Home range and activity patterns of the eastern hognose snake, *Heterodon platyrhinos*, at the Brookhaven National Lab

Abstract:

Once thought to have been extirpated from Long Island, viable populations of eastern hognose snakes, *Heterodon platyrhinos*, were rediscovered at Brookhaven Nation Lab in 2001. Since their recent discovery at Brookhaven, intense surveys have extrapolated many valuable data on population size estimates, home ranges, and densities. In this study we used radio telemetry to track and record movements of 12 snakes during two years, movements were mapped using GPS and GIS. In addition to tracing movements, we recorded weekly measurements of weight, snout-vent length, and total length for each snake. Our results confirm that home ranges of individual hognose snakes are extensive and that movement patterns show trends regarding daily and yearly cycles. Estimates of home range sizes are needed to determine the amount of land and types of landscapes necessary to manage viable populations of *H. platyrhinos*. As destructive development continues, intense conservation techniques will be needed to protect *H. platyrhinos* in Pine Barrens habitats of the Northeast USA.

Introduction:

The genus *Heterodon* (Latreille 1801) includes three species, all which occur only in North America. The eastern hognose snake occurs throughout most of the eastern half of the USA, except for northern New England and most of New York State (Conant and Collins 1998). Hognose snakes are usually inconspicuous in their grassy or brushy habitat, but when spotted they can perform a rather flamboyant act. Disturbing a hognose snake will usually cause it to fan its neck and hiss loudly, replicating the act of a cobra (except the hognose is, as Abbott wrote, “wholly unable to inflict the slightest injury”) (1884). If harmed or aggravated for long enough the hognose snake will coil, flip belly side up, defecate all over itself and gape its mouth with its tongue left to hang out. The adaptation of death feigning behavior remains unclear, but may have to do with toxins from toads in the feces that protect the snake from predators (Zug *et al*. 2001). Literature on eastern hognose snake behavior and activity is scarce, More research must be done, especially in understudied areas (North and Southeast USA), to develop a better understanding of the habitat type and habitat size necessary to sustain viable populations.

In this study we used radio telemetry, GPS and GIS to track and record movements for twelve hognose snakes over two years. Analysis reavealed information on habitat usage, movement patterns and home range. Additionally, conclusions were drawn from this information regarding nesting and hibernation activity. Effective conservation and land management techniques used to protect species such as *H. platyrhinos* rely on basic reasearch in ecology, home ranges and population dynamics, as are revealed in this research.

Map of BNL on Long Island, NY

Map of BNL Campus

Methods:

Research was conducted at the U.S. Department of Energy’s Brookhaven National Laboratory in Suffulk Co., New York. The 5,265 acre site is located on Long Island, approximately 100 km east of New York City and mid latitude on the island, 16 km from either the Atlantic Ocean or the Long Island Sound. Vegatation at the Brookhaven campus reflects that of the Central Pine Barrens, with forests dominated by mature pitch pines (*Pinus rigida*) and oaks (*Quercus* spp.); scrublands dominated by young pitch pines, sensitive fern (*Onoclea sensibilis*), and scrub oaks; and grasslands dominated by various grass species.

Transmitters were implanted into five snakes in 2003 and nine snakes in spring 2004, including two snakes used in a radio telemetry study in 2003. All transmitters were less than 6.1% of each snakes body weight. Snakes were kept for no more than 14 days after transmitter implantation. Snakes were tracked most days, and never left more than two days unattended, during the active season. At each snake’s location we plotted a GPS point and recorded time, general location, specific habitat, whether we saw the snake, its activity if any, estimated cloud cover, and climatic conditions (temperature, relative humidity, wind speed). Morphological measurements (weight, length) were taken opportunistically, but no more than once a week per snake. Gut contents, if expelled, were measured, recorded and preserved.

Common habitat type where hognose snakes are found

Transmitter that will be subcutaneously implanted into a snake

In June 2003 five snakes were implanted with transmitters and released into their respective locations and were thereafter tracked on a daily basis until October 2003. Two snakes that were tracked in 2003 were recaptured in February 2004 and refitted with new transmitters with fresh batteries. Additionally, seven new snakes were captured between April and May of 2004 and implanted with transmitters, making nine snakes total that were tracked in 2004. Due to casualties involving vehicles, mammals and snakes becoming seperated from their transmitters only three snakes were left by the end of the 2003 tracking season and five snakes by the end of 2004.

Transmitter implantation surgery at the Bronx Zoo

Radio tracking snakes in the field with antenna and receiver

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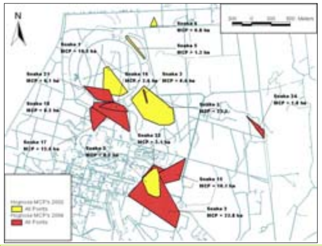
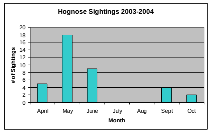
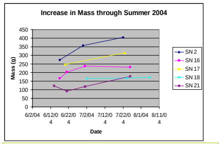
Results:



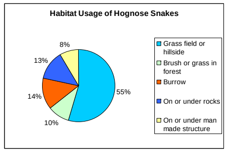
Shows home ranges including the minimum convex polygon (MCP) for each snake. Map shows the Northwest corner of the research site at Brookhaven National Laboratory. Snake home ranges from 2003 are differentiated from those of 2004.



Shows hognose snake sightings or captures in 2003 and 2004 combined. Mating occurs in April and early May.



Shows increase in mass for each individual snake during the 2004 summer. Only snakes that survived the entire tracking season are shown.



Shows types of habitats used by hognose snakes. Data taken only from snakes that survived the entire 2004 active season.

Snake I.D.	S ex	SVL (cm)	Total Lg. (cm)	Weight (g)	Dates monitored	Movement (m/d)	Home range (ha)	Days tracked (d)	Fate
1	F	51	61	129	6/9/2003 - 10/7/2003	60.6	10.5	121	hibernated
5	F	66	79	282	6/9/2003 - 6/30/2003	87	1.3	22	lost, transmitter failure
6	F	56	66	227	6/18/2003 - 7/14/2003	41.5	0.8	27	lost, transmitter failure
2	F	67	80	338	6/9/2003 - 10/30/2003 and 2/1/2004 - 7/30/2004	106.9 / 139.4	8.2 / 33.8	324	active
3	M	61	75	241	6/9/2003 - 10/30/2003 and 2/1/2004 - 6/22/2004	86.1/ 68.4	23.3 / 0.4	286	transmitter found without snake
15	M	44	59	135	4/27/2004 - 6/1/2004	284.6	10.1	36	transmitter found without snake
16	F	56	65	196	5/4/2004 - 7/30/2004	78.9	3.6	88	active
17	F	68	82	299	5/4/2004 - 7/30/2004	98.2	12.6	88	active
18	M	43.5	56	82	5/7/2004 - 7/30/2004	101.7	8.2	85	active
21	F	43	51	101	5/7/2004 - 7/30/2004	100.5	6.1	85	active
22	F	65	72	213	5/19/2004 - 6/25/2004	83.4	3.1	38	eaten by mammal(s)
24	F	56.8	67.4	243	5/25/2004 - 6/21/2004	80.5	1.8	28	run over by large truck

Snakes tracked in 2003
Snakes tracked in 2003 and 2004
Snakes tracked in 2004

Shows general information for individual snakes. Snakes 2 and 3 have two sets of movements and home ranges for both (2003) / (2004). SVL, total length and weight are taken from measurements at the time of transmitter implantation.

Discussion:

The home range map shows the extensive amount of land used by some snakes, including snake 2 that covered the largest range of 33.8 hectares. Also, the graph showing preferred habitat indicates that *H. platyrhinos* uses open grassy fields and slopes more than half of the time. Such information on land and habitat usage can be applied to manage and protect sites with known *H. platyrhinos* populations.

Lucky Survivor

One obscure side note must be mentioned in regards to this project involving examination of gut contents. During a weekly examination to record weight and length one of the snakes regurgitated a live and healthy spadefoot toad (*Scaphiopus h. holbrookii*) at 1500 h in the afternoon. This finding confirms that *H. platyrhinos*, a diurnal species, is foraging for *S. h. holbrookii*, a nocturnal species, in burrows and under coverboards during the day rather than hunting at night for active *S. h. holbrookii.* The spadefoot toad is still alive and well in a terrarium two weeks since being swallowed by a hognose snake.

References:

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Abbott, Charles C. 1884. Science, Vol. 3, No. 56, pp. 253-256.

Zug, G.R., L.J. Vitt, J.P. Caldwell. 2001. Herpetology: An Introdutory Biology of Amphibians and Reptiles. Second Edition. pp. 228-229. Academic Press, San Diego, CA.

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