

# **NORTHERN BLACK RACER ASSESSMENT**

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## INTRODUCTION

Since 1968, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has developed and refined wildlife species assessments to formulate management goals, objectives, and strategic plans. Assessments are based upon available information and the judgments of professional wildlife biologists responsible for individual species or groups of species. This document represents the first planning effort by MDIFW for northern black racers, a snake designated as an “endangered species” in Maine.

Assessments provide the background for species planning initiatives. A “Natural History” section reviews biological characteristics of the species useful to understanding its status. The “Management” section recaps previous actions, strategic plans, relevant rules, and regulatory authority. Historic, current, and projected future conditions for the species are discussed individually for “Habitat,” “Population,” and “Use and Demand” analyses. The major points of an assessment appear in a “Summary and Conclusions.”

Owing to both the scarcity of northern black racers in Maine and to limited information about them, this assessment draws heavily on studies and insights from other regions. Mark McCollough prepared the initial draft of this assessment.

## NATURAL HISTORY

### Description

Eastern racers (*Coluber constrictor*) are long, slender snakes aptly named because they are fast and difficult to catch. The subspecies found in the northeastern U. S., the northern black racer (*C. c. constrictor*), is Maine's largest snake and the only one that is glossy black on its back (Vickery 1999; Figure 1). Adult racers may grow to 1.9 m (75 in) in overall length (Ernst and Zug 1996:161). Most found in Maine were <140 cm long, although an intact, shed skin measured 192 cm (Vickery 1999).

An adult northern black racer appears shiny black, slate, or bluish-black dorsally. Its belly is dark or medium gray in color. The chin, throat, and neck are variably gray or milky-white. Northern individuals have less light coloration, possibly visible on only a few chin plates (Ditmars 1908:278). Young racers are grayish with a patterned, mid-dorsal row of dark gray, brown, or reddish-brown blotches and a series of small dark spots on the venter. Thus, juveniles superficially resemble northern water snakes or milk snakes. All traces of patterned blotches and spots fade with age and disappear when racers reach 70 or 80 cm in length (Ernst and Barbour 1989). Seventeen rows of smooth scales taper to fifteen at the vent on an eastern racer (Ortenburger 1928).

Racers can be reliably sexed only by determining the presence or absence of hemipenes (the paired copulatory organs of males). Visual determinations based upon size are not absolute given overlap in most indices. Males have slightly stouter, longer tails (23-29% of body length), 167-193 ventral scales and 78-120 subcaudals. Females

Figure 1. A northern black racer (*Coluber constrictor constrictor*).

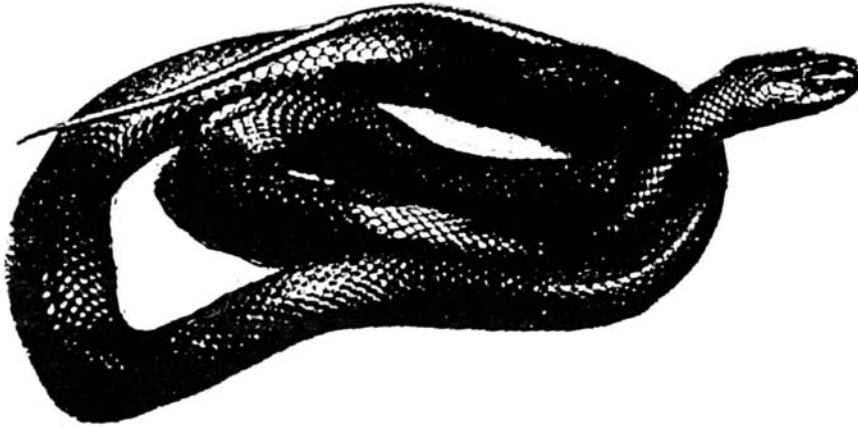
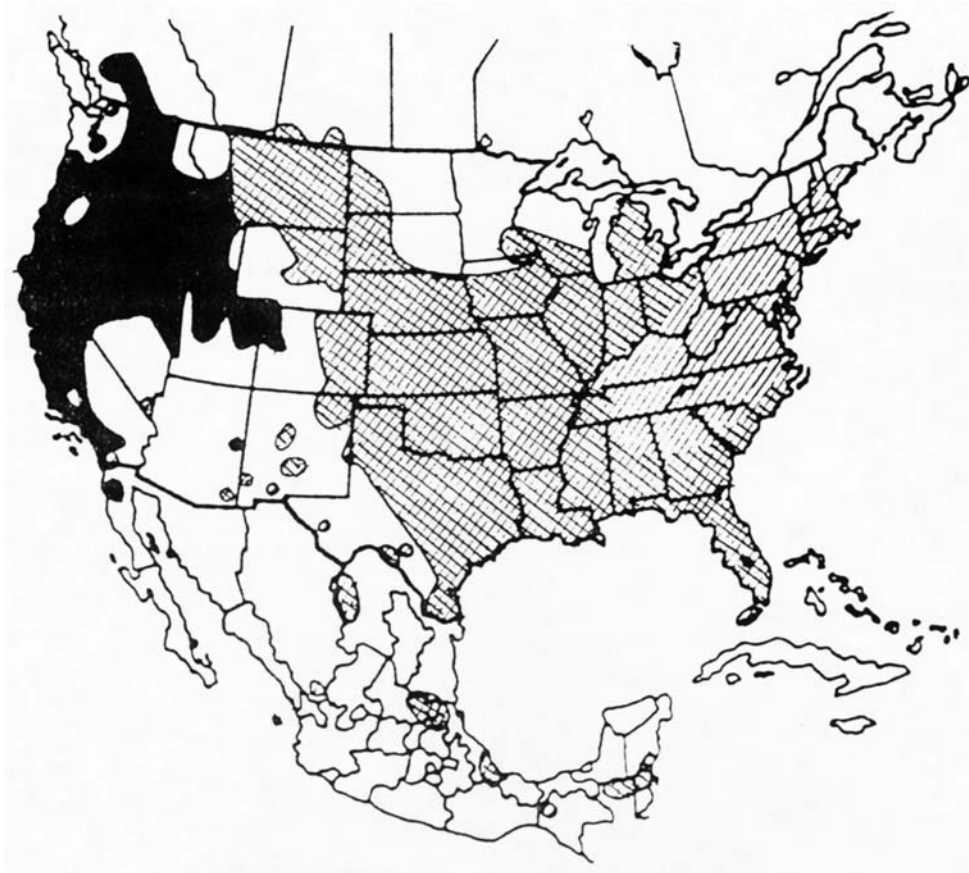


Figure 2. Range of the northern black racer (*Coluber constrictor constrictor*, hatched areas), other eastern racer subspecies (*Coluber constrictor*, cross-hatched), and western racers (*Coluber mormon*; solid) across North America.



are longer but have thinner, shorter tails (19-27% of body length), 151-184 ventral scales, and 70-99 subcaudals (Ernst and Barbour 1989, Brown and Parker 1984).

### Distribution

Eastern racers occur broadly across the United States. The present distribution of *Coluber constrictor* (Figure 2; Ortenburger 1928, Auffenberg 1955, Conant 1975, Wilson 1978, Ernst and Barbour 1989) nearly spans the continental U. S. They range from southernmost Canada, through all states east of the Continental Divide, to Mexico and Guatemala. Racers are absent or scant in the higher latitudes of some northern tier states, but otherwise are sparingly distributed only in the southwestern U. S. Their northern range limits, a crucial issue from Maine's perspective, are (from east to west): southern Maine; central portions of New Hampshire, Vermont and New York; southwest Ontario; central Michigan and Wisconsin; southernmost Minnesota; western North Dakota, central Montana; southernmost Saskatchewan; northern Idaho; southwestern British Columbia; and western Washington.

Bleakney (1958) reviewed evidence of *Coluber constrictor* in eastern Canada. Their existence in the Maritime provinces is based solely on unverified sight records and an unlabelled specimen. Several accounts (Wright and Wright 1957, Conant 1958, Logier and Toner 1961) include this region, while others (Cook 1967, Conant 1975) discount it as part of its range. Froom (1972:54) argued for the validity of racer reports in New Brunswick, Nova Scotia, and Prince Edward Island during the late 1800's. The range of blue racers (another subspecies, *C. c. foxii*) has contracted in southern Ontario (Kamstra 1991). Range reductions in Maine are discussed in "Population Assessment."

## Taxonomy

Racers are included in the family Colubridae which contains 63% of >2400 species of snakes currently known in the world (Ernst and Zug 1996:155-167). Thirty-eight genera of colubrids are described in the U. S. (Smith 1961). All 9 snake species extant in Maine are members of the family Colubridae (Hunter *et al.* 1999).

Racers belong to the genus *Coluber*. Taxonomists previously listed a single North American species, but two are now recognized (Collins 1997): eastern racers (*Coluber constrictor*) and western racers (*C. mormon*). Their division by the Continental Divide has been frequently debated (Fitch *et al.* 1981, Greene 1984, Corn and Bury 1986). Other species in this genus occur in northern and western Africa, in Europe, and across Asia from the Middle East to central China (Mattison 1995). In the western hemisphere, the closely related genus *Masticophis* (whip snakes) is represented by 8 resident species (Peters and Orejas-Miranda 1970).

Wilson (1978) identified 11 subspecies of eastern racers, but taxonomists now recognize only nine (Collins 1997). The subspecies found in Maine is the northern black racer, *Coluber constrictor constrictor* (Linnaeus). It ranges from southern Maine and central portions of New Hampshire, Vermont, and New York southward to Georgia, Alabama, and Mississippi. Here it abuts regions inhabited by *C. c. priapus*, southern black racers. Northern black racers occur westward through Tennessee, Kentucky, and eastern Ohio where they overlap *C. c. flaviventris*, eastern yellowbelly racers (Wright and Wright 1957, Ernst and Barbour 1989).

### Habitat, Diet and Movements

Racers utilize many habitats but usually occur in terrestrial sites (Ditmars 1908). Wright and Wright (1957) documented 36 habitat categories used by racers including nearly all rural, upland habitats. Ortenberger (1928) noted that racers frequented dry open fields or meadows, thickets, brush piles, and bushy field edges. In the East, Fitch (1963) associated *C. constrictor* with woodland edges. Gibbons and Semlitsch (1988) indicated that the species is quite common in areas with sparse vegetation. Rosen (1991) cited seasonal changes in habitat: open uplands and riparian thickets prevailed in spring and summer but mature forests were favored in autumn. In the Northeast, northern black racers occur in moist and dry areas, forested areas and fields, human development (farms, old buildings, roadsides, stone fences), large tracts of mixed old fields and woodland, swamps, and marshes (DeGraaf and Rudis 1986, Humphrey and Royte 1990).

Racers have a catholic, opportunistic diet (Ditmars 1908, Uhler *et al.* 1939, Hamilton and Pollack 1956, Klimstra 1959, Fitch 1963, Ernst and Barbour 1989). Prey of adults include small snails; spiders; insects - grasshoppers, crickets, mole crickets, cicadas, beetles, true bugs, ichneumonid wasps, moths, and their caterpillars; reptiles - small turtles, lizards and their eggs, snakes; amphibians - anurans and salamanders; birds - nestlings and eggs of many species; and mammals - moles, shrews, mice, rats, squirrels, rabbits, and weasels. Small vertebrates and insects are foremost in diets of young racers (Rosen 1991). The opportunism of racers is exemplified by predation on fish eggs (Cook 1984) despite their reputation as a highly terrestrial snake. They are also cannibalistic and may feed on young of their own species (Fitch 1963).

Contrary to their specific name, racers are not constricting snakes. They seize prey in their mouth and either eat it alive or press it to the ground until it dies. Racers readily climb as high as 3 m in trees in search of food or to escape threats (Fitch 1963, Fitch and Shirer 1971). They are extremely swift and move at burst speeds up to 5.6 km / hr (Mosaur 1932) or sustain locomotion at  $\leq 0.6$  km / hr for 30+ minutes (Walton *et al.* 1990) by lateral undulation. Racers also use concertina locomotion (side winding), but this method is slower and requires more energy (Jayne and Davis 1991). Their movements consume 60% of daily energy expenditures (Plummer and Congdon 1996).

Eastern racers are diurnal and are particularly active in the morning (Fitch 1963). They have a mean disposition when cornered and will readily strike, inflicting a painful but relatively harmless bite. Aggression during defensive behavior correlates positively with temperature (Keogh and Deserto 1994). Most inactive periods occur during some portion of the shedding cycle (from eye translucence to skin sloughing), a period when they seek refuge underground or in trees (Plummer and Congdon 1994).

Racers remain active from late-March to late-October, but (even in the north) some individuals emerge on warm winter days (Conant 1938, Robinson *et al.* 1974). Northern black racers hibernate in mammal burrows, caves, rock crevices, old stone walls, gravel banks, cisterns, wells, rotting logs, and stumps (Ernst and Barbour 1989). There is high fidelity to traditional sites (Brown and Parker 1976). Racers can move inside a hibernaculum to seek warmth and / or thermal stability (Sexton and Hunt 1980). Snake body temperatures do not differ from that of the den substrate, and the animals do not metabolize fat reserves during winter dormancy (Brown *et al.* 1974). Hibernacula may be shared with other snake species (Parker and Brown 1973).

Racers are among the earliest snakes to emerge from hibernation (Fitch 1963). Emergence from hibernation has been described as gradual and usually entails a few days of basking at the site before full activity is resumed (Cohen 1948). Extensive basking at hibernacula occurred during the fall in a Michigan population, but spring dispersal was immediate after emergence from dens (Rosen 1991). Northern black racers in Massachusetts can warm to 27° C on a 10° C day by basking (Lazell 1976).

The species is active over a wide range of body temperatures (17 - 41° C) but performs best between 22.4 and 37.4° C (Kitchell 1969). Racers tolerate warmer ambient conditions than most snakes and seem to prefer air temperatures of 22 - 30° C (Fitch 1963). The critical thermal minimum for *C. constrictor* is near 3° C (Robinson *et al.* 1974), permitting a long season of activity well into autumn months (Fitch 1963).

Racers disperse up to 2.3 km (averaging between 383 m and 848 m in various studies) from denning sites to their summer home ranges in northern latitudes (Fitch 1963, King 1968, Brown and Parker 1976, Rosen 1991). Travel rates for spring migrations averaged about 100 m / day in Utah (Brown and Parker 1976). Migrations are not observed in southern portions of their range (Plummer and Congdon 1994).

Male racers had an average home range (convex polygon) of about 2.9 ha, and females 1.8 ha in Kansas (Fitch 1963, Fitch and Shirer 1971). Females in Utah had an average summer home range of 0.4 ha (Brown and Parker 1976). In South Carolina (Plummer and Congdon 1994), large home ranges (mean = 12.2 ha) were attributed to trophic differences and changes in the local environment. Geographic differences in home range size are partly attributable to clinal variation in size (racers are largest in the East) which influences position in the food chain (Brown and Parker 1976). A

single northern black racer radio-tagged at Kennebunk Plains, Maine occupied a 3.1 ha area during the period from 7 September to 6 October (Zappalorti and Brown 1989) but only partly represents a full summer home range typical in this region.

During summer, daily racer movements averaged only 33 m in Utah (Brown and Parker 1976), 37 m in Kansas (Fitch and Shirer 1971), and 104 m in South Carolina (Plummer and Congdon 1994) but were 424 m in Michigan (Rosen 1991). Eastern racers are very territorial and seem to have non-overlapping home ranges for much of the summer (Smith 1956, Brown and Parker 1976). Aggression among adult racers has been documented independent of foraging activities (Engeman *et al.* 1984).

### Reproductive Ecology

In Kansas, males mature sexually and first produce sperm in August and September when just over a year old, but do not mate until the following spring (Fitch 1963). Most females in a Michigan population matured at ages 2 - 3 years (Rosen 1991). They grow somewhat faster than males and achieve greater size (Brown and Parker 1984). Overall lengths of adult *Coluber constrictor* range from 680 to 1900 mm (Wright and Wright 1957, Ernst and Zug 1996).

Ovulation usually occurs in late-May (Ernst and Barbour 1989) but peaked during early-June in a northern portion of their range (Rosen 1991). Mating typically occurs in May or June (Wright and Wright 1957). Males may follow scent trails to locate females (Lillywhite 1985), and several males may court the same female. Racers are often solitary except during periods of courtship and mating (Fitch 1963).

*C. constrictor* lays eggs from early-June to early-August (Fitch 1963). Old sawdust piles, rotting logs, stumps, and mammal burrows are favorite nest sites (Ernst and Barbour 1989). Individual nesting is most common, but some females may nest communally at the same site for many years (Foley 1971, Swain and Smith 1978), especially if suitable sites are limiting.

From 2 to 31 eggs are laid in each clutch (Fitch 1963), but 9-16 eggs are most common (Ernst and Barbour 1989, DeGraaf and Rudis 1986). Clutch size increases with age and body length of the female. Incubation takes 43 - 65 days with about 50 days being average (Fitch 1970, Ernst and Barbour 1989). Eggs of eastern racers incubated at 28° C hatched in 39 - 40 days compared to 62 - 63 days for eggs at 22° C (Burger 1990). Sex of hatchlings is apparently not temperature-dependent. Racers hatched from eggs incubated at warmer temperatures are more vigorous than those incubated at cooler temperatures (Burger 1990). The young snakes usually hatch from late-July to September and are range between 270 and 290 mm in total length.

#### Survival, Growth, and Longevity

Annual survival rates averaged 54% among eastern racers aged 1 - 4 years but only 12% among yearlings in Michigan (Rosen 1991). Recapture patterns implied that most deaths were associated with overwintering. Annual survivorship of racers was determined as 62% in Kansas (Fitch 1963) and 70% in Utah (Brown and Parker 1984). Decreased mortality was reflected in an older age distribution than in Michigan. In Utah, Brown and Parker (1984) found 93% overwinter survival among western racers.

Age distribution of a healthy racer population in late-summer is characterized as: hatchlings- 50%, yearlings- nearly 25% and adults- the remainder (Ernst and Barbour 1989). The following ranges of snout - vent length (SVL) are reported among age - sex groups of *C. constrictor* from Kansas (Fitch 1963):

<u>Age (years)</u>	<u>SVL (mm) -</u> <u>males</u>	<u>SVL (mm) -</u> <u>females</u>
2	560 - 674	580 - 738
3	648 - 755	730 - 880
4	725 - 809	791 - 920
5	743 - 855	833 - 1088
6	765 - 883	892 - 1020
7	788 - 900	919 - 1050
> 7	740 - 890	930 - 1085

Wright and Wright (1957) report a longevity of eastern racers as 2 to 5 years, but Fitch (1963) found individuals living > 10 years. Significant mortality may occur in areas of high road density (Ernst and Barbour 1989). Some mammals and other snakes may occasionally kill racers, especially at nests or hibernacula. Birds of prey can be a major predator of racers, particularly nesting females (Plummer and Congdon 1992).

## MANAGEMENT

### Regulatory Authority

Enabling statutes (12 MRSA Chapter 713) direct MDIFW to "preserve, protect and enhance the inland fisheries and wildlife resources of the state; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for the effective management of these resources" (§7011). "Wildlife" is defined as "any species of the animal kingdom, except fish, which is wild by nature, whether or not bred in captivity, and includes any part, egg, or offspring thereof or the dead body parts thereof" (§7001).

Nevertheless, state law provides only minimal protection for most reptiles. The first restrictions on take or possession of snakes and most turtles from the wild were bans on export, sale, or commercial uses enacted in 1993 (§7471). Wildlife (including reptiles) may be possessed for other uses in Maine, if appropriate permits are obtained:

- "exhibition" = any person intending to keep, purchase, sell, or transport wildlife for either exhibition or attracting trade (§7231);
- "transportation" = any person intending to take or transport wildlife within the state for breeding or advertising purposes (§7241);
- "importation" = import, receive, or introduce wildlife (§7237).

Scientific collection permits are not necessary to hunt, trap, possess, band, or transport reptiles or amphibians in Maine since §7242 applies only to "wild animals" (defined as mammals, by statute) and wild birds. Similarly, MDIFW has no jurisdiction for rehabilitation permits (§7235-B) issued for most reptiles or amphibians. MDIFW

regulations (Chapter 7) govern the housing, care, and health standards for captive animals as well as criteria for determining that wildlife importation does not threaten native wildlife or humans. Such animals may not be displayed in licensed pet shops.

Additional protection for the eastern racer stems from the designation of *Coluber constrictor* (including the subspecies of concern [*C. c. constrictor* = northern black racers] and eight others) as “endangered” in Maine (§7753). It has been a state endangered species since Maine’s inaugural listing of vertebrate wildlife in 1986. Prohibitions for eastern racers and other endangered or threatened wildlife (§7756) under Maine’s Endangered Species Act (1975) and a 1987 amendment include:

- export from the state;
- hunting, trapping, or possession in the state;
- transport, delivery, carry, ship, sale, offering for sale or processing; and
- deliberate feeding, baiting, or harassment (except for educational or scientific purposes intended to enhance its survival or propagation).

Incidental take is a new provision (§§7756.2-C, D) enacted in 1999 stipulating that lawful activities that do not threaten the recovery of listed species may occur under a plan that minimizes such takings and is approved by the Commissioner.

A 1988 amendment to Maine’s Endangered Species Act (§7755) created a mechanism for habitat protection. When implemented, special rules enable oversight of state and municipal functions potentially affecting the listed species in designated areas. These “essential habitats” are locales currently or historically providing physical or biological features essential to the conservation of the species and which may require special management considerations. Essential habitats must be defined and

mapped by rule. Protection guidelines are also promulgated according to state rulemaking procedures. These regulations direct that “a state agency or municipal government shall not permit, license, fund, or carry out projects within an essential habitat without review by MDIFW.”

The Natural Resources Protection Act (38 MRSA Article 5-A) is also applicable. Habitats of endangered or threatened wildlife, including northern black racers, may be mapped for designation as "significant wildlife habitats." This statute, administered by Maine's Department of Environmental Protection (MDEP), requires permits for any alteration of soils, waters, vegetation, or permanent structures in a protected natural resource (§480-C). This includes other significant wildlife habitats (§480-B) and threatened or endangered plant habitats (§480-D), pertinent to several sandplain barrens in southern Maine where racers have been documented.

To date, essential habitat and significant wildlife habitat have not been defined for northern black racers. Both designations provide advance notification of threatened or endangered species issues enabling MDIFW review and consultation with property owners or development interests. Case-by-case evaluations are subsequently based on regulatory standards promulgated by state rulemaking procedures.

The Site Location of Development Act (38 MRSA Article 6) is among the few laws pertinent to protecting potential racer habitat such as pine-oak forests, sandplain pine barrens, heathlands, or reverting farmland. “Developments of state or regional significance that may substantially affect the environment” (e.g., those >20 acres, mineral extraction's, most subdivisions >20 acres, transmission lines >100 kV, and

several other large-scale projects; §§482, 487-A) require approval by MDEP or certified municipalities.

Another relevant statute is the Farmland Registration Act (7 MRSA Chapter 2-B). It discourages incompatible development of a 100-foot buffer on lands abutting registered farmlands (§56) and insures disclosure during adjacent realty transactions (§55). The Farm and Open Space Tax Law (36 MRSA: Part 2, Chapter 105) offers incentives to those interested in long-term conservation of farmlands, such as devaluation on property tax liability (§§1105-1106) and easement opportunities (§1111).

Maine's Comprehensive Growth Management Act (30-A MRSA) lists state goals to guide local comprehensive planning and land use management, required in all municipalities (§§4312, 4321). The overall theme is to promote orderly development. Approved plans must include: “protection of the state’s other critical natural resources, including without limitation, wetlands, wildlife and fisheries habitat ...” Strategies that might benefit northern black racers include the maintenance of rural character and a minimization of sprawl in Maine communities. Both issues are currently being addressed as methods of effectively implementing land use plans. The Land Use Regulation Commission (12 MRSA) administers a comprehensive plan with similar purposes (§§685A-C) for “wildlands” in the state's unorganized townships.

### Past Goals and Objectives

MDIFW has not previously established specific goals and objectives for northern black racers. Efforts undertaken thus far adhere to the basic theme of Maine's

Endangered Species Act: to maintain the species as part of Maine's traditional wildlife heritage.

### Past and Current Management

Northern black racers in Maine have received little direct management attention. Most of the few occurrence records currently known were obtained during the Maine Amphibian and Reptile Atlas Project conducted from 1984 to 1988 (Hunter *et al.* 1992). These data, several additional recent sightings, and site-specific, historic records are catalogued in MDIFW's Biological Conservation Database. Racer sightings recently documented are also included in the Department's Habitat Consultation Areas Mapping Project in order to identify sites with potential management concern to the agency.

An in-depth study of northern black racers was conducted by Zappalorti and Brown (1988, 1989) at a key site in Kennebunk. Two artificial hibernacula were built as mitigation at an adjacent subdivision. Acquisition of the 590 ha Kennebunk Plains by The Nature Conservancy (TNC) and Land for Maine's Future Board in the late-1980's protected a premiere habitat for northern black racers. MDIFW and TNC manage the property (Bozenhard 1993) with prescribed burns to perpetuate grasslands supporting several rare plants and 3 endangered or threatened wildlife species: northern black racers, grasshopper sparrows and upland sandpipers. To date, there has been one enforcement action: confiscation of a racer sold in a northern Maine pet store in 1990.

## HABITAT ASSESSMENT

### Historic Trends

Racers are usually found in open terrestrial habitats or their ecotones with woodlands. Native Americans and European settlers both created a patchwork of forest clearings in colonial Maine (Cronon 1983). The conversion of upland forests to farms prevalent during the 1800's may have benefited northern black racer populations and possibly enabled the species to increase in numbers or expand its range in the state. Thus, farmland acreage (Table 1) provides a surrogate index of habitat trends. Maine's agricultural land base (croplands and pasture lands) peaked at 1.41 million ha in 1880. The 1880 agricultural census tallied 931,911 ha of farmlands across the traditional range of northern black racers in 5 southern Maine counties (York, Oxford, Cumberland, Kennebec, and Androscoggin).

Farmlands diminished statewide by >77% during the next 100 years (Table 1). Most of this decline, 76%, occurred since 1925. In the 5-county range of Maine's racers, >82% of all farmland acreage was converted to other land uses between 1880 and 1982. Acreage of pasture (an apparently optimal type of agricultural land for racers) dwindled by 89% in this region. Through 1980, 72.5% of the reduction in farmland was due to reforestation, and most of the other lost acreage experienced rural development (Benson and Frederic 1982). Such areas remain potentially attractive to northern black racers, albeit with lessened suitability.

Table 1. Long-term trends, 1880-1982, of agricultural land uses in 5 southern Maine counties comprising the traditional range of northern black racers.

County Year	Land in farms <sup>1</sup>		Acreage (hectares) <sup>1</sup>		
	hectares	% of land area	Cropland	Pasture <sup>2</sup>	Woodland
<b><u>Androscoggin County</u></b>					
1880	99,063	80.1%	32,804	31,922	25,456
1925	86,080	72.4%	31,454	14,415	37,299
1982	30,036	24.3%	10,258	6,505	11,368
<b><u>Cumberland County</u></b>					
1880	162,994	72.0%	52,044	47,325	59,145
1925	94,348	42.7%	36,573	13,412	40,846
1982	25,130	11.1%	9,338	4,407	9,621
<b><u>Kennebec County</u></b>					
1880	194,135	85.7%	61,603	73,304	54,919
1925	169,932	74.6%	58,796	34,614	70,770
1982	47,571	21.0%	16,795	9,281	18,253
<b><u>Oxford County</u></b>					
1880	255,661	48.4%	60,013	66,138	121,541
1925	152,218	29.7%	34,573	24,424	88,996
1982	31,676	6.0%	8,284	5,136	16,903
<b><u>York County</u></b>					
1880	173,210	66%	43,963	56,980	55,554
1925	129,736	51%	38,347	18,355	70,297
1982	33,761	13%	10,570	5,529	15,092
<b><u>STATEWIDE TOTAL</u></b>					
1880	2,651,828	33.1%	754,416	655,926	1,085,525
1925	2,088,830	27.0%	744,358	232,853	1,007,423
1982	594,372	7.4%	212,049	85,527	254,931

<sup>1</sup> MDIFW compilation from data furnished by the Maine State Planning Office, U. S. Census of Agriculture, and U. S. Department of Agriculture.

<sup>2</sup> 1982 acreage includes pastured woodlands and rangelands (not tallied in 1880 or 1925); 1982 data are comparable to statistics reported in Table 2.

Circumstances are not entirely clear, but broad landscape changes related to agriculture (initial land clearing, vanishing farmlands, and intensive cultivation) appear influential at the species' range limits here in Maine. Further setbacks in the quality or quantity of suitable habitats available to northern black racers in southern Maine may have had local impacts or contributed to an apparently shrinking range of the species (see "Population Assessment"). On the other hand, man-made features such as quarries, stone walls, refuse dumps, cisterns, etc. sometimes benefit racers by providing special microhabitat needs (e.g., niches for nests or winter hibernacula).

### Current Assessment

Humphrey and Royte (1990) quantified habitat variables at 12 extant racer sites in Maine. Prevalent traits were open herbaceous strata (< 80% ground cover) at 88% of all sites and a large component of ericaceous shrubs (> 20% ground cover) as found at 75% of all locations. Most were open heathlands or other successional stages of pine - heath or pitch pine - scrub oak woodlands. A meaningful habitat suitability model and quantified habitat indices are not yet possible without better documentation of racer habitat use in Maine's largely wooded landscape. As a general indicator, recent trends in the quantity of farmlands (Table 2) reveal a continued statewide decline and greater rates of loss in southern Maine.

From 1987 to 1997, farmland acreage declined by > 16% (nearly double the statewide rate, Table 2) in 5 southern Maine counties traditionally inhabited by northern black racers. As elsewhere in the state, southern Maine farmlands have reverted to forests. However, only modest increases in York County forestland, from 74% to 81%,

Table 2. Recent trends of agricultural land uses in 5 southern Maine counties comprising the traditional range of northern black racers, 1987-1997.

County Year	Land in farms <sup>1</sup>		Acreage (hectares) <sup>1</sup>		
	hectares	% of land area	Cropland	Pasture <sup>2</sup>	Woodland
<b><u>Androscoggin County</u></b>					
1987	28,147	23.1%	10,287	4,886	11,268
1992	25,189	20.7%	8,442	3,744	11,537
1997	22,625	18.6%	7,668	2,899	9,786
<b><u>Cumberland County</u></b>					
1987	23,369	10.8%	8,841	3,597	8,988
1992	21,810	10.1%	7,508	3,430	9,236
1997	20,166	9.3%	8,145	3,515	6,954
<b><u>Kennebec County</u></b>					
1987	45,409	20.2%	16,404	9,389	17,433
1992	38,609	17.2%	15,724	5,957	15,212
1997	35,668	15.9%	14,879	6,126	12,651
<b><u>Oxford County</u></b>					
1987	28,658	5.3%	7,955	4,414	14,563
1992	25,688	4.8%	6,952	4,849	12,452
1997	25,884	4.8%	7,002	2,994	14,896
<b><u>York County</u></b>					
1987	29,062	11.3%	8,508	4,385	14,307
1992	25,009	9.7%	8,339	3,115	12,203
1997	23,611	9.2%	8,126	2,529	11,166
<b><u>STATEWIDE TOTAL</u></b>					
1987	543,345	6.8%	204,301	74,193	224,949
1992	509,232	6.4%	196,821	62,208	220,093
1997	490,354	6.1%	192,196	53,943	213,005

<sup>1</sup> MDIFW compilation from data furnished by the National Agriculture Statistical Service, U. S. Department of Agriculture.

<sup>2</sup> Includes pastured woodlands, rangelands and croplands used for pasture / grazing; these data are comparable to 1982 statistics reported in Table 1.

were recorded during the period 1960 - 1982 (Ferguson and Longwood 1960, Powell and Dickson 1984). Conversions of rural land in many southern Maine communities increasingly involve industrial, commercial, and high-density residential developments (Benson and Frederic 1982). Although racers utilize diverse habitats, these dramatic changes erode statewide carrying capacity by reducing the quality (and possibly, the quantity) of existing habitats available to racers.

Recent records of northern black racer are mostly from York County, the primary range of the species in Maine at present. Because they utilize many upland habitats, as much as 93.5% of York County could be considered potentially suitable habitat: 208,825 ha of forests and 23,611 ha of farmland (Powell and Dickson 1984, Table 2).

Neither extensive woodlands or intensive, row-crop agriculture are very attractive to racers. Thus, the availability of functional habitats is certainly much less. However, York County is also characterized by great habitat diversity and extensive ecotones that are considered beneficial to this species. Edge indices were greater for York County than any other region in Maine (Brooks *et al.* 1986). Racers can occupy a variety of settings, but open fields and associated forest / field ecotones appear to be optimal habitats in Maine (Zappalorti and Brown 1989).

Of course, racers are not distributed throughout all of York County or other disjunct portions of their current range in Oxford and Cumberland Counties. Localities developed beyond the rural character typically inhabited by racers may no longer be suitable habitat. Commercial developments and high-density residential areas fragment remaining habitats. Future research may reveal specific habitat components limiting to northern black racers (*e.g.*, denning sites or hibernacula) in southern Maine. All

inferences point to reduced carrying capacity for northern black racers in the state, only a local influence on racers in many regions but a substantial concern at their northern range limits here in Maine.

### Projections

The Maine State Planning Office predicts 0.7% annual growth of York County's human population through 2005, a rate only slightly below the 1980 - 1996 average of 0.8%. Continued growth will result in further residential and commercial development, a concern magnified if sprawl tendencies in the state are not resolved. These trends could result in additional setbacks to the supply of suitable habitats for northern black racers, already jeopardized by northern range limits and previous, dramatic reductions of optimal farmland habitats in the state. Effective conservation for reptiles must address specific microhabitat needs above and beyond the general maintenance of suitable community types (Block and Morrison 1998).

## POPULATION ASSESSMENT

### Historic Trends

Maine is generally depicted as a northern boundary of the eastern racer's range. Within the last century, this range may have extended into the Maritime provinces of Canada (Bleakney 1958; see "Natural History - Distribution"). There is considerable debate on these accounts since the Maritimes are > 175 km beyond traditional racer range in southwestern Maine. Eastern Maine has no documented racer occurrences.

Despite being at or near their northern range limits, there is compelling evidence that populations have persisted in Maine for at least 3 centuries. Josselyn (1672) wrote "About the middle of May, 1639 ... I killed within a stone's throw of our house, above four score of snakes, some of them as big as the small of my leg, black of colour, and three yards long..." Norton (1929) interpreted this account of "black snakes" to indicate the historic presence of racers in the town of Scarborough. The area is still referred to as Black Point. Williamson (1832), Fogg (1862), and Lowe (1928) all included "black racers" (now named "eastern racers") in early lists of Maine herpetofauna.

There are few insights on the historic abundance of Maine's racer population. Fowler (1942) reported "it is a common species along the stone walls of the fields back of the lake" (Cobbosseecontee) in Winthrop. Northern black racers were recorded in central Maine as far north as Auburn (Ortenburger 1928) and presumably occurred widely across southern portions of the state. Babcock (1929) characterized them as "fairly common" in New England but offered no specifics on the species in Maine.

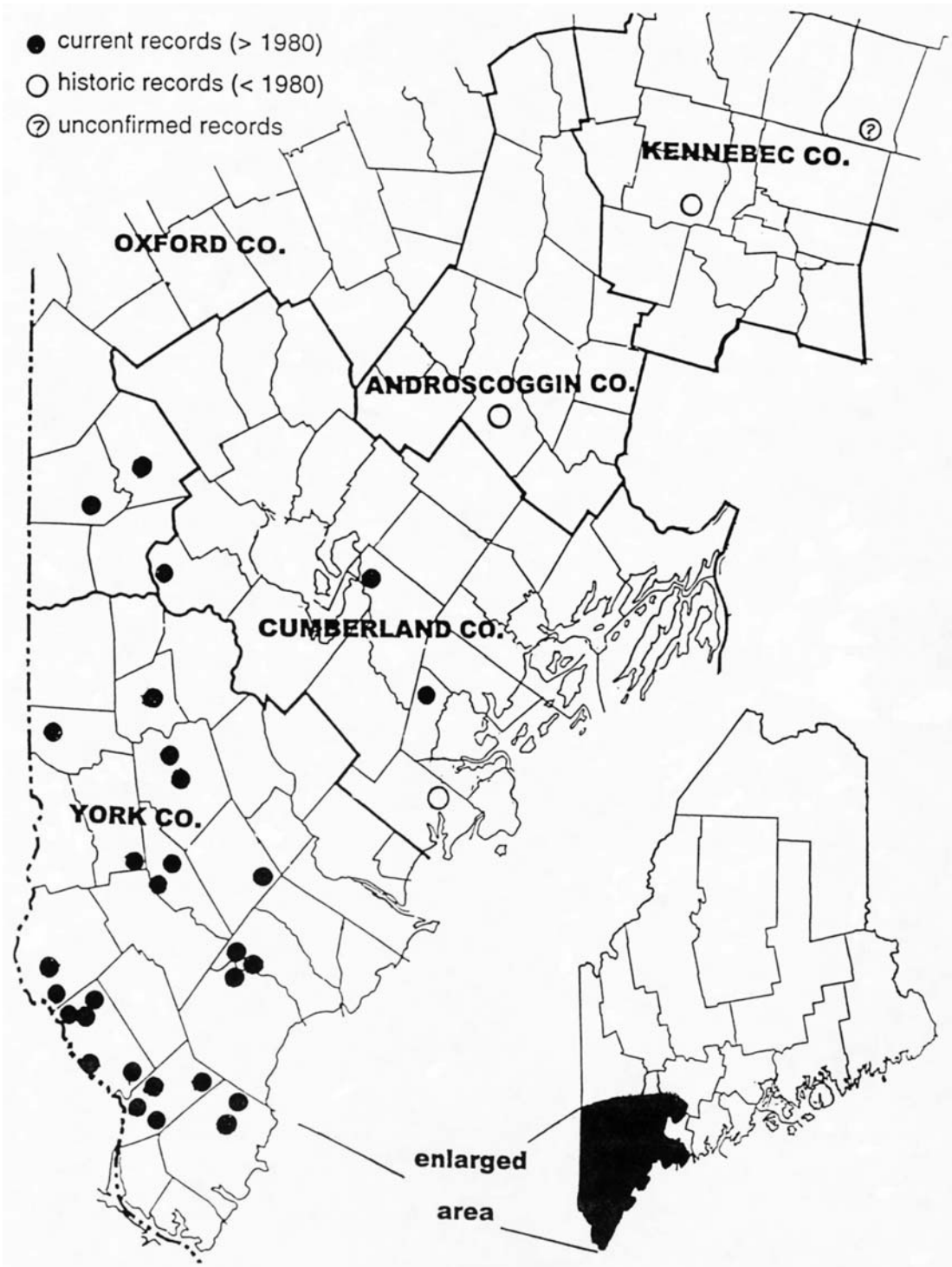
## Current Assessment

Numbers of northern black racers in the state's current population are unknown. Recent records (Appendix 1, Figure 3) include 45 credible reports, of which most (87%) are from York County in southernmost Maine. Five of 6 occurrences in other portions of their traditional range are reputable sightings but are not documented by a specimen, photo, handling of a snake, or verified by an expert. The few encounters in Maine imply rarity because racers are considered relatively easy to detect. Their large size, high activity, and preference for open settings render them moderately conspicuous.

The only reoccurring records are at 3 neighboring York County locales: a rural agricultural site in Alfred and 2 sandplain grasslands: Kennebunk Plains and Wells Barren. It is easier to observe racers in these large openings, and the 2 grasslands have been regularly monitored for > 15 years on behalf of another endangered species, the grasshopper sparrow. Racers may be extant at other recent sites but not detected anew due to the lack of a focused survey or monitoring difficulties in wooded ecotones.

The size or density of local populations are unknown. Sites of former abundance in Kennebec and Cumberland Counties appear vacant and suggest range reductions in Maine. DeGraaf and Rudis (1986) characterize the species as "locally abundant" in New England. It is unknown whether racer populations are contiguous or disjunct across their remaining range. An intensive study at Kennebunk Plains implied very low density, < 0.1 adults / ha (Zappalorti and Brown 1988, 1989). In Kansas (Fitch 1963) and Virginia (Ernst and Barbour 1989), summer densities ranged from 1 - 7 adults / ha.

Figure 3. Range of the northern black racer in Maine.



## Projections

Possible local extirpations, range reductions, and low numbers at the state's premiere site justify concern for the population viability of northern black racers in Maine. Annual population changes of an expanding racer population in Utah varied from 22% declines to 19% increases (Brown and Parker 1984). Climatic influences on juvenile recruitment and survival appeared responsible. This could be a greater threat to a population at the species' northern range limits, such as Maine's eastern racers.

Rarity has proven to be the best predictor of vulnerability to extinction (Terbourgh and Winter 1980). A minimum viable population size has yet to be determined for racers but is thought to be in the range of 500 - 1000 individuals for many species (Thomas 1990). In small, isolated populations the probability is great that numbers inevitably fluctuate low enough to enter "extinction vortices" and ultimately decline to extinction (Gilpin and Soule 1986). Rare species are particularly sensitive to habitat fragmentation. Fragmented populations are less able to survive stochastic fluctuations. Further setbacks in the quantity, quality, or conectiveness of suitable racer habitats in Maine could jeopardize genetic interchange of small, disjunct populations. Extirpation of racers has occurred in some portions of their range and is also conceivable here.

## Limiting Factors

Definitive data are lacking to evaluate existing racer populations in Maine or their inherent limiting factors. Here at the species' northern extent of its range, climatic and habitat conditions may be marginal and partly responsible for its apparent rarity. The northern range limit of *C. constrictor* closely parallels the mean winter frost penetration

contour of 102 cm across North America (Rosen 1991). In the Pacific Northwest and Rocky Mountains, low summer temperatures are also influential. Highly variable rainfall likely impacts racers in the Southwest's Great Basin.

Ernst and Barbour (1989) cite automobiles, pesticides, and widespread habitat alterations as causes for local extirpations of racers. At least seven of 51 encounters with northern black racers in Maine were road-killed individuals. Increased residential development in southern Maine has boosted traffic and road construction. Racers in northern areas are particularly fond of basking on paved roads and thus vulnerable to highway mortality (Breckenridge 1970:116-119, Campbell and Perrin 1991). Impairment from pesticides has not been verified, but a York county orchardist claimed that racers were abundant in his orchard until he began applying pesticides. Notable residues (wet weight) of environmental contaminants in blue racers from Ontario averaged 24.1 ppm polychlorinated biphenyls and 0.41 ppm mercury (Campbell and Perrin 1991).

Eastern racers are not generally considered a habitat specialist. Habitat issues are suggested as significant limiting factors only in extreme situations, several of which parallel circumstances in Maine. Range reductions and loss of suitable sites following reversion to forests are reported in Ontario (Johnson 1989, Kamstra 1991), also at the northern periphery of the species' range. Intensive agriculture (*e.g.*, crop monoculture and large-scale cultivation) are implicated in local racer extirpations in Missouri (Fitch 1963), Illinois (Smith 1961:198), Indiana (Minton 1972:174) and Ontario (Campbell and Perrin 1991). Suburban development in Indiana (Minton 1968) and urbanization in both Illinois (Pope 1944:174) and Georgia (Neill 1950) coincided with local extirpations.

## USE AND DEMAND ASSESSMENT

### Historic Trends

Direct interactions between man and northern black racers appear to have been infrequent in Maine. Racers are typically not targeted by either the pet trade or snake enthusiasts owing to their ill-temperment, nervousness, and tendency to bite when in captivity (Ditmars 1909:281, Matison 1995:213). Nevertheless, classified newspaper advertisements soliciting racers appeared in this state as recently as 1987.

Direct persecution was reported only once in Maine and stemmed from a general fear of snakes. Mass killings of racer aggregations at winter hibernacula have been widely reported across their range (Conant 1938, Fitch 1963, Ernst and Barbour 1989). Agricultural practices can unintentionally harm the species by plowing hibernacula or nests as well as accidental deaths from mechanized cultivation, mowing, controlled burns, etc. (Fitch 1963, Campbell and Perrin 1991).

### Current Assessment

Opportunities to observe this species are confined to southern Maine, primarily York County. An unknown number of individuals gain enjoyment from seeking and observing northern black racers. They contribute to the biological diversity of our state, and their presence adds to the ecological value of upland habitats in southern Maine. An estimated 90% of Maine's adult citizens engaged in some nonconsumptive use of wildlife and expended > \$50 million in 1988 (Boyle *et al.* 1990). This intrinsic value of

racers as a rare element of Maine's wildlife heritage is the basic theme in the preamble to Maine's Endangered Species Act (1975):

"The Legislature finds that various species of fish or wildlife have been and are in danger of being rendered extinct within the State of Maine, and that these species are of esthetic, ecological, educational, historical, recreational, and scientific value to the people of the State. The Legislature, therefore, declares that it is the policy of the State to conserve, by according such protection as is necessary to maintain and enhance their numbers, all species of fish or wildlife found in the State, as well as the ecosystems upon which they depend."

### Projections

Recent trends will likely continue for the foreseeable future. Public demand will promote conservation of the greatest diversity of species possible at state, national, and global levels (Kellert 1980). These desires reflect increasing public perception of the scientific, utilitarian, and cultural values of biological diversity. Many side with ethical arguments for preserving species that are endangered by the actions of society. Even inconspicuous species, such as northern black racers, will gain importance because of their role as "flagship" species by virtue of their rarity (Gibbons 1988).

## SUMMARY AND CONCLUSIONS

MDIFW listed northern black racers as "endangered" in 1986 because of their rarity, range declines, and inadequate protection from take. Thirty new site records (83% in York County) emerged during a statewide atlas effort for amphibians and reptiles or from intensive turtle studies in southern Maine during the last 15 years. They should be seen more frequently if the species were relatively common. Northern black racers are large, easily identified, and often seen basking in open areas or road-killed.

The widespread distribution of eastern racers across North America, diverse diets, and varying habitat associations all attest to its ecological success. Ortenburger (1928) characterized them as a very common snake in the eastern U. S., "... although not nearly so abundant as formerly." There are several examples of declining range and local populations. All involve dramatic land use changes in traditional racer habitats, and most relate to trends in agricultural activities.

Northern black racers are on the northern periphery of their range in Maine. Natural phenomena (e.g., peripheral range, climatic factors, etc.) and human influences (e.g., habitat alterations and fragmentation) may be working individually or in synergy to induce the rarity of this species. Northerly distribution of racers and other large snakes in North America appears limited by the ability to overwinter successfully (Rosen 1991). Additional research is needed to evaluate species status and limiting factors in Maine. Racers are in jeopardy in several areas along the northern periphery of their range. Other jurisdictions giving them special status are Vermont (special concern), New Jersey (protected), Ontario (endangered), and Saskatchewan (endangered).

The status and population viability of Maine's northern black racers are unknown. Nearly all recent encounters (87%) are reported in York County. Areas once noted for local racer abundance in Cumberland and Kennebec Counties appear vacant. Isolated pockets may remain in central Maine, but only a few widely dispersed sightings of individuals are currently known. The apparent population decline and range reduction coincided with major landscape changes as farmland acreage dwindled in the state. Changing landscapes may be beyond the scope of racer recovery alone, but resolution of vanishing farmlands and sprawl problems are state priorities. Innovative land use planning and conservation efforts for uplands (*i.e.*, farm or open space initiatives) may help secure suitable habitats and a lasting niche for this species in Maine.

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## APPENDIX I

Appendix 1. Historic and recent records of northern black racers in southern Maine, by county and township.

County Township	Month /Year	No. of racers <sup>1</sup>	Location: Habitat	Source <sup>2</sup>
<b><u>Androscoggin County</u></b>				
Auburn	<1928	many ?		(Ortenburger 1928)
<b><u>Cumberland County</u></b>				
Baldwin	9/1997	1	Saddleback Hills: mixed woods,	MDIFW ( <i>fide</i> Wendt)
Scarborough	1672	many	Black Point: ?	(Josselyn 1672)
Westbrook	1998	[1]	Mitchell Hill: powerline corridor, farmland	MDIFW ( <i>fide</i> Foley)
Windham	1980's	[1]	North Woods Dr.: powerline corridor, mixed woods	(Humphrey and Royte 1990)
<b><u>Kennebec County</u></b>				
Vassalboro	6/1996	[1]	Seward Mills: field, mixed woods, stone wall	MDIFW ( <i>fide</i> Dugas)
Winthrop	1934	many	Cobosseecontee Lake: fields - woods ecotone,	(Fowler 1942)
	1935	"	especially along extensive rock walls	(Fowler 1942)
	1937	"	" " " " "	(Fowler 1942)
	1941	"	" " " " "	(Fowler 1942)
<b><u>Oxford County</u></b>				
Brownfield	9/1985	[1]	Burnt Meadow Pond: sandplain, mixed woods	MARAP ( <i>fide</i> Kamys)
Denmark	5/1986	[1]	Schoolhouse Cemetery: mixed woods, stone wall	MARAP ( <i>fide</i> Devereaux)
<b><u>York County</u></b>				
Alfred	1990	1	Shaker Brook, Gile Rd.: pasture, stone wall	MDIFW ( <i>fide</i> Van Wyck)
	8/1989	1	mixed woods & a few homes	
	1986 or 1987	1	" "	
	1998	1	Yeaton Hill: powerline corridor	MDIFW ( <i>fide</i> Hanson)

Appendix 1 (continued).

County Township	Month /Year	No. of racers <sup>1</sup>	Location: Habitat	Source <sup>2</sup>
<b><u>York County (continued)</u></b>				
Berwick	7/1986	1	Hubbard Rd. sanplain, riparian woods	MARAP ( <i>fide</i> Vickery)
	7/1986	1	Ridlon Rd. - Plains Rd.: sandpalin, mixed woods	MARAP ( <i>fide</i> Vickery)
	8/1985	1	Little River Rd.: mixed woods, hardwood swamp	MARAP ( <i>fide</i> Getchell)
	8/1985	1	Cranberry Meadow Rd.: old field, mixed woods	MARAP ( <i>fide</i> Getchell)
	6/1984	[1]	Randall Rd.: gravel pit, mixed woods	MARAP ( <i>fide</i> Leland)
Kennebunk	9/1996	1	Kennebunk Plains: sandplain grassland, adjacent	MDIFW ( <i>fide</i> Weik)
	6/1995	4	pine - heath woodlands	TNC ( <i>fide</i> Sferra)
	10/1990	1	" " " "	MDIFW ( <i>fide</i> Lortie, Cowan)
	7/1990	1	" " " "	MDIFW ( <i>fide</i> Vickery)
	7-9/1989	3	" " " "	(Zappalorti and Brown 1990)
	1986-87	4	" " " "	(Zappalorti and Brown 1990: <i>fide</i> MAS)
	6/1985	2-3	" " " "	MDIFW ( <i>fide</i> Childs, Wells)
	6/1984	2	" " " "	MARAP ( <i>fide</i> Vickery)
	9/1989	1-2	Mousam River, Cold Water Brook: pine -heath	(Zappalorti and Brown 1990)
1985-1988	3	woodlands NW, N & NE of Kennebunk	MDIFW ( <i>fide</i> Vickery)	
7/1984	1	Plains grassland	MDIFW ( <i>fide</i> Vickery)	
Lebanon	7/1992	1	Hubbard Rd.: sandplain & a few homes	MDIFW ( <i>fide</i> Yamasaki, Getchell)
	5/1986	1	Upper Guinea Rd.: old fields, mixed woods	MARAP ( <i>fide</i> Yamasaki)
Limerick	4/1987	[1]	Doles Ridge Rd.: dump, gravel pit, mixed woods	MARAP ( <i>fide</i> Cooper)

Appendix 1 (continued).

County Township	Month /Year	No. of racers <sup>1</sup>	Location: Habitat	Source <sup>2</sup>
<b>York County (continued)</b>				
Lyman	7/1980	1	Goodwins Mills: sandplain, pine barrens	MDIFW ( <i>fide</i> Van Wyck)
Newfield	1986	[>1]	Libby Road: old field, orchard	MDIFW ( <i>fide</i> Carlton)
Shapleigh	6/1993	[1]	Walnut Hill Road: pine - heath woodland	MDIFW ( <i>fide</i> Morin)
So. Berwick	6/1992	1	Rocky Hills: powerline corridor, dense shrubs	MDIFW ( <i>fide</i> Haskins)
	6/1992	1	Rocky Hills: pine - heath woodland	MDIFW ( <i>fide</i> Swann)
	6/1991	1	Old County Rd.: mixed woods & a few homes	MDIFW ( <i>fide</i> Haskins)
	1984	-	Knights Pond: oak - pine woods, gravel pits	(Humphrey and Royte 1990)
Waterboro	1980's	[1]	Warren Pond: ?	MDIFW ( <i>fide</i> Eastman)
	5/1989	[1]	Little Ossippee Pond: sandplain, mixed woods	MARAP ( <i>fide</i> Cooper)
	1988	1	Chadbourn Ridge Rd.: ?	MDIFW ( <i>fide</i> Brown)
Wells	1987-89	4-7	Wells Barren: sandplain, pine - heath	MDIFW ( <i>fide</i> Vickery)
	8/1986	2-3	barrens & riparian woodlands	MARAP ( <i>fide</i> Vickery, Wells)
	1984	?	" " " "	MARAP ( <i>fide</i> Vickery)
York	6/1991	[1]	Ogunquit Road / I -95: mixed hardwood forest	MDIFW ( <i>fide</i> Nowell)
	1990	[1]	" " " "	MDIFW ( <i>fide</i> Nowell)
	1980's	[>1]	Groundnut Hill: old fields, oak woodlands	MDIFW ( <i>fide</i> Nowell)

<sup>1</sup> Occurrence in brackets aren't documented by specimen, photograph, handling or verification by experienced observers.  
<sup>2</sup> Organizational sources: MARAP = Maine Amphibian and Reptile Atlas Project, MAS = Maine Audubon Society, MDIFW = Maine Department of Inland Fisheries and Wildlife, TNC = Maine Chapter of The Nature Conservancy.