REPRODUCTION IN THE MOLE KINGSNAKE, *Lampropeltis calligaster rhombomaculata*

The mole kingsnake, *Lampropeltis calligaster rhombomaculata*, ranges from the vicinity of Baltimore, Maryland south to the Florida panhandle and westward to central Tennessee and southern Mississippi (Conant, 1975). It is a fossorial species most often seen at twilight. Because of its secretive habits, little is known of its natural history, especially its breeding habits. The purpose of this paper is to present new data on eggs and hatchlings of this snake, and to compare reproductive data between the subspecies *L. c. calligaster* and *L. c. rhombomaculata*.

On 2 June 1984, an obviously gravid female mole kingsnake was captured by Lovich at Woodbridge, Prince William County, Virginia. Its measurements were as follows: total body length, 851 mm, snout-vent length, 753 mm, tail length, 98 mm (11.5% of total body length). The snake was brought to George Mason University (GMU) where it was housed in a Neodesha, 24 inch reptile cage. She shed on 24 June, and, as ecdysis has often preceeded oviposition by 7-10 days in other captive *Lampropeltis* we have kept, a nesting box with damp sawdust was provided the next day.

Sixteen white, smooth-shelled eggs were laid on 5 July; fifteen regularly-shaped, elongated eggs and one smaller, almost round egg. This is a record clutch for *L. c. rhombomaculata*. The eggs were measured with dial calipers accurate to 0.1 mm (unfortunately no weights were taken), and placed in moist sawdust in a gallon jar and incubated at room temperature (approximately 23°C). A group of eight elongated eggs and the smaller rounded egg comprised a large adherent cluster, while two other elongated eggs were also stuck together in a separate cluster. Adherence in *Lampropeltis* eggs is well known (Blanchard, 1921).

The female shed again on 29 July, but refused all food and was eventually preserved (GMU 2454).

Hatching began on 19 September and the last hatchling emerged on the 21st, an incubation period of 76-78 days. Nine young emerged. Of the other seven eggs, five contained near term dead embryos (GMU 2538), one was destroyed early in incubation by mold, and the smaller rounded egg was infertile. Egg and hatchling parameters are presented in Tables 1-2, and Figure 1 shows a plot of weight versus total body length in the nine hatchling *L. c. rhombomaculata*. The young snakes immediately showed belligerent dispositions, shaking their tails and striking when approached. Ecdysis began on 30 September with the last hatchling shedding its skin 9 October. Five hatchlings were preserved (GMU 2539-2543), and the other four were released at the Mason Neck National Wildlife Refuge Fairfax County, Virginia on 12 October.

Tables 1-2 present comparative data on nesting dates, eggs, incubation periods, hatching success, and hatchling parameters for *L. c. rhombomaculata* and the western subspecies *L. c. calligaster*. Nesting occurs in both subspecies during June and July, and there is no significant difference in mean clutch size between the two races (chi-square test, $p>0.05$). However, it is apparent that *L. c. calligaster*, the slightly longer subspecies (Conant, 1975), lays larger, heavier eggs. Hatching occurs in August and September in both subspecies. The relatively long incubation period we report, comparable only to that reported for a Missouri *L. c. calligaster* by Anderson (1965), was probably due to a lower incubation temperature. Table 2 shows that the hatchlings of *L. c. calligaster* are also significantly larger and more heavy (chi-square test, $p>0.05$) than those of *L. c. rhombomaculata*. In Figure 2, clutch size is plotted against female total body length for the Virginia clutch and those literature clutches with corresponding data. Generally, clutch size increases with greater female body length.

Tryon and Carl (1980) determined, by hemipenal eversion, the sex ratio for their 17 hatchling *L. c. rhombomaculata* to be 11 males and 6 females. Their males had tail lengths of 10.4-15.5% ($\bar{X}$ = 13.2%) of total body length, while those of their females were 11.0-13.0% ($\bar{X}$ = 12.1%). Sexes of the nine Virginia hatchlings were determined by tail length to be four males and five females. The males had tail lengths of 12.5-14.5% ($\bar{X}$ = 13.8%) and the females, 11.0-12.0% ($\bar{X}$ = 11.4%).

TABLE 1. Egg data for the snake, *Lampropeltis calligaster* (measurements in mm; weights in g).

	Clutch Size	Mean Length	Mean Width	Mean Weight	Incubation Period (Days)	Hatching Rate (%)	Source
L. c. rhombomaculata:							
Virginia							
5 July	16	27.8 (25.3-33.3)	21.1 (17.4-23.2)	---	76-78	9(56)	
Georgia							
2 June	5	39.6 (37-43)	16 (14-17)	6.4	49-54	4(80)	Tryon & Carl, 1980
7 June	13	29.7 (27-34)	18.3 (17-19)	5.7	49-54	13(100)	Tryon & Carl, 1980
Maryland							
11 June	15	---	---	---	---	---	Howden, 1946
L. c. calligaster:							
Illinois							
August (found)	11	---	---	---	---	---	Blanchard, 1921
17 August (found)	9	44-49	24-28	---	---	---	Cagle, 1942
19 June	11	37.9 (34-43)	21.1 (19-22)	10.7 (10-11.4)	45-46	9(90)*	Shoop, 1957
27 June	8	40.0 (38-46)	18.0 (17-19)	8.9 (8.2-9.6)	49-50	7(88)	Shoop, 1957
5 July	9	---	---	---	---	---	Smith, 1961
6 July	18	---	---	---	52	13(72)	Miller, 1962
Indiana							
22 July	11	---	---	---	54**	---	Minton, 1972
Kansas							
15 July	9	44.1 (41-48.5)	21.0 (19-22)	11.6 (10.9-12.4)	---	---	Clarke, 1954
25 June (found)	13	---	---	---	54-55	13(100)	Fitch, 1978
19 June	7	---	---	---	67-68	---	Fitch, 1978
	10	---	---	---	62-63	---	Fitch, 1978
Missouri							
13 July	6	50	20	---	---	---	Anderson, 1965
23 June	12	47	21	---	73-75	13(100)	Anderson, 1965
August (found)	13	---	---	---	---	---	Anderson, 1965
22 June	17	---	---	---	---	---	Dietrich, 1960
Nebraska							
9 June	13	---	---	---	53	---	Iverson, 1975
Oklahoma							
1 July	14	39.3	23.7	---	---	---	Carpenter, 1958
20 July	14	24.3	16.5	---	---	---	Carpenter, 1958
Texas							
17 June (dissected)	8	---	---	---	---	---	Guidry, 1953

* = One egg opened by Shoop.
** = Embryos killed just before hatching.

TABLE 2. Hatchling data for the snake, *Lampropeltis calligaster* (measurements in mm, weights in g).

	N.	Mean Total Length	Mean Snout-Vent Length	Mean Tail Length	Mean Weight	Source
L. c. rhombomaculata:						
Virginia	9	221.6 (200-236)	193.4 (176-210)	28.1 (24-33)	4.0 (2.7-4.7)	
Georgia	4	220.7 (193-236)	---	---	5.5 (5.1-6.4)	Tryon & Carl, 1980
	13	219.5 (210-230)	---	---	5.8 (4.9-6.5)	Tryon & Carl, 1980
Maryland	9	225	---	---	---	Grogan & Prince, 1971
L. c. calligaster:						
Illinois	9	260.5 (249-271)	---	33.4 (28-37)	9.1 (7.7-10.1)	Shoop, 1957
	7	265.4 (250-277)	---	33.5 (32-39)	7.5 (6.9-8.0)	Shoop, 1957
Indiana	3	244-255	---	---	---	Minton, 1972
Kansas	26	---	272 (234-308)	---	7.96 (6.9-12.2)	Fitch, 1978
Nebraska	13	297 (290-305)	---	---	---	Iverson, 1975

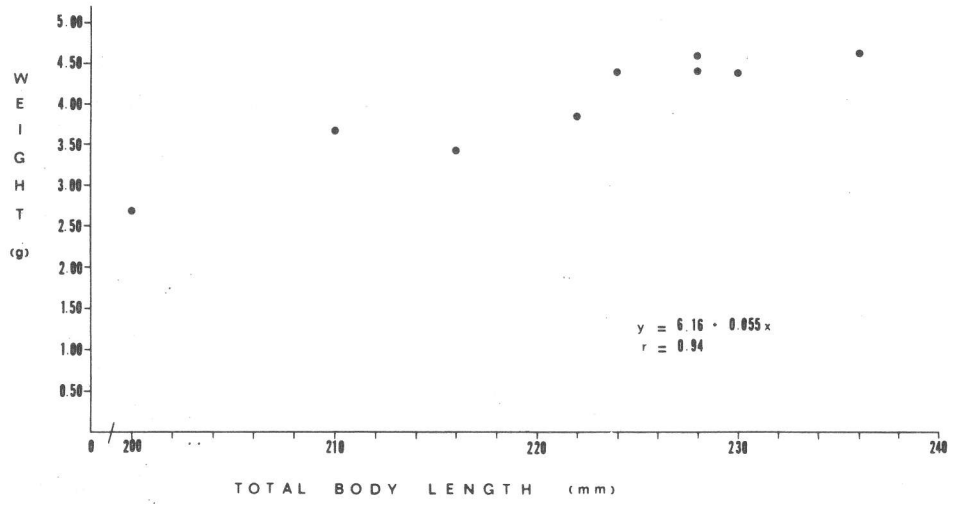

Figure 1. The relationship of weight to total body length in hatchling *Lampropeltis calligaster rhombomaculata* (N = 9).

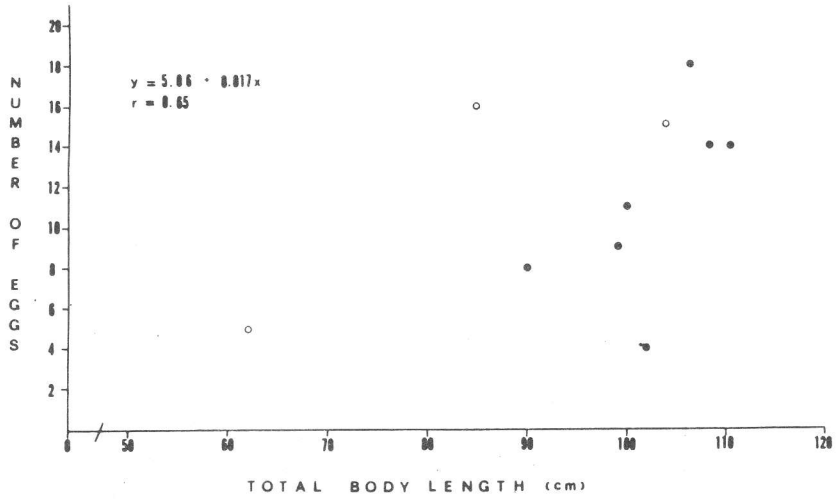

Figure 2. The relationship of clutch size to female total body length in the snake, *Lampropeltis calligaster* (N = 10). Solid circles = *L. c. calligaster*; hollow circles = *L. c. rhombomaculata*.

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—Carl H. Ernst, and Steve W. Gotte, *Department of Biology, George Mason University, Fairfax, Virginia 22030*, and Jeffrey E. Lovich, *Institute of Ecology, University of Georgia, Athens, Georgia 30602.*

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