COSSARO Candidate Species at Risk Evaluation

for

Massasauga (*Sistrurus catenatus*)

Carolinian Population

Committee on the Status of Species at Risk in Ontario (COSSARO)

Assessed by COSSARO as ENDANGERED

January 2013

Final

Massasauga (population carolinienne) (*Sistrurus catenatus*)

Le massasauga est un serpent à sonnette relativement petit au corps trapu ayant des motifs en sablier caractéristiques sur sa face dorsale. Il vit du sud de l'Ontario vers l'ouest et le sud-ouest en passant par les États du Midwest jusqu'au nord du Mexique. En Ontario, le Massasauga présente deux unités désignables : 1) la région de la baie Georgienne et 2) la région carolinienne le long de la rive nord du lac Érié. Ces deux unités désignables sont séparées de 200 km l'une de l'autre et il n'existe aucune preuve qu'elles ont été historiquement reliées. Les massasaugas de ces deux régions dont génétiquement différentes et occupent des habitats différents. Dans l'unité désignable carolinienne, il y avait au moins 17 endroits dans le sud-ouest de l'Ontario où se trouvait l'espèce entre Toronto et Windsor, mais depuis les années 1970, seules deux populations séparées par une grande distance persistent : dans la prairie de hautes graminées relique Ojibway de Windsor et dans les tourbières reliques Wainfleet près de Port Colborne. Cette partie de l'Ontario est caractérisée par une exploitation agricole intensive et s'urbanise de plus en plus. Ces populations ont subi une perte d'habitat extrême et un haut taux de mortalité en raison de l'important réseau routier. Puisque ce serpent est venimeux, il a grandement souffert de la persécution par les humains. La population de la prairie Ojibway est actuellement tellement réduite que sa disparition au cours des années qui suivent est probable. Pour cette raison, l'unité désignable carolinienne est désignée **en voie de disparition** en Ontario.

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PART 1

CURRENT STATUS AND DISTRIBUTION

Current Designations:

GRANK – **G 3 G4 T3Q** (Assessed 13/10/2010) (NatureServe, accessed 15/01/2013)

NRANK Canada – **N 3** (Assessed 13/10/2010) (NatureServe, accessed 15/01/2013)

COSEWIC – **Endangered** (COSEWIC, Nov 2012)

SARA – Threatened (Schedule 1) (Environment Canada, 2012). This designation currently applies to a single DU in Ontario.

ESA 2007 – **Threatened** (1 DU for all Ontario) (Ministry of Natural Resources, 2002)

SRANK – **S 3** (NHIC/NatureServe, accessed 15/01/2013)

Distribution in Ontario:

This Designatable Unit (DU) exists in two restricted locations in the Carolinian region of southwestern Ontario; at Ojibway Prairie in Windsor/LaSalle and at Wainfleet Bog near Port Colborne. At least 17 subpopulations of Massasauga are recognized from the Carolinian DU. These have been recorded along the north shore of Lake Erie and as far north as Sarnia and Hamilton. By the late 1800s and early 1900s, Massasaugas were already scarce in the Carolinian DU (Garnier 1881; Nash 1905; Miner 1928), and by the 1970s the species is presumed to have been extirpated from its entire historical Carolinian range except for the Windsor/LaSalle and Wainfleet areas (Weller and Parsons 1991). An estimated 85 - 90% decline in the area of occupancy of this DU has occurred since European settlement (COSEWIC 2012). For more than 40 years, all verified records have been only from Ojibway Prairie or Wainfleet Bog. A further decline is projected in this DU with the likely imminent extinction of the Ojibway population (COSEWIC 2012).

Distribution and Status Outside Ontario:

Massasaugas occur in a large but discontinuous range from central Canada to northern Mexico. The subspecies, Eastern Massasauga (*Sistrurus c. catenatus*), occurs in the eastern portion of the species' range, with historical and contemporary occurrences in Ontario, Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Wisconsin (USFWS 2010). Although the current estimated global range of the eastern subspecies is similar to the presumed historical range, it has

become increasingly fragmented (USFWS 2010, 2011). Nine of the 11 jurisdictions within the historical range have lost 30-50% of their populations. Also ~40 % of counties with historical populations no longer support the subspecies (USFWS 2010). In the U.S., more than 65% of populations are thought to have a low to moderate likelihood of remaining viable in the long term (USFWS 2010).

PART 2

ELIGIBILITY FOR ONTARIO STATUS ASSESSMENT

2.1 APPLICATION OF ELIGIBILITY CRITERIA

Taxonomic Distinctness

Yes. Massasauga has been a recognized species for almost 200 years. The eastern subspecies, *S. c. catenatus* that inhabits Ontario is under review at present and may be elevated to a full species (Crother *et al*. 2012; Kubatko *et al*. 2012), but currently the subspecies is being retained. The Carolinian DU was recognized in the Nov. 2012 meeting of COSEWIC (COSEWIC 2012).

Designatable Units

Two Designatable Units (DUs) are recognized for the Massasauga (*Sistrurus c. catenatus)* in (Ontario) Canada: the Carolinian and Great Lakes/St Lawrence DUs (COSEWIC 2012). Each unit is discrete and significant based on: genetic distinctiveness, eco-geographic regions, range disjunction, and ecological setting (COSEWIC 2012). All subpopulations (including historical) in the vicinity of Georgian Bay are included in the Great Lakes/St. Lawrence DU, and both Wainfleet Bog and Ojibway Prairie subpopulations are included in the Carolinian DU.

The 2012 COSEWIC report on Massasauga has an extensive discussion on the species' strong population spatial structure and variability and assignment of designatable units, which is summarized here. For the subspecies *S. c. catenatus*, three weakly differentiated geographic subunits based on mitochondrial DNA haplotypes have been described (Eastern, Central and Western: Ray 2009; King pers. comm. 2011; COSEWIC 2012, Figures 2, 3). Snakes from the Ojibway population were grouped in the central subunit, whereas snakes from Wainfleet, Bruce County and Parry Sound District were grouped in the eastern subunit (see Figures 2, 3 in COSEWIC 2012). Sample size for Wainfleet Bog was only a single snake so the inclusion of this site in the Eastern subunit should be viewed with caution. Snakes from all Ontario sites sampled belonged to the same cytochrome B group (Ray 2009).

Analysis of nuclear DNA microsatellites indicates that most sampled Ontario subpopulations are genetically distinct and currently physically isolated from one another (Chiucchi and Gibbs 2010; Dileo and Lougheed (2011). These results, coupled

with data from U.S. populations strongly suggest that fine-scale genetic structure is the natural state of Massasauga populations (Gibbs *et al.* 1997; Chiucchi and Gibbs 2010). Broad scale genetic isolation and low levels of gene flow among populations are thought to derive from limited dispersal and/or long term habitat heterogeneity and not from human-induced habitat fragmentation (Gibbs *et al*. 1997; Chiucchi and Gibbs 2010). Identification of DUs based on nuclear genetics alone, therefore, would be problematic at the present time due to 1) the need to define and identify each genetically distinct subpopulation in the Great Lakes/St. Lawrence DU, (which may amount to dozens if the number of "locations" provides a reasonable estimate of distinct populations), and 2) the lack of genetic data for the majority of subpopulations in the Georgian Bay region.

Populations in the proposed DUs appear to have been disjunct since before European settlement in Ontario. The Wainfleet Bog and Ojibway Prairie subpopulations are the only two remaining from over a dozen historical subpopulations of Massasauga in the Carolinian Zone. When viewed as a cluster, these historical Carolinian populations are geographically separated from historical Great Lakes/St. Lawrence populations by a band at least 80 km wide within which there is a total absence of records (Figures 4, 5, COSEWIC 2012). Whereas the current disjunction between the Ojibway Prairie and Wainfleet Bog populations was caused by the extirpation of intermediate subpopulations by people, there is little evidence to suggest a similar cause for the historical disjunction between the two putative DUs. No documented records exist from this gap in distribution, and the species' range is presumed to have declined perhaps in response to climatic shifts long before European settlement. There is little evidence that Massasaugas ever occupied the Lake Huron shore south of the Bruce Peninsula (Rowell 2012), but they still occur in the northern Lower Peninsula of Michigan, including Bois Blanc Island and, until recently, Charity Island at the extreme northern extent of the Lower Peninsula (Holman 2012). This distribution suggests Massasaugas may have entered the Great Lakes/St. Lawrence region via northern Michigan rather than from southern Ontario. Regardless, current evidence suggests that populations within the Carolinian DU have been naturally separate from populations within the Great Lakes/St. Lawrence DU for an extended period.

The Wainfleet and Ojibway subpopulations (and all historical Carolinian subpopulations) exist within the COSEWIC Carolinian Terrestrial Amphibian and Reptile Faunal Province, whereas all subpopulations in the Georgian Bay region (including historical) exist within COSEWIC's Great Lakes/St Lawrence Terrestrial Amphibian and Reptile Faunal Province (COSEWIC 2012).

Populations in each DU persist in unique ecological settings for the species in Canada that are likely to lead to local adaptations. The Carolinian DU supports the only Canadian representatives of a tallgrass prairie-oak-savannah population (Ojibway Prairie) and a Carolinian peatbog (Wainfleet Bog) (COSEWIC 2012). The Great Lakes/St. Lawrence DU supports the only Canadian representatives of alvar and rock

barren populations. These ecological settings have given rise to local behavioural adaptations of site fidelity to hibernacula and of long distance dispersal (COSEWIC 2012).

Native Status

Yes The Massasauga has been recognized as a valid species in Ontario's Carolinian region since the 1800's **(**Garnier 1881; Nash 1905; Miner 1928).

Presence/Absence

Present The Carolinian DU is still extant in two small areas of southwestern Ontario (COSEWIC 2012)..

2.2 ELIGIBILITY RESULTS

1. The putative taxon or DU is valid. **Yes**

2. The taxon or DU is native to Ontario. **Yes**

3. The taxon or DU is **Present** in Ontario**.**

PART 3

ONTARIO STATUS BASED ON COSSARO EVALUATION CRITERIA

3.1 APPLICATION OF PRIMARY CRITERIA (Rarity and Declines)

1. Global Rank
Threatened. G3 G4T3Q. (NatureServe accessed 15/01/2013)

2. Global Decline
Threatened. Nine of 11 jurisdictions have lost > 30% of their populations (COSEWIC 2012).

3. Northeastern North America Ranks
Endangered. Seven of nine jurisdictions (77%) that list Massasauga rank it S1 or S2 (Appendix 1). The global and northeastern North American ranges are nearly equivalent. If we add Missouri (rank S 1) to complete the global range, then the status remains Endangered (S1 or S2 in 8 of 10=80%). The endangered value is the more credible of criteria 2 and 3 because it is based on more precise data than NatureServe's global rank which seems to rest mostly on the total extent of occurrence.

4. Northeastern North America Decline
Endangered. In long term (30-70%) or short term (10-50%; NatureServe 2013). This criterion may not warrant inclusion as the northeastern North American range of the species, infraspecific taxon or DU is the same, or largely the same, as its global range. This claim becomes a bit tricky because these reports are dealing with DU's that are entirely in Ontario and there is lack of consensus in the species/subspecies taxonomy (Crother *et al.* 2012).

5. Ontario Occurrences
Endangered. There are only two extant element occurrences in the Carolinian DU (COSEWIC 2012)**.**

6. Ontario Decline
Endangered. There are < 20 extant element occurrences and more than 85% of historical locations have been extirpated (COSEWIC 2012)**.**

7. Ontario's Conservation Responsibility
Not in any category. The current population of the Carolinian DU represents < 5% of the global population (COSEWIC 2012).

3.2 APPLICATION OF SECONDARY CRITERIA (Threats and Vulnerability)

8. Population Sustainability

Endangered. There is evidence that the Ojibway subpopulation is still declining and cannot sustain itself. Total number of adults in the Carolinian DU may be as few as 50, which makes the population vulnerable to stochastic genetic and demographic events that could lead to imminent extinction (COSEWIC 2012).

9. Lack of Regulatory Protection for Exploited Wild Populations

Not in any category. The Massasauga is currently listed as Threatened under the *Ontario Endangered Species Act,* 2007 and Threatened (Schedule 1) under the federal *Species at Risk Act*, 2002 (Parks Canada 2009b). This species is also a “specially protected reptile" under Ontario's *Fish and Wildlife Conservation Act* (January 1999). It is illegal to harm, harass, possess, or kill a Massasauga in Ontario.

10. Direct Threats

Endangered. There are many and varied threats to this DU including loss of habitat, mortality on roads, persecution, illegal collection for trade, and effects of small population size (COSEWIC 2012). Taken together these represent serious threats to the persistence of the DU. Overall threat is more serious for the Ojibway population where habitat is highly fragmented. Most of the habitat of the Wainfleet population is protected but this population is still subject to illegal collection and effects of small population size.

11. Specialized Life History or Habitat-use Characteristics

Endangered. Most females only give birth once every 2-3 years, and given an age of maturity of 3-6 years and a maximum life span of 12 years, most females will not produce more than two dozen young in their lifetime. Indeed, in Wainfleet Bog few females produce more than one litter in their lives (COSEWIC 2012). The Ojibway population is confined to tallgrass prairie habitat whereas the Wainfleet population is confined to a Carolinian peatland. Both are provincially rare habitats. Massasaugas also often hibernate in large numbers in the same place which renders them susceptible to a single threat such as cold temperatures or anthropogenic threats such as illegal collection or disturbance for construction of roads, buildings or mineral extraction (COSEWIC 2012). Most of these threats are ranked as being of “high” level of concern in the draft Massasauga recovery plan (Parks Canada Agency 2012). When large proportions of subpopulations share a confined common hibernaculum threats may become more significant.

3.3 COSSARO EVALUATION RESULTS

1. Criteria satisfied in each status category

Number of primary and secondary criteria met in each status category:

ENDANGERED – [4/3]
THREATENED – [2/0]
SPECIAL CONCERN – [0/0]

Ontario-specific criteria met in each status category (primary criteria 5, 6 and 7):

ENDANGERED – [2]
THREATENED – [0]
SPECIAL CONCERN – [0]

2. Data Deficiency

No.

3. Status Based on COSSARO Evaluation Criteria

The application of COSSARO evaluation criteria suggests that **Massasauga (Carolinian DU)** is **Endangered** in Ontario.

PART 4

ONTARIO STATUS BASED ON COSEWIC EVALUATION CRITERIA

4.1 APPLICATION OF COSEWIC CRITERIA

Regional (Ontario) COSEWIC Criteria Assessment

Criterion A – Decline in Total Number of Mature Individuals
There is insufficient historical information on population size and trends to estimate amount of decline.

Criterion B – Small Distribution Range and Decline or Fluctuation
Endangered. Both the EO and IAO meet Endangered thresholds (B1,2), the population is known to exist at only two locations (Ojibway and Wainfleet (a), and there is a continuing decline (observed, inferred and projected) in EO, IAO, quality of habitat, and number of mature individuals (i,ii,iii,v).

Criterion C – Small and Declining Number of Mature Individuals
Endangered. There are fewer than 2,500 adults, there is a continuing decline, and no population is estimated to contain > 250 mature individuals (C2ai).

Criterion D – Very Small or Restricted Total Population
Endangered. Population is estimated to have between 40-110 mature individuals (<250 mature individuals).

Criterion E – Quantitative Analysis
Insufficient information. The quantitative analysis that is available is not considered robust enough to meet this criterion.

Rescue Effect
No. The subspecies is in decline across its North American range and protected in almost every jurisdiction. Both Carolinian subpopulations are isolated geographically and genetically (Chiucchi and Gibbs 2010) from the Great Lakes/St. Lawrence populations and the closest U.S. populations.

Special Concern Status
NA

4.2 COSEWIC EVALUATION RESULTS

1. Criteria satisfied in each status category

ENDANGERED – [yes]
THREATENED – [no]
SPECIAL CONCERN – [no]

2. Data Deficiency
No

3. Status Based on COSEWIC Evaluation Criteria
The application of COSEWIC evaluation criteria suggests that **Massasauga (Carolinian DU)** is **Endangered** in Ontario.

PART 5

ONTARIO STATUS DETERMINATION

5.1 APPLICATION OF COSSARO AND COSEWIC CRITERIA

COSSARO and COSEWIC criteria give the same result. **Yes**

5.2 SUMMARY OF STATUS EVALUATION

Massasauga (Carolinian DU) is classified as **Endangered** in Ontario.

The Massasauga (*Sistrurus catenatus*) is a relatively small, thick-bodied rattlesnake with distinctive hourglass markings on its dorsum. It ranges from southern Ontario west and southwest through the Midwestern United States into northern Mexico. In Ontario, the Massasauga occurs as two Designatable Units: (1) in the Georgian Bay region, and (2) in the Carolinian region along the north side of Lake Erie. The two DUs are widely separated by about 200 km with no evidence they were ever connected historically. Massasaugas from these two regions differ genetically, and occupy different habitats. The Carolinian DU historically occurred in at least 17 locations in southwest Ontario between Toronto and Windsor, but since the 1970s only two widely separated populations remain: in remnant tallgrass prairie at Ojibway Prairie in Windsor, and in remnant peatlands in Wainfleet Bog near Port Colborne. This part of Ontario is intensively agricultural and becoming increasingly urbanized. These Massasaugas have experienced extreme habitat loss, and high road mortality from the extensive road network. Being venomous they have suffered heavily from human persecution. The Ojibway Prairie population is currently so reduced that extirpation in the coming years is likely. Consequently the Carolinian DU is designated as Endangered in Ontario.

Information Sources

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2. Community and Aboriginal Traditional Knowledge Sources

ATK supplied to the COSEWIC (2012) report has been incorporated into this report where applicable.

APPENDIX 1

NORTHEASTERN NORTH AMERICA STATUS RANK AND DECLINE

	Subnational Rank	Sources	Decline	Sources
CT	NA	NatureServe	See section 3.1.4	NatureServe
DE	NA	NatureServe		
IL	S2	NatureServe		
IN	S2	NatureServe		
IA	S1	NatureServe		
LB	NA	NatureServe		
KY	NA	NatureServe		
MA	NA	NatureServe		
MB	NA	NatureServe		
MD	NA	NatureServe		
ME	NA	NatureServe		
MI	S3S4	NatureServe		
MN	S1	NatureServe		
NB	NA	NatureServe		
NF	NA	NatureServe		
NH	NA	NatureServe		
NJ	NA	NatureServe		
NS	NA	NatureServe		
NY	S1	NatureServe		
OH	SNR	NatureServe		
ON	S3	NatureServe		
PA	S1	NatureServe		
PE	NA	NatureServe		
QC	NA	NatureServe		
RI	NA	NatureServe		
VA	NA	NatureServe		
VT	NA	NatureServe		
WI	S1	NatureServe		
WV	NA	NatureServe		

Occurs as a native species in 10 of 29 northeastern jurisdictions
Srank or equivalent information available for 9 of 10 jurisdictions = (90%)
S1, S2, SH, or SX in 7 of 9 = (77%)