

**Ontario Species at Risk Evaluation Report for Lake
Erie Watersnake (*Nerodia sipedon insularum*)**

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

Assessed by COSSARO as Special Concern

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Final

Couleuvre d'eau du lac Érié (*Nerodia sipedon insularum*)

La couleuvre d'eau du lac Érié est une sous-espèce de la couleuvre d'eau (*Nerodia sipedon*) à la coloration distincte (rayures plus fines et plus petites ou gris plus saturé) de celle des autres sous-espèces sur le continent. Elle est endémique dans le bassin ouest du lac Érié. Au Canada, elle se trouve actuellement sur seulement trois îles (l'île Middle, l'île Pelée et l'île Sister Est), mais possiblement aussi sur l'île Hen. Les populations sont très fidèles à leur habitat : moins de 3 % des spécimens se déplacent d'une île à l'autre chaque année.

La couleuvre d'eau du lac Érié a bénéficié de l'invasion du gobie à taches noires (*Neogobius melanostomus*) dans le lac Érié, où elle trouve maintenant 90 % de sa nourriture. Cette transition alimentaire a entraîné une augmentation du taux de croissance et de la taille des spécimens. Sur l'île Pelée, la circulation automobile représente une menace : des dizaines de couleuvres d'eau du lac Érié sont tuées chaque année sur les routes longeant le rivage. Les aménagements empiétant sur le rivage nuisent aussi à la qualité de son habitat. On soupçonne qu'une partie de la mortalité est due à la persécution intentionnelle. Même si on ne dispose d'aucune donnée sur la tendance des populations au Canada, la couleuvre d'eau du lac Érié est considérée comme une espèce préoccupante en raison de son aire de répartition restreinte, la taille réduite de sa population, sa mobilité limitée entre différents habitats, le maintien des menaces et la responsabilité élevée de l'Ontario en matière de conservation.

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

Executive summary

Lake Erie Watersnake is a subspecies of the Northern Watersnake (*Nerodia sipedon*) that has distinct colouration (with fewer and smaller bands and/or more solid grey coloration) that differs from the mainland subspecies. Lake Erie Watersnake is endemic to the western basin of Lake Erie. In Canada, they are known to be extant on only three islands (i.e., Middle Island, Pelee Island and East Sister Island), with a possible fourth location on Hen Island. They have high site fidelity with fewer than 3% of individuals moving between islands each year.

Lake Erie Watersnake has benefitted from the invasion of exotic Round Goby (*Neogobius melanostromus*) in Lake Erie, which now comprise 90% of the Lake Erie Watersnake diet. This shift in diet has led to greater growth rates and larger body sizes of Lake Erie Watersnake. On Pelee Island, vehicular traffic is a threat with dozens of Lake Erie Watersnake killed each year on roadways that are close to the shoreline. Shoreline development on private land also reduces habitat quality for this snake. Mortality from intentional persecution is suspected to be ongoing. Although population trend data are not available for the Canadian population of Lake Erie Watersnake, it is assessed to be of Special Concern due to its restricted range, small population size, and limited mobility between locations, on-going threats, and Ontario's high conservation responsibility.

1. Background information

1.1. Current designations

- GRANK: G5T2 (NatureServe 2016)
- NRANK Canada: N2
- COSEWIC: SC (2015)
- SARA: END (Schedule 1)
- ESA 2007: END (2004)
- SRANK: S2

1.2. Distribution in Ontario

The Lake Erie Watersnake is endemic to the Western Basin of Lake Erie and is limited to the islands of the Lake Erie Archipelago and a small portion of the southern shore of Lake Erie in Ohio. Its distribution in Ontario is currently known on only three islands: Middle Island, Pelee Island and East Sister Island. Whether it still occurs on Hen Island is unknown; it had been observed historically, but was last recorded there in 1990 (NHIC 2016). Historical records of the species on Middle Sister Island date back to the mid-20th century, but searches in 1989 and 1990 failed to reveal any Lake Erie Watersnake: it is presumed extirpated at that site. No records exist for this species from the other Canadian Erie Islands: Chick, Big Chicken or Little Chicken Island (Rowell 2012, in COSEWIC 2015). Depending on whether or not the subspecies is extant on Hen Island, the number of locations for Lake Erie Watersnake is 3-4, with each island representing a separate location. NHIC considers each island population as a separate Element Occurrence (EO) with a total of 5 EOs for the province (though the Middle Sister Island EO is ranked as extirpated).

1.3. Distribution and status outside Ontario

In the US, Lake Erie Watersnake occupy part of Ohio's Catawba-Marblehead Peninsula as well as 12 islands on the Ohio side of the Lake Erie Archipelago. Population monitoring at eight intensively studied sites on US islands from 2001 to 2008 revealed a population growth rate of approximately 6% per year (95% confidence interval: 2-10%) (USFWS 2010). Increasing population size is attributed to a shift in the Lake Erie Watersnake's diet. The exotic, invasive Round Goby (*Neogobius melanostromus*) now comprises over 90% of the Lake Erie Watersnake's diet and has led to greater growth rates and body sizes of the snake as compared to specimens sampled prior to the establishment of the invasive fish (King et al., 2006).

1.4. Ontario conservation responsibility

Forty-one km of the total shoreline habitat of Lake Erie Watersnake are found along the shores of the Ontario islands of the Lake Erie Archipelago, accounting for approximately 38% of the global shoreline habitat for this subspecies (COSEWIC 2015). The

estimated number of mature individuals in Canada is 3470 (COSEWIC 2015), whereas the population in the US was estimated to be at least 9800 in 2010 (USFWS 2010). The Canadian population is therefore estimated to comprise 26% of the global population of Lake Erie Watersnake.

1.5. Direct threats

The threats to Lake Erie Watersnake in Canada were assessed using the COSEWIC threats calculator process as having an overall low impact on the Canadian population (COSEWIC 2015).

The largest subpopulation of Lake Erie Watersnake in Canada occurs on Pelee Island, which has seasonal and permanent residents and a road network that includes roadways in close proximity to the shore (likely bisecting movement corridors of Lake Erie Watersnake between summer shoreline habitat and inland hibernacula). Mortality from intentional persecution and accidental encounters with motor vehicles and lawn maintenance machinery is known from Pelee Island, though the degree of impact on the subpopulation on Pelee Island is unknown.

In terms of road mortality, 64 road-killed Lake Erie Watersnakes were found on Pelee Island in 1995. Spring surveys in 2000 – 2002 documented 21 road-killed Lake Erie Watersnakes there, with the majority classified as adults, of which more than half were females (COSEWIC 2015). In the US, road mortality was not considered to be a significant threat because surveys revealed that mature individuals comprised a small proportion (4%) of a total of 45 individuals found killed by automobiles. Furthermore population numbers were rising in the US despite documented road mortality (COSEWIC 2015). Radio telemetry research revealed that 95% of the summertime movements of Lake Erie Watersnake occurred within 26 m from the shore (Stanford et al., 2010). Because the roadways on Pelee Island are very close to the shore (whereas most of the main roadways on the US islands of the Lake Erie Archipelago are further inland), the Pelee Island subpopulation may be more susceptible to road mortality than subpopulations on US islands. The other Canadian islands of the Lake Erie Archipelago do not have any roadways but they are much smaller subpopulations.

The cause of mortality of several dead Lake Erie Watersnakes on Middle Island and East Sister Island in 2005 appeared to be consistent with persecution by humans (D. Jacobs, unpubl. data, in COSEWIC 2015).

Habitat alteration from shoreline development (including clearing vegetation, mowing, spraying, infilling, disrupting rock berms, shoreline hardening, etc.) reduces the quality and quantity of habitat available for Lake Erie Watersnake (Stanford et al, 2010). Property “clean ups” have affected at least one inland hibernaculum on Pelee Island (COSEWIC 2015). Pelee Island and Hen Island are the only two islands with private land; the other two Canadian Islands with Lake Erie Watersnakes are within National or Provincial parks and would therefore be unlikely to be developed in such ways.

Whether there is any impact on Lake Erie Watersnake from high densities of nesting Double Crested Cormorants (*Phalacrocorax auritus*) either from direct predation or

habitat alteration from vegetation loss under nesting trees on Middle Island and East Sister Island is unknown at this time (COSEWIC 2015).

Habitat alteration from the invasion of Common Reed (*Phragmites australis*) is a possible threat to habitat quality, particularly at Lighthouse Point Provincial Nature Reserve on Pelee Island.

The subpopulations of Lake Erie Watersnake associated with the smaller islands of the Lake Erie Archipelago may be susceptible to extreme weather events or changes in water level (COSEWIC 2015).

1.6. Specialized life history or habitat use characteristics

Movements of Lake Erie Watersnake between islands and from the islands to mainland shorelines are potentially restricted by long distances (5-14 km). Although there are reports of long-distance movements by a small number of PIT tagged individuals (at least 11 km from Kelley's Island to Middle Island, and 32.9 km from Middle Bass Island to Point Pelee National Park), movements of Lake Erie Watersnake between islands or from islands to the mainland are considered to be unusual (COSEWIC 2015). Fewer than 3% of adults move between islands each year (King and Lawson, 1995). This is supported by more recent radio telemetry work in the US (Stanford et al., 2010) where all of the 54 Lake Erie Watersnakes that were radio tracked did not disperse from the islands where they were first captured.

2. Eligibility for Ontario status assessment

2.1. Eligibility conditions

2.1.1. Taxonomic distinctness

Yes. Population subdivision of a formerly continuous population of Northern Watersnake occurred approximately 4000 ybp when the uplift of the Eastern Basin of Lake Erie after the retreat of the Wisconsin glaciation flooded the Western Basin, isolating islands of the Lake Erie Archipelago from the mainland. While interbreeding is possible and does occur, there is limited gene flow between the mainland and insular subpopulations: 0.08% - 1% of the island subpopulations are recruited from mainland individuals each generation (King and Lawson, 1995). Differences between mainland and insular habitat of *Nerodia sipedon* in Lake Erie are associated with distinctive colour variations (ranging from banded morphs with fewer and smaller bands than the mainland population to unbanded, gray morphs).

King and Lawson (1995) suggest that "recessive alleles for pattern reduction are more likely to have been present in ancestral populations" and that both the initial population subdivision and subsequent natural selection pressures that favour the reduced patterning of the insular subpopulations are responsible for the differentiation between island and mainland populations.

2.1.2.Designatable units

No. All Lake Erie Watersnakes occur within a very confined area in the Western Basin of Lake Erie and gene flow does occur between subpopulations (King and Lawson, 1995).

2.1.3.Native status

Yes. Records of Lake Erie Watersnakes in the Lake Erie Archipelago date back at least as far as 1893 (COSEWIC 2015).

2.1.4.Occurrence

Extant. Lake Erie Watersnakes have been relatively well studied and observed regularly on three of the Canadian islands of the Lake Erie Archipelago.

2.2. Eligibility results

Lake Erie Watersnake (*Nerodia sipedon insularum*) is eligible for status assessment in Ontario.

3. Ontario status assessment

3.1. Application of endangered or threatened status in Ontario

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

Insufficient Information. An estimate of the number of individuals on Pelee Island has been determined to be 3286 (COSEWIC 2015); however, as a model based on habitat quality and population densities from similar habitat types in the US population, there remains some uncertainty around the applicability of these numbers in the Canadian context. The number of Lake Erie Watersnakes on each of the remaining islands are estimated to be 119 (with a wide 95% Confidence Interval: 67-246) on Middle Island, 50 on East Sister Island and fewer than 15 on Hen Island (COSEWIC 2015), for a total estimated population of approximately 3470. Population size estimates using comparable methodology were not available in previous years; therefore, population trends for this subspecies cannot be determined at this time. Although the US subpopulations have been increasing, it is unknown whether the Canadian subpopulations are following similar trends. Consequently, it is not possible to determine whether or not, and to what degree, there is a decline in number of mature individuals.

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

Insufficient Information.

The Extent of Occurrence for this subspecies is 188 km² and Index of Area of Occupancy is 72 km² (both meet the threshold for Endangered in the first subcriteria B1

and B2, respectively). Furthermore Lake Erie Watersnake is known at fewer than 5 locations (subcriterion a). However, there is insufficient information to determine whether there is continuing decline in any of the indices (i-v) listed under subcriterion b. Subcriterion c does not apply: there are not extreme fluctuations in any of: the extent of occurrence, index of area of occupancy, number of locations, number of subpopulations, nor number of mature individuals.

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

Insufficient information. The total Ontario population is estimated to be fewer than 10,000 mature individuals, which is under the threshold for Threatened but there is no clear evidence of recent decline. Population trend data are not available to determine the applicability of criterion C.

3.1.4. Criterion D – Very small or restricted total population

Does Not Apply. The population estimate for Lake Erie Watersnake in Ontario exceeds the threshold of for 1000 individuals for Threatened under criterion D1. Although there is some uncertainty to the population estimate, the best available information suggests the Canadian population exceeds 1000 individuals. The subspecies does not qualify under D2 because the Index of Area of Occupancy is $> 20 \text{ km}^2$. The application of the number of locations being 5 or fewer under D2 requires the subspecies to be “prone to the effects of human activities or stochastic events within a very short time period (1-2 generations) in an uncertain future, and is thus capable of becoming endangered, extirpated or extinct in a very short time period”. Given that none of the threats evaluated in the COSEWIC threats calculator were anticipated to have an impact on greater than 10% of the Canadian Lake Erie Watersnake population in the next 3 generations, the term location is unusable for this criterion.

3.1.5. Criterion E – Quantitative analysis

Insufficient information. A quantitative analysis has not been conducted for this subspecies in Canada.

3.2. Application of Special Concern in Ontario

Lake Erie Watersnake is very geographically restricted, with an extent of occurrence and index of area of occupancy both being well within thresholds for Endangered under Criterion B. However, because of insufficient information regarding population trends and rates of habitat alteration, Criterion B cannot be applied. Occupying fewer than 5 islands, and with limited dispersal between islands, the subspecies may be vulnerable to stochastic events.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

The NatureServe Global Rank for this subspecies is G5T2: while the Northern Watersnake (*Nerodia sipedon*) is ranked G5, the infraspecific taxon status of the Lake Erie Watersnake subspecies is T2. With greater than 38% of the global habitat and 26% of the global population of this subspecies occurring in the province, Ontario's conservation responsibility for this subspecies is significant.

3.3.2. Rescue effect

While the population size of this subspecies is known to be increasing in the US, Lake Erie Watersnakes are known to have high site fidelity with only 3% of adults moving between islands each year. Rescue effect is quite possible, and as long as the quality and quantity of available habitat on the Canadian islands of the Lake Erie Archipelago are not degraded, the subspecies would be well adapted and have suitable conditions in which to potentially recolonize from the US subpopulations.

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

Lake Erie Watersnake (*Nerodia sipedon insularum*) is classified as Special Concern due to its restricted range, small population size, limited mobility between locations, on-going threats, and Ontario's high conservation responsibility.

5. Information sources

COSEWIC. 2015. [COSEWIC assessment and status report on the Lake Erie Watersnake *Nerodia sipedon insularum* in Canada](#). Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 37 pp.

King, R.B. and R. Lawson. 1995. Color-pattern variation in Lake Erie water snakes: the role of gene flow. *Evolution* 49:885-896.

King, R.B., J.M. Ray, and K.M. Stanford. 2006. Gorging on gobies: beneficial effects of

alien prey on a threatened vertebrate. *Canadian Journal of Zoology* 84:108-115.

Stanford, K.M., R.B. King, and D. Wynn. 2010. Summer and winter spatial habitat use by the Lake Erie Watersnake. *Journal of Fish and Wildlife Management* 1:122-130.

U.S. Fish and Wildlife Service (USFWS). 2010. Federal register final rule: removal of the Lake Erie watersnake (*Nerodia sipedon insularum*) from the federal list of endangered and threatened wildlife. *Federal Register* 75:30319-30338.

Appendix 1: Technical summary for Ontario

Species: Lake Erie Watersnake (*Nerodia sipedon insularum*)

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.	Approx. 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?	<ul style="list-style-type: none"> a. Yes, for some causes such as intentional mortality. b. Yes c. No, there is evidence of continued road mortality and intentional persecution
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. (Request value from MNR or use http://geocat.kew.org/)	188 km ²

Index of area of occupancy (IAO). (Request value from MNRF or use http://geocat.kew.org/)	72 km ²
Is the total population severely fragmented? (i.e. is >50% of its total area of occupancy is in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?)	a. No b. No
Number of locations (as defined by COSEWIC).	3-4
Number of NHIC Element Occurrences (Request data from MNRF)	5 (including one that is considered extirpated)
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?	Unknown (status of Hen Island subpopulation is unknown)
Is there an observed, inferred, or projected continuing decline in number of populations?	Unknown (status of Hen Island subpopulation is unknown)
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown (status of Hen Island subpopulation is unknown)
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Unknown
Are there extreme fluctuations in number of populations?	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)	N of Mature Individuals
Pelee Island	3286
Middle Island	119 (67-246 95% CI)
East Sister Island	50
Hen Island	<15
TOTAL	3470

Quantitative analysis (population viability analysis conducted)

Not conducted.

Rescue effect

Rescue effect attribute	Likelihood
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Yes
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Yes (delisted in USA, Endangered status in state of Ohio)
Is rescue from outside populations reliant upon continued intensive recovery efforts?	No.

Appendix 2: Adjoining jurisdiction status rank and decline Information regarding rank and decline for Lake Erie Watersnake

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S2	Unknown	n/a
Quebec	not present	n/a	n/a
Manitoba	not present	n/a	n/a
Michigan	not present	n/a	n/a
Minnesota	not present	n/a	n/a
Nunavut	not present	n/a	n/a
New York	not present	n/a	n/a
Ohio	S1	Increasing	USFWS 2010
Pennsylvania	not present	n/a	n/a
Wisconsin	not present	n/a	n/a

Acronyms:

AOO: area of occupancy

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

COSSARO: Committee on the Status of Species at Risk in Ontario

EOO: extend of occurrence

ESA: Endangered Species Act

GRANK: global conservation status assessments

IAO: index of area of occupancy

MNRF: Ministry of Natural Resources and Forestry

NHIC: Natural Heritage Information Centre

NNR: Unranked

NRANK: National conservation status assessment

SARA: Species at Risk Act

SNR: unranked

SRANK: subnational conservation status assessment

S1: critically imperiled

S2 : Imperiled