipedon* were hand collected from Collins Creek (Butler County, Ohio) and maintained in the laboratory until parturition. Females gave birth to three and six neonates with RCM values of 0.108 and 0.120, respectively. The extremely small litter sizes and RCM values are, by far, the lowest ever recorded for this species in Ohio and throughout their entire North American range. This local population should be investigated further to determine if and how reproductive output is being depressed at Collins Creek.

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INTRODUCTION

Relative clutch mass (RCM), which is the ratio of the total mass of a clutch to the postpartum body mass of the female, is considered by many an important life history trait that indirectly quantifies reproductive effort in reptiles (Seigel and Fitch 1984; Shine 1992). Because a high RCM will likely reduce the locomotor abilities of females making them more vulnerable to predators, natural selection should favor individuals with an optimal RCM to maximize fitness. Typical RCM values for snakes range from about 0.14 to 0.40 (Seigel and Fitch 1984). RCM values tend to be lower in viviparous snakes because they must carry their young for a longer period of time (Shine and Schwartzkopf 1992). Moreover, RCM values tend to be lower in species that frequently use aquatic locomotion since pregnancy disrupts stream-lining necessary for efficient swimming (Shine 1988). Ford and Seigel (1989) showed that clutch size and clutch mass are plastic in relation to resource levels (e.g. food intake) in the viviparous Checkered Gartersnake (*Thamnophis marcianus*), with the reduction of RCM when resource levels are depressed.

Arguably one of Ohio's most abundant snakes is the Northern Watersnake (*Nerodia sipedon sipedon*), being found in all 88 counties (Wynn and Moody 2006). This viviparous species is found in a variety of lentic and lotic freshwater habitats across the state and feeds on a wide variety of prey (Gibbons and Dorcas 2004). The mean litter size for *N. s. sipedon* is 26 and litter sizes ranging from four to 99 have been reported throughout their entire North American range (Ernst and Ernst 2003; Gibbons and Dorcas 2004). Previous reports of RCM for *N. s. sipedon* range from 0.15 to 0.52 with typical values falling between 0.20 and 0.38 (Barron 1997). Herein, we provide a report of extremely small litter sizes and RCM values for two female *N. s. sipedon* originating from a small stream in southwestern Ohio.

MATERIALS AND METHODS

Two gravid females were hand collected less than 30 m from each other on 19 July 2006. Both females were basking in low lying riparian vegetation overhanging Collins Creek, a third order stream located in Butler County, Ohio (39°29'52"N; 84°43'57"W). Snakes were transported to the laboratory where they were fed Fathead minnows (*Pimephales promelas*) daily until parturition. Females and newborns were measured to the nearest 0.1 cm and weighed to the nearest 0.1 g. This study was conducted in accordance with the Miami University Institutional Animal Care and Use Committee (Protocol # 634).

RESULTS

One female (A) gave birth to six offspring (combined weight = 15.5 g) on 17 August 2006 and the second female (B) gave birth to three offspring (combined weight = 14.7 g) on 18 August 2006 (Table 1). RCM values were 0.120 and 0.108 for females A and B, respectively.

DISCUSSION

Relative clutch masses reported here are the smallest ever reported for *Nerodia sipedon sipedon* within Ohio and throughout its entire range, and are among the smallest reported for the entire genus *Nerodia* in North America. Since offspring mass was very similar to those reported elsewhere for *N. s. sipedon* (Ernst and Ernst 2003; Gibbons and Dorcas 2004), the decrease in RCM is a direct result of the reduced litter sizes of both females. The observed litter sizes are extremely low compared to those reported for this species throughout the rest of their geographic range and, to our knowledge, the litter size of three is the smallest ever reported for *N. s. sipedon*.

These small litter sizes, and hence low RCM values, observed are likely due to decreased energy intake via consumption of low quality food or reduced food intake (Ford and Seigel 1989). Since these females were captured in the same stream within 30 m of each other, we cannot rule out that these individuals are closely related. However, the apparently high population density of Northern Watersnakes at Collins Creek (G.W. Gerald, personal observation) suggests that decreased litter sizes could be a result of intense intraspecific competition for resources. This population should be investigated further to determine whether or not reduced litter sizes are characteristic of this population and, if so, ascertain precisely the factors depressing the reproductive output of female *N. s. sipedon* in this particular stream.

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Table 1

Summary of mass, snout-vent lengths (SVL), tail lengths, total lengths, and relative clutch mass (RCM) for two female Nerodia sipedon sipedon *and their offspring. Each individual offspring, which are denoted by a letter (indicating the mother) and number, are listed directly under the mother.*

Individual	Pre-birth mass (g)	Post-birth mass (g)	SVL (cm)	Tail (cm)	Total (cm)	RCM
Female A	159.2	129.4	65.7	17.9	83.6	0.1198
A1	-	3.0	14.3	3.8	18.1	
A2	-	3.0	14.5	3.7	18.2	
A3	-	1.6	11.3	3.7	15.0	
A4	-	3.1	15.0	4.1	19.1	
A5	-	3.2	15.2	4.7	19.9	
A6	-	1.6	12.4	3.7	16.1	
Female B	161.0	135.7	59.1	13.3	72.4	0.1083
B1	-	4.8	17.2	6.0	23.2	
B2	-	5.3	17.9	4.9	22.8	
B3	-	4.6	16.0	5.8	21.8	

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