Distribution and Relative Abundance of the Hognose Snake, *Heterodon platirhinos,* in Eastern New England

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Abstract: - Range extensions for the eastern hognose snake, *Heterodon platirhinos*, are compared to known and new data from eastern New England: Rhode Island, Massachusetts east of the Worcester County line, and New Hampshire. The species is unknown from coastal islands; reasons are suggested. The disjunct New Hampshire population occupies inland sandy habitats dominated by white pine (*Pinus strobus*). Albino and melanistic specimens occur.

Eastern New England, including New Hampshire, Rhode Island, and Massachusetts east of the Worcester County line, is regarded as part of the peripheral range of *Heterodon platirhinos,* where the species is "rare or only locally common in semi-isolated populations"(Platt, 1969). The only previous evidence we can find for occurrence of this species in New Hampshire, for example, is the photograph of an albino and the letter published by Newton (1940). The species is not, however, listed by the state of Massachusetts for special consideration (Blodget and Cardoza, 1983). New Hampshire has no state listings at present. One of us (JDL) has extensive experience with this species in the southern region of eastern New England, and the other (MCM) in the northern portion. Our field experience overlapped for many years in the centrally located suburban Boston area. Because Edgren (1961) examined no New Hampshire specimens, and saw only 25 from Massachusetts, we believe a range and population analysis is warranted at this time.

Aspects of geographic distribution are shown in Fig. 1. Little (1971) plots eight major environmental variables of climate and physiographic features. None corresponds closely with the limits of hognose snake distribution. Only the ranges of two tree species, swamp white oak, *Quercus bicolor,* and Atlantic white cedar, *Chamaecyparis thyoides,* show some correspondence (Little, 1971). Both of these trees are characteristic of wet areas in typical southern New England pine barrens, preferred by the hognose snake in much of its range, where adjacent drier areas are dominated by pitch pine, *Pinus rigida.* Our records from southern New Hampshire (Hillsborough and Merrimack counties) show good correspondence to inland soils derived from sandy material (Goldthwait et al., 1951), but not with the sandy coastal plain soils utilized by these snakes from Long Island southward (Conant, 1975).

We have previously (Lazell and Michener, 1976) suggested that three factors control hognose snake distribution in the sandy soils of this region:

1. *Heterodon platirhinos* is a southern form, whose range has only recently moved north; therefore, the species arrived in New England after sea levels had risen significantly since the Wurm (ca. 10,000 yr BP), and the species has not colonized across sea water.
2. These snakes must have an abundance of toads *(Bufo* spp.) as prey to sustain adult populations.
3. They must have a supply of small amphibians, either salamanders, *Plethodon cinereus,* or peepers, *Hyla crucifer,* to sustain hatchlings and young until they are big enough to eat toads. Small toads alone cannot supply the young snakes' diet, because these amphibians do not metamorphose into the terrestrial form until well into the summer of each year. Hognose snakes are thus able to colonize peninsular habitats where soils are loose enough to permit burrowing and the habitats can supply needs two and three above.

Hognose snakes seem to be absent from all of the islands in Rhode Island (Table 1). Similarly, hognose snakes are absent from all of the Massachusetts coastal islands including Monomoy, which has been connected to the mainland and which does support toads. Monomoy lacks both woodland salamanders and peepers (Lazell and Michener, 1976).

Two peninsular barrier systems support good populations of hognose snakes: Sandy Neck and the Provincelands, in Barnstable County, Massachusetts. Details of their physiography are given in Laze11 (1979). A mark recapture survey has been begun on Sandy Neck; preliminary results indicate approximately one hognose snake per three hectares of land, excluding salt marsh. Hognose snakes are abundant north of Provincetown in Provincelands, where at old dump sites one may find more than one per hectare. Both of these peninsulas supply all three range requirements noted above.

We are convinced that *Heterodon platirhinos,* albeit more or less common, is fairly continuously distributed south of Conant's (1975) line, given minor adjustments (Fig. 1). Because this snake does well in edificarian habitats, and is most common in the pine barrens ecosystem widespread in southern Massachusetts and Rhode Island, we do not believe the species deserves protective listing in either state at this time.

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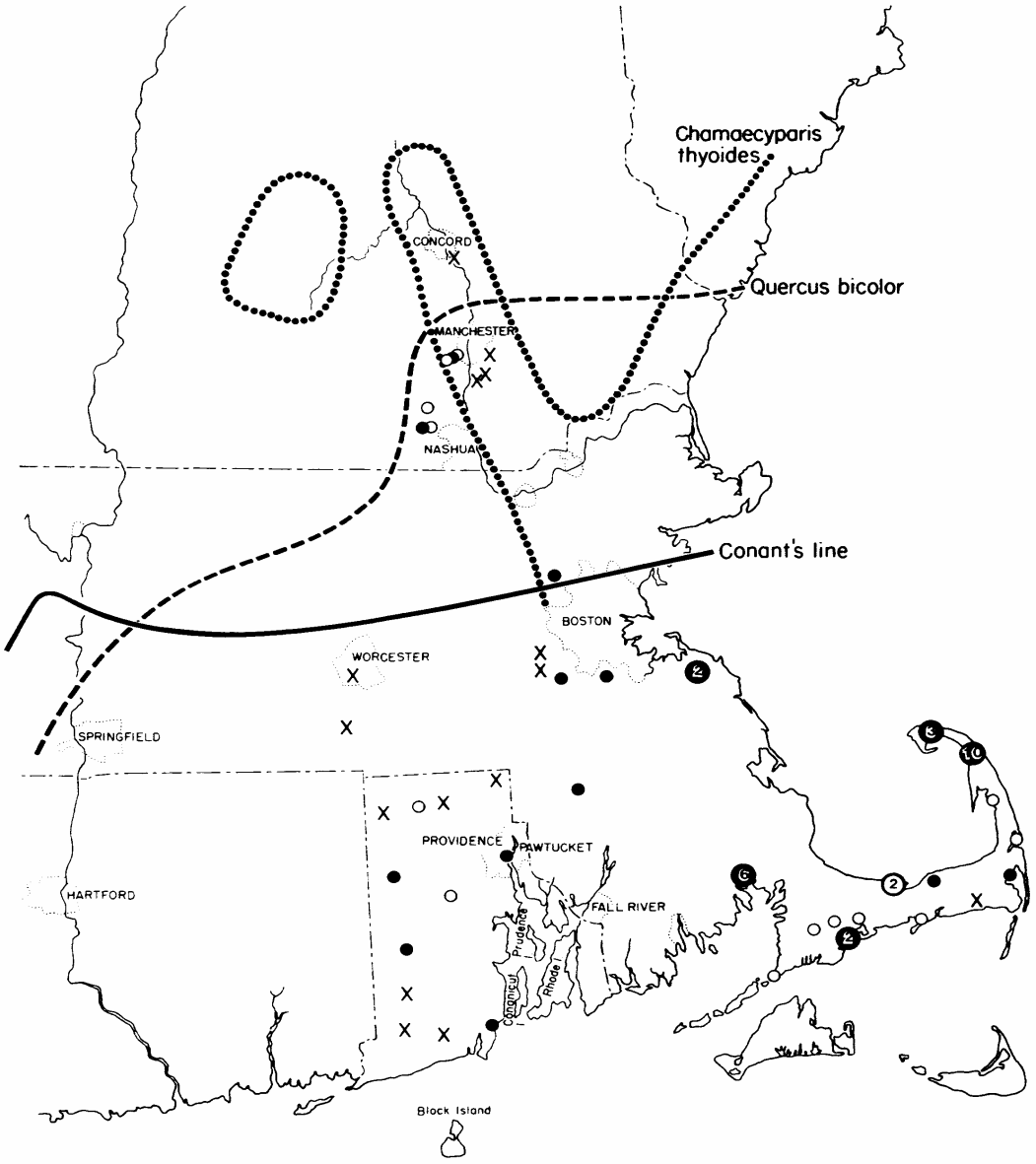

FIG. 1. Distribution of the hognose snake in eastern New England. Black circles are museum specimens, open circles photographs; the number of individuals in each case is indicated if more than one. Sight records are indicated by X. Urban areas are stippled.

TABLE 1. The major islands of Rhode Island. None is known to support hognose snakes. Habitat characteristics are more fully described in text.

	Habitat prerequisites		
Island name	1: Connected to mainland recently	2: Presence of *Bufo* sp.	3: Presence of small amphibians
Rhode or Aquidneck	+	+	+
Conanicut	–	–	+
Prudence	–	+	+
Block	–	–	+

THE NEW HAMPSHIRE POPULATION

Merrimack and Hillsborough counties, New Hampshire, include an extensive sandy pine ecosystem (an area we estimate originally to have been more than 50,000 ha), larger and farther north than the "pine bush" area near Albany, New York (1600 ha; Rittner, 1976). The sandy soils of these communities are found throughout New Hampshire in depressions and river valleys, where relict dunes and outwash deposits remain from the retreat of the Wurm glaciation (Goldthwait et al., 1951). Much of the original areas have been, or are being, mined for sand or gravel, frequently down to bedrock or the water table, whichever is higher. The soils of these regions are named and characterized in Bond and Handler (1980).

In xeric locations wherever these communities have been periodically purged by fire, the natural vegetation is devoid of most tree species except for the fire-tolerant pitch pine, with understories of scrub oak, *Quercus ilicifolia*, sheep laurel, *Kalmia angustifolia*, and low bush blueberry, *Vaccinium angustifolium.* There are three extensive examples in New Hampshire in the southern part of the Merrimack drainage: east of Concord, south of Manchester, and west of Nashua. Each of these three sand plains has been developed extensively, each with a municipal airport (Concord Municipal, Grenier Field, and Boire, respectively) and numerous businesses and residences. Detailed vegetation lists are available for several examples of the northern limits of the pine barrens (Rittner, 1976, for Albany; Stone, 1911, for New Jersey); none are available for New Hampshire.

Sandy sites with a history of fire suppression are dominated by white pine, *Pinus strobus*, in New Hampshire, and are considerably more common than pitch pine barrens. These communities also occupy Hinckley and Windsor soils. We undertook vegetation surveys sampling ten points with basal area factor 10 prism in these woodland habitats. White pine dominates these level or gently rolling sandy areas, with a basal area (BA) averaging 33.3 m^2 per hectare; with scattered pitch pines (0.9 m^2/ha) and a variable mixture of hardwoods, including white oak, *Quercus alba* (1.8 m^2/ha), red oak, *Quercus rubra*, large-toothed aspen, *Populus grandidentata*, black cherry, *Prunus serotina*, each with BA 0.2 m^2/ha. Tree species also include paper and gray birches, *Betula papyrifera* and *B. populifolia*,chestnut, *Castanea dentata*, aspen, *Populus tremuloides*, red and sugar maples, *Acer rubrum* and *A. saccharum.* The lower layers are characteristically sparse, with scattered gray birches, huckleberries, *Gaylussacia baccata* and *G. frondosa*, low bush blueberry, hazelnut, *Corylus americana*, and some sheep laurel, *Kalmia angustifolia*, in patches.

Non-sandy uplands in southern New Hampshire, with soils derived from glacial till, support similar lists of trees, but with hardwoods more common and white pines more sparse. Typically, other trees include hemlock, *Tsuga canadensis*, shagbark hickory, *Carya ovata*, and black birch, *Betula lenta.* Upland shrub species commonly include mountain laurel, *Kalmia latifolia*, maple-leaf viburnum, *Viburnum acerifolium*, and sheep laurel.

All of our New Hampshire records come from white pine dominated woodlands, rather than from pitch pine barrens typical for the species in the southern coastal plain. In addition to those listed in Table 2, an individual was seen and adequately described in Bedford and another observed and photographed in Amherst by Roger Hogan, U.S. Fish and Wildlife Service. Both were found at the edge of sandy white pine forests. Meristic characters are given in Table 3.

TABLE 2. New Hampshire records of hognose snakes. Photos of specimens for which meristic data are given in Table 3 are asterisked. Xeric soils: Hs, Hinckley; So, Scarboro.

No. of specimen or observation	Location	Soil series	Observer and date
AMHN 3623	"New Hampshire"	—	"Dr. Taylor"
MCZ 164928	Witches Spring Rd., Hollis, Hillsborough Co.	Hs	M. Michener, 27.vii.83
MCZ 164929	Nashua Rd., Bedford, Hillsborough Co.	So	M. Michener, 18.viii.83
Photo	3.2 mi SE of Amherst	Hs	R. Hogan, v.81
Photo	Witches Spring Rd., Hollis, Hillsborough Co.	Hs	M. Michener, 16.viii.81
Photo*	Sebbins Pond, Bedford, Hillsborough Co.	Hs	C. Perrins, 15.v.85 (M. Michener photo)
Photo*	Nashua Rd., Bedford, Hillsborough Co.	Hs	W. Bosworth, 23.v.85 (M. Michener photo)

At least two distinct sorts of melanism appear in eastern hognose snakes. Satin black or jet seems to be a discrete morph widespread in the southeastern part of the species range. In New England we have not found this morph. Instead, in some individuals slate black pigment may obscure the pattern elements. At the extreme of this variation individuals are uniformly dark, but slate-colored, as in Fig. 2.

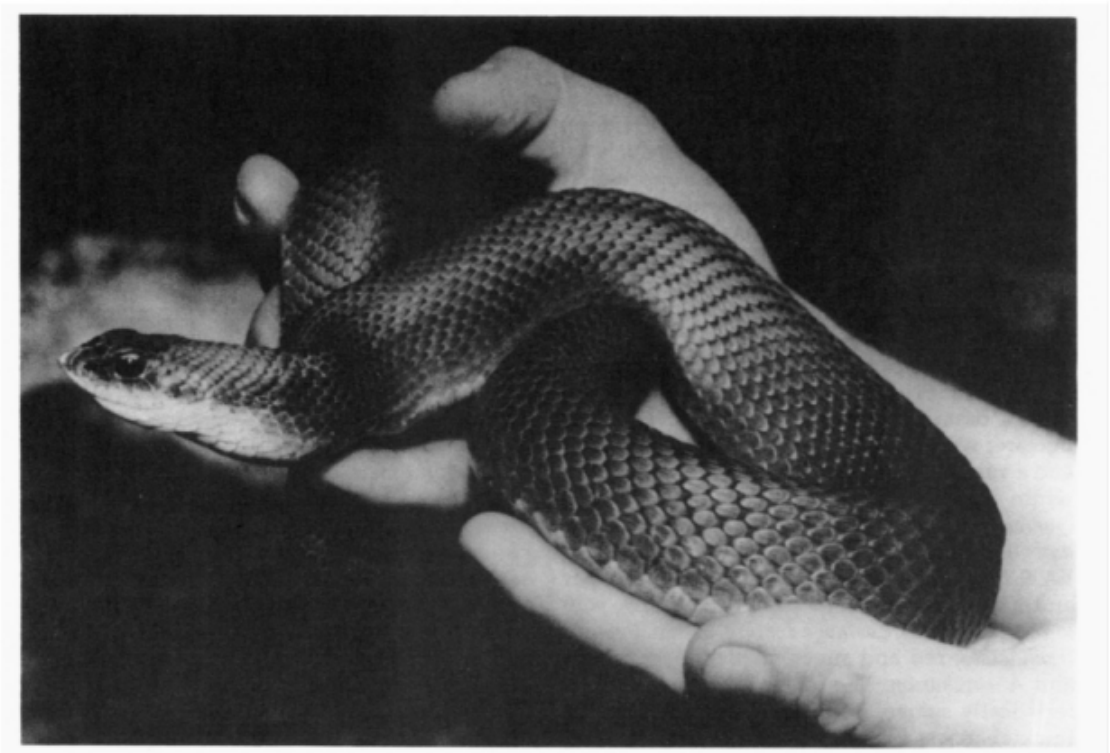

FIG. 2. A melanistic adult female hognose snake, *Heterodon p. platirhinos*, photographed by the senior author, 23 May 1985, at Bedford, Hillsborough County, New Hampshire. This represents an extreme of variation, not a discrete morph. The snake is essentially uniform slate-black. Intermediates with normally patterned individuals occur, e.g., MCZ 15476 from Lexington, Massachusetts.

All the specimen localities in the Merrimack River drainage occur in sandy soils: five in Hinckley (Hs), and one in Scarboro (So). Most of these recent records come from the periphery of the sandy deposits, near till and bedrock uplands. It is tempting to speculate that the adult hognose snakes were observed in these areas, having followed their growing prey (toads) into the upland (rocky, till) woods and away from the protection of the easy burrowing sandy soils, where the probability was higher of being exposed to human observers or lethal road encounters.

In New Hampshire, pitch pine plains are notably scarcer than white pine forests; a roadside survey of sandy regions producing a ratio of approximately one to eight. It may therefore be fortuitous that these scarcer pitch pine areas have produced no hognose snake records. It appears more likely, however, that the white pine forests are the habitat of choice for this species at this northern extreme of their range.

It is particularly noteworthy that no records exist from the coastal plain, where sandy areas are found, both Atlantic white cedar and white oak occur, and zoologists are perhaps most abundant within the state. Cook (1984) emphasizes the isolation of the New Hampshire population (and three others near the northern limit of the species' range). He notes of Ontario populations that in ". . . some areas of its former range it appears to have completely disappeared."

TABLE 3. Meristics of hognose snakes from north of Conant's (1975) line. Two New Hampshire specimens have stumped tails. The melanistic individual is shown in Fig. 2.

No. of specimen or observation	Sex	Body blotches	Ventrals	Subcaudals	Locality
AMNH 3623	male	31	127	51	"New Hampshire"
MCZ 164929	male	28	122	—	Bedford, NH
MCZ 164928	female	32	135	—	Hollis, NH
MCZ 154767	female	36	134	44	Lexington, MA
MCM--photo 15.v.85	female	30	130	38	Bedford, NH
MCM—photo 23.v.85	female	melanistic	130	38	Bedford, NH

RELATIVE ABUNDANCE

We cannot yet provide a comprehensive analysis of the abundance of hognose snakes. We can make comparisons based on experience such as field encounters with hognose snakes and with other species, and based on the collected material in the Museum of Comparative Zoology (MCZ). For this purpose we exclude two species, *Storeria dekayi* and *Natrix s. sirtalis* (taxonomy of Lazell, 1974), because they are so abundant, and so often collected in large series, as to be incomparable. Several other species of small snakes show clumped distributions and are often, therefore, collected in large series: *Diadophis punctatus edwardsii, Opheodrys v. vernalis, Storeria o. occipitomaculata,* and *Natrix s. saurita* (see Lazell and Michener, 1976).

The largest series of *H. platirhinos* from our study area are six in MCZ, collected by the indefatigable Outram Bangs at Wareham, Massachusetts, over a two-year period, 1912-1913, and 10, in United States National Museum (USNM), collected in 1889 and 1890 at North Truro, Massachusetts. The most encountered in a single day has been two (in the Provincelands, Barnstable County, Massachusetts, 28 July 1974 and Bedford, Hillsborough County, New Hampshire, 23 May 1985). The hognose snake in eastern New England seems especially comparable to the larger, more infradispersed species such as *Coluber c. constrictor, Lampropeltis t. triangulum,* and *Natrix s. sipedon.* Two of these species, the racer and the water snake, are conspicuously diurnal during much of their lives, and are seen with greater frequency than hognose snakes (Table 4).

TABLE 4. Relative abundance of the hognose snake in eastern New England and other snake species within its range.

Species	Specimens in MCZ	Pattern	Abundance relative to hognose snake
Heterodon platirhinos	34	infradispersed	—
Diadophis punctatus	31	clumped	scarcer
Coluber constrictor	57	infradispersed	more common
Lampropeltis triangulum	51	infradispersed	more common
Opheodrys vernalis	71	clumped	nearly the same
Storeria occipitomaculata	45	clumped	notably scarcer
Natrix saurita	38	clumped	scarcer
Natrix sipedon	116	both	at least twice as common

SUMMARY

The eastern hognose snake, *Heterodon platirhinos,* is a fairly common inhabitant of pine forest habitats in eastern New England right to the northern limit of its range in Hillsborough and Merrimack counties, New Hampshire. Fresh material extends its known range some 40 km to the town of Pembroke, just south of Concord, New Hampshire. Outside pitch pine and white pine forests, in suburbs, deciduous forests, heath and dune habitats, the hognose is of irregular occurrence though often encountered.

In Massachusetts and Rhode Island, with over one hundred thousand hectares of pine barrens, *Heterodon platirhinos* does not deserve special legal protective status at this time. However, the persistent threats to the pine barrens so well articulated by Williams, Burg, and others in Mitchell (1983) need to be addressed by responsible governmental and private agencies to preclude future endangerment of this (and many other) species.

In New Hampshire *Heterodon platirhinos* deserves special protective status because it has a restricted, small distribution along the Merrimack River to Concord. The pine barrens and white pine forest ecosystems, presently estimated to cover more than 30,000 ha within the Merrimack drainage, are currently being consumed by sand mining and development; neither habitat has legal protection despite the peripheral relationship of these areas to the more extensive coastal plain to the south. The New Hampshire population of hognose snakes may now be an isolated disjunct, resulting from habitat destruction in the Merrimack and Nashua valleys caused by urban development. Its absence from the sandy coast north of Boston despite the presence of suitable habitat requirements is, at this time, unexplained.

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