Ontario Species at Risk Evaluation Report for Spring Salamander (*Gyrinophilus porphyriticus*)

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

(Carolinian Population)

Assessed by COSSARO as Data Deficient

February 4, 2021

Salamandre pourpre (*Gyrinophilus porphyriticus*)

La salamandre pourpre (*Gyrinophilus porphyriticus*) est classée dans la catégorie des espèces pour lesquelles les données sont insuffisantes en Ontario par le CDSEPO.

La salamandre pourpre compte parmi les plus grandes salamandres de la famille des *Plethodontidae* et est représentée au Canada par la salamandre pourpre du Nord (*G. p. porphyriticus*). En Ontario, la présence de l'espèce était apparemment liée à un seul spécimen de musée restant, recueilli dans un ruisseau le long de la péninsule du Niagara en 1877 (« Welland Co, opposite Buffalo »). Les deux autres spécimens recueillis dans cette région pendant la même période ont été perdus depuis. De récents travaux de recherche sur le spécimen restant mettent en doute son identité. À part cette unique localité signalée en Ontario, son aire de répartition s'étend du sud du Québec en direction du sud, jusqu'au Mississippi, en Alabama et en Géorgie.

Cette espèce est principalement associée à des cours d'eau d'amont frais et bien oxygénés, où les roches ou le gravier et le couvert forestier abondent et où les poissons prédateurs sont peu nombreux. Les adultes se livrent à certaines activités terrestres sur le bord des ruisseaux, mais les larves demeurent exclusivement dans les ruisseaux. Le long développement des larves dure de 3 à 6 ans. La maturité peut être atteinte plus d'un an après la métamorphose.

Les menaces en Ontario sont notamment la réduction ou l'altération du débit de l'eau et la réduction de la qualité de l'eau à cause de la pollution, de l'envasement et de l'acidification découlant des activités agricoles, de l'aménagement résidentiel et récréatif, de la récolte de bois et des activités industrielles. Les larves sont particulièrement vulnérables à l'envasement, à la diminution de l'oxygène dissous et à la prédation par les poissons. Depuis 1877, un aménagement de grande ampleur a eu lieu dans la zone générale où la présence de l'espèce a été documentée auparavant.

Depuis la dernière évaluation de la situation, des activités de recherche en détail sur l'unique spécimen de référence ont semé le doute au sujet de sa forme taxinomique. Compte tenu des méthodes actuellement disponibles et du mauvais état de la larve de salamandre, il est impossible d'identifier le spécimen de manière positive.

Ce spécimen, recueilli en 1877, a été la principale raison du classement initial de l'espèce en tant qu'espèce disparue en Ontario, à la fois par le COSEPAC et par le CDSEPO. Cette nouvelle information ne permet pas de confirmer avec certitude que ce spécimen est une salamandre pourpre (*Gyrinophilus porphyriticus*) et la validité de l'unité désignable de la forêt carolinienne est donc contestable.

Executive summary

Spring Salamander is one of the largest salamanders in the family Plethodontidae and is represented in Canada by the Northern Spring Salamander subspecies (*G. p. porphyriticus*). In Ontario, the species was purportedly known from a single remaining museum specimen, collected in a stream along the Niagara Peninsula in 1877 ("Welland Co, opposite Buffalo"). The additional two specimens collected in this area during the same period have since been lost. Recent investigation into the remaining specimen casts doubt on its identity. Outside of this single reported Ontario location, the range extends from southern Quebec south to Mississippi, Alabama and Georgia.

The species is primarily associated with cool, well-oxygenated headwater streams with an abundance of rock or gravel, forest cover, and few predatory fish. Adults show some terrestrial activity along nearby shorelines, though larvae are restricted to streams. Larvae have a long development time, lasting 3 to 6 years. Maturation may take over a year after metamorphosis.

Threats in Ontario include reduction or alteration of water flow, and reduced water quality as a result of pollution, siltation, erosion and acidification brought about by agriculture, residential and recreational development, timber harvest and industry. Larvae are especially susceptible to siltation, decreases in dissolved oxygen and predation by fish. Since 1877, significant development has occurred in the general area the species was previously documented.

Since the last status assessment, a detailed investigation into the sole voucher specimen has resulted in doubt surrounding its taxonomic form. Under currently available methods, and due to the poor condition of the larval salamander, a positive identification of the specimen cannot be made. The specimen, originally collected in 1877, was a primary reason for the species originally being listed as an extirpated Ontario species by both COSEWIC and COSSARO. With this new information, the specimen cannot currently be confirmed for certain as Spring Salamander (*Gyrinophilus porphyriticus*) and subsequently the validity of the Carolinian DU is in question.

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

Spring Salamander is considered a valid species based on current taxonomic treatments. The subspecies that was purportedly found in Ontario is the Northern Spring Salamander (*Gyrinophilus porphyriticus porphyriticus*). Clarification on the identification of the sole remaining museum specimen collected in Ontario, cannot be accomplished using current methods.

1.1.2. Designatable units

In Canada, two designatable Units have been established, the Adirondack / Appalachian population in Quebec, and the Carolinian population in Ontario. The Ontario DU is currently based on one questionable voucher specimen collected in 1877, and thus may not be valid.

1.1.3. Native status

The species was previously confirmed as native but extirpated in Ontario, though new information (Mills, 2016) calls into question this assumption. The validity of the sole remaining museum specimen is in question.

1.1.4. Occurrence

Spring Salamander does not currently occur in Ontario. The last potential occurrence was recorded in 1877.

1.2. Eligibility results

Spring Salamander (*Gyrinophilus porphyriticus*) is eligible for status assessment in Ontario. The species may or may not be native to Ontario, we will use the precautionary principle and carry out the assessment in the event the species was naturally occurring in the province.

2. Background information

2.1. Current designations

- GRANK: G5 (NatureServe 2021)
- IUCN: Least Concern (August 25, 2015)
- NRANK Canada: N3
- COSEWIC: Data deficient (April 2018)
- SARA: Non-active

- ESA 2007: Extirpated (June 2010)
- SRANK: SNA (ranked in 2016)

2.2. Distribution in Ontario

A single remaining preserved museum specimen was confirmed collected from a site in Welland County, opposite Buffalo, along the Niagara Peninsula in 1877. Despite repeated searches in the surrounding streams since this time, no additional specimens have been located in Ontario (COSEWIC, 2011; COSEWIC 2018). The species was presumed extirpated and assessed as such by both COSSARO (2010) and COSEWIC (2011), though new information casts doubt on the identification of the voucher specimen. A recent COSEWIC assessment (2018) for Spring Salamander, resulted in a reassessment as Data Deficient. Furthermore, Dr. Francis Cook, who has studied the potential for this species in the province since the 1950s, suggests no longer recognizing *Gyrinophilus porphyriticus* as a "natural resident of Ontario" based on recent information and the potential for discarded bait, of which salamanders were often used. It should be noted that mapping from IUCN and NatureServe do not indicate that this species is present in Ontario.

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

In eastern North America, Spring Salamander is a relatively widespread and secure species. Its range extends from Quebec, Canada, south to Mississippi, Alabama, and Georgia. The species is of conservation concern in some US jurisdictions and one additional Canadian province at the edge of its range: MS, RI (S1); CT (S2); ME, MA, NJ, QC – S3).

Table 1. Condition of the Species in Adjacent Jurisdictions and Broader Biologically Relevant Geographic Range

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
Quebec	No	S3	Population is in continuing decline. There are no records for this species near the Ontario boarder suggesting that this population is unlikely to be part of the BBRR.
Manitoba	n/a	Not Present	
Michigan	n/a	Not Present	
Minnesota	n/a	Not Present	
Nunavut	n/a	Not Present	
New York	No	S5	Population is secure or apparently secure however, there are no records for this species near the Ontario boarder suggesting that this

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
			population is unlikely to be part of the BBRR.
Ohio	No	SNR	This species is not at risk in Ohio. There are no records for this species near the Ontario boarder suggesting that this population is unlikely to be part of the BBRR.
Pennsylvania		S5	Population is secure or apparently secure. There are no records for this species near the Ontario boarder suggesting that this population is unlikely to be part of the BBRR.
Wisconsin	n/a	Not Present	
Other Relevant Jurisdiction			

2.4. Ontario conservation responsibility

Less than 1% of the species' global range occurred in Ontario.

2.5. Direct threats

Direct threats include reduction or alteration of water flow, and reduced water quality as a result of pollution, siltation, erosion and acidification brought about by agriculture, residential and recreational development, timber harvest and industry. Larvae are especially susceptible to siltation, decreases in dissolved oxygen and predation by fish. Since 1877, significant development has occurred in the general area the species was previously documented, with approximately 64% of the Niagara Peninsula now converted to agricultural land (COSEWIC, 2011).

2.6. Specialized life history or habitat use characteristics

Spring Salamander require stream habitats with well-oxygenated, cool water, an abundance of rock or gravel substrate and few predatory fish. Adults may use the adjacent shoreline to forage, while aquatic larvae are restricted to the stream. Egg laying sites can be submerged or partially submerged cover items, including large rocks. Both adult and juvenile animals use the stream bed or overhanging stream bank during winter. Forest cover is necessary to ensure micro-habitat features are appropriate. The long larval period of 3 to 6 years makes this species exceptionally vulnerable to water flow changes, pollution and predation during development.

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 apply. Species has not been reported since 1877.

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

Does not apply. Species has not been reported since 1877.

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

Does not apply. Species has not been reported since 1877.

3.1.4. Criterion D – Very small or restricted total population

Does not apply. Species has not been reported since 1877.

3.1.5. Criterion E – Quantitative analysis

Does not apply. Species has not been reported since 1877.

3.2. Application of Special Concern in Ontario

Does not apply. Species has not been reported since 1877.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Does not apply. Species has not been reported since 1877, is not globally at risk and Ontario's Conservation Responsibility is low.

3.3.2. Status modification based on rescue effect or level of risk in broader biologically relevant geographic range

Small areas of suitable habitat potentially remain in the area of historic observation; however, rescue is unlikely due to anthropogenic changes along the Niagara Peninsula and isolation of any potential, former habitat. Individuals from the US are unlikely to re-establish populations naturally, and no indication of immigration has been documented over the past 140 years.

New York populations are not currently known from areas directly adjacent to Ontario. Therefore, for the purpose of this assessment, the BBRR for Spring Salamander in Ontario is considered to be the extent of the historic observation.

3.4. Other status categories

3.4.1. Data deficient

Spring Salamander was presumed extirpated and assessed as such by both COSSARO (2010) and COSEWIC (2011), though new information casts doubt on the identification of the remaining voucher specimen. Spring Salamander was recorded at two sites in Ontario, over 100 years ago, though not recorded since. The Britannia Creek specimen was doubtful based on location, and not considered in the 2011 COSWEIC assessment. Three larval specimens were also recorded from Welland County, opposite Buffalo New York in 1877. Two of the three voucher specimens associated with this record were lost, and the sole remaining specimen was the basis for the 2010 assessment. Due to recent doubt surrounding the identity of the remaining specimen, a recent COSEWIC addendum (2018) for Spring Salamander, resulted in a reassessment of the species as Data Deficient. A primary push for the addendum was due to a detailed investigation into the voucher specimen since the last COSSARO (2010) and COSEWIC (2011) status assessments. The new information has resulted in doubt surrounding the identification and thus validity of *Gyrinophilus porphyriticus* as a native Ontario species.

Both molecular and morphological assessment using currently available identification methods would not confidently provide an accurate identification of the specimen. Peter Mills, states that identification is not possible at this time due to the larval salamander's degraded condition from being preserved for over 140 years in formalin (COSWEIC 2018). Additionally, despite x-rays, comparisons with other preserved salamanders, and macro-photography of the animal, there is no currently reliable way to distinguish the larval forms of *Gyrinophilus porphyriticus* and *Pseudotriton ruber* (Red Salamander), due in part to the lack of skull ossification and poor body condition. Both species have a similar distribution in New York. Based on further review of the literature, Peter Mills' 2016 investigation of the voucher specimen, and overview of surveys carried out by Wayne Weller and others, Dr. Francis Cook suggests, "not recognizing either species as a natural resident of Ontario" (COSEWIC 2018). Dr. Cook has studied the voucher specimen in the past, collected the bulk of information on the species for Ontario, and participated in and compiled survey records for the species in Ontario.

The specimen collected in 1877 was a primary reason for the salamander originally being listed as an extirpated Ontario species by both COSEWIC and COSSARO. With this new information, the specimen cannot be confirmed for certain as Spring Salamander (*Gyrinophilus porphyriticus*) and subsequently the validity of the Carolinian DU is in question. In the absence of additional information, an inability to identify the specimen using current techniques and lack of additional records during past and present surveys (COSEWIC 2011, COSEWIC 2018), Spring Salamander qualifies as Data Deficient.

The potential that Spring Salamander is a native species to Ontario remains, though cannot be verified using available methods. The Ontario Natural Heritage Information Centre has recently removed Spring Salamander as a provincially tracked species due

to this new information. Based on the best available information, we cannot presently state with certainty if the species is native to Ontario and if the DU is valid; subsequently, Spring Salamander meets COSSARO, COSEWIC and IUCN guidelines as Data Deficient since there is documented taxonomic and provenance uncertainty.

3.4.2. Extinct or extirpated

Recent research has raised doubt regarding the identity of the sole remaining voucher specimen collected in 1877 (Mills 2016). The previous assessment of Spring Salamander was heavily based on this specimen. If confirmation of the museum specimen through additional testing becomes available in the future, the species may be reassessed as extirpated from Ontario.

3.4.3. Not at risk

Not applicable.

4. Summary of Ontario status

Spring Salamander (*Gyrinophilus porphyriticus*) is classified as Data Deficient in Ontario.

COSEWIC recently listed Spring Salamander as Data Deficient (COSEWIC 2018). The species was previously assessed by COSSARO as Extirpated. The change in status from the 2010 assessment is considered a non-genuine change based on previously unavailable information.

5. Information sources

COSEWIC. 2011. COSEWIC assessment and status report on the Spring Salamander, Adirondack / Appalachian and Carolinian populations *Gyrinophilus porphyriticus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 52 pp.

COSEWIC. 2018. Addendum to the COSEWIC Status Report on the Spring Salamander *Gyrinophilus porphyriticus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi pp

COSSARO. 2010. COSSARO Candidate Species at Risk Evaluation Form for Spring Salamander (*Gyrinophilus porphyriticus*). Committee on the Status of Species at Risk in Ontario. 4 pp.

Mills, P.B. 2016. The Spring Salamander in Ontario. The Canadian Herpetologist 6(1): 15-16.

Appendix 1: Technical summary for Ontario

Species: Spring Salamander (*Gyrinophilus porphyriticus*)

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.	7 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Not applicable (no recent records)
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Not applicable
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Not applicable
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Not applicable
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.	Not applicable
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Not applicable b. Not applicable c. Not applicable
Are there extreme fluctuations in number of mature individuals?	Not applicable

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	0 km^2
Index of area of occupancy (IAO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	0 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	a. Not applicable b. Not applicable

Extent and occupancy attributes	Value
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. *See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.*	0
Number of NHIC Element Occurrences *Request data from MNRF.*	0
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Not applicable
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Not applicable
Is there an observed, inferred, or projected continuing decline in number of sub-populations or EOs?	Not applicable
Is there an observed, inferred, or projected continuing decline in number of locations?	Not applicable
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Not applicable
Are there extreme fluctuations in number of populations?	Not applicable
Are there extreme fluctuations in number of locations?	Not applicable
Are there extreme fluctuations in extent of occurrence?	Not applicable
Are there extreme fluctuations in index of area of occupancy?	Not applicable

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

Sub-population (or total population)	Number of mature individuals
Insert additional rows as necessary. If total population, do not use table format.	0

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is not applicable.

Threats

Habitat loss due to anthropogenic sources would have likely led to declines/loss if it were to be determined a native species.

Rescue effect

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	New York (S5), though no current records exist near the international border.
Status of outside population(s) most likely to provide immigrants to Ontario	S5
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No
Would immigrants be adapted to survive in Ontario?	Possibly
Is there sufficient suitable habitat for immigrants in Ontario?	Not likely in the area they were historically found in Ontario.
Are conditions deteriorating in Ontario?	Probably
Is the species of conservation concern in bordering jurisdictions?	No
Is the Ontario population considered to be a sink?	Possibly
Is rescue from outside populations likely?	No

Sensitive species

Not a data sensitive species.

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