Home Range Size and Spatial Ecology of Eastern Hognose Snakes (*Heterodon platirhinos*) at Brookhaven National Laboratory

WENDY FINN [1,3], JEREMY FEINBERG [2,3], and TIMOTHY GREEN [3]

[1] University of Rhode Island, College of Environment and Life Sciences, Kingston, RI 02881
[2] U.S. Fish and Wildlife Service, Long Island National Wildlife Refuge Complex
[3] Brookhaven National Laboratory, Environmental Services and Waste Management Division, Upton, NY 11973

Abstract

Once considered an abundant species on Long Island the eastern hognose snake, *Heterodon platirhinos*, is now found only in small fragmented portions of its former island range. After 1996, *H. platirhinos* was incorrectly believed to be extirpated from Long Island as there were no sightings of the species until 2001 when the species was rediscovered at Brookhaven National Laboratory (BNL). Since the spring of 2003, radio telemetry studies have been conducted at BNL on *H. platirhinos* to learn more about the factors triggering this species' decline. In this study, radio telemetry was utilized to discover more information about the snakes' habitat preferences, mortality rates, and home range sizes. The 2005 phase of this study consisted of eight snakes that were tracked and monitored daily with the use of GPS/GIS. Aside from tracking, snout vent length, total length measurements and weights were recorded opportunistically to obtain data on growth rates and possible nesting behavior in the snakes. Snakes were active on 67% of days tracked during a portion of the activity season for the species. Preliminary data collected for home ranges displays a maximum home range of 10.7ha for SN30 with the a minimum size of 1.1ha for SN37(excludes data for snakes introduced later into the study). The data collected from this study will be used to further enhance the conservation of this Special Concern status species.

Introduction

The Brookhaven National Laboratory (BNL) is located in the core of the Central Pine Barrens (CPB) of Long Island and provides ideal habitat for many declining species of herpetofauna native to the area. Due in part to the fact that the BNL property is protected from the spreading development occurring throughout the area, many rare and special concern species are found on the site with viable populations living among the sandy soils, pitch pine/ shrub forests, and wetlands of the CPB. A variety of herpetofauna such as spotted turtles (*Clemmys guttata*), eastern tiger salamanders (*Ambystoma tigrinum tigrinum*) and eastern Hognose snakes (*Heterodon platirhinos*) occur at BNL.

This study focused on a total of eight Eastern Hognose Snakes in 2005 and their movements during a portion of the activity season for the species, which generally falls between April and October. Historically an abundant species on Long Island, *H. platirhinos* was commonly found in habitats such as coastal dune communities and the sandy soiled Pine Barrens [1,2]. After losing much of its preferred habitat to development on Long Island this understudied species was brought to biologists' attention after it was deemed extirpated in the area after 1996. Since its rediscovery in 2001 at BNL, *H. platirhinos* has become the focus of a three year (including current study) radio-telemetry project that has helped biologists gain a greater view into what factors are causing this species' decline. Since 2003 radio-telemetry studies have been implemented at BNL on a total of 19 snakes, overseen by biologists from the US Fish and Wildlife Service and BNL. The goals of this study have helped these biologists gain a better understanding of this species' home range size, habitat preferences, and local distributions.

The range of *H. platirhinos* extends from central Minnesota to s. New Hampshire to Florida west to Texas and Kansas [3]. The hognose snake is a robust snake that varies in size from 500mm to 1156mm with an average length of 500 to 650mm for males and 650 to 850mm for females [4]. *H. platirhinos'* color is extremely variable with specimens ranging from yellow with dark bands to olive black with the normal coloring being tan with 20-30 darker bands placed laterally across the body [3]. *H. platirhinos'* sharply upturned rostrum and wide neck aid the snake in its usual activities of foraging for its main prey the fowlers toad *(Bufo Woodhousei fowleri)*, burrowing for shelter, and bluffing perceived predators with its elaborate "cobra" display [5]. The snake generally uses a progressive behavioral defense technique that begins with its famous cobra imitation followed by its characteristic death-feigning act. Once disturbed, the snake will try to deter predators by fanning the hood of its neck, raising its head, mock striking while hissing loudly. If that act fails to dissuade the perceived threat, the snake immediately resorts to playing dead by rolling over on its dorsal side and writhing about with its mouth agape and tongue lolling out. Even when manually placed back on its ventral side the snake will instinctively revert back to its belly-up position.

Results

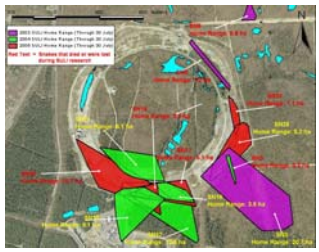

Figure 1. Minimum convex polygons representing home range for individual snakes (north area of BNL) through 30 July in three successive years (2003, 2004, and 2005).

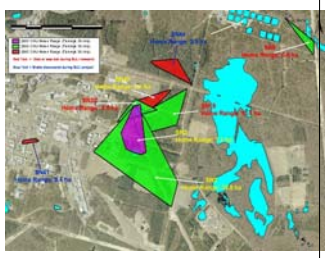

Figure 2. Minimum convex polygons representing home range for individual snakes (central area of BNL) through 30 July in three successive years (2003, 2004, and 2005).

Figure 3. Directional movements for individual snakes tracked in 2005 (north area of BNL) through 30 July.

Figure 4. Directional movements for individual snakes tracked in 2005 (central area of BNL) through 30 July.

Snake I.D.	Sex	SVL (cm)	Total Lg. (cm)	Weight (g)	Dates monitored	Average distance per movement(m)	Home range (ha)	Days tracked (d)	Fate
1	F	51	61	129	6/9/2003 - 10/7/2003	210	10.5	121	lost, transmitter failure
5	F	66	79	282	6/9/2003 - 6/30/2003	285	1.3	22	lost, transmitter failure
6	F	56	66	227	6/18/2003 - 7/14/2003	136	0.8	27	lost, transmitter failure
2	F	67	80	338	6/9/03-9/23/04	438(2003) / 457(2004)	8.2 / 33.8	132	died in hibernation
9	M	61	75	241	6/9/03-7/23/04	300(2003)/224(2004)	23.3 / 0.4	76	transmitter found w/ithout snake
10	M	44	59	135	4/27/2004 - 6/1/2004	932	10.1	36	transmitter found w ithout snake
18	M	43.5	56	82	5/7/2004 - 7/30/2004	101.7	8.2	85	mammalian predation
21	F	43	51	101	5/7/2004 - 7/30/2004	100.5	6.1	85	lost, transmitter failure
22	F	65	72	213	5/19/2004 - 6/25/2004	83.4	3.1	38	mammalian predation
24	F	56.8	67.4	243	5/25/2004 - 6/21/2004	80.1	1.9	28	killed by vehicle
16	F	62.5	72	252	5/4/04- 7/22/05	254(2004) / 154(2005)	3.5 / 2.9	100	mammalian predation
17	F	68	83	250	5/4/04-6/27/05	351 (2004)/ 146(2005)	12.6 / 5.1	121	avian predation
30	M	49	63	164	9/14/04-6/17/05	288	10.7	25	transmitter found w ithout snake
34	M	59	72.2	211	5/12/05-5/16/05	n/a	n/a	1	avian predation
35	M	50	62	114	5/12/05-7/29/05	154	5.2	43	active
37	F	51	61	159	5/19/05-7/29/05	107	1.1	37	avian predation
40	F	55.5	66.8	171	6/6/05-7/29/05	117	3	36	active
41	F	56.5	67	137	7/6/05-7/29/05	62	0.4	19	active
44	F	74	89	376	7/21/05-7/29/05	345	3.9	8	active

Snakes tracked in 2003
Snakes tracked in 2003 and 2004
Snakes tracked in 2004
Snakes tracked in 2004 and 2005
Snakes tracked in 2005

Table:1 Compilation of general data for all snakes tracked to present. Represents only data collected up to 30 July of each year.

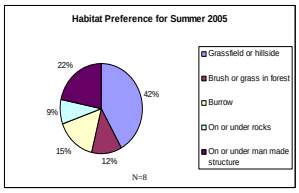

Figure 5. Habitat occupied by *H. platirhinos* during 2005 activity season.

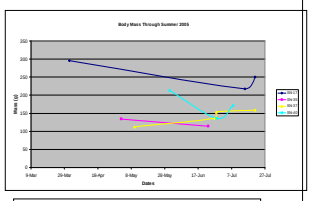

Figure 6. Represents fluctuations mass through tracking season.

References

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Materials and Methods

A total of eight snakes were tracked on a daily basis excluding weekends to determine home range size, habitat use, and survivorship among the specimens. Five of the eight snakes (including SN16 and SN17 who were in the 2004 study) were originally captured at the site of BNL's Relativistic Heavy Ion Collider (RHIC), a heavily disturbed open area surrounded by a 4 km circumference 10m high man made berm. Since its construction, the RHIC ring has been the capture site of a majority of the snakes used in the previous two years of the study due to its sandy and open, high grass habitat. The three remaining snakes were captured in varying habitats such as SN40 who preferred high grass fields bordered by white pine groves, SN41 who was found at the residential heart of BNLs site, and SN44 who resided in the large portion of white pine forest on the site.

After the initial capture, surgery for transmitter implantation was performed by wildlife veterinarians at the Wildlife Health Center of the Wildlife Conservation Society (Bronx Zoo). Each snake was implanted with 5g Holohil SB-2 radio transmitter and released to their respective sites within fourteen days after the procedure. After the location of a snake was confirmed, weather data was collected with the use of a Sky Master weather station for the relative humidity, air temperature and average wind speed. A GPS point was taken each day at each location using a Garmin Rino 110 unit. The location of snakes, macro and micro habitat, and activity were also recorded. The area was then flagged with information such as the snakes' identification number, air temp, date and time. Arc View 3.3 GIS was used to analyze the area of each snakes home range.

Snout vent length, total length and weights were obtained when possible but did not exceed once per week per snake. Measurements and weights were only obtained when the snake was active so as not to disturb the snake into false movements. Weights were taken to track growth and identify gravid females through the rapid weight gain and loss that is associated with egg development and oviposition.

Discussion and Conclusion

A Student *t*-test was performed with the data from the 2003, 2004, and current study to determine if there was a correlation between mass and home range size (hr) for *H. platirhinos*. The results showed no significant difference between the two variables for each comparison: 2003 vs. 2004(p=.2449 hr and p=.3693mass), 2004 vs. 2005(p=.2093hr and p=.8508mass), and 2003 vs. 2005(p=.9876hr and p=.3030mass).

Due to the high mortality rate among this species, it has been difficult to collect and compare long-term data on individual snakes between the years that this study began in 2003. Many factors contribute to the disruption of this study such as the discovery of loose transmitters on the ground with no apparent signs of predation. A possible solution to this puzzling phenomenon may have been found this season when SN37 was captured for the purpose of collecting morphological data on 27 June, 2005. It was discovered that the transmitter of SN37 was in the process of expulsion from the snake. The snake was collected and held in observation until it was transported to the Bronx Zoo for a new surgical technique to be applied to the transmitter placement surgery. Shortly thereafter on July 7, 2005, another snake (SN40) was noted to be undergoing this same condition and was also collected for the new transmitter replacement procedure to be performed. A different suture technique was applied to both snakes to ensure the placement of the transmitters and has proven to be very effective to date.

More research needs to be extrapolated about *H. platirhinos'* habitat preferences and life history characteristics to further enhance the conservation of this species. The preservation of habitats preferred by *H. platirhinos* will likely play a key role in ensuring viable populations of this species for the future.

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