Ontario Species at Risk Evaluation Report for Porter's Twisted Moss (*Tortula porteri*)

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

Assessed by COSSARO as Not at Risk

December 2016

Final

Tortule méridionale (*Tortula porteri*)

La tortule méridionale est une bryophyte de très petite taille, qui mesure moins de 3 mm de hauteur. Elle est dioïque, c'est-à-dire que ses organes reproducteurs mâles et femelles se trouvent sur deux plantes différentes, et semble avoir un cycle végétatif annuel. L'espèce avec laquelle la tortule méridionale risque le plus d'être confondue est un membre de la même famille : la tortule éphémère. Elles se différencient par leurs caractéristiques morphologiques et chimiques, ce qui ne peut être vérifié sur le terrain.

En Ontario, 15 sous-populations de tortule méridionale sont connues. L'une d'entre elles, qui se trouvait sur l'île Middle, a été décimée en raison de la dégradation de son habitat, attribuable à la nidification des cormorans à aigrettes. Il n'existe pas de données permettant de définir les tendances en matière de population pour les autres sous-populations, mais on sait que la plupart d'entre elles sont présentes sur les propriétés publiques, telles que les parcs nationaux et les aires de conservation. D'autres sous-populations restent sans doute à découvrir, car c'est une espèce qui pousse souvent dans des endroits inaccessibles (par exemple, des falaises escarpées).

On ne trouve la tortule méridionale que dans la zone carolinienne de l'Ontario, où elle est associée aux roches calcaires du Paléozoïque exposées. Son indice de zone d'occupation est très proche de la superficie des roches du Paléozoïque dans la région. La tortule méridionale colonise les surfaces rocheuses nues, et ne tolère pas la concurrence des mousses et des plantes vasculaires plus grandes qu'elle. Elle peut persister sur les roches érodées provenant des carrières, mais elle semble incapable de coloniser de nouvelles parois rocheuses fraîchement exposées.

Il n'existe pas de données sur le déclin de la population de la tortule méridionale. L'une de ses sous-populations est disparue, et les tendances entourant les 14 autres lieux ne sont pas connues. D'après les projections des modèles climatiques, des zones possédant à la fois un climat adéquat et des substrats de roche exposée et calcaire du Paléozoïque n'apparaîtront pas d'ici 2100 en Ontario.

À la lumière des données disponibles, le CDSEPO considère que la tortule méridionale est une espèce non en péril, compte tenu de sa longue persistance dans les lieux où les menaces sont manifestement peu nombreuses.

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Porter's Twisted Moss» *n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère des Richesses naturelles et des Forêts au recovery.planning@ontario.ca.*

Executive summary

Porter's Twisted Moss is a tiny bryophyte less than 3 mm in height. It is dioicous, with male and female reproductive structures on separate plants, and is presumed to have an annual lifecycle. Porter's Twisted Moss is most likely to be confused with another member of the same family, Heim's Pottia. These two species can be distinguished by morphological and chemical features, which cannot be confirmed in the field.

In Ontario, Porter's Twisted Moss is known from 15 subpopulations. One of these subpopulations occurred on Middle Island. It was destroyed due to habitat degradation caused by nesting Double-crested Cormorants. No population trend data is available for the remaining subpopulations, but most occur on public property, including National Park lands and Conservation Areas. It is likely that additional subpopulations remain undocumented, as this species tends to occur in inaccessible locations (i.e., steep cliffs).

Porter's Twisted Moss is limited to the Carolinian zone of Ontario, where it is associated with exposed, calcareous palaeozoic rock. The Index of Area of Occupancy closely matches the extent of Palaeozoic rock in this region. It colonizes bare rock surfaces, and cannot tolerate competition from larger mosses or vascular plants. It can persist on weathered rock that has been moved from quarries, but apparently is unable to colonize freshly cut rock-faces.

No information on population decline is available. One subpopulation is extirpated; no trends are available for the remaining 14 locations. Climate model projections suggest that areas with both suitable climate and exposed calcareous palaeozoic rock substrates will not exist in Ontario by 2100.

After reviewing the available data, COSSARO assessed this species as Not at Risk, due to its long-term persistence at sites with few apparent threats.

1. Background information

1.1. Current designations

- GRANK: G3? (NatureServe 2016: assessed in 1999 as *Desmatodon porteri* James in Austin.)
- NRANK Canada: N1
- COSEWIC: Not at Risk (2016)
- SARA: Not Listed
- ESA 2007: Not Listed (2016)
- SRANK: S2 (ranked in 2015)

1.2. Distribution in Ontario

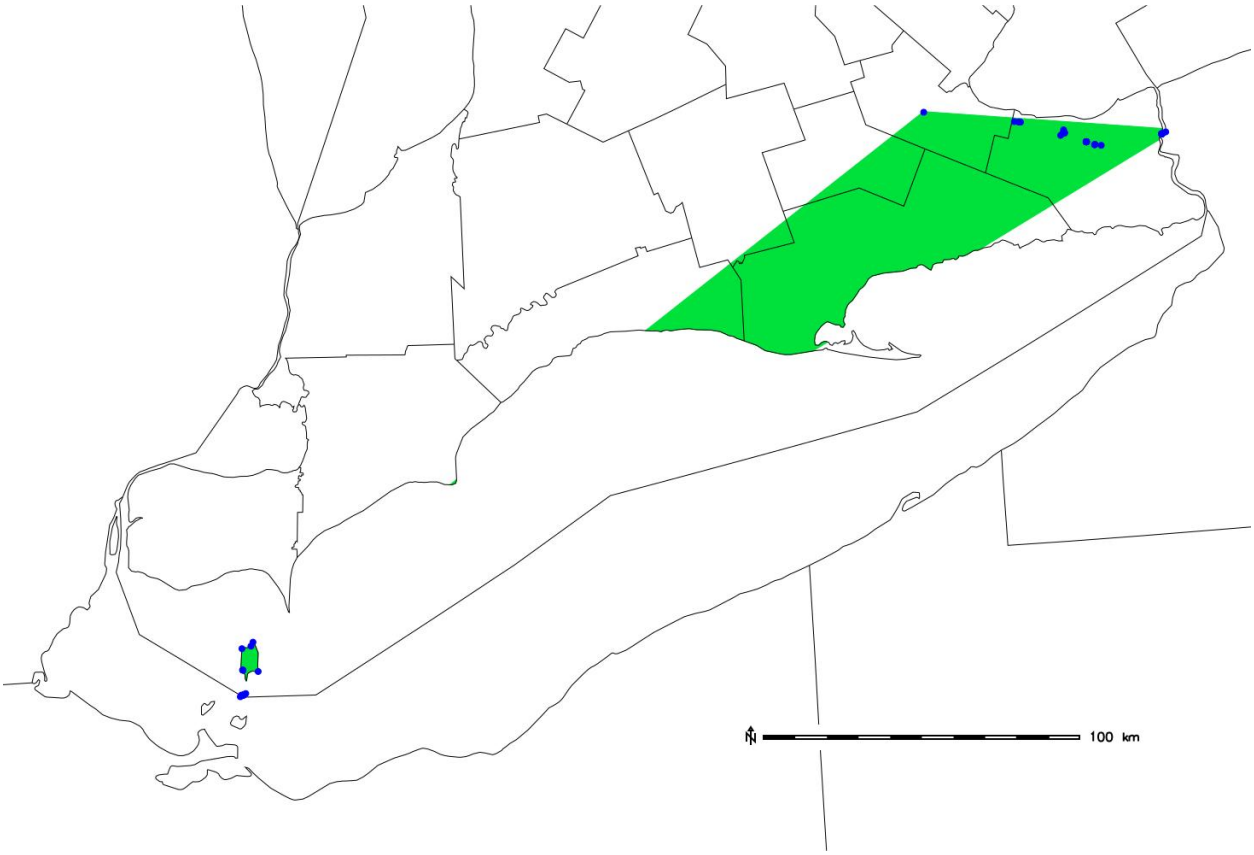
Porter's Twisted Moss has been documented at 15 subpopulations in Ontario (Figure 1). (One subpopulation is reported in the NHIC database, but not in COSEWIC 2016). One of these, on Middle Island in Lake Erie, is now extirpated. The habitat on Middle Island was destroyed by Double-crested Cormorants; the chemistry of all rock surfaces there has been dramatically changed by cormorant feces.

Five of the extant subpopulations are on Pelee Island (four on crown land). The remaining nine subpopulations are in the Niagara region, and are mostly on protected public land (four owned by the Niagara Peninsula Conservation Authority, two by Parks Canada).

Although there was substantial targeted survey effort for this species in 2014, it is possible that additional locations remain undiscovered. Much of its suitable habitat, especially along the Niagara Escarpment, is at physically inaccessible sites on private property.

Each of the extant subpopulations is considered to be a distinct location. Climate change is expected to have a negative impact on the entire Canadian population in the next century, but this is outside the three-generation (i.e., three years for this annual) horizon for status assessment. None of the threats that are likely to have a serious impact on this species within three years are likely to affect more than a single subpopulation.

Figure 1. All Ontario Porter's Twisted Moss records from the NHIC database as of November 9, 2016. Most of these are currently classified as 'candidate EOs'. The estimated extent of occurrence is shown in green, 4920 km2. The northernmost record, in Hamilton, was not mapped for the COSEWIC status report. Consequently, the EOO here is larger than the COSEWIC estimate.



1.3. Distribution and status outside Ontario

Porter's Twisted Moss occurs across the northeastern USA, from Oklahoma and Iowa east to Virginia and New Hampshire. A single specimen has been confirmed from Venezuela. Additional records from Quebec are all believed to be mislabeled or misidentified specimens.

1.4. Ontario conservation responsibility

Less than 1% of the global population occurs in Ontario.

1.5. Direct threats

Cormorants have directly destroyed the habitat of Porter's Twisted Moss on Middle Island. Climate change modeling indicates that climate suitable for this species may disappear from southern Ontario in the next 100 years.

Other potential threats include habitat degradation due to mining, recreational activity (especially rock climbing), and land slides.

The overall threat assessment by the COSEWIC (2016) review was “Low”, in part as a consequence of most of the remaining subpopulations occurring in protected areas.

1.6. Specialized life history or habitat use characteristics

Porter's Twisted Moss is presumed to be an annual species (based on its minute size and intolerance of competition) that colonizes bare rock surfaces. It does not tolerate competition from other plants, and has specialized substrate requirements. Consequently, although it is apparently secure in its current subpopulations, it is unlikely that it will be able to migrate to new habitat in response to shifting climate.

2. Eligibility for Ontario status assessment

2.1. Eligibility conditions

2.1.1. Taxonomic distinctness

There is no taxonomic uncertainty around the status of this species. It was first described in 1870, as *Desmatodon porteri* James in Austin. The first Canadian specimens were described as *Barbula subcarnifolia* C. Mull. & Kindb. in Macoun & Kindb., but this species is now considered a synonym of *D. porteri*. Modern taxonomic treatments place *D. porteri* in the genus *Tortula* (i.e., *Tortula porteri,* as in Zander and Eckel 2007).

2.1.2. Designatable units

There is no data to support recognizing separate DUs within Porter's Twisted Moss. Only one DU is appropriate for this species.

2.1.3. Native status

There is no uncertainty around the native status of this species, which was first collected in Ontario in 1892.

2.1.4. Occurrence

This species currently occurs in Ontario, and is apparently native here.

2.2. Eligibility results

Porter's Twisted Moss (*Tortula porteri*) is eligible for status assessment in Ontario.

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

3.1.1. Criterion A – Decline in total number of mature individuals

Insufficient information. The only evidence of a decline in the number of mature individuals is the loss of the MIddle Island subpopulation. However, there is no data to allow for quantifying the extent of this loss. It is not likely the loss amounts to more than 30% of the total population, the threshold for applying criterion A.

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Insufficient information. The extent of occurrence of this species (EOO = 4920 km^2) is below the threshold for Endangered status under criteria B1 (5000 km^2). The Index Area of Occupancy (IAO = 60 km^2) also meets the threshold for Endangered under B2 (500 km^2) However, these thresholds only apply if the population is severely fragmented or exists at less than 10 locations; there is a continuing inferred or observed decline; or there are extreme fluctuations in EOO, IAO, locations or number of mature individuals.

None of these conditions obtain. The subpopulations do not qualify for consideration as highly fragmented. The IUCN guidelines on fragmentation state in part: “A taxon can be considered to be severely fragmented if most (>50%) of its total area of occupancy is in habitat patches that are ... smaller than would be required to support a viable population” (IUCN 2016). The available data suggest that this species is capable of persisting for long periods (> 150 years at one subpopulation) in very restricted habitat patches.The species is currently known from 14 locations, and more may be discovered as more suitable habitat is searched.

The only evidence of decline is the loss of the Middle Island population. This is attributed to the unique situation at that site (the Cormorant nesting colony), and that threat is not likely to impact other subpopulations. There is no indication of extreme fluctuations; indeed some of the subpopulations have persisted for more than a century (e.g., Niagara Glen, first documented in 1901, and Pelee Island, first documented in 1882).

3.1.3. Criterion C – Small and declining number of mature individuals

Insufficient information. The number of mature individuals is not known.

3.1.4. Criterion D – Very small or restricted total population

Does not apply. Close to the threshold for Threatened under D2 (IAO 60 km^2, threshold < 20 km^2). However, the number of locations exceeds the threshold (14 locations, threshold <= 5). Furthermore, there is no expectation that human activities or stochastic events will lead to critical endangerment within 1-2 generations, so D2 does not apply.

3.1.5. Criterion E – Quantitative analysis

Insufficient information. No quantitative analysis has been performed.

3.2. Application of Special Concern in Ontario

Does not apply. Porter's Twisted Moss meets some of the criteria for Special Concern: it is meets some parts of criteria for Endangered under criteria B1 and B2, as described above. However, given the low threat assessment, and the apparent stability of the existing populations, there is no indication that this species is likely to decline to such an extent as to satisfy the criteria for Threatened in the near future (i.e., 2-3 generations or 10 years.) Accordingly, Special Concern status does not apply.

3.3. Status category modifiers

3.3.1. Ontario’s conservation responsibility

Not applicable. Although this species is ranked G3, less than 25% of the global range and population occur in Ontario.

3.3.2. Rescue effect

Not applicable. Rescue by US populations is considered possible, since there are populations in adjacent New York reported in the mid-1980s (and not reflected in the SH status). Nonetheless, the species is likely rare in the northeast US, and rescue seems improbable.

3.4. Other status categories

3.4.1. Data deficient

Not applicable. There is no trend data available for this species, and mosses in general are undersurveyed in Ontario relative to other taxa. However, the persistence of some subpopulations over many decades suggests that Porter’s Twisted Moss subpopulations are relatively stable. Over 400 person hours were spent in targeted searches in suitable habitat for this species in Canada. Although data are not abundant, a substantial effort has been made to determine the species’ presence in Canada.

3.4.2. Extinct or extirpated

Not applicable.

3.4.3. Not at risk

Not at Risk status is the most appropriate for this species as no other status applies. See discussion under Special Concern and Data Deficient.

4. Summary of Ontario status

Porter's Twisted Moss (*Tortula porteri*) is classified as Not At Risk in Ontario based on long-term persistence at sites with few apparent threats.

5. Information sources

Cameron, R. Personal communication.

COSEWIC. 2016. COSEWIC assessment and status report on the Porter's Twisted Moss *Tortula porteri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 37 pp.

Doubt, J. Personal communication.

IUCN Standards and Petitions Subcommittee. 2016. Guidelines for Using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee.

Ohio Moss and Lichen Association. 2016. *Tortula porteri*. Accessed online December 23, 2016.

Zander, R. H. and Eckel, P. M. *Tortula* Hedwig. *in* Flora of North America Editorial Committee. Flora of North America North of Mexico, Vol. 27: Bryophyta, part 1. Oxford University Press, New York, USA. Accessed online December 13, 2016.

Appendix 1: Technical summary for Ontario

Species: Porter's Twisted Moss (*Tortula porteri*)

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	Probably 1 year
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Unknown, no data available
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown, subpopulations suspected to be relatively stable.
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. N/A b. N/A c. N/A
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value

Estimated extent of occurrence (EOO).	_4920__ km^2 (calculated directly from NHIC records, including extirpated location, explicitly excluding Lake Erie, in GRASS GIS. Note that one NHIC record was not included in the COSEWIC report, and the portion of the EOO that overlapped with Lake Erie was estimated)
Index of area of occupancy (IAO).	_76 km^2 (calculated directly from NHIC EO data in GRASS GIS, including the extirpated location. COSEWIC reported this value as 60 km^2)
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is in habitat patches that are: (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. Unknown
Number of locations	14
Number of NHIC Element Occurrences	15 (1 extirpated)
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Unknown
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Unknown
Is there an observed, inferred, or projected continuing decline in number of populations? (subpopulations?)	Unknown
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Unknown
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

Unknown.

Quantitative analysis (population viability analysis conducted)

A PVA has not been completed.

Threats

- Mining and quarrying (ongoing within Canadian range)
- Recreational activities (particularly rock climbing, ongoing on Niagara Escarpment)
- Problematic native species (Double-crested Cormorants on Middle Island)
- Airborne pollutants (pervasive in southern Ontario)
- Landslides

Was a threats calculator completed for this species and if so, by whom? Yes. By D. Fraser (discussion chair), R. Belland (SSC Co-chair), J. Doubt (report co-writer), R. Boles (CWS), E. Snyder (Ontario), R. Caners (SSC member), K. Golinski (SSC member).

Rescue effect

Rescue effect attribute	Value
Status of outside population(s) most likely to provide immigrants to Ontario	Unknown
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possible
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Yes
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	Unknown

Sensitive species

No.

Appendix 2: Adjoining jurisdiction status rank and decline

Information regarding rank and decline for Porter's Twisted Moss (*Tortula porteri*)

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S2	Unknown	NHIC 2016
Quebec	Not Present	N/A	COSEWIC 2016
Manitoba	Not Present	N/A	COSEWIC 2016
Michigan	Not Present	N/A	NatureServe2016
Minnesota	Not Present	N/A	NatureServe2016
Nunavut	Not Present	N/A	COSEWIC 2016
New York	SH	N/A	NatureServe2016
Ohio	Present	Unknown	not listed in Ohio by NatureServe2016; Ohio Moss and Lichen Association (2016) lists records across Ohio.
Pennsylvania	Not Present	N/A	NatureServe2016
Wisconsin	Not Present	N/A	NatureServe2016

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Endangered Species Act
GRANK: global conservation status assessments
IAO: index of area of occupancy
MNRF: Ministry of Natural Resources and Forestry
NHIC: Natural Heritage Information Centre
NNR: Unranked
NRANK: National conservation status assessment
SARA: Species at Risk Act
SNR: unranked
SRANK: subnational conservation status assessment
S1: Critically imperiled
S3: Vulnerable
S5: Secure
IUCN: International Union for Conservation of Nature and Natural Resources
CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario