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Size and Demographic Structure of an Isolated Population of Western Hognose Snakes, *Heterodon nasicus*, in Northwestern Illinois

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Introduction

The distribution of the western hognose snake, *Heterodon nasicus*, extends from southern Canada through the Great Plains of the U.S. into Mexico (Conant and Collins, 1991). Several isolated populations exist to the east of the contiguous range in Missouri, Iowa, Minnesota, and Illinois, and to the west in Wyoming and Colorado. Relict eastern populations are holdovers in xeric habitats from a post-Pleistocene period of high temperatures and aridity (Smith, 1957). Little is known about the isolated populations (e.g., Roth et al., 1989), and only a few studies of populations within the contiguous range exist (Platt, 1969; Pendlebury, 1976). Populations in Illinois are located in sand prairies or sandy areas along the Mississippi, Green and Illinois Rivers (Smith, 1961).

The purpose of this study is to estimate the population size and evaluate the demographic structure of a western hognose snake (Figures 1 and 2) population in northwestern Illinois. The western hognose snake is a threatened species in Illinois (see Redmer and Kruse, 1998), and any information on the status of populations within the state is valuable.

Materials and Methods

The field site is an approximately 0.233 km^2 segment of relictual sand prairie on the eastern bank of the Mississippi River in Carroll and Whiteside Counties, Illinois. The area is administered by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. The field site represents only a portion of the total area of suitable habitat available for hognose snakes in the area. Dominant vegetation includes *Opuntia humifusa*, *Stypa* sp., and *Rhus aromatica*. Ground cover is heterogeneous with a mixture of grassy areas and sand blowouts (i.e., areas of exposed sand with little vegetation; see Figure 2 in Warner, 1998).

Daily transects were conducted in sand prairie habitat from 0700–1100 h from 26 May to 3 July 1996–1998. Snakes were captured by hand, weighed to the nearest gram, snout–vent length (SVL) was measured to the nearest millimeter, ventral scale clips were taken for tissue samples, and snakes were sexed with a probe when possible (some juveniles were too small). Additionally, a passive integrated transponder (PIT) tag was inserted into each snake for future identification. Total person-hours spent conducting transects was approximately 300 hours in 1996, 340 hours in 1997, and 207 hours in 1998. More precipitation in 1998 resulted in fewer hours in the field. This three-year study represents the beginning of a long-term monitoring study of western hognose snakes and other reptiles at this study site.

Results and Discussion

We made 88 captures and recaptures of 73 snakes during this study. Thirty-four were adult females, 25 were adult males, and 14 were unsexed (mostly juvenile). We captured 60 snakes one time, 11 snakes twice, and two snakes three times. The population mean SVL was 328 mm (SD = 135 mm; Range = 168–633 mm) and the mean mass was 59 g (SD = 62 g; Range = 4–240 g). Females were larger than males for both SVL ($t = 2.38$; $p = 0.021$) and mass ($t = 2.87$; $p = 0.006$) (Table 1). SVL and mass were positively correlated for both females ($N = 33$, $r^2 = 0.86$, $p < 0.0001$; mass was not re-

Figure 1. *Heterodon nasicus* from an isolated population in northwestern Illinois. Photograph by Daniel A. Warner.

Figure 2. *Heterodon nasicus* performing a typical death-feigning display including the coiled posture, open mouth and everted cloaca. Photograph by Daniel A. Warner

Table 1. Snout–vent length (mm) and mass (g) of female, male and unsexed (mostly juvenile) western hognose snakes, *Heterodon nasicus*, in a northwestern Illinois population.

		Snout–vent length			Mass		
	N	Mean	SD	Range	Mean	SD	Range
Females	34	386	148	168–633	90	71	4–240
Males	25	303	107	172–495	45	42	5–149
Unsexed	14	232	57	170–353	12	10	5–43

corded for one snake) and males ($N = 25$, $r^2 = 0.85$, $p < 0.0001$). The size structure of the population showed a bimodal distribution with 36 snakes in the 150–300 mm (mostly juvenile) size classes and 19 snakes in the 400–500 mm size classes (mostly adult females) (Figure 3). Sex ratio of adult females to males was 1.36:1 and not significantly different from a 1:1 sex ratio ($\chi^2 = 1.37$, $p = 0.241$).

Data for recapture SVL and mass were collected for five snakes. All five showed an increase in both SVL and mass (Table 2). Two snakes gained 72 mm in SVL from 1997 to 1998 and one gained 100 mm in SVL over two years (1996–1998). Two females were gravid, so their increase in mass largely reflects the mass of their clutch and body mass gained. One non-gravid female and one male showed 129% and 80% increases in mass from 1997 to 1998, respectively.

Due to the small number of captures and recaptures, I used a Bayesian method to estimate the population size (Gazey and Staley, 1986). I used this method to calculate separate probabilities for each population size from 72 to 1000. The population size with the highest probability (i.e., 0.0083) was 205 and the 95% confidence interval ranged from 87 to 271. This size

Table 2. Increase in snout–vent length (mm) and mass (g) for five western hognose snakes, *Heterodon nasicus*, in a northwestern Illinois population.

		Capture		Recapture		Increase (% incr.)	
	Sex	SVL	Mass	SVL	Mass	SVL	Mass
RA 01*	F	477	76	521	152	44 (9)	76 (100)
RA 05†	F	410	83	510	151	100 (24)	68 (82)
RA 31	F	258	21	330	48	72 (28)	27 (129)
RA 34*	F	633	240	638	>300	5 (0.7)	>60 (>25)
RA 60	M	330	46	402	83	72 (22)	37 (80)

* Gravid females.

† Two years between capture and recapture (1996–1998).

estimate includes only the study site (0.233 km^2), which is a subset of the total continuous habitat (approximately 1.815 km^2) available for these snakes in the area.

We observed western hognose snakes at our study site eating both turtle eggs and lizards. Consumption of turtle eggs by western hognose snakes has been reported from many parts of its range (Platt, 1969; Barten, 1980; Iverson, 1990; Kolbe et al., 1999). The frequency of snakes collected at our study site in 1997 that had consumed turtle eggs was 17.3% (Kolbe et al., 1999), slightly higher than the maximum of 11.1% reported by Platt (1969). Though several species of turtles inhabit or nest in our study site, eggs consumed by hognose snakes are believed to be painted turtle, *Chrysemys picta*. Hognose snakes were found on two occasions consuming eggs from *C. picta* nests (Kolbe et al., 1999). Fewer than 7% of snakes consumed the six-lined racerunner (*Cnemidophorus sexlineatus*) in both

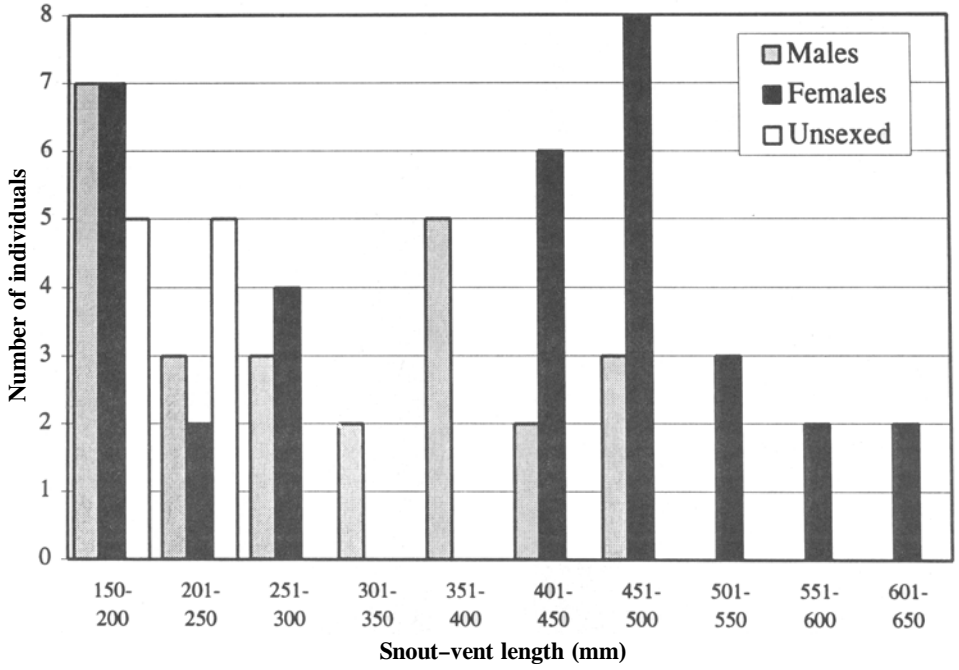

Figure 3. Size structure of a western hognose snake (*Heterodon nasicus*) population in a northwestern Illinois.

1996 and 1997 at our study site (Kolbe et al., 1999). In contrast, 22.2% of the snakes examined by Platt (1969) had eaten racerunners. The size of the *C. sexlineatus* population for a portion of the available habitat (0.465 km^2) was estimated with 95% confidence to range from 66 to 222 individuals (Warner, 1998). No other prey items were observed, although we did not force snakes to regurgitate to assess prey composition in more detail.

The population estimate of between 87 and 271 individuals includes the study area only. Other habitat adjacent to the study site is suitable for hognose snakes. Thus, this size estimate almost certainly underestimates the total population size. Platt (1969) used Jolly's (1965) model to estimate the population size for a Harvey County, Kansas, population of western hognose snakes at 121 individuals. Platt's study area was an approximately 0.012 km^2 segment within a 1.317 km^2 county park. The Illinois population structure appears healthy with a balanced sex ratio, all size classes represented (Figure 3) from young of the year to the state record length individual (Total Length = 705 mm; see Kolbe et al., 1999), and gravid females. The range of SVLs observed in this study (Figure 3) is similar to that reported by Platt (1969). Growth rates reported by Platt (1969) decrease with size; the limited data in this study are consistent with this trend (Table 2). The six-lined racerunner population in this area is under study (see Warner, 1998) and some turtle nesting is monitored. However, little else is known about hognose snake feeding habits in this area except that they take both painted turtle eggs and six-lined racerunners. Future genetic work will address the genetic diversity and level of inbreeding in this population.

The demographic structure of this isolated hognose snake population is similar to populations studied by Platt (1969) within the contiguous range of the species. Thus, I do not think there is immediate concern for the sustainability of this population. However, this population is particularly susceptible to habitat destruction, illegal collecting, and loss of snakes on roads. Though most of the suitable habitat in this area for hognose snakes is federal or state land, human activity is high (e.g., there are cabins, roads, a boat ramp, and a newly constructed bike path within the study area). These could all have a negative impact on this population of threatened snakes. Hopefully, the western hognose snake's threatened status in Illinois (Redmer and Kruse, 1998) will prevent further human threats to this population.

Acknowledgments

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A Modern Locality for a Unicolor *Lampropeltis triangulum blanchardi* Stuart

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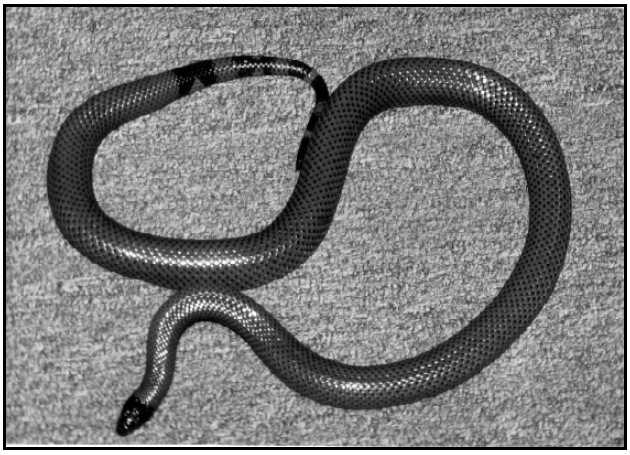
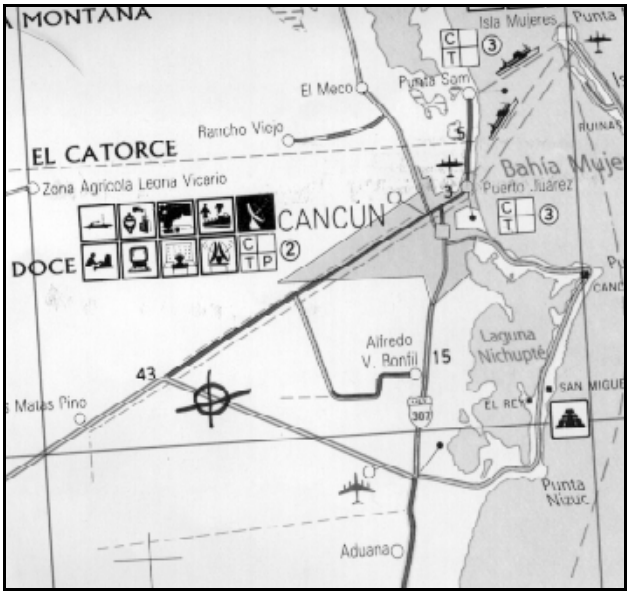
Williams (1988) notes a single specimen of *Lampropeltis triangulum blanchardi* (UMMZ 76162), completely lacking body rings, having the typical black head of the subspecies but the body being wholy red except the body scales which are black-tipped. This specimen was reported from "Coloma Santa María" by Stuart (1935). In personal communication with Dr. Julian Lee, she states Coloma Santa María=Colonia Santa María, but the whereabouts of the locality is uncertain.

On 23 July 1997, at 2245 h, a young male, 58.2 cm, of the unicolor variation was observed on Highway 180, 14 km NW of the intersection with Highway 307 near Cancun, Quintana Roo, Mexico. It fits well the scalation description in Williams. The area is well-drained limestone, supporting a forest dominated by zapote (*Achras zapote*) and chaca (*Bursera* sp.), both of which rarely exceed 20 m in height. No rain had occurred within the area for the previous 8 days. Daytime highs ranged from 30°C to 34°C. Nighttime lows ranged from 23°C to 25°C. On no occasion did the author find much in the way of animal activity on the roads at night.



Unicolor *Lampropeltis triangulum blanchardi* from the Cancun area, Quintana Roo, Mexico. Photograph by Neil Alt



Map of the general area with locality marked.

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