

Ontario Species at Risk Evaluation Report for

Carolina Mantleslug

Limace á manteaux de la Caroline

(Philomycus carolinianus)

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

Assessed by COSSARO as Threatened

September 2020

Limace à manteau de la Caroline (*Philomycus carolinianus*)

La limace à manteau de la Caroline est une grosse limace terrestre qui mesure en moyenne 7 cm. Le manteau marbré qui couvre la totalité de son corps va du gris foncé au brun, et son dos arbore deux lignes centrales de points noirs. La limace, souvent observée lorsqu'elle est inactive, ne laissera pas voir sa tête; seule une paire de tentacules gris pâle sortira parfois de son manteau (COSEPAC, 2019).

La limace à manteau de la Caroline habite les forêts anciennes et non perturbées et les zones riveraines de la région de la forêt carolinienne de l'Ontario, près de la limite nord de son aire de répartition mondiale. Les escargots et, par extension, les limaces (collectivement, les gastropodes), jouent habituellement un rôle de premier plan dans le fonctionnement d'un écosystème forestier, surtout en facilitant la décomposition, le cycle nutritif et les processus de naissance et de développement du sol.

La limace à manteau de la Caroline est une espèce principalement inactive qui vit cachée sous de vieux débris ligneux très humides. De récentes recherches ont confirmé l'existence d'un petit nombre seulement d'emplacements à l'intérieur de cette modeste aire de répartition. L'espèce est menacée par les changements climatiques (températures extrêmes, sécheresses et inondations), les brûlages dirigés et les espèces envahissantes. Selon les résultats de l'évaluation, la limace à manteau de la Caroline fait partie des espèces menacées en Ontario.

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Carolina Mantleslug» 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 l'Environnement, de la Protection de la nature et des Parcs au cossarosecretariat@ontario.ca

Executive summary

The Carolina Mantleslug (*Philomycus carolinianus*) is a terrestrial air-breathing slug that prefers undisturbed wet and riparian areas of older-growth deciduous forests with abundant well-decayed wood. It occurs in southwestern Ontario at the following locations; Pelee Island in Lake Erie, Grape Fern Woods in Lambton County, and Wheatley Provincial Park, Rondeau Provincial Park, and Sinclair's Bush in Chatham-Kent County. These Ontario subpopulations represent the northern limit of the global range, the remainder of which extend across the US from Maine to Minnesota in the north and from Florida to Texas in the south.

As with other native slugs and snails, it has limited ability to disperse, leaving it susceptible to localized threats. The decline in Ontario is thought to be a result of decline in habitat quality from a variety of sources, including climate change (extreme temperatures, droughts, and flooding), prescribed burns, and invasive species.

Carolina Mantleslug is classified by COSSARO as Threatened. This is considering that there are only 6-8 known locations resulting in a low extent of occurrence and index of area of occupancy. There is also a projected continuing decline in the extent and quality of habitat caused by anticipated extreme temperatures, droughts, and flooding caused by climate change. This classification is consistent with the federal classification of this species by COSEWIC (2019).

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

Carolina Mantleslug is a large slug with a grey mantle covering the entire body, averaging a length of 7cm. The mantle is marbled dark grey to brown and there are two central lines of black dots on its back. The slug is most often seen when inactive, so the head is not visible and only one pair of light grey tentacles may extend from beneath the mantle (COSEWIC, 2019).

Carolina Mantleslug is considered to be distinct with anatomy of reproductive organs and external morphology continuing to be used to distinguish new species within this genus (COSEWIC, 2019).

1.1.2. Designatable units

There is only one designatable unit in Canada where all subpopulations are within the Great Lakes Plains ecological area.

1.1.3. Native status

Carolina Mantleslug are native to Ontario (Natureserve, 2020). Notable historical surveys that mention Carolina Mantleslug include those conducted by John Ougton between about 1930 and 1940 and by Grimm between 1970 and the mid-1990s (COSEWIC, 2019).

1.1.4. Occurrence

The current range of Carolina Mantleslug in Ontario includes at least five known subpopulations: Pelee Island, Wheatley Provincial Park, Grape Fern Woods, Rondeau Provincial Park, and Sinclair's Bush. On Pelee Island the species has been recorded from eight sites in three natural areas blocks within the last 20 years.

1.2. Eligibility results

Carolina Mantleslug (*Philomycus carolinianus*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- GRANK: G5 (NatureServe 2020)
- IUCN: NA (September 2020)
- NRANK Canada: N1
- COSEWIC: Threatened (November 2019)
- SARA: Not on Schedule 1
- ESA 2007: Not on ESA
- SRANK: S1S2 (ranked in 2019)

2.2. Distribution in Ontario

At least five subpopulations currently exist in Ontario: Pelee Island in Lake Erie, Grape Fern Woods in Lambton County, and Wheatley Provincial Park, Rondeau Provincial Park, and Sinclair's Bush in Chatham-Kent County. These locations were determined based on a general gastropod survey that was conducted between 2013 and 2019 in southwest Ontario (COSEWIC, 2019). More than one subpopulation could occur on Pelee Island as paved roads or tracks as narrow as 3m may fragment gastropod populations, because snails tend not to cross roads. The Pelee Island subpopulation is separated by approximately 54km of open water and mostly unsuitable land from the closest subpopulation on the mainland in Ontario (COSEWIC, 2019).

2.3. Distribution, broader biologically relevant geographic range and status outside Ontario

Carolina Mantleslug is distributed across eastern North America. The northern limit is southern Ontario, Michigan, and Vermont. The east-west distribution in the US is from Maine to Minnesota in the north and from Florida to Texas in the south. In Michigan, Carolina Mantleslug is ranked as S2 (Imperiled). The remaining border states have not yet ranked (SNR) this species (NatureServe, 2020).

2.4. Ontario conservation responsibility

The Ontario subpopulations represent the northern limit of the global. Range-edge populations can have significance for genetic diversity, long-term survival, and evolution of the species (COSEWIC, 2019). Ontario has a low conservation responsibility of less than 10% of the global range.

2.5. Direct threats

Notable direct threats to the species is climate change (extreme temperatures, droughts, and flooding), prescribed burns, and invasive species.

The COSEWIC Threat Calculation for threats associated with climate change and severe weather ranged from HIGH to LOW impact. With increasing average temperature, spring frost is more frequent, which can cause spring mortality as observed in snails when snow cover is absent. Droughts can cause high mortality in some gastropod species depending on the presence of shelter. With increased precipitation due to climate change, flooding can be expected over a larger area. Even though Carolina Mantleslug is a specialist of wet forest, unusually high floods in the winter and spring when the slugs are inactive can increase mortality.

The COSEWIC Threat Calculation for threats associated with prescribed burns is LOW impact. Burning directly and indirectly affects the survival of ground nesting animals, litter dwelling organisms, and soil invertebrates, including snails. In areas where prescribed burns have been implemented, slugs were not found at over a quarter of the sites that supported them during pre-fire surveys (COSEWIC, 2019).

The COSEWIC Threat Calculation for threats associated with other ecosystem modifications, like invasive flora and fauna, is UNKNOWN impact. There are several highly invasive plants in southern Ontario, including garlic mustard (*Alliaria petiolate*) in Carolina Mantleslug habitat. Garlic mustard was observed displacing native vegetation and altering soil nutrient cycles, thereby slowing restoration. However, the impact of invasive plants on Carolina Mantleslug is unknown. Non-native earthworms have invaded parts of Canada relatively recently and have altered forest floor habitats by reducing or eliminating the natural leaf litter layer and digging up and mixing mineral soil with the organic surface layer. While direct evidence of effects of exotic earthworms on terrestrial gastropods is lacking, it is suggested that invasive earthworms could indirectly

alter terrestrial gastropod communities by potentially reducing available fungi, for example.

2.6. Specialized life history or habitat use characteristics

Carolina Mantleslug only occurs in the Carolinian Forest Region, near the northern limit of its global range. Snails, and by extension slugs (collectively gastropods), represent 2.5 to 6% of the total animal biomass of boreal forest ecosystems. Gastropods generally play important roles in forest ecosystem functioning, specifically by aiding in decomposition, nutrient cycling, and soil building processes. Gastropod diversity can also indicate the degree of anthropogenic disturbance (COSEWIC, 2019).

Carolina Mantleslug is a mostly inactive species that lives hidden under old, very moist, decaying logs. It can live inside a log and access cavities through holes that are smaller than its body diameter, which makes it difficult to find without destroying the log it is residing in. They prefer undisturbed wet forests and riparian areas and are found on the floor of older-growth deciduous forests with abundant, well-decayed wood (COSEWIC, 2019). It is crepuscular or nocturnal, but can also come out from under logs or from holes in logs during daytime as long as the log is moist.

It is an air-breathing slug that is a simultaneous hermaphrodite (possesses both male and female reproductive organs) and lays eggs. In general, both members of a mating pair exchange sperm and produce eggs, but self-fertilization is possible but may result in lower reproductive success. Clutch size for Carolina Mantleslug ranges between 65 and 75 eggs with a hatching success varying between 40 and 75% (COSEWIC, 2019). Eggs and immature stages are not known to be dispersed by wind. However, some exotic slug species can survive periods in water and may be transported by water. Also rafting on floating objects, such as logs, may also be a mean of passive transportation in slugs. Compared to other slugs, Carolina Mantleslug has a high desiccation tolerance. They also form huddles of several individuals, which has been shown to reduce water loss (COSEWIC, 2019).

Carolina Mantleslug is a fungivore and prefers a range of mushrooms and lichens. They do not actively search for fresh plant material as food, so it is unlikely that it would be transported by human activity, for example with horticultural or agricultural products, and introduced to new areas.

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.

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

Meets Threatened B1ab(iii)+B2ab(iii). Even though both the EOO (2,070km²) and IAO (36km²) are well below the thresholds for Endangered (<5,000km², 500 km² respectively), there are between 6-8 locations (a). There is also a projected continuing decline in extent and quality of habitat (b(iii)) caused by a variety of threats.

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

Insufficient information.

3.1.4. Criterion D – Very small or restricted total population

Insufficient information.

3.1.5. Criterion E – Quantitative analysis

Insufficient information.

3.2. Application of Special Concern in Ontario

Not applicable.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

There is insufficient information available to calculate the percentage of the global range in Ontario.

3.3.2. Status modification based on rescue effect

Not applicable. It is considered imperiled in Michigan, with insufficient information available to determine conservation status for other bordering states. Further, the likelihood of dispersal from the US is nonexistent given the slug's poor dispersal capabilities.

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

Carolina Mantleslug (*Philomycus carolinianus*) is classified as Threatened in Ontario based on meeting criterion B1ab(iii)+B2ab(iii). This classification is consistent with COSEWIC (2019).

This status of this species is consistent with the definition of Threatened under the Endangered Species Act, 2007.

5. Information sources

COSEWIC. 2019. COSEWIC assessment and status report on the Carolina Mantleslug *Philomycus carolinianus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 54pp.

NatureServe. 2020. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org> [website accessed September, 2020]

Appendix 1: Technical summary for Ontario

Species: Carolina Mantleslug (*Philomycus carolinianus*)

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.	~2 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes, there is an inferred decline based on habitat loss/degradation and projected threats due to climate change.
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?	Unknown

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	2070 km ²
Index of area of occupancy (IAO). <i>If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.</i>	36 km ²
Is the total population severely fragmented?	a. No b. Yes

Extent and occupancy attributes	Value
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?	
Number of locations. <i>See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.</i>	6-8
Number of NHIC Element Occurrences <i>Request data from MNRF.</i>	None
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 sub-populations or EOs?	Unknown
Is there an observed, inferred, or projected continuing decline in number of locations?	Yes – historical habitat loss/degradation; projected continuing decline due to threats
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?	Unknown
Are there extreme fluctuations in extent of occurrence?	Unknown
Are there extreme fluctuations in index of area of occupancy?	Unknown

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

Sub-population (or total population)	Number of mature individuals
Pelee Island (due to distance and dispersal barriers, there could be three subpopulations on Pelee Island)	Unknown
Wheatley Provincial Park	Unknown
Grape Fern Woods	Unknown
Sinclair's Bush	Unknown

White Oak Woods (Leamington)	Unknown
Entire range	Unknown

Quantitative analysis (population viability analysis conducted)

No population viability analysis has been conducted.

Threats

A threats calculation was prepared for this species (COSEWIC, 2019) and resulted in an overall impact of HIGH-LOW.

Threats include:

Climate change and extreme weather (HIGH-LOW impact)

Natural system modifications (LOW impact)

Transportation & service corridors (NEGLIGIBLE impact)

Biological resource use (NEGLIGIBLE impact)

Human intrusions & disturbance (NEGLIGIBLE impact)

Invasive & other problematic species & genes (NEGLIGIBLE impact)

Pollution (UNKNOWN impact)

Low dispersal or migration capacity, low resistance to fluctuating environmental conditions.

Rescue effect and broader biologically relevant geographic range

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	Possibly, but unlikely
Status of outside population(s) most likely to provide immigrants to Ontario	Ohio (SNR), Michigan (SU)
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Unknown but probably
Is the species of conservation concern in bordering jurisdictions?	Yes (Michigan S2)
Is the Ontario population considered to be a sink?	Unknown, but unlikely
Is rescue from outside populations likely?	No

Sensitive species

This is not a data sensitive species.

Appendix 2: Broader biologically relevant geographic range

Information regarding rank and decline for Carolina Mantleslug (*Philomycus carolinianus*)

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Status & Trends	Condition	Notes & Sources
Quebec	n/a	Not present	-	NatureServe, 2020
Manitoba	n/a	Not present	-	NatureServe, 2020
Michigan	No	S2 Imperiled Trend Unknown	Unknown. Presumed to be in decline	NatureServe, 2020
Minnesota	n/a	Not present	-	NatureServe, 2020
Nunavut	n/a	Not present	-	NatureServe, 2020
New York	No	SNR Trend unknown	Unknown. Presumed to be in decline	NatureServe, 2020
Ohio	No	SNR Trend unknown	Unknown. Presumed to be in decline	NatureServe, 2020
Pennsylvania	n/a	Not present	-	NatureServe, 2020
Wisconsin	No	SU Trend unknown	Unknown. Presumed to be in decline	NatureServe, 2020

Broader Biologically Relevant Geographic Range in Other Jurisdictions

Carolina Mantleslug is distributed across eastern North America. The northern limit is southern Ontario, Michigan, and Vermont. The east-west distribution in the US is from Maine to Minnesota in the north and from Florida to Texas in the south. In Michigan, Carolina Mantleslug is ranked as S2 (Imperiled). For other bordering states, the species is either not present or insufficient data is available to determine trends (NatureServe, 2020).

Global Status and Trends

GRANK: G5 (NatureServe 2020)
 IUCN: NA (September 2020)
 NRANK Canada: N1
 COSEWIC: Threatened (November 2019)
 SARA: Not on Schedule 1
 ESA 2007: Not on ESA

SRANK: S1S2 (ranked in 2019)

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
IUCN: International Union for Conservation of Nature and Natural Resources
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
S2: Imperiled
S3: Vulnerable
S4: Apparently Secure
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