Ontario Species at Risk Evaluation Report for

Northern Brook Lamprey

Lamproie du Nord

(*Ichthyomyzon fossor*)

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

(Great Lakes – Upper St. Lawrence Populations)

Assessed by COSSARO as Special Concern

April 2021

Final

Lamproie du Nord (*Ichthyomyzon fossor*)

La lamproie du Nord (*Ichthyomyzon fossor*) est classée dans la catégorie des espèces préoccupantes en Ontario par le CDSEPO.

La lamproie du Nord (*Ichthyomyzon fossor*) est impossible à distinguer de la lamproie argentée (*Ichthyomyzon unicuspis*), à laquelle elle s'apparente, leur longue phase larvaire étant commune. La lamproie du Nord atteint sa maturité sexuelle pendant la métamorphose, avant le frai et avant de mourir sans se nourrir; les adultes ne sont pas parasites.

Cette espèce est présente dans les affluents de tous les Grands Lacs, à l'exception du lac Ontario, et a été recensée en tant que seule population. Les menaces qui pèsent sur la lamproie du Nord dans les affluents des Grands Lacs sont principalement associées au contrôle de la lamproie marine envahissante. Les barrages et les obstacles qui empêchent la lamproie marine d'accéder au cours supérieur des affluents occupés par les lamproies du Nord résidentes protègent un grand nombre de leurs populations contre les lampricides. Les populations de lamproies du Nord du nord-ouest de l'Ontario peuvent être vulnérables à l'incidence des espèces envahissantes et du changement climatique (p. ex. hausse des températures, réduction de la quantité d'eau).

Cette publication hautement spécialisée 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 Northern Brook Lamprey (*Ichthyomyzon fossor*) is indistinguishable from the closely related to the Silver Lamprey (*Ichthyomyzon unicuspis*) with which it shares a long larval phase. Northern Brook Lamprey sexually matures during metamorphosis before spawning and dying without feeding; adults are not parasitic. This species is found in tributaries of all the Great Lakes with the exception of Lake Ontario and has been identified as a single population. Threats to Northern Brook Lampreys in Great Lakes tributaries is primarily associated with the control of invasive Sea Lamprey. Dams and barriers that exclude Sea Lamprey from the upper reaches of tributaries occupied by resident Northern Brook Lamprey protect many populations of the latter species from exposure to lampricides. In populations in Northwestern Ontario, Northern Brook Lamprey may be susceptible to impacts from invasive species and climate change (e.g., increased temperatures, decreased water quantity).

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

Ichthyomyzon, derived from Greek, translates to “fish” (ichthys) and “suckle” (myzo). The species moniker *fossor*, meaning “digger,” refers to the Northern Brook Lamprey’s mature life stage where it burrows in substrate to filter feed (Scott and Crossman 1998). Previous nomenclature of the Northern Brook Lamprey includes: *Ammocoetes unicolor* (DeKay 1842), *Ammocoetes borealis* (Agassiz 1850), and *Reighardina unicolor* (DeKay 1842).

1.1.1. Designatable units

Northern Brook is known to occur in Ontario within a single designatable unit. In Northwestern Ontario, there is distribution gap between the most northwesterly occurrence record in Ontario and the easternmost locality in Manitoba that is substantial and divides the populations between the two provinces.

1.1.2. Native status

Northern Brook Lamprey are native to Ontario.

1.1.3. Occurrence

Northern Brook Lamprey are found primarily in tributaries of the Great Lakes and the Ottawa River. This species is absent from tributaries of Lake Ontario but has been documented in Lake Nipissing and its tributaries.

1.2. Eligibility results

Northern Brook Lamprey (*Ichthyomyzon fossor*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- GRANK: G4 (NatureServe 2021)
- IUCN: LC (2013)
- NRANK Canada: N3
- COSEWIC: SC (November 2020)
- SARA: SC (Schedule 1)
- ESA 2007: Special Concern
- SRANK: S3

2.2. Distribution in Ontario

Northern Brook Lamprey in Ontario extends from West of Thunder Bay along the northern shorelines of the Great Lakes and includes the Ottawa River. In the Great Lakes, northern brook lamprey are found in tributaries of lakes Superior, Michigan, Huron, and Erie but has not been found in Lake Ontario. Records of Northern Brook Lamprey exist for tributaries of Lake Nipissing as well.

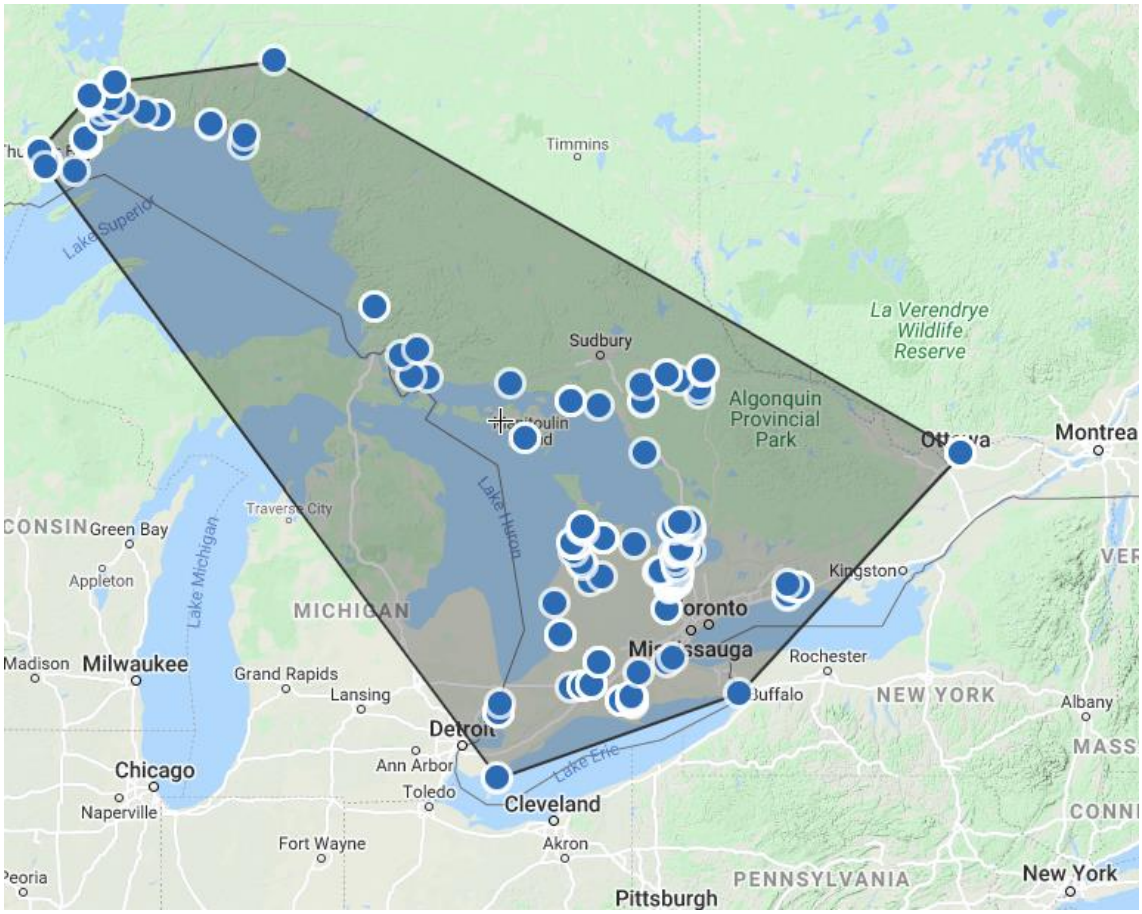

Figure 1. Northern Brook Lamprey records from Ontario (NHIC 2021). Created for this report using GeoCAT [website accessed November 21, 2015].

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

Northern Brook Lamprey are found throughout States that boarder the shoreline of the great lakes. Data available from the Great Lakes Fisheries Commission indicates that this species is more prevalent throughout the tributaries found along the southern shorelines of the Great Lakes (COSEWIC 2020).

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	Yes	S2	NatureServe 2021
Manitoba	Yes	SU	NatureServe 2021
Michigan	Yes	S4	NatureServe 2021
Minnesota	Yes	S3	NatureServe 2021
Nunavut	No		
New York	Yes	S2	NatureServe 2021
Ohio	Yes	S1	NatureServe 2021
Pennsylvania	Yes	S1	NatureServe 2021
Wisconsin	Yes	S5	NatureServe 2021
Other Relevant Jurisdiction			

2.4. Ontario conservation responsibility

Ontario's conservation responsibility is moderate to high for this species as a considerable portion of the global range lies within provincial boundaries.

2.5. Direct threats

Threats: Natural threats include larger fish, which can feed on eggs and larvae, as well as fluctuating water levels which can expose larval burrows during low water or cause excessive movement during flood conditions. Human threats include water quality degradation and ongoing lampricide applications similar to other lamprey species. Barriers to sea lamprey migration offer some refuge in the upper reaches of streams that often support northern brook lamprey, as these portions of the stream are not exposed to the chemical application (COSEWIC 2020). Barriers also have the potential to limit gene flow, although the limited migration of northern brook lamprey likely suggest this threat is minimal.

While larval northern brook lamprey are 25% less susceptible to the lampricide TFM than sea lamprey larvae, the difference is insufficient to allow for control of sea lamprey without incurring native lamprey mortality. Lampricide treatments are likely the largest mortality source for northern brook lamprey, although treatments are conducted only in areas of streams that are infested with sea lamprey; areas above barriers or in headwaters are typically not included in these treatments (COSEWIC 2020).

2.6. Specialized life history or habitat use characteristics

The Northern Brook Lamprey (*Ichthyomyzon fossor*) is indistinguishable from the

closely related to the Silver Lamprey (*Ichthyomyzon unicuspis*) with which it shares a long larval phase. Adults remain within their home stream, moving only short distances upstream to spawn in relatively shallow areas with coarse gravel and a moderate current. Habitat includes clean, clear gravel riffles and runs of small rivers (Page and Burr 2011) and not occur in large rivers or small brooks. Northern Brook Lamprey are typically found associated with gravel or sand-silt bottoms in moderately warm water, generally unsuitable for brook trout (Becker 1983). Larvae burrow into sand-silt bottoms in eddies. Spawning occurs in coarse gravelly or stony bottoms of creeks or small rivers in areas of strong current. The larval stage lasts 3-7 years Northern Brook Lamprey with mature individuals living for only 6-8 months. Northern Brook Lamprey sexually matures during metamorphosis before spawning and dying without feeding. Adults reach lengths between 120—150 mm at maturity and are not parasitic (COSEWIC 2020).

Threats to Northern Brook Lamprey is primarily associated with the control of invasive Sea Lamprey. Dams and barriers that exclude Sea Lamprey from the upper reaches of tributaries occupied by the stream- resident Northern Brook Lamprey protect many populations of the latter species from exposure to lampricides. In the Saskatchewan - Nelson River populations, Northern Brook Lamprey may be susceptible to impacts from invasive species and climate change (e.g., increased temperatures, decreased water quantity) (COSEWIC 2020).

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

Not applicable. Insufficient information is available on population trends.

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

Not applicable. IAO meets threshold for Threatened, B2; however, populations are not severely fragmented and are in >10 locations. No evidence of continuing decline however, declines were documetned > 3 generations ago. Fluctuations that have been documented may be related to variations in search effort.

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

Not applicable. Insuffucuent information available on population size.

3.1.4. Criterion D – Very small or restricted total population

Not applicable. Insuffucuent information available on population size.

3.1.5. Criterion E – Quantitative analysis

Not applicable. Data not available.

3.2. Application of Special Concern in Ontario

Approximately 50 % of the streams Northern Brook Lamprey are known to inhabit are currently subjected to ongoing chemical treatment for Sea Lamprey control, which in turn results in causes significant mortality to larval Northern Brook Lampreys (COSEWIC 2020). Barriers that exclude Sea Lamprey protect this species from exposure to lampricides in upper reaches of many tributaries, and it is still relatively abundant in untreated streams. Brook Lamprey tend to be present in upper reaches of the watershed compared to Sea Lamprey. While there is overlap in the occupied areas of streams for both Brook Lamprey and Sea Lamprey, lampricide applications are generally limited to the lower reaches of watershed. The overall population of Brook Lamprey in Ontario is thought to be currently stable (COSEWIC 2020). However, ongoing threats such as pollution from agricultural effluents, increased temperatures, and decreased water flows related to climate change and water control structures. If these threats are not addressed, this population may become at greater risk of extinction.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Ontario's conservation responsibility is moderate to high for this species as a considerable portion of the global range lies within provincial boundaries. Modifier not applicable.

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

As this species is non-migratory, the potential for rescue from adjacent jurisdictions is limited or absent. This species requires watercourse that lack dams and waterfalls as these structures are barriers to upstream movement. Northern Brook Lamprey status throughout the broader biologically relevant geographic range varies from Secure (S5) to Critically Imperiled (S1).

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

Northern Brook Lamprey (*Ichthyomyzon fossor*) is classified as Special Concern in Ontario.

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

5. Information sources

Becker, G.C. 1983. Fishes of Wisconsin. The University of Wisconsin Press, Madison, Wisconsin. 1052 pp.

COSEWIC. 2020. COSEWIC assessment and status report on the Northern Brook Lamprey *Ichthyomyzon fossor* (Great Lakes - Upper St. Lawrence populations and Saskatchewan - Nelson River populations) and the Silver Lamprey *Ichthyomyzon unicuspis* (Great Lakes - Upper St. Lawrence populations, Saskatchewan - Nelson River populations and Southern Hudson Bay - James Bay populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 156 pp.

Page, L.M. and B.M. Burr. 2011. Peterson Field Guide to Freshwater Fishes of North America North of Mexico. Second Edition. Houghton Mifflin Harcourt, Boston, Massachusetts. xix + 663 p.

Scott, W.B. and E.J. Crossman. 1998. Freshwater Fishes of Canada. Galt House Publication Ltd., Oakville, Ontario. xx + 966 pp.

Appendix 1: Technical summary for Ontario

Species: Northern Brook Lamprey (*Ichthyomyzon fossor*)

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 years
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. Unknown 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). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	419,126 km^2 (COSEWIC 2020)
Index of area of occupancy (IAO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	180 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. No b. No

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.*	>32
Number of NHIC Element Occurrences	No available at time of reporting
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	No
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Yes, observed, although apparent decline may be due to differences in search effort and exclusion of populations with only unidentified larvae; largest decline > 3 generations ago
Is there an observed, inferred, or projected continuing decline in number of sub-populations or EOs?	No
Is there an observed, inferred, or projected continuing decline in number of locations?	No; 36 locations reported for 1990—2006; any declines > 3 generations ago
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	No
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)

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

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

Threats

A threats calculator was completed by COSEWIC in 2020 for Northern Brook Lamprey. Results of this assessment indicates that overall the threat is Very High for this species.

i. Lampricide treatments of populations co-existing with Sea Lamprey larvae (High)
ii. Dams and water management/use (Medium-Low)
iii. Climate change and severe weather (Medium-Low)
iv. Invasive non-native species (Medium-Low)
v. Other pollution (especially agricultural effluent) (Low)

Rescue effect

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	Possibly
Status of outside population(s) most likely to provide immigrants to Ontario	Species is “Apparently Secure” in the United States
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possible but unlikely as this species is non-migratory and doesn’t tend to leave its home stream.
Would immigrants be adapted to survive in Ontario?	Probably
Is there sufficient suitable habitat for immigrants in Ontario?	Yes, however, lampricide treatments are ongoing and would represent similar threats in both Canada and the United States.
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?	Unknown but ongoing lampricide treatments may cause populations to function as a sink.
Is rescue from outside populations likely?	No

Sensitive species

This is 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