

**Update
COSEWIC Status Report**

on

The Eastern Massasauga
Sistrurus catenatus catenatus

prepared for

**COMMITTEE ON THE STATUS OF ENDANGERED
WILDLIFE IN CANADA**

by

Jeremy D. Rouse

Ontario Ministry of Natural Resources

Parry Sound

Jeremy.rouse@mnr.gov.on.ca

And

Robert J. Willson

The Wilds of Pelee Island

rwillson@wildsofpelee.ca

DRAFT

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EXECUTIVE SUMMARY

Species information

The Eastern massasauga (*Sistrurus catenatus catenatus*), family Viperidae, is Ontario's only extant venomous snake. It is a relatively small-sized rattlesnake (adults up to 76 cm total length) with a thick body and a segmented rattle on the tail tip. Background colour is gray to dark brown with dark brown dorsal blotches alternating with three rows of smaller lateral blotches. Ventral colour is dark brown or black, often with white mottling. Eastern massasaugas may be confused with other non-venomous, banded/blotched Ontario species such as: Eastern hog-nosed snake (*Heterodon platirhinos*), Eastern fox snake (*Elaphe gloydi*), Eastern milksnake (*Lampropeltis triangulum triangulum*) and Northern watersnake (*Nerodia sipedon sipedon*).

Distribution

The Eastern massasauga is found in the northeastern United States in Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania and Wisconsin. In Canada, populations of this snake are restricted to four geographically distinct regions within Ontario. Historical evidence suggests that the Bruce Peninsula and western Georgian Bay populations in central Ontario were likely once a continuous population. The Wainfleet and Ojibway populations in southwestern Ontario are small and completely isolated.

Habitat

The Eastern massasauga's habitat varies from wet prairie, sedge meadows and old fields, to peatlands, bedrock barrens and coniferous forest, however each habitat provides physical similarities to meet the species' habitat requirements. Massasaugas require a semi-open habitat to provide both cover from predators and opportunities for thermoregulation (ie. basking). Hibernation sites are often damp or water-saturated, suggesting that moisture content is a key variable in successful hibernation. Both quantity and quality of massasauga habitat in Ontario have declined, and in many places continue to decline, due to human development.

Biology

The active season of the Eastern massasauga is from late April to October in Canada. Mating occurs in late summer and females store the sperm until ovulation the following spring. Females mature between three and five years of age (males mature slightly earlier) and produce litters of 3-20 young every two to three years. Males and females begin returning to hibernacula in September, remaining in hibernation until April. Local climatic conditions (ie. cooler than average temperatures) can affect the age of maturity, frequency of reproduction and active season of the Eastern massasauga. These predators primarily ambush terrestrial prey, but have also been observed actively hunting prey in both arboreal and aquatic habitats.

Population sizes and trends

The relative size of the four Eastern massasauga populations is influenced by the quantity of habitat remaining at each site. The Georgian Bay population is the largest, followed by the Bruce Peninsula population. There are no available estimates of population size at this time, however following the 2002 sampling period population estimates will be available for two study sites within the Georgian Bay area. The southwestern Ontario populations exist at much lower densities and are several orders of magnitude smaller than the two central Ontario populations. Despite intensive searches in 2000, insufficient data are available to conduct population estimates, however radio-tracking has shown that survivorship is low. These two populations appear to be at critically low levels.

Limiting factors and threats

Habitat destruction and fragmentation caused by human development are the most serious threats to the survival of the Eastern massasaugas in Ontario. In particular, the expansion of Hwy 69/400, along the shoreline of Georgian Bay area, and the West Bruce Lands project, along the western shoreline of the Bruce Peninsula, will negatively affect the quality of massasauga habitat within their immediate areas. Associated with these developments is an increase in the number of actively used roads, which increases the risk of snakes being killed while crossing or thermoregulating on roadways. The southwestern Ontario populations face the additional threat of stochastic extinction due to their small size and high degree of isolation.

Special significance of the species

As Canada's only remaining venomous snake, the Eastern massasauga provides a unique opportunity for humans to respect and co-exist peacefully with a creature that retains the ability to cause them harm. Not only is it a fascinating product of evolution, it also occupies an important niche in Ontario's fauna. From a conservation perspective, it is important to note that the most secure populations of *S.c. catenatus* in North America occur in the Georgian Bay and Bruce Peninsula regions of Ontario.

Existing protection or other status designations

The Eastern massasauga was designated **Threatened** by COSEWIC in 1991 and by the OMNR in 1998. It is also considered a "specially protected reptile" under the 1999 Ontario Fish and Wildlife Conservation Act, making it illegal to harass, possess (without a permit), or kill individuals of this species. The species is ranked G3G4 globally.

Summary of status report

Since COSEWIC designated the Eastern massasauga as a **Threatened** species in 1991, there has been cause for optimism. Significant research and education initiatives have increased the public's knowledge of and concern for this species,

undoubtedly decreasing the number of massasaugas wantonly killed each year. There has also been increased protection of habitat in the Wainfleet area, as well as plans for protecting massasauga habitat in the Ojibway area. However, the populations in southern Ontario are small, isolated and at significant risk of stochastic extinction, while the central Ontario populations continue to be threatened by habitat loss and fragmentation. The gains in survivorship through education efforts cannot compensate for increased mortality due to habitat destruction. Therefore, we recommend that the taxon's **Threatened** status in Canada be retained.

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SPECIES INFORMATION

Name and classification

Class: Reptilia

Order: Squamata

Suborder: Serpentes

Family: Viperidae

Subfamily: Crotalinae

Species: *Sistrurus catenatus* (Rafinesque 1818) Massasauga Rattlesnake

Subspecies: *S. c. catenatus* Eastern Massasauga Rattlesnake

Number of subspecies - 3; Number of subspecies in Canada - 1

Description

The Eastern Massasauga (hereafter, massasauga) is Ontario's only extant venomous snake. It is a thick-bodied, dorsally blotched snake with a small well-developed rattle at the end of its tail. The massasauga has elliptical pupils and a pair of heat-sensitive facial pits situated between the eyes and nostrils. *Sistrurus catenatus catenatus* is a relatively small rattlesnake with adults measuring up to 76 cm in total length (Conant and Collins 1991). Lateral and dorsal scales often have a gray to dark brown background colouration with dark brown dorsal blotches alternating with three rows of smaller lateral blotches. The ventral scales (or scutes) are dark brown or black, often with white mottling (J. Rouse pers. obs.). Neonates and yearlings (snakes in their first full active season) look similar to the adults, except that they have a grayer background colour resulting in a higher contrast between background and blotches, and a less-developed rattle. In Ontario, massasaugas may be confused with several banded/blotched snake species including the eastern hog-nosed snake (*Heterodon platirhinos*), eastern fox snake (*Elaphe gloydi*), eastern milksnake (*Lampropeltis triangulum triangulum*), and northern watersnake (*Nerodia sipedon sipedon*).

DISTRIBUTION

Global range

Historically, the Eastern Massasauga ranged as far west as Minnesota and Iowa, to Ohio in the east, and to central Ontario in the north. *Sistrurus catenatus catenatus* occurs in Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Wisconsin, and the province of Ontario (Figure 1; Johnson *et al.* 2000). Evidence suggests, however, that the subspecies has recently been extirpated from Minnesota (Szymanski 1998).

Canadian range

Sistrurus catenatus catenatus is currently found in four geographically disjunct localities of unequal size and extent within Ontario (Prior *et al.* 2000). The largest of the four populations, in terms of contiguous suitable habitat, occurs along the eastern

shores of Georgian Bay from near Port Severn north to Killarney (ca. 5 484 km²; mixedwood shield ecoregion; Prior *et al.* 2000; Figure 2). Although relatively undisturbed habitat exists from Georgian Bay to Algonquin, massasaugas are restricted to a band of habitat that follows the shoreline (maximum recorded distance inland is ca. 50 km; Prior *et al.* 2000). The second largest massasauga population in Ontario occurs on the Bruce Peninsula from Oliphant to Fitzwilliam Island, just south of Manitoulin Island, (ca. 1 963 km²; mixedwood plains ecoregion; Prior *et al.* 2000). While historical evidence suggests that these two regional populations were once continuous (Weller and Parsons 1991), it is highly probable that they are now completely disjunct. The two massasauga populations occurring in southern Ontario (deciduous forest zone) are comparatively small and isolated. The Wainfleet population is centred in a 1500 ha peatland located along the Niagara peninsula near Port Colborne, while the Ojibway population encompasses several prairie and old field fragments (suitable habitat restricted to ca. 450 ha) within the township of LaSalle which is just inside the city limits of Windsor.

HABITAT

Habitat Requirements

Like other reptiles living in northern latitudes, massasauga rattlesnakes are restricted to climatic regions where daily and seasonal temperatures permit them to successfully carry out fundamental life processes (e.g., feeding, reproduction). In particular, suitable temperature regimes are critical for successful reproduction and hibernation at these northern latitudes. To obtain these temperatures, massasaugas require a semi-open habitat that can provide sufficient cover from predators and the elements, while providing thermoregulatory opportunities necessary for activities such as gestation and digestion. Studies in Ontario, as well as from the rest of the Eastern Massasauga's distribution in the US, strongly suggest moisture content of the substrate to be a key variable in successful hibernation (see Johnson *et al.* 2000 for review). Massasaugas frequently overwinter in damp or water-saturated sites, often characterized by the presence of sphagnum moss, although water-saturated old fields with crayfish and rodent burrows are also commonly used where present. Physical data collected over the winter of 2000 at six known massasauga hibernacula in Georgian Bay showed that water levels were close to the surface at all sites (J. Rouse *et al.* unpub. data).

Massasaugas are known to utilize strikingly different habitats across their range (Prior *et al.* 2000). For example, they are known to use wet prairie (Seigel 1986), fens and sedge meadows (Johnson 1995, Kingsbury 1996, 1999), peatlands (Johnson 1995, Johnson and Leopold 1998), bedrock barrens (Parent 1997, J. Rouse personal observation), coniferous forest (Weatherhead and Prior 1992), meadows and old fields (Reinert and Kodrich 1982). Although these habitats vary considerably in vegetative composition and structure, all possess distinctive microhabitats exhibiting physical similarities. For example, granite table rocks situated in rock barrens in Georgian Bay may offer similar daily temperatures to gestating females as do mounds of rotting vegetation or brush piles found in old fields or prairie (R. Willson personal observation).

Extensive radiotelemetric data have shown Georgian Bay massasaugas to use a mosaic of bedrock barrens, conifer swamps, beaver meadows, fens, bogs, and shoreline habitats (M. Villeneuve unpub. data, Beausoleil Island; C. Parent unpub. data, Killbear Provincial Park; Rouse *et al.* 2001, Hwy 69 corridor). More limited radiotracking of massasaugas on the Bruce Peninsula has shown them to use shore marshes, shrubby swamps, fens, and small clearings associated with coniferous forest (Weatherhead and Prior 1992). Finally, recent radiotelemetry data collected from massasaugas occurring in the southern Ontario populations have shown them to use tall grass prairies composed of dry, sandy, low forb prairie and recently disturbed, goldenrod dominated habitats at Ojibway, and bog habitat, wet woods, adjacent farm fields, old fields, and hedgerows at Wainfleet (Pratt *et al.* 2000).

Trends

The quantity and quality of habitat remaining at all four sites has continued to decline since 1991, albeit at different rates and scale. Thus, it is likely that the Georgian Bay and Bruce Peninsula populations have lost more area of habitat to human development, but that the southern Ontario populations have experienced more serious percentage habitat loss. For example, the loss of a 20-ha old field for the Ojibway population is far more serious than an equivalent loss of area in either Georgian Bay or the Bruce. Increases in housing and cottage developments, associated road infrastructure, and human use of these areas threatens the continued existence of all formally unprotected habitat within the four massasauga populations. Particularly alarming is the fact that the Ojibway population, LaSalle/Windsor area, has lost more habitat in the last five years than in the previous 20 (P. Pratt pers. comm.). In contrast, ca. 74% of Wainfleet Bog/Marsh is under public ownership and peat mining has ceased in these areas. Active peat mining, however, still occurs adjacent to those areas now protected (R. Tervo pers. comm.).

Protection/ownership

Within the extent of the Georgian Bay and Bruce Peninsula populations, habitat currently used by massasaugas is protected within the boundaries of two national parks, Georgian Bay Islands and Bruce Peninsula, and several provincial parks. Additional massasauga habitat will be afforded protection as a result of regulations under the new "Conservation Reserves and Park Additions" as part of Ontario's Living Legacy (OLL) Program. Important habitat on crown land is also given reasonable levels of protection. The Wainfleet Bog (1500 ha) is designated a Class 1 wetland and the majority of the bog is publicly owned and protected (Niagara Peninsula Conservation Authority - 801 ha; OMNR - 231 ha; Nature Conservancy of Canada - 81 ha). Although several parcels of potential massasauga habitat, mainly tallgrass prairie, have formal protection within the boundaries of the City of Windsor and adjacent town of LaSalle (total ca. 250 ha), only one LaSalle site has had recent rattlesnake sightings. No reliable observations of the species have been made in the protected Windsor sites since the mid-1970's. Most recent observations (captures or radiotelemetric relocations) have been from unprotected locations that are in developing residential areas of LaSalle and Windsor. Re-colonization of the protected sites from nearby unprotected areas currently harbouring massasaugas is becoming more unlikely as

roads continue to innervate all available corridors between the remaining habitat patches. Plans are underway to protect the remaining 117 ha of potential massasauga habitat within the City of Windsor if funding can be secured. Unlike current (or potential) massasauga habitat in Georgian Bay and the Bruce Peninsula, habitat in southwestern Ontario not expressly purchased for protection has little chance of remaining in a natural state. The non-existence of crown land in southwestern Ontario necessarily constrains massasaugas to small habitat fragments that have, in many cases, long been isolated.

BIOLOGY

Activity Range and Movements

Eastern Massasauga rattlesnakes are active from roughly late April to October across their Canadian range. Limited data has been published on the activity range and movements of massasaugas in Ontario (e.g., Weatherhead and Prior 1992). Unpub. data from Ontario shows that massasauga movement patterns can vary substantially between populations or study sites (C. Parent, J. Rouse, P. Pratt, R. Tervo unpub. data). In a peninsular population in Killbear Provincial Park (hereafter Killbear), males and nongravid females may move up to 500 m by 1000 m in any one active season (C. Parent unpub. data); whereas, males and non-gravid females within a study population further inland from Georgian Bay (but still only 40 km from Killbear) moved up to 1000 m by 2000 m, with one male moving over 4000 m from initial capture location to his overwintering site (Rouse *et al.* 2001). While gravid (see Reproduction), massasaugas are relatively sedentary and can often be relocated at their preferred gestation site until parturition. Massasaugas often shift their centres of activity between seasons: spending the fall, winter and spring in wet, heavily-vegetated habitats (at least in comparison to the surrounding habitat matrix), such as conifer swamps; then moving to upland, drier habitats in the summer (e.g., bedrock barrens; Reinert and Kodrich 1982, Seigel 1986, Weatherhead and Prior 1992, Johnson 2000, Pratt *et al.* 2000, Parent and Weatherhead 2000, Rouse *et al.* 2001).

Reproduction

The massasauga is ovoviviparous (in some discussions synonymous with viviparous) and most commonly reproduces biennially in Ontario; however, triennial or greater cycles also occur (Parent *et al.* unpub. data) because of the short activity season available for females to acquire sufficient energy reserves to invest in reproduction. In Ontario, climatic conditions and local site characteristics (e.g., prey density) can influence age of maturation. Although there is substantial interindividual variation in age of maturity, even within single populations (C. Parent *et al.* unpub. data), females generally mature between three and five years of age and it is presumed that males mature slightly earlier. Throughout Ontario, mating occurs in late summer (late July to early September) and females store the sperm until ovulation the following spring. In Killbear, gravid massasaugas on average spend two to three weeks in foraging habitat before making predictable movements to distinctive microhabitats (gestation sites or rookeries), where they will remain until parturition in late summer

(mid-July to mid-September; C. Parent *et al.* unpub. data). In some areas, optimal gestation sites may be of limited occurrence and their rarity may contribute to their use by multiple females (although thermoregulatory and social roles for communal rookeries are also likely; R. Willson unpub. data). Litter sizes range from 3 to 20 young (mean = 13.3 ± 2.74 ; SD; Parent and Weatherhead 2000) and neonates average 20 cm SVL.

Hibernation

Although Eastern Massasaugas are most commonly reported to be solitary hibernators; data from Killbear and the Hwy 69 corridor show that occupancy of a definable hibernaculum (i.e., a site with obvious boundaries such as a low-lying mossy depression within a rock outcropping or bedrock barren) can be from one individual to at least 10 massasaugas (C. Parent unpub. data, Rouse *et al.* 2001). In Ontario, massasaugas begin to make recognizable movements (i.e., often relatively straight-line movements, J. Rouse, R. Willson personal observations) back to the vicinity of their hibernacula in September and are often underground by the end of September or middle of October (C. Parent unpub. data, Rouse *et al.* 2001). Neonate massasaugas, not having hibernated before, may scent-track conspecifics to hibernacula. Fortuitous mark-recapture data has demonstrated that neonate massasaugas are capable of moving at least 400 m from their birth site to find a suitable hibernaculum, in this case, a previously documented den site (J. Rouse *et al.* unpub. data). Fissures in the bedrock, cavities associated with tree roots, animal burrows, including those of crayfish, have all been documented as massasauga hibernacula in Ontario.

Food and Feeding

Massasaugas are primarily diurnal ambush (sit-and-wait) predators, but can be nocturnally active during the warmer months (July and August) and will also actively forage. Although their morphology dictates mainly terrestrial foraging, massasaugas have been observed actively searching for, and consuming, prey in arboreal habitats. Small mammals and songbirds are their primary prey items in Ontario (K. Prior unpub. data, C. Parent *et al.* unpub. data). Young massasaugas will feed on the young of smaller snake species (Seigel 1986, J. Rouse, R. Willson personal observations) and also may consume amphibians and invertebrates (Seigel 1986).

Survival

Probable natural predators of adult massasaugas in Ontario include the larger birds of prey, such as great horned owls (*Bubo virginianus*) and red tailed hawks (*Buteo jamaicensis*) and carnivorous mammals such as fisher (*Martes pennanti*), raccoons (*Procyon lotor*), red fox (*Vulpes vulpes*), and coyote (*Canis latrans*). The young are vulnerable to a wider variety of avian and mammalian predators. Harsh winters (e.g., colder temperatures and/or less snow cover than usual, etc.) leading to unsuccessful overwintering are a major source of natural mortality in adults, and probably to a higher degree in neonates (C. Parent pers. comm.).

Behaviour/adaptability

Massasauga populations appear to tolerate intermediate levels of human disturbance - something the mere existence of the Ojibway population attests to. Massasaugas can co-exist with relatively high levels of human use over short periods, as evidenced by the continued use of shelter rocks (frequently gestation sites) immediately adjacent to trails well-used by human hikers in Killbear (Parent and Weatherhead 2000). Additionally, gravid massasaugas successfully brood their young at these sites, and return in subsequent years of reproductive activity (i.e., in two- to three-year intervals; C. Parent unpub. data; J. Rouse and R. Willson personal observations). Data from Killbear also suggest that massasaugas seem able to incorporate disturbed areas (e.g., regularly used campgrounds) into their yearly activity ranges (Parent and Weatherhead 2000). Therefore, as long as suitable habitat remains, while persecution by humans is limited, such as is the case in this park environment, massasauga populations can persist (at least in the short term).

POPULATION SIZES AND TRENDS

Since the last report on the massasauga's status in Canada in 1991 (Weller and Parsons 1991), substantially more demographic data have been collected. The relative size of the four massasauga populations in Ontario roughly parallels the quantity of habitat existing at each site. Thus, the Georgian Bay population would logically contain the greatest number of massasaugas, followed by the Bruce Peninsula population. The sizes of the southern Ontario populations are several orders of magnitude smaller than the two regional populations. It is difficult to say, however, which population, Wainfleet or Ojibway, is in a more precarious state in terms of numbers of animals. Both southern Ontario sites exhibit significantly lower capture rates per unit of search effort compared to similarly-sized areas within the regional populations.

At the Wainfleet site, a total of 1,060 person hours were spent searching for massasaugas in 2000 (Pratt *et al.* 2000). These searches yielded nine massasaugas (four females, one male, four neonates). Two of these females were gravid in 2000 and successfully gave birth. Of the three massasaugas radiotracked at Wainfleet in 2000, one was killed by an unknown predator, one developed what would have been a fatal abdominal infection (unrelated to the transmitter implantation), and the third successfully overwintered (Pratt *et al.* 2000).

At the Ojibway site, a total of 156 hours were spent in the field searching for massasaugas from 1999 to 2000. During this time, a total of 26 massasaugas were located (four gravid females, two nongravid females, two males, and 18 neonates; Pratt *et al.* 2000). Five individuals (four females and one male) were subsequently radiotracked. Unfortunately, all of the females died within one year of their implantation date: two females were depredated by unknown predators shortly after implantation, one was killed by a motor vehicle on a newly constructed road after ca. 11 months of radiotracking, and finally, one died overwintering in a small animal/crayfish burrow. The lone male survivor overwintered successfully and has been observed mating in two consecutive years (Pratt *et al.* 2000).

Examination of the data collected from the southern Ontario populations should

make it clear that conventional population estimation techniques are not appropriate at this stage; it should suffice to say that the population levels are critically low. Additionally, if the modeling of other vertebrate populations is at all reliable, then the massasauga populations at both Wainfleet and Ojibway cannot be viable in the long term (e.g., see Seigel and Sheil 1999, but see caveats therein). Whereas the estimation of population parameters at Wainfleet and Ojibway is plagued by low sample sizes, the expansiveness of the regional populations of Georgian Bay and the Bruce Peninsula make an estimation of total population size extremely difficult and likely unreliable. Additionally, there are many areas in Georgian Bay where field surveys for snakes have been inadequate, and attempts to model, and thus predict, areas of massasauga occurrence based on physical parameters have largely been unsuccessful.

On a local level, however, there has been intensive, relatively long term collection of demographic data for the Killbear massasauga population (Parent *et al.* unpub. data). At this site, a rigorous mark-recapture program has continued since 1994 and was first initiated in 1992. Consequently, estimation of population parameters for the Killbear population is feasible and currently underway (C. Parent pers. comm.); however, these data are not available at this time. For comparison with the southern Ontario populations, ca. 80 adult and juvenile massasaugas, and between 50 and 300 neonates are captured and "processed" each season; the majority of them being captured within two study sites, each ca. 150 ha in size. Recent, intensive mark-recapture studies north of the Moon River and west of Mactier (the new Hwy 69 corridor) have found similar numbers of massasaugas: 100 adults and juveniles and ca. 100 neonates (2000 and 2001; J. Rouse *et al.* Unpub. data). While this study site is larger, at approximately 650 ha, it does provide additional evidence that the southern Ontario populations exist at low densities. Estimation of population parameters for this site should be feasible upon the conclusion of the third sampling period in 2002. Mark-recapture studies on Bruce Peninsula populations have been conducted, albeit, at lower intensities and duration (e.g., Prior 1996, cited in Parker and Prior 1999). In 2000, Bruce Peninsula National Park (BPNP) initiated a long-term monitoring program for massasaugas (F. Burrows pers. comm.). Finally, a recent radiotelemetric investigation of the thermal ecology of massasaugas in BPNP was initiated in 2001, and researchers located ca. 50 massasaugas over the field season (F. Burrows pers. comm.; P. Weatherhead *et al.* unpub. data).

LIMITING FACTORS AND THREATS

Since the massasauga was designated **Threatened** by COSEWIC in 1991, several of the factors contributing to the species decline in Canada have continued unabated. Foremost in severity, habitat destruction and fragmentation has accelerated in recent years. Tightly coupled to the continuing fragmentation of remaining habitat is a concomitant increase in the number of actively used roadways. Consequently, incidental mortality of massasaugas on roadways has become a serious concern to their conservation. Perhaps the only limiting factor that has decreased in impact since 1991 is direct human persecution, although it no doubt still occurs across the massasauga's range. This anecdotally documented decrease in human persecution is

largely a result of the tireless education efforts of concerned groups at the Metro Toronto Zoo, as well as other dedicated individuals and organizations.

Potential, and ongoing, developments that threaten the integrity of local massasauga populations in the Georgian Bay and Bruce Peninsula regions are too numerous to describe or document. Two notable examples, however, are the twinning and expansion of Hwy 69/400 along the eastern shoreline of Georgian Bay, and the West Bruce Lands project along the western shoreline of the Bruce Peninsula. When completed, both developments will negatively impact the quality of massasauga habitat in their immediate vicinity, and data collected from areas cleared for the Hwy 69 corridor show that massasaugas have also been negatively affected during the construction phase (Rouse *et al.* 2001). These examples are unique because members of the massasauga recovery team have been given input into, or at least had the opportunity to comment on, their construction and design. It is anticipated that large scale developments like the previous examples will continue to be proposed, and thus in concert with smaller-scale cottage development, habitat quantity and quality will decrease within the Georgian Bay and Bruce Peninsula regions.

The Wainfleet and Ojibway populations also face continued loss of suitable habitat as one of the primary threats to their persistence (see Habitat Trends). As a larger area is formally protected at Wainfleet, and this population occurs in a more slowly developing rural area, it is reasonable to speculate that the Ojibway population is in greater jeopardy of extirpation. Massasaugas at the Ojibway site may also run a greater risk of being killed on the roadways, as the habitat fragments currently occupied are small, and some are decreasing in size (e.g., the Sandwich West Woodlot), whereas traffic volume increases. Massasaugas at Wainfleet are probably occasionally killed by agricultural machinery (Prior *et al.* 2000) as individuals have been observed spending substantial portions of their active seasons outside of the peatland habitat (Pratt *et al.* 2000). For both populations, given their small size and high degree of isolation, the possibility of stochastic extinction remains great. These populations would be unable to compensate for a series of chance events that reduced survivorship or increased mortality due to their lack of genetic variation.

SPECIAL SIGNIFICANCE OF THE SPECIES

As Ontario's only remaining venomous snake, the massasauga occupies an important and unique "niche" in the province's fauna. In a metaphorical way, it symbolizes an important approach to wildlife conservation in the 21st century; that *Homo sapiens*, in this case Canadians, can co-exist with a creature that retains the ability to cause them harm. A healthy respect for an equally fascinating product of evolution is required, not a loathing of a potential threat to one's livelihood. In many Canadian's minds, rattlesnakes are creatures of the southern US deserts, not something to be found in cottage country. Consequently, there are many young Ontarions (the authors included) that have been thrilled to suddenly discover the existence of such an animal in "their own backyard". To be fair, there is also a significant percentage of Ontarions that would rather not have knowledge of such things—for them the message should be one of tolerance and co-existence. From a national

conservation perspective, it is noteworthy that the most secure populations of *S. c. catenatus* in North America occur in the Georgian Bay and Bruce Peninsula regions of Ontario. Finally, Canada would be a poorer place, both in terms of biological and cultural diversity, were the "black snapper" to be extirpated from its wetlands and prairies.

EXISTING PROTECTION OR OTHER STATUS

Sistrurus catenatus catenatus is a "specially protected reptile" under Ontario's Fish and Wildlife Conservation Act (January 1999), making it illegal to harass, possess (without a permit), or kill the snake. The Eastern Massasauga was designated **Threatened** by COSEWIC in 1991 and by the OMNR in 1998. Using the Nature Conservancy's system, the Eastern Massasauga is ranked G3G4T3T4 (1996-10-31) globally (T denotes that the rank applies to a subspecies or variety) and S3 (1999-10-31) provincially.

SUMMARY OF STATUS REPORT

Since COSEWIC's 1991 assessment of the Eastern Massasauga rattlesnake's status in Canada, significant research and education initiatives have been conducted across the snake's Ontario range. The substantial increase in public awareness regarding the plight of this unique animal has undoubtedly decreased the number of massasaugas wantonly killed. Also, the recent investigations at Wainfleet and Ojibway, and the protection of a portion of the bog habitat, are causes for optimism. However, habitat loss and fragmentation have occurred across the entirety of the massasauga's Canadian range and road mortality is likely to continue increasing in areas traversed by roads. In all likelihood, these losses effectively negate the gains in survivorship made via education efforts. Assessed independently, the Wainfleet and Ojibway massasauga populations certainly warrant Endangered status; however, given the isolated nature of the majority of existing snake populations in southern Ontario (e.g., *Elaphe obsoleta*, *Heterodon platirhinos*; each with COSEWIC status assessed across the entirety of their Canadian range), it would not be practical for COSEWIC to evaluate each of the massasauga populations separately. Therefore, we recommend COSEWIC treat the four extant massasauga populations as a whole, and consequently retain the taxon's **Threatened** status designation in Canada.

TECHNICAL SUMMARY

Sistrurus catenatus catenatus

Eastern massasauga rattlesnake

Ojibway, Wainfleet populations, Georgian Bay, Bruce Peninsula populations

South and central Ontario

Extent and Area information	
<ul style="list-style-type: none"> • <i>extent of occurrence (EO)(km²)</i> 	Not Calculated
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>specify trend (decline, stable, increasing, unknown)</i> 	Unknown
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>are there extreme fluctuations in EO (> 1 order of magnitude)?</i> 	No
<ul style="list-style-type: none"> • <i>area of occupancy (AO) (km²)</i> 	Not Calculated
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>specify trend (decline, stable, increasing, unknown)</i> 	Unknown
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>are there extreme fluctuations in AO (> 1 order magnitude)?</i> 	No
<ul style="list-style-type: none"> • <i>number of extant locations</i> 	4
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>specify trend in # locations (decline, stable, increasing, unknown)</i> 	Unknown
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>are there extreme fluctuations in # locations (>1 order of magnitude)?</i> 	No
<ul style="list-style-type: none"> • <i>habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat</i> 	Declining
Population information	
<ul style="list-style-type: none"> • <i>generation time (average age of parents in the population) (indicate years, months, days, etc.)</i> 	6 years +
<ul style="list-style-type: none"> • <i>number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)</i> 	Unknown
<ul style="list-style-type: none"> • <i>total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals</i> 	Unknown
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)</i> 	----
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • <i>are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?</i> 	Unknown
<ul style="list-style-type: none"> • <i>is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?</i> 	Yes in southern Ontario Probably in Central Ontario

<ul style="list-style-type: none"> • <i>list each population and the number of mature individuals in each</i> 	Unknown
<ul style="list-style-type: none"> • <i>specify trend in number of populations (decline, stable, increasing, unknown)</i> 	Unknown
<ul style="list-style-type: none"> • <i>are there extreme fluctuations in number of populations (>1 order of magnitude)?</i> 	No
Threats (actual or imminent threats to populations or habitats)	
-Loss of Habitat, sever persecution by people, fragmenting distribution, small numbers	
Rescue Effect (immigration from an outside source)	
<ul style="list-style-type: none"> • <i>does species exist elsewhere (in Canada or outside)?</i> 	U.S.
<ul style="list-style-type: none"> • <i>status of the outside population(s)?</i> 	Varied
<ul style="list-style-type: none"> • <i>is immigration known or possible?</i> 	No
<ul style="list-style-type: none"> • <i>would immigrants be adapted to survive here?</i> 	Unknown
<ul style="list-style-type: none"> • <i>is there sufficient habitat for immigrants here?</i> 	No - South / Yes - Central
Quantitative Analysis	

Jeremy Rouse, January 2002

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BIOGRAPHICAL SUMMARY OF CONTRACTOR

Robert Willson received his B.Sc. and M.Sc. degrees from the University of Guelph in 1997 and 2001 respectively. His graduate research involved an investigation of the reproductive ecology of eastern fox snakes on Pelee Island (1998-1999). Prior to his graduate work, he assisted with a radiotelemetric study of the Eastern Massasauga rattlesnake in Georgian Bay (1994-1997). He has been actively involved with snake research on Pelee Island since 1994, including mark-recapture studies on blue racers, Lake Erie water snakes, and eastern fox snakes.

Jeremy Rouse received his B.Sc. with specialization in Environmental Toxicology from the University of Guelph in 1997. He is currently working on a study monitoring the effects of highway construction on Eastern Massasauga rattlesnakes south of Parry Sound for the OMNR. Prior to his current work, he conducted research on the ecotoxicology of northern and Lake Erie water snakes in the Great Lakes (1998-1999) for the Canadian Wildlife Service, as well as assisting with a number of large snake projects in Ontario (1995-1999).

AUTHORITIES CONSULTED

Black, R. 2001. MNR District Biologist, Parry Sound Area, Parry Sound, ON. P2A 1S4; Tel: (705) 773-4225, email: ron.black@mnr.gov.on.ca

Burrows, F. 2001. Park Warden. Bruce Peninsula Nation Park, Tobermory, ON. Tel: (519) 596-2444 ext.310, email: Frank_Burrows@pch.gc.ca

Parent, C. E. 2001. Researcher, Killbear Provincial Park, Nobel, ON. P0G 1G0; Tel: (705) 342-5492, e-mail: chris.parent@mnr.gov.on.ca

Pratt, P. 2001. Ojibway Nature Centre. Windsor, ON. Tel: (519) 966-5852, email: ppratt@city.windsor.on.ca

Tervo, R. 2001. MNR-OLL Intern. Niagara Area, Vineland, ON. L0R 2E0 Tel: (905) 562-4147, email: rob.tervo@mnr.gov.on.ca

Figure 1. North American distribution for the eastern massasauga rattlesnake
(Based on Conant and Collins 1998)

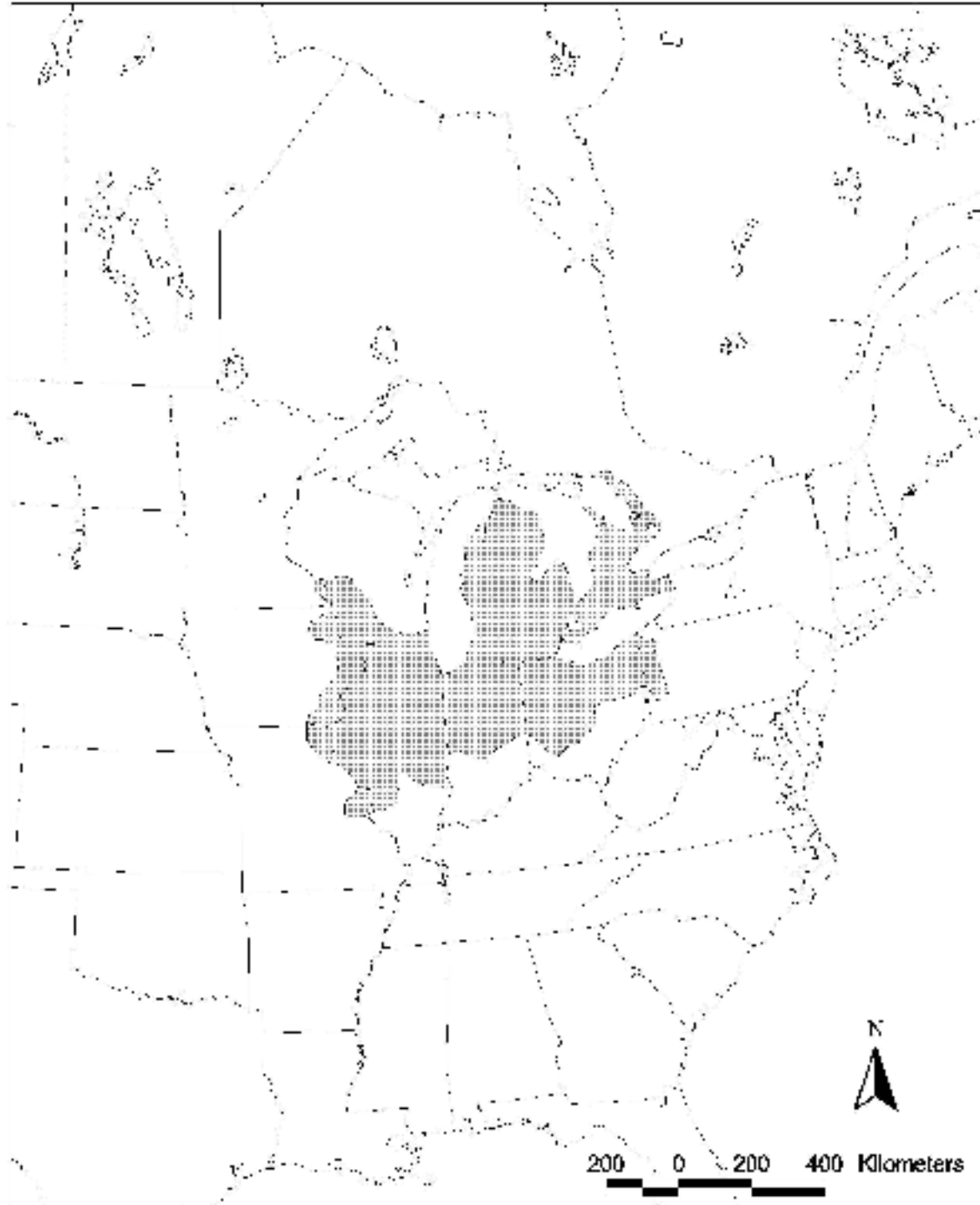


Figure 2. Ontario distribution for the eastern massasauga rattlesnake.
(Based on records from the NHIC)

