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 (*Coluber constrictor constrictor* Linnaeus 1758), a snake listed as endangered in Maine and a priority 2 species in the State's Wildlife Action Plan (MDIFW 2005).

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 under "Habitat," "Population," and "Use and Demand". Finally, the major points of an assessment are given in the "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 states and regions. Mark McCollough prepared an earlier draft of this assessment.

NATURAL HISTORY

Description

Racers, *Coluber constrictor* Linnaeus 1758, are long, slender snakes aptly named because they are fast and difficult to catch. The subspecies found in the northeastern United States, 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, Appendix 3). Adult racers may grow to 191.1 cm (75 in) in total body length (Ernst and Zug 1996, Ernst and Ernst 2003: 77). Most found in Maine were less than 140 cm long, although an intact, shed skin measured 192 cm (Vickery 1999); it is not uncommon for sheds to measure greater than 15% longer than the actual snake (Mattison 1995).

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. Towards the northern extent of their range, individuals have less light coloration, possibly visible on only a few chin plates (Ditmars 1907). Racers have smooth scales with anterior and mid-body dorsal row counts of 17, but tapering to 15 posterior to the vent (Ortenburger 1928, Ernst and Ernst 2003). Young racers are grayish with a patterned, 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 (*Nerodia sipedon*) or milk snakes (*Lampropeltis triangulum*). All traces of patterned blotches and spots fade with age and disappear when racers reach 70 to 80 cm in length (Ernst and Barbour 1989).

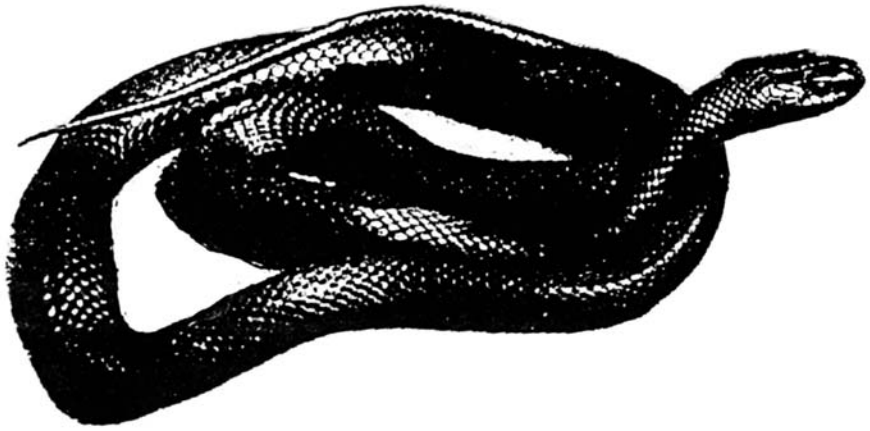

Figure 1. A northern black racer (*Coluber constrictor constrictor*); drawing by M.McCollough.

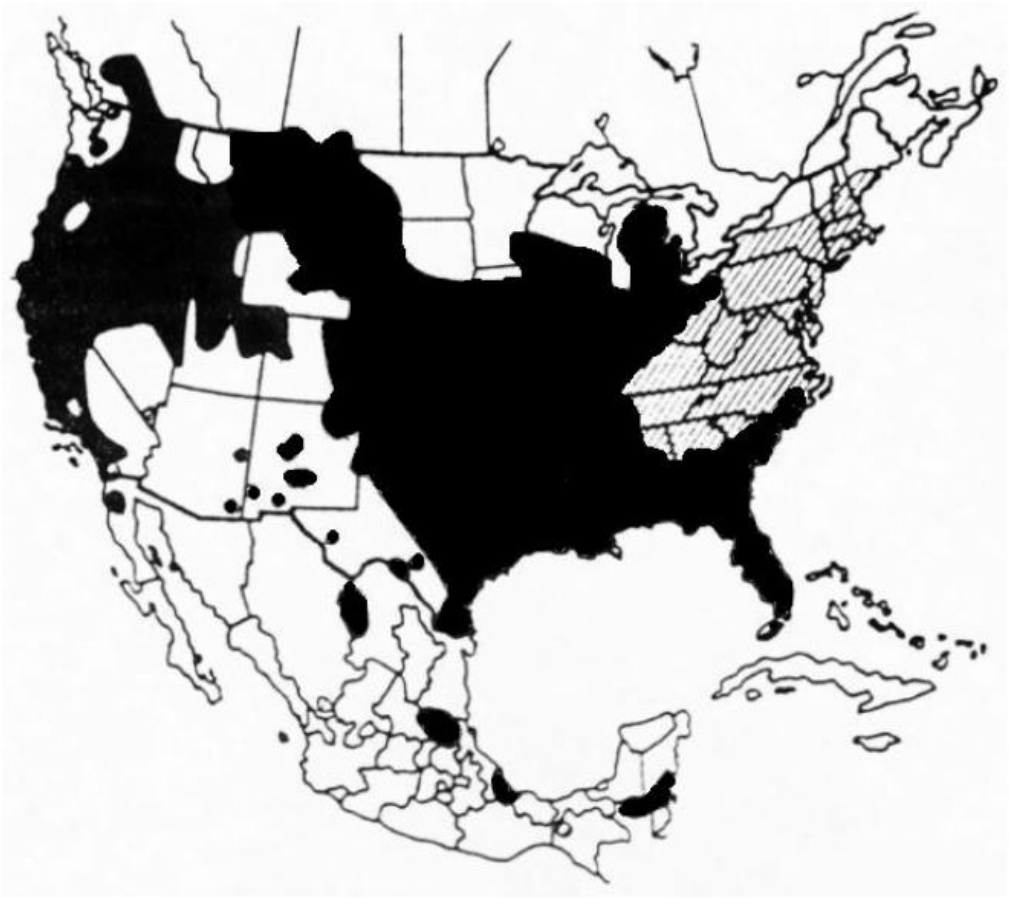

Figure 2. Range of the racer (*Coluber constrictor*) across North America (solid and hatched area), including the northern black racer (*C. c. constrictor*, hatched area).

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), 160-193 (mean 175) ventral scales and 66-120 (mean 95) subcaudals. Females are longer but have thinner, shorter tails (19-27% of body length), 151-192 (mean 179) ventral scales, and 70-106 (mean 90) subcaudals (Brown and Parker 1984, Ernst and Barbour 1989, Ernst and Ernst 2003).

Distribution

Racers occur broadly across the United States. The present distribution of *Coluber constrictor* (Figure 2; Ortenburger 1928, Auffenberg 1955, Conant and Collins 1991, Wilson 1978, Ernst and Barbour 1989, Ernst and Ernst 2003) nearly spans the continental United States. They range from southernmost Canada to Mexico and Guatemala. Racers are absent or scant in the higher latitudes of some northern tier states and are sparingly distributed in the southwestern United States. 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.

The presence of northern black racers in eastern Canada has been heavily debated. Bleakney (1958) reviewed records of *Coluber constrictor* for this area in a section entitled "Rare or Questionable Reports". Froom (1972) argued for the validity of

racer reports in New Brunswick, Nova Scotia, and Prince Edward Island during the late 1800's. Several accounts (Wright and Wright 1957, Conant 1958, Logier and Toner 1961) include this region, while others (Cook 1967, Conant and Collins 1991, Ernst and Ernst 2003) discount it as part of its range. Their existence in the Maritime provinces is based solely on unverified sight records and an unlabelled specimen. Further doubt is cast on these accounts since the Maritimes are greater than 175 km beyond traditional racer range in southwestern Maine (Cook 1967). The range of blue racers (another subspecies, *C. c. foxii*) has contracted in southern Ontario with the only remaining Canadian population restricted to Pelee Island in western Lake Erie (Kamstra 1991).

In Maine, northern black racers are known from southern Androscoggin County, central and western Cumberland County, southern Oxford County, and York County. Fowler (1942) reported Maine's northern most racer occurrence from Winthrop in Kennebec County. The range of racers in Maine is discussed in more detail under "Population Assessment."

Taxonomy

Racers are included in the family Colubridae which contains 63% of more than 2400 species of snakes currently known in the world (Ernst and Zug 1996). Thirty-eight genera of colubrids are described from the United States (Smith 1961). All nine snake species extant in Maine are members of the family Colubridae (Hunter *et al.* 1999).

Racers belong to the genus *Coluber*. There has been much debate regarding the number of North American species in this genus and their division by the Continental Divide (Fitch *et al.* 1981, Greene 1984, Corn and Bury 1986, Collins 1997).

Current taxonomies recognize only one species, *Coluber constrictor*, with eleven subspecies (*C. c. anthicus, C. c. constrictor, C. c. etheridgei, C. c. flaviventris, C. c. foxii, C. c. helvigularis, C. c. latrunculus, C. c. mormon, C. c. oaxaca, C. c. paludicola,* and *C. c. priapus*) of racer (Wilson 1978, Crother et al. 2000, Ernst and Ernst 2003). Recent molecular work, however, suggests that three racer species may eventually be recognized (Crother et al. 2000). 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).

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

Racers utilize many habitats but usually occur in terrestrial sites (Ditmars 1908, Ernst and Ernst 2003). Wright and Wright (1957) documented 36 habitat categories used by racers including nearly all rural, upland types. Ortenberger (1928) noted that racers frequented dry open fields or meadows, thickets, brush piles, and bushy field edges. In Kansas, Fitch (1963) associated *C. constrictor* with woodland edges but also noted seasonal shifts in habitat, where snakes traveled from rocky, woodland

hibernacula to open field type habitats in summer. Like Fitch, Rosen (1991) cited seasonal changes in habitat: open uplands and riparian thickets prevailed in spring and summer but mature forests were favored in autumn. Gibbons and Semlitsch (1988) indicated that the species is quite common in areas with sparse vegetation.

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). Andrews (2006) reported two radio-tracked, male racers in Vermont only used open, early successional habitats including the margins of an interstate and a power line cut. Comparing study sites in New Hampshire with intensive racer activity to those with limited use, Kjoss and Litvaitis (2001) found coverage by forbs at preferred sites was greater and coverage by woody vegetation was less. In addition, greater than 95% of their racer observations were associated with early successional habitats or structures that bordered these habitats (Kjoss and Litvaitis 2001). A Connecticut study documented a single black racer utilizing a variety of habitats including both woodlands and open fields but also noted that the snake was always associated with substantial cover (Fraser and Somers 1996).

When looking at habitats utilized over their entire range, racers seem to be habitat generalists. Populations or racers at their northern range limits may have more specialized needs and additional research is needed.

Activity and Movements

Racers are extremely swift and move at burst speeds up to 5.6 km / hr (Mosaur 1932) or sustain locomotion at ≤ 0.6 km / hr for 30+ minutes (Walton *et al*. 1990) by lateral undulation. Racers also use concertina locomotion (similar to 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).

Racers are diurnal and are particularly active in the morning (Fitch 1963). When cornered they 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 will 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).

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). Northern black racers in Massachusetts can warm to 27° C on a 10° C day by basking (Lazell 1976).

Racers in northern latitudes migrate up to 2.3 km (averaging between 383 m and 848 m in various studies) from denning sites to their summer home ranges (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).

Racers typically exhibit large home ranges, though the size varies between individuals and across their range (Table 1). 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 brief period from 7 September to 6 October (Zappalorti and Brown 1989) but this only partly represents a full summer home range typical in this region. Conversely, Fraser and Somers (1996) reported a single racer radio-tagged in Connecticut to have a 259 ha

home range, though this likely includes both the core or summer home range and the distance the snake moved from a hibernaculum.

Table 1: Mean home range and mean daily movements for *Coluber constrictor*.

Location	n	Mean Home Range (hectares)	Mean Daily Movement (meters)	Citation(s)
Kansas	12	10.1	32.5	Fitch 1963, Fitch and Shirer 1971
New Hampshire	5	14.7	not reported	Kjoss and Litvaitis 2001
South Carolina	10	12.2	104	Plummer and Congdon 1994
Utah	13	1.4	31	Brown and Parker 1976

As with home range, mean daily movements vary between individuals and populations (Table 1). Though the majority of mean daily movements documented are less than 100 m, mean daily movements of 424 m were reported in Michigan (Rosen 1991). 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).

Diet

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 (Fitch 1963, Fitch and Shirer 1971). Racers are generalist predators with an 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. This diversity of diet is further demonstrated by Palmer and Braswell (1995) who report prey items from North Carolina racers to include 3 species of small mammal, 1 bird, 16 species of snake, 7 species of lizard, 3 species of frog, cicadas, bronzed cutworms, and caterpillars. 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 both the young and smaller adults of their own species (Fitch 1963, Rainwater et *al.* 2007).

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 two to three years (Rosen 1991). Females grow somewhat faster than males and achieve greater size (Brown and Parker 1984). Minimum length at maturity for adult racers is 68 cm (Wright and Wright 1957, Ernst and Zug 1996, Ernst and Ernst 2003).

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).

Racers are oviparous and lay 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 two to 31 eggs are laid in each clutch (Fitch 1963), but nine to 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 to 65 days with about 50 days being average (Fitch 1970, Ernst and Barbour 1989). Eggs of racers incubated at 28° C hatched in 39 to 40 days compared to 62 to 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 range between 27 and 29 cm in total length.

Survival, Growth, and Longevity

Annual survival rates averaged 54% among racers aged one to four years but only 12% among yearlings in Michigan (Rosen 1991). Recapture patterns implied that most deaths were associated with over-wintering. Annual survivorship of racers was determined as 62% in Kansas (Fitch 1963) and 70% in Utah (Brown and Parker 1984). In Utah, Brown and Parker (1984) found 93% over-winter 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). Table 2 illustrates ranges of snout-vent length (SVL) reported from a Kansas study among age / sex groups of *C. constrictor* (Fitch 1963).

Table 2: Range of snout-vent length (SVL) among age/sex groups of *C. constrictor* from Kansas (Fitch 1963)

Age (years)	SVL (cm) -males	SVL (cm) - females
2	56.0 - 67.4	58.0 - 73.8
3	64.8 - 75.5	73.0 - 88.0
4	72.5 - 80.9	79.1 - 92.0
5	74.3 - 85.5	83.3 - 108.8
6	76.5 - 88.3	89.2 - 102.0
7	78.8 - 90.0	91.9 - 105.0
> 7	74.0 - 89.0	93.0 - 108.5

Wright and Wright (1957) report the longevity of racers as two to five years, but Fitch (1963) found individuals living greater than ten years. Significant mortality may occur in areas of high road density (Ernst and Barbour 1989). Some mammals, including domestic cats, and other snakes occasionally kill racers, especially at nests or hibernacula (Ernst and Barbour 1989). Birds of prey can be a major predator of racers, particularly nesting female snakes (Plummer and Congdon 1992).

MANAGEMENT

Regulatory Authority

Enabling statutes (Title 12 MRSA, 2004) 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" (Chapter 903, §10051). "Wildlife" is defined as "any species of the animal kingdom, except fish, that is wild by nature, whether or not bred or reared in captivity, and includes any part, egg, or offspring of the animal, or the dead body or parts of the animal" (Chapter 901, §10001).

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 (Chapter 917, §12159). In addition, Title 12 Chapter 915 (§12152) states that a permit is required to possess any wildlife species regulated by the state, with some exceptions (§10105). Though only the commercial take of snakes and turtles is specifically restricted, the state is still *regulating* these species, so the above described possession permit (§12152) applies to them. Any collection of native reptiles, personal or commercial, without this permit is thus technically a violation of Maine Law (MDIFW Warden Service, pers. comm.). Researchers and rehabilitators may apply for scientific collection permits. To date, there has been at least one enforcement action of illegal possession: confiscation of a racer sold in a northern Maine pet store in 1990

Additional protection for the racer stems from the designation of *Coluber constrictor* (including the subspecies of concern [*C. c. constrictor* = northern black racers]) as "endangered" in Maine (Chapter 925, §12803). Black racer has been a state endangered species since Maine's inaugural listing of vertebrate wildlife in 1986. Prohibitions for racers and other endangered or threatened wildlife (Chapter 925, §12808) under Maine's Endangered Species Act (1975) and a 1987 amendment include:

- Import into the State or export out of the State any endangered or threatened species
- Hunt, take, trap or possess any endangered or threatened species within the State
- Possess, process, sell, offer for sale, deliver, carry, transport or ship any means whatsoever, any endangered or threatened species or any part of an endangered or threatened species
- Feed, set bait for or harass any endangered or threatened species

These prohibitions encompass both negligent and intentional acts. "Take" is defined as the act or omission that results in the death of any endangered or threatened species (Chapter 925, §12808). "Harass" means an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns (Chapter 901, §10001).

Incidental take is a provision (Chapter 925, §12808) 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 permit for incidental take is considered if 1) such taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity, 2) the taking will not impair the recovery of any endangered species or threatened species, and 3) the person develops and implements an incidental take plan approved by the commissioner to take an endangered or threatened species.

A 1988 amendment to Maine's Endangered Species Act (§12804) created a mechanism for stronger 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 that 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 or mapped for northern black racers. Until further information is obtained on racer habitat needs in Maine, these avenues are not likely to be pursued. Both designations provide advance notification of threatened or endangered species issues enabling MDIFW review and consultation with property owners or development interests.

The Site Location of Development Act (38 MRSA Article 6, Chapter 375) is among the few laws pertinent to protecting potential racer habitat such as pine-oak forests, sandplain pine barrens, heathlands, or reverting farmland. Specifically, this act enumerates that “there will be no unreasonable disturbance to” habitat for state or federally listed endangered or threatened species. “Developments of state or regional significance that may substantially affect the environment" (*e.g.*, mineral extraction, most residential subdivisions >15 lots on 30 or more acres, or, for commercial subdivisions >5 lots on 20 or more acres, transmission lines >100 kV, and several other large-scale projects; §§482, 487-A) require approval by MDEP or certified municipalities. When such projects intersect northern black racer habitat, MDEP consults with MDIFW for potential management restrictions and conditions associated with the Site Law Permit.

Another relevant statute that assists in the protection of racer habitat is the Farm and Open Space Tax Law (36 MRSA: Part 2, Chapter 105). This law 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

Farms for the Future program (7 MRSA, Chapter 10-B), is a business assistance program for farmers that increases the long-term economic viability of their farms. Cash grants are awarded to help implement farm improvements and the farmers sign a five-year, non-development agreement pertaining to their land.

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.

Stewardship Incentives (Non-regulatory Programs)

In addition to the above regulations pertaining to northern black racers, there exists additional incentives that promote habitat conservation and management. Two of the most applicable for racers are Beginning with Habitat (BwH) and the Wildlife Habitat Incentive Program (WHIP)

Beginning with Habitat is a habitat-based landscape approach to assessing wildlife and plant conservation needs and opportunities. The goal of the program is to maintain sufficient habitat to support all native plant and animal species currently breeding in Maine by providing each Maine town with a collection of maps and accompanying information depicting and describing various habitats of statewide and

national significance found in the town. These maps provide communities with information that can help guide conservation of valuable habitats. To date, 12 of the 13 towns with validated racer occurrences have received BwH maps (Table 3).

Table 3: Maine towns with validated racer records and Beginning With Habitat maps.

Township	Year(s) Maps Received*
Alfred	2001
Baldwin	2003
Berwick	2002 and 2005
Hiram	2005
Kennebunk	2005
Lebanon	2002 and 2006
Limerick	2004 and 2006
Mechanic Falls	no maps made
Sanford	2002 and 2005 (only one map made in 05)
Shapleigh	2002 and 2007
South Berwick	2002/2003/2004 (pieced together over the years) and 2006
Waterboro	2002
Wells	2001 and 2005

**** After 2 years BwH maps are considered outdated but are updated at the towns request***

The Wildlife Habitat Incentives Program is another voluntary conservation program administered by the National Resources Conservation Service (NRCS) of the United States Department of Agriculture. This program provides technical and financial assistance to landowners for developing, improving, or managing wildlife habitat or for restoring natural ecosystems on eligible land. Landowners agree to prepare and implement a wildlife habitat conservation plan and NRCS provides technical and financial assistance to implement the wildlife habitat restoration practices. For eligible land, NRCS places primary emphasis on enhancing habitat for fish and wildlife species experiencing declines or those with significantly reduced populations. Other important considerations are those practices beneficial to fish and wildlife that may not otherwise

be funded through other conservation programs, and wildlife and fishery habitat enhancement priorities identified by local and State partners and Indian tribes. In Maine, NRCS priority habitats and species are delineated in the Maine NRCS Fish and Wildlife Action Plan.

Past Goals and Objectives

Maine's Department of Inland Fisheries and Wildlife 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 native wildlife heritage.

To be eligible for additional federal grants and to satisfy requirements for participating in the State Wildlife Grant (SWG) program, Maine recently completed a Wildlife Action Plan entitled *Maine's Comprehensive Wildlife Conservation Strategy* (CWCS). The CWCS provides a framework for wildlife conservation and a mechanism for prioritizing conservation efforts. The CWCS recognizes northern black racers as a priority 2 species (one of the State's herptofauna in greatest need of conservation). As such, northern black racers in Maine are eligible for United States Fish and Wildlife Service SWG funds designed to help states research and conserve species of greatest conservation concern.

Past and Current Management

Northern black racers in Maine have received little direct management attention. Most of the occurrence records were obtained during the Maine Amphibian and Reptile Atlas Project (MARAP) conducted from 1984 to 1998 (Hunter et *al.* 1999). Racer

observations are catalogued in MDIFW's MARAP database. Documented racer occurrences are also included in the Natural Heritage Database (Biotics) maintained by MDIFW's Habitat Group in order to identify sites with potential management concern to the agency. These data are used for consultation purposes during permit reviews, land conservation initiatives, and land use planning efforts. Since 2005, a minimum of four permit reviews have been triggered by racers.

An in-depth study of northern black racers was conducted by Zappalorti and Brown (1988, 1989) on the Kennebunk Plains. This study confirmed the presence of an extant, though small, population of racers on the plains and provided management recommendations for improving surrounding habitat conditions. Per these recommendations, plans to construct an artificial hibernaculum on a parcel of land adjacent to the plains were considered. However, it is uncertain whether or not the construction ever took place. Another study at Kennebunk Plains tested the efficacy of using artificial cover objects for monitoring racers (Ward and deMaynadier 2003). Though two racers were observed under the black, plastic cover sheets (8' X 5'), the authors do not recommend this technique alone to assess presence/absence of racers at sites in southern Maine.

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. Further, as part of a recent Incidental Take Plan mitigation package, an additional 38 ha adjacent to the Kennebunk Plains were acquired in 2006. Along with the land acquisition, two artificial hibernacula and two educational kiosks on racer biology and conservation will be constructed on the plains (TRC Environmental

Corporation, 2006) under supervision and consultation with MDIFW. Maine Department of Inland Fisheries and Wildlife and TNC manage the Kennebunk Plains as a Wildlife Management Area (Bozenhard 1993 [revised by Forbes in 2006]). Prescribed burning is used to perpetuate grasslands supporting several rare plants and three state endangered or threatened wildlife species: northern black racers, grasshopper sparrows (*Ammodramus savannarum*), and upland sandpipers (*Bartramia longicauda*).

In addition to the above research and conservation efforts, several public outreach initiatives have been undertaken to promote Maine's reptiles and amphibians and Maine's endangered and threatened wildlife, both of which include the black racer. Using records generated from MARAP, *The Amphibians and Reptiles of Maine* was published in 1992 by Hunter et *al*. The book included species accounts and range maps for all known herptiles found in the state. Seven years later, due to increased public interest and new research, a revised edition entitled *Maine Amphibians and Reptiles* was published (Hunter et *al.* 1999). This second edition contained updated range maps and species accounts and also included a compact disc featuring frog and toad calls. In 2003, both a poster and a book entitled *Maine's Endangered and Threatened Wildlife* were published by MDIFW (McCollough et *al*.). The book featured fact sheets for Maine's threatened and endangered animals and highlighted species threats and recommendations for their conservation. In 2004, a 3-poster series (*Amphibians of Maine, Snakes of Maine, and Turtles of Maine*) was produced by MDIFW. Funded in part by a Maine Outdoor Heritage Fund grant, sets of these posters were mailed statewide to every middle school science class. Most of these publications

are still available for purchase via the Department's website or the main office in Augusta.

HABITAT ASSESSMENT

Historic Trends

Racers are usually found in open terrestrial habitats or their ecotones with woodlands. Native Americans and European settlers 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 4) 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 five southern Maine counties (York, Oxford, Cumberland, Kennebec, and Androscoggin).

Farmlands diminished statewide by greater than 77% during the next 100 years (Table 4). Most of this decline, 76%, occurred since 1925. In the five county range of Maine's racers, greater than 82% of all farmland acreage was converted to other land uses between 1880 and 1982. Acreage of pasture (a potentially 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).

Circumstances are not entirely clear, but broad landscape changes related to agriculture (initial land clearing, vanishing farmlands, and intensive cultivation) appear

Table 4. Long-term trends, 1880-2002, of agricultural land uses in Maine and the five southern counties comprising the historical range of northern black racers.

County / Year	Land in farms[1] hectares	Land in farms[1] % of land area	Acreage (hectares)[1] Cropland	Acreage (hectares)[1] Pasture[2]	Acreage (hectares)[1] Woodland[3]
Androscoggin County					
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
1992	25,189	20.7%	8,442	3,744	11,537
2002	22,574	18.5%	8,704	2,593	11,178
Cumberland County					
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
1992	21,810	10.1%	7,508	3,430	9,236
2002	22,037	10.2%	8,719	3,176	9,988
Kennebec County					
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
1992	38,609	17.2%	15,724	5,957	15,212
2002	34,871	15.5%	16,335	4,683	15,138
Oxford County					
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
1992	25,688	4.8%	6,952	4,849	12,452
2002	27,278	5.1%	8,551	3,255	16,449
York County					
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
1992	25,009	9.7%	8,339	3,115	12,203
2002	23,156	9.0%	8,829	3,082	11,532
STATEWIDE TOTAL					
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
1992	509,232	6.4%	196,821	62,208	220,093
2002	554,325	6.9%	217,251	51,521	284,314

[1] MDIFW compilation from data furnished by the Maine State Planning Office, U. S. Census of Agriculture, and National Agriculture Statistical Service, U. S. Department of Agriculture.

[2] 1982, 1992, and 2002 acreage includes pastured woodlands and rangelands (not tallied in 1880 or 1925 – i.e., only 1982, 1992, and 2002 data are comparable)

[3] Woodland refers to forested land that is part of the farmland tract and farm operations (e.g., wooded wetlands, timber stands)

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, anthropogenic features such as quarries, stone walls, refuse dumps, cisterns, etc. potentially benefit racers by providing special microhabitats for nesting or winter hibernation.

Current Assessment

Humphrey and Royte (1990) quantified habitat variables at twelve extant racer sites in Maine. Prevalent characteristics were open herbaceous strata (greater than 80% ground cover) at 88% of all sites and a large component of ericaceous shrubs (greater than 20% ground cover) as found at 75% of all locations. Most were open heathlands or other successional stages of pitch pine (*Pinus rigida*), heath (plants of the family Ericaceae), or scrub oak (*Quercus ilicifolia*). A meaningful habitat suitability model is not yet possible without better documentation of racer habitat use in Maine's largely wooded landscape. As a general indicator, trends in the quantity of farmlands (Table 4) reveal a continued decline in the majority of southern Maine counties. However, state totals rose slightly in 2002.

From 1987 to 1997, farmland acreage declined by greater than 16% (nearly double the statewide rate, Table 4) in five 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%, were recorded during the period 1960 to 1982 (Ferguson

and Longwood 1960, Powell and Dickson 1984). Farmland censuses are conducted every five years with the next one scheduled for 2007.

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 quantity, and likely the quality, of existing habitat 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 4). Neither extensive forests or intensive, row-crop agriculture are 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 occupy a variety of settings throughout their range, 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 Androscoggin, Cumberland, or Oxford 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.*, nesting sites or hibernacula) in southern Maine. All inferences point to reduced carrying capacity for northern black racers in the state.

Projections

The Maine State Planning Office, based on United States Census Data from 2000, predicts a 1.26% annual growth of York County's human population through 2010, a rate only slightly below the 2000 to 2005 average of 1.47% but markedly higher than the 1980 through 1996 average of 0.8% (Maine State Planning Office 2003). A report published by the State Planning Office (1997), *The Cost of Sprawl*, addresses the phenomenon of unplanned development or "sprawl." The report states that an increasing desire by the state's population for a low-density, suburban life style has resulted in a 30-year trend of populace moving 10 to 25 miles away from population centers to "new suburbs" (Figure 3, Maine State Planning Office 1997). As the population expands, so does the infrastructure necessary to support it. 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 habitat for northern black racers, already jeopardized by northern range limits and previous, dramatic reductions of optimal farmland habitats in the state.

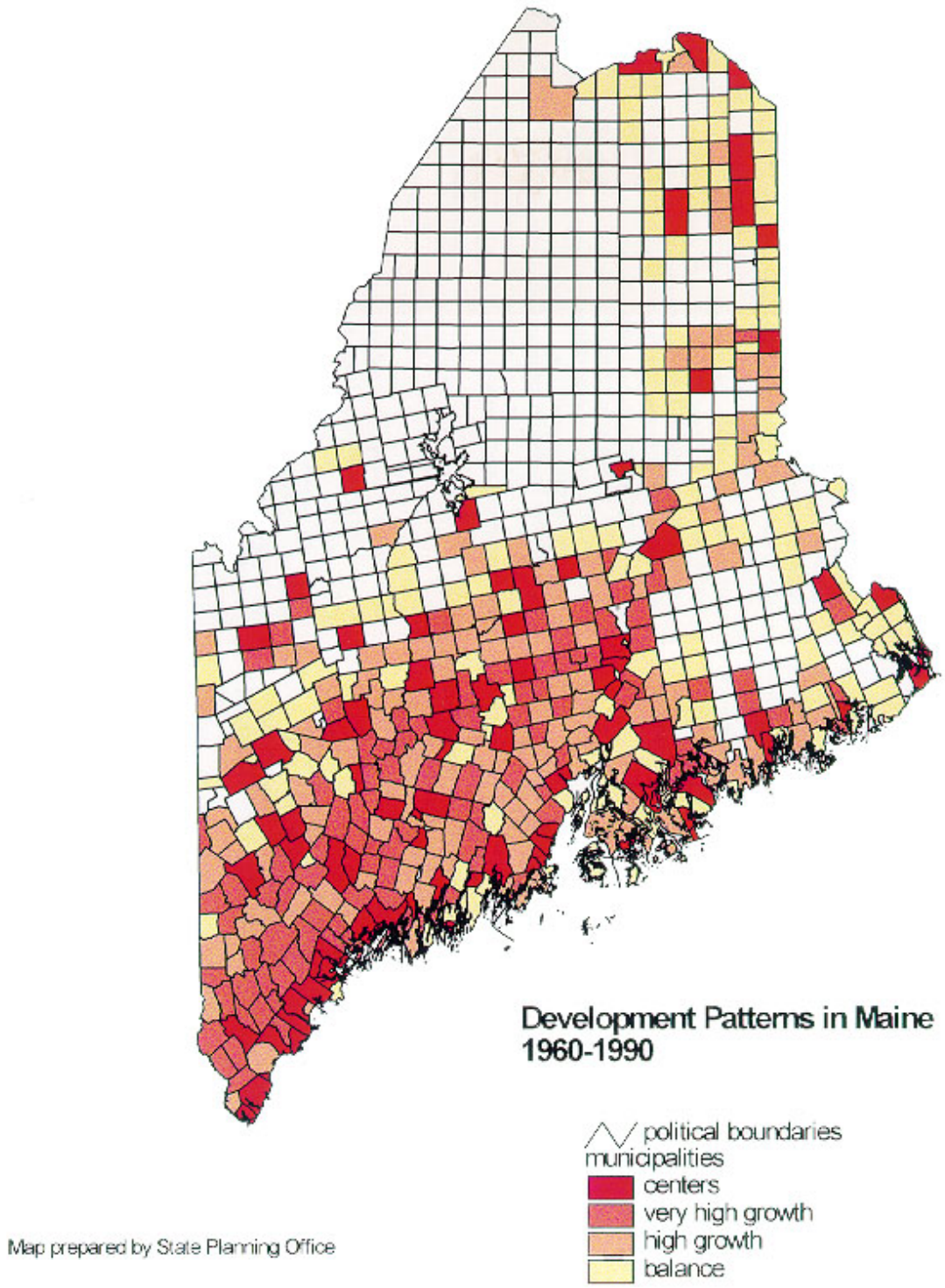

Figure 3. The fastest growing towns in Maine (Maine State Planning Office 1997)

POPULATION ASSESSMENT

Historic Trends

Southern Maine is generally depicted as a northern boundary of the racer's range (see "Natural History - Distribution" and Bleakney 1958 for discussion on the presence of racers in the Maritimes). 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 three 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" 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. Modern records (Figure 4, Appendix 1) include 29 well-documented reports of public review quality (used for environmental review), of which most (86%) are from York County in southernmost Maine. Twenty-eight additional reports are likely reputable sightings but are not documented by a specimen, photo, complete description, or verified by an expert. Another 27 reports, most of which were gleaned from interviews with elderly land owners, are considered leads requiring additional follow-up (Haskins 2000). 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 recurring records are from three neighboring York County locales: a rural agricultural site in Alfred and two sandplain grasslands: Kennebunk Plains and Wells Barren. The two grasslands have been regularly monitored for over 15 years on behalf of another state endangered species, the grasshopper sparrow (*Ammodramus savannarum*). Recent (within the last five years), validated sightings have been recorded in the townships of Lebanon, Sanford, South Berwick, and Wells in York County and Mechanic Falls in Androscoggin County. Racers may indeed be extant at other sites but not detected due to lack of focused survey or monitoring difficulties in wooded eco-tones.

DeGraaf and Rudis (1986) characterize the species as "locally abundant" in New England. However, sites of former abundance in Kennebec and Cumberland Counties appear vacant and suggest a pattern of likely range reduction in Maine (Figure 4), from

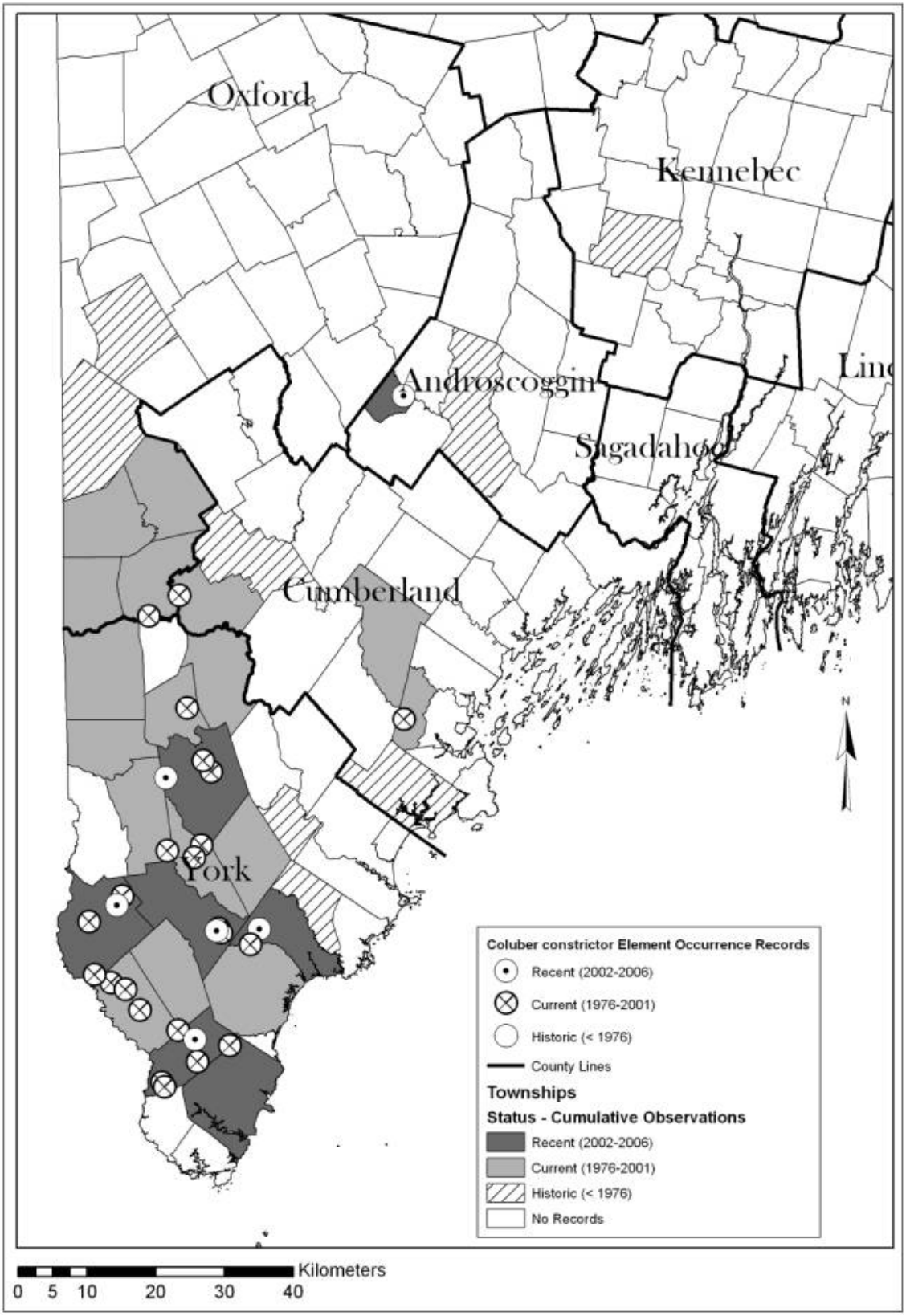

Figure 4. Range of the northern black racer in Maine. Element occurrence records (public review quality) and cumulative observations (MARAP and leads) as of April 2007.

north to south. It is unknown whether racer populations are contiguous or disjunct across their remaining range. Two intensive studies at Kennebunk Plains implied very low densities, less than 0.1 adults / ha (Zappalorti and Brown 1988, 1989, Ward and deMaynadier 2003). In Kansas (Fitch 1963) and Virginia (Ernst and Barbour 1989), summer densities ranged from 1 - 7 adults / ha.

Projections

Possible local extirpations, range reductions, and low numbers at the state's premiere sites justify concern for the population viability of northern black racers in Maine. Annual population changes of an expanding racer population in Utah varied from a decline of 22% to an increase of 19% (Brown and Parker 1984). Climatic influences on juvenile recruitment and survival appeared responsible. Climate could be an even greater threat to a population at the species' northern range limits, such as Maine's northern black 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 to 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 connectiveness 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 (e.g., *C. c. foxii* in Ontario) and is also conceivable here (Campbell *et al.* 1991, Kamstra 1991).

Limiting Factors and Threats

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 and Great Basin.

Ernst and Barbour (1989) cite automobiles, pesticides, and widespread habitat alterations as causes for local extirpations of racers. Research by Rudolph *et al.* (1999) in Texas suggest populations of large bodied snakes, like racers, may be reduced by more than 50 percent within 450 m of roads with moderate use. Four of the 29 element occurrence records of northern black racers in Maine have been road-killed individuals. Increased residential development in southern Maine has led to increased road construction and traffic volumes. Large home ranges (>10 ha) and migration movements to and from hibernacula make northern black racers particularly prone to road mortality. In addition, racers in northern areas are particularly fond of basking on paved roads (Breckenridge 1970, 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 (Haskins 2000). 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).

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-temperament, nervousness, and tendency to bite when in captivity (Ditmars 1909, Matison 1995). Nevertheless, classified newspaper advertisements soliciting racers appeared in this state as recently as 1987.

Direct persecution, though rarely reported in Maine, is certainly a threat to a large, aggressive species like the racer. Mass killings of racer aggregations at winter hibernacula have been widely reported across their range (Conant 1938, Fitch 1963, Ernst and Barbour 1989). These persecutions likely stem from a general fear of snakes by an increasingly intolerant, urbanized public. 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).

Though racers are not generally considered habitat specialists, habitat fragmentation is a limiting factor for a species with large area requirements (Kjoss and Litvaitis 2001). 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) is 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. Along with taking and fragmenting habitat, suburban development and urbanization increase the risk of predation (on racer eggs, hatchlings, and adults) by subsidized predators such as raccoons and house cats (Ernst and Barbour 1989, Mitchell *et al.* 2006).

FUTURE RESEARCH NEEDS

Northern Black Racers, like many of Maine's other snake species, reach the northern extent of their range in southern Maine. Though research is available on various aspects of racer biology from other geographic areas, the results may not directly apply to northeastern populations. Though limited den sites and overwintering survival have been hypothesized to explain racer rarity, this hypothesis is untested and thus it remains a mystery why these snakes are so rarely encountered in the state. Based on research in other areas of their range and occasional observations in Maine, racers are believed to require large blocks of pine-oak forests, sandplain barrens, shrublands, and/or reverting farmland. Further research is needed to determine what habitat types are preferred and how large these patches need to be to sustain local populations of Maine racers.

The racer has a high risk of extirpation in Maine due to a reduction in its statewide range, rarity at the northern edge of its geographic range, and on-going habitat loss and fragmentation. In order to properly protect this species, there is a need to better understand racer home range size, movements, and specific habitat requirements. In addition, further effort should be expended to properly document additional racer element occurrence records and gain a better understanding of their precise distribution within the state.

USE AND DEMAND ASSESSMENT

The 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."

Racers contribute to the biological diversity of our state, and their presence adds to the ecological value of upland habitats in southern Maine. Northern black racers are an important link in ecological food webs, preying on human pests such as mice and being predated by other wildlife such as hawks and owls (Plummer and Congdon 1992, Ernst and Ernst 2003).

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. An estimated 90% of Maine's adult citizens engaged in some non-consumptive use of wildlife and expended greater than $50 million in 1988 (Boyle *et al*. 1990). The scientific success of Maine's "Amphibian and Reptile Atlasing Project", with over 250 volunteers, is testament to Maine's growing public interest in reptiles, amphibians, and conservation (Hunter *et al.* 1999). The recently formed "Partners for Amphibian and Reptile Conservation" is yet another successful initiative with an active northeast chapter promoting research and conservation. 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 by virtue of their rarity (Gibbons 1988).

SUMMARY AND CONCLUSIONS

Maine Department of Inland Fisheries and Wildlife listed northern black racers as "endangered" in 1986 because of their rarity, range declines, and inadequate protection from take. Twenty-one new site records emerged during a statewide atlas effort for amphibians and reptiles and from intensive turtle studies in southern Maine during the last 20 years. Northern black racers are large, easily identified, and often seen basking in open areas. They should be seen more frequently then recorded if the species were relatively common.

The widespread distribution of 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 United States, "... 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. The northerly distribution of racers and other large snakes in North America appears limited by the ability to over-winter successfully (Rosen 1991). Additional research is needed to evaluate species status, habitat preferences, home range, 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 New Hampshire (special concern), Vermont (threatened), Ontario (endangered), and Saskatchewan (endangered). Preservation of species, especially at the periphery of their range, is important for maintaining their genetic diversity, ecological contributions, and to help safeguard against endangered status on a federal level (Hunter and Hutchinson 1994).

The status and population viability of Maine's northern black racers is not well known. Nearly all recent encounters are reported in York County. Areas once noted for local racer abundance in Cumberland and Kennebec Counties now appear vacant or disjunct from the species southern core range. 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 was lost to succession and development statewide. Resolution of vanishing farmlands and unchecked sprawl are state priorities. Effective conservation for racers must also address specific microhabitat needs above and beyond the general maintenance of suitable natural community types (Block and Morrison 1998, Mitchell et al. 2006). Innovative land use planning and conservation efforts for early successional upland landscapes (*i.e.*, farm or open space initiatives) and identification of movement patterns, microhabitat preferences, and limiting factors may help in the conservation of this species in Maine.

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APPENDICES

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

County / Township	Last Observation Date	Location: Habitat	Source	Quality[1]
Androscoggin County				
Auburn	1928 pre-	Auburn	Ortenburger 1928	M
Mechanic Falls	2002	Mechanic Falls Village	MDIFW (Haskins)	P
Cumberland County				
Baldwin	1960	Baldwin	Haskins 2000	L
	1997	Rte 113, West Badwin: mixed woods	MDIFW (Wendt)	P
Scarborough	1672	Black Point	Josselyn 1672	M
Sebago	1960	Sebago	Haskins 2000	L
Westbrook	1998	Mitchell Hill Farm: powerline corridor, farmland	MDIFW (Foley)	M
Windham	1980's	North Wood Drive: powerline corridor, mixed woods	MDIFW (anonyomous)	M
Kennebec County				
Winthrop	1941	Cobbosseecontee Lake/YMCA Camp: fields, woods ecotone, extensive rock walls	Fowler 1942	P
Oxford County				
Brownfield	1965	Brownfield	Haskins 2000	L
	1975	Brownfield	Haskins 2000	L
	1985	Burnt Meadow Pond: sandplain, mixed woods	MARAP (Kamys)	M
Denmark	1990	Denmark	Haskins 2000	L
	1986	Schoolhouse Cemetary: mixed woods, stone wall	MARAP (Devereaux)	M
Fryeburg	1940	East Fryburg	Haskins 2000	M
Hiram	1950	Hiram	Haskins 2000	L
	1985	Durgintown	Haskins 2000	M
	1999	Ossipee River	MARAP (Albert)	P
Lovell	1940	Lovell	Haskins 2000	L
Porter	1940	Porter	Haskins 2000	L
	1960	Bickford Pond	Haskins 2000	M
	1995	Ossipee River Valley	Haskins 2000	M
York County				
Alfred	1985	Alfred	Haskins 2000	L
	1989	Federal Street/Gile Road: orchard, pasture, stone wall, mixed woods	MDIFW (Van Wyck)	P
	1989	Yeaton Hill: powerline corridor	MDIFW (Hanson)	P
Arundel	1960	Arundel	Haskins 2000	L
Berwick	1984	Randall Road: gravel pit, mixed wood	MARAP (Leland)	P
	1985	Little River Road: pine oak woods, old fields	MARAP (Getchell)	P
	1985	Cranberry Meadow Road: pine-oak woods, old field	MARAP (Getchell)	P
	1986	Hubbard Road: sandplain, riparian woods	MARAP (Vickery)	M

[1] P = Public Review Quality (documented with a specimen, photograph, or by a knowledgeable observer), M = Maine Amphibian and Reptile Atlasing Project Quality (reported but not documented to the level needed for public review), L = Lead Quality (reported but lacking information)

County Township	Last Observation Date	Location: Habitat	Source (original)	Quality[1]
York County (continued)				
Berwick (cont'd)	1986	Ridlon Road/Plains Road: sandplain, mixed woods	MARAP (Vickery)	P
	1999	Blackberry Hill	Haskins 2000	M
Dayton	1960	Dayton	Haskins 2000	L
	1960	Dayton	Haskins 2000	L
Kennebunk	2002	Kennebunk Plains: sandplain grassland, adjacent pine-heath woodlands	MDIFW (multiple reports)	P
Lebanon	1985	Lebanon	Haskins 2000	L
	2000	Lebanon	Haskins 2000	L
	1986	Upper Guinea Road/Merchant Row Road: mixed forest, old fields	MARAP (Yamasaki)	P
	1992	Hubbard Road: sandplain and a few homes	MDIFW (Getchell, Yamasaki)	P
	1998	West Lebanon	Haskins 2000	M
	2000	Hebo Hybo Road	Haskins 2000; MDIFW (Sutton)	P
	2002	Depot Road	MDIFW (Vasalle)	P
	2005	Oak Hill Rd: residential area	MDIFW (Christiansen)	L
Limerick	1987	Doles Ridge Road: dump, gravel pit, mixed wood	MARAP (Cooper)	P
Limington	1980	West Limington Orchards	Haskins 2000	M
	1990	Doles Ridge	Haskins 2000	M
Lyman	1965	Lyman	Haskins 2000	L
	1965	Lyman	Haskins 2000	L
	1980	Country Woods Development: sandplain, pine barrens	MDIFW (Van Wyck)	M
Newfield	1986	Libby Road: sandplain, pine barrens	MDIFW (Van Wyck)	M
	1996	Newfield	Haskins 2000	L
North Berwick	1990	North Berwick	Haskins 2000	L
	1995	Lower Oak Woods Road	Haskins 2000	M
Parsonsfield	1995	Moulton Hill	Haskins 2000	M
Sanford	1960	Sanford	Haskins 2000	L
	1960	Sanford	Haskins 2000	L
	1996	Route 99, East of Route 109 near Sanford Airpot	MDIFW (Walters)	P
	1998	Sanford Country Club	Haskins 2000	M
	2001	Sanford Airport	MDIFW (Walters)	P
	2006	Sanford 2006 ITP site	MDIFW (Blais)	P
Shapleigh	1975	Shapleigh	Haskins 2000	L
	1960	Deering Ridge	Haskins 2000	M
	1993	Walnut Hill Road: pine-heath woodland	MDIFW (Morin)	P

[1] P = Public Review Quality (documented with a specimen, photograph, or by a knowledgeable observer), M = Maine Amphibian and Reptile Atlasing Project Quality (reported but not documented to the level needed for public review), L = Lead Quality (reported but lacking information)

County Township	Last Observation Date	Location: Habitat	Source (original)	Quality[1]
York County (continued)				
South Berwick	1984	Knights Pond: pine-oak woods, gravel pits	Humphrey and Royte 1990	M
	1985	South Berwick	Haskins 2000	L
	1980-1985	Warren Pond	MDIFW (Eastman)	P
	1984	Route 4: pine forest	MARAP (Leland)	M
	1991	Old County Road: mixed woods, a few homes	MDIFW (Haskins)	P
	1992	Rout 236 Powerline/Rocky Hills: powerline corridor, dense shrubs	MDIFW (Haskins)	P
	1992	Rocky Hills: pine-heath woodland	MDIFW (Swann)	P
	1996	Old Pond Road	Haskins 2000	M
	2002	Hooper Sands Road	MDIFW (Ward)	P
	2006	off Route 91	MDIFW (Schuerman)	L
Waterboro	1988	Chadbourne Ridge Road	MDIFW (Brown)	P
	1989	Little Ossipee Pond: sandplain, mixed woods	MARAP (Cooper)	P
	2003	Round Pond/Waterboro Barrens	MDIFW (Schuerman)	P
Wells	1970	Wells	Haskins 2000	L
	1980	Wells	Haskins 2000	L
	1965	Bragdon Farms	Haskins 2000	M
	1996	Wells Barren: sandplain, pine-heath barrens, riparian woodlands	MDIFW (Vickery); MARAP (Wells)	P
York	1980's	Goundnut Hill: old fields, oak woodlands	MDIFW (Nowell)	M
	1991	Ogunquit Road Overpass, I-95: mixed hardwood fores	MDIFW (Nowell)	M
	2006	Mount Agamenticus region	MDIFW (Leuchs)	L

[1] P = Public Review Quality (documented with a specimen, photograph, or by a knowledgeable observer), M = Maine Amphibian and Reptile Atlasing Project Quality (reported but not documented to the level needed for public review), L = Lead Quality (reported but lacking information)

Appendix 2. Confidence code definitions and there application to northern black racer records.

Confidence Codes

1M/H = specimen collected
2M/H = photograph taken of specimen and is identifiable to species
3M/H = specimen handled by knowledgeable observer
4M/H = specimen observed by knowledgeable observer **OR** two or more independent reports (5 or 6 quality) from different observers of unknown qualifications
5M/H = specimen handled and convincing description (two or more diagnostic characters) by observer of unknown qualifications
6M/H = specimen observed and convincing description (two or more diagnostic characters) by observer of unknown qualifications
7M/H = reported but lacking identification details (or observer info., etc)
8M/H = reported but containing questionable information

M = Modern (defined by species specialist)
H = Historic (defined by species specialist)

knowledgeable observer = a professional biologist (including consultants, technicians, and researchers) or someone who has demonstrated proficiency with the taxa or species being reported

Northern Black Racer, *Coluber constrictor*

M = Modern (< or = 30 years old)
H = Historic (> 30 years old)

Conf. Code	Public Review	MARAP	Lead
1M	*Yes (Tier 1)*	*Yes*	*N/A*
1H	*Yes (Tier 2)*	*Yes*	*N/A*
2M	*Yes (Tier 1)*	*Yes*	*N/A*
2H	*Yes (Tier 2)*	*Yes*	*N/A*
3M	*Yes (Tier 1)*	*Yes*	*N/A*
3H	*Yes (Tier 2)*	*Yes*	*N/A*
4M	*Yes (Tier 1)*	*Yes*	*N/A*
4H	*Yes (Tier 2)*	*Yes*	*N/A*
5M	*Yes (Tier 2)*	*Yes*	*N/A*
5H	--	*Yes*	*Yes*
6M	*Yes (Tier 2)*	*Yes*	*N/A*
6H	--	*Yes*	*Yes*
7M	--	*Yes*	*Yes*
7H	--	*Yes*	*Yes*
8M	--	--	*Yes*
8H	--	--	*Yes*

*** Tier 1** = full regulatory quality
**** Tier 2** = option of treating the element occurrence as present **OR** can choose to make a best effort to detect if still present (if not detected then no avoidance or mitigation required)

Appendix 3. *Coluber constrictor constrictor* photographs.

Adult Northern Black Racer (*Coluber constrictor constrictor*)

Adult Northern Black Racer (*Coluber constrictor constrictor*)

Adult Northern Black Racer (*Coluber constrictor constrictor*), basking amongst grasses and sweet fern

Adult Northern Black Racer (*Coluber constrictor constrictor*), foraging in low bush blueberry

Juvenile Northern Black Racer; note blotchy dorsal pattern and large eye