

**Ontario Species at Risk Evaluation Report for**  
**Eastern Foxsnake**  
**Couleuvre Fauve de L'Est**  
**(*Pantherophis vulpinus*)**

Great Lakes / St. Lawrence Population  
(formerly Georgian Bay Population)

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

Assessed by COSSARO as Threatened

March 2022

Final

## Executive summary

Eastern Foxsnake (*Pantherophis vulpinus*) is a ratsnake and one of the largest snakes in Ontario. Adults Foxsnakes are yellowish in colour with dark blotches along their length with alternating smaller dark blotches along their sides. In Ontario, Eastern Foxsnakes occurs as two distinct populations: the Carolinian population in southwestern Ontario and the Great Lakes/St. Lawrence population along the eastern shoreline of Georgian Bay.

Eastern Foxsnakes spend most of the active season in open habitats, including wetlands and rocky shorelines. The snakes can swim for kilometres along shorelines and across open water to access island habitat, but expanses of intensive agriculture are a barrier to movement. Foxsnakes are adept at using some human-made structures to meet their needs. This species requires suitable hibernation sites and egg-laying sites, many of which are used by multiple of snakes year-after-year. The Great Lakes/St. Lawrence population is thought to contain about 1,180–2,190 mature individuals.

Human-caused threats are contributing to a continuing decline in abundance of this species include habitat loss as a result of historical and ongoing conversion of wetlands and other natural areas to residential, commercial, and highway development. Road mortality is considered to be the predominant threat to the Eastern Foxsnakes in the Great Lakes/St. Lawrence population, followed by climate change, and natural system modifications.

# 1. Eligibility for Ontario status assessment

## 1.1. Eligibility conditions

### 1.1.1. Taxonomic distinctness

Eastern Foxsnake (*Pantherophis vulpinus*: Baird and Girard 1853) is classified as a North American ratsnake (Family = Colubridae, Order = Squamata, Class = Reptilia). Other English names that are sometimes used locally for this snake include: hardwood rattler, marsh whomper, and copperhead. The scientific name *vulpina* (= fox) is presumed to have been derived from the type specimen's collector, Rev. Charles Fox (Conant 1940; Rivard 1979).

The scientific name of Eastern Foxsnake (genus and species) has changed since the previous status report (detailed account provided by Crother *et al.* 2011). COSSARO previously assessed Eastern Foxsnake as *Elaphe gloydi*. The generic name *Elaphe* is no longer applied to New World ratsnakes (Utiger *et al.* 2002; Crother 2017), which are now represented by the genus *Pantherophis* (Crother *et al.* 2011). Eastern Foxsnake was therefore recognized as *P. gloydi* until Crother *et al.* (2011) re-evaluated Foxsnake taxonomy using mitochondrial DNA (mtDNA) analysis. The current accepted scientific name for Eastern Foxsnake is *P. vulpinus* (Crother 2017), with *gloydi* now considered a junior synonym of *vulpinus* (Crother *et al.* 2011).

Based on this information, COSSARO is changing from the use of *Pantherophis gloydi* to *Pantherophis vulpinus* for the Eastern Foxsnake.

### 1.1.2. Designatable units

Two designatable units (DU) were identified in 2008 based on discreteness and evolutionary significance: Carolinian population and the Georgian Bay population. COSEWIC re-evaluated these DUs were re-evaluated with a specific focus on whether or not snakes inhabiting the Norfolk County area (part of the Carolinian DU – but geographically isolated) should be recognized as a separate DU (COSEWIC 2021). Although there is some evidence for the discreteness of snakes from the Norfolk County area from a genetic and physical fragmentation perspective, it is not considered evolutionarily significant, and for the purposes of this report, they are considered to be part of the Carolinian DU.

COSSARO has previously referred to the population present along the eastern shore of Georgian Bay as the Georgian Bay Population. However, to improve consistency in how populations of Eastern Foxsnake are referred to in Ontario, COSSARO will co-opt the label of Great Lakes/St. Lawrence for the Georgian Bay population.

There is a clear natural disjunction separating Foxsnakes in the Georgian Bay region from those in the Carolinian region (~250–300 km). Genetic analyses (Row *et al.* 2011)

and historical assessment of habitat distribution suggest these disjunctions predate European settlement. Although genetic analysis found little genetic differentiation in the Georgian Bay region, some differentiation was found with the Carolinian DU (Row *et al.* 2011).

### 1.1.3. Native status

Eastern Foxsnakes are native to Ontario.

### 1.1.4. Occurrence

The global range of Eastern Foxsnake is limited to the Great Lakes region of North America east of the Mississippi River (Figure 1). It is found mainly in Ontario and the states of Illinois, Indiana, Michigan, Missouri, Ohio, and Wisconsin (Crother *et al.* 2011; NatureServe 2022).

In Ontario, Eastern Foxsnakes occur in two discrete areas of the province, Carolinian and Eastern Georgian Bay regions (Figure 2). This species therefore spans two Amphibian and Reptile faunal provinces (Carolinian and Great Lakes / St. Lawrence). In the Carolinian region, Foxsnakes are found in Essex, Chatham-Kent, and Lambton counties, and in the Norfolk County area (Port Burwell to Port Maitland, including Long Point). In the Georgian Bay Region, Foxsnakes are found along the Eastern shoreline between Port Severn and Key Harbour.

## 1.2. Eligibility results

Eastern Foxsnake (*Pantherophis vulpinus*) is eligible for status assessment in Ontario.

## 2. Background information

### 2.1. Current designations

- GRANK: G5 (NatureServe 2022)
- IUCN: Least Concern (April 18, 2016)
- NRANK Canada: N3
- COSEWIC: Threatened (December 2021)
- SARA: Endangered (Schedule 1)
- ESA 2007: Endangered (month and year of last assessment)
- SRANK: S3

### 2.2. Distribution in Ontario

The Ontario range of Eastern Foxsnake is limited to southwestern and central Ontario and spans two Amphibian and Reptile faunal provinces (Carolinian and Great Lakes / St. Lawrence) (Figure 2). Foxsnakes occur in two discrete areas of Ontario, Carolinian and Georgian Bay regions. In the Georgian Bay Region, Foxsnake distribution is

restricted to the eastern shoreline of Georgian Bay, with approximate boundaries of Port Severn in the south and Key Harbour in the north.

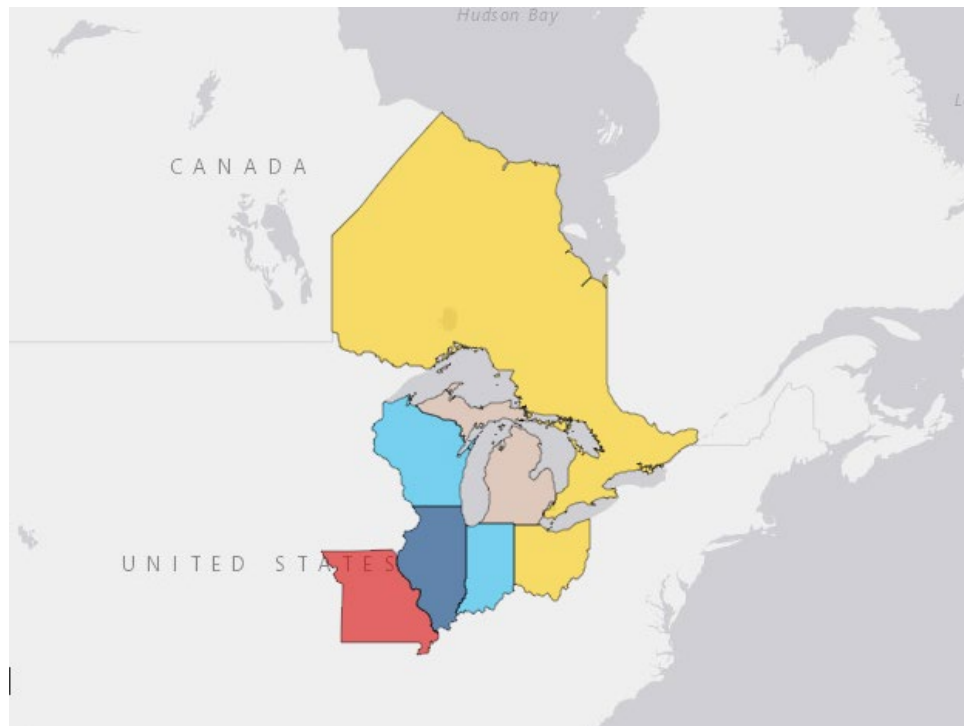


Figure 1. Eastern Foxsnake global range (NatureServe Explorer 2022).

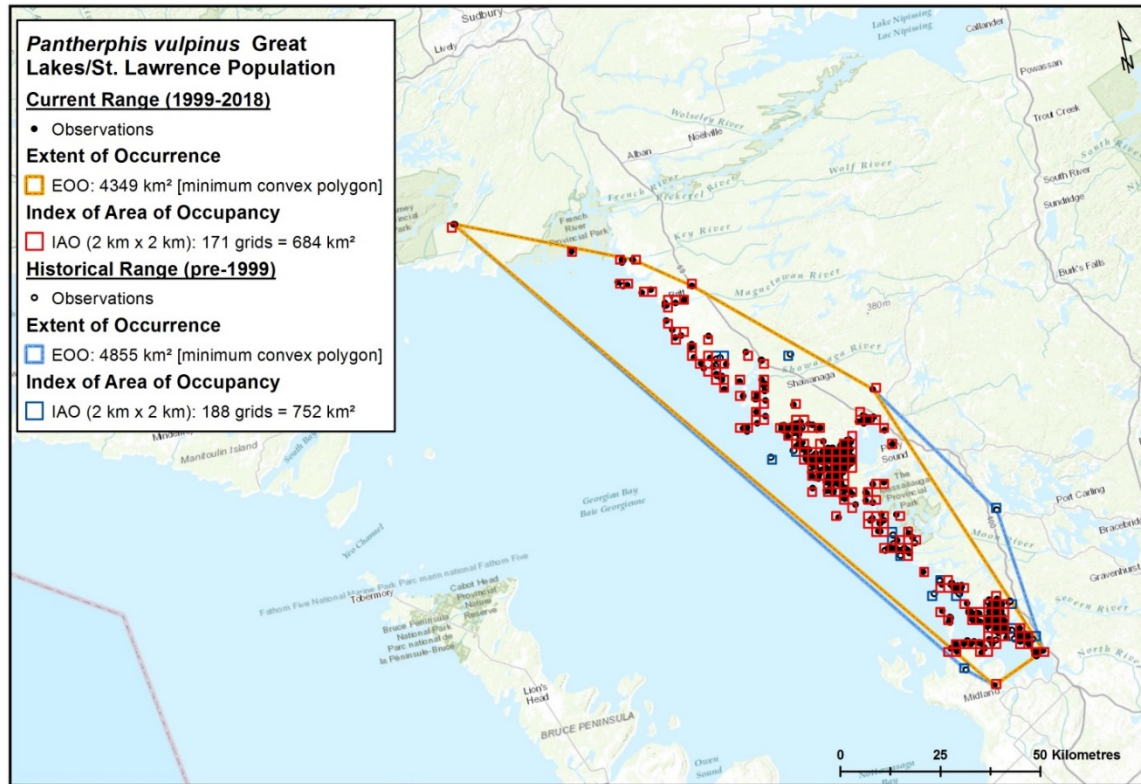


Figure 2. Eastern Foxsnake range in the Great Lakes/St. Lawrence DU based on current (1999-2018) and historical (pre-1999) observation records as provided in COSEWIC (2021).

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

Eastern Foxsnakes range from the Great Lakes region to the Mississippi River. In Canada, this species is only found in the province of Ontario. In the United States, Eastern Foxsnakes are found in Illinois, Indiana, Michigan, Missouri, Ohio, and Wisconsin. The entire range for this species is separated into two disjoint regions. The first region is loosely defined as the northern Wisconsin and the Upper Peninsula of Michigan southward to east-central Missouri, southern Illinois, and central Indiana (Vogt 1981, Powell 1990, Oldfield and Moriarty 1994, Harding 1997). The second region includes the northern Lake Erie shoreline to Long Point Bay (Ontario), Pelee Island and several other small Lake Erie Islands, and the southern Lake Erie shoreline in Erie County, Ohio (Powell 1990; Harding 1997). Second area also includes the Great Lakes basin in southern Ontario and Georgian Bay.

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

<b>Adjacent Jurisdictions</b>	<b>Biologically Relevant to Ontario (n/a, yes, no)</b>	<b>Condition</b>	<b>Notes &amp; Sources</b>
Quebec			
Manitoba			
Michigan	No	SNR	NatureServe 2022
Minnesota			
Nunavut			
New York			
Ohio	No	S3	NatureServe 2022
Pennsylvania			
Wisconsin	No	S4S5	NatureServe 2022
<i>Other Relevant Jurisdiction</i>			

## 2.4. Ontario conservation responsibility

Approximately 70% of the range for Eastern Foxsnakes is found within Ontario (COSEWIC 2008) indicating that the conservation responsibility for this species is high.

## 2.5. Direct threats

As is the case with many species at risk, the ecological life history traits of Eastern Foxsnake increase the threats to the species. These traits include seasonal migrations that expose the snakes to road mortality and other threats and their propensity to concentrate in larger numbers during specific times of year.

### Hibernation

Eastern Foxsnakes hibernate communally resulting in seasonal concentrations of individuals during spring and fall. When concentrated at hibernation sites, Eastern Foxsnakes are vulnerable to natural disturbance and stochastic events (i.e., flooding, collapse, temperature extremes, and predation), which can result in mortality and on occasion loss of individuals (Shine and Mason 2004). Additionally, alteration to the structure of hibernation sites can result in catastrophic loss of individuals. Over the past three generations, there has been an increase in the discovery of previously undocumented hibernation sites in the Georgian Bay area (Lawson 2005). One communal hibernaculum at Killbear Provincial Park was depredated over winter causing the loss of dozens of adults (Paleczny *et al.* 2005). Unpredictable mortality events due to environmental stochasticity are an important limitation threatening already small and isolated local populations with extirpation, especially during times when individuals of the species are concentrated.

### Road Mortality

Road mortality is one of the most conspicuous and commonly reported sources of Foxsnake mortality in Canada. Foxsnakes will readily cross or bask near roads (Rivard

1976), placing them at risk. Outside of settled areas, road mortality and the isolating effect of roads (including genetic fragmentation) have been best documented on county roads and provincial highways (Row *et al.* 2010). Many protected areas still have high road densities and/or traffic volumes within or adjacent to their boundaries (Crowley 2006; Farmer and Brooks 2012; Choquette and Valliant 2016). Due to Ontario's extensive road network and the number of studies that have documented substantial Eastern Foxsnake mortality along relatively small stretches of road (Ashley and Robinson 1996; Brooks *et al.* 2000; MacKinnon *et al.* 2005; Farmer and Brooks 2012), the number of Foxsnakes regularly killed on roads across its range is presumed to be considerable and potentially unsustainable. For example, a road mortality study of a 10 km section of road in the Georgian Bay region in 2003–2004 documented 16 dead Foxsnakes (Brooks *et al.* 2003; Mackinnon 2005).

### Habitat Loss

The expansion of human settlements results in permanent loss and fragmentation of Foxsnake habitat, and the death of individuals during construction and operation. Human settlements may also act as population sinks due to the combined effects of many associated threats (Lawson 2004). Settlement and land clearing in the Georgian Bay region has been slower than in the Carolinian region due to low agricultural potential; however, Eastern Foxsnakes range is limited to the areas proximate to the Georgian Bay shoreline.

The Parry Sound ecodistrict is currently dominated by natural cover types, including ~48% of the land area presumed to be suitable for Eastern Foxsnakes (COSEWIC 2021). By the early 1850s there were only a few thousand people living in the Georgian Bay region (GBBR 2004). Human population growth occurred from 1872 to 1880 due to the lumber industry, with deforestation and land clearing peaking in 1905 (GBBR 2004). In recent decades, cottage development has been a main driver of development within the species' range, but overall development rates have been relatively low. Within the Georgian Bay Biosphere Reserve, urban development rates were 3 to 6% from 2004 to 2014 with no significant changes in the main habitat types or ecosystems GBBR (2014). There was a 10.8% loss of coastal wetland cover in the southern portion of the Georgian Bay region from 1987 to 2013, largely due to decreasing water levels (GBBR 2019). However, because Foxsnakes are largely confined to habitats within ca. 100 m from the Georgian Bay shoreline, its habitat throughout the region is succumbing to cottage and other recreational developments. This region continues to experience development pressure due to its proximity to the Greater Toronto Area and its appeal as prime cottage country, resulting in ongoing habitat loss.

Wild and prescribed fires can result in direct mortality, sometimes of multiple individuals in a short time period. A wildfire spread across an 11,000-ha area within land adjacent to the eastern shore of Georgian Bay in the summer of 2018 (caused by a wind energy development; White 2019). Despite no documentation of Foxsnake mortality, wildfires can be a major threat to subpopulation viability of large snakes (e.g., Eastern Massasauga; Miller 2005). Even when fires are prescribed and well planned, snakes can be killed (Russell *et al.* 1999; Cross *et al.* 2015).



## Persecution

Foxsnakes are deliberately killed out of dislike or fear of snakes, their large size, and as they are sometimes mistaken for venomous species (e.g., Eastern Massasauga, Eastern Copperhead [*Agkistrodon contortix*]) due to their size, the markings and coloration of their head, the bold markings on their body, and habit of vibrating their tail in dry vegetation when alarmed (Rivard 1976). Human encounters with Foxsnakes are common because much of the species' Canadian range occurs within a heavily populated area, and because the snakes inhabit sites that experience high levels of human use. Foxsnakes are adept at using human-made features and often are found in boat houses, sheds, basements, campsites, and on roads, placing them at an elevated risk of intentional killing (Rivard 1976; COSEWIC 2021).

Eastern Foxsnakes are also sometimes collected as pets. Although Foxsnakes do fairly well in captivity, few captive-bred individuals are available (Staszko and Walls 1994), creating a demand for wild snakes. The collection of wild Foxsnakes as pets was identified by Rivard (1976).

## 2.6. Specialized life history or habitat use characteristics

In general, Foxsnakes enter hibernation in September and October, emerge in mid-April to mid-May, and breed from late May to mid-June. Foxsnakes become reproductively active, and are therefore considered mature, at snout-vent lengths of 93–100 cm (Lawson 2005), and after four to five years of age (Willson 2000; ECCC 2020). Mature snakes typically account for ~46% of individuals in a subpopulation (range of 29–67%), based on average capture rates from studies completed in Ontario. Longevity is estimated at 12–15 years in the wild (ECCC 2020). Most of the adult females in an area are gravid annually (Mackinnon 2005).

In Ontario, females lay eggs from early to mid-July (Willson 2000; Brooks *et al.* 2003), after 30–50 days of gestation (Willson and Brooks 2006). Females lay 6–29 eggs per clutch (Willson 2000) and will only spend 1–4 days at their oviposition site before leaving the eggs to incubate on their own (COSEWIC 2008; MacKinnon pers. comm. 2008). Eggs require 50 to 65 days to incubate (Harding 1997). Clutches of eggs may be deposited singly or communally (Brooks *et al.* 2003; Lawson 2005; Marks pers. comm. 2019) and communal sites can contain dozens of eggs (e.g., 84 eggs laid by four females: Willson 2000; 10 females using one site: Lawson pers. comm. 2005). Female Foxsnakes may show strong annual fidelity to specific oviposition sites for at least two consecutive years (Willson 2000; Paleczny *et al.* 2005; Lawson pers. comm. 2005).

Eastern Foxsnakes in the Georgian Bay region use open habitats along shorelines and on islands during the active season (e.g., coastal rock barrens and meadow marshes with intermittent trees and shrubs), as well as forest clearings and edges (Lawson 2005; MacKinnon 2005). Snakes in this region show a high affinity for habitats that are in close proximity to the Georgian Bay shoreline. For example, 95% of all telemetry locations from individuals at Killbear Provincial Park and Honey Harbour-Port Severn study sites were within 94 to 149 m of the shorelines of Georgian Bay (MacKinnon

2005), and most individuals used water for dispersal between sites and to access rocky offshore islands (Lawson 2005; MacKinnon 2005).

Eastern Foxsnakes are known to congregate at communal hibernation sites. In some cases, a large proportion of snakes occupying a distinct area may rely on a small number of hibernation sites. In the Georgian Bay region, 150 to 264 individuals were documented using a single hibernation site (MacKinnon 2005; Xuereb *et al.* 2012). A large proportion of Foxsnakes will return to previously used hibernation sites annually (Watson 1994; Marks pers. comm. 2019), with some sites used by Foxsnakes for over a decade (GBBR 2019). At least one occupied site in the Georgian Bay region, centred on a locally rare limestone formation at the southern extent of the DU, is characterized by similar habitats to those in the Carolinian region and includes old field and anthropogenic microhabitats in an agricultural landscape (MacKinnon 2005).

Eastern Foxsnakes are proficient swimmers and will take to the water and swim long distances across bays and between islands. Swimming can create links across large expanses of open water. Open water swims of 6–12 km to access rocky offshore islands were recorded by radio-tracking of Foxsnakes in the Georgian Bay region (Brooks *et al.* 2003; Lawson 2005; MacKinnon 2005).

Eastern Foxsnakes use discrete microhabitat features for thermoregulation, shelter from predators, digestion, and ecdysis (shedding), with some individuals showing annual fidelity to these features (Paleczny *et al.* 2005; Willson and Brooks 2006). In the Georgian Bay region, microhabitat features used are predominantly rock-based (e.g., table rocks with suitable rock-substrate gaps, or fissures in the bedrock); however, brush piles, root systems of living and downed trees, and junipers are sometimes used.

As ectotherms, Eastern Foxsnakes are constrained by the thermal characteristics of their local environment. Three temperature-dependent processes that have been studied include thermoregulation by gravid females (Willson and Brooks 2006), cold water swimming, and environmentally-induced stress. MacKinnon *et al.* (2006) documented 49 radio-tagged Foxsnakes swimming 313 times in water as cold as 11°C in the Georgian Bay region, and observed a maximum body temperature decrease of 22.6°C over 11 minutes (35.6°C to 13°C). Xuereb *et al.* (2012) found that stress levels were significantly greater in Foxsnakes from the Georgian Bay region than in those from the Carolinian region, and a negative relationship was found between stress and residual growth rate in the Georgian Bay snakes, possibly due to lower average temperatures in the Georgian Bay region.

## 2.7. Existing Conservation and Recovery Actions

A recovery strategy for Eastern Foxsnake in Ontario was published in 2010, followed by a government response statement in 2011, and a specific habitat regulation for each DU in 2012 (EFRT 2010; OMECP 2016).

A recovery strategy for Eastern Foxsnake in Canada was published in 2020, wherein

designated critical habitat is described (ECCC 2020). Within the Carolinian DU, protected areas represent less than 1% of this species occupied range.

Through the Species at Risk Stewardship Fund, province of Ontario has supported stewardship partners to conduct multiple projects focused on the Great Lakes / St. Lawrence population of Eastern Foxsnake. These projects have looked at habitat use and spatial ecology of the species, genetic analysis, and road mitigation.

### 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 data to reliably infer, project, or suspect population decline.

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

Not applicable. EOO of 4,349 - 4,855 km<sup>2</sup> is below threshold for Endangered and IAO of 684 - 752 km<sup>2</sup> is below threshold for Threatened. The population is not severely fragmented (i.e., occurs at >10 locations), and does not experience extreme fluctuations.

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

Meets Threatened, C2a(i). Number of mature individuals is 1,180–2,189, with fewer than 1000 in any one subpopulation, and there is an inferred and projected continuing decline; a(ii) does not apply because more than one subpopulation is expected to be present due to high fidelity of snakes to specific hibernacula.

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

Not applicable. The population is not very small or restricted.

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

Not applicable. No analysis completed.

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

Not applicable as species meets criteria for Threatened under Criterion C.

#### 3.3. Status category modifiers

### 3.3.1. Ontario's conservation responsibility

Approximately 70% of the range for Eastern Foxsnakes is found within Ontario (COSEWIC 2008); however, as this species is listed as Secure (G5) this modifier is not applicable.

### 3.3.2. Status modification based on level of risk in broader biologically relevant geographic range

As outlined above in **Section 2.3**, Eastern Foxsnakes are found in two disjoint regions. Portions of the species' global range that extends into northern Wisconsin and the Upper Peninsula of Michigan southward to east-central Missouri, southern Illinois, and central Indiana are located far enough from the Ontario populations that they should not be considered part of the broader biologically relevant range.

The portion of the Foxsnake range that includes the Great Lakes Basin the Georgian Bay area represents a unique ecological setting for Foxsnakes. Typically, this species is found associated with sparsely forested, or unforested, early successional vegetation communities, while the occupied portions of Georgian Bay are comprised of a freshwater island archipelago containing a mosaic of coastal rock barrens and sparse boreal forest. Occupation of this habitat by Foxsnakes, together with local climate may have given rise to potentially heritable life history, behavioural, and ecological traits including unique hibernation habitat, extremely dense hibernation congregations, large home range sizes, and long-distance swimming behaviour. Based on the unique nature of the ecological setting of Foxsnakes found the in Great Lakes / St. Lawrence DU, the broader biologically relevant range does not extent beyond Ontario.

### 3.3.3. Rescue Effect

Eastern Foxsnakes in the Great Lakes / St. Lawrence DU are endemic to Ontario and as such rescue from surrounding jurisdictions is not possible.

## 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 as species meets criteria for Threatened under Criterion C.

## 4. Summary of Ontario status

Eastern Foxsnake (*Pantherophis vulpinus*, Carolinian DU) is classified as Threatened in Ontario based on meeting criterion C2a(i).

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

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## Appendix 1: Technical summary for Ontario

Species: Eastern Foxsnake (*Pantherophis vulpinus*) – Great Lakes / St. Lawrence

### 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.	7.5 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes, inferred and projected decline.
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). <i>If value in COSEWIC status report is not applicable, then use <a href="http://geocat.kew.org">geocat.kew.org</a>. State source of estimate.</i>	4,349 - 4855 km <sup>2</sup>
<i>Based on minimum convex polygon (MCP) within Ontario using records from 1999-2018.</i>	
Index of area of occupancy (IAO). <i>If value in COSEWIC status report is not applicable, then use <a href="http://geocat.kew.org">geocat.kew.org</a>. State source of estimate.</i>	684 - 752 km <sup>2</sup>
<i>AOI is based on records from 1999-2018 (current)</i>	
Is the total population severely fragmented?	a. No

<b>Extent and occupancy attributes</b>	<b>Value</b>
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?	b. No
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>	Unknown but considered to be considerably more than 10.
Number of NHIC Element Occurrences <i>Request data from MNR.</i>	37
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Unknown. Difficult to determine due to search effort
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Unknown. Difficult to determine due to search effort
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?	Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes, observed and projected decline in area and quality of habitat due to ongoing threats.
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>Sub-population (or total population)</b>	<b>Number of mature individuals</b>
<i>Insert additional rows as necessary. If total population, do not use table format.</i>	Estimated to be 1,700 (1,180 – 2,189, 95% confidence interval)

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

## Threats

Based on the results of the threats calculator completed by COSEWIC on May 29, 2020 the overall threat impact for this species is “High”. The following were identified as the primary threats.

- Transportation and Service Corridors (medium)
- Climate Change and Severe Storms (medium – low)
- Residential and Commercial Development (low)
- Biological Resource Use (low)
- Natural System Modifications (low)

Additional limiting factors identified by the threats calculator include:

- Large congregations at hibernation sites that place snakes at risk of natural catastrophes and anthropogenic disturbance
- Long seasonal migrations that place snakes at risk of road mortality
- Cold climate limiting range expansion

## Rescue effect

<b>Rescue effect attribute</b>	<b>Value</b>
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	No
Status of outside population(s) most likely to provide immigrants to Ontario	Not applicable
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Unknown but unlikely
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
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?	No as the population is endemic to Ontario.

## Sensitive species

Yes, species is considered a “restricted species” by the Ontario Natural Heritage Information Centre (NHIC).

## 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