PROPOSED

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Recovery Strategy Series
Adopted under Section 44 of SARA

Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*), Carolinian and Great Lakes/St. Lawrence populations, in Canada

Eastern Foxsnake

2017

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

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RECOVERY STRATEGY FOR THE EASTERN FOXSNAKE (*Pantherophis gloydi*), CAROLINIAN AND GREAT LAKES/ST. LAWRENCE POPULATIONS, IN CANADA

2017

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario* (Part 2) and the *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement*[2] (Part 3) under Section 44 of the *Species at Risk Act* (SARA), replacing the term "Georgian Bay population" with "Great Lakes/St. Lawrence population". Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Eastern Foxsnake in Canada consists of three parts:

Part 1 – Federal addition to the *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) Carolinian and Georgian Bay populations in Ontario,* prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario*, prepared by the Eastern Foxsnake Recovery Team for the Ontario Ministry of Natural Resources[3].

Part 3 – *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources.

[2] The Government Response Statement is the Ontario Government's policy response to the recovery strategy and summarizes the prioritized actions that the Ontario Government intends to take and support.
[3] On June 26, 2014, the Ontario Ministry of Natural Resources became the Ontario Ministry of Natural Resources and Forestry.

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Part 3 – *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources.

Part 1 – Federal addition to the *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) Carolinian and Georgian Bay populations in Ontario*, prepared by Environment and Climate Change Canada

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[4] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Eastern Foxsnake (Carolinian population) and the Eastern Foxsnake (Great Lakes/St. Lawrence population) (henceforth referred to as the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations) and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. SARA section 44 allows the Ministers to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). A single document has been prepared to address the recovery of the two Eastern Foxsnake populations (Carolinian and Great Lakes/St. Lawrence) under SARA. The Ontario Ministry of Natural Resources (now the Ontario Ministry of Natural Resources and Forestry) led the development of the attached recovery strategy for the Eastern Foxsnake Carolinian and Georgian Bay populations (Part 2) in cooperation with Environment and Climate Change Canada and the Parks Canada Agency. In this federal addition, “Georgian Bay population” has been replaced by the term “Great Lakes/St. Lawrence population” because that is how the species is listed under SARA, and these terms may be used interchangeably. The Province of Ontario also led the development of the attached Government Response Statement (Part 3), which is the Ontario Government’s policy response to its provincial recovery strategy and summarizes the prioritized actions that the Ontario Government intends to take and support.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations) and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada, the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to

[4] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[5] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

[5] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Bird Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgements

The original draft of the federal addition was prepared by Talena Kraus (Artemis Eco-Works). Subsequent drafts were developed by Angela McConnell and Lee Voisin (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario). This federal addition benefited from input, review and suggestions from the following individuals and organizations: Angela Darwin, Kari Van Allen, Krista Holmes, Marie-Claude Archambault, Marsha Smith, John Brett, Liz Sauer, Lesley Dunn, Kim Borg (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario), Vivian Brownell, Joe Crowley, Anita Imrie, Jay Fitzsimmons (Ontario Ministry of Natural Resources and Forestry), and Joanne Tuckwell (Parks Canada Agency).

Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Aboriginal organizations and individuals, landowners, citizens and stakeholders who provided input and/or participated in consultation meetings.

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) Carolinian and Georgian Bay populations in Ontario* (Part 2 of this document, referred to henceforth as "the provincial recovery strategy") and/or to provide updated or additional information.

Environment and Climate Change Canada is adopting the Ontario recovery strategy (Part 2) with the exception of section 2.0, Recovery. In place of section 2.0, Environment and Climate Canada has established population and distribution objectives that are consistent with the provincial recovery goal, and is adopting the government-led and government-supported actions of the *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement* (Part 3) as the broad strategies and general approaches to meet the population and distribution objective, and is adopting the habitat regulated under Ontario's *Endangered Species Act, 2007* (ESA) as critical habitat (with the exception of subsection (4)(a) under section 24.4 of Ontario Regulation 242/08; see pages 12-13 and 19-20 of this document for details) for the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations).

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the provincial recovery strategy referring to protection of the species' habitat may not directly correspond to federal requirements. Recovery measures dealing with the protection of habitat are adopted; however, whether these measures will result in protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

1. Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Eastern Foxsnake (Carolinian population and Great Lakes/St. Lawrence population). In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

   Yes (Carolinian and Great Lakes/St. Lawrence populations). Adults capable of reproduction are available in Ontario to sustain the species in Canada;

communal oviposition[6] has been documented in all three regional sub-populations (COSEWIC 2008). However, COSEWIC (2008) notes that there is no current estimate of mature individuals for the Canadian population. Mature adults are also available in Michigan and Ohio states, however, relocating individuals from the United States to Canada would require further study and the use of reintroduction techniques which have not yet been investigated.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

   Unknown (Carolinian). Eastern Foxsnakes (Carolinian population) require a mosaic of habitat types, but use mainly unforested, early successional habitat (especially marsh and coastal meadow marsh, but also prairie, savannah, old field, sand dunes and dune-slough complexes) during the active season, and show a strong preference for shoreline edge habitats and other ecotones (COSEWIC 2008). The Carolinian population occurs primarily in an agricultural landscape; small areas of suitable habitat are available in southern Ontario, however, these areas are highly fragmented, and are subject to high levels of human disturbance (e.g. intensive agriculture, high densities of roads). Because large, protected, roadless areas are limited in the Carolinian region, it is not known whether or not the available habitat is sufficient to maintain the existing population. Management and restoration techniques, including maintaining open conditions and suitable hibernacula and providing adequate nesting sites, and cover, can be used to increase quality and the amount of suitable habitat available, but it is unknown if this would mitigate the impacts of the severe habitat fragmentation in this region.

   Yes (Great Lakes/St. Lawrence). Eastern Foxsnakes (Great Lakes/St Lawrence population) require a mosaic of habitat types, but use mainly unforested, early successional habitat (including rock barrens, coastal meadow marsh, shoreline and other similar habitats) during the active season, and show a strong preference for shoreline edge habitats and other ecotones (COSEWIC 2008), and sufficient habitat is available to support the current population. Much of the Eastern Foxsnake Great Lakes/St. Lawrence population habitat is along a thin strip of shoreline and is subject to loss or modification due to intensive road development and recreational activities. Although the availability of habitat in eastern Georgian Bay has not declined to the same degree as in the Carolinian population, increasing development and recreational land use in this region is almost certainly resulting in a reduction of suitable habitat (COSEWIC 2008). Management and restoration techniques, including maintaining open conditions and suitable hibernacula and providing adequate nesting sites, and cover, can be used to increase quality and the amount of suitable habitat available.

[6] Egg laying

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

   Unknown (Carolinian and Great Lakes/St. Lawrence populations). The primary threats to the species include road mortality, habitat loss and fragmentation, direct persecution, and illegal collection. Although there are available techniques to reduce road mortality, it is unknown if they will be successful at mitigating this threat (Eastern Foxsnake Recovery Team 2010). It is likely possible to avoid and/or mitigate habitat loss and fragmentation in the Great Lakes/St. Lawrence population, through legislation and stewardship, however, it is unknown if the effects of habitat loss can effectively be mitigated in the Carolinian population. Public education and law enforcement can help to reduce direct persecution and illegal collection, however, it is unknown how effective these techniques will be at reducing direct persecution and curbing illegal collection.

   Additionally, Snake Fungal Disease (SFD) has been identified as a potential threat to the Eastern Foxsnake in this recovery strategy as new information has become available since the completion of the provincial recovery strategy. Methods for controlling wildlife diseases in general have been developed but have not been proven for SFD, although the spread of the disease can be mitigated through instrument decontamination if snakes are handled (Langwig et al. 2015).

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

   Unknown (Carolinian and Great Lakes/St. Lawrence populations). Recovery techniques such as habitat protection through land acquisition, regulations, zoning, landscape planning and stewardship are available and are being used to protect the species. Best management practices have been developed and can be communicated to provide landowners with the information necessary to coexist with the species without destroying suitable habitat (e.g., Best Management Practices such as maintaining basking areas, creating artificial nests and providing additional shelter such as cover boards, rock piles and brush and compost piles). Public awareness and educational materials have been developed and will continue to be an integral part of recovery for the species. Addressing road mortality and habitat degradation due to increased road development will be more difficult as much of this habitat alteration is irreversible or would require implementing substantial changes using techniques that have not yet been proven effective for this species. Further studies on snake road ecology are being conducted, and may be useful in developing future mitigation techniques. However, it is unknown whether these recovery techniques will be successful in achieving the population and distribution objective in a reasonable timeframe.

2. Species Status Information

Both populations of the Eastern Foxsnake (Carolinian population and Great Lakes/St. Lawrence population[7]) are listed as Endangered[8] on Schedule 1 of the federal *Species at Risk Act* (SARA). In Ontario, the Eastern Foxsnake (Carolinian population) is listed as Endangered[9] under the provincial *Endangered Species Act*, *2007* (ESA), while the Eastern Foxsnake (Georgian Bay population) is listed as Threatened[10] (ESA).

Eastern Foxsnakes (*Pantherophis gloydi*) are found in three distinct regions of Ontario: Essex-Kent and Haldimand-Norfolk in southwestern Ontario (Carolinian population), and the eastern side of Georgian Bay (Great Lakes/St. Lawrence population) (COSEWIC 2008; Eastern Foxsnake Recovery Team 2010). The Carolinian population is ranked Imperilled (N2) in Canada (NatureServe 2014) while the Great Lakes/St. Lawrence population is ranked Vulnerable (N3) in Canada. With these two Canadian populations making up approximately 70% of the global population (COSEWIC 2008), the Eastern Foxsnake is ranked globally as Vulnerable/taxon not yet ranked (G3TNR; NatureServe 2014[11]).

The area of occupancy is estimated at 188 km^2 (COSEWIC 2008) for each of the Carolinian and Great Lakes/St. Lawrence populations.

The Eastern Foxsnake is also known to occur in Michigan, where it is considered threatened (MDNR 2014), and Ohio, where it is considered a species of special concern (ODNR 2014). The Eastern Foxsnake distribution is quite limited within both states and the species is mainly found close to Lake Huron and Lake Erie (COSEWIC 2008).

[7] While the province of Ontario refers to this population as the Georgian Bay population, it will be referred to as the Great Lakes/St. Lawrence population in this federal addition to align with the population name listed under SARA.
[8] A wildlife species facing imminent extirpation or extinction.
[9] A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
[10] A species that lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it.
[11] NatureServe recently included Eastern Foxsnake (*Pantherophis gloydi)* with the population of Western Foxsnakes (*P.vulpinus)* occurring east of the Mississippi River due to genetic similarities. NatureServe (2014) currently lists the two species together under *P. vulpinus* and ranks it as globally secure (G5). However, the Canadian subpopulations are listed separately as G3TNR.

3. Threats

As described in the provincial recovery strategy (Part 2, section 1.6), road mortality, habitat loss and degradation, direct persecution, collection, subsidized predation[12], and chemical toxins are the main threats to Eastern Foxsnakes in Canada.

In addition to the threats outlined in Part 2, another potential threat that may affect the Eastern Foxsnake is Snake Fungal Disease (SFD) (*Ophidiomyces ophiodiicola).* This is an emerging disease in wild snakes that causes severe skin lesions, leading to widespread morbidity and mortality (Sleeman 2013; Allender et al. 2015). SFD is currently known to affect at least seven snake species, including the Eastern Foxsnake (*Pantherophis gloydi),* Northern Watersnake (*Nerodia sipedon sipedon*), Eastern Milksnake (*Lampropeltis Triangulum*), and Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) (Sleeman 2013; Allender et al. 2015; J. Crowley pers. comm. 2015). SFD has been confirmed in an Eastern Foxsnake in southwestern Ontario, and several other Eastern Foxsnakes and a Butler's Gartersnake (*Thamnophis butleri)*, also from southwestern Ontario, are suspected of having the disease (J. Crowley pers. comm. 2015). SFD has been found in nine states including New York, Ohio, Wisconsin, and Illinois and is considered likely to be even more widespread (Sleeman 2013).

The disease can spread directly through contact with infected snakes and may also spread indirectly via environmental exposure (i.e., contaminated soil (Sleeman 2013; Allender et al. 2015)). While the population-level effects of SFD remain unclear, it appears to spread easily and is often fatal, and there is concern it could have negative impacts on small snake populations of conservation concern (Sleeman 2013; Allender et al. 2015). For example, SFD is thought to have contributed to a 50% decline in Timber Rattlesnake abundance in New Hampshire from 2006 to 2007 (Sleeman 2013). Climate change has the potential to further increase the risk of SFD to snake populations, as warming temperatures may lead to increased infection rates in hibernating snakes (Allender et al. 2015).

Although the impacts to the Eastern Foxsnake are currently unknown, this disease may have the potential to spread through direct or indirect contact with infected snakes within the species' range. Further research is required to determine the threat it poses to Canadian snake populations and conservation measures must be developed to prevent or limit outbreaks within Canadian snake populations.

[12] Subsidized predation: Predation by predators whose populations increase in response to low densities or absence of top predators and increased food availability from human soruces (e.g.; food handouts, garbage, crops).

4. Population and Distribution Objectives

The provincial recovery strategy recommended the following recovery goal for the recovery of the Eastern Foxsnake (Carolinian and Georgian Bay populations) in Ontario:

- The recovery goal is to ensure population persistence, maintain the current range of occupancy and enhance connectivity of Eastern Foxsnake within both the Carolinian and Georgian Bay populations.

The *Government Response Statement* for the Province of Ontario (Part 3) lists the following goal for the recovery of the Eastern Foxsnake (Carolinian and Georgian Bay populations) in Ontario:

- The government's goal for the recovery of the Eastern Foxsnake is to ensure the persistence of the species and to maintain the current range of occupancy and connectivity of its habitat within both the Carolinian and Georgian Bay populations.

Under SARA, a population and distribution objective for the species must be established. Consistent with the goal set out in the Government of Ontario's Government Response Statement, Environment and Climate Change Canada's population and distribution objectives for the Eastern Foxsnake in Canada are:

- To maintain the current abundance, area of occupancy, and habitat connectivity within local populations of the Eastern Foxsnake (Great Lakes/St. Lawrence population); and

- To maintain the current abundance, area of occupancy of the Eastern Foxsnake (Carolinian population) and, where feasible, increase habitat connectivity within local populations.

As with the provincial recovery strategy, emphasis for these objectives is placed upon the protection of existing populations. As no estimates of Eastern Foxsnake abundance in Canada are currently available, surveys are required to determine the status and distribution of local populations. Results from the collaborative monitoring program described in the government-led and government-supported action tables from the *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement* (Part 3) will be used to establish a baseline population estimate against which future population trends will be gauged.

Maintaining the current abundance and area of occupancy will require protecting and maintaining habitat connectivity within local populations. Sufficient habitat and habitat connectivity (movement corridors) are critical to ensuring populations have the necessary elements required for survival. Without habitat connectivity, individuals may not be able to access different habitats within their home range to complete necessary

life cycle activities (e.g., nesting, hibernation) or to migrate, which facilitates rescue effect[13] and gene flow. This is especially important for the Carolinian population as the remaining suitable habitat is extremely limited and highly fragmented. Increasing habitat connectivity will help maintain access to the remaining patches of suitable habitat within the landscape. The broad strategies, along with the identification of critical habitat will help ensure such habitat is maintained within both the Carolinian and the Great Lakes/St. Lawrence populations.

Government-supported protection activities in the Ontario Government Response Statement include the identification and mitigation of threats and securement and restoration of habitat as opportunities arise (see Part 3). Threat mitigation and/or maintaining or increasing suitable habitat where the Eastern Foxsnake (Carolinian and Georgian Bay populations) occurs (including connecting habitats within the populations) will be key to ensuring the long-term population persistence of the Eastern Foxsnake in Canada.

5. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported action tables from *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement* (Part 3) are adopted as the broad strategies and general approaches to meet the population and distribution objectives. Environment and Climate Change Canada is not adopting the Approaches to Recovery identified in section 2 of the *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) Carolinian and Georgian Bay populations in Ontario* (Part 2).

6. Critical Habitat

6.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species".

Identification of critical habitat is not a component of the provincial recovery strategy under the Province of Ontario's ESA. However, following the completion of the provincial recovery strategy for this species, a provincial habitat regulation was developed for each of the Eastern Foxsnake populations, and both regulations came into force July 1, 2012. A habitat regulation is a legal instrument that prescribes an area

[13] Rescue effect is genetic or demographic immigration into a population to reduce extinction pressures.

that will be protected[14] as the habitat of the species by the Province of Ontario. The habitat regulation identifies the geographic area within which the habitat for the species is prescribed and the regulation may apply, and explains how the boundaries of regulated habitat are determined (based on biophysical and other attributes). The regulation is dynamic and automatically in effect whenever the condition(s) described in the regulation are met within the specified geographic area.

Environment and Climate Change Canada adopts the description of Eastern Foxsnake (Carolinian population) and Eastern Foxsnake (Georgian Bay population) habitats under section 24.3 and 24.4 (with the exception of subsection (4)(a)), respectively, of Ontario Regulation 242/08[15] made under the provincial ESA as critical habitat for the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations). The provincial habitat regulation is dynamic and automatically in effect whenever the conditions described in the regulation are met, however, areas identified as critical habitat within this recovery strategy will remain as critical habitat until revised in an updated recovery strategy or subsequent action plan. Additional critical habitat may be added in the future if new information supports the inclusion of areas beyond those currently identified.

The areas defined under these provincial habitat regulations (excluding subsection (4)(a) under section 24.4 of Ontario Regulation 242/08) contain the biophysical attributes required by the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations) to carry out its life cycle processes. To meet specific requirements of SARA, the biophysical attributes and geographic locations of critical habitat are further detailed in the subsections below.

6.1.1. Critical Habitat for Eastern Foxsnake (Carolinian population)

Ontario Habitat Regulation

The areas prescribed under **Ontario Regulation 242/08 – Eastern Foxsnake (Carolinian population) habitat** are described as follows:

24.3 (1) For the purpose of clause (a) of the definition of "habitat" in subsection 2 (1) of the Act, the areas described in subsection (2) that are located in the following geographic areas and parts of geographic areas are prescribed as the habitat of eastern foxsnake (Carolinian population):

1. *The geographic areas of Chatham-Kent, Essex, Haldimand, Lambton and Norfolk.*
2. *The parts of the geographic area of Elgin composed of the lower-tier municipalities of Bayham and West Elgin. O. Reg. 122/12, s. 4.*

[14] Under the federal SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.
[15] http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_080242_e.htm#BK57

(2) Subsection (1) applies to the following areas:

1. *An eastern foxsnake (Carolinian population) hibernaculum.*
2. *The area within 100 metres of the area described in paragraph 1.*
3. *A naturally occurring eastern foxsnake (Carolinian population) egg laying site that is being used, or has been used at any time in the previous three years, by an eastern foxsnake (Carolinian population).*
4. *An eastern foxsnake (Carolinian population) egg laying site, other than a naturally occurring egg laying site, being used by an eastern foxsnake (Carolinian population) from the time it is used until the following November 30.*
5. *A naturally occurring eastern foxsnake (Carolinian population) shedding or basking site that is being used, or has been used at any time in the previous three years, by two or more eastern foxsnakes (Carolinian population).*
6. *An eastern foxsnake (Carolinian population) shedding or basking site, other than a naturally occurring shedding or basking site, that is being used by two or more eastern foxsnakes (Carolinian population) from the time it is used until the following November 30.*
7. *The area within 30 metres of an area described in paragraph 3, 4, 5 or 6.*
8. *Any part of a prairie, savannah, hedge row, shoreline, marsh, old field, forest, sand dune or similar area that is being used by an eastern foxsnake (Carolinian population) or on which an eastern foxsnake (Carolinian population) directly depends to carry on its life processes.*
9. *An area that provides suitable foraging, thermoregulation, or hibernation conditions for eastern foxsnake (Carolinian population) that is within 1,500 metres of any area described in paragraph 8.*
10. *An area that provides suitable conditions for an eastern foxsnake (Carolinian population) to move between areas described in paragraphs 1 through 9. O. Reg. 122/12, s. 4.*

(3) Subsection (1) does not apply to an area that is part of a lake or river below the historical low water mark. O. Reg. 122/12, s. 4.

The habitat for the Eastern Foxsnake (Carolinian population) is protected under the ESA 2007 so long as the specified area has been used within the prescribed period of time, as outlined above. The 100 metres around a hibernaculum and 30 metres around an egg laying, shedding, or basking site is intended to protect the feature itself and the terrestrial area required to maintain the suitability of the site. The three year term represents approximately the time period in which Eastern Foxsnakes (Carolinian population) may use naturally occurring egg laying, shedding, and basking sites. For non-naturally occurring egg laying, shedding, and basking sites, protection is limited to the active season and ends November 30 of the year of use. This allows the species to complete its life processes without disturbance yet allows for potential removal or disturbance of the feature once the active season is over (e.g. removal of materials such as old metal sheets, compost piles, etc.). The removal of such features outside of the active season will not disturb the individuals of the species and it is likely that similar features can be found the following year. The 1500 metre distance represents the

average distance traveled by Eastern Foxsnakes (Carolinian population) from their hibernacula, and is meant to protect an individual's home range.

Biophysical Attributes of Critical Habitat

The areas of habitat defined under Ontario's habitat regulation contain the biophysical attributes required by Eastern Foxsnake (Carolinian population) to carry out its life processes. For the purposes of defining critical habitat, these biophysical attributes are described below (Table 1).

Table 1. Detailed Biophysical Attributes of Critical Habitat for the Eastern Foxsnake (Carolinian population)

Life Cycle Process	Biophysical Attributes	References
Foraging	• Primarily habitats with early successional characteristics, especially marsh and coastal meadow marsh, other shoreline edge habitats, as well as forests; habitat types may include, but are not limited to, the following examples: • Marsh and other wetlands, prairie, savannah, hedge row, shoreline, old field, forest, sand dunes and dune-slough complexes, and other similar habitats.	COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; DeGregorio et al. 2011.
Hibernation	• Structures and features that extend below the frost line, with sufficient humidity to prevent snakes from drying out, and that provide protection from flooding (e.g. above high water mark) and predators. Such structures and features include limestone bedrock fissures, small animal burrows (naturally occurring features), bases of utility poles, canals, wells, cisterns, building foundations, septic tiles (non-naturally occurring features[16]).	COSEWIC 2008; Eastern Foxsnake Recovery Team 2010
Oviposition	• Presence of natural composting-type sites with high humidity to prevent eggs from drying out and protected from predators such as rotting cavities of downed trees (e.g., Eastern Cottonwood (*Populus deltoides*)), rotting wood on beaches, along or within root systems of dune grasses, abandoned rodent burrows excavated in loamy soil, along dune blow outs or margins of wetland sites (naturally occurring features), abandoned drains, artificial nests erected for snake nesting, compost piles, woodchip piles, or leaf piles (non-naturally occurring features); • Sites are typically found in old field (semi-maintained grass and fields), natural and restored prairie savannah, marsh (wetland), dune-shoreline, and other similar habitats.	Porchuk and Brooks 1995; Brooks et al. 2000; Willson and Brooks 2006; COSEWIC 2008; Eastern Foxsnake Recovery Team 2010

[16] Non-naturally occurring features are human-constructed or maintained structures with a primary purpose other than providing habitat for wildlife (e.g., barns and wells).

Thermoregulation[17] (basking/shelter) and shedding	• Features that provide opportunities for sun and shade exposure such as brush piles, juniper bushes, table rocks, tree stumps, root systems of downed trees, driftwood (naturally occurring features), and non-naturally occurring features (including wooden planks, abandoned vehicles, asphalt, and masonry). • Sites are typically found in open or semi-open habitats such as marsh (wetlands), prairie, savannah, hedge row, shoreline, old field, forest, sand dunes and dune-slough complexes, and other similar habitats.	COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; Willson and Brooks 2006; Watson 1994
Movement	• Areas that allow for movement between hibernation, oviposition, foraging and thermoregulation locations.	Watson 1994; COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; Row et al. 2010

Eastern Foxsnakes (Carolinian population) require a mosaic of habitat types, but use mainly unforested, early successional and shoreline habitat during the active season (Ernst and Barbour 1989; MacKinnon 2005; COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; Row et al. 2010; Row et al. 2012). Eastern Foxsnakes are also tolerant of non-naturally occurring features and/or areas with limited or low human activity such as fields, hedgerows, canals, abandoned buildings, cottages and dump sites. Areas suitable for Eastern Foxsnakes (Carolinian population), including areas used for thermoregulation, foraging, oviposition and hibernation, are typically found in old field (semi-maintained grass and fields), natural and restored prairie savannah, marsh (wetland), dune-shoreline, and other similar habitats, including forests.

Non-natural Habitat Features

Non-naturally occurring features (e.g., compost piles, old wells, scrap metal piles) have been included in the identification of critical habitat for the Carolinian population of the Eastern Foxsnake to support the species' recovery. Suitable habitat for this population is extremely limited and the use of non-natural habitat is crucial to its survival. Individuals within this population are known to utilize non-natural features for various life processes. Without non-natural habitat individuals may not be able to successfully carry out their life functions, including reproduction and overwintering. Additionally, as Eastern Foxsnakes are at the northern extent of their range in Ontario, thermoregulation is particularly important and basking sites are often used prior to or following oviposition. Thus, non-naturally occurring features which provide thermoregulatory characteristics as identified in Table 1 should be left in place where found during the active season.

It may be possible to replace the function served by non-natural structures or features should they need to be removed or disturbed after the active season since it is likely that similar features can be found the following year. However, this determination will need to be made on a case-by-case basis taking into consideration a number of factors

[17] The process of raising or lowering body temperature by varying exposure to environmental conditions.

including species' biology, potential risk to the species, the availability of natural and non-natural features in the surrounding area, and options for mitigation or replacement.

Critical Habitat Criteria

Hibernacula are one of the most important habitat features for Eastern Foxsnakes (Carolinian population), as they are critical for over-winter survival. It is not currently known to what extent the subterranean features of hibernacula extend from an entrance or exit point. Based on expert opinion, a distance of 100 m around a hibernaculum is considered required to maintain the physical and biological composition, structure and function of the surrounding subterranean environment and to protect staging areas in the vicinity of the hibernacula used in the spring and fall.

Because of their close relationship with survival and recruitment of individuals as well as some ecological traits of the Eastern Foxsnake (e.g., reproductive strategy), oviposition, basking and shedding habitats are also addressed separately from other, more general habitats. The 30 m distance around an oviposition, shedding or thermoregulation site is, based on expert opinion, required to ensure that the thermoregulatory, vegetative and lighting properties of the site are maintained.

The maintenance of a healthy Eastern Foxsnake population (Carolinian population) requires connectivity of suitable habitats to enable gene flow between snakes from neighbouring hibernacula as well as permitting snakes to move between areas used for thermoregulation, foraging and oviposition. A radial distance of 1500 m around each Eastern Foxsnake observation is used to determine the extent of critical habitat and is based on the average movement distances from hibernacula observed using radiotelemetry at two locations on the Lake Erie shoreline (Row et al. 2010), and is consistent with average home range lengths observed for locations in southwestern Ontario (COSEWIC 2008).

While the Eastern Foxsnakes in the Great Lakes/St. Lawrence population will readily swim in large expanses of open water, most individuals in the Carolinian population do not demonstrate the same behaviour. Lakes and rivers below the historical low water mark do not contain the attributes of critical habitat and are therefore not included in the identification of critical habitat.

Active agricultural fields in row crops or in crop rotation do not contain the attributes of critical habitat and are therefore not included in the identification of critical habitat. Use of these habitats can result in increased rates of mortality and such habitats may become ecological traps[18].

Through this recovery strategy, the areas prescribed as habitat for the Eastern Foxsnake (Carolinian population) under section 24.3 of Ontario Regulation 242/08 become critical habitat under SARA. The identification of critical habitat is based on

[18] A low-quality habitat that animals choose over other available, better quality habitats.

available observations (up to December 2013) for the Eastern Foxsnake (Carolinian population) from the past 50 years. The Eastern Foxsnake is a relatively secretive species and surveys have not been undertaken in many areas, thus it is appropriate to include observations from the past 50 years unless the habitat has been determined to no longer be suitable or the location has been designated as extirpated by the Ontario Natural Heritage Information Centre (NHIC)[19].

While the provincial habitat regulation is dynamic and automatically in effect whenever the conditions described in the regulation are met, the areas identified as critical habitat within this recovery strategy will remain as critical habitat until revised in an updated recovery strategy or subsequent action plan. Furthermore, if any new locations of the Eastern Foxsnake (Carolinian population) or its habitat features are confirmed within the geographic areas listed under subsection (1) of the regulation (see Figure A-1), the habitat regulation under the ESA will automatically apply to these new locations. Refer to the *Habitat Protection Summary for Eastern Foxsnake* (Carolinian population) (OMNR 2012a) for further details on the provincial habitat regulation and its application. Should new occurrences of Eastern Foxsnake (Carolinian population) be identified that meet the criteria above the area will not automatically become critical habitat, however, the additional critical habitat may be identified in an updated recovery strategy or a subsequent action plan.

Application of Critical Habitat Criteria

Application of the critical habitat criteria above to the best available data identifies partial critical habitat for the Eastern Foxsnake (Carolinian population). The total area within which critical habitat for the Eastern Foxsnake (Carolinian population) is found is 193 995 ha (Figure B-1, see also Table B-1). The area estimate is derived from a 1500 m radial distance boundary around an Eastern Foxsnake (Carolinian population) occurrence, merging overlapping boundaries. Actual critical habitat within this area occurs only in those areas described in subsections 2 and 3 of the provincial habitat regulation for Eastern Foxsnake (Carolinian population), and therefore the actual area would likely be less than reported and would require field verification to develop a more precise estimate. The areas derived from a 100 m and 30 m radial distance around identified hibernaculum and egg laying, shedding or basking sites, respectively, are included within this estimate where known. The critical habitat identified is considered a partial identification of critical habitat, and is insufficient to meet the population and distribution objective. Precise observation data are lacking for some areas within the Eastern Foxsnake's current Carolinian range, so further information is required to identify additional suitable areas. A schedule of studies (Section 6.2) has been developed to provide the information necessary to complete the identification of critical habitat.

[19] Locations with data accuracy of more than 1km are considered to have low locational accuracy and are not included in the identification of critical habitat.

For clarity, Eastern Foxsnakes (Carolinian population) were found to inhabit the habitat within the Rt. Hon. Herb Gray Parkway (HGP)[20] footprint, located in Windsor, Ontario. These individuals were relocated into existing suitable habitat or restored habitat (the majority of these restoration sites occur within the Ojibway Prairie complex and surrounding areas in Windsor, Ontario). The HGP relocation sites are included in the identification of critical habitat as many of the sites already supported Eastern Foxsnakes. No Eastern Foxsnakes were reported in the Gordie Howe International Bridge (GHIB)[21] Plaza site. Any observations or areas within 1500 m of an observation that occur within the HGP footprint where road construction and expansion has occurred and mitigation/relocation of individuals was carried out are not identified as critical habitat at this time. A large amount of land (>35 ha) within the current HGP construction footprint is to be restored back to snake habitat under the provincial ESA permit, and it is expected that Eastern Foxsnakes (Carolinian population) will recolonize these formerly occupied areas once restoration activities are completed and habitat becomes available. Critical habitat will be revisited as additional information on the success of this restoration project becomes available.

Critical habitat identified for the Eastern Foxsnake (Carolinian population) is presented using 50 x 50 km UTM grid squares. Critical habitat was presented at this scale to minimize risk to the species from direct persecution and collection for the pet trade. The UTM grid squares presented in Figure B-1 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes. The areas of critical habitat within each grid square occur where the description of habitat above is met. More detailed information on the regulated habitat may be requested on a need-to-know basis from the Ontario Ministry of Natural Resources and Forestry. More detailed information on critical habitat to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

[20] The Rt. Hon. Herb Gray Parkway is a major highway infrastructure project that will form part of the transportation corridor connecting Highway 401 in Ontario to Interstate 75 in Michigan.
[21] The Gordie Howe International Bridge, previously known as the Detroit River International Crossing, will connect the HGP to Interstate 75 in Michigan.

6.1.2. Critical Habitat for Eastern Foxsnake (Great Lakes/St. Lawrence population)

Ontario Habitat Regulation

The areas prescribed under **Ontario Regulation 242/08 – Eastern Foxsnake (Georgian Bay population) habitat** are described as follows:

24.4 (1) For the purpose of clause (a) of the definition of "habitat" in subsection 2 (1) of the Act, the areas described in subsection (2) that are located in the following geographic areas and parts of geographic areas are prescribed as the habitat of eastern foxsnake (Georgian Bay population):

1. *The geographic areas of Parry Sound and Sudbury.*
2. *The part of the geographic area of Muskoka composed of the lower-tier municipality of Georgian Bay.*
3. *The parts of the geographic area of Simcoe composed of the lower-tier municipalites of Midland, Penetanguishene, Severn, Tay and Tiny. O. Reg. 122/12, s. 4.*

(2) Subsection (1) applies to the following areas:

1. *An eastern foxsnake (Georgian Bay population) hibernaculum.*
2. *The area within 100 metres of the area described in paragraph 1.*
3. *A naturally occurring eastern foxsnake (Georgian Bay population) egg laying site that is being used, or has been used at any time in the previous three years, by an eastern foxsnake (Georgian Bay population).*
4. *An eastern foxsnake (Georgian Bay population) egg laying site, other than a naturally occurring egg laying site, being used by an eastern foxsnake (Georgian Bay population) from the time it is used until the following November 30.*
5. *A naturally occurring eastern foxsnake (Georgian Bay population) shedding or basking site that is being used, or has been used at any time in the previous three years, by two or more eastern foxsnakes (Georgian Bay population).*
6. *An eastern foxsnake (Georgian Bay population) shedding or basking site, other than a naturally occurring shedding or basking site, that is being used by two or more eastern foxsnakes (Georgian Bay population) from the time it is used until the following November 30.*
7. *The area within 30 metres of an area described in paragraph 3, 4, 5 or 6.*
8. *Any part of a rock barren, open forest, old field, marsh, shoreline or similar area that is being used by an eastern foxsnake (Georgian Bay population) or on which an eastern foxsnake (Georgian Bay population) directly depends to carry on its life processes.*
9. *An area that provides suitable foraging, thermoregulation, or hibernation conditions for eastern foxsnake (Georgian Bay population) that is,*
    - *i. within 3,600 metres of an area described in paragraph 8 and no more than 500 metres above the high water mark of Georgian Bay, or*
    - *ii. within 1,500 metres of any area described in paragraph 8 and within the boundaries set out in subsection (3).*

10. An area that provides suitable conditions for an eastern foxsnake (Georgian Bay population) to move between areas described in paragraphs 1 through 9. O. Reg. 122/12, s. 4.

(3) The boundaries referred to in subparagraph 9 ii of subsection (2) are as follows:

1. *Beginning at the point where the northern limit of the road allowance between Concessions 6 and 7 of the Geographic Township of Baxter meets the waters edge of Georgian Bay.*
2. *Thence easterly along said limit to the western limit of Highway 400.*
3. *Thence southerly along the western limit of Highway 400 to the northern waters edge of Tug Channel.*
4. *Thence northerly along the shore of Georgian Bay to the point of commencement. O. Reg. 122/12, s. 4.*

(4) Subsection (1) does not apply to,

(a) an area that is part of a lake or river below the historical low water mark; or
(b) an area that was used to grow corn, potatoes, soya beans, wheat or any other row crop in the previous 12 months. O. Reg. 122/12, s. 4.

The habitat for the Eastern Foxsnake (Georgian Bay population) is protected under the ESA 2007 so long as the specified area has been used within the prescribed period of time, outlined above. The 100 metres around a hibernaculum and 30 metres around an egg laying, shedding, or basking site is intended to protect the feature itself and the terrestrial area required to maintain the suitability of the site. The three year term represents approximately the time period in which Eastern Foxsnakes (Georgian Bay population) may use naturally occurring egg laying, shedding, and basking sites. For non-naturally occurring egg laying, shedding, and basking sites, protection is limited to the active season and ends November 30 of the year of use. This allows the species to complete its life processes without disturbance yet allows for the potential removal or disturbance of the feature once the active season is over (e.g. removal of materials such as old metal sheets, compost piles, etc.). The 3600 metre distance represents the average maximum distance travelled by an individual within their home range, and 500 metres from the high water mark represents the average distance traveled by Eastern Foxsnakes (Georgian Bay population) inland from the water's edge. These distances are meant to protect an individual's home range.

Subsection (4)(a) under section 24.4 of the Ontario Regulation 242/08, which states that the habitat regulation does not apply to an area that is part of a lake or river below the historical low water mark, is not being adopted as part of the critical habitat. Individuals within the Great Lakes/St. Lawrence population of Eastern Foxsnake regularly use lakes and rivers as movement habitat to travel between hibernation, foraging, mating, and oviposition sites. These movement corridors are critical to the survival of the species. Therefore, critical habitat includes open water as a biophysical attribute.

Biophysical Attributes of Critical Habitat

The areas of habitat defined under Ontario's habitat regulation (with the exception of subsection (4)(a) under section 24.4 of Ontario Regulation 242/08) contains the

biophysical attributes required by Eastern Foxsnake (Great Lakes/St. Lawrence population) to carry out its life processes. For the purposes of defining critical habitat, these biophysical attributes are described in Table 2.

Table 2. Detailed Biophysical Attributes of Critical Habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population)

Life Cycle Process	Biophysical Attributes	References
Foraging	• Primarily habitats with early successional characteristics, especially rock barrens with intermittent trees and shrubs such as White Pine (*Pinus strobus*) and Common Juniper (*Juniperus communis*), and shoreline habitats, as well as forests; habitat types may include, but are not limited to, the following examples: ◦ Marsh including coastal meadow marsh, rock barrens, hedge row, shoreline, old field, forest, sand dune, and other similar habitats.	COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; DeGregorio et al. 2011.
Hibernation	• Structures and features that extend below the frost line, with sufficient humidity to prevent snakes from drying out, and that provide protection from flooding (e.g. above high water mark) and predators. Such structures and features include granite and limestone bedrock fissures, animal burrows (naturally occurring features), bases of utility poles, canals, wells, cisterns, building foundations, septic tiles (non-naturally occurring features).	COSEWIC 2008; Eastern Foxsnake Recovery Team 2010; Lawson 2005; MacKinnon 2005
Oviposition	• Presence of natural composting-type sites with high humidity to prevent eggs from drying out and protected from predators such as rock crevices, rotten interior cavities of large logs and stumps, composting vegetation piles (naturally occurring features), abandoned drains, artificial nest erected for snake nesting, compost piles, woodchip piles, or leaf piles (non-naturally occurring features); • Sites are typically found in old field (semi-maintained grass and fields), natural and restored prairie savannah, marsh (wetland), dune-shoreline and other similar habitats.	MacKinnon 2003; Lawson 2005; MacKinnon 2005; COSEWIC 2008; Eastern Foxsnake Recovery Team 2010
Thermoregulation (basking/shelter) and shedding	• Features that provide opportunities for sun and shade exposure such as table rocks with suitable rock- substrate gaps or fissures in the bedrock, brush piles, root systems of living and downed trees, juniper shrubs (naturally occurring features), and non-naturally occurring features (including wooden planks, abandoned vehicles, asphalt, and masonry). • Sites are typically found in open or semi-open habitats such as marshes, rock barrens, hedge row, shoreline, old field, open forest, sand dune, and other similar habitats.	COSEWIC 2008; MacKinnon 2005; Eastern Foxsnake Recovery Team 2010
Movement	• Areas that allow for movement between hibernation, oviposition, foraging and thermoregulation locations, including open water.	Lawson 2005; MacKinnon 2005;

Habitats suitable for Eastern Foxsnakes (Great Lakes/St. Lawrence population), including habitats used for thermoregulation, foraging, oviposition, hibernation, and movement, are typically found in shoreline, rock barrens, sparse forests, beach dunes, and coastal meadow marsh (COSEWIC 2008; Lawson 2005; MacKinnon 2005). They prefer shoreline edge habitats, especially where field, marsh or rock barrens meet along the shoreline. Radio-telemetry data show that Eastern Foxsnakes generally avoid closed canopy forest (Lawson 2003, MacKinnon 2005), likely because of cool microclimates and lack of thermoregulation opportunities. However, closed canopy forest may be used for movement. Eastern Foxsnakes (Great Lakes/St. Lawrence population) will readily use open water for movement to offshore Georgian Bay islands (COSEWIC 2008, Eastern Foxsnake Recovery Team 2010).

Non-natural Habitat Features

Non-naturally occurring features (e.g., compost piles, old wells, scrap metal piles) have been included in the identification of critical habitat for the Great Lakes/St. Lawrence population of the Eastern Foxsnake. Individuals within this population are known to utilize non-natural features for various life processes Non-natural features may provide ideal thermoregulatory properties that are superior to natural features, or non-natural features may be used as there is no suitable alternative natural feature despite there being what appears to be suitable habitat nearby (MacKinnon and Lawson pers. comm. 2015). Without non-naturally occurring features individuals may not be able to successfully carry out their life functions, including reproduction and successfully overwintering.

It may be possible to replace the function served by non-natural structures or features should they need to be removed or disturbed after the active season since it is likely that similar features can be found the following year. However, this determination will need to be made on a case-by-case basis taking into consideration a number of factors including species' biology, potential risk to the species, the availability of natural and non-natural features in the surrounding area, and options for mitigation or replacement.

Critical Habitat Criteria

Hibernacula are one of the most important habitat features for Eastern Foxsnake (Great Lakes/St. Lawrence population) as they are critical for over winter survival. It is not currently known to what extent subterranean features of hibernacula extend from an entrance or exit point. Based on expert opinion, a distance of 100 m around a hibernaculum is determined to maintain the physical and biological composition, structure and function of the surrounding subterranean environment and to protect staging areas in the vicinity of the hibernacula used in the spring and fall.

Because of their close relationship with survival and recruitment of individuals as well as some ecological traits of the Eastern Foxsnake (e.g., reproductive strategy), oviposition, basking and shedding habitats are also addressed separately from other, more general habitats. Based on expert opinion, the 30 m distance around an oviposition, shedding or

thermoregulation site is required to ensure that the thermoregulatory, vegetative and lighting properties of the site are maintained. The maintenance of a healthy Eastern Foxsnake population (Great Lakes/St. Lawrence population) requires connectivity of suitable habitats to enable gene flow between snakes from neighbouring hibernacula as well as permitting snakes to move between areas used for thermoregulation, foraging and oviposition. A precautionary radial distance of 3600 m is used to determine the extent of critical habitat and is based on an Eastern Foxsnake telemetry study in the Georgian Bay area (MacKinnon 2005), where the observed average maximum movement distance from hibernacula was 3578 m (n = 22).

Eastern Foxsnakes (Great Lakes/St. Lawrence population) show strong fidelity to the Georgian Bay shoreline and its islands. Although the Eastern Foxsnake may be found farther inland, the majority of movement is observed within 500 m of the high water mark of the shoreline (Mackinnon 2005). As such, the landward extent of critical habitat is 500 m from the high water mark of the Georgian Bay shoreline (mainland and islands).

Within the Great Lakes/St. Lawrence population, Eastern Foxsnakes can be found at an inland location (i.e. > 500 m from the Georgian Bay shoreline) near Port Severn. Eastern Foxsnake movement patterns at this location appear to be different from the other Georgian Bay sites. None of the transmitter-equipped snakes moved large distances in a telemetry study of the population – the only snake tracked for the entire season had a range length of 949 m, which is more similar to Carolinian population range lengths than those elsewhere in the Great Lakes/St. Lawrence population (Mackinnon 2005). At this location, a radial distance of 1500 m (as is used in the Carolinian population) is used to determine the extent of critical habitat (i.e., replacing the 3600 m distance elsewhere in the Great Lakes/St. Lawrence population).

Active agricultural fields in row crops or in crop rotation do not contain the attributes of critical habitat and are therefore not included in the identification of critical habitat. Use of these habitats can result in increased rates of mortality and such habitats may become ecological traps[22].

Through this recovery strategy, the areas prescribed as habitat for the Eastern Foxsnake (Georgian Bay population) under section 24.4 of Ontario Regulation 242/08 (with the exception of subsection (4)(a) under section 24.4 of Ontario Regulation 242/08) become critical habitat under SARA. The identification of critical habitat is based on available observations (up to December 2013) for the Eastern Foxsnake (Great Lakes/St. Lawrence population) from the past 50 years. The Eastern Foxsnake is a relatively secretive species and surveys have not been undertaken in many areas, thus it is appropriate to include observations from the past 50 years unless the habitat has been determined to no longer be suitable or the location has been designated as

[22] A low-quality habitat that animals choose over other available, better quality habitats.

extirpated by the Ontario Natural Heritage Information Centre (NHIC)[23]. This approach to identify sites as critical habitat is consistent with the approach taken by the OMNRF for habitat regulated under section 24 of Ontario Regulation 242/08.

While the provincial habitat regulation is dynamic and automatically in effect whenever the conditions described in the regulation are met, the areas identified as critical habitat within this recovery strategy will remain as critical habitat until revised in an updated recovery strategy or subsequent action plan. Furthermore, if any new locations of the Eastern Foxsnake (Georgian Bay population) or its habitat features are confirmed within the geographic areas listed under subsection (1) of the regulation (see Figure A-2), the habitat regulation under the ESA will automatically apply to these new locations. Refer to the *Habitat Protection Summary for Eastern Foxsnake (Georgian Bay population)* (OMNR 2012b) for further details on the provincial habitat regulation and its application. Should new occurrences of Eastern Foxsnake (Great Lakes/St. Lawrence population) be identified that meet the criteria above the area will not automatically become critical habitat, however, additional critical habitat may be identified in an updated recovery strategy or a subsequent action plan.

Application of Critical Habitat Criteria

Application of the critical habitat criteria above to the best available data identifies critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population). The total area within which critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population) is found is 131 632 ha (Figure B-2, see also Table B-2). The area estimate is derived from a 3600 m (or 1500 at those locations described in subsection (3) of Ontario Regulation 242/08 – Eastern Foxsnake (Georgian Bay population) habitat) radial distance boundary around an Eastern Foxsnake (Great Lakes/St. Lawrence population) occurrence, merging overlapping boundaries, and restricting to 500 m inland from the Georgian Bay shoreline. Actual critical habitat within this area occurs only in those areas described in subsections 2, 3 and 4b of the provincial habitat regulation for Eastern Foxsnake (Great Lakes/St. Lawrence population), and therefore the actual area would likely be less than reported and would require field verification for a more precise estimate. The areas derived from a 100 m and 30 m radial distance around identified hibernaculum and egg laying, shedding or basking sites, respectively, are included within this estimate where known. The critical habitat identified is considered sufficient to meet the population and distribution objective.

Critical habitat identified for the Eastern Foxsnake (Great Lakes/St. Lawrence population) is presented using 50 x 50 km UTM grid squares. Critical habitat was presented at this scale to minimize risk to the species from direct persecution and collection for the pet trade. The UTM grid squares presented in Figure B-2 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment

[23] Locations with data accuracy of more than 1 km are considered to have low locational accuracy and are not included in the identification of critical habitat.

purposes. The areas of critical habitat within each grid square occur where the description of habitat above is met. More detailed information on the regulated habitat may be requested on a need-to-know basis from the Ontario Ministry of Natural Resources and Forestry. More detailed information on critical habitat to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

6.2 Schedule of Studies to Identify Critical Habitat

Critical habitat for Eastern Foxsnake (Carolinian population) is partially identified in this Recovery Strategy, and is considered insufficient to meet the population and distribution objective for this population. There are locations that may support Eastern Foxsnakes (Carolinian population), but where there is a lack of certainty in the data or where data sharing agreements are required, further work needs to be conducted before an identification of critical habitat can be completed. More information is required to identify suitable habitat in the species' current range. Targeted surveys of local populations are necessary to help obtain this information.

Table 3. Schedule of Studies

Description of Activity	Rationale	Timeline
Conduct surveys for the species and/or hibernacula and/or oviposition sites within the known range.	To collect additional information on habitat use to further refine critical habitat identification.	2017-2022
Confirm habitat occupancy in locations where Eastern Foxsnake (Carolinian population) records are historic, spatially imprecise, cannot be associated to specific locations, or for those records where there is insufficient information associated. If a local population is found, determine the extent of biophysical attributes present.	This activity is needed to complete critical habitat identification.	2017-2027
Conduct population surveys and habitat assessments to confirm species' presence in areas that have received insufficient survey effort. If a local population is found, determine the extent of biophysical attributes present.	Information on the recent presence of individuals is required to support the identification of critical habitat (i.e. determination of habitat occupancy).	2017-2027

6.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Destruction of critical habitat for Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations) can occur at a variety of scales. It may occur from an activity taking place either within or outside of the critical habitat boundary, and it may occur at any time of year. It may be possible to replace the function served by non-natural structures should they need to be removed after the active season. Decisions on potential removal/disturbance and mitigation measures will need to be considered on a case-by case basis. Activities described in Table 4 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 4. Activities Likely to Destroy Critical Habitat of Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations)

Description of Activity	Description of Effect (biophysical attribute or other)	Location of the activity likely to destroy critical habitat			
		Within critical habitat unit			Outside critical habitat unit
		Foraging, oviposition, shedding, and thermoregulation habitat	Movement habitat	Hibernacula	
Activities that cause habitat fragmentation (e.g., road construction and development)	Activities such as construction of infrastructure and the development of roads, trails and footpaths used by wheeled traffic can lead to habitat fragmentation by forming physical barriers that reduce or impede dispersal (e.g. steep roadside slopes, large roads with concrete lane dividers), thereby preventing individuals from accessing habitats required to carry out life processes or impeding movement and increasing mortality (e.g., greater risk of vehicle collision and predation). These activities result in the destruction of critical habitat by reducing the area of contiguous critical habitat and by inhibiting Eastern Foxsnake from accessing suitable habitat areas. Additionally, construction of infrastructure and the development of roads between critical habitat units may impact attempts to maintain and/or improve connectivity and potentially increase occupied areas. Activities occurring at any time of year can lead to degradation or destruction of critical habitat.	X	X	X	X
Activities that result in the permanent reduction or removal of habitat features, such as wetlands, shoreline, rock barrens, sparse forests, beach dunes, coastal meadow marsh (e.g., wetland draining, residential development, land clearing)	Development or clearing of land can lead directly to loss, fragmentation or degradation of critical habitat (hibernacula, oviposition, shedding and thermoregulation sites). Although some of these activities can result in the creation of a different habitat type that is still useable by Eastern Foxsnake (e.g., conversion of forest to field), if these features are cleared for development and/or built upon, this would result in the permanent removal of habitat, and/or reduce the amount of available habitat for the species, and/or fragment remaining habitat by permanently removing	X	X	X	X

	parts of the contiguous areas of habitat and/or pieces of the habitat mosaic on which this species relies. Additionally, development or clearing of land between critical habitat units may impact attempts to maintain and/or improve connectivity and potentially increase occupied areas. Activities occurring at any time of year may lead to degradation or destruction of critical habitat.As explained above (Section 6.1.1), the removal of non-naturally occurring egg-laying or thermoregulation features such as compost or garbage piles or old machinery may not destroy critical habitat if done during the inactive season (November 30 to April 1) providing that the function served by these features can be replaced.				
Removal or alteration of documented nesting sites or hibernacula that may be found in habitat features	Removal or alteration of these sites would result in loss of habitat features critical for overwintering and the future survival of the population. Removing hibernacula or nesting sites is direct destruction of critical habitat and would reduce the number of such sites available in the landscape. Alteration of such sites could make them inaccessible or no longer suitable or functional. Removal of trees and vegetation can change the thermoregulatory properties of Eastern Foxsnake habitat (which are necessary at nesting sites and hibernacula as well as at specific thermoregulation sites). Such activities can make that habitat unsuitable for the Eastern Foxsnake as it no longer provides the necessary characteristics such as cover, warmth, shading required. The alteration of water levels at/near hibernacula would result in changes to temperature and humidity, both of which are critical for overwintering survival of Eastern Ratsnake. This activity can lead to degradation or destruction of critical habitat at any time of the year. The removal of non-naturally occurring egg-laying features such as compost or garbage piles may not destroy critical habitat if done during the inactive season (November 30 to April 1) providing that the function served by these features can be replaced.	X		X	

Activities that remove vegetation	Removal of trees and vegetation can change the thermoregulatory properties of Eastern Foxsnake habitat. Such activities can make that habitat unsuitable for the Eastern Foxsnake as it no longer provides the necessary characteristics such as cover, warmth, shading (etc.) required. Vegetation removal such as tree removal and the excavating/alteration of drainage ditches and creek banks reduces cover in travel corridors. Such removal renders those areas unsuitable due to lack of cover and as such may reduce, fragment or eliminate critical habitat. Such activities occurring during the active season would degrade or destroy critical habitat. Activities occurring outside of the active season (November 30 to April 1) would not impact critical habitat and therefore would be permitted. However, the removal of large numbers of trees from one area would constitute destruction of critical habitat at any time of year.	X	X		
Motorized vehicle usage and failure to follow operational guidelines/best management practices (e.g. use of recreational vehicles (ATVs) in sensitive areas).	Activities such as motorized vehicle use could cause damage to sites beneficial to the life process of Eastern Foxsnake. Alteration of habitat and soil compaction can render the critical habitat unusable. Heavy use of certain areas could impact the species ability to move between habitats, limiting their ability to disperse or to return to important features such as hibernaculum.	X	X	X	

7. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Every five years, success of recovery strategy implementation will be measured against the following performance indicators:

- the area of occupancy has been maintained within both the Carolinian and Great Lakes/St. Lawrence populations of the Eastern Foxsnake;
- the habitat connectivity within local populations has been maintained within the Great Lakes/St. Lawrence population of Eastern Foxsnake, and has been maintained, and where feasible, increased within the Carolinian population;
- the abundance[24] of Eastern Foxsnakes has been maintained or increased in both the Carolinian and Great Lakes/St. Lawrence populations.

8. Statement on Action Plans

One or more action plans will be completed for the Eastern Foxsnake (Carolinian and Great Lakes/St. Lawrence populations) by December 31, 2023.

9. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[25]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[26] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a

[24] The element occurrence rank will be used to measure performance. If the element occurrence rank of a local population remains stable or has improved from that of the rank in 2014 then progress has been made towards recovery. If the rank declines progress has not been successful and alternative measures may be necessary.
[25] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[26] http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

In general, protecting the habitat of the Eastern Foxsnake in Canada will benefit other species and ecosystem functions within the heavily altered Carolinian Zone and along the coast of Georgian Bay. Several other species at risk and rare species share similar preferred habitat to the Eastern Foxsnake including but are not limited to: Spotted Wintergreen (*Chimaphila maculata*), Eastern Prairie Fringed-orchid (*Platanthera leucophaea*), Eastern Milksnake (*Lampropeltis triangulum*), Northern Map Turtle (*Graptemys geographica*), Spotted Turtle (*Clemmys guttata*), Blanding's Turtle (*Emydoidea blandingii*), Spiny Softshell (*Apalone spinifera*), Eastern Musk Turtle (*Sternotherus odoratus*), Eastern Ribbonsnake (*Thamnophis sauritis*), Butler's Gartersnake (*Thamnophis butleri*), Blue Racer (*Coluber constrictor foxii*), and Five-lined Skink (*Plestiodon fasciatus*), although it is not known whether any of these have been found at sites currently occupied by Eastern Foxsnake.

The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. At this time, recovery actions for the Eastern Foxsnake focus on research, monitoring, protection, stewardship and outreach. These activities have very little potential to lead to adverse effects on other species that may share the habitat or range of the Eastern Foxsnake. Activities with potential impacts on other species, such as habitat management, are not recommended at this time. Government-led and government supported actions (see Part 3) focus exclusively on developing protocols, encouraging collaboration, funding, education and outreach.

Consequently, the SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects. For further details, the reader should refer to the following sections of the document, in particular: habitat needs (Part 2, section 1.4), knowledge gaps (Part 2, section 1.7) and the government-led and government-supported actions tables from Ontario's Government Response Statement for Eastern Foxsnake (Part 3).

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Appendix A: Regulated Habitat for the Eastern Foxsnake in Canada

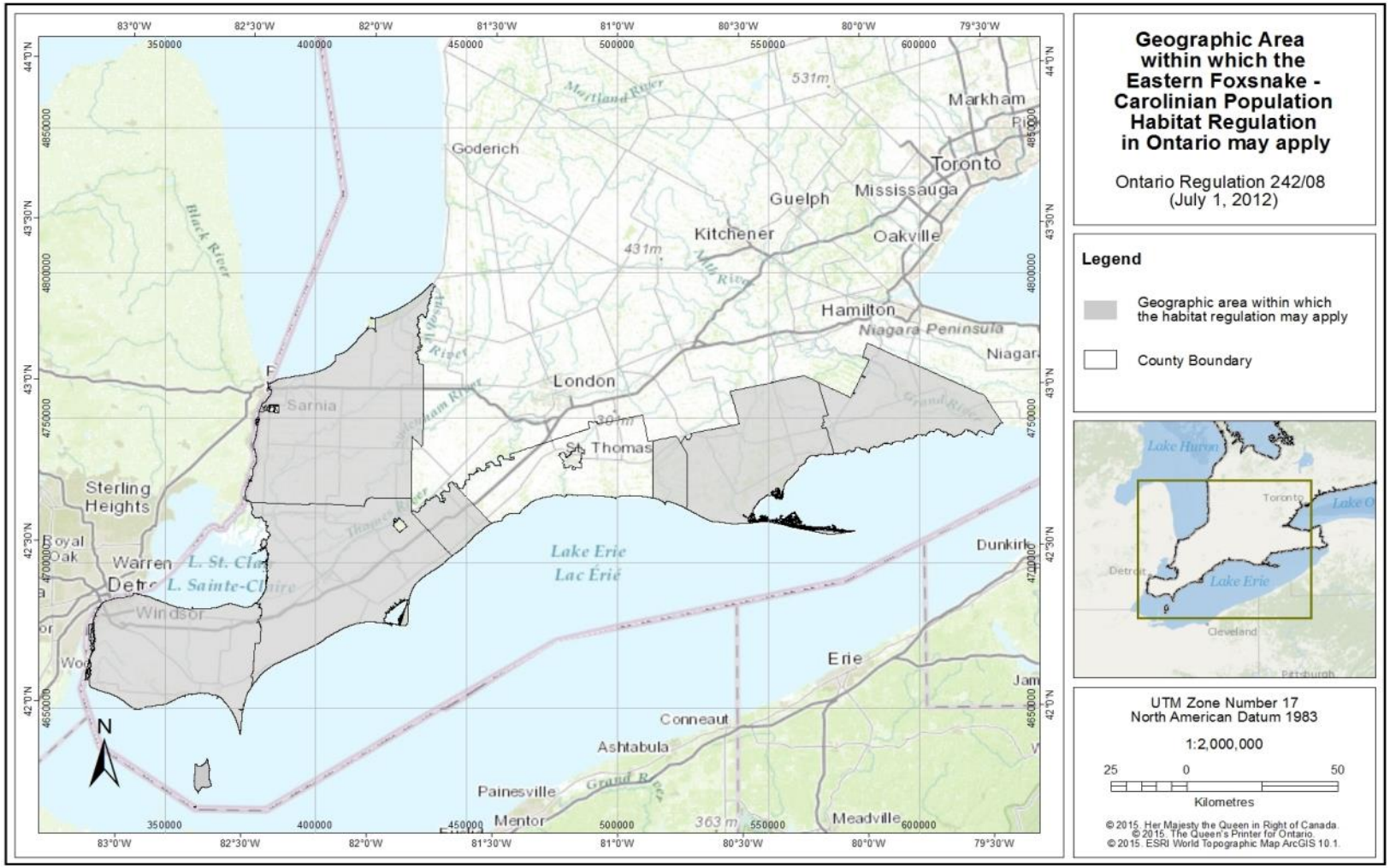

Figure A-1. The geographic areas within which the habitat regulation for the Eastern Foxsnake (Carolinian population) may apply, if the habitat meets the criteria described in section 24.3 of Ontario Regulation 242/08 under the provincial ESA.

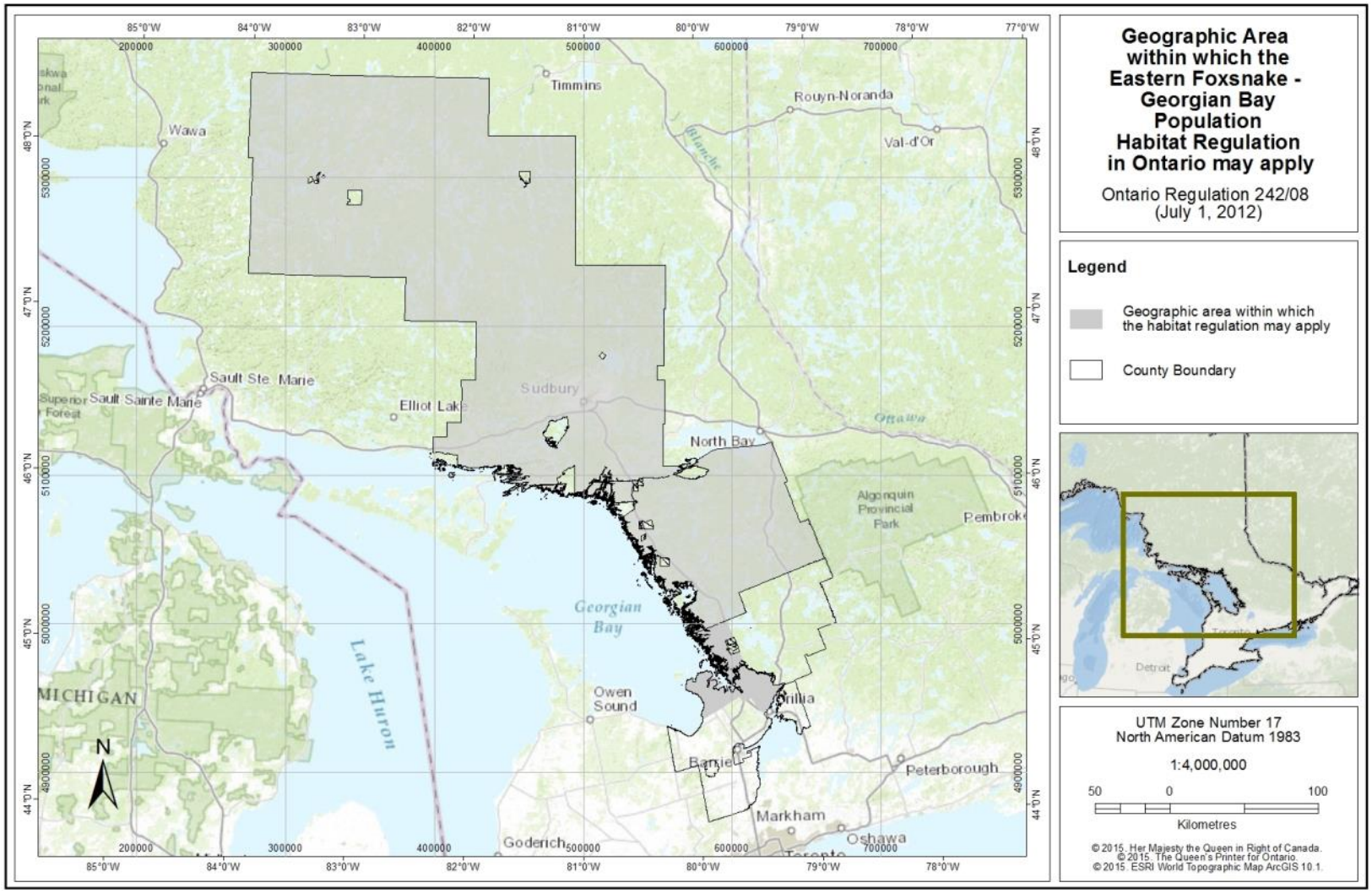

Figure A-2. The geographic areas within which the habitat regulation for the Eastern Foxsnake (Georgian Bay population) may apply, if the habitat meets the criteria described in section 24.4 of Ontario Regulation 242/08, under the provincial ESA.

Appendix B: Critical Habitat for the Eastern Foxsnake in Canada

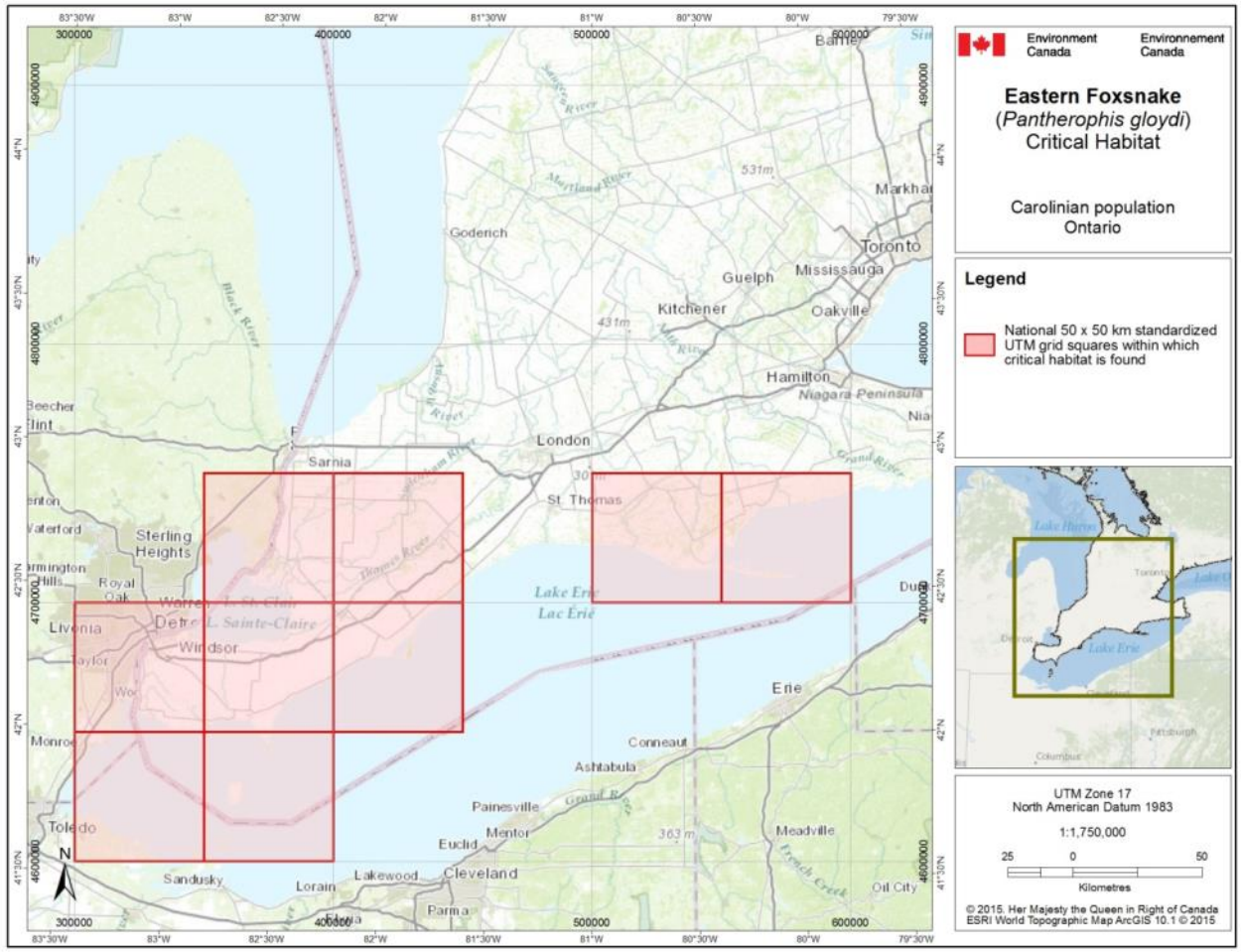

Figure B-1. Grid squares that contain critical habitat for the Eastern Foxsnake (Carolinian population) in Canada. Critical habitat for the Eastern Foxsnake (Carolinian population) occurs within these 50 x 50 km UTM grid squares (red outline), where the description of critical habitat in Section 6.1.1 is met.

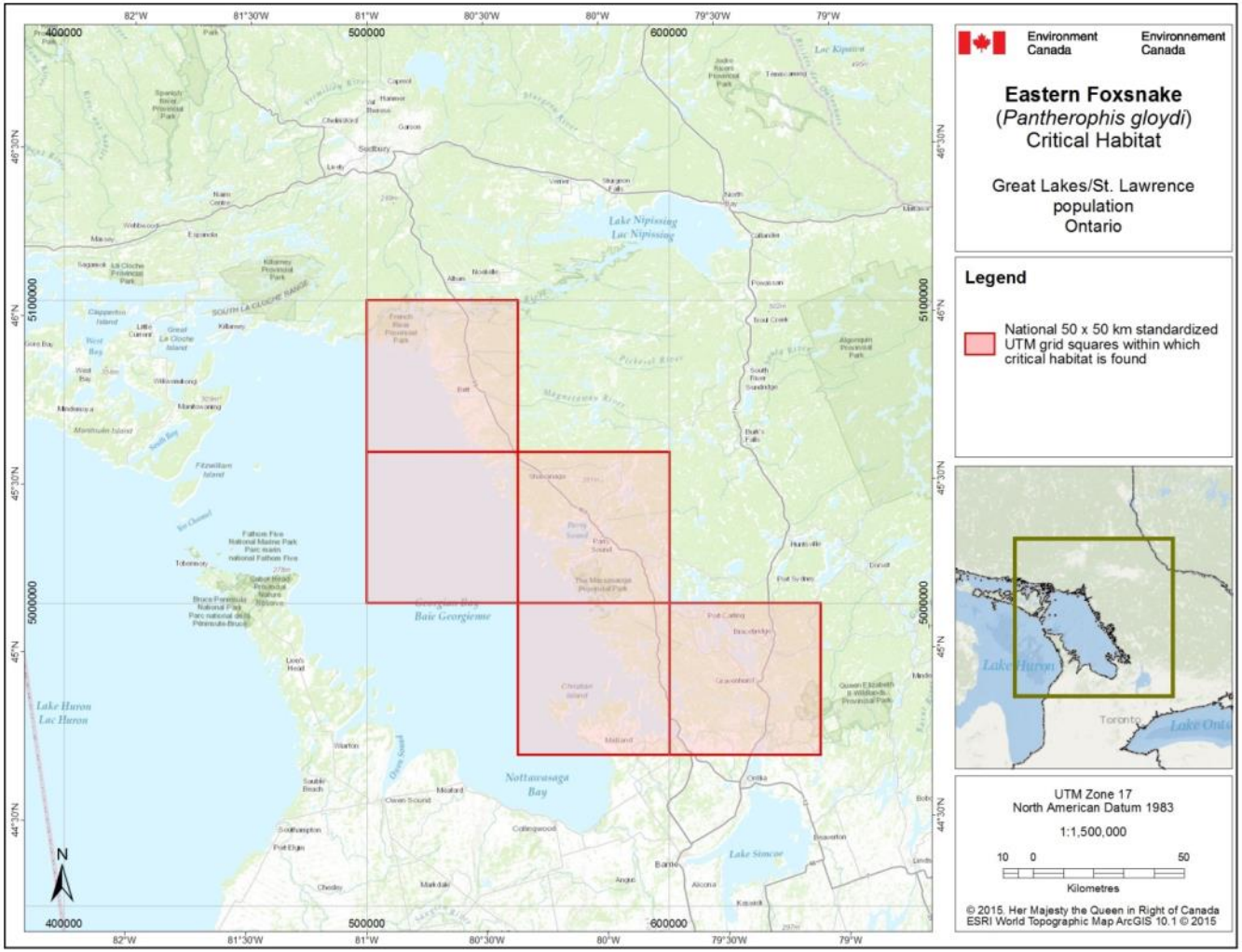

Figure B-2. Grid squares that contain critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population) in Canada. Critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population) occurs within these 50 x 50 km UTM grid squares (red outline), where the description of critical habitat in Section 6.1.2 is met.

Table B-1. Grid squares that contain critical habitat for the Eastern Foxsnake (Carolinian population) in Canada. Critical habitat for the Eastern Foxsnake (Carolinian population) occurs within these 50 x 50 km UTM grid squares where the description of critical habitat is met.

50 x 50 km Standardized UTM Grid Square ID[1]	Province/Territory	UTM Grid Coordinates[2]		Land Tenure[3]
		Easting	Northing	
17TLGA	Ontario	300000	4600000	Non-federal Land
17TLGB	Ontario	300000	4650000	Other Federal Land and Non-federal Land
17TLGC	Ontario	350000	4600000	Federal Protected Area (Point Pelee National Park), Other Federal Land and Non-federal Land
17TLGD	Ontario	350000	4650000	Federal Protected Area (St. Clair National Wildlife Area), Other Federal Land and Non-federal Land
17TLHC	Ontario	350000	4700000	Federal Protected Area (St. Clair National Wildlife Area), Other Federal Land and Non-federal Land
17TMGB	Ontario	400000	4650000	Other Federal Land and Non-federal Land
17TMHA	Ontario	400000	4700000	Non-federal Land
17TNHA	Ontario	500000	4700000	Federal Protected Area (Big Creek National Wildlife Area), Other Federal Land and Non-federal Land
17TNHC	Ontario	550000	4700000	Federal Protected Area (Long Point National Wildlife Area), Other Federal Land and Non-federal Land

[1] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first digits and letter represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid followed by a letter to represent the 50 x 50 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 50 x 50 km standardized UTM grid square containing all or a portion of the critical habitat. The coordinates may not fall within critical habitat and are provided as a general location only.

[3] Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat has been identified and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

Table B-2. Grid squares that contain critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population) in Canada. Critical habitat for the Eastern Foxsnake (Great Lakes/St. Lawrence population) occurs within these 50 x 50 km UTM grid squares where the description of critical habitat is met.

50 x 50 km Standardized UTM Grid Square ID[1]	Province/Territory	UTM Grid Coordinates[2]		Land Tenure[3]
		Easting	Northing	
17TNKD	Ontario	550000	4950000	Federal Protected Area (Georgian Bay Islands National Park), Other Federal Land and Non-federal Land
17TNLA	Ontario	500000	5000000	Other Federal Land and Non-federal Land
17TNLB	Ontario	500000	5050000	Other Federal Land and Non-federal Land
17TNLC	Ontario	550000	5000000	Other Federal Land and Non-federal Land
17TPKB	Ontario	600000	4950000	Other Federal Land and Non-federal Land

[1] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first digits and letter represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid followed by a letter to represent the 50 x 50 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 50 x 50 km standardized UTM grid square containing all or a portion of the critical habitat. The coordinates may not fall within critical habitat and are provided as a general location only.

[3] Land tenure is provided as an approximation of the types of land ownership that exist where critical habitat has been identified and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

Part 2 – *Recovery Strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario,* prepared by the Eastern Foxsnake Recovery Team for the Ontario Ministry of Natural Resources

Photo: Scott Gillingwater

Eastern Foxsnake

(Pantherophis gloydi) Carolinian and Georgian Bay populations in Ontario

Ontario Recovery Strategy Series

Recovery strategy prepared under the *Endangered Species Act*, 2007

September 2010

Natural. Valued. Protected.

Ministry of Natural Resources

Ontario

About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the Endangered Species Act, 2007 (ESA, 2007) and the Accord for the Protection of Species at Risk in Canada.

What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

Under the ESA, 2007, a recovery strategy provides the best available scientific knowledge on what is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA, 2007 outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. There is a transition period of five years (until June 30, 2013) to develop recovery strategies for those species listed as endangered or threatened in the schedules of the ESA, 2007. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources Species at Risk webpage at: www.ontario.ca/speciesatrisk

RECOMMENDED CITATION

Eastern Foxsnake Recovery Team. 2010. Recovery strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 39 pp.

Cover illustration: Scott Gillingwater

ISBN 978-1-4435-4003-2 (PDF)

Cette publication hautement spécialisée Recovery strategies prepared under the *Endangered Species Act, 2007*, *n'est disponible qu'en Anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec Pamela Wesley au ministère des Richesses naturelles au 705-755-1661.*

AUTHORS

Eastern Foxsnake Recovery Team

ACKNOWLEDGMENTS

Members of the recovery team wish to thank James Kamstra of Kamstra Ecostudies for the original drafting of the recovery strategy in 2008. The process was led by co-chairs Brian Hutchison (former) and Gary Allen with much assistance by Angela McConnell. Hilary Gignac consolidated all of the comments on the first draft. Vicki M^{c}Kay, in particular, provided many editorial comments. In addition, Paul Pratt, Mary Gartshore and Paul Ashley shared their observations and information. Funding for the writing of the strategy was provided by Parks Canada Agency and the Ontario Ministry of Natural Resources. The process to transform the recovery strategy into the Ontario template was undertaken by Shavonne Meyer, Rhonda Donley and present co-chair Jeremy Rouse. Anna Lawson, Carrie MacKinnon-Molson, Robert Willson and Jeff Row provided valuable information and comments on the habitat regulation recommendations.

DECLARATION

The Ontario Ministry of Natural Resources has led the development of this recovery strategy for the Eastern Foxsnake (Carolinian and Georgian Bay populations) in accordance with the requirements of the *Endangered Species Act, 2007* (ESA 2007). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all of the individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

RESPONSIBLE JURISDICTIONS

Ontario Ministry of Natural Resources
Environment Canada, Canadian Wildlife Service – Ontario
Parks Canada Agency

EXECUTIVE SUMMARY

The Eastern Foxsnake (*Pantherophis gloydi*) occurs in two restricted regions of Ontario, the Carolinian Forest region and the eastern side of Georgian Bay. Provincially, the Carolinian population and the Georgian Bay population are designated under the *Endangered Species Act*, *2007* as endangered and threatened respectively. Federally, the species is designated by the *Species at Risk Act* as endangered in both the Carolinian and Great Lakes/St. Lawrence populations. Causes of the species decline include wetland drainage for agriculture, impacts resulting from housing and cottage development, road mortality, human persecution and collection for the pet trade. For survival, Eastern Foxsnakes require a mosaic of habitat types that include open foraging habitat, thermoregulating sites, suitable hibernation sites, egg-laying sites and natural corridors linking them. They are usually associated with shorelines, islands or wetlands near the Great Lakes.

The recovery goal for Eastern Foxsnake in Ontario is to ensure population persistence, maintain the current range of occupancy and enhance connectivity of Eastern Foxsnake within both the Carolinian and Georgian Bay populations. The main objectives to achieving recovery are to:

1. track the state of populations and recovery of the species;
2. improve knowledge of populations, habitat use and threats;
3. identify and protect habitat and habitat connections within the current distribution;
4. reduce mortality by minimizing the threats;
5. enhance, restore and reconnect populations; and,
6. promote protection of the species through legislation, policies and land use plans.

Each of these objectives is divided into components and specific steps are recommended to achieve them.

The recovery team has recommended areas to be prescribed as habitat in a habitat for both the Georgian Bay and Carolinian populations. This recommendation includes hibernation and oviposition sites and associated habitat. For hibernacula, it is recommended that the area within 100 metres of known or suspected entrances/exits be prescribed as habitat in a habitat regulation. Additionally, for the Carolinian population it is recommended that natural or anthropogenic structures that extend below the frost line within 1500 metres of an area where one or more Eastern Foxsnakes have been observed in the past ten years also be prescribed as habitat to account for hibernacula that have not been identified. As a precautionary approach to protect undetected hibernacula used by the Georgian Bay population, the recovery team recommends that the area within 100 metres of the high-water mark be prescribed as habitat until such time as it has been determined that Eastern Foxsnake hibernacula do not occur in the those areas.

For oviposition (nesting) sites, it is recommended that known oviposition sites and surrounding 30 meters be prescribed as habitat in the habitat regulation. Additionally, any feature (natural or man-made) that may function as an oviposition site should be prescribed as habitat in the regulation if Eastern Foxsnakes have been observed within 30 metres of the feature during the oviposition period. For the Carolinian population all potential natural oviposition features that are consistent in composition with, and which occur within one kilometre of known occupied oviposition sites should also be prescribed as habitat for the duration of the feature's natural life. For the Georgian Bay population, all potential oviposition structures in appropriate habitat within 100 metres of the high-water mark (or in the exception area in Port Severn) should be prescribed as habitat for the duration of the structure's natural life.

In addition to sites for hibernation and oviposition, Eastern Foxsnakes require habitat areas for foraging, mating, thermoregulation, shedding and movement corridors. For the Carolinian population it is recommended that the marsh and prairie habitat within the current occupied range of the Carolinian population be prescribed as habitat. For the Georgian Bay population the water between the shoreline and the outer islands and all lands and islands within one kilometre from the high-water mark should be prescribed as habitat with the exception of urban areas where the buffer should be reduced to 100 metres.

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1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Eastern Foxsnake

SCIENTIFIC NAME: *Pantherophis gloydi*

SARO List Classification:
Eastern Foxsnake (Carolinian population) – Endangered
Eastern Foxsnake (Georgian Bay population) - Threatened

SARO List History:
Eastern Foxsnake (Carolinian population) – Endangered (2009)
Eastern Foxsnake (Georgian Bay population) – Threatened (2009)
Eastern Foxsnake – Threatened (2004)

COSEWIC Assessment History:
Eastern Foxsnake (Carolinian population) – Endangered (April 2008)
Eastern Foxsnake (Great Lake/St. Lawrence population) – Endangered (April 2008)
Eastern Foxsnake – Threatened (April 1999)

SARA Schedule 1:
Eastern Foxsnake (Carolinian population) – Endangered (March 17, 2010)
Eastern Foxsnake (Great Lake/St. Lawrence population) – Endangered (March 17, 2010)

CONSERVATION STATUS RANK:
GRANK: G3 NRANK: N3 SRANK: S3

The glossary provides definitions for the abbreviations above.

1.2 Species Description and Biology

Species Description
The Eastern Foxsnake (*Pantherophis gloydi*) is Ontario's second largest snake attaining lengths of up to 175 centimetres (Conant and Collins 1991). The species has a characteristic dorsal pattern of bold dark blotches on a yellowish background that alternate with smaller dark blotches on the sides. The scales are weakly keeled and the anal scale is divided. The head colouration varies from brown to red and generally lacks conspicuous markings except for a dark line extending from the eye to the angle of the jaw which is most prominent in juveniles (Conant and Collins 1991). Sexes are visually similar except that males have proportionately longer tails (Willson and Prior 1998). Juveniles have a similar pattern but have a lighter, usually gray background colour and distinct patterns on the head.

Eastern Foxsnake may be confused with several blotched snake species found in Ontario. These include the Massasauga (*Sistrurus catenatus*), Milksnake (*Lampropeltis triangulum*), Eastern Hog-nosed Snake (*Heterodon platirhinos*), Northern Watersnake (*Nerodia sipedon*), Blue Racer (*Coluber constrictor foxii*) and the Gray Ratsnake (*Pantherophis spiloides*). Because of their reddish head, Eastern Foxsnakes are sometimes mistaken for the venomous Copperhead (*Agkistrodon contortrix*), a species that does not occur in Canada. Juvenile Eastern Foxsnakes are most similar to juvenile Gray Ratsnakes and can be distinguished only on the basis of scale row counts.

The Eastern Foxsnake is docile in temperament, but is prone to exuding a foul-smelling secretion from the cloaca when disturbed (Froom 1972). It is an adept tree climber, a proficient swimmer and will take to the water and swim long distances across bays and between islands (MacKinnon 2003, Lawson 2004, MacKinnon et al. 2006). Natural predators of Eastern Foxsnake include large birds of prey such as Red-tailed Hawk (*Buteo jamaicensis*) and Great Horned Owl (*Bubo virginianus*) and carnivorous mammals (e.g., raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), fisher (*Martes pennanti*) and mink (*Mustela vison*) (COSEWIC, 2008).

It is estimated that male and female Eastern Foxsnakes in Georgian Bay reach maturity at 5.15 years and 3.61 years respectively, and reach a maximum age of approximately 12 to 15 years (Row and Lougheed, 2006). These variables have not yet been estimated for the Carolinian population, but due to a warmer climate, they may differ from the Georgian Bay population.

1.3 Distribution, Abundance and Population Trends

Eastern Foxsnakes have a very restricted global distribution, with about 70 percent of their entire range occurring in Ontario, Canada. In the United States, they are confined to southeastern Michigan and extreme northwestern Ohio. The species has a small global range and consequently has been given a conservation status rank of vulnerable (G3) by NatureServe. The Eastern Foxsnake is designated as threatened in Michigan with a rank of imperiled (S2) and special concern in Ohio with a rank of vulnerable (S3) (NatureServe 2010). The closely related Western Foxsnake (*Pantherophis vulpinus*), which has a more extensive range in the midwest of the United States, was considered to be another subspecies of the same species until Collins (1997) recommended it be recognized as a separate species.

The range of Eastern Foxsnakes encompasses two distinct regions of Ontario: the eastern side of Georgian Bay (Georgian Bay population) and the Carolinian Forest region (Carolinian population). Between the two regions is a gap of approximately 250 kilometres from which there are no records of Eastern Foxsnake except for two disjunct records in southern Bruce County. The Georgian Bay population consists of a large meta-population (or several sub-populations) that extends along the eastern shoreline of the Bay from the Midland-Penetang Peninsula north to the vicinity of the French

River. The Carolinian Forest region, along the north shore of Lake Erie, has two apparently disjunct areas of occurrence: Long Point and surrounding Norfolk Sand Plain; and extreme southwestern municipalities of Essex, Chatham-Kent and Lambton. The Georgian Bay population extends no more than five kilometres inland, whereas the Carolinian population occurs more than 20 kilometres inland (Oldham and Weller 2000).

No estimates of Eastern Foxsnake abundance for Ontario as a whole have been made. One communal hibernaculum is known to harbour as many as 264 individuals (MacKinnon 2005), although most contain far fewer and some contain only a single individual (Lawson 2005, MacKinnon 2005). Known records of Eastern Foxsnake observations were compiled by the Natural Heritage Information Centre (NHIC) (Figure 1). It is believed that these records accurately reflect the current distribution of Eastern Foxsnake in the province at the scale of Geographic Township.

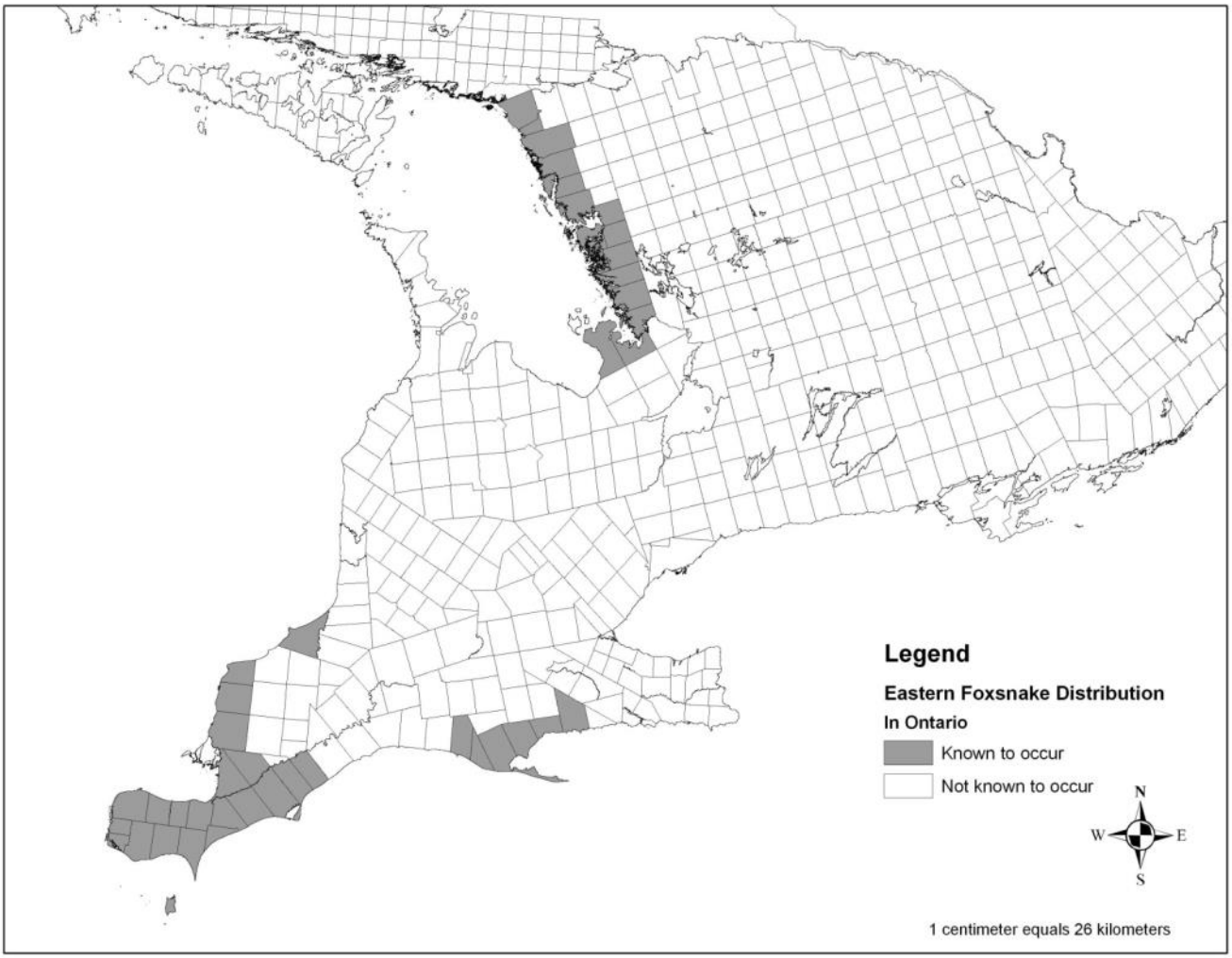

Figure 1. Current distribution of Eastern Foxsnake in Ontario (NHIC 2010)

The species' overall geographic distribution in Ontario does not appear to have been significantly reduced, based on a comparison with Logier and Toner (1961) and more

recent NHIC data. It is believed that some local populations have declined or disappeared, however. Long-term empirical data on Ontario Eastern Foxsnake populations do not exist, consequently it is not possible to know the rate of population decline, or how present populations compare with historic ones. One recent indication of declining populations noted at both the Ojibway Prairie Complex Nature Reserve in Windsor (P. Pratt pers. comm. 2004) and Point Pelee National Park (T. Linke pers. comm. 2004) is that the average size of adults has declined over the past two decades, indicating that adults are dying before they attain a large size. A significant population decline has been reported on the eastern half of the Long Point peninsula (P. Ashley pers. comm. 2004). This area is exposed to minimal human disturbance and the cause for the decline of this population is unknown. High water levels in the 1980's are thought to have inundated hibernacula and could be a potential contributor to the population decline. Road mortality at the base of the Long Point peninsula and surrounding area may be a significant contributor to decline in these populations (Ashley and Robinson 1996, Ashley et al. 2007).

1.4 Habitat Needs

The Eastern Foxsnake requires a mosaic of habitat types that includes suitable sites for hibernation, foraging, thermoregulating and oviposition, as well as natural linkages that allow for free movement between locations that provide these important functions (MacKinnon 2005, Row et al. in prep.). While hibernacula may be the most sensitive and important component of habitat, identifying hibernacula is not easy because they are not recognizable on the landscape and are extremely difficult to locate (Prior and Weatherhead 1996).

Eastern Foxsnakes are typically associated with unforested habitats including old fields, prairies, savannas, shorelines, rock barrens, marshes and beach dunes, though they can utilize a broad range of habitat types including forest (MacKinnon 2005, Row et al. in prep.). They exhibit a strong preference for shoreline edge habitats, especially where field, marsh or rock barrens meet along the shoreline, as well as the forest-scrub ecotone. Eastern Foxsnakes are reasonably tolerant of anthropogenic habitats and/or areas with limited or low human activity such as fields, hedgerows, canals, abandoned buildings, cottages and dump sites. Eastern Foxsnakes frequently move along the shoreline through a mosaic of habitat types and readily swim for considerable distances (up to 10 km) in open water to offshore islands in the Georgian Bay area (MacKinnon 2003, A. Lawson pers. comm. 2004, MacKinnon et al. 2006). They are excellent arboreal predators, foraging for bird eggs and nestlings.

Mature females require oviposition sites, which can include rotten, interior cavities of large logs and stumps, dune slopes, decaying leaf piles, compost or wood chips. On Pelee Island, large, fallen tree trunks along shorelines offered the best oviposition sites (Porchuk and Brooks 1995, R. Willson pers. comm. 2004). Large rotting logs and driftwood were also found to provide important oviposition sites at Rondeau Provincial Park (S. Gillingwater pers. comm. 2004) and Point Pelee National Park (J. Row pers.

comm. 2007). In Georgian Bay, rock crevices were most commonly used as oviposition sites and compost piles were used occasionally (MacKinnon 2003, A. Lawson pers. comm. 2004). Eastern Foxsnakes hibernate communally in traditionally used underground bedrock fissures, animal burrows and anthropogenic features such as old wells and foundations (COSEWIC 2008). Hibernation normally extends for as much as seven months (October to April) of each year (COSEWIC 2008). Neonate and juvenile Eastern Foxsnakes have been found hibernating communally with the mature snakes, however their active-season habitat needs remain largely unknown.

Georgian Bay population

In eastern Georgian Bay, the Eastern Foxsnake distribution is strongly linked with the Bay; 99.5% of radio-telemetry locations (representing 46 individual Eastern Foxsnakes and 5,091 radio-telemetry locations) occurred within one kilometre of the shoreline (MacKinnon 2005). Further evidence of this shoreline affinity was elucidated by measuring the distance between all Eastern Foxsnake records compiled by the NHIC and the Georgian Bay shoreline. Of 107 records, 96 (90%) were within one kilometre of the Georgian Bay shoreline with the most distant record occurring approximately 2.3 kilometres from the shoreline.

Shorelines along eastern Georgian Bay are variable but generally consist of expanses of exposed bedrock with limited soil and irregularly scattered trees, shrubs and forbs. It is these open habitats that are favourable to these large snakes. Current data indicate that all the essential habitat components are contained within one kilometre of the Georgian Bay shore for nearly all individual Eastern Foxsnakes. Anthropogenic sites are not avoided in these shorelines as Eastern Foxsnakes are frequently seen in the vicinity of cottages or buildings. Habitat use by Eastern Foxsnakes was found to be non-random with respect to habitat availability; individuals used rock barrens and sparse forests significantly more than mixed, deciduous or coniferous forests (MacKinnon 2005). Radio-telemetry data has shown that Eastern Foxsnakes generally avoid closed canopy forest (Lawson 2003, MacKinnon 2005), likely because of cool microclimates and lack of thermoregulating opportunities.

Individuals of the Georgian Bay population of Eastern Foxsnake are highly aquatic and on occasion are known to swim for more than 10 kilometres, and therefore can occur on islands well offshore and a considerable distance from their hibernation site (Lawson 2004, Lawson 2005, MacKinnon 2005).

Carolinian population

Eastern Foxsnakes in the Carolinian population of southwestern Ontario do not show the same affinity for open water as observed in the Georgian Bay population. The NHIC has documented some records more than 20 kilometres inland. Although some individuals may, most individuals do not regularly swim out across large expanses of open water (e.g., between the islands in Lake Erie).

Unlike the Georgian Bay area, the landscape used by Eastern Foxsnakes in southwestern Ontario has changed dramatically. Across the distribution of the

Carolinian population, the conversion of original habitats (often wetlands) to agricultural fields has been extensive (Whitaker 1938). Most of the original wetlands in this part of the province have been drained. For example, Essex County and the municipality of Chatham-Kent lost 95 percent of their original wetlands between 1800 and 1982 (Snell 1987). Nevertheless, Eastern Foxsnakes regularly frequent some human-modified habitat as long as there is a sufficient amount of wetland and natural vegetation cover nearby.

A recent study quantified habitat-use patterns of Eastern Foxsnakes in the Carolinian population at two locations (Point Pelee National Park and Hillman Marsh Conservation Area) using radio telemetry and across the range of Eastern Foxsnakes in Essex and Chatham-Kent counties using occurrence records (Row et al. in prep.). This study showed that Eastern Foxsnakes had a strong preference for marsh and natural and semi-natural open habitat and a strong avoidance for agricultural fields. Open natural and semi-natural habitat included features such as natural and restored prairie habitat down to semi-maintained grass and fields greater than 15 metres in width along drainage ditches, creeks, roads and railway tracks. These trends were consistent across three spatial scales: (1) locations within the active-range; (2) active-range within the study area; and (3) across a large regional population. Thus, similar habitat-use patterns of Eastern Foxsnakes (e.g., use of open natural and semi-natural habitat) are likely across the Carolinian population.

Through the research in the Carolinian population, a number of natural and anthropogenic nesting features were identified (Row et al. in prep). Root wads and logs provide cover and shelter; once these features begin decomposing they provide nesting habitat, particularly in dune or prairie habitat. In addition to these natural oviposition sites, Eastern Foxsnake oviposition sites are frequently leaf, wood chip or compost piles created by humans. These nests can be large and support clutches from multiple females (J. Row pers. comm. 2009). Other anthropogenic ovipostion sites include abandoned drains under roads and intentionally-created artificial nests.

Radio-telemetry studies at Point Pelee National Park and Hillman Marsh Conservation Area found the majority of radio-tracked Eastern Foxsnakes hibernated in anthropogenic features such as old wells, canal dikes, septic tile beds and building foundations (Watson 1994, J. Row pers. comm. 2009). Eastern Foxsnakes have also been known to hibernate in buildings and people's homes (J. Row pers. comm. 2009). Anthropogenic features do provide habitat for Eastern Foxsnakes and the presence and use of these features as hibernacula or oviposition sites may be necessary for the survival of some populations, because suitable natural (pre-settlement condition) features may no longer occur in some areas.

1.5 Limiting Factors

Life history features such as age of maturity, spring and fall concentrations at hibernacula, fidelity to hibernacula, and intermittent juvenile recruitment predispose

Eastern Foxsnake populations to major demographic fluctuations when subjected to disturbances or stresses. Large seasonal movements to and from hibernacula may increase the probability of mortality by predators or human traffic (boat and road traffic). These seasonal congregations can also make Eastern Foxsnakes more susceptible to predation or collection for the pet trade. The presence of suitable hibernacula may be a limiting factor, particularly towards the northern part of their range where cold temperatures can make potential hibernacula unsuitable. Exceptionally cold winters (e.g., winter of 1994) can result in high mortality to snakes during hibernation (M. Gartshore pers. comm. 2004, R. Willson pers. comm. 2004). Even small increases in the rate of adult mortality may alter the reproductive capacity of a population to such an extent that it becomes highly vulnerable to extirpation.

1.6 Threats to Survival and Recovery

Road Mortality

Vehicle collisions with Eastern Foxsnakes on roads are one of the most significant causes of Eastern Foxsnake mortality. A very extensive road network and increasing traffic are leading to increasing incidences of road mortality in both regional populations in Ontario. The causeway at the base of Long Point, which crosses three kilometres of marsh, shows consistently high mortality of Eastern Foxsnakes and many other herpetofauna (P. Ashley pers. comm. 2004, Ashley and Robinson 1996). In 2003 alone, 15 Eastern Foxsnakes were killed along a short stretch of highway approximately 10 kilometres north of Point Pelee National Park (V. M^{c}Kay pers. comm. 2004). High rates of road mortality have also been reported on Pelee Island (R. Willson pers. comm. 2004). Even within protected areas such as Point Pelee National Park (V. M^{c}Kay pers. comm. 2004) and Rondeau Provincial Park (S. Dobbyn pers. comm. 2004), Eastern Foxsnake road mortalities are well documented.

By comparison, there are fewer roads in the Georgian Bay range of the Eastern Foxsnakes, nevertheless, development is increasing in this area, and with that, more access roads are being constructed (J. Rouse pers. comm. 2010). Populations present in mainland areas with road networks are experiencing mortality. Even lightly used roads are taking a significant toll on Eastern Foxsnakes (G. Clayton pers. comm. 2004). Eight Eastern Foxsnakes were noted as being killed on a 10 kilometre stretch of a Muskoka road in 2003 (MacKinnon 2003) and another nine in 2004 (MacKinnon et al. 2005). In Killbear Provincial Park, two out of nine radio-telemetered Eastern Foxsnakes were killed on roads in 2003 (Lawson 2003). Heavy boat traffic is believed to be causing some mortality as well, since the snakes are known to swim long distances in open water between islands. However, it is difficult to substantiate or quantify this mortality risk. It is believed that the greatest threat to Eastern Foxsnakes in the Georgian Bay population are new or upgraded roads within one kilometre from the shoreline of eastern Georgian Bay because they increase both habitat fragmentation and vehicle caused mortality.

Habitat Loss, Degradation and Fragmentation

The loss of wetland and forest-field mosaics are thought to be a key cause of the species decline throughout its range in southwestern Ontario (Willson and Prior 1998). Historically, wetlands covered a large portion of what are now the Municipality of Chatham-Kent and Essex County. Most have been drained for agriculture so that now, less than five percent of wetland habitat remains (Snell 1987). It is reasonable to assume that Eastern Foxsnakes, which show a strong affinity to wetlands, would have been much more common and widespread prior to these extensive losses. Agricultural and housing development continues along the Lake St. Clair and Lake Erie shorelines, including the Lake Erie Archipelago, reducing the snakes' favoured habitat, nesting and hibernation locations (Willson and Porchuk 2001).

The amount of wetland loss has been low in recent decades because there was little left to drain. However, the trend to larger cropped fields results in removal of hedgerows and small patches of natural or disturbed vegetation that still function as habitat (e.g., field and edge). In addition, debris such as logs and fallen trees are cleared along shorelines, thereby eliminating important micro-habitat features.

Although the availability of habitat in eastern Georgian Bay has not declined to the same degree as in the Carolinian population, increasing development and recreational land use in this region is almost certainly resulting in a reduction of suitable habitat (COSEWIC 2008).

Because Eastern Foxsnakes seem to require a variety of habitat elements (e.g., shorelines, marshes, fields, a suitable hibernaculum) within an active range, the overall suitability or quality of a landscape is presumably highest where these elements occur in certain proportions. Habitat quality may vary with the relative proportion of requisite elements; consequently Eastern Foxsnake habitat may be degraded by:

1) the absolute loss of specific habitats (e.g., marsh, natural shorelines, hibernation sites);
2) an alteration in the relative proportions and or juxtaposition of the habitat elements; and,
3) the fragmentation of habitat elements with roads and other barriers

Such changes in landscape composition may affect spatial and activity patterns of snakes and limit the capacity of a given region to support a population. Retaining the appropriate habitat composition and linkages may be a key to the future persistence of populations, particularly in southwestern Ontario.

The Carolinian population occurs within a predominantly agricultural landscape. As such, this population has been subjected to severe landscape-scale habitat alteration including the fragmentation and reduction of wetland and forest to be replaced by largely unsuitable habitat (e.g., intensive agricultural crops like corn, soybeans and vegetables). Given the avoidance of agricultural fields by Eastern Foxsnakes (Row et. al. 2009), the amount of suitable habitat available to the population has been drastically

reduced and fragmented. The remaining large patches of suitable habitat are found mainly in provincially and nationally protected areas and private land preserved for hunting. However, Eastern Foxsnakes are found in small patches of suitable habitat on private and municipal land (e.g., old fields, sewage lagoons, riparian habitat along drainage ditches, small creeks and roadside drainages where there are patches of relatively undisturbed grasses).

Confusing the issue, however, is that Eastern Foxsnakes in southwestern Ontario are frequently using, and may now be forced to depend on, abandoned anthropogenic features (e.g., building foundations, garbage piles and wells) for shedding sites, hibernacula, oviposition sites, and foraging habitat. As these features get 'cleaned up' with newer developments or changed agricultural practices, the snakes may lose their ability to persist in such a human influenced landscape.

Recent research into the genetic structure of Eastern Foxsnakes in southwestern Ontario indicates that the Carolinian population consists of a number of genetically distinct sub-populations (DiLeo et. al. in press). Based on the distribution of suitable habitat, some or all of this genetic distinctness appears to be attributable to the isolation of clusters of individuals resulting from habitat loss and fragmentation, which has reduced connectivity between populations. Small isolated populations have an increased extirpation risk (Saccheri et al. 1998, O'Grady et al. 2006). Therefore, it is likely that further fragmentation through habitat loss and/or road, urban and residential development would increase the number and likelihood of local extirpations across this region.

Due to deforestation and shoreline development, many Eastern Foxsnakes across southwestern Ontario are unlikely to have access to natural nest sites. It is likely, however, that they now rely on nest features that are created by humans, especially compost piles. These nests can be large and support clutches from multiple females (J. Row pers. comm. 2009). Regular turning of occupied compost piles during the reproductive period (early July to early September inclusively) likely results in nest failure or egg or neonate mortality. The protection of natural nesting sites and creation of artificial nest sites would decrease the reliance of Eastern Foxsnakes on active anthropogenic features. For example, driftwood and snags along the shorelines in both the Georgian Bay and Carolinian regions provide important cover and oviposition sites, but these habitat features are often removed or burned, in both protected and non-protected areas (Gillingwater 2001). Without safe and productive nesting habitat, populations are unlikely to persist. Although it is less common for Eastern Foxsnakes in the Georgian Bay population to use compost piles as nesting sites, similar impacts would result from disturbance of any compost pile nest during the incubation period.

Subterranean disturbances associated with development (e.g., disturbance through blasting or excavation for building foundations or septic systems), digging of wells and removal of old foundations have been reported to unearth Eastern Foxsnakes while in hibernation in the Georgian Bay population, resulting in the destruction of hibernation

habitat and death to the Eastern Foxsnakes through exposure (J. Rouse pers. comm. 2010).

Direct Persecution

There is a segment of the human population that strongly dislikes snakes and kills them on sight. Eastern Foxsnakes, being large and rather slow, in addition to being mistakenly identified as rattlesnakes or copperheads (because of their blotched pattern and habit of tail vibrating), are feared and therefore frequently killed, especially when they turn up near homes or cottages. Even in Rondeau Provincial Park, cottage owners have admitted to killing Eastern Foxsnakes when encountered on their property. Similarly, Eastern Foxsnakes have been found killed by humans within the Long Point National Wildlife Area (S. Gillingwater pers. comm. 2004). This likely pertains to other protected areas as well.

Collection

Some Eastern Foxsnakes are collected for pets since they are impressive, attractive, docile and rare. In most cases, these are probably individual specimens that are taken from the wild for personal pets. Even the removal of a single reproductive animal from the gene pool of some populations may be significant. The extent of larger scale collection for the pet trade is unknown but there are unconfirmed reports of collectors removing snakes from protected areas. The significance of this activity needs to be assessed. Collecting could have a highly significant impact if hibernacula were discovered, since a large proportion of a local population could be removed. Hibernation traps for research are potentially vulnerable to would be collectors, which underlies the need for confidentiality of known hibernacula.

Subsidized Predation

Eastern Foxsnakes are susceptible to predation and are particularly vulnerable at hibernacula where a large number of individuals may concentrate. Although natural predation occurs from species such as mink and raptors, predation is a particular concern where human-subsidized predators such as raccoons or cats are numerous. Domestic dogs have also been reported killing Eastern Foxsnakes within Norfolk County, though the extent of such losses is unknown (S. Gillingwater pers. comm. 2004). Eastern Foxsnake nests have also been predated by subsidized predators such as raccoons and coyotes (*Canis latrans*). Skunk, Red Fox (*Vulpes vulpes*) and Virginia Opossum (*Didelphis virginiana*) may also prey on nests (COSEWIC, 2008).

Chemical Toxins

Eastern Foxsnakes at Point Pelee National Park have been found to contain relatively high levels of DDT in their tissues even though DDT has not been used there since the 1960s (Russell et al. 1994). The large snakes at Point Pelee National Park exhibited some of the highest concentrations of chemical contaminants detected in any Point Pelee National Park organisms to date. Biomagnification of PCBs and DDT was observed in Eastern Foxsnakes, with higher concentrations than in one of their main prey items, mice. No differences in tissue chemical concentrations were found in Eastern Foxsnakes with respect to sex, size and condition. The impact to their health is

not known. Eastern Foxsnakes outside of Point Pelee National Park in southwestern Ontario may be subjected to high levels of contaminants, particularly those living near polluted waterways or any agricultural areas where persistent pesticides have been applied.

Other Threats

A number of other human activities result in unintentional mortality of Eastern Foxsnakes. For example, they get run over by boats, mowers or farm equipment. Some types of nylon mesh used to prevent erosion or used in gardening are of a size that can entangle adult Eastern Foxsnakes. In a number of cases, multiple Eastern Foxsnakes were found strangled in this type of material (M. Gartshore pers. comm. 2004). MacKinnon (2003) reported that 2 of 13 transmitter-equipped Eastern Foxsnake deaths resulted from interactions with non-passenger vehicles off the roadways (forklift and ditch mower). Fire can also be a cause of mortality. An accidental fire is reported to have killed 18 adult Eastern Foxsnakes at Rondeau Provincial Park in May 2000 (Gillingwater 2001). Scientific field studies also inadvertently cause negative effects (including mortality) on study animals. It is likely that most populations are subject to a variety of stresses, and therefore any additional increase in mortality could tip the balance of sustainability.

The timing of maintenance and restoration activities can contribute to accidental Eastern Foxsnake mortality. The deep grasses along drainage ditches (20 to 30 cm in length) provide cover for Eastern Foxsnakes, however maintenance and mowing of these drainage ditches removes this cover and can directly injure or kill individuals (R. Gould pers. comm. 2010). During June and July when gestating females often congregate around rock piles found in drainage ditches (J. Row pers. comm. 2010), removal of the deep grass cover could be having an impact on survival.

1.7 Knowledge Gaps

Distribution, Abundance and Population Trends

Comparative population data from representative sites across the Eastern Foxsnake range are needed to determine whether populations are stable or declining and, where they are declining, the causes and rates of decline. Comparative population data at specific locations (e.g., Long Point, Port Severn) is needed to understand if, and at what rate, the Eastern Foxsnakes at those locations are declining, and the causes of the declines.

For populations that occur partly within protected areas (e.g., Point Pelee National Park/Hillman Marsh, Rondeau Provincial Park, Ojibway Prairie, Fish Point and Lighthouse Point Provincial Nature Reserves, Big Creek, Long Point and St Clair National Wildlife Areas, The Massasauga Provincial Park, Killbear Provincial Park and Georgian Bay Islands National Park), further study is required to determine the significance of the respective protected area in the context of the surrounding unprotected lands.

Habitat Needs

The size and condition of logs and root wads preferred as nesting sites need to be determined. This information is necessary to effectively identify and protect natural nest sites and to create or enhance nesting habitat.

The micro-climate conditions found within natural and anthropogenic hibernacula need to be determined. Such information will assist in the creation of artificial features and in determining the suitability of existing structures that may or may not currently be used by snakes but have the potential to act as hibernacula.

Methods for identifying hibernacula should be devised and tested. Further habitat studies should be conducted to determine, as closely as possible, the ideal proportions of habitat types required within a mosaic; as well as determining threshold values below which Eastern Foxsnake populations begin to decline.

Threats to Survival and Recovery

The degree of human induced mortality in aquatic habitat warrants further studies to determine if, and to what extent, it occurs as well as possible mitigation strategies to reduce impacts to Eastern Foxsnakes.

The eggs of some other reptiles, including snakes, are afflicted by parasitoids that can cause significant mortality. It is presently unknown, but should be determined, if this is a problem with Eastern Foxsnakes.

A comprehensive health and disease screening study would be useful in determining if pathogens are affecting populations.

At Point Pelee National Park, tissues of Eastern Foxsnakes were found to contain high levels of contaminants, particularly DDT (Russell et al. 1994). Kraus and Schuett (1983) reported finding an aberrant melanistic (having unusual amounts of black pigment) Eastern Foxsnake with visible deformities, as well as other oddly coloured individuals in a contaminated, industrial area of Lucas County, Ohio. It is not known how this is affecting survival of that population or if other populations are similarly affected. Populations whose area of occupancy is in agricultural or industrial areas (e.g., near the Detroit River) are likely exposed to contaminants. The impacts of pesticide contamination at Point Pelee National Park should be determined. Impacts should also be determined in any other areas where contamination might be affecting Eastern Foxsnake populations.

The effect of subsidized (e.g., raccoons, cats) and hyperabundant (e.g., wild turkeys) predators on Eastern Foxsnake populations is unknown but may be a significant threat. A study investigating how these predators are affecting Foxsnakes is needed.

Species Biology and Ecology

More information is required about population level habitat requirements and what conditions allow for population viability. For example, an understanding of neonate and juvenile dispersal and habitat use is required. Ideal conditions for egg development are currently unknown. Sex-specific mortality factors could be investigated (e.g., Are females or males more likely to cross roads or be killed in particular areas? Is there a difference in water crossings/movement between sexes?).

Radio-telemetry studies in Georgian Bay (Georgian Bay Islands National Park and Killbear Provinicial Park) and the Carolinian region (Point Pelee National Park and Hillman Marsh Conservation Area) have documented habitat use and movement patterns for individuals. For the Carolinian population, more research is needed on the movement patterns and habitat of individuals outside protected areas. Although Row et al. (in press) showed that individuals avoided agricultural fields, there are areas across this region where individuals persist in much more disturbed habitat and these individuals are essential to maintaining and hopefully restoring connectivity. Understanding how individuals use and move through habitat in these heavily disturbed areas will assist with protecting this population. Unfortunately, there are challenges associated with filling this knowledge gap. For instance, it can be difficult to attain landowner permission for accessing private property in this area. In addition, locating Eastern Foxsnakes can be an issue because of low densities and studies can be difficult due to high mortality rates.

In order to gain baseline data on population trends, mark-recapture studies have been carried out for selected populations in Georgian Bay (near Georgian Bay Islands National Park) and the Carolinian region (Point Pelee National Park to Hillman Marsh Conservation Area). This research should be continued to have a better idea of long-term demography and population trends (e.g., population fluctuations, population increases or decreases). Without such baseline data it is difficult to accurately assess population viability.

Mitigation of Threats to Survival and Recovery

Effective mitigation against the various human caused impacts needs to be developed in order to minimize unnatural mortality.

Little is known about how the threat of road mortality could be mitigated. Research and development of effective crossing structures that increase the permeability of linear barriers (i.e., roads) would assist in recovery for the species.

1.8 Recovery Actions Completed or Underway

Research and Monitoring

- The NHIC maintains a database that compiles all known records of Eastern Foxsnake in Ontario, including hibernation data where possible. The database is continually updated as new information is obtained.

- The Georgian Bay Reptile Awareness Program (GBRAP) collected records of species at risk in the Georgian Bay area, which were forwarded to the NHIC.
- Radio-telemetry studies at three locations on Georgian Bay; Killbear Provincial Park (2000 to 2004), Georgian Bay Islands National Park of Canada (GBINP) (2003 and 2004) and Awenda Provincial Park, are providing data on movement patterns, habitat characteristics (vegetation types, distance to shoreline), habitat use, hibernation locations, mating behaviour, egg laying sites, population characteristics, etc. Communal hibernacula in the central Georgian Bay (A. Lawson pers. comm. 2004) and southern Georgian Bay (C. MacKinnon pers. comm. 2004) areas have been monitored.
- Radio-telemetry, habitat use and demography (mark-recapture) research was conducted at Point Pelee National Park and Hillman Marsh Conservation Area in Essex County (2006 to 2009) and a mark-recapture study was continued in southern Georgian Bay area (2007 to 2009) (J. Row pers. comm. 2009). Large scale habitat use and population genetic patterns were established across southwestern Ontario and updated landcover maps were developed (DiLeo et al. in press, Row et al. in prep).
- Previous radio-telemetry studies were conducted at Point Pelee National Park in 1992 and 1993 (Watson 1994), Pelee Island (Wilson 2000), and at Norfolk County in 1992 and 1993 (M. Gartshore pers. comm. 2004). The 1992 and 1993 Point Pelee National Park radio-telemetry data was analyzed by Row (2007) to identify habitat characteristics.
- Ongoing compilation of records including morphological measurements and passive integrated transponder (PIT) tagging at Point Pelee National Park, Long Point National Wildlife Area, Rondeau Provincial Park, East Sister Island, Killbear Provincial Park and Ojibway Nature Reserve.
- Blood samples were collected from several sites for DNA analysis by Queens University researchers (R. Brooks pers. comm. 2004). Samples from Long Point area snakes have been sent to Carleton University.

Education

- The GBRAP, based out of Parry Sound produced an extensive outreach program on all reptile species at risk in the Georgian Bay area. This program was delivered to about 2000 students and 2300 members of the public in 2003. Outreach programs were delivered at schools (targeting grades 4 and 10) and to cottage associations. Snake sensitivity training was offered for construction workers (G. Clayton pers. comm. 2004).
- The GBRAP produced a poster and brochure on reptiles of Georgian Bay. These materials have been distributed throughout the area.
- The Georgian Bay Biosphere Reserve provides outreach programs and materials that include information on the Eastern Foxsnake and other species at risk.
- Outreach programs delivered by the Upper Thames River Conservation Authority promote species at risk including Eastern Foxsnakes. These programs reach between 2000 and 5000 people each season.
- Natural history interpretation programs that include information on Eastern Foxsnakes are in effect at GBINP, Point Pelee National Park, Rondeau

Provincial Park, Killbear Provincial Park, Awenda Provincial Park, Ojibway Nature Centre in Windsor and the Pelee Island Heritage Centre. Nature interpretation programs are not currently available to the public at Long Point and Turkey Point Provincial Parks where nature interpretation would greatly enhance public attitude.

- Staff from Point Pelee National Park, GBINP, Rondeau Provincial Park, Killbear Provincial Park, Awenda Provincial Park, Ojibway Nature Reserve and MNR District Offices respond to concerned local people who find Eastern Foxsnakes on their lands.
- Toronto Zoo (Adopt-a-Pond) created and distributes an "Ontario Snakes" poster to promote snake appreciation and conservation. Prior to that, the Norfolk Field Naturalists produced and distributed a different "Ontario Snakes" poster to every public school in Norfolk County.
- Non-profit organizations such as "Sciensational Sssnakes" provide education and encourage appreciation of snakes.
- In response to declining reptile populations and ongoing habitat threats, the Long Point Basin Land Trust launched its "Conserving Carolinian Reptiles" project in 2009. The Land Trust developed a multi-faceted project including reptile surveys and population monitoring, education and outreach and a variety of on-the-ground habitat creation projects which benefit reptiles.
- Parry Sound District MNR produced a fact sheet outlining the danger of erosion blanket mesh to large snakes.
- Queen's University researchers in collaboration with the Essex County Stewardship Network and Chatham-Kent Stewardship Network developed an educational website and pamphlet, which was delivered to landowners across Essex County and the Municipality of Chatham-Kent. Continuing with this stewardship, they have attempted to get the public involved in Eastern Foxsnake conservation through an ongoing artificial nest program.

<u>Management</u>

- Most of the large remaining wetland and prairie habitat patches within the range of the Carolinian population (Essex/Chatham-Kent/Lambton and Norfolk) are in protected areas (national parks, national wildlife areas, provincial conservation reserves, conservation areas and First Nation reserves) (J. Row pers. comm. 2009). Most of these protected areas are small and poorly, if at all, connected to other natural areas. In themselves, these areas may not contain enough habitat to support a viable population of Eastern Foxsnake. Along eastern Georgian Bay, there are a series of larger protected areas that are fairly well connected.
- Outside of protected areas, some of the larger habitat areas in the range of the Carolinian population are lands preserved for hunting and are under the ownership of private hunt clubs. These areas indirectly provide protection for Eastern Foxsnake (J. Row pers. comm. 2009).
- A landowner agreement exists to protect hibernacula on private lands near GBINP.
- The Provincial Policy Statement (PPS 2005) requires that significant natural heritage features will be protected from incompatible development. In particular

the policy states “Development and site alteration shall not be permitted in: significant habitat of endangered species and threatened species”.

- The ESA 2007 provides general habitat protection for the Eastern Foxsnake in Ontario until such time as a species-specific habitat regulation is developed.
- Seasonal road closures are used within Rondeau Provincial Park to lessen road mortality associated with snakes basking on park roads on cool sunny days in the fall.
- Point Pelee National Park implements a Wildlife Mortality Monitoring Protocol that allows a staged approach, from public education to road closures, to control traffic on days when weather is expected to lead to snake and other wildlife road mortality.
- Control of Common Reed (*Phragmites australis ssp. australis)* has been initiated within wetland areas of Rondeau Provincial Park and is ongoing.

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal for Eastern Foxsnake in Ontario is to ensure population persistence, maintain the current range of occupancy and enhance connectivity of Eastern Foxsnake within both the Carolinian and Georgian Bay populations.

2.2 Protection and Recovery Objectives

Table 1. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Track the state of populations and recovery of the species
2	Improve knowledge of populations, habitat use and threats
3	Identify and protect habitat and habitat connections within the current distribution
4	Reduce mortality by minimizing the threats
5	Enhance, restore and reconnect populations
6	Promote protection of the species through legislation, policies and land use plans

2.3 Approaches to Recovery

Recovery action should focus attention at both local and landscape scales. At the local scale this should include: identifying and protecting hibernacula, habitat management, population surveys, habitat use determination and attempting to mitigate the impact of those roads where mortality is highest. At a broader scale, education and outreach needs to continue and expand, identifying and securing currently unprotected, important sites for the species and identifying where vegetation restoration is necessary to improve habitat linkages.

Table 2. Approaches to recovery of the Eastern Foxsnake in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Track the state of populations and recovery of the species				
Critical	Short-term and Ongoing	Inventory, Monitoring and Assessment	**1.1** Develop and implement a collaborative monitoring program across the species' Ontario distribution that includes hibernacula population monitoring and coordinated road surveys • This program would provide information on population trends, severity of threats and effectiveness of recovery actions and threat mitigation • In depth monitoring should be undertaken at priority sites	• Knowledge gaps: Distribution, abundance and population trends
Beneficial	Long-term	Inventory, Monitoring and Assessment	**1.2** Given the large amount of genetic structure (DiLeo et al. in press) found in the Carolinian population, this population should be sampled periodically to ensure inbreeding does not become a problem in the future and that populations are not becoming increasingly fragmented	• Threats: Habitat loss, degradation and fragmentation

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
2. Improve knowledge of populations, habitat use and threats				
Critical	Short-term	Research	**2.1** Update knowledge of distribution • Continue province wide compilation of records through MNR District Offices, the NHIC and Ontario Nature's new herpetofaunal atlas • Identify detailed distribution pattern outside of protected areas • Continue and expand data recording in protected areas • Conduct surveys of public and professionals to collect Eastern Foxsnake presence-absence data • Conduct strategic field surveys to refine knowledge of distribution (e.g., Elgin County shoreline, north of Key River) • Conduct GIS analyses to evaluate current distribution, population connectivity and habitat use. Map known hibernacula	• Knowledge gaps: Distribution, abundance and population trends
Critical	Medium-term	Research	**2.2** Increase knowledge of the species' ecology and genetics • Conduct research on juvenile snakes to determine their ecological needs and investigate juvenile dispersal • Determine how much habitat is required to support a self-sustaining population of Eastern Foxsnakes in southwestern Ontario	• Knowledge gaps: Species biology and ecology
Beneficial	Long-term	Research	**2.3** Conduct comprehensive health and disease screening • Determine if egg parasitism is a significant factor in egg survival	• Knowledge gaps: Threats to survival and recovery

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	Long-term	Research	**2.4** Investigate impacts of pesticides and other contaminants on individuals and populations • Identify toxicological effects on individuals in Point Pelee National Park and Hillman Marsh Conservation Area • Determine if contaminants are affecting the health of other Eastern Foxsnake populations	• Knowledge gaps: Threats to survival and recovery
Beneficial	Long-term	Research	**2.5** Investigate the scale and significance of illegal collection	• Threat: collection
3. Identify and protect habitat and habitat connections within the current distribution				
Critical	Short-term	Inventory, Monitoring and Assessment	**3.1** Describe and map habitat and corridors used by Georgian Bay and Carolinian populations • Develop a list of priority areas (based on proximity to occupied sites or potential development) to investigate for potential Eastern Foxsnake habitat • Define habitat features associated with specific life history stages • Describe and map habitat and assess spatial needs • Assess the probable long-term viability of habitats from both natural and human influences • Determine population level habitat requirements and conditions that allow for population viability • Assess whether further spatial analysis of existing radio-telemetry datasets (e.g., Point Pelee National Park and Pelee Island) would yield information useful for habitat identification for those sites or inform identification at other sites	• Threats: Habitat loss and degradation • Knowledge gaps: Habitat needs

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Necessary	Long-term	Research	**3.2** Conduct radio-telemetry studies to improve knowledge of habitat use and identify hibernacula • Investigate relationship between sub-populations that occur within (or partly within) protected areas and sub-populations occupying surrounding unprotected lands • Priority studies should include populations/systems that are representative of other populations	• Knowledge gaps: Distribution, abundance, population trends; Habitat needs
Critical	Short-term	Protection	**3.3** Identify and investigate opportunities for securing lands for conservation purposes • Identify landowners of key Eastern Foxsnake habitat • Conserve habitat through stewardship or land acquisition processes	• Threat: Habitat loss and degradation
Critical	Short-term	Protection	**3.4** Develop habitat protection guidelines • Ensure confidentiality of hibernacula, oviposition sites and Eastern Foxsnake concentrations • Develop and promote best management practices [especially with respect to development of linear facilities (e.g., roads, utility lines)] for Eastern Foxsnake. Promote the use of these guidelines by landowners and municipal planners • Develop guidelines for Environmental Impact Studies to ensure that Eastern Foxsnake habitat is adequately considered and addressed where development proposals occur within their range • Promote inclusion of habitat in Official Plans	• Threat: Habitat loss and degradation; Accidental kills related to infrastructure development, upgrades or repairs

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Necessary	Long-term	Protection; Management	**3.5** Develop management actions to improve or maintain priority parcels or networks	• Threat: Habitat degradation
Necessary	Long-term	Inventory, Monitoring and Assessment	**3.6** Conduct research to identify hibernacula for populations where hibernacula have not been monitored or identified in the past 10 years or where locations of the significant hibernacula are unknown	• Knowledge gap: Distribution • Threat: Habitat loss
4. Reduce mortality by minimizing threats				
Critical	Short-term	Research	**4.1** Investigate significance of causes of mortality • Conduct a study that examines variables associated with road mortality (e.g., Point Pelee National park, Rondeau, Long Point) • Investigate off road mortality • Investigate incidence of mortality from nets or mesh (erosion control structures, chicken wire, garden netting) • Investigate extent of human induced mortality in aquatic habitats and potential mitigation strategies • Investigate impact of subsidized predators (e.g., raccoons, cats, wild turkeys) on adults, neonates and eggs • Determine significance of each mortality factor across range and within populations	• Knowledge gaps: Threats to survival
Critical	Short-term	Stewardship; Protection; Management	**4.2** Develop, implement and evaluate mitigation measures for various human caused impacts and mortality • Erect signage along known areas of high road mortality • Encourage temporary road closures in protected areas during periods of high mortality	• Threats: Road mortality, Human persecution and Accidental mortality

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
			• Develop and implement appropriate measures to mitigate road mortality • Prevent or minimize proliferation of new roads in Eastern Foxsnake habitat • Discourage use of mesh silt fences near Eastern Foxsnake habitat	
Critical	Short-term	Protection; management; stewardship	**4.3** Identify locations of hibernacula and other significant habitat that are inside and outside of protected areas • Focus on areas where new development projects or decommissioning projects (e.g., building demolition, well decommissioning) are proposed • Acquire detailed site-specific information • Increase awareness of the presence of Eastern Foxsnakes particularly where activities could contravene section 9 and 10 of the ESA 2007 (e.g., municipal departments, utility companies) • Identify a chain of custody or protocol to be used if hibernating Eastern Foxsnakes are accidentally unearthed	• All Threats
Necessary	Short-term	Communications, Education and Outreach	**4.4** Identify organizations involved in recovery and integrate communications with existing programs	• All Threats
Necessary	Short-term	Communications, Education and Outreach	**4.5** Evaluate effectiveness of existing outreach programs to identify gaps and make improvements	• All Threats
Necessary	Short-term	Communications, Education and Outreach	**4.6** Promote Eastern Foxsnake (and other species at risk) as an integral part of the interpretation programs at parks where Eastern Foxsnakes occur	• All Threats

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	Short-term	Communications, Education and Outreach	**4.7** Plan and create resource presentation materials for adult audiences to be used by outreach extension volunteers	• All Threats
Necessary	Short-term	Communications, Education and Outreach	**4.8** Conduct outreach to farm workers and rural residents in areas where Eastern Foxsnakes are likely to be encountered	• All Threats
Beneficial	Short-term	Communications, Education and Outreach	**4.9** Develop, promote and implement citizen science program (e.g., road mortality survey)	• All Threats • Knowledge gaps: Distribution, abundance and population trends
5. Enhance, restore and reconnect populations				
Necessary	Long-term	Stewardship; Management	**5.1** Restore habitat • Review and summarize all potentially useful restoration practices (e.g., artificial nesting sites, artificial hibernacula, habitat manipulation techniques, ecological restoration) • Identify potential locations where habitat restoration would improve or increase habitat • Implement restoration practices in a strategic manner, including site-specific monitoring • Explore opportunities to restore habitat linkages between isolated populations in southwestern Ontario • Identify potential partners, including other species recovery teams, as the recovery of several species at risk may be involved	• Threats: Habitat degradation • Knowledge gaps: Threats to survival

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	Long-term	Research	**5.2** Experimentally evaluate restoration practices	• Threats: Habitat loss and degradation
Beneficial	Long-term	Management; Stewardship	**5.3** Based on results of experimental evaluation of restoration practices and research into threats and ecology, develop and implement a strategy to enhance, restore and/or reconnect populations • Evaluate monitoring results and adjust management practices accordingly	• All Threats
6. Promote protection of the species through legislation, policies and land use plans				
Critical	Short-term	Protection	**6.1** Inform specific landowners of legal protection given to hibernacula and oviposition sites through letters or outreach	• All Threats
Critical	Short-term	Protection	**6.2** Develop and deliver training workshops and materials to engage wildlife officers	• All Threats

Narrative to Support Approaches to Recovery

Approach 1.1
Monitoring protocols and methods for identifying hibernacula should be tested.

Trends in range occupation should be compared every five years. If possible, populations at selected communal hibernacula should be monitored over the long term as a measure of comparison.

The status of Eastern Foxsnakes on the Long Point peninsula should to be assessed and, if a decline is found, the cause should be determined.

Approach 1.2
A recent comprehensive genetic study quantified the genetic population across southwestern Ontario (DiLeo et al. in press). Across Essex, Chatham-Kent and Lambton counties there was a significant amount of genetic structure. Across this relatively small area there were approximately five genetic clusters with very little gene flow between the clusters. For most clusters it appears that cluster size is large enough to avoid problems with inbreeding. However this approach proposes monitoring to ensure inbreeding and further fragmentation do not become problems.

Approach 2.1
Field Surveys and/or questionnaires to determine where potentially viable populations occur in Eastern Georgian Bay and southwestern Ontario outside of protected areas are needed. Areas where infrequent observations have been reported should be investigated further. Any reported observations should be correlated to habitat conditions and ground truthed. This will help determine limits of range and investigate apparent occurrence gaps where habitat should be protected. These studies should be completed within the next three to five years.

Approach 3.1
It appears that in southwestern Ontario Eastern Foxsnakes are dependent on a landscape that includes a mosaic of features that provide the essential components to support their life cycle. They survive in relatively open habitats but likely need a critical minimal amount (i.e., percentage of the landscape) of natural vegetation that can provide sites for hibernation, oviposition, foraging and movement corridors. Presumably there is a critical minimum amount of wetland and habitat linkage, beyond which the Eastern Foxsnakes will not survive. Radio-telemetry data from the few sites available should to be superimposed on detailed vegetation maps so that movement patterns can be realized in the context of a given landscape mosaic. Further radio-telemetry studies are recommended because data from Point Pelee National Park and Pelee Island are not representative of most of the Eastern Foxsnake's range of occupancy in southwestern Ontario, since those areas contain relatively large core blocks of habitat. Other populations occur in landscapes where required habitat features may be very fragmented. A series of studies to define habitat and examine issues is recommended over the next five years.

Radio-telemetry studies are expensive, time consuming and difficult to conduct outside of protected areas due to the need to obtain access permission from multiple landowners. An analysis of landscape features associated with reliable observation records compiled by the NHIC (e.g., distance to shorelines, distance to wetlands) should be conducted to evaluate the data's potential to inform habitat identification in areas lacking detailed data instead of conducting a radio-telemetry study. This work should be completed in the next three to five years.

Approach 3.2
The priority for radio-telemetry based studies should be Eastern Foxsnake populations/systems in southern Ontario that can reasonably be considered the most representative of other southern Ontario populations. Because some sites will have wider applicability, and because it is not realistic to consider studying all populations, strategically locating studies will be an important first step. For example, studies at Long Point (Provincial Park and National Wildlife Area) and/or Rondeau Provincial Park have the potential to provide spatial data that would best represent "sand-spit" populations, whereas radio-telemetry studies conducted further inland would provide better inference to sites with similar landscape characteristics (e.g., agricultural land bordered by hedgerows).

Hibernacula are critically important habitat features since a significant portion of a local population could congregate there during winter months. From a protection perspective, identifying hibernacula is a challenge that is best accomplished by labour-intensive radio-telemetry studies. This may limit the ability to effectively protect some populations outside of protected areas and needs to be weighed against the potential losses of individuals resulting from such a study. Clearly, radio telemetry will not be possible in most areas of Eastern Foxsnake range occupancy, which emphasizes the need to protect sizeable blocks of habitat outside of existing protected areas.

Approach 3.4
In order to alleviate threats, government agencies, land resource managers, municipal planners, land developers, landowners and the public should become much more aware of and take into consideration the species' ecological requirements. In short, rural landscapes should be used in ways compatible with the needs of snake populations.

Approach 5.1
In southwestern Ontario, habitat connectivity will probably need to be actively restored (e.g., linkages between habitat patches reconnected) so that Eastern Foxsnakes can move through the landscape in relative safety. Otherwise isolated populations may not be viable in the long term. By contrast, sensitive land-use management and restrained land development may be sufficient to maintain large tracts of quality habitat and healthy, interacting populations along Georgian Bay. However, it is important to ensure that habitats are not fragmented and bisected with roads and that habitat connectivity is maintained, as development pressures are mounting.

Recovery efforts should be coordinated with existing landscape conservation initiatives. Substantial wetland restoration in southwestern Ontario would not only help Eastern Foxsnakes, but also many other species at risk. Participation with organizations such as the North American Wetland Conservation Council (Canada), Eastern Habitat Joint Venture, Nature Conservancy Canada and Ontario Stewardship could play a big role.

2.4 Area for Consideration in Developing a Habitat Regulation

Under the ESA 2007, a recovery strategy must include a recommendation to the Minister of Natural Resources on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the recovery team will be one of many sources considered by the Minister when developing the habitat regulation for this species.

Given the high fidelity of Eastern Foxsnakes to their hibernacula, and the communal nature of hibernacula, and given the communal nature and repeated use of oviposition sites and their importance to reproductive success, it is recommended that these sites be prescribed as habitat in a habitat regulation for the species. These sites are essential to ensure a population's persistence in a given area or region.

Hibernation Habitats

Because of the high site fidelity that Eastern Foxsnakes show to hibernacula, as well as the communal nature of these microhabitats, destruction of this type of habitat could have a catastrophic impact on local population viability. Hence, these habitat features should be considered the most important to protect. All identified hibernacula, including natural and anthropogenic sites, should be prescribed as habitat in a habitat regulation. Natural hibernacula that are structurally stable should be protected indefinitely, whereas anthropogenic sites, which can degrade to an unusable state faster than geological or bedrock-based features, should be protected while they still have the potential to function as hibernation habitat for the species.

Data collected from known hibernacula indicate that the subterranean portion of these habitats can extend several metres laterally from the entrance/exit, which is often an inconspicuous hole or fissure in the substrate. It is therefore recommended that the area within 100 metres of the known or suspected entrance/exit be identified as habitat in a habitat regulation. If there are multiple known or suspected entrances/exits, then the identified area should be generated accordingly. The 100 metre area should extend from the perimeter of a known hibernaculum or from a known or suspected entrance to a hibernaculum where the exact location of the hibernaculum itself has not been identified. It is the expert opinion of the recovery team that this approach would ensure that all components of a hibernaculum remain functional, including any basking or staging areas used by foxnakes in the days/weeks before entering hibernation in the fall and emerging in the spring.

Georgian Bay population: Within the area of occurrence of the Georgian Bay population, all known hibernation sites are located within 100 metres of the high-water mark, excluding one unique limestone outlier in the Port Severn area, and generally occur within, but are not limited to, areas with vertical structure (R. Willson pers. comm. 2004, Lawson 2005, MacKinnon 2005, J. Rouse pers. comm. 2005). The recovery team, through expert study and opinion, estimates that less than five percent of the hibernation sites are known, because hibernation sites are difficult to identify due in part to the subterranean nature and the lack of persons in the areas to observe Eastern Foxsnakes during egress and ingress which occur in early spring and fall. Thus, as a precautionary approach to protect undetected hibernacula, the recovery team recommends that the area within 100 metres of the high-water mark be protected until such time as it has been determined that Eastern Foxsnake hibernacula do not occur in the specific area.

Carolinian population: The vast majority of hibernation sites have not been identified across the Carolinian region. Given that virtually any structure that extends below the frost line could comprise a hibernaculum, any probable hibernacula within the current occupied range of the Carolinian population should be prescribed as habitat within a habitat regulation. It is the opinion of the recovery team that a probable hibernaculum is any natural or anthropogenic structure that extends below the frost line within 1500 metres of an area where one or more Eastern Foxsnakes have been observed in the past ten years. Row et al. (in prep.) found that the average maximum distance from hibernation for Eastern Foxsnakes radio-tracked at Point Pelee National Park and Hillman Marsh Conservation Area was 1500 metres. The ten year period is recommended as a precautionary approach due to the normal life span of Eastern Foxsnakes, the subterranean nature of hibernacula, the lack of long-term intensive radio-telemetry work on these populations, the number of private landowners, lack of permission to access private property and the lack of persons in the areas to observe Eastern Foxsnakes during egress and ingress which occur in early spring and fall. Since all of the communal hibernation sites identified through radio telemetry from 2007 to 2009 appeared to be in man-made structures, including sites in parks and protected areas (J. Row pers. comm. 2009), this protection should apply to both natural and anthropogenic features.

Oviposition Habitats

Oviposition occurs in rock crevices, dune slopes, manure piles, compost piles, rotting logs and masses of dead vegetation. Oviposition sites are often communal and females bask near the chosen oviposition site for several days or more prior to, during and after oviposition (J. Row pers. comm. 2009). It is suspected that neonates remain near the nest site up to several weeks after hatching (J. Row pers. comm. 2009). Once an oviposition site is identified, an area 30 metres surrounding it should be prescribed as habitat in a habitat regulation. It is the recovery team's expert opinion that 30 metres (average tree height) will ensure that the themoregulatory properties of the site are maintained and will encompass nearby basking/resting sites and travel corridors around the oviposition site.

It is recommended that the features prescribed as habitat in a habitat regulation include both natural and artificial oviposition sites. With the exception of oviposition sites that occur within fractures in the bedrock or under large table rocks, the physical characteristics of sites functioning as nests are ephemeral and are often suitable for oviposition for a few years. The vegetative components of the site continue to decompose until the conditions are no longer selected for oviposition. It is recommended that oviposition sites that naturally decompose (e.g., large rotting trees) be prescribed as habitat until two years after the last known use of the site and the feature can no longer support conditions required for nest survival. Structurally stable oviposition sites should be protected indefinitely. For man-made oviposition structures (e.g., compost piles, wood piles) the duration should be for the time period when the snakes could be occupying the habitat (usually July through October for oviposition sites).

It is recommended that any feature (natural or man-made) that appears to have the physical characteristics necessary to function as an oviposition site be included in the regulation if Eastern Foxsnakes have been observed within 30 metres of the feature during the oviposition period regardless of whether eggs are found.

Georgian Bay population: In the range of the Georgian Bay population, it is recommended that all potential oviposition structures in appropriate habitat within 100 metres of the high-water mark (or in the exception area in Port Severn) should be prescribed as habitat in a habitat regulation for the duration of the structure's natural life: for geological formations that are structurally stable rock-based sites that is indefinitely, while for sites that naturally decompose (e.g., large rotting trees) the duration would be less.

Carolinian population: Most oviposition areas have not been identified for this species. Due to the ephemeral nature of the oviposition sites used by the Carolinian population, it is the expert opinion of the recovery team that all potential natural oviposition features that are consistent in composition with, and which occur within 1 kilometre of known occupied oviposition sites (natural, anthropogenic or artificial), should also be prescribed as habitat in a habitat regulation for the duration of the feature's natural life This recommendation is based on the rationale that females can move one kilometre or more to nest sites.

Other Habitat Areas

In addition to sites for hibernation and oviposition, Eastern Foxsnakes require habitat areas for foraging, mating, thermoregulation, shedding and movement corridors.

Georgian Bay population: It is recommended that the area along Georgian Bay including the water between the shoreline and the outer islands and all lands (i.e., terrestrial and aquatic) and islands within 1 kilometre from the high-water mark be prescribed as habitat for Eastern Foxsnakes in a habitat regulation. The distance was established from two extensive research projects (Lawson 2005, MacKinnon 2005), NHIC and local MNR Eastern Foxsnake distribution data. This area extends from the

north side of the French River mouth to north side of the Severn River mouth and the eastern side of the Penetanguishene Peninsula, excluding established developed urban areas (e.g., Town of Parry Sound). In these urban areas, 100 metres from the high-water mark should be prescribed as habitat in a habitat regulation. A distance of 100 metres is recommended in these areas because the density of roads and loss of natural inland habitat has essentially excluded Eastern Foxsnakes from these areas (J. Rouse pers. comm. 2010). Additionally, the geological limestone outlier in the Port Severn area (which is more than 1 kilometre from the shoreline and is the only known hibernation complex further than 100 metres from high-water mark) and the lands one kilometre [related to the distance Eastern Foxsnakes travel from this hibernation site (R. Willson pers. comm. 2004, MacKinnon 2005)] out from the base of the geological limestone outlier and/or east to the four-lane Highway 400 should also be prescribed as habitat.

Within the Georgian Bay range, Eastern Foxsnakes have been found to congregate at shedding sites and use them in successive years (A. Lawson pers. comm. 2004). These traditionally used communal shedding sites should also be prescribed as habitat in a habitat regulation.

Carolinian Population: It is recommended that the marsh and prairie habitat within the current occupied range of the Carolinian population be prescribed as habitat in a habitat regulation to preserve ecosystem function (e.g., prey abundance).

For the Carolinian population, it is recommended that old fields, habitat bordering sewage lagoons, woodlands, natural and restored prairie habitat, and patches of habitat (riparian, grass, or hedgerow) along drainage ditches, creeks, roads and railway tracks be considered for inclusion in the area prescribed as habitat in a habitat regulation.

Upland hedgerows between riparian features or other core habitat areas and vegetated bluffs associated with the Lake Erie shoreline or ravines can be very important to Eastern Foxsnakes in this highly fragmented region (Gould pers. comm. 2010, Woodliffe pers. comm. 2010). These vegetation features provide important movement corridors between larger contiguous habitat patches and can contain specific habitat features such as compost piles and rotting logs for oviposition, vegetation suitable for shedding, foraging areas and rock or debris piles for thermoregulation (Gould pers. comm. 2010, Woodliffe pers. comm. 2010). Some of these features will be more significant to the species than others. Due to knowledge gaps regarding Eastern Foxsnake distribution in much of its Carolinian range, individual vegetation patches or features may need to be assessed to determine if they represent important habitat for the species. Considering that several new Eastern Foxsnake locations are documented within the Carolinian zone each year (Gould pers. comm. 2010) it may be more practical to evaluate habitat areas and features on a site specific basis. It is recommended that any vegetation patch or specific feature that is known to provide habitat for Eastern Foxsnakes, from existing information or through future evaluation, be prescribed as habitat in a habitat regulation.

GLOSSARY

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

1 = critically imperilled
2 = imperilled
3 = vulnerable
4 = apparently secure
5 = secure

Ecdysis: the regular molting or shedding of an outer covering layer (e.g., of skin)

Endangered Species Act, 2007 (ESA 2007): The provincial legislation that provides protection to species at risk in Ontario.

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This act establishes Schedule 1 as the legal list of wildlife species at risk to which the SARA provisions apply. Schedules 2 and 3 contain lists of species that at the time the act came into force needed to be reassessed. After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

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Part 3 – *Eastern Foxsnake – Carolinian and Georgian Bay Populations – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources

Ministry of Natural Resources

Natural. Valued. Protected.

Eastern Foxsnake – Carolinian and Georgian Bay Populations

Ontario Government Response Statement

PROTECTING AND RECOVERING SPECIES AT RISK IN ONTARIO

Species at risk recovery is a key part of protecting Ontario's biodiversity. Biodiversity – the variety of life on Earth – provides us with clean air and water, food, fibre, medicine and other resources that we need to survive.

The *Endangered Species Act, 2007* (ESA) is the Government of Ontario's legislative commitment to protecting and recovering species at risk and their habitats. As soon as a species is listed as extirpated, endangered or threatened under the ESA, it is automatically protected from harm or harassment. Also, immediately upon listing, the habitats of endangered and threatened species are protected from damage or destruction.

Under the ESA, the Ministry of Natural Resources (the Ministry) must ensure that a recovery strategy is prepared for each species that is listed as endangered or threatened. A recovery strategy provides science-based advice to the government on what is required to achieve recovery of a species.

GOVERNMENT RESPONSE STATEMENTS

Within nine months after a recovery strategy is prepared, the ESA requires the Ministry to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The recovery strategy for the Eastern Foxsnake was completed on September 10, 2010 (http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STDPROD_066839.html).

The response statement is the government's policy response to the scientific advice provided in the recovery strategy. In addition to the strategy, the response statement is based on input from stakeholders, other jurisdictions, Aboriginal communities and members of the public. It reflects the best available traditional, local and scientific knowledge at this time and may be modified if new information becomes available. In implementing the actions in the response statement, the ESA allows the Ministry to determine what is feasible, taking into account social and economic factors.

The Eastern Foxsnake is non-venomous and is Ontario's second-largest snake, reaching lengths of up to 1.75 metres. The snakes are usually found near water in both marsh and woodland, and often near human habitation. They are constrictors and feed mostly on rodents or birds.

Ontario

MOVING FORWARD TO PROTECT AND RECOVER EASTERN FOXSNAKE

The Eastern Foxsnake (Carolinian population) and the Eastern Foxsnake (Georgian Bay population) (together "Eastern Foxsnake") are listed as endangered and threatened respectively under the ESA, which protects both the animal and its habitat. The ESA prohibits harm to or harassment of the species and damage to or destruction of their habitat without authorization. Such authorization would require that conditions established by the Ministry be met.

In Ontario, the Eastern Foxsnake is found in the Georgian Bay region, on the east shore of Lake Huron and on the north shore of Lake Erie, including associated islands and wetlands. The most significant threats to the Eastern Foxsnake are habitat loss and fragmentation, road mortality and human persecution.

The government's goal for the recovery of the Eastern Foxsnake is to ensure the persistence of the species and to maintain the current range of occupancy and connectivity of its habitat within both the Carolinian and Georgian Bay populations.

Protecting and recovering species at risk is a shared responsibility. No single agency or organization has the knowledge, authority or financial resources to protect and recover all of Ontario's species at risk. Successful recovery requires intergovernmental co-operation and the involvement of many individuals, organizations and communities.

In developing the government response statement, the Ministry considered what actions are feasible for the government to lead directly and what actions are feasible for the government's conservation partners to undertake with government support.

GOVERNMENT-LED ACTIONS

To help protect and recover the Eastern Foxsnake, the government will directly undertake the following actions:

- Develop a protocol to protect hibernating Eastern Foxsnakes (or other snake species at risk) if they are accidentally unearthed.
- Develop a survey protocol to be used by proponents and partners to detect the presence or absence of Eastern Foxsnakes.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Eastern Foxsnake data to the Ministry's central repository at the Natural Heritage Information Centre or to the Ontario Reptile and Amphibian Atlas. Ensure appropriate data sensitivity guidelines are put in place.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario.

- Protect the Eastern Foxsnake and its habitat through the ESA. Develop and enforce a regulation prescribing the habitat of the species.
- Support conservation, agency, municipal and industry partners in undertaking activities to protect and recover the Eastern Foxsnake. Support will be provided through funding, agreements, permits (including conditions) and advisory services.
- Establish and communicate annual priority actions for government support in order to encourage collaboration and reduce duplication of effort.

GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions for the protection and recovery of the Eastern Foxsnake. Actions identified as "high" will be given priority consideration for funding or for authorizations under the ESA. The government will focus its support on these high-priority actions over the next five years.

Focus Area: **Monitoring and Research**
Objective: Improve knowledge of Eastern Foxsnake distribution, population trends, ecology and habitat use.

Actions:

1. **(HIGH)** Identify locations of hibernacula, other habitat features and the extent of the species' distribution.
2. **(HIGH)** Develop and implement a collaborative monitoring program across the species' Ontario distribution that includes monitoring of hibernacula and co-ordinated road surveys.
3. Conduct studies into the species' ecology, habitat use and genetics, including a focus on the ecological needs and dispersal patterns of juveniles.

Focus Area: **Protection**
Objective: Identify and protect the habitat of Eastern Foxsnakes within their current distribution.

Actions:

4. **(HIGH)** Develop and promote best management practices to encourage management of rural landscapes that is compatible with the needs of snake populations.
5. As opportunities arise, support the securement of lands that contain Eastern Foxsnake sub-populations through existing land securement and stewardship programs.

Focus Area:	**Threat Management**
Objective:	Reduce mortality of Eastern Foxsnakes by minimizing human-related threats.

Actions:

6. **(HIGH)** Develop, implement and evaluate mitigation measures for human-caused impacts, particularly road mortality. These may include:
   - erecting signs along roads in known areas of high road mortality;
   - considering temporary road closures during periods of high mortality;
   - developing and implementing appropriate measures to allow Eastern Foxsnakes to safely cross barriers such as roads; or
   - discouraging the use of mesh silt fences and erosion-control blankets near Eastern Foxsnake habitat.
7. Investigate the scale and significance of threats to the species. This may include studies of the impact of pesticides and other contaminants, illegal collection, road mortality, net or mesh materials and subsidized predators.◆

Focus Area:	**Awareness**
Objective:	Reduce human persecution of Eastern Foxsnake and promote stewardship.

Actions:

8. Evaluate existing communications and outreach approaches and develop new strategies that will have a positive impact on people's behaviour.
9. Deliver effective communications and outreach to key stakeholders, including landowners, cottage associations and schools within the range of Eastern Foxsnake.

Focus Area:	**Restoration**
Objective:	Enhance and restore the availability of habitat for the Eastern Foxsnake (Carolinian population).

Actions:

10. Evaluate potential restoration techniques and their effectiveness at enhancing the quality of Eastern Foxsnake (Carolinian population) habitat features (e.g., artificial nesting sites, artificial hibernacula and ecological restoration).
11. Co-operate with existing landscape-restoration activities to strategically implement habitat-restoration measures for the Eastern Foxsnake (Carolinian population) and to maintain connectivity and the availability of a mosaic of habitat types and features.

◆ These are predators that exist at unnaturally high levels because of "subsidies" (e.g., food waste and crops) that humans provide.

IMPLEMENTING ACTIONS

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Fund, Species at Risk Farm Incentive Program or Community Fisheries and Wildlife Involvement Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with the Ministry. The Ministry can also advise if any authorizations under the ESA may be required to undertake the project.

Implementation of the actions may be subject to changes in priorities across the multitude of species at risk, availability of resources and the capacity of partners to undertake recovery activities. Where appropriate, the implementation of actions for multiple species will be co-ordinated across government response statements.

REVIEWING PROGRESS

The ESA requires the Ministry to conduct a review of progress toward protecting and recovering a species not later than five years from the publication of this response statement. The review will help determine whether adjustments are needed to achieve the protection and recovery of the Eastern Foxsnake.

ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the "Recovery strategy for the Eastern Foxsnake – Carolinian and Georgian Bay populations in Ontario" for their dedication to protecting and recovering species at risk.

For additional information:
Visit the species at risk website at
ontario.ca/speciesatrisk
Contact your MNR district office
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