

# **Ontario Species at Risk Evaluation Report for Eastern Pondmussel (*Ligumia nasuta*)**

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

Assessed by COSSARO as Special Concern

November 2017

Final

## Ligumie pointue (*Ligumia nasuta*)

La ligumie pointue est une moule d'eau douce de taille moyenne (longueur moyenne de 74 mm) de la famille des *Unionidae*, dotée d'une coquille comprimée et allongée dont la couleur varie du noir jaunâtre au noir verdâtre chez les juvéniles, et du brun foncé au noir chez les adultes. Chez les spécimens de l'Ontario, la couche interne de la coquille est généralement blanc argenté ou blanc bleuté. Il est difficile de distinguer les mâles des femelles par la forme de leur coquille. La reproduction a lieu à la fin de l'été, et la femelle porte ses larves tout l'hiver. Au printemps, les larves atteignent un stade spécifique, celui de glochidie. Elles sont alors libérées et vont se fixer aux branchies d'un poisson-hôte, où elles doivent passer un certain temps pour survivre : c'est grâce à lui qu'elles obtiennent des nutriments et qu'elles atteignent le stade juvénile. On croit que les hôtes des glochidies au Canada sont l'épinoche à cinq épines, l'achigan à grande bouche, le crapet-soleil et la perchaude. Après une certaine période de croissance, les moules juvéniles se détachent de leur hôte et s'enfouissent dans le substrat où elles se nourrissent de bactéries, d'algues et d'autres particules organiques qu'elles trouvent directement dans le substrat ou dans l'eau interstitielle. Une fois adultes, les moules consomment les mêmes types d'aliments, qu'elles obtiennent de la colonne d'eau par filtration. Les habitats privilégiés de l'espèce sont les zones abritées des lacs et les parties des rivières où le courant est faible et où l'on trouve du substrat de sable fin et de boue.

La ligumie pointue n'est présente que dans l'Est de l'Amérique du Nord, depuis les Grands Lacs inférieurs vers l'est jusqu'aux États de New York et du New Hampshire, et vers le sud jusqu'en Caroline du Sud. Au Canada, on la trouve seulement dans la région des Grands Lacs du Sud de l'Ontario, où on la recense habituellement en faibles nombres éparpillés dans des coins isolés de milieux humides dans les Grands Lacs inférieurs et quelques lacs intérieurs. Grâce à la récente intensification du travail de recherche, on a découvert que la ligumie pointue était aussi présente dans certains milieux humides côtiers du lac Érié et du lac Ontario, ainsi que dans plusieurs lacs intérieurs de l'Est de l'Ontario. Cette découverte vient gonfler sensiblement les anciennes estimations quant à la zone d'occupation de l'espèce et au nombre d'endroits où on la trouve. On a également observé une hausse de son abondance dans la sous-population du delta de la rivière Sainte-Claire. Les répercussions sur les populations de l'invasion des moules de la famille des *Dreissenidae* se sont atténuées, bien qu'elles posent toujours problème. Parmi les autres menaces, mentionnons la pollution découlant du rejet d'eaux usées, et les effluents agricoles et industriels. Bien que considérée par le passé comme une espèce en voie de disparition, la ligumie pointue passe au statut d'espèce préoccupante grâce à la découverte de plusieurs nouveaux endroits et à la hausse de son abondance dans au moins une sous-population.

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Eastern Pondmussel» 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 CDSEPO au [COSSAROSecretariat@ontario.ca](mailto:COSSAROSecretariat@ontario.ca).

## Executive summary

Eastern Pondmussel, *Ligumia nasuta*, is a medium-sized (average length of 74 mm) freshwater unionid mussel with a compressed, elongate shell in colours that range from yellowish- to greenish-black in juveniles to dark brown or black in adults. The interior lining of shell is usually silvery-white or bluish-white in Ontario mussels. Males and females are difficult to differentiate on the basis of their shell morphology. Reproduction occurs in late summer, and females brood the larvae over the winter. By the spring, the larvae reach a specialized stage known as glochidia, which are released onto the gills of host fish. In order to survive, glochidia must spend a period of time attached to a host fish; they obtain nutrients from this host and develop into juveniles. Hosts in Canada are thought to include Brook Stickleback, Largemouth Bass, Pumpkinseed and Yellow Perch. After a period of development, the juvenile mussels drop off their hosts, and bury into the substrate where they feed on bacteria, algae and other organic particles obtained directly from the substrate or interstitial water. Adult mussels feed on similar types of food that they filter from the water column. Preferred habitat is found in sheltered areas of lakes and slow-flowing sections of rivers with substrates of fine sand and mud.

Eastern Pondmussel occurs only in eastern North America, with a distribution that runs from the lower Great Lakes east through New York to New Hampshire, and south to South Carolina. In Canada, it has been found only in the Great Lakes region of southern Ontario, where it has typically been recorded at low abundance in many isolated wetland patches in the lower Great Lakes and a few inland lakes. A recent increase in search effort has led to new findings of Eastern Pondmussel in some of the coastal wetlands of Lake Erie and Lake Ontario, and also in several eastern Ontario inland lakes. These new findings substantially increase the previous estimates of area of occupancy and number of locations. In addition, an increase in abundance has been recorded for the St. Clair River delta subpopulation. The impacts of invasive dreissenid mussels on populations have lessened, although they remain a threat. Other threats include pollution from wastewater discharge, and agricultural and industrial effluents. Although previously assessed as Endangered, the discovery of several additional sites and the increase in abundance in at least one subpopulation has allowed the Eastern Pondmussel to be down-listed to Special Concern.

## **1. Eligibility for Ontario status assessment**

### **1.1. Eligibility conditions**

#### **1.1.1. Taxonomic distinctness**

*Ligumia nasuta* (Say) is recognized as a species by Turgeon et al. (1998) and Graf and Cummings (2007). Although taxonomic revisions of the genus *Lagumia* may be forthcoming (Zanatta and Murphy, 2006; Kuehn, 2009), these do not reflect any uncertainty regarding the taxonomic distinctness of *L. nasuta*.

#### **1.1.2 Designatable units**

All Canadian subpopulations are found within the Great Lakes-Upper St. Lawrence National Freshwater Biogeographic Zone (COSEWIC, 2017). Additionally, there is no evidence of multiple DUs based on mitochondrial DNA sequences of Eastern Pondmussels sampled across the Great Lakes region including sites in Ontario (Scott et al. 2014).

#### **1.1.3 Native status**

Eastern Pondmussel was first recorded in Canada in 1860 (COSEWIC, 2017). It is considered a native Ontario species.

#### **1.1.4 Occurrence**

Numerous records from the past decade show the Eastern Pondmussel still occurs in Ontario.

## **1.2. Eligibility results**

Eastern Pondmussel (*Ligumia nasuta*) is eligible for status assessment in Ontario.

## **2. Background information**

### **2.1. Current designations**

- GRANK: G4 (NatureServe accessed October, 2017)
- NRANK Canada: N1
- COSEWIC: Special Concern (2017)
- SARA: Endangered (Schedule 1)
- ESA 2007: Endangered (April, 2007)
- SRANK: S1 (ranked in 2013)

### **2.2. Distribution in Ontario**

Prior to the invasion of dreissenid mussels in the 1980s, Eastern Pondmussel was one of the most common species of freshwater mussel in the lower Great Lakes region. Since that time it has apparently been eliminated from numerous sites in the offshore waters of Lake St. Clair and Lake Erie in Canada, although a subpopulation with an estimated size of 270,000 – 1,200,000 individuals remains in the nearshore areas of the St. Clair River delta (Figure 1). Extant subpopulations (of unknown sizes) exist in the coastal wetlands of Lake Erie and Lake Ontario, and several eastern Ontario inland lakes and rivers including Fishing, Loughborough and White/Ingelsby lakes, and Lyn Creek (a tributary of the upper St. Lawrence River). A recent increase in sampling effort identified previously unknown subpopulations along the Lake Ontario nearshore in the lower Trent River, Rouge River Marsh, Carruthers Creek, Lynde Creek Marsh, Presqu'ile Bay (shells only), Weller's Bay and Pleasant Bay Marsh; the majority of these assessments were based on records of live individuals (Figure 2), and reflect an increase in search effort in recent years (Table 1).

The recent COSEWIC assessment identifies a total of 15 subpopulations (COSEWIC, 2017): Detroit River, St. Clair River Delta, Lake Erie, Sydenham River, Grand River, Coyle Creek (Welland River), Niagara River, Lake Ontario, Mill Dam Pond (Rouge River), White/Ingelsby Lake, Beaver Lake, Loughborough Lake, Fishing Lake, Whitefish Lake, and Lyn and Golden Creeks. NHIC currently lists 16 EO<sub>s</sub>, although records from two of these pre-date the ‘current’ timeframe as defined by COSEWIC (2017) (pre-2007), and additional records are awaiting review and verification by NHIC.

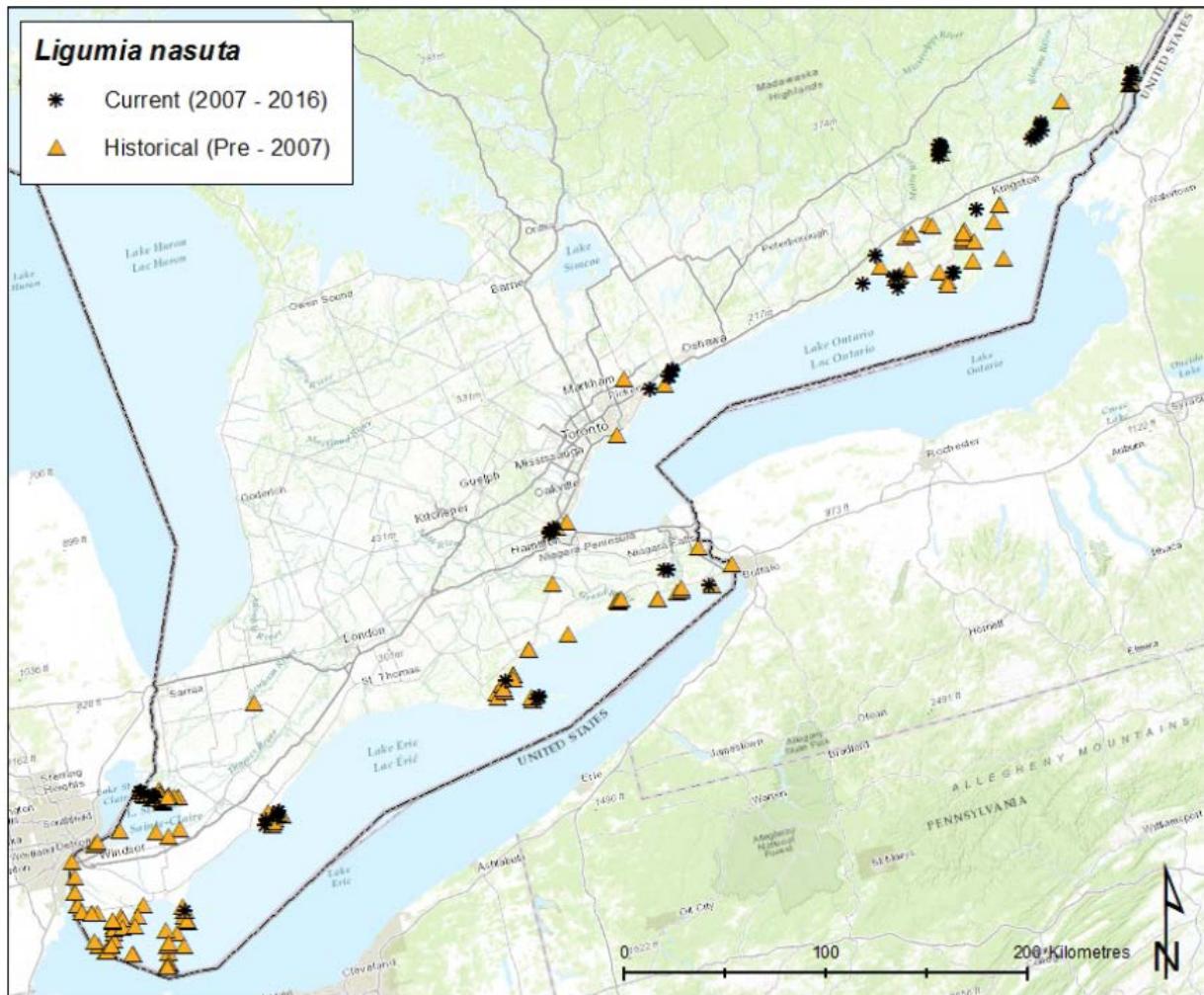


Figure 1. Historical (1894-2006) and current distribution (2007-2015) of Eastern Pondmussel in Canadian water (based on records from the Lower Great Lakes Unionid Database). Historical distributions are based on 255 records, 20% of which represent known live occurrences; the remaining historical records are for shells that, in many cases, could have washed up on the shore from deeper water. Figure copied from COSEWIC (2017).

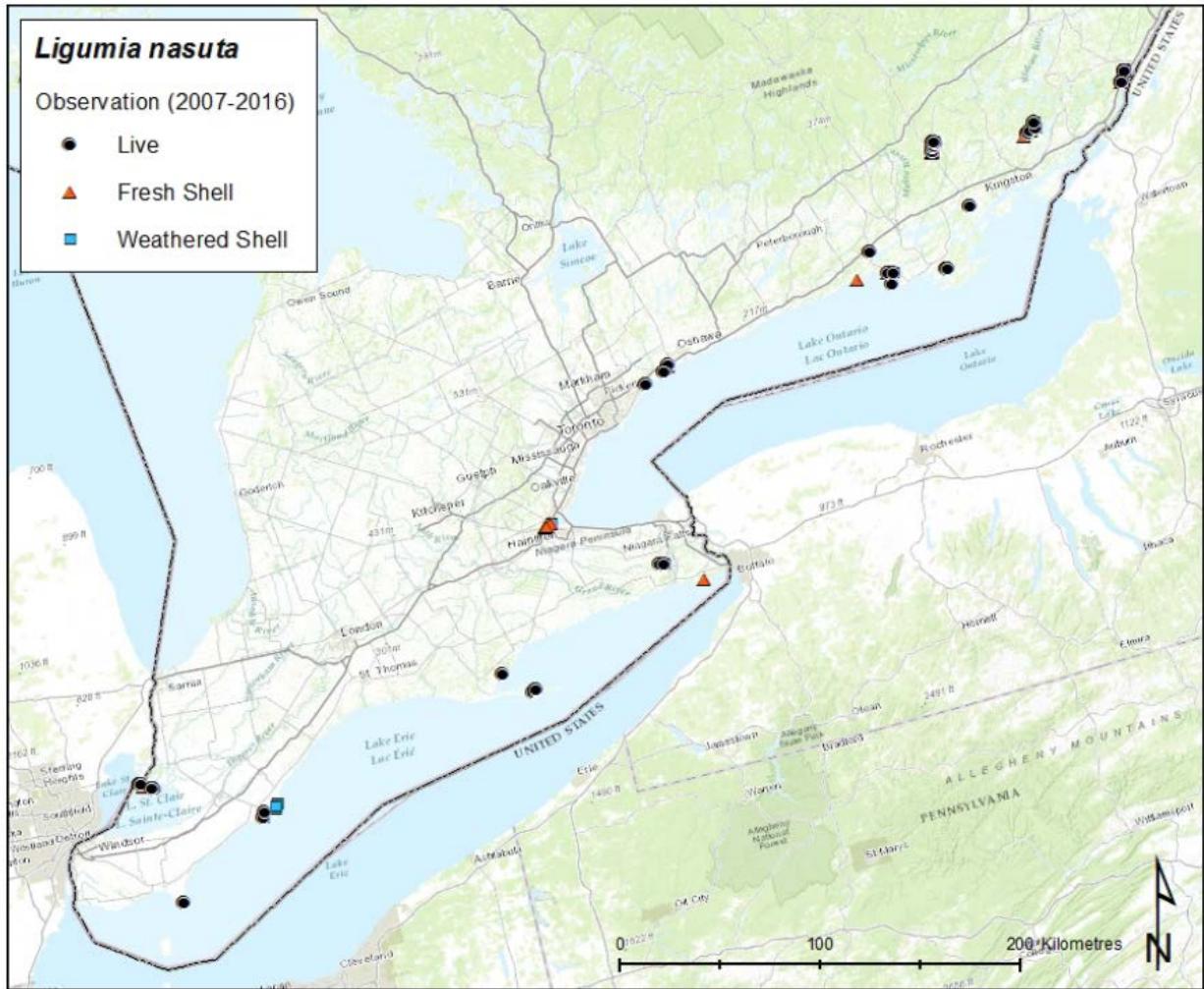


Figure 2. Current distribution of Eastern Pondmussel in Canadian water with condition of specimen indicated (live, fresh shell or weathered shell). Figure copied from COSEWIC (2017).

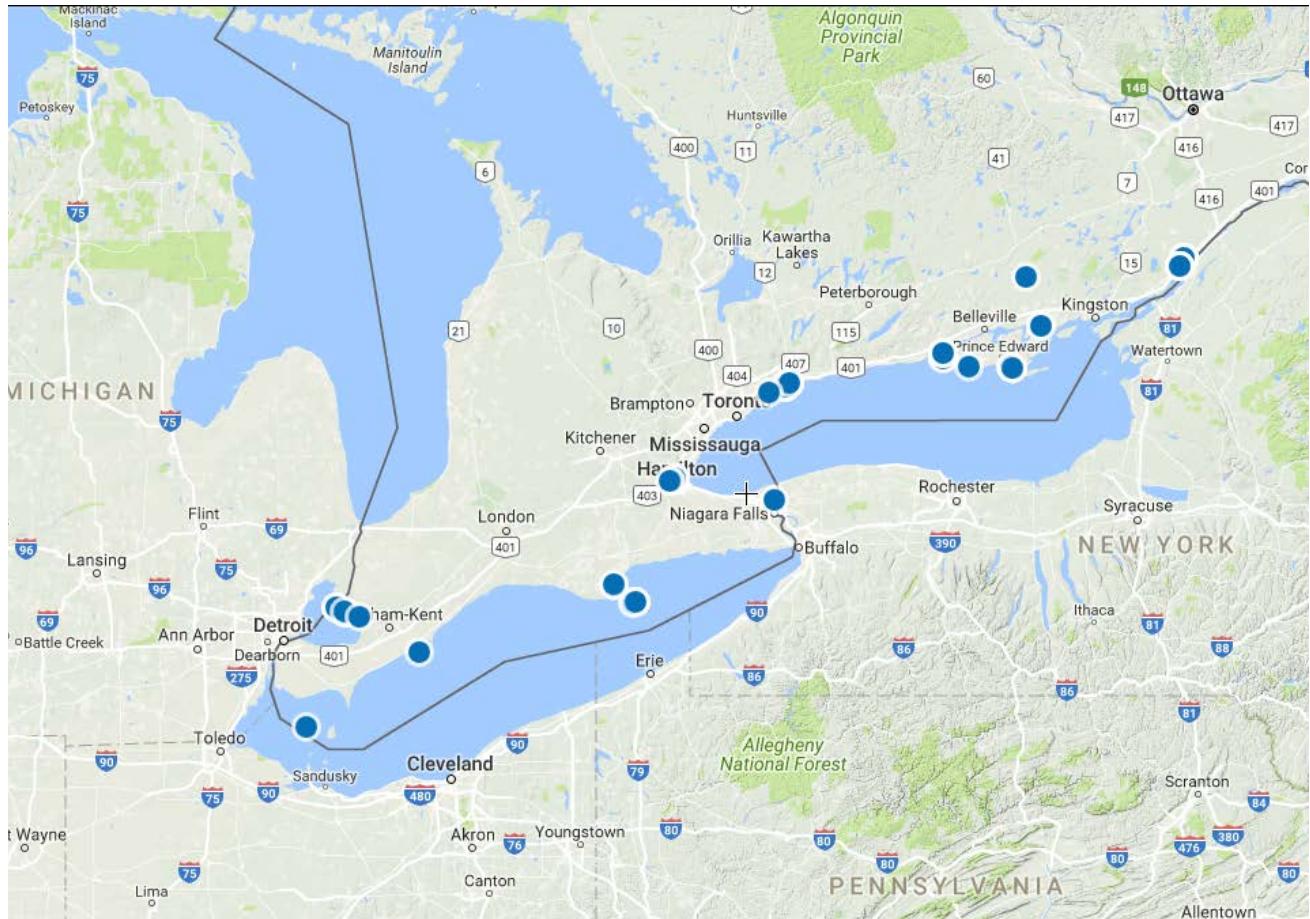


Figure 3. Recent (2007 onwards) observations of Eastern Pondmussel from the NHIC database as of October, 2017. A number of records are awaiting review and verification by NHIC. Map created for this report using [GeoCAT](#) (Bachman et al. 2011; website accessed October 19<sup>th</sup>, 2017).

Table 1. Summary of recent (2007 onwards) unionid sampling effort within the Canadian range of Eastern Pondmussel. PH refers to the number of person-hours searched and numbers in superscript signify the sites where only shells were found. Data and table from COSEWIC (2017).

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Beaver Lake	0/1 <sup>1</sup>	2012	Shoreline search	Not applicable	Schueler unpublished data
Beaver Lake	9/12 <sup>1</sup>	2015	2 PH clam rake and visual/tactile	Targeted EPM surveys	Reid unpublished data
Fishing Lake	2/7 <sup>5</sup>	2015	Shoreline search	Targeted EPM surveys	McRae and Schueler unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Grand River	0/11	2007	Visual and shoreline searches	Targeted Rainbow surveys	Timmerman unpublished data
Grand River	0/2	2007	Hand searching and excavation	Not applicable	Mackie unpublished data
Grand River	0/4	2007	48-65 x 1 m <sup>2</sup> quadrats	All sites included in Metcalfe- Smith et al. 2000b	Morris unpublished data
Grand River	0/11	2008	Visual and shoreline searches	Targeted surveys for Rainbow	Timmerman unpublished data
Grand River	0/7	2008	Unknown	Not applicable	Zanatta unpublished data
Grand River	0/1	2008	825 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Region of Waterloo and Stantec)	Mackie 2008a
Grand River	0/5	2009	Visual and shoreline searches	Targeted surveys for Rainbow	Timmerman unpublished data
Grand River	0/1	2009	1525 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Bot Construction)	Mackie 2009
Grand River	0/4	2010	Visual and shoreline searches	Targeted surveys for Rainbow	Timmerman unpublished data
Grand River	0/1	2010	3.8 PH timed search	Not applicable	Morris unpublished data
Grand River	0/2	2010	78 and 93 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Region of Waterloo and Ecoplans)	Mackie 2010
Grand River	0/4	2011	6 PH timed search/half-hectare method	Not applicable	Morris unpublished data
Grand River	0/6	2011	4.5 – 6 PH timed search	Resurveys	Morris unpublished data
Grand River	0/1	2011	10 PH timed search	Not applicable	Gillis unpublished data
Grand River	0/1	2011	435 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Natural Resource Solutions)	Mackie 2011
Grand River	0/15	2012	Visual and shoreline searches	Targeted Rainbow surveys	Timmerman unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Grand River	0/1	2012	Timed search 3 PH	Resurvey	Morris unpublished data
Grand River	0/2	2012	8 PH timed search	Not applicable	Gillis unpublished data
Grand River	0/1	2012	3640 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Natural Resource Solutions)	Mackie 2012
Grand River	0/1	2012	289 x 1 m <sup>2</sup> quadrats	Grand River relocation project (Ministry of Transportation and Dufferin Construction)	Mackie et al. 2012
Grand River	0/1	2013	Visual search	Informal survey before potential relocation project	Mackie pers. comm. 2014
Grand River	0/2	2013	2.25 and 8 PH timed search	Resurvey	Ackerman unpublished data
Grand River	0/1	2013	5 PH timed search	Resurvey	Morris unpublished data
Grand River	0/1	2014	30 PH timed search	Resurvey	Morris unpublished data
Grand River	0/2	2015	17.5 PH timed search	Resurvey	Morris unpublished data
Lake Erie	0/3	2007	Unknown	Long Point	Gilbert unpublished data
Lake Erie	1/2	2008	6 PH timed search	Cedar Creek Marsh (live EPM) and Crown Marsh	Gilbert and Oldenburg 2013
Lake Erie	0/1	2009	28 PH timed search	Cedar Creek Marsh Targeted EPM survey	Gilbert and Oldenburg 2013
Lake Erie	1/1	2009	3 PH	Turkey Point	Gilbert and Oldenburg 2013
Lake Erie	0/11	2013	Shoreline search	Bay Beach	Schueler unpublished data
Lake Erie	1/1	2013	4.5 PH timed search	McGeachy Pond	Morris unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Lake Erie	0/126	2014	4.5 PH visual/tactile search with viewers	Rondeau Bay Targeted Rainbow survey	Reid and Morris unpublished data
Lake Erie	1/212	2015	4.5 PH visual/tactile search with viewers	Rondeau Bay (live and shells), Gravelly Bay, Nickel Beach, Lynn River, Port Dover Beach, Selkirk Provincial Park Beach and Wetland (15 sites Rondeau Bay, 1 site each for the rest). Targeted EPM survey	Reid unpublished data
Lake Erie	0/1	2015	Incidental Search	Lake Henry, Pelee Island	Ontario Parks unpublished data
Lake Erie	0/1	2016	20 x 50 x 50 m blocks tactile search	Lake Henry, Pelee Island	Ontario Parks unpublished data
Lake Erie	1/10	2016	4.5 PH tactile and clam rake	Lake Pond (live EPM and shells; 5 sites surveyed), East Cranberry Pond (1 site), Sanctuary Pond (3 sites) and West Cranberry Pond (1 site) in Point Pelee National Park	Reid and Morris unpublished data
Lake Ontario	0/44	2007	Shoreline search	Blackbird Marsh, Hopkin's Bay, Carroll's Bay	Royal Botanical Gardens unpublished data
Lake Ontario	0/11	2008	Shoreline search	Carrol's Bay	Royal Botanical Gardens unpublished data
Lake Ontario	0/11	2009	Shoreline search	Sunfish Pond	Royal Botanical Gardens unpublished data
Lake Ontario	0/11	2010	Shoreline search	Spencer Creek	Royal Botanical Gardens unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Lake Ontario	8/726	2011	2 PH visual/tactile and clam rake	Targeted SAR surveys in coastal wetlands. Live EPM found in Lynde Creek and Marsh, and Hay Bay/Wilton Creek. Shells found in Presqu'ile Bay. None in Duffin's Creek Marsh, Port Britain Marsh, Oshawa Second Marsh.	Reid unpublished data
Lake Ontario	0/3	2011	3.5 PH scoops – half- hectare method	Sunfish Pond, Grindstone Creek, Carrolls Bay	Morris unpublished data
Lake Ontario	12/2063	2012	2 PH visual/tactile and clam rake	Targeted SAR surveys in coastal wetlands. Live EPM found in Rouge River Marsh, Carruthers Creek, Pleasant Bay Marsh and East Lake Marsh. Shells found in Presqu'ile Bay. None in Humber River Marsh, Huyck's Bay, Jordan Station, Big Island Marsh, Big Sand Bay, Bowmanville Marsh, McLaughlin Bay, Parrott Bay, Sawguin Creek Marsh, West Lake Marsh, Wilmot Creek and West Side Marsh. 12 sites per wetland. Live EPM at Lynde Creek resurvey (2 sites, approx. 20 PH total)	Reid unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Lake Ontario	3/1803	2013	2 PH clam rake and visual/tactile or 4.5 PH timed search (Trent River Tributaries)	Targeted SAR surveys in coastal wetlands and Trent River tributaries. Live EPM found in Consecon Lake and the Lower Trent River. None found in Bell Creek Complex, Belleville Marsh, Cootes Paradise, Great Cataraqui Marsh, Hills Island, Johnson Bay, Jones Creek, Landon's Bay, Lower Napanee River, Presqu'ile Bay, Sixteen and Seventeen Mile Creek, Thompson Bay or Trent River tributaries. 12 sites per wetland/locality.	Reid unpublished data
Lake Ontario	0/10	2013	2 – 3 PH quadrat survey	Targeted EPM surveys in the Rouge River	Whibbs (Toronto Zoo) unpublished data
Lake Ontario	0/2	2014	1 and 10 PH timed search with scoops	Jordan Harbour	T.J. Morris unpublished data
Lake Ontario	0/9	2014	2 – 3 PH quadrat survey	Targeted EPM surveys in the Rouge River	Whibbs (Toronto Zoo) unpublished data
Lake Ontario	2/891	2015	2 PH clam rake and visual/tactile	Targeted SAR surveys in coastal wetlands and Trent River. EPM shell found in Weller's Bay. None in Black River, Dead Creek, Martindale Pond, Milne Pond, Trent River and Wesleyville Wetland. Live EPM in East Lake Marsh resurvey (10 PH at 1 site) and Rouge River resurvey (9 PH at 1 site).	Reid unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Lake Ontario	0/21	2015	1 – 7.5 PH timed search	Includes Sixteen Mile Creek Pond and Wetland, Four Mile Creek and Pond, Fifteen Mile Creek and Pond, and Martindale Pond.	Wright et al. in Prep (b)
Lake Ontario	0/101	2015	4.5 – 5 PH timed search	EPM & Mapleleaf survey in Cootes Paradise.	Wright et al. in Prep (b)
Loughborough Lake	0/11	2009	Shoreline search	Not applicable	Schueler unpublished data
Loughborough Lake	5/12	2015	2 PH clam rake and visual/tactile	Targeted EPM surveys	Reid unpublished data
Lyn and Golden creeks	1/1	2007	Shoreline survey	Targeted EPM surveys at the Lyn Creek and Golden Creek confluence.	Schueler unpublished data
Lyn and Golden creeks	1/1	2008	Unknown	Targeted EPM survey	McNichols-O'Rourke and Ackerman unpublished data
Lyn and Golden creeks	4/4	2008	Shoreline survey	Targeted EPM surveys	Schueler unpublished data
Lyn and Golden creeks	0/11	2009	Shoreline survey	Targeted EPM survey	Schueler unpublished data
Lyn and Golden creeks	1/1	2009	4.5 PH timed search	Targeted EPM survey	Morris unpublished data
Lyn and Golden creeks	1/1	2011	13 PH timed search	Targeted EPM survey	Ackerman unpublished data
Lyn and Golden creeks	1/1	2012	12.5 PH timed search	Targeted EPM survey	Ackerman unpublished data
Lyn and Golden creeks	1/1	2013	7.5 PH timed search	Targeted EPM survey	Ackerman unpublished data
Lyn and Golden creeks	0/33	2013	Shoreline survey	Targeted EPM surveys at Golden Creek	Schueler unpublished data
Lyn and Golden creeks	2/2	2014	7.5 – 10 PH timed search	Targeted EPM re-surveys	Ackerman unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Mill (Milne) Dam Pond, Rouge River	0/1	2015	4.5 PH timed search	Targeted EPM survey	Reid unpublished data
St. Clair River delta	5/91	2011	5 – 101 x 65 m <sup>2</sup> circular plots snorkelling (stake and rope survey), or 2 – 3 PH timed search	Resurveys of Metcalfe-Smith et al. 2004 sites	Morris unpublished data
Sydenham River	0/4	2007	~ 20 PH timed search with excavation	Targeted surveys for SAR females, all sites previously surveyed in 1999 - 2003	McNichols-O'Rourke pers. comm. 2014
Sydenham River	0/2	2007	Excavation	Mussel identification course; all sites previously surveyed in 1999-2003	Morris unpublished data
Sydenham River	0/4	2008	~ 41 PH timed search with excavation	Targeted surveys for SAR females, all sites previously surveyed in 1999 - 2003	McNichols-O'Rourke pers. comm. 2014
Sydenham River	0/2	2008	Excavation	Mussel identification course; all sites previously surveyed in 1999-2003	Morris unpublished data
Sydenham River	0/1	2008	167 x 1 m <sup>2</sup> quadrats	Sydenham River relocation project (Wallaceburg Community Task Force and Chatham-Kent Economic Development Services)	Mackie 2008b
Sydenham River	0/at least 11	2008 - 2009	Unknown	Not applicable	Zanatta unpublished data
Sydenham River	0/3	2009	~ 35 PH timed search with excavation	Targeted surveys for SAR females, all sites previously surveyed in 1999 - 2003	McNichols-O'Rourke pers. comm. 2014
Sydenham River	0/2	2009	Excavation	Mussel identification course; all sites previously surveyed in 1999-2003	Morris unpublished data
Sydenham River	0/3	2010	~ 39 PH timed search with excavation	Targeted surveys for SAR females, all sites previously surveyed in 1999 - 2003	McNichols-O'Rourke pers. comm. 2014

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Sydenham River	0/2	2010	Excavation	Mussel identification course; all sites previously surveyed in 1999-2003	Morris unpublished data
Sydenham River	0/2	2011	~ 61 PH timed search with excavation	Targeted surveys for SAR females, all sites previously surveyed in 1999 - 2003	McNichols-O'Rourke pers. comm. 2014
Sydenham River	0/2	2011 - 2015	Excavation	Mussel identification course; all sites previously surveyed in 1999-2003	Morris unpublished data
Sydenham River	0/1	2011	4.5 PH timed search	Not applicable	Morris unpublished data
Sydenham River	0/13	2012 - 2015	69 – 75 x 1 m <sup>2</sup> quadrats	All sites previously surveyed in 1999 -2003. One site was a full excavation where 375 m <sup>2</sup> quadrats were completed	Morris unpublished data
Sydenham River	0/2	2013	60 and 60.5 PH timed search	Targeted surveys for SAR, all sites previously surveyed in 1999 - 2003	Ackerman unpublished data
Sydenham River	0/1	2015	14 PH timed search	Targeted search for grad student project	Ackerman unpublished data
Sydenham River	0/1	2015	2 PH timed search	Targeted search for grad student project	Morris unpublished data
Welland River	0/8	2008	4.5 PH timed search	Includes Lyon and Oswego creeks	Morris unpublished data
Welland River	0/1	2014	14.5 PH visual search and scoops	Targeted Mapleleaf surveys	Morris unpublished data
Welland River	2/13	2015	1.5 – 9 PH timed search	Welland River and Coyle Creek (live EPM)	Wright et al. in Prep (a)
White/Ingelsby Lake	0/11	2012	Shoreline search	Not applicable	Schueler unpublished data
White/Ingelsby Lake	0/11	2013	Shoreline search	White/Ingelsby lakes resurvey	Schueler unpublished data
White/Ingelsby Lake	2/12	2015	2 PH clam rake and visual/tactile	Targeted EPM surveys	Reid unpublished data

Waterbody	# of sites where live individuals occurred/Total # of sites surveyed	Year	Effort (per site)	Notes	Source
Whitefish Lake	0/12	2015	2 PH clam rake and visual/tactile	Targeted EPM surveys	Reid unpublished data

## 2.3. Distribution and status outside Ontario

Eastern Pondmussel has been recorded from 15 states in the USA: Michigan (SNR), Ohio (S1), Pennsylvania (S1), New York (S2S3), New Hampshire (S1), Massachusetts (S3), Connecticut (S1S2), New Jersey (S2), Delaware (S1), Maryland (S1S2), District of Columbia (SNR), Virginia (S3), Rhode Island (S1), North Carolina (S1) and South Carolina (S2) (NatureServe, 2017).

## 2.4. Ontario conservation responsibility

Unknown, but based on the distribution map Ontario has <25% of the total range.

## 2.5. Direct threats

The greatest threat to Eastern Pondmussel are invasive Zebra Mussels (*Dreissena polymorpha*) and Quagga Mussels (*Dreissena rostiformis bugensis*), which compete with unionid mussels for resources and also attach themselves to almost any substrate including unionid shells. Eastern Pondmussel favour habitat with soft sediment, where they may be particularly susceptible to dreissenid mussels colonizing the hard substrate that is provided by Eastern Pondmussel. Over 90% of historical records for Eastern Pondmussel are from areas that are now infested with dreissenids (COSEWIC, 2017). Furthermore, several of the inland lakes sustaining Eastern Pondmussel have been invaded by dreissenids and others may be susceptible. Invasive species, most notably dreissenid mussels, were collectively identified as a low-medium threat in the threats calculator (COSEWIC, 2017).

Additional threats come from habitat loss driven by *Phragmites australis*, and ecosystem modification resulting from water pollution and effluents. Modification of habitat was identified as a low threat in the threats calculator (COSEWIC, 2017). Collectively these threats led to a calculated overall threat impact of **medium** (COSEWIC, 2017).

## 2.6. Specialized life history or habitat use characteristics

Unionid mussels require an appropriate host fish species in order to complete their life cycle. Eastern Pondmussel hosts are thought to include Brook Stickleback, Largemouth Bass, Pumpkinseed and Yellow Perch. These species are widespread and common and therefore unlikely to be a factor limiting the sustainability of Eastern Pondmussel populations.

### **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**

Does not meet criteria. The number of mature individuals is unknown for most of the subpopulations. It is also unknown if there is a continuing decline.

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

Does not meet criteria. While the IAO is calculated as 268 km<sup>2</sup>, which is within the threshold for Endangered (<500 km<sup>2</sup>: B2), the species is found at more than 10 locations and is not severely fragmented. The species does not undergo extreme fluctuations.

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

Does not meet criteria. The number of mature individuals is unknown but there is a minimum of 270,000 in the St. Clair River Delta alone, which exceeds the threshold.

##### **3.1.4. Criterion D – Very small or restricted total population**

Does not meet criteria. The number of mature individuals, number of locations and IAO exceed the thresholds. The number of mature individuals is greater than 270,000, the IAO is 268 km<sup>2</sup> (continuous), and the number of locations is 12–20.

##### **3.1.5. Criterion E – Quantitative analysis**

Not applicable. Analyses have not been done.

#### **3.2. Application of Special Concern in Ontario**

Eastern Pondmussel does classify as special concern for the following reasons:

(a) it has declined due to the invasion of Zebra and Quagga Mussels, which persist throughout a substantial part of Eastern Pondmussel's range in Ontario (although these data do not reflect the 10 year/3 generation criteria). Although numbers are lacking, the extant subpopulations appear to be small, therefore their persistence could be threatened by genetic, demographic or environmental stochasticity.

(b) if the factors that negatively influence this species are not managed effectively, this species may become threatened. Although the impact of dreissenids is now outside the 3 generation window, this threat may limit the recovery of the species. Low impact threats from pollution and other habitat modifiers, if not effectively managed, may negatively affect the species resulting in it becoming Threatened.

(c) this species has a small IAO and meets criteria of B2bi, ii, iiix, and is therefore close

to meeting the criteria for threatened under this category.

### 3.3. Status category modifiers

#### 3.3.1. Ontario's conservation responsibility

Not applicable. Global rank is G4, and Ontario does not have significant conservation responsibility.

#### 3.3.2. Rescue effect

Rescue is possible for St. Clair River delta subpopulation, but unknown, for all others. Status of bordering populations is SNR (Michigan), S1 (Ohio, Pennsylvania), and S2S3 (New York).

### 3.4. Other status categories

#### 3.4.1. Data deficient

Not applicable

#### 3.4.2. Extinct or extirpated

Not applicable

#### 3.4.3. Not at risk

Not applicable

## 4. Summary of Ontario status

Eastern Pondmussel (*Ligumia nasuta*) is classified as Special Concern in Ontario based on ongoing threats, small population sizes, and a small IAO. The change in status of this species from the 2007 assessment is considered a largely non-genuine change based on the discovery of additional sites which likely pre-dated the 2007 assessment; however, the increase in abundance in the St. Clair delta subpopulation may represent a genuine change.

## 5. Information sources

Bachman, S., Moat, J., Hill, A.W., de la Torre, J., Scott, B. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. In: Smith V, Penev L (Eds) e-Infrastructures for data publishing in biodiversity science. ZooKeys 150: 117–126.

COSEWIC. 2017. [COSEWIC assessment and status report on the Eastern Pondmussel \*Ligumia nasuta\* in Canada](#). Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 61 pp. ([Species at Risk Public Registry](#)).

Graf, D. L., and K. S. Cummings. 2007. Review of the systematics and global diversity of freshwater mussel species (Bivalvia: Unionida). *Journal of Molluscan Studies* 73:291-314.

Kuehnl, K.F. 2009. Exploring levels of genetic variation in the freshwater mussel genus *Villosa* (Bivalvia Unionidae) at different spatial and systematic scales: implications for biogeography, taxonomy, and conservation. Ph.D. dissertation, Ohio State University, Columbus, Ohio, U.S.A. xx + 261 pp.

NatureServe. 2017. [NatureServe Explorer: An online encyclopedia of life](#) [web application]. Version 7.1. NatureServe, Arlington, Virginia. [website accessed October 17, 2017].

Scott, M. W., M. T. Begley, R. A. Krebs, and D. T. Zanatta. 2014. Mitochondrial DNA variation in the Eastern Pondmussel, *Ligumia nasuta* (Bivalvia: Unionida) in the Great Lakes region. *Walkerana*, 17(2): 60-67.

Turgeon, D. D., J. F. Quinn, A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P.M. Mikkelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M. Vecchione and J.D. Williams. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks, 2nd edition. American Fisheries Society Special Publication 26:1-526.

Zanatta, D.T., and R.W. Murphy. 2006. Evolution of active host-attraction strategies in the freshwater mussel tribe Lampsilini (Bivalvia: Unionidae). *Molecular Phylogenetics and Evolution* 41(1):195-208.

# Appendix 1: Technical summary for Ontario

Species: Eastern Pondmussel (*Ligumia nasuta*)

## 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.	6-9 years (inferred from other short-lived lampshells)
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Unknown
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
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. No b. Yes c. No
Are there extreme fluctuations in number of mature individuals?	No

## Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO).	43,522 km <sup>2</sup> (COSEWIC, 2017)
Index of area of occupancy (IAO).	164 km <sup>2</sup> (discrete 2 x 2 grid) 268 km <sup>2</sup> (continuous 2 x 2 grid) (COSEWIC, 2017)
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	a. No b. No

<b>Extent and occupancy attributes</b>	<b>Value</b>
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations.	12-20 locations were identified by COSEWIC (2017) and additional unrecorded localities are expected.
Number of NHIC Element Occurrences	16, although records from two of these pre-date the 'current' timeframe as defined by COSEWIC (2017) (pre-2007), and additional records are awaiting review and verification by NHIC.
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	There is an observed decline of 18% from the historical EOO, but this decline has abated over the last decade.
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	There is an observed decline from historical IAO of 63-87% (discrete and continuous grids, respectively), but this decline has abated over the last decade.
Is there an observed, inferred, or projected continuing decline in number of populations?	No
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?	Observed historical decline and a projected continuing decline in quality of habitat.
Are there extreme fluctuations in number of populations?	No
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)

<b>Subpopulation</b>	<b>Number of mature individuals</b>
Detroit River	Unknown
St. Clair River Delta	270,000 – 1,200,000
Lake Erie	Unknown
Sydenham River	0
Grand River	0
Coyle Creek (Welland River)	Unknown
Niagara River	Unknown
Lake Ontario	Unknown
Mill (Milne) Dam Pond (Rouge River)	0
White/Ingelsby Lake	Unknown
Beaver Lake	Unknown
Loughborough Lake	Unknown
Fishing Lake	Unknown
Whitefish Lake	0
Lyn and Golden Creeks	Unknown
<b>Total</b>	Unknown

## Quantitative analysis (population viability analysis conducted)

Not applicable; analysis has not been done.

## Threats

Was a threats calculator completed for this species? Yes

- i. Invasive species (Dreissenid mussels) = Low to medium threat
- ii. Ecosystem modifications (*Phragmites*) and pollution (household sewage and urban wastewater, industrial and military effluents, agricultural and forestry effluents = low threat

Overall threat = medium

## Rescue effect

<b>Rescue effect attribute</b>	<b>Value</b>
Status of outside population(s) most likely to provide immigrants to Ontario	Michigan SNR Ohio S1 Pennsylvania S1 New York S2S3
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possible for St. Clair River delta subpopulation. Unknown, for all others.

<b>Rescue effect attribute</b>	<b>Value</b>
Would immigrants be adapted to survive in Ontario?	Probably
Is there sufficient suitable habitat for immigrants in Ontario?	Probably
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?	Possible for St. Clair River delta subpopulation. Unknown, but possible for all others.

## Sensitive species

Not a data sensitive species.

## Appendix 2: Adjoining jurisdiction status rank and decline

Information regarding rank and decline for Eastern Pondmussel (*Ligumia nasuta*)

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S1	Unknown	NatureServe 2017
Quebec	Not present	Not applicable	NatureServe 2017
Manitoba	Not present	Not applicable	NatureServe 2017
Michigan	SNR	Unknown	NatureServe 2017
Minnesota	Not present	Not applicable	NatureServe 2017
Nunavut	Not present	Not applicable	NatureServe 2017
New York	S2S3	Unknown	NatureServe 2017
Ohio	S1	Unknown	NatureServe 2017
Pennsylvania	S1	Unknown	NatureServe 2017
Wisconsin	Not present	Not applicable	NatureServe 2017

### 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

EO: Element occurrence (as defined by NHIC)

EOO: extent of occurrence

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