

FINAL REPORT

The population status of the timber rattlesnake (*Crotalus horridus*)
in east-central Illinois.

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INTRODUCTION

This report details the research at Rocky Hollow, a parcel of land in Clark County, Illinois, portions of which are privately owned by several individuals. The overall project concerns the status of a relict population of timber rattlesnakes (*Crotalus horridus*). Previous work by an IDNR intern included interviews with all land owners in the Rocky Hollow area, the responses to which suggested that there might be a small population of *C. horridus* inhabiting this site. The purpose of the study covered under this grant contract was to find individuals representing this population, and quantify its size, age structure, and general health, as well as document the locations of any hibernacular retreats in the area.

Study Site

The study site, approximately 280 ha in size, was located on privately-owned land in Clark County, Illinois (Fig. 1). Agriculture row-crops (soybeans [*Glycine max*] and corn [*Zea mays*]) surround and fragment a mixed mesic hardwood forest in a ridge-valley system, creating a large amount of edge habitat. Dominant woody vegetation in the forests includes beech (*Fagus*), oak (*Quercus*), and maple (*Acer*) trees mixed sparsely with pines (*Pinus*) in certain areas. Prevalent understory growth in the forest was made up of an assortment of ferns and mosses, mayapple (*Podophyllum*), Virginia creeper (*Parthenocissus*), stinging nettles (*Urtica*), and poison ivy (*Toxicodendron*). The ecotone between the forest and the agricultural fields was dominated by species found in the forest understory, with an increase in blackberry (*Rubus*), multiflora rose (*Rosa*), and pokeweed (*Phytolacca americana*).

Rocky hillsides with potential hibernacula sites are located in the forest habitat. Various small creeks or "hollows" have eroded the topsoil, leaving sandstone outcroppings

within ravines. These creeks flow into a relatively young (approximately 12 years old) man-made lake of approximately 30 ha (created by the structure 9-Mill Creek reservoir), which fragments the forest habitat. The surrounding row-crop agriculture has also fragmented and reduced the forest habitat. County Road 1400 E bisects the site, and a power line fragments the forest habitat in the western area of the site (Fig. 1).

Background & Objectives

The timber rattlesnake, *Crotalus horridus*, is a long-lived, late-maturing snake that inhabits the forests of eastern North America (Brown 1992, Martin 1992). Each Autumn, individuals typically follow conspecific scent trails to return to their communal dens for hibernation (Brown 1992, 1993, Martin 1992). In the colder parts of its range, *C. horridus* aggregate in occasionally high numbers (greater than 100; Brown 1993) at a single hibernaculum, the "life center" of the population (Martin 1992).

Anthropogenic habitat alteration and fragmentation has contributed to the local extinction of *C. horridus* from Maine, Rhode Island and Ontario, Canada. These activities are also believed responsible for the dramatic declines in *C. horridus* populations observed in 20 states (HSUS 1999, Reinert and Rupert 1999). In Illinois, *C. horridus* is protected as a threatened species – although populations appear to be stable in the southern portion of the state, relict populations elsewhere in the state are greatly reduced from historical records (Smith 1961, Phillips et al. 1999). Remaining populations of *C. horridus* should be documented so that they might be afforded protection.

In recent years, the occurrence of road kills or poached specimens in Clark County, Illinois, has indicated the possible presence of a population of *C. horridus* in east-central portion of the state. The Wildlife Preservation Fund supported a Landowner Contact Project

in 2000–2001 to compile recent and historic locations of timber rattlesnake observations in Clark County. The report documented numerous credible sightings previously unknown to the agency, compiled landowner contact information, and provided several forms of documentation of rattlesnake reports from these landowners (including Richard Davis, Laymon Davison, Harold East, and Harold Maroney). Numerous reports centered on a relatively remote area of Clark County locally referred to as Rocky Hollow. All landowners in the Rocky Hollow area agreed to permit research activities on their property.

The purpose of the proposed research was to determine whether or not there is a relict population of *C. horridus* in Clark County, Illinois. If *C. horridus* was detected in the Rocky Hollow area, additional objectives included the documentation of the size, age structure, and health of the population, along with the specific location(s) of any hibernacula.

MATERIALS & METHODS

This project was conducted with assistance from C. Drew Foster and Sarabeth Klueh, graduate students in my laboratory. The funds from the current grant period were used to cover travel expenses to/from Rocky Hollow, and purchase equipment (*e.g.*, receiver) and supplies (*e.g.*, transmitters, surgical utensils, forestry flagging, *etc.*) necessary to conduct this study. Funds were also used to provide a stipend to two graduate research assistants for their efforts on this project.

In spite of several preliminary searches of Rocky Hollow in Summer 2002, as well as intensive surveys of the area throughout the 2003 and 2004 activity seasons, *C. horridus* was

not found at this site. We responded quickly to land-owner sightings of supposed *C. horridus* on their property, but all such observations yielded other snake species. Additionally, an article was published in The Reporter (Casey, Illinois) on 5 September 2002 informing readers in the area that we were interested in studying this species in its natural habitat. No *C. horridus* were observed at the site by May 2003 and, for this reason, I decided to implant radio transmitters into central ratsnakes (*Pantherophis spiloides*) with the hopes that some individuals would have den sites in common with *C. horridus*. Other studies suggest that, when den sites are limited, *C. horridus* occupies sites that are simultaneously used by other snake species (*P. spiloides*, *Coluber constrictor*, *Thamnophis sirtalis*, etc.; Brown 1982). So, the expectation was that relocating *P. spiloides* at a den site would, by extended observation at that site, increase the likelihood of encountering *C. horridus* also using that hibernaculum.

The radio transmitters (Holohil Systems, Ltd.; model #SI-2T, mass = 12.95 g) were implanted in five *P. spiloides* following the methods of Hardy and Greene (1999, 2000) and Reinert and Cundall (1982). The transmitters contained a thermocouple that emitted a temperature-sensitive pulse rate. Thus, when each snake was relocated, the pulse rate could be recorded along with the ambient temperature (± 0.5 °C). Subject body temperature was then determined using a calibrated scale of pulse rate intervals.

RESULTS

In the process of searching for *C. horridus*, and radio-tracking the *P. spiloides*, many other species of reptiles and amphibians were observed at the Rocky Hollow site (Table 1). Of these, 5 were new records for Clark County, and 14 were updates from pre-1980 records for the county (Phillips et al. 1999). Representative specimens have been accessioned with the Illinois Natural History Survey Collection.

Of the five ratsnakes monitored during this study, three were collected during the 2003 activity season and two during the 2004 activity season. Mean mass (± 1 standard error) for these individuals was 654.5 ± 243.7 g, and mean SVL was 119.8 ± 25.2 cm (Table 2). Snakes were relocated a total of 418 times. Four hibernacula were used by these subjects, and they were active away from these sites between 6 April and 7 November. Because the subjects were occasionally relocated in a previously-recorded position (sometimes remaining at that location for time periods exceeding two weeks), only 161 sample points (for the determination of home range size and habitat selection) were obtained. The mean (± 1 SE) calculated home range size was 11.59 ± 3.33 ha.

Spatial data

The areas of available habitat types were not uniformly distributed within the combined home ranges of all individuals, and subjects appeared to use the eight habitat types non-randomly. Examining the dominant habitat types only – agricultural field, deciduous forest, and edge habitat (each comprising, on average, 29.92 % of the available habitat within the home ranges – snakes appeared to prefer forest and forest edges and avoided open habitats

such as agricultural fields and grasses altogether. Snakes did not appear to prefer forest edges to forest interiors.

Thermoregulation

Mean ambient temperature at time of subject relocation was 20.4 ± 0.8 °C in forest habitat and 21.68 ± 0.52 °C in forest edge habitat. Mean snake body temperature was 19.5 ± 0.7 °C in forests and 20.9 ± 0.5 °C in forest edges. Snake body temperatures were correlated with ambient temperatures for each individual and for data pooled across all individuals ($r^2 = 0.73$, $p < 0.001$; Fig. 2).

STATUS & RECOMMENDATIONS

Over 1200 man-hours were spent at the Rocky Hollow site, and all habitats were surveyed repeatedly during different time intervals during the 2003 and 2004 activity seasons. Additionally, several landowners with dwellings adjacent to the forest habitat of Rocky Hollow (thus, spending additional time in the immediate vicinity) were aware of my efforts and willing to contact me upon spotting any *C. horridus* (thus, increasing the chances of a sighting). In spite of these efforts, no *C. horridus* were ever observed within this area.

The most recent record of *C. horridus* in Clark County is represented by a Polaroid photograph (INHS #16257) of a specimen killed at a mobile trailer park alongside Craig Lake, approximately 1 km south of the southern-most extent of the forested habitat of Rocky Hollow. This specimen was documented on 27 July 2000, but it is uncertain how much time elapsed between the specimen being collected and photographed. If the specimen had been

recently killed then, given the relatively close proximity of Craig Lake to Rocky Hollow, it is possible that a *C. horridus* population existed in the area sometime prior to this study. It is also possible that the Rocky Hollow area acted as a sink for individuals from neighboring *C. horridus* populations displaced from surrounding habitats by changes in land use (Sjögren 1991, Gilpin 1987) – this would explain the relatively frequent sighting in the years leading up to the Landowner Contact Project. In this scenario, the habitat at Rocky Hollow simply might not have been suitable for sustaining a population of *C. horridus* (Reinert 1984).

The *P. spiloides* that were radio-tracked during this study over-wintered in four different hibernacula within the Rocky Hollow site. In contrast to previous studies that documented a consistent south or southeast orientation to hibernacula (Blouin-Demers et al. 2000, Loughheed et al. 1999), the orientation of the hibernacula utilized by *P. spiloides* in this study was variable, ranging from east to south to northwest in orientation. The periods of activity away from these hibernacula were consistent with those reported previous studies for this species (Durner and Gates 1993, Fitch 1963).

Additional Management Efforts

At this time, I do not recommend that IDNR commit any further resources to the assessment of a *C. horridus* population in the Rocky Hollow area. Because the diversity of amphibians (14 species) and reptiles (17 species) recorded at this site is suggestive of a healthy community of herpetofauna and trophic interactions between those species and other organismal forms found in Rocky Hollow, I advise that IDNR remain in periodic contact, and maintain good relations, with the landowners of the area. At worst, IDNR could be made aware of any possible *C. horridus* sightings in the future. Should multiple landowners express similar interest, however, IDNR might also wish to consider purchasing several

adjacent parcels in the Rocky Hollow area to be set aside as an Illinois Nature Preserve.

Fragments having relatively undisturbed habitats that support diverse faunal communities are rare in Clark County. In preserving such a parcel of land for preservation, the residents of Clark County might show an increased appreciation for the level of biodiversity available in their region and foster a sustained and healthy relationship with IDNR.

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LITERATURE CITED

- Blouin-Demers, G., K.A. Prior, and P.J. Weatherhead. 2000. Patterns of variation in spring emergence by black rat snakes (*Elaphe obsoleta obsoleta*). *Herpetologica* 56:175-188.
- Brown, W.S. 1982. Overwintering body temperatures of timber rattlesnakes (*Crotalus horridus*) in northeastern New York. *J. Herpetol.* 16:145-150.
- Brown, W.S. 1992. Emergence, ingress, and seasonal captures at dens of northern timber rattlesnakes, *Crotalus horridus*. Pp. 251-258 in *Biology of the Pitvipers* (ed. J.A. Campbell and E.D. Brodie, Jr.). Selva, Tyler, TX.
- Brown, W.S. 1993. Biology, status, and management of the timber rattlesnake (*Crotalus horridus*): A guide for conservation. *Herpetological Circular* No. 22, Society for the Study of Amphibians and Reptiles (ed. J.P. Collins). Univ. of Kansas Press, Lawrence, KS. 78 pp.
- Durner, G.M., and J.E. Gates. 1993. Spatial ecology of black rat snakes on Remington Farms, Maryland. *J. Wildl. Manage.* 57:812-826.
- Fitch, H.S. 1963. Natural history of the black rat snake (*Elaphe o. obsoleta*) in Kansas. *Copeia* 1963:649-658.
- Gilpin, M.E. 1987. Spatial structure and population vulnerability. Pp. 125-139 in *Viable Populations for Conservation*. Cambridge Univ. Press, Cambridge.
- Hardy, D.L., Sr., and H.W. Greene. 1999. Surgery on rattlesnakes in the field for implantation of transmitters. *Sonoran Herpetol.* 12:25-27.
- Hardy, D.L., Sr., and H.W. Greene. 2000. Inhalation anesthesia of rattlesnakes in the field for processing and transmitter implantation. *Sonoran Herpetol.* 13:110-114.

- HSUS (Humane Society of the United States). 1999. The Truth Behind Rattlesnake Roundups. HSUS Press, Washington DC. 14 pp.
- Lougheed, S.C., H.L. Gibbs, K.A. Prior, and P.J. Weatherhead. 1999. Hierarchical patterns of genetic population structure in black rat snakes (*Elaphe obsoleta obsoleta*) as revealed by microsatellite DNA analysis. *Evolution* 53:1995-2001.
- Martin, W.H. 1992. Phenology of the timber rattlesnake (*Crotalus horridus*) in an unglaciated section of the Appalachian Mountains. Pp. 259-277 in *Biology of the Pitvipers* (ed. J.A. Campbell and E.D. Brodie, Jr.). Selva, Tyler, TX.
- Phillips, C.A., R.A. Brandon, and E.O. Moll. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Natural History Survey, Champaign, IL. 282 pp.
- Reinert, H.K. 1984. Habitat variation within sympatric snake populations. *Ecology* 65:1673-1682.
- Reinert, H.K., and D. Cundall. 1982. An improved surgical implantation method for radio-tracking snakes. *Copeia* 1982:702-705.
- Reinert, H.K., and R.R. Rupert, Jr. 1999. Impacts of translocation on behavior and survival of timber rattlesnakes, *Crotalus horridus*. *J. Herpetol.* 33:45-61.
- Sjögren, P. 1991. Extinction and isolation gradients in metapopulations: The case of the pool frog (*Rana lessonae*). *Biol. J. Linn. Soc.* 42:135-147.
- Smith, P. 1961. The Amphibians and Reptiles of Illinois. Illinois Nat. Hist. Survey Bull. 28:1-298.

Table 1. Species list of amphibians and reptiles observed in the Rocky Hollow region of Clark County between February 2003 and November 2004.

<u>Taxon</u>	<u>County record</u>	<u>post-1980 update of county record</u>	<u>INHS accession #</u>
Caudata			
<i>Ambystoma texanum</i>			
<i>Furycea cirrigera</i>			
<i>Plethodon cinereus</i>			INHS 19340
<i>Plethodon glutinosus</i>		Y	
Anura			
<i>Bufo a. americanus</i>			
<i>Bufo fowleri</i>		Y	INHS 18902
<i>Acris crepitans blanchardi</i>			
<i>Hyla chrysoscelis (x versicolor)</i>	Y		
<i>Pseudacris crucifer</i>			
<i>Pseudacris triseriata</i>			
<i>Rana blairi</i>	Y		
<i>Rana catesbeiana</i>			
<i>Rana clamitans</i>			
<i>Rana utricularia</i>			
Testudines			
<i>Chelydra serpentina</i>		Y	
<i>Chrysemys picta marginata</i>		Y	INHS 18800

Table 1, continued.

<u>Taxon</u>	<u>County record</u>	<u>post-1980 update of county record</u>	<u>INHS accession #</u>
<i>Trachemys scripta elegans</i>			
<i>Terrapene c. carolina</i>			
Lacertilia			
<i>Eumeces fasciatus</i>		Y	INHS 18801
<i>Eumeces laticeps</i>		Y	
<i>Scincella l. laterale</i>	Y		INHS 18494
Serpentes			
<i>Carphophis amoenus helenae</i>	Y		INHS 2002.10
<i>Coluber constrictor foxii</i>		Y	INHS 18901
<i>Diadophis punctatus</i>		Y	INHS 18900
<i>Lampropeltis c. calligaster</i>		Y	INHS 19339
<i>Liochlorophis aestivus</i>		Y	INHS 19337
<i>Nerodia sipedon pleuralis</i>		Y	INHS 18799
<i>Pantherophis spiloides</i>		Y	INHS 19338
<i>Storeria dekayi wrightorum</i>		Y	INHS 19434
<i>Storeria o. occipitamaculata</i> red-bellied	Y		INHS 18495
<i>Thamnophis s. sirtalis</i>	Y		INHS 18803

Table 2. Morphometrics (snout-vent length [SVL] and mass) and inclusive tracking dates for three male central ratsnakes (*Pantherophis spiloides*) radio-tracked in Clark County, Illinois, during the 2003 and 2004 activity seasons.

<u>Subject #</u>	<u>SVL (cm)</u>	<u>Mass (g)</u>	<u>Tracking Dates</u>
1	130.8	910.0	19 May-15 July 2003
2	76.2	350.0	29 July 2003 – 15 September 2004
3	157.5	920.0	29 July 2003 – 30 June 2004
4	114.0	549.5	7 May – 7 November 2004
5	133.0	834.0	7 May –7 November 2004
6	107.0	363.5	7 May – 19 July 2004

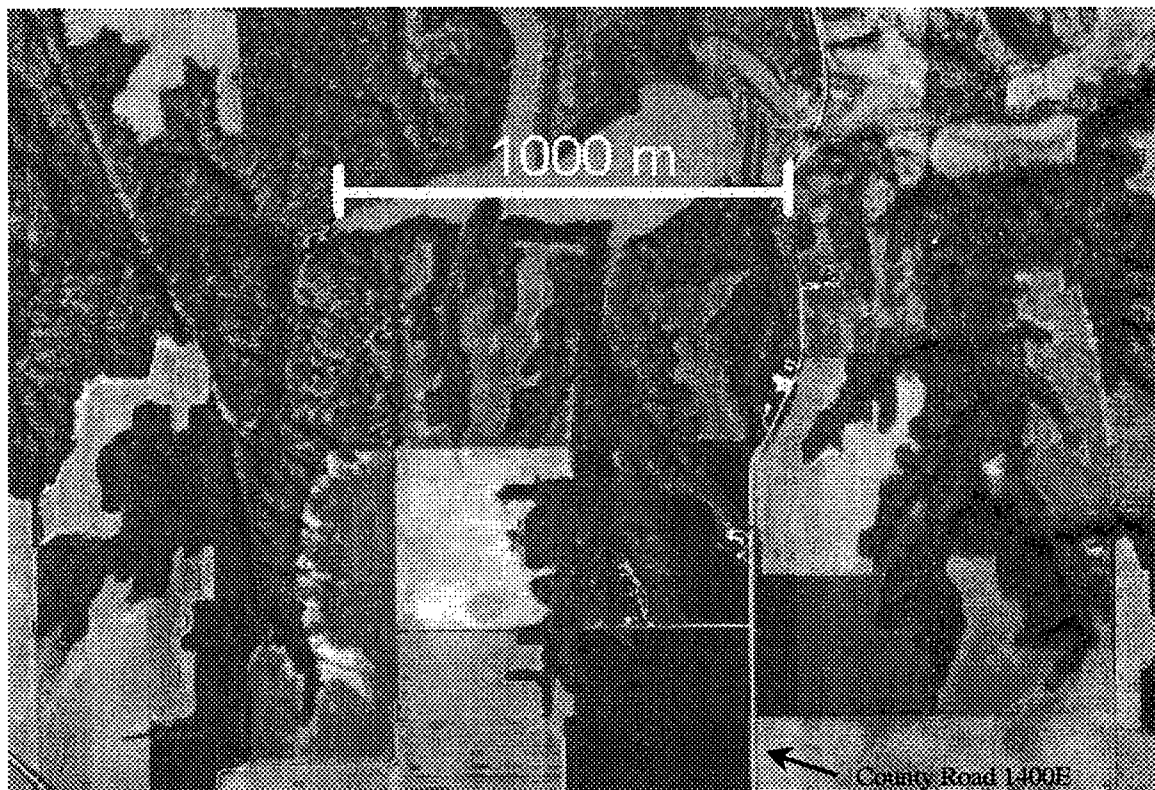


Figure 1. Digital Orthogonal Quadrangle map of the Rocky Hollow area in Clark County, Illinois, that was intensively surveyed for timber rattlesnakes (*Crotalus horridus*) during the 2003-04 activity seasons.

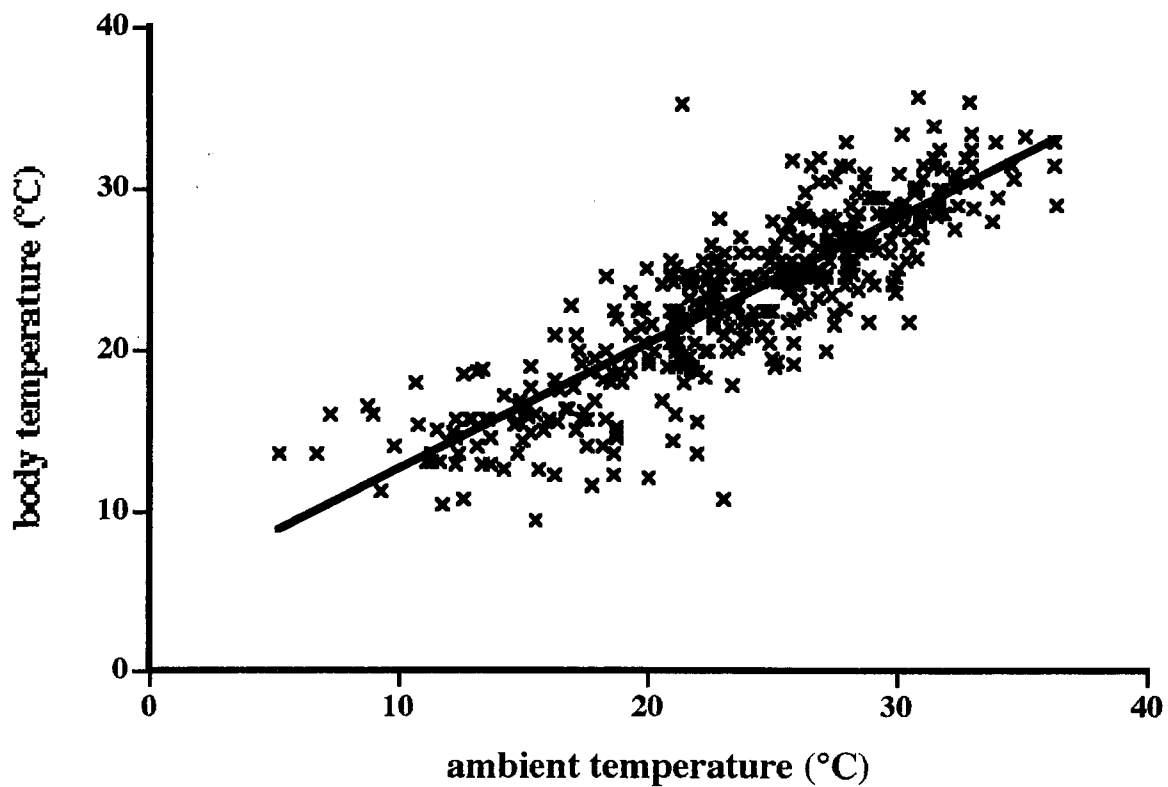


Fig. 2. Scatter plot of ambient temperatures and body temperatures (°C) of central ratsnakes (*Pantherophis spiloides*; $n = 6$) radio-tracked in the Rocky Hollow region of Clark County, Illinois, during the 2003 and 2004 activity seasons. Simple regression analysis revealed that body temperature is correlated with ambient temperature ($r^2 = 0.73$, $p < 0.001$).