

REPRODUCTION AND DISTRIBUTION OF THE SOUTH FLORIDA MOLE  
KINGSSNAKE (*LAMPROPELTIS CALLIGASTER OCCIPITOLINEATA*) FROM  
CENTRAL PENINSULAR FLORIDA

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*Abstract.* Aspects of reproduction including courtship, copulation, ova and offspring are described for the South Florida mole kingsnake (*Lampropeltis calligaster occipitolineata*). Data derived from one natural and two laboratory breedings resulted in 21 fertile and 4 infertile eggs, with 19 live offspring yielding a sex ratio of 9:10 (M:F). Breeding took place in April, oviposition in May, and hatching in July and August. Copulation to oviposition lasted 32 to 62 days ( $x = 47$ ). Incubation of eggs lasted 63 to 65 days ( $x = 64.3$ ). About 40 *L. c. occipitolineata* have been reported from scattered localities in central peninsular Florida. Because *L. c. occipitolineata* is extremely fossorial and there appears to be extensive suitable habitat from Brevard to DeSoto counties, we suggest that this snake may be much more widespread than previously believed.

*Key Words:* *Lampropeltis*; snake; reproduction; geographic distribution; Florida.

#### INTRODUCTION

The South Florida mole kingsnake (*Lampropeltis calligaster occipitolineata*) was described in 1987 (Price, 1987), and information in the literature on this species has been mainly limited to geographic distribution records (Layne et al., 1986; Krysko and Hurt, 1998). *Lampropeltis c. occipitolineata* is considered rare and is endemic in central peninsular Florida (Means, 1992), as fewer than 40 individuals are known to have been collected (Tennant, 1997). Individuals have been found at scattered localities in Brevard, Okeechobee (Layne et al., 1986; Means, 1992), DeSoto (Krysko and Hurt, 1998), Glades and Hendry counties (K. M. Enge, pers. comm.).

Little is known about *L. c. occipitolineata* and the life history of this disjunct

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Table 1. *Lampropeltis calligaster occipitolineata* used in breeding experiments.

Identification Number	Sex	SVL (cm) in spring 1999	Remarks
CH-m1	M	88.9	Collected near Arcadia, DeSoto Co., FL in June 1992
CH-f1	F	83.8	Collected near Arcadia, DeSoto Co., FL in March 1995, gravid
LEK-95028	F	67.3	Offspring between CH-f1 and unknown male from wild

taxon is speculated to be similar to the mole kingsnake (*L. c. rhombomaculata*) (Means, 1992; Tennant, 1997), which ranges from southeastern Louisiana east to panhandle and northern peninsular Florida and north to Maryland (Ernst and Barbour, 1989; Conant and Collins, 1991). We document aspects of the reproduction in *L. c. occipitolineata*, and review its geographic distribution.

## MATERIALS AND METHODS

Three adult *L. c. occipitolineata* were captured from 1992-1995: a gravid female, a non-reproductive female, and a male (Table 1). Each snake was housed separately outdoors in a 38 L aquarium. From 14 February to 1 May 1999, the male (CH-m1) was alternated weekly between pairings with one of the females (CH-f1 or LEK-95028). The pairs were observed closely for breeding behavior.

Eggs resulting from the 1999 laboratory breedings and the 1995 copulation of female (CH-f1) with an unknown male in the wild were placed in plastic shoe boxes, covered with moist sphagnum moss, and incubated at mean temperature of 26°C. Length and width of the eggs were measured to the nearest mm. Snout-vent length (SVL) to the nearest mm and sex of young were recorded after hatching. Newborns *L. c. occipitolineata* were offered newborn pink mice (*Mus musculus*), ground skinks (*Scincella lateralis*) and southeastern five lined skinks (*Eumeces inexpectatus*) at 5 to 7 days after hatching.

## RESULTS

Male (CH-m1) was observed aggressively pursuing female LEK-95028 on 7 April 1999, at 2230 hr. A cold front was approaching and atmospheric conditions were 21°C, falling pressure 30.16, humidity 78%, and dew point 17. Both snakes were observed side by side with the male pressing his snout, flicking his tongue, and occasionally biting along the female's body and neck, while both made simultaneous jerking movements. The male placed his body over the female in several places as he pulsated his body in a series of waves from tail to head. He placed his tail under the female's tail and copulation was witnessed, lasting more than 1 hour. Female (LEK-95028) laid five opaque, white eggs 8 June 1999 (Table 2). Copulation to oviposition lasted 62 days. These fertile eggs measured 40 to 45 mm ( $x = 42.5$  mm) long and 15 to 20 mm ( $x = 17.5$  mm) wide. Four eggs hatched 12 August 1999, yielding a sex ratio of 1:3 (M:F)(Table 2). Incubation lasted 65 days at mean temperature of 26°C. The fifth egg was opened on 14 August, which contained a dead full term embryo with several vertebral kinks.

Male (CH-m1) was observed aggressively pursuing female CH-f1 on 14 April 1999, at 1900 hr. A cold front was approaching and atmospheric conditions were 22°C, falling pressure 29.89,

Table 2. Reproduction data for female *Lampropeltis calligaster occipitolineata*. \* Indicates natural breeding with unknown male. Offspring sex ratio is male:female.

Identification Number	Date of Copulation	# Eggs	Date Laid	Copulation to Oviposition (days)	# Hatched	Date Hatched	Incubation (days, mean temp °C)	Sex Ratio
*CH-f1	? 1995	11	12 May 1995	N/A	10	16 July 1995	65, N/A	4:6
CH-f1	14 April 1999	9	16 May 1999	32	5	18 July 1999	63, 26	4:1
LEK-95028	7 April 1999	5	8 June 1999	62	4	12 Aug. 1999	65, 26	1:3

humidity 82%, and dew point 17. The male's courtship behavior was similar to its pairing with LEK-95028, but copulation was not witnessed. Female (CH-f1) laid nine eggs 16 May 1999 (Table 2), with four being infertile because of their atypical wet appearance and transparent, yellowish coloration. Copulation to oviposition lasted 32 days. Fertile eggs measured 35 to 40 mm ( $x = 37.5$  mm) long and 20 to 22.5 mm ( $x = 21.2$  mm) wide. Five eggs hatched 18 July 1999, yielding a sex ratio of 4:1 (M:F)(Table 2). Incubation lasted 63 days at mean temperature of 26°C. Offspring measured 152.4 to 177.8 mm SVL ( $x = 165.1$  mm). One male offspring had a slight kink along its vertebrae. Additionally, the wild collected, gravid female (Ch-f1) laid 11 eggs 12 May 1995 (Table 2). Sixty-five days after oviposition, 10 eggs hatched yielding a sex ratio of 4:6 (M:F). One newborn *L. c. occipitolineata* fed on *Mus musculus*, while all others fed on *Scincella lateralis* and *Eumeces inexpectatus*.

#### DISCUSSION

Study *L. c. occipitolineata* produced 21 fertile and four infertile eggs, with 19 live offspring yielding a sex ratio of 9:10 (M:F)(Table 2). Copulation to oviposition lasted between 31 to 62 days ( $x = 47$ ). Although copulation was not witnessed between male CH-m1 and female CH-f1 14 April 1999, we believe these two snakes mated. Like the mating between male CH-m1 and female LEK-95028, male CH-m1 and female CH-f1 exhibited all the signs of courtship before mating. No other signs of breeding interest were observed in pairings either before or after this date. We do not know when female CH-f1 copulated with an unknown male in the wild in 1995, but based on as oviposition date of 12 May 1995, we calculated their natural breeding occurred between 11 March and 11 April 1995 (31 to 62 days earlier). Ernst et al. (1985), Ernst and Barbour (1989), and Means (1992) reported *L. c. rhombomaculata* clutch sizes of five to 16 eggs, an incubation period from 45 to 78 days, and offspring measuring 193 to 236 mm. Our data for *L. c. occipitolineata* from central peninsular Florida is comparable to that of *L. c. rhombomaculata*, as clutch sizes ranged from 5 to 11 eggs, incubation period of 63 to 65 days ( $x = 64.3$ ), and offspring measured from 152.4 to 177.8 mm SVL ( $x = 165.1$  mm)(Table 2). Although our study was based on a small sample size, we acquired important information not previously documented for this taxon. Since the majority of newborn *L. c. occipitolineata* fed on *Scincella lateralis* and *Eumeces inexpectatus*, this suggests that they may have a preference for these small skinks, which are common in their natural habitat.

Layne et al. (1986) suggested that *L. c. occipitolineata* existed in two disjunct populations in

central Florida, one in Brevard Co. and another in Okeechobee County. Since then additional specimens have been found in these same areas and those extending southwest into Glades and Hendry counties (K. M. Enge, pers. comm.), and DeSoto Co. (Krysko and Hurt, 1998). Throughout this region there appears to be extensive suitable habitat for *L. c. occipitolineata* consisting of well drained, sandy loam soils in mainly pasture lands, orange groves and other agricultural fields, along with scattered wire grass (*Aristida stricta*), wax myrtle (*Myrica cerifera*), greenbrier (*Smilax* spp.), cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*), pine (*Pinus* spp.), and live oak (*Quercus virginiana*). Because most of this region is on private properties, it has gone unsurveyed for *L. c. occipitolineata*. In addition to the two wild collected *L. c. occipitolineata* used in this study, we know of three adult males that were found in the same vicinity suggesting a larger population than previously believed. One of these males (KLK-xx267) was found in February 1997 and died shortly after from being hit by a car and was deposited in the Florida Museum of Natural History. Because *L. c. occipitolineata* is fossorial and there appears to be extensive suitable habitat throughout much of central peninsular Florida, we believe this species may exist in one population extending from Brevard to DeSoto counties, but disjunct from the primary populations in southeastern U.S.

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