

Recovery Strategy for the Gray Ratsnake (*Pantherophis spiloides*), Carolinian and Great Lakes/St. Lawrence populations, in Canada

Gray Ratsnake



2020



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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](https://www.sarregistry.gc.ca/)¹.

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¹ www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

RECOVERY STRATEGY FOR THE GRAY RATSNAKE (*Pantherophis spiloides*), CAROLINIAN AND GREAT LAKES/ST. LAWRENCE POPULATIONS, IN CANADA

2020

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 Gray Ratsnake (Pantherophis spiloides) – Carolinian and Frontenac Axis populations in Ontario* (Part 2) and the *Gray Ratsnake – Carolinian and Frontenac Axis Populations – Ontario Government Response Statement*² (Part 3) under Section 44 of the *Species at Risk Act* (SARA), replacing the term “Frontenac Axis 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 Gray Ratsnake in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Gray Ratsnake (Pantherophis spiloides) – Carolinian and Frontenac Axis populations in Ontario*, prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Strategy for the Gray Ratsnake (Pantherophis spiloides) – Carolinian and Frontenac Axis populations in Ontario*, prepared by T. Kraus, B. Hutchinson, S. Thompson and K. Prior for the Ontario Ministry of Natural Resources³.

Part 3 – *Gray Ratsnake – Carolinian and Frontenac Axis 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 2 – *Recovery Strategy for the Gray Ratsnake (Pantherophis spiloides)* – *Carolinian and Frontenac Axis populations in Ontario*, prepared by T. Kraus, B. Hutchinson, S. Thompson and K. Prior for the Ontario Ministry of Natural Resources.

Part 3 – *Gray Ratsnake – Carolinian and Frontenac Axis Populations – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources.

Part 1 – Federal Addition to the *Recovery Strategy for the Gray Ratsnake (Pantherophis spiloides)* – *Carolinian and Frontenac Axis 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 Gray Ratsnake (Carolinian population) and the Gray Ratsnake (Great Lakes/St. Lawrence population) (henceforth referred to as the Gray Ratsnake, Carolinian population and Gray Ratsnake, Great Lakes/St. Lawrence population) 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 Gray Ratsnake, Carolinian and Great Lakes/St. Lawrence populations 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 Gray Ratsnake Carolinian and Frontenac Axis populations (Part 2) in cooperation with Environment and Climate Change Canada and the Parks Canada Agency. In this federal addition, “Frontenac Axis population” has been replaced by the term “Great Lakes/St. Lawrence population” because of 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 Gray Ratsnake, 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 appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

⁴ www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

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 area⁵ 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 Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgements

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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 Indigenous 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 Gray Ratsnake* (*Pantherophis spiloides*) – *Carolinian and Frontenac Axis 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 provincial recovery strategy (Part 2) with the exception of section 2, Recovery. In place of section 2, Environment and Climate Change Canada has established its own population and distribution objectives that are consistent with the provincial recovery goal, and is adopting the government-led and government-supported actions of the *Gray Ratsnake – Carolinian and Frontenac Axis Populations – Ontario Government Response Statement*⁶ (Part 3) as broad strategies and general approaches to meet the population and distribution objectives, and is adopting the habitat regulated under Ontario’s *Endangered Species Act, 2007* (ESA 2007) as critical habitat for the Gray Ratsnake, 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.

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 Gray Ratsnake, Carolinian and Great Lakes/St. Lawrence populations. 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 (Great Lakes/St. Lawrence). This population has been estimated to contain 25,000 – 67,000 mature individuals (COSEWIC 2018). However, an increase in road development has been observed throughout this region, leading to an increase in

⁶ 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.

individuals, particularly females, lost to road mortality, which may have significant effects on the population as a whole (Kraus et al. 2010; COSEWIC 2018).

Unknown (Carolinian). Due to the secretive nature of these snakes and a lack of demographic⁷ sampling in this region, the size of this population, and its structure, are unknown. There are four highly isolated subpopulations recognized within the Carolinian region, known as Big Creek, Oriskany Sandstone, Skunk's Misery and Niagara (Kraus et al. 2010; COSEWIC 2018). However, for two of these subpopulations, namely Skunk's Misery and Niagara, there have been no verified records in the past 20 years which are believed to indicate that these two subpopulations are now extirpated (COSEWIC 2018). It is unlikely that the remaining Big Creek and Oriskany subpopulations comprise more than 200 and 30 mature individuals, respectively (COSEWIC 2018). During a study of one subpopulation, two snakes were tracked and another was found dead on a road, but no others were found despite efforts made to search for them (Yagi and Tervo 2006). Based on the amount of suitable habitat available and the few observations of individuals, this population may also be threatened by negative genetic effects of small population size and demographic stochasticity⁸, as well as numerous other threats.

While most of the range of this species is in the United States, both the Great Lakes/St. Lawrence and Carolinian populations are genetically distinct and geographically isolated from the populations found in continuous portions of this range, with the exception of a small portion of the Great Lakes/St. Lawrence population which extends into upper New York State. Although immigration of individuals from this portion of the population into the Canadian portion of the Great Lakes/St. Lawrence population may be possible, rescue⁹ is unlikely to occur as Highway 401 and the St. Lawrence River are significant barriers to movement (COSEWIC 2018). Additionally, population viability analysis indicates that a population of 141 mature individuals is needed to sustain a viable population of Gray Ratsnake (COSEWIC 2018).

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

Yes (Great Lakes/St. Lawrence). Suitable habitat for the Gray Ratsnake consists of a broad range of habitat types, including forests, forest edges, old fields, meadows, rocky outcrops and marshes (Blouin-Demers and Weatherhead 2001a, b, c, and 2002b). Population viability analysis suggests that 540 hectares of continuous suitable habitat are required to sustain a viable Great Lakes/St. Lawrence population (COSEWIC 2018); currently, sufficient suitable habitat is available to support this

⁷ Relating to the dynamic balance of a population especially with regard to density and capacity for expansion or decline.

⁸ Fluctuations in population growth rates due to random variation in survival and reproduction among individuals.

⁹ Rescue or rescue effect is genetic or demographic immigration into a population to reduce extinction pressures.

population. The regeneration of forest habitat across the region may result in an increase of suitable habitat for the species, although some habitat loss is irreversible and the expansion of road networks continues to fragment habitats. There has also been an increase in residential development within this population's range, particularly for cottages and recreational activities. Although it is unlikely that additional land will be cleared for agriculture, there is a high possibility that it will be cleared for housing or recreational development, which will likely reduce and fragment the habitat further. It is not known at what threshold there would no longer be sufficient habitat to support the population, but given recent genetic studies it is unlikely that the population could withstand much habitat loss and still remain self-sustaining (Prior et al. 1997; Howes et al. 2009).

Unknown (Carolinian). Much of the suitable habitat for this population has already been irreversibly lost or is highly fragmented due to agricultural and urban development as well as high road density. Because population size is much lower and road mortality is likely higher, continuous suitable habitat larger than 540 hectares would be needed to support a viable Carolinian population (COSEWIC 2018). Gray Ratsnakes require relatively large areas of habitat in a mosaic¹⁰ of forest and open areas due to their large home ranges and ability to travel long distances from their hibernacula¹¹, as well as to maintain connectivity and facilitate gene flow between existing subpopulations (Weatherhead and Charland 1985; Blouin-Demers and Weatherhead 2001a and b; Blouin-Demers and Weatherhead 2002a; COSEWIC 2018).

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

Yes (Great Lakes/St. Lawrence). The primary threats to the Gray Ratsnake include habitat loss, degradation and fragmentation, direct mortality and road mortality, and disturbance or destruction of hibernacula. Through protection of the available habitat through legal and stewardship means (e.g., habitat protection under Ontario's ESA 2007 and SARA, conservation easements, awareness and education campaigns such as those run by Ontario Nature, and partnerships between government and stakeholder groups such as the Lanark County property owners association), future habitat loss, degradation and fragmentation could possibly be mitigated, as could destruction of hibernacula and some direct mortality. Road mortality may be more difficult to mitigate, as common techniques such as eco-passages implemented in some parts of Ontario (i.e., Highway 69/400) have had varied levels of success (Taylor et al. 2014; Baxter-Gilbert et al. 2015). However, research on eco-passage effectiveness is growing, and approaches continue to be updated and refined. Additionally, a recent study conducted along the Thousand Islands Parkway indicates that road mortality for Gray Ratsnakes, among other snake species, was strongly linked to time of year and temperature over multiple years, which may have implications for where mitigation efforts could be focused (Garrah et al. 2015).

¹⁰ An area or site comprised of multiple habitat types.

¹¹ An area where an organism seeks refuge or shelter for hibernation.

Lastly, Snake Fungal Disease (SFD) has been identified as a potential threat to the Gray Ratsnake in this recovery strategy as new information has become available since the completion of the provincial recovery strategy (McKenzie et al. 2018). 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).

Unknown (Carolinian). As with the Great Lakes/St. Lawrence population, future habitat loss, degradation and fragmentation could be mitigated through the protection and management of available habitat through legal and stewardship means, while restoration techniques could be used to increase the amount of available suitable habitat and increase connectivity between local populations where loss or fragmentation is not irreversible. Other primary threats may also be mitigated through various recovery activities; additional monitoring for hibernacula in this region could help to identify important overwintering areas requiring further protection measures, while direct mortality could be mitigated through increased education and promotion of best management practices for landowners. Habitat connectivity could also be improved through protection and management of movement habitat between known sites, though the active restoration of forest habitat is likely required to alleviate this threat.

There are several ways through which the primary threats to the species and its habitat can be mitigated; however, the validity of these methods for reducing significant threats to the Carolinian population and likelihood of success is not well known. Given the small size and fragmented nature of the population, and the already relatively poor quality of the habitat, it is unknown whether recovery actions could sufficiently mitigate threats to the population or its habitat to a point where recovery would be deemed feasible. Also, similar to the Great Lakes/St. Lawrence population, SFD is also a concern for the Carolinian population.

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

Unknown (Great Lakes/St. Lawrence). Stewardship, protection and education/outreach activities to address threats of accidental mortality and habitat loss and degradation exist and are being used to aid in the recovery of the species (see Section 1.8 in Part 2). 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 (Leeds County Stewardship Council 2008; Scienstational Sssnakes!! 2014; Ontario Species at Risk Landowner's Guide for Black Rat Snake¹² 2008). While Best Management Practices are available, negative attitudes toward snakes can present challenges to implementation due to a lack of support for stewardship actions

¹² The Gray Ratsnake is also commonly known as the Black Ratsnake or Eastern Ratsnake.

benefitting snakes (Kelly and Seidel 2015). 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 the ecological impact of roads on snakes are being conducted, and may be useful in developing future mitigation techniques.

Unknown (Carolinian). Some habitat restoration and best management techniques exist, as do artificial nest programs for this population (Kraus et al. 2010; COSEWIC 2018). Work to further refine and encourage the application of best management practices is being conducted through increasing outreach with landowners and school boards, and educational resources and booklets are being provided to raise public awareness of the species' recovery needs. However, in addition to the challenge of road mortality, it is not known if these techniques are sufficient to recover this population.

1. COSEWIC* Species Assessment Information

Date of Assessment: April 2018

Common Name (population): Gray Ratsnake – Great Lakes/St. Lawrence population

Scientific Name: *Pantherophis spiloides***

COSEWIC Status: Threatened

Reason for Designation: One of the largest snakes in Canada, this species is characterized by late age of maturity and low reproductive rates. It occupies an increasingly fragmented region of southern Ontario and is threatened by ongoing development and by expansion of road networks. The extent of its occurrence appears to have declined significantly. Mark-recapture analyses from several subpopulations indicate decreasing population trends at some sites, although widespread estimates of abundance or population trend are lacking. Development especially threatens communal hibernacula. Traffic on roads where snakes bask represents a significant mortality threat. Additionally, this species is intentionally killed, both along roads and at hibernacula. Rescue from other populations is unlikely since this population is already separated from upstate New York by the St. Lawrence River and by at least 100 km from the main species range in New York.

Canadian Occurrence: Ontario

COSEWIC Status History: The species was considered a single unit and designated Threatened in April 1998 and in May 2000. Split into two populations in April 2007. The Great Lakes/St. Lawrence population was designated Threatened in April 2007. Status re-examined and confirmed in April 2018.

Date of Assessment: April 2018

Common Name (population): Gray Ratsnake – Carolinian population

Scientific Name: *Pantherophis spiloides***

COSEWIC Status: Endangered

Reason for Designation: One of the largest snakes in Canada, this species is characterized by late age of maturity and low reproductive rates. Once spread across most of the Carolinian zone of southwestern Ontario, it occupies an increasingly fragmented region of Ontario and is threatened by ongoing development and expansion of road networks. This population presently contains only two small disjunct subpopulations, surrounded by intensive agriculture, and residential and commercial development. Although accurate estimates of abundance are lacking, the number of mature individuals is most likely less than 250. Two additional subpopulations in this population appear to have been extirpated in the past 10 years, and its geographic range has declined precipitously over that same period. Development especially threatens communal hibernacula. Roads represent a significant mortality threat as snakes bask on them. Additionally, this species is persecuted, both along roads and at hibernacula. Rescue from other populations is unlikely as the Carolinian population is disjunct and separated from adjacent populations in the U.S. by Lake Erie.

Canadian Occurrence: Ontario

COSEWIC Status History: The species was considered a single unit and designated Threatened in April 1998 and in May 2000. Split into two populations in April 2007. The Carolinian population was designated Endangered in April 2007. Status re-examined and confirmed in April 2018.

*COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

** When Gray Ratsnake was assessed by COSEWIC in 2007, the scientific name used in the 2007 species status report was *Elaphe spiloides*. In 2009, the scientific name was updated to *Pantherophis spiloides*, and this is the name that appears on Schedule 1 of SARA and is used for the purposes of this Recovery Strategy.

2. Species Status Information

The Gray Ratsnake, Carolinian population is listed as Endangered¹³ on Schedule 1 of the federal *Species at Risk Act* (SARA), while the Gray Ratsnake, Great Lakes/St. Lawrence population is listed as Threatened¹⁴. In Canada, Gray Ratsnakes are only found in Ontario, and occur in two regions; the Carolinian population occurs in the Carolinian

¹³ A wildlife species facing imminent extirpation or extinction.

¹⁴ A wildlife species likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

forest region along the north shore of Lake Erie in southwestern Ontario, and the Great Lakes/St. Lawrence population is associated with the Frontenac Axis region in southeastern Ontario. In Ontario, the Gray Ratsnake, Carolinian population is listed as Endangered under the provincial ESA, while the Gray Ratsnake, Frontenac Axis population¹⁵ is listed as Threatened¹⁶.

The Gray Ratsnake is ranked globally as Secure (G5), while the Gray Ratsnake, Carolinian population is ranked as Critically Imperilled (N1) and the Gray Ratsnake, Great Lakes/St. Lawrence population is ranked as Vulnerable (N3) in Canada (NatureServe 2019; Appendix B).

The Canadian distribution of this species represents less than 5% of the global range, with the majority of the Canadian population made up of the Great Lakes/St. Lawrence population (Area of Occupancy¹⁷ 612 km²) and only a small fraction occurring in the Carolinian population (Area of Occupancy 60 km²); the remainder of the species' population is in the United States (COSEWIC 2018).

3. Threats

3.1 Threat Assessment

Threats for the Gray Ratsnake are assessed for both the Great Lakes/St. Lawrence and Carolinian populations based on the IUCN-CMP (International Union for Conservation of Nature–Conservation Measures Partnership) unified threats classification system (Salafsky et al. 2008). Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For the purpose of threat assessment, only present and future threats are considered. Threat information in Table 1 and Table 2 is derived from the COSEWIC assessment and status report for the species (COSEWIC 2018). Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section (Section 3.2).

Due to the geographic separation and difference in overall threat impact between the Great Lakes/St. Lawrence and Carolinian populations, the threats tables are included separately for each population.

¹⁵ While the province of Ontario refers to this population as the Frontenac Axis 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.

¹⁶ 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.

¹⁷ COSEWIC typically calculates area of occupancy as the area within the “extent of occurrence” that is occupied by a taxon, excluding cases of vagrancy, using a grid with a cell size of 2km x 2km (Index of Area of Occupancy) (COSEWIC 2009).

Great Lakes/St. Lawrence population

Historical threats, indirect or cumulative effects of the threats, and any other relevant information that would help understand the nature of the threats are presented in the narrative (Section 3.2) and the provincial recovery strategy (Section 1.6). Limiting factors are not considered during this assessment process. See the table footnotes for details on how the values are assigned.

Table 1. Threat Classification Table for the Gray Ratsnake, Great Lakes/St. Lawrence population.

Threat #^a	Threat Description	Impact^b	Scope^c	Severity^d	Timing^f
1	Residential & commercial development	Low	Small	Extreme – Serious	High
1.1	Housing & urban areas	Low	Small	Extreme – Serious	High
1.2	Commercial & industrial areas	Negligible	Negligible	Extreme	High
1.3	Tourism & recreation areas	Low	Small	Moderate	High
2	Agriculture & aquaculture	Low	Small	Serious	High
2.1	Annual & perennial non-timber crops	Low	Small	Serious	High
2.2	Wood & pulp plantations	Negligible	Negligible	Slight	High
2.3	Livestock farming & ranching	Negligible	Negligible	Negligible	High
3	Energy production & mining	Low	Small	Extreme	High
3.2	Mining & quarrying	Low	Small	Extreme	High
3.3	Renewable energy	Low	Small	Serious	High
4	Transportation & service corridors	High - Medium	Pervasive	Serious – Moderate	High
4.1	Roads & railroads	High - Medium	Pervasive	Serious – Moderate	High
4.2	Utility & service lines	Negligible	Negligible	Slight	High
5	Biological resource use	Low	Small	Extreme	High
5.1	Hunting & collecting terrestrial animals	Low	Small	Extreme	High
5.3	Logging & wood harvesting	Low	Small	Slight	High
6	Human intrusions & disturbance	Negligible	Negligible	Negligible	High
6.1	Recreational Activities	Negligible	Negligible	Negligible	High

Threat # ^a	Threat Description	Impact ^b	Scope ^c	Severity ^d	Timing ^f
7	Natural system modifications	Negligible	Negligible	Slight	High
7.1	Fire & fire suppression	Negligible	Negligible	Slight	High
7.3	Other ecosystem modifications	Negligible	Negligible	Negligible	High
8	Invasive & other problematic species & genes	Unknown	Small	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	High
8.2	Problematic native species	Unknown	Small	Unknown	High

^a**Threat #** - Threats are numbered using the IUCN Classification System. Only those threats relevant to Gray Ratsnake, Great Lakes/St. Lawrence population, are presented in this table and in Section 3.2. Description of Threats and Part 2 (Recovery Strategy for the Gray Ratsnake (*Pantherophis spiloides*) in Ontario).

^b**Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

^c**Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

^d**Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

^f**Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

Carolinian population

The Gray Ratsnake Carolinian population is relatively small leaving it vulnerable to damage or complete loss from identified potential threats. Historical threats, indirect or cumulative effects of the threats, and any other relevant information that would help understand the nature of the threats are presented in the narrative (Section 3.2) and the provincial recovery strategy (Section 1.6). Limiting factors are not considered during this assessment process. See the table footnotes for details on how the values are assigned in the table.

Table 2. Threat Classification Table for the Gray Ratsnake, Carolinian population.

Threat #^a	Threat Description	Impact^b	Scope^c	Severity^d	Timing^f
1	Residential & commercial development	Low	Small	Extreme	High
1.1	Housing & urban areas	Low	Small	Extreme	High
1.2	Commercial & industrial areas	Negligible	Negligible	Extreme	High
1.3	Tourism & recreation areas	Negligible	Negligible	Moderate	High
2	Agriculture & aquaculture	Medium - Low	Pervasive	Moderate - Slight	High
2.1	Annual & perennial non-timber crops	Medium - Low	Pervasive	Moderate - Slight	High
2.3	Livestock farming & ranching	Negligible	Negligible	Negligible	High
3	Energy production & mining	Medium	Restricted	Extreme - Serious	High
3.2	Mining & quarrying	Medium	Restricted	Extreme – Serious	High
3.3	Renewable energy	Negligible	Negligible	Slight	High
4	Transportation & service corridors	High – Medium	Pervasive	Serious - Moderate	High
4.1	Roads & railroads	High – Medium	Pervasive	Serious - Moderate	High
4.2	Utility & service lines	Negligible	Negligible	Slight	High
5	Biological resource use	Low	Small	Extreme	High
5.1	Hunting & collecting terrestrial animals	Low	Small	Extreme	High
5.3	Logging & wood harvesting	Low	Small	Slight	High
6	Human intrusions & disturbance	Negligible	Negligible	Negligible	High
6.1	Recreational Activities	Negligible	Negligible	Negligible	High

Threat # ^a	Threat Description	Impact ^b	Scope ^c	Severity ^d	Timing ^f
7	Natural system modifications	Low	Small	Slight	High
7.1	Fire & fire suppression	Negligible	Negligible	Slight	High
7.2	Dams & water management/use	Low	Small	Slight	High
8	Invasive & other problematic species & genes	Unknown	Pervasive	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Unknown	Unknown	High
8.2	Problematic native species	Unknown	Pervasive	Unknown	High
11	Climate change & severe weather	Unknown	Pervasive	Unknown	High
11.3	Temperature extremes	Unknown	Pervasive	Unknown	High

^a**Threat #** - Threats are numbered using the IUCN Classification System. Only those threats relevant to Gray Ratsnake, Carolinian population, are presented in this table and in Section 3.2. Description of Threats and Part 2 (Recovery Strategy for the Gray Ratsnake (*Pantherophis spiloides*) in Ontario).

^b**Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

^c**Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

^d**Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

^f**Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

3.2 Description of Threats

The overall threat impact for the Gray Ratsnake, Great Lakes/St. Lawrence and Carolinian populations is High¹⁸ and Very High - High¹⁹, respectively. This overall threat considers the cumulative impacts of multiple threats. Threats are listed in order as they appear in the Threats Classification Table (Table 1; Table 2).

See Section 1.6 (Threats to Survival and Recovery) in the provincial recovery strategy for more information on threats. The list below identifies how the IUCN threat categories used in Table 1 and Table 2 correspond to the threat categories used in section 1.6 of the provincial recovery strategy. Threat #3.3 Renewable energy, threat #8.1 Invasive non-native/alien species, threat #8.2 Problematic native species, and threat #11.3 Temperature extremes are identified in COSEWIC 2018, but were not addressed in the provincial recovery strategy and may also affect the Gray Ratsnake, Great Lakes/St. Lawrence and Carolinian populations.

IUCN Threat #1. Residential & commercial development:

Section 1.6 of the provincial recovery strategy: '*Habitat Degradation and Fragmentation*', '*Habitat Loss*' and '*Disturbance or Destruction of Hibernacula*'

IUCN Threat #2. Agriculture & aquaculture:

Section 1.6 of the provincial recovery strategy: '*Habitat Degradation and Fragmentation*'

IUCN Threat #3. Energy production & mining:

IUCN Threat 3.2 Mining & Quarrying

Section 1.6 of the provincial recovery strategy: '*Disturbance or Destruction of Hibernacula*'

IUCN Threat 3.3 Renewable energy

Areas of suitable habitat are increasingly being developed for establishment of solar farms in the Gray Ratsnake, Great Lakes/St. Lawrence population range (COSEWIC 2018). Covering 100 – 200 acres (40 – 80 hectares) per site, solar farm developments further threaten hibernation sites, and eliminate and fragment habitats for feeding and reproduction (COSEWIC 2018). Solar power and wind farms are also in existence within the range of the Gray Ratsnake, Carolinian population (COSEWIC 2018).

¹⁸ The overall threat impact was calculated following Master et al. (2012) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 1 High, 4 Low (Table 1). The overall threat considers the cumulative impacts of multiple threats.

¹⁹ The overall threat impact was calculated following Master et al. (2012) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 1 High, 2 Medium, 3 Low (Table 2). The overall threat considers the cumulative impacts of multiple threats.

IUCN Threat #4. Transportation and service corridors:

Section 1.6 of the provincial recovery strategy: '*Habitat Degradation and Fragmentation*', '*Direct mortality*' and '*Road mortality*'

IUCN Threat #5. Biological resource use:

Section 1.6 of the provincial recovery strategy: '*Direct mortality*'

IUCN Threat #6. Human intrusions & disturbance:

Section 1.6 of the provincial recovery strategy: '*Direct mortality*' and '*Disturbance or Destruction of Hibernacula*'

IUCN Threat #7. Natural system modifications:

Section 1.6 of the provincial recovery strategy: '*Habitat Degradation and Fragmentation*' and '*Direct mortality*'

IUCN Threat #8. Invasives & other problematic species & genes:

IUCN Threat 8.1 Invasive non-native/alien species

Another potential threat that may affect the Gray Ratsnake is Snake Fungal Disease (SFD) (*Ophidiomyces ophiodiicola*). This is an emerging fungal disease in wild snakes that causes severe skin lesions, leading to widespread morbidity and mortality (Sleeman 2013; Allender et al. 2015). SFD has been confirmed in several North American snakes species including the Northern Watersnake (*Nerodia sipedon sipedon*), Eastern Foxsnake (*Pantherophis gloydi*), Eastern Milksnake (*Lampropeltis triangulum*), and Massasauga (*Sistrurus catenatus*) (Sleeman 2013). SFD has also been confirmed in southwestern Ontario, in an Eastern Foxsnake found in 2015 (Crowley pers. comm. 2015). In 2018 there was one case of positively identified SFD in Gray Ratsnake in Kentucky (McKenzie et al. 2018). Infection has also been confirmed in nine other states in the U.S., although it is likely to be even more widespread (Sleeman 2013; McKenzie et al. 2018).

The disease spreads directly through contact with infected snakes and indirectly via environmental exposure (i.e., contact with 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 a small Timber Rattlesnake (*Crotalus horridus*) population in New Hampshire in 2006 to 2007 (Clark et al. 2011). Due to the small and isolated range of the Gray Ratsnake both globally and in Canada, SFD may threaten population viability if it becomes established in the population.

IUCN Threat 8.2 Problematic native species

The reintroduction of Wild Turkey (*Meleagris gallopavo*) within the range of the Gray Ratsnake, Great Lakes/St. Lawrence and Carolinian populations, may be a threat to juvenile Gray Ratsnakes as wild turkeys are known to prey on small snakes (COSEWIC 2018). Additionally, predators such as the Raccoon (*Procyon lotor*), Striped Skunk (*Mephitis mephitis*) and Coyote (*Canis latrans*) are subsidized in urbanized areas which causes their populations to increase. These species have the ability to locate nest sites, leading to increased mortality for the Gray Ratsnake in Ontario (COSEWIC 2018).

IUCN Threat #11. Climate change and severe weather:

IUCN Threat 11.3 Temperature extremes

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). Further, winter warming events are expected to result in increased stress and vulnerability to predation due to early emergence from hibernation (COSEWIC 2018).

4. Population and Distribution Objectives

Under SARA, a population and distribution objective must be established for listed Endangered, Threatened and Extirpated species when recovery is deemed feasible. The population and distribution objectives established by Environment and Climate Change Canada for the Gray Ratsnake are:

- To maintain the current abundance, area of occupancy and habitat connectivity within the Gray Ratsnake, Great Lakes/St. Lawrence population; and
- To maintain and, where biologically and technically feasible, increase the current abundance, area of occupancy and habitat connectivity within the subpopulations of the Gray Ratsnake, Carolinian population.

The Great Lakes/St. Lawrence population is relatively large and currently self-sustaining, but threats to habitat (e.g., fragmentation) and road mortality have led to declines. The Great Lakes/St. Lawrence population in Canada is estimated to contain approximately 25,000 – 67,000 mature individuals, and the Index of Area of Occupancy is estimated at 612 km² ; reflecting a 30% increase over 2 generations due to increased search effort (COSEWIC 2018). Regular monitoring using standard methods should indicate if the abundance and area of occupancy of the population is being maintained and that estimates of abundance meet or exceed previous reports.

It is unknown whether the Carolinian population will persist due to its small size and isolation, as well as the severe fragmentation of remaining suitable habitat (COSEWIC

2018). As such, consistent with the provincial goal, the objective is to maintain the population and if found to be feasible, increase its size, distribution and habitat connectivity. Maintaining and, where feasible, increasing the size, and distribution of the Carolinian population of Gray Ratsnake will require improving habitat connectivity, and it will likely be necessary to conduct active habitat restoration within subpopulations in order to maintain the population and therefore halt further declines. The protection of remaining high quality movement habitat and identifying key priority sites for restoration are required to reduce isolation, fragmentation and the potential for inbreeding depression²⁰; thus supporting these objectives.

These objectives are consistent with the province of Ontario's Government Response Statement developed under the provincial ESA 2007, which outlines the provincial government's goal for the recovery of the species and summarizes the prioritized actions the government intends to take and support (see Part 3 for more information). The Government Response Statement for the province of Ontario lists the following goal for the recovery of the Gray Ratsnake in Ontario:

The government's goal for the recovery of the Gray Ratsnake is to maintain a viable self-sustaining Frontenac Axis population and to halt the decline of the Carolinian population. The government supports investigating the feasibility of increasing the distribution and size of the Carolinian population.

5. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported action tables from *Gray Ratsnake – Carolinian and Frontenac Axis 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 identified in section 2.3 of the *Recovery Strategy for the Gray Ratsnake* (*Pantherophis spiloides*) *Carolinian and Frontenac Axis populations in Ontario* (Part 2).

In addition to the above, and to address the additional threats from COSEWIC 2018 (see section 3. Threats) not specifically addressed in *Gray Ratsnake – Carolinian and Frontenac Axis Populations – Ontario Government Response Statement* (Part 3), threats from the development of solar power and wind farms can be mitigated by ensuring conservation through land protection, land use planning, development of regulations, and enforcement of existing regulations. Threats from problematic native species and invasive non-native species can be mitigated by promoting landowner stewardship programs, and implementing restoration techniques and best management practices at all known locations, thereby increasing the amount of available suitable habitat and connectivity between local populations where loss or fragmentation is not irreversible. Lastly, further investigation of the threat of SFD to Gray Ratsnake within

²⁰ The reduced biological fitness in a given population as a result of inbreeding (i.e., breeding of related individuals).

Canada, including presence of the disease within the Canadian population, possible vectors of the disease, methods of disease, and the potential of climate change to increase risk infection rates is required.

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 provincial recovery strategies under the Province of Ontario's ESA. However, following completion of the provincial recovery strategy for this species, a provincial habitat regulation was developed for each of the Gray Ratsnake populations, and both regulations came into force July 1, 2012. A habitat regulation is a legal instrument that prescribes an area that will be protected²¹ 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. The identification of the critical habitat for the Gray Ratsnake is based on the habitat regulation to promote consistency between SARA and the ESA 2007 in protecting critical habitat on federal and non-federal lands.

Environment and Climate Change Canada adopts the description of Gray Ratsnake (Frontenac Axis population) and Gray Ratsnake (Carolinian population) habitats under sections 27.2 and 27.1, respectively, of Ontario Regulation 242/08²² made under the provincial ESA 2007 as critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence and Carolinian populations. In addition, where the critical habitat criteria described in this recovery strategy are met, critical habitat has been identified on any federal lands, including First Nations lands, within the grid squares identified in Appendix A. 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. Additional critical habitat may be added in the future if new information supports the inclusion of areas beyond those currently identified.

²¹ 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.

²² http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_080242_e.htm#BK65

The area defined under these provincial habitat regulations contain the biophysical attributes required by the Gray Ratsnake, Carolinian and Great Lakes/St. Lawrence populations to carry out its life processes. To meet specific requirements of SARA, the biophysical attributes and geographic locations of critical habitat for each species are further detailed in the subsections below.

6.1.1. Critical Habitat for Gray Ratsnake (Great Lakes/St. Lawrence population)

Ontario Habitat Regulation

The areas prescribed under **Ontario regulation 242/08 – Gray Ratsnake (Frontenac Axis population) habitat** are described as follows:

27.2 (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 gray ratsnake (Frontenac Axis population):

- 1. The geographic area of Leeds and Grenville.*
- 2. The parts of the geographic area of Frontenac composed of the lower-tier municipalities of Central Frontenac, Frontenac Islands and South Frontenac and the single-tier municipality of Kingston.*
- 3. The parts of the geographic area of Lanark composed of the lower-tier municipalities of Drummond-North Elmsley and Tay Valley. O. Reg. 122/12, s. 4.*

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

- 1. A gray ratsnake (Frontenac Axis population) hibernaculum.*
- 2. The area within 150 metres of the area described in paragraph 1.*
- 3. A naturally occurring gray ratsnake (Frontenac Axis population) egg laying site that is being used, or has been used at any time in the previous three years, by a gray ratsnake (Frontenac Axis population).*
- 4. A gray ratsnake (Frontenac Axis population) egg laying site, other than a naturally occurring egg laying site, being used by a gray ratsnake (Frontenac Axis population) from the time it is used until the following November 30.*
- 5. A naturally occurring gray ratsnake (Frontenac Axis 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 gray ratsnakes (Frontenac Axis population).*
- 6. A gray ratsnake (Frontenac Axis population) shedding or basking site, other than a naturally occurring shedding or basking site, that is being used by two or more gray ratsnakes (Frontenac Axis 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, forest, hedge row, shoreline, old field, wetland or similar area that is being used by a gray ratsnake (Frontenac Axis population) or on which a gray ratsnake (Frontenac Axis population) directly depends to carry on its life processes.*
- 9. An area that provides suitable foraging, thermoregulation, or hibernation conditions for gray ratsnake (Frontenac Axis population) that is within 1,000 metres of an area described in paragraph 8.*
- 10. An area that provides suitable conditions for gray ratsnake (Frontenac Axis population) to move between areas described in paragraphs 1 through 9. O. Reg. 122/12, s. 4.*

(3) 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 Gray Ratsnake (Frontenac Axis 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 150 m distance around a hibernaculum and 30 m distance around an egg laying or communal 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 Gray Ratsnakes (Frontenac Axis population) may use naturally occurring egg laying sites, communal shedding sites and communal 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 1000 m distance represents the average distance traveled by Gray Ratsnakes (Frontenac Axis 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 contains the biophysical attributes required by Gray Ratsnake, Great Lakes/St. Lawrence population to carry out its life processes. For the purposes of defining critical habitat, these biophysical attributes are described below (Table 3).

Table 3: Detailed Biophysical Attributes of Critical Habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population in Canada.

Life Cycle Activity	Biophysical Attributes	References
Foraging	<ul style="list-style-type: none"> Rock barren, forest, hedgerow, shoreline, old field, wetland and other similar areas that together create a mosaic of forest, forest edge and open habitats with high edge to area ratio. 	COSEWIC 2018; Row 2006; Blouin-Demers and Weatherhead 2001a; Weatherhead and Charland 1985
Hibernation	<ul style="list-style-type: none"> 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 crevices, fissures or underground ledges (naturally occurring features), old wells, septic tile beds and building foundations (non-naturally occurring^a features); Presence of relatively large, partially dead and/or hollow trees near the hibernaculum. 	Prior and Weatherhead 1996
Oviposition ^b	<ul style="list-style-type: none"> Presence of natural composting-type sites with high humidity to prevent eggs from drying out and suitable temperature (~ 30°C) for incubation such as rotten interior cavities of large deciduous trees and stumps, rotting logs or masses of dead vegetation (naturally occurring features), manure piles or compost piles (non-naturally occurring features); Sites are typically found in rock barren, forest, hedgerow, shoreline, old field, wetland or other similar areas. 	COSEWIC 2018; Blouin-Demers et al. 2004
Thermoregulation ^c (basking/ shelter) and shedding	<ul style="list-style-type: none"> Features that provide opportunities for sun and shade exposure such as rocks and rock ledges, standing snags, tree cavities, stumps and logs (naturally occurring features), barns, hay piles, old machinery and buildings (non-naturally occurring features); Sites typically located in edge, (forest/field or forest interior openings) open or semi-open habitat. 	Blouin-Demers and Weatherhead 2001a; Blouin-Demers and Weatherhead 2002b; Prior and Weatherhead 1996
Movement	<ul style="list-style-type: none"> Rock barren, forest, hedgerow, shoreline, old field, wetland and other similar areas and hay fields that allow for movement between hibernation, oviposition, foraging and thermoregulation locations. 	Blouin - Demers and Weatherhead 2001a

^a 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).

^b Egg laying.

^c The process of raising or lowering body temperature by varying exposure to environmental conditions.

Areas suitable for Gray Ratsnakes, Great Lakes/St. Lawrence population, including areas used for thermoregulation, foraging, oviposition and hibernation, are typically found in rock barren, forest, hedgerow, shoreline, old field, wetland and other similar areas that together create a mosaic of forest, forest edge and open habitat with high edge to area ratio (Weatherhead and Charland 1985; Blouin-Demers and Weatherhead 2001a; Row 2006; COSEWIC 2018).

Non-natural Habitat Features

As explained above, non-naturally occurring features (e.g., compost piles, old wells) have been included in the identification of critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population to support the species' recovery. Recent genetic studies indicate that it is unlikely that the population could withstand much habitat loss and still remain self-sustaining (Prior et al. 1997; Howes et al. 2009), and because of the species high fidelity to hibernacula and the high importance of egg laying sites (particularly those which are communal) to the species, non-naturally occurring features which provide this type of habitat are important, especially in areas where natural habitat has been lost or is insufficient for the species needs. Additionally, as Gray Ratsnakes are at the northern extent of their range, thermoregulation is particularly important (Blouin-Demers and Weatherhead 2001b) and basking sites are often used prior to or following oviposition. Thus, non-naturally occurring features which provide thermoregulatory characteristics as identified in Table 3 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. However, this determination will need to be done on a case-by-case basis taking into consideration a number of factors including the species' biology, potential risk to the species, the availability of natural and non-natural structures or features in the surrounding area, and options for mitigation or replacement.

Critical Habitat Criteria

Hibernacula are one of the most important habitat features for Gray Ratsnake, 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. A distance of 150 m around a hibernaculum is necessary 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 (Blouin-Demers and Weatherhead 2002a).

Because of their close relationship with survival and recruitment of individuals as well as some ecological traits of the Gray Ratsnake (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, to ensure that the thermoregulatory, vegetative and lighting properties of the site are maintained (Kraus et al. 2010).

The maintenance of a healthy Gray Ratsnake, Great Lakes/St. Lawrence population will require connectivity of forest and forest edge 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. Based on the average distance that radio-tracked Gray Ratsnakes, Great Lakes/St. Lawrence population traveled from their hibernaculum to their oviposition site (Kraus et al. 2010), a radial distance of 1,000 m is used to determine the extent of critical habitat.

Lakes and rivers, below the historical low water mark, as well as 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 traps²³.

Through this recovery strategy, the areas prescribed as habitat for the Gray Ratsnake (Frontenac Axis population) under section 27.2 of Ontario Regulation 242/08 become critical habitat identified under SARA. In addition, the areas described in subsection (2) of the Ontario regulation that are located on any federal lands are also identified as critical habitat. The identification of critical habitat is based on available observations (up to March 2015) for the Gray Ratsnake, Great Lakes/St. Lawrence population from the past 50 years. The Gray Ratsnake, Great Lakes/St. Lawrence population is a relatively cryptic species, has a life span of about 30 years (Blouin-Demers et al. 2002) and survey effort in some locations is limited, 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)²⁴.

This approach to critical habitat aligns with the approach taken by the province to habitat regulated under the ESA 2007 and intends to promote consistency in habitat protection on and off federal lands in Ontario. The areas identified as critical habitat within this recovery strategy will remain as critical habitat until revised in an updated recovery strategy or In addition, should new occurrences of Gray Ratsnake, Great Lakes/St. Lawrence population be identified that meet the criteria above, the area will not automatically become critical habitat; however, the new information will be considered and additional critical habitat may be identified in an updated recovery strategy, as appropriate.

Concurrently, the provincial habitat regulation remains dynamic and automatically in effect whenever the conditions described in the regulation are met, Furthermore, if any new locations of the Gray Ratsnake (Frontenac Axis population) or its habitat features are confirmed within the geographic areas listed under subsection (1) of the regulation,

²³ A low-quality habitat that animals choose over other available, better quality habitats.

²⁴ 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.

the habitat regulation under the ESA 2007 will automatically apply to these new locations. Refer to the *Habitat Protection Summary for Gray Ratsnake (Frontenac Axis Population)* (OMNR 2012a) for further details on the provincial habitat regulation and its application.

Application of Critical Habitat Criteria

Application of the critical habitat criteria above to the best available data identifies critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population. The total area within which critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population is found is 70,614 hectares (Figure A-1, See also Table A-1). The total area estimate is derived from a 1,000 m radial distance boundary around a Gray Ratsnake, Great Lakes/St. Lawrence 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 Gray Ratsnake (Frontenac Axis 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 150 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 objectives for the Gray Ratsnake, Great Lakes/St. Lawrence population; therefore a schedule of studies is not required.

Critical habitat identified for the Gray Ratsnake, Great Lakes/St. Lawrence population is presented using 10 X 10 km UTM²⁵ grid squares. Critical habitat was presented at this scale to minimize risk to the species from persecution and human disturbance. The UTM grid squares presented in Figure A-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 critical habitat description 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.

6.1.2. Critical Habitat for Gray Ratsnake (Carolinian population)

Ontario Habitat Regulation

The areas prescribed under Ontario regulation 242/08 – Gray Ratsnake (Carolinian population) habitat are described as follows:

²⁵ Universal Transverse Mercator (UTM) Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>)

27.1 (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 gray ratsnake (Carolinian population):

- 1. The geographic areas of Brant, Elgin, Haldimand, Niagara and Norfolk.*
- 2. The part of the geographic area of Middlesex composed of the upper-tier municipality of Middlesex. O. Reg. 122/12, s. 4.*

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

- 1. A gray ratsnake (Carolinian population) hibernaculum.*
- 2. The area within 150 metres of the area described in paragraph 1.*
- 3. A naturally occurring gray ratsnake (Carolinian population) egg laying site that is being used, or has been used at any time in the previous three years, by a gray ratsnake (Carolinian population).*
- 4. A gray ratsnake (Carolinian population) egg laying site, other than a naturally occurring egg laying site, being used by a gray ratsnake (Carolinian population) from the time it is used until the following November 30.*
- 5. A naturally occurring gray ratsnake (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 gray ratsnakes (Carolinian population).*
- 6. A gray ratsnake (Carolinian population) shedding or basking site, other than a naturally occurring shedding or basking site, that is being used by two or more gray ratsnakes (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 meadow, forest, hedge row, shoreline, old field, wetland or similar area that is being used by a gray ratsnake (Carolinian population) or on which a gray ratsnake (Carolinian population) directly depends to carry on its life processes.*
- 9. An area that provides suitable foraging, thermoregulation, or hibernation conditions for gray ratsnake (Carolinian population) that is within 2,000 metres of an area described in paragraph 8.*
- 10. An area that provides suitable conditions for gray ratsnake (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 Gray Ratsnake (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 150 m distance around a hibernaculum and 30 m distance

around an egg laying or communal 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 Gray Ratsnakes (Carolinian population) may use naturally occurring egg laying sites, communal shedding sites and communal basking sites. The 2,000 m distance represents the average maximum distance traveled by Gray Ratsnakes (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 Gray Ratsnake, Carolinian population to carry out its life processes. For the purposes of defining critical habitat, these biophysical attributes are described in Table 4. Due to the restricted size of the Carolinian population, limited studies have been conducted on habitat use and movement. While some differences in habitat use (based primarily on available habitat) are known, much of the information presented in Table 4 is based on information available for the Great Lakes/St. Lawrence population.

Table 4: Detailed Biophysical Attributes of Critical Habitat for the Gray Ratsnake, Carolinian population in Canada.

Life Cycle Activity	Biophysical Attributes	References
Foraging	<ul style="list-style-type: none"> Meadow, forest, hedgerow, wetland, shoreline, old field and similar habitat types that together create a mosaic of forest, forest edge and open habitats with high edge to area ratio. 	COSEWIC 2018; Blouin-Demers and Weatherhead 2001a; Weatherhead and Charland 1985
Hibernation	<ul style="list-style-type: none"> Structure that extends below the frost line, with sufficient humidity to prevent snakes from drying out, and protected from flooding (e.g., above high water mark) and predators such as crevices, fissures or underground ledges, small mammal burrows (naturally occurring features), old wells, septic tile beds and building foundations (non-naturally occurring features); Presence of relatively large, partially dead and/or hollow trees near the hibernaculum. 	Prior and Weatherhead 1996
Oviposition	<ul style="list-style-type: none"> Presence of natural composting-type sites with high humidity to prevent eggs from drying out and suitable temperature for incubation such as rotten interior cavities of large deciduous trees and stumps, or masses of dead vegetation (naturally occurring features) manure piles, compost piles (non-naturally occurring features); Sites are typically found in meadow, forest, hedgerow, wetland, shoreline, old field and similar habitat types. 	COSEWIC 2018; Blouin-Demers et al. 2004
Thermoregulation (basking/shelter) and shedding	<ul style="list-style-type: none"> Features that provide opportunities for sun and shade exposure such as rocks and rock ledges, standing snags, tree cavities, stumps, logs (naturally occurring features), barns, hay piles and buildings (non-naturally occurring features); Often located in edge habitat (forest/field or forest interior openings), open or semi-open habitat. 	Blouin-Demers and Weatherhead 2001a; Blouin-Demers and Weatherhead 2002b; Prior and Weatherhead 1996
Movement	<ul style="list-style-type: none"> Meadow, forest, hedgerow, wetland, shoreline, old field, and similar habitat types; active agricultural fields and some urban areas that allow for movement between hibernation, oviposition, foraging and thermoregulation locations. 	Blouin-Demers and Weatherhead 2001a

Areas suitable for Gray Ratsnakes, Carolinian population, including areas used for thermoregulation, foraging, oviposition and hibernation, are typically found in meadow, forest, hedgerow, shoreline, old field, wetland and other similar areas that together create a mosaic of forest, forest edge and open habitat with high edge to area ratio (Weatherhead and Charland 1985; Blouin-Demers and Weatherhead 2001a; Row 2006; COSEWIC 2018).

Non-natural Habitat Features

As explained above, non-naturally occurring habitat (e.g., compost piles, old wells) has been included in the identification of critical habitat for the Gray Ratsnake, Carolinian population. Suitable habitat in the Carolinian region is severely restricted and heavily fragmented, and it is unknown whether enough habitat remains to support viable populations of Gray Ratsnakes (COSEWIC 2018). Because of the species high fidelity to hibernacula and the importance of egg laying sites to the species, non-naturally occurring features which provide this type of habitat are important to the species continued survival, especially in areas where natural habitat has been lost or is insufficient for the species needs. Additionally, as Gray Ratsnakes are at the northern extreme of their range, thermoregulation is particularly important (Blouin-Demers and Weatherhead 2001b) and basking sites are often used prior to or following oviposition. Thus, non-naturally occurring features which provide thermoregulatory characteristics as identified in Table 4 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. However, this determination will need to be done on a case-by-case basis taking into consideration a number of factors including the species' biology, potential risk to the species, the availability of natural and non-natural structures or features in the surrounding area, and options for mitigation or replacement.

Critical Habitat Criteria

Hibernacula are one of the most important habitat features for Gray Ratsnake, Carolinian population as they are critical for overwinter survival. It is not currently known to what extent subterranean features of hibernacula extend from an entrance or exit point. A distance of 150 m around a hibernaculum is considered necessary to maintain the 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 (Blouin-Demers and Weatherhead 2002a).

Because of their close relationship with survival and recruitment of individuals as well as some ecological traits of the Gray Ratsnake (e.g., reproductive strategy), oviposition, basking and shedding habitats are also addressed separately from other, more general habitat. The 30 m distance around an oviposition, shedding or thermoregulation site was chosen to ensure that the thermoregulatory, vegetative and lighting properties of the site are maintained (Kraus et al. 2010).

The maintenance of a healthy Gray Ratsnake population, Carolinian population will require connectivity of forest and forest edge 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. Yagi and Tervo (2006) found that Gray Ratsnakes in the Oriskany sub-population travelled nearly two kilometres, thus a radial distance of 2,000 m is used to determine the extent of critical habitat.

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.

Through this recovery strategy, the areas prescribed as habitat for the Gray Ratsnake, Carolinian population under section 27.1 of Ontario Regulation 242/08 become critical habitat identified under SARA. In addition, the areas described in subsection (2) of the Ontario regulation that are located on any federal lands are also identified as critical habitat. The identification of critical habitat is based on available observations (up to March 2015) for the Gray Ratsnake, Carolinian population from the past 50 years. The Gray Ratsnake, Carolinian population is a relatively cryptic species, has a life span of about 30 years (Blouin-Demers et al. 2002) and recent survey effort in some locations is limited, 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).

This approach to critical habitat aligns with the approach taken by the province to habitat regulated under the ESA 2007 and intends to promote consistency in habitat protection on and off federal lands in Ontario. The areas identified as critical habitat within this recovery strategy will remain as critical habitat until revised in an updated recovery strategy. In addition, should new occurrences of Gray Ratsnake, Carolinian population be identified that meet the criteria above the area will not automatically become critical habitat; however, the new information will be considered and additional critical habitat may be identified in an updated recovery strategy, as appropriate.

Concurrently, the provincial habitat regulation remains dynamic and automatically in effect whenever the conditions described in the regulation are met. Furthermore, if any new locations of the Gray Ratsnake, Carolinian population or its habitat features are confirmed within the geographic areas listed under subsection (1) of the regulation, the habitat regulation under the ESA 2007 will automatically apply to these new locations. Refer to the *Habitat Protection Summary for Gray Ratsnake (Carolinian Population)* (OMNR 2012b) for further details on the provincial habitat regulation and its application.

Application of Critical Habitat Criteria

Application of the critical habitat criteria above to the best available data identifies critical habitat for the Gray Ratsnake, Carolinian population. The total area within which critical habitat for the Gray Ratsnake, Carolinian population is found is 30,118 ha and includes area for the four known sub-populations (Figure A-2, See also Table A-2). The total area estimate is derived from a 2,000 m radial distance boundary around a Gray Ratsnake, 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 Gray Ratsnake, 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 150 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 for Gray Ratsnake, Carolinian population; therefore a schedule of studies is not required.

Critical habitat identified for the Gray Ratsnake, Carolinian population is presented using 10 X 10 km UTM grid squares. Critical habitat was presented at this scale to minimize risk to the species from persecution and human disturbance. The UTM grid squares presented in Figure A-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 purposes. The areas of critical habitat within each grid square occur where the critical habitat description 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.

6.2 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 Gray Ratsnake, 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 or features should they need to be removed or disturbed 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 5 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 5. Activities Likely to Result in the Destruction of Critical Habitat (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, development, recreational vehicle use [e.g. ATVs] in sensitive areas)	Activities such as construction of infrastructure and the development of roads, trails and footpaths used by wheeled traffic can lead to fragmentation of critical habitat by forming physical barriers that 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 by 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 Gray Ratsnake 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 forests, woodlands, wetlands, shorelines, rock outcrops, hedgerows, and meadows (e.g., housing development, land clearing)	Development or clearing of land can lead directly to loss, fragmentation or degradation of critical habitat. Although some of these activities can result in the creation of a different habitat type that is still useable by Gray Ratsnake (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 parts of the contiguous areas of habitat and/or pieces of the habitat	X	X	X	X

	<p>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.</p> <p>Activities occurring at any time of year can lead to degradation or destruction of critical habitat. As explained above (Section 6.1.1), the removal of non-naturally occurring egg laying or thermoregulatory 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.</p>				
Removal or alteration of documented nesting sites or hibernacula that may be found in habitat features (e.g., rotting logs or compost piles)	<p>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.</p> <p>Removal of trees and vegetation can change the thermoregulatory properties of Gray Ratsnake 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 Gray Ratsnake as it no longer provides the necessary characteristics such as cover, warmth, and shading required.</p> <p>As explained above (section 6.1.1), 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.</p>	X		X	

Activities that result in the alteration of water levels at/near documented hibernacula (e.g., drainage of damp and/or wet areas; water removal)	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 Gray Ratsnakes. This activity can lead to degradation or destruction of critical habitat at any time of the year.			X	X
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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 current abundance and area of occupancy of the Great Lakes/St. Lawrence population, and the degree of habitat connectivity within the population, have been maintained.
- The Carolinian population has been maintained, and where biologically and technically feasible, the current abundance, area of occupancy and habitat connectivity within subpopulations have been increased.

8. Statement on Action Plans

The Parks Canada Agency completed the Multi-species Action Plan for the Thousand Islands National Park of Canada in 2015 and this document will contribute towards implementation of this recovery strategy.

One or more additional action plans will be completed and posted on the Species at Risk Public Registry for Gray Ratsnake by December 31, 2025.

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*](#)²⁶. 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*](#)'s²⁷ (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 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.

²⁶ www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

²⁷ www.fdsd-sfdd.ca/index.html#/en/goals/

In general, protecting this species and its habitat will benefit other species of multiple taxa, as the Gray Ratsnake is both predator and prey for a number of species (e.g., it provides an important component of a healthy ecosystem, food for some species, and a form of natural population control for others). Gray Ratsnakes also use multiple habitat types over large areas (i.e., mixed and deciduous forest, open areas such as rocky outcrops, wetlands, and small fields, and the edge habitat between forest and open habitats; see Part 2), and protection of these habitats will maintain habitat for other species as well (e.g., Cerulean Warblers, Golden-winged Warblers, Flooded Jellyskin, Pale-bellied Frost Lichen, Eastern Loggerhead Shrikes). Protection of natural features in the Carolinian region in particular will be of benefit to many species as the natural habitat in that region is already quite fragmented. The Carolinian ecosystem itself is one of the most threatened in Ontario and supports over 125 species at risk, such as Spotted Wintergreen, Red Mulberry, Cucumber Tree, Henslow's Sparrow, Yellow-breasted Chat, Fowler's Toad, and Queensnake.

The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. None of the management activities proposed includes activities that would negatively affect other species. The SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects.

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Appendix A: Critical Habitat for the Gray Ratsnake in Canada

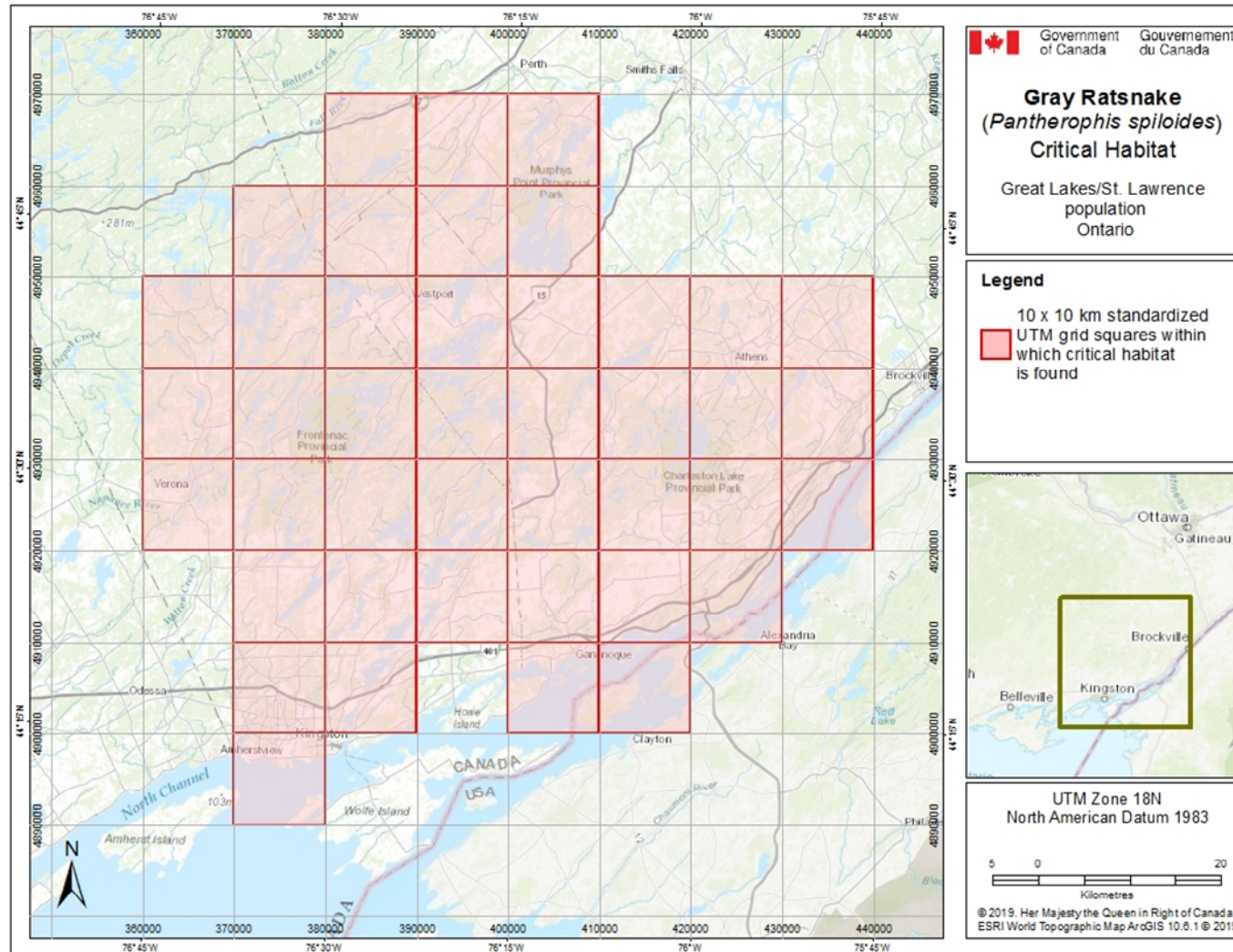


Figure A-1. Grid squares that contain critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population in Canada. Critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population occurs within these 10 x 10 km UTM grid squares (red shaded squares), where the description of critical habitat in Section 6.1.1 is met.

Table A-1. Grid squares that contain critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population in Canada. Critical habitat for the Gray Ratsnake, Great Lakes/St. Lawrence population occurs within these 10 x 10 km UTM grid squares where the description of critical habitat is met.

10 x 10 km standardized UTM grid square ID ¹	Province / Territory	UTM Grid Square Coordinates ²		Land tenure ³
		Easting	Northing	
18TUP79	Ontario	370000	4890000	Other federal land and Non-federal land
18TUQ62		360000	4920000	Non-federal land
18TUQ63		360000	4930000	Non-federal land
18TUQ64		360000	4940000	Non-federal land
18TUQ70		370000	4900000	Non-federal land
18TUQ71		370000	4910000	Non-federal land
18TUQ72		370000	4920000	Non-federal land
18TUQ73		370000	4930000	Non-federal land
18TUQ74		370000	4940000	Other federal land and Non-federal land
18TUQ75		370000	4950000	Non-federal land
18TUQ80		380000	4900000	Non-federal land
18TUQ81		380000	4910000	Non-federal land
18TUQ82		380000	4920000	Non-federal land
18TUQ83		380000	4930000	Other federal land and Non-federal land
18TUQ84		380000	4940000	Other federal land and Non-federal land
18TUQ85		380000	4950000	Non-federal land
18TUQ86		380000	4960000	Other federal land and Non-federal land
18TUQ91		390000	4910000	Other federal land and Non-federal land
18TUQ92		390000	4920000	Other federal land and Non-federal land
18TUQ93		390000	4930000	Other federal land and Non-federal land
18TUQ94		390000	4940000	Other federal land and Non-federal land
18TUQ95		390000	4950000	Non-federal land
18TUQ96		390000	4960000	Non-federal land
18TVQ00		400000	4900000	Other federal land and Non-federal land
18TVQ01		400000	4910000	Non-federal land
18TVQ02		400000	4920000	Non-federal land
18TVQ03		400000	4930000	Other federal land and Non-federal land
18TVQ04		400000	4940000	Non-federal land
18TVQ05		400000	4950000	Other federal land and Non-federal land
18TVQ06		400000	4960000	Other federal land and Non-federal land
18TVQ10		410000	4900000	Other federal land and Non-federal land
18TVQ11		410000	4910000	Other federal land and Non-federal land
18TVQ12		410000	4920000	Non-federal land
18TVQ13		410000	4930000	Non-federal land
18TVQ14		410000	4940000	Other federal land and Non-federal land
18TVQ21		420000	4910000	Federal protected area (Thousand Islands National Park), Other federal land and Non-federal land
18TVQ22		420000	4920000	Other federal land and Non-federal land

18TVQ23		420000	4930000	Non-federal land
18TVQ24		420000	4940000	Non-federal land
18TVQ32		430000	4920000	Federal protected area (Thousand Islands National Park), Other federal land and Non-federal land
18TVQ33		430000	4930000	Non-federal land
18TVQ34		430000	4940000	Non-federal land

¹Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789>), where the first 2 digits and letter refer to the UTM zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid, followed by 2 digits to represent the 10 x 10 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).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

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

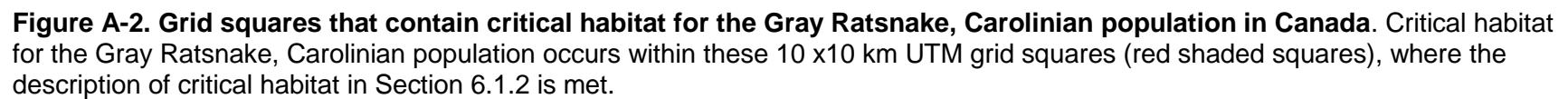


Table A-2. Grid squares that contain critical habitat for the Gray Ratsnake, Carolinian population in Canada. Critical habitat for the Gray Ratsnake, Carolinian population occurs within these 10 x 10 km UTM grid squares where the description of critical habitat is met.

10 x 10 km standardized UTM grid square ID ¹	Province / Territory	UTM Grid Square Coordinates ²		Land Tenure ³
		Easting	Northing	
17TNH11	Ontario	510000	4710000	Non-federal Land
17TNH12		510000	4720000	Non-federal Land
17TNH21		520000	4710000	Non-federal Land
17TNH22		520000	4720000	Non-federal Land
17TNH23		520000	4730000	Non-federal Land
17TNH31		530000	4710000	Non-federal Land
17TNH32		530000	4720000	Non-federal Land
17TNH33		530000	4730000	Non-federal Land
17TNH41		540000	4710000	Non-federal Land
17TNH42		540000	4720000	Non-federal Land
17TNH43		540000	4730000	Non-federal Land
17TNH44		540000	4740000	Non-federal Land
17TNH53		550000	4730000	Non-federal Land
17TNH54		550000	4740000	Non-federal Land
17TNH63		560000	4730000	Non-federal Land
17TNH73		570000	4730000	Non-federal Land
17TNH74		570000	4740000	Non-federal Land
17TNH85		580000	4750000	Non-federal Land

¹Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789>), where the first 2 digits and letter refer to the UTM zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid, followed by 2 digits to represent the 10 x 10 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).

²The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

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

Appendix B: Subnational Conservation Ranks of Gray Ratsnake (*Pantherophis Spiloides*) in Canada and the United States

Gray Ratsnake (<i>Pantherophis spiloides</i>)				
Global (G) Rank	National (N) Rank (Canada)	Sub-national (S) Rank (Canada)	National (N) Rank (United States)	Sub-national (S) Rank (United States)
G5	N3	Ontario (S3)	N5	Alabama (S5), Florida (SNR), Georgia (SNR), Illinois (SNR), Indiana (SNR), Kentucky (S5), Louisiana (SNR), Michigan (S2S3), Mississippi (SNR), New York (S4), Ohio (SNR), Tennessee (S5), Wisconsin (S3)

Rank Definitions (NatureServe 2017)

N1/S1: Critically Imperilled (National/State) - At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

N2/S2: Imperilled (National/State) - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

N3/S3: Vulnerable (National/State) - At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors.

S4: Apparently Secure (State) - At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences but with possible cause for some concern as a result of local recent declines, threats or other factors.

G5/S5/N5: Secure (Global/State/National) - At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

SU: Unrankable (State) - An occurrence rank cannot be assigned due to lack of sufficient information on the occurrence.

SH: Historical (State) - Recent field information verifying the continued occurrence is lacking.

SX: Extirpated (State) - Adequate surveys by one or more experienced observers at times and under conditions appropriate for the species at the occurrence location, or other persuasive evidence, indicate that the species no longer exists there or that the habitat or environment of the occurrence has been destroyed to such an extent that it can no longer support the species.

NNR/SNR: Unranked - National or subnational conservation status not yet assessed.

?: Used to indicate uncertainty in any of the above ranks, usually because data is lacking.

**Part 2 – *Recovery Strategy for the Gray Ratsnake*
(*Pantherophis spiloides*) – *Carolinian and Frontenac Axis*
populations in Ontario, prepared by Kraus et al. for the
Ontario Ministry of Natural Resources**



Gray Ratsnake

(*Pantherophis spiloides*) Carolinian and
Frontenac Axis populations in Ontario

Ontario Recovery Strategy Series

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

September 2010

Natural. Valued. Protected.

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

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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

Talena Kraus – Artemis Eco-Works
Brian Hutchinson – Parks Canada Agency
Shaun Thompson – Ontario Ministry of Natural Resources
Kent Prior – Parks Canada Agency

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DECLARATION

The Ontario Ministry of Natural Resources has led the development of this recovery strategy for the Gray Ratsnake (Carolinian and Frontenac Axis 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 Gray Ratsnake is a large snake that is native to North America and in Ontario it is only found in two locations: the Carolinian forest and Frontenac Axis. It is Ontario's largest snake and can grow to 185 centimetres in length. It has keeled scales and a powerful slender body with a wedge-shaped head. The body tends to be more square than round in cross section. Hatchling Gray Ratsnakes have a pattern of dark grey or black blotches and spots over a background of light gray. As the snake ages, this pattern fades and adults are predominantly black. The underneath of the chin and throat are usually white, often mottled with grey and black blotches. They can live up to 30 years, and reach maturity at about seven years. Mating occurs between late May and mid-June and females usually reproduce every two to three years.

The Frontenac Axis population of Gray Ratsnakes was listed as threatened in 2009 under Ontario's *Endangered Species Act*, 2007 and the Carolinian population was listed as endangered. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the Frontenac Axis population as threatened and the Carolinian population as endangered in 2007.

The Gray Ratsnake requires a mosaic of habitat features, including forest and edge habitat. Mature females require oviposition (egg-laying) sites, typically rotten interior cavities of large deciduous trees and stumps or compost piles. This species overwinters underground in communal hibernacula and shows high fidelity to those hibernacula.

Life history features such as late age of maturity, long life span, biennial reproduction and intermittent juvenile recruitment predispose Gray Ratsnake populations to major demographic fluctuations when subjected to disturbances and do not allow for a natural capacity to rapidly rebound from demographic low points.

Threats to the Gray Ratsnake include habitat degradation, fragmentation and loss, direct mortality, road mortality and disturbance or destruction of hibernacula. Knowledge gaps relate to population persistence and viability measures, efficacy of mitigation measures and juvenile and neonate ecology. A number of recovery actions have been completed or are underway and range from stewardship and outreach activities to habitat and genetic research.

The recovery goal for the Gray Ratsnake in Ontario is to retain the current distribution, population size and connectivity among extant sub-populations within the Frontenac Axis population of eastern Ontario and to achieve self-sustaining sub-populations in the Carolinian population by increasing the distribution and size of the population.

Protection and recovery objectives that guide the approaches to recovery are to:

1. Develop and implement a coordinated monitoring plan focused on population indices and distribution, habitat stresses and efficacy of recovery actions;

Recovery Strategy for the Gray Ratsnake (Carolinian and
Frontenac Axis populations) in Ontario

2. Conduct research to fill knowledge gaps including ecological studies of habitat, genetic connectivity and the impacts of various threats;
3. Describe and map habitat required to meet recovery goals for each of the Ontario populations;
4. Protect and manage the habitat of the species and mitigate priority threats; and
5. Improve the delivery and evaluation of stewardship and communications to increase awareness, land stewardship, application of best management practices and citizen science efforts.

A number of approaches are identified for each of these objectives.

It is recommended that the area prescribed as Gray Ratsnake habitat in a habitat regulation include all known hibernacula and the area within a 150 metre radius of them; and all known oviposition sites and the area within a 30 metre radius of them. In addition, for the Carolinian population, the area prescribed as habitat in the regulation should also include all natural features (e.g., woodlands, wetlands, hedgerows, meadows) within five kilometres of known hibernacula, oviposition sites and locations at which a Gray Ratsnake has been observed (accurate to 100 metres). For the Frontenac Axis population, a map based on quantified measures of preferred habitat including indices of suitable habitat, road density, measures of connectivity and likelihood of supporting existing populations is included in the strategy. It is recommended that cells in the map with suitable habitat (cell value of 0.5 or greater) be prescribed as habitat in a habitat regulation for the population. This area is roughly bordered by Highway 7 in the north, the St. Lawrence River in the south, Highway 38 and in the west and Highway 29 in the east.

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1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Gray Ratsnake

SCIENTIFIC NAME: *Pantherophis spiloides*

SARO List Classification:

Gray Ratsnake (Carolinian population) – Endangered

Gray Ratsnake (Frontenac axis population) – Threatened

SARO List History:

Gray Ratsnake (Carolinian population) – Endangered (2009)

Gray Ratsnake (Frontenac axis population) – Threatened (2009)

Eastern Ratsnake – Threatened (2004)

COSEWIC Assessment History:

Gray Ratsnake (Carolinian population) – Endangered (2007)

Gray Ratsnake (Great Lakes/St. Lawrence population) – Threatened (2007)

Eastern Ratsnake – Threatened (2000 and 1998)

SARA Schedule 1:

Gray Ratsnake (Carolinian population) – Endangered (March 5, 2009)

Gray Ratsnake (Great Lakes/St. Lawrence population) – Threatened (March 5, 2009)

CONSERVATION STATUS RANKINGS:

GRANK: G5

NRANK: N3

SRANK: S3

The glossary provides definitions for the abbreviations above. The Gray Ratsnake is also known as Black Ratsnake, Black Rat Snake, Gray Rat Snake and Eastern Ratsnake and by the scientific names of *Pantherophis obsoletus*, *Elaphe obsoleta* and *Elaphe spiloides*.

1.2 Species Description and Biology

Species Description

The Gray Ratsnake is Ontario's largest snake. It reaches sexual maturity at an average of 105 centimetres in length and can grow to 185 centimetres in length. The average diameter of the snake's body is 4 centimetres at the widest point. It has keeled scales and a powerful slender body with a wedge-shaped head. The body tends to be more square than round in cross section. The anal plate of the Gray Ratsnake is divided. The Gray Ratsnake is highly variable in colouration and pattern depending upon the age of the snake. Hatchling Gray Ratsnakes have a pattern of dark grey or black blotches and spots over a background of light gray. As the snake ages, this pattern fades and

adults are predominantly black. Slight traces of the juvenile pattern often remain even in the adult Gray Ratsnake, resulting in small specks of white and occasionally even tinges of red and brown scattered throughout the scales. The underside of the chin and throat are usually white, often mottled with grey and black blotches.

Some adults attempt to protect themselves by coiling their body and vibrating their tails in dead leaves to simulate a rattle. If the snakes continue to be provoked they will strike. Gray Ratsnakes produce a foul-smelling musk as a deterrent, releasing and spreading it on a predator if they are picked up.

Species Taxonomy

The taxonomic classification of Gray Ratsnake has changed over the years resulting in a number of different common names and scientific names for the species. At present the accepted common name is Gray Ratsnake and the accepted scientific name is *Pantherophis spiloides* (Gibbs et al. 2006). Several genetic studies over the past decade have been conducted (Burbrink 2001, Burbrink et al. 2001, Utiger et al. 2002, Gibbs et al. 2006, Burbrink and Lawson 2007, Collins and Taggart 2008, Pyron and Burbrink 2009). Research indicates that although the two Canadian populations are genetically different, the Carolinian population is a subset of the Frontenac Axis population (Gibbs et al. 2006) and therefore this distinction should not affect conservation of the species.

Species Biology

Gray Ratsnakes are estimated to live up to 30 years and they become sexually mature at approximately seven years (COSEWIC 2007). The mating season in Ontario runs from late May to mid-June. Females usually produce a clutch of 10 to 15 eggs every two to three years, but may produce clutches for two or three years in a row (COSEWIC 2007). Gray Ratsnakes thermoregulate through behaviour. Since they are at the northern limit of their range in Ontario this is an important underlying feature of habitat selection and use (COSEWIC 2007). Home range size is on average 18.5 hectares and Gray Ratsnakes migrate between hibernacula and home ranges (COSEWIC 2007). Overwinter dormancy normally persists for up to seven months (October to April) each year (Blouin-Demers et al. 2000; Blouin-Demers and Weatherhead 2001b). Gray Ratsnakes overwinter communally in traditional underground hibernacula. It is possible that undisturbed hibernacula have been continuously occupied for hundreds of years. It is not known where juveniles hibernate before they begin to attend communal hibernacula at about seven years of age (Prior et al. 2001), but preliminary data suggest that some hibernate singly in rock fissures (Blouin-Demers et al. 2007).

Gray Ratsnakes exhibit relatively fluid gene flow across the entire Frontenac Axis which is indicative of significant relationships among local populations (Lougheed et al. 1999). Recent evidence of multiple paternity in Gray Ratsnakes (Blouin-Demers and Gibbs 2003; Blouin-Demers et al. 2005) suggests that some gene flow is realized by mating among members of different hibernacula. Juvenile dispersal also contributes to this gene flow (Blouin-Demers and Weatherhead unpublished data).

1.3 Distribution, Abundance and Population Trends

Gray Ratsnakes are restricted to North America. In the United States they are widely distributed and can be found where appropriate habitat occurs across much of the eastern half of the country. In the southern parts of their range they may be relatively abundant. In the east, they are found from southwestern New England south to central Georgia, while in the midwest they occur from southwestern Wisconsin south to southern Oklahoma, northern Texas and northern Louisiana (COSEWIC 2007).

In Canada, Gray Ratsnakes are only found in Ontario. In Ontario, the Gray Ratsnake is found in two regions (Figure 1) (COSEWIC 2007). The Carolinian forest region, along the north shore of Lake Erie in southwestern Ontario, has two extant disjunct sub-populations (the Big Creek sub-population in Norfolk and Elgin counties and the Oriskany Sandstone sub-population in Haldimand County) and other sub-populations to be confirmed in Skunk's Misery (Middlesex and Kent counties) and the Niagara area. These sub-populations are highly isolated and appear to be quite small. The Frontenac Axis region in southeastern Ontario has one population that extends across the United States border into upper New York State. The entire Frontenac Axis population is disjunct from the populations in the eastern and central United States. Populations in Ontario are on the northern edge of the species' distribution, geographically peripheral to the species' central range.

The species' geographic distribution in Ontario is estimated to have been reduced by as much as 75 percent over the past 100 years with a concomitant reduction in population size. Anecdotal evidence based on reduced sightings over the past 50 years in the southwestern Ontario portion of the species' range further indicates that population size is continuing to decline. Long-term mark-recapture data from two areas on the Frontenac Axis (St. Lawrence Islands National Park and Queen's University Biological Station) have indicated that populations are declining, even in protected areas (Weatherhead et al. 2002).

Communal hibernacula are known to have as many as 60 individuals each and there are assumed to be hundreds of active hibernacula across the Frontenac Axis region. The Gray Ratsnake population density estimate at Queen's University Biological Station is 0.261 mature snakes per hectare (Blouin-Demers and Weatherhead 2002b).

No estimates of the number of hibernacula or population abundance for Gray Ratsnake in southwestern Ontario have been made. Consensus among members of the Gray Ratsnake Recovery Team suggests that at least 75 percent of the species historical distribution has been eliminated from southwestern Ontario.

Recovery Strategy for the Gray Ratsnake (Carolinian and
Frontenac Axis populations) in Ontario

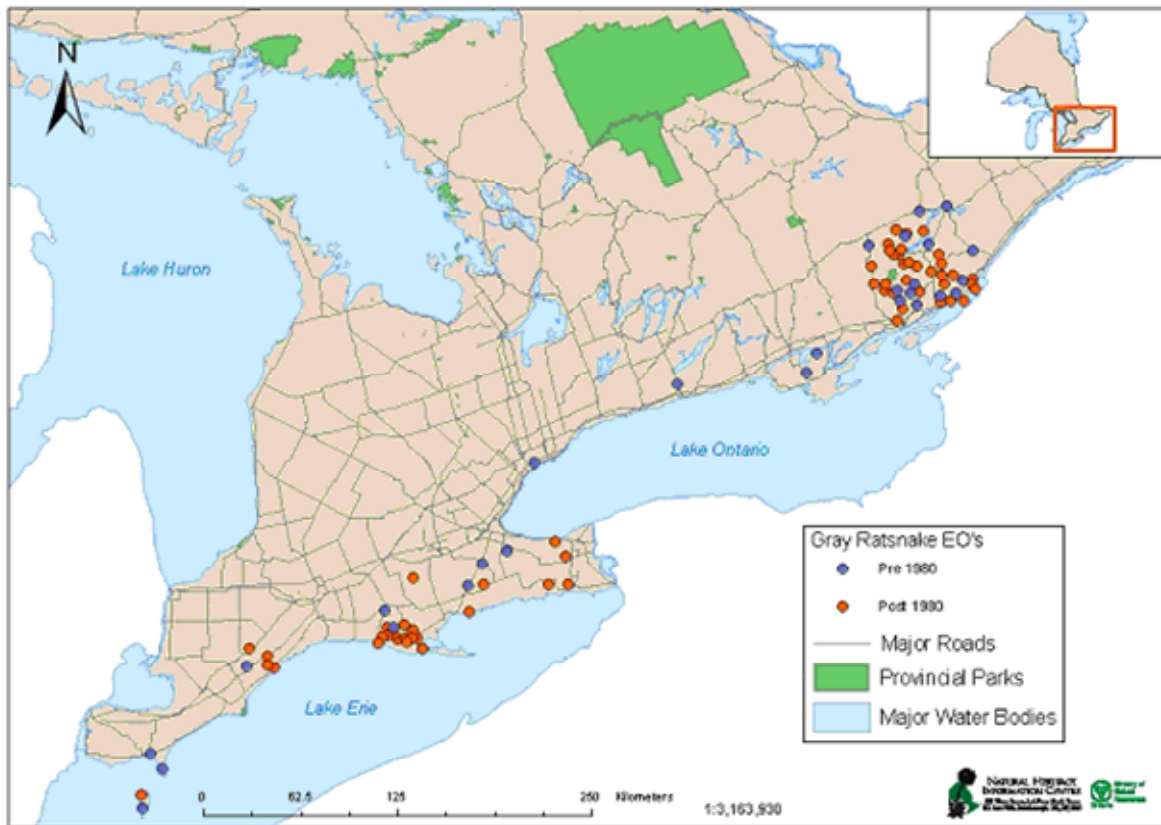


Figure 1. Recent (1980-2005) and historic (pre-1980) element occurrences (EOs) of Gray Ratsnake in Ontario (Natural Heritage Information Centre 2005)

1.4 Habitat Needs

Gray Ratsnakes are typically associated with deciduous forest, though they appear to be capable of utilizing a broad range of habitat types. They exhibit a strong preference for 'edge habitats' where open habitats (such as old field, meadow, rocky outcrops or marshes) and deciduous forest vegetation communities meet (Blouin-Demers and Weatherhead 2001a, b, c, 2002b). It is important that individuals are able to include forest and forest edges within their home ranges. Work conducted in Maryland suggests that a landscape mosaic composed of 50 percent mixed forest and 33 percent cropland may be sufficient to support a healthy population when climate is not a limiting factor (Durner and Gates 1993). Because climate is much more challenging for snakes in Ontario, these estimates may not apply. Research in a relatively undeveloped Ontario study area (within Frontenac Axis) suggests that Gray Ratsnakes use considerably less open habitat (i.e., 3% field, 4% wetland and 10% rocky outcrops) and more forest than the snakes in the Maryland study (Blouin-Demers and Weatherhead 2001a). Analyzing known home range data, Row (2006) found that Gray Ratsnakes preferred home ranges containing forest cover of 41 to 53 percent; less than 28 percent edge habitat (defined as 10 metres on either side of forest); and less than 17 percent marsh. Average home range size in the Frontenac Axis population studied is

approximately 18.5 hectares (Blouin-Demers and Weatherhead 2001a). A habitat use analysis of juveniles in the Frontenac Axis population found that juvenile Gray Ratsnakes used their habitat randomly (Blouin-Demers et al. 2007). The authors did note the possibility that this random use of habitat may have been due to the fact that habitat in the area is very suitable for Gray Ratsnakes. No data are currently available for habitat use of neonate Gray Ratsnakes (approximately 0 – 5 years).

Mature females require oviposition (egg-laying) sites, typically rotten interior cavities of large deciduous trees and stumps or compost piles (Blouin-Demers and Weatherhead 2000). Oviposition sites maintain thermal conditions necessary for egg incubation. After eggs are laid in late June to early August, incubation is approximately 60 days, with hatching occurring in late August to early October (COSEWIC 2007). Gray Ratsnakes overwinter underground in communal hibernacula and show high fidelity to those hibernacula (COSEWIC 2007). Hibernacula are subterranean structures (e.g., rock fissures) generally located in rocky areas and must extend below the frost line to provide adequate protection from freezing (COSEWIC 2007).

1.5 Limiting Factors

Life history features such as late age of maturity (9 – 10 years), long life span (25 – 30 years), biennial reproduction and intermittent juvenile recruitment predispose Gray Ratsnake populations to major demographic fluctuations when subjected to disturbances (Blouin-Demers and Weatherhead 2002a) and do not allow for a natural capacity to rapidly rebound from demographic low points. For example, even minor increases in the rate of adult mortality (e.g., through deliberate killing by humans or incidental mortality on roads) may alter the reproductive capacity of a population to such an extent that it becomes highly vulnerable to extinction (Weatherhead et al. 2002, Row et al. 2007).

1.6 Threats to Survival and Recovery

The threats are the same in all areas of Ontario where the Gray Ratsnake is found, but they are more severe in Carolinian sub-populations.

Habitat Degradation and Fragmentation

Because Gray Ratsnakes seem to require a variety of habitat elements (forest, open habitats) within their home range the overall suitability or quality of a landscape is presumably commensurate with the relative proportion of required elements. If so, then Gray Ratsnake habitat may be degraded by (1) the loss of specific habitats (e.g., deciduous forest) from the mosaic; (2) an alteration in the relative proportions or configuration of the habitat elements; and (3) an increase in road density. It is generally accepted that roads fragment habitat due to changes in light, sound and edge features. Habitat degradation and fragmentation across the landscape may affect spatial and activity patterns of snakes and limit the capacity of a given region to support a viable

population. Retaining the appropriate habitat composition may be a key to the future persistence of the Frontenac Axis population.

The Carolinian region sub-populations persist in a predominantly agricultural landscape. As such, these sub-populations have been subjected to severe landscape-scale habitat alteration including the fragmentation and reduction of forest and the expansion of largely unsuitable habitat (e.g., intensive agricultural crops like tobacco). These landscape-scale changes are the primary cause of the reduced size and extreme isolation of sub-populations found there today. Interrupting among-site connectivity by blocking snake movements (e.g., via habitat fragmentation, land clearing, road development) or the elimination of entire hibernacula can be viewed as the first step toward population isolation and the disintegration of meta-population structure. The highly isolated nature of each of the Carolinian region sub-populations means that local populations can not be augmented through natural re-colonization or immigration and thus are susceptible to extirpation.

Habitat Loss

The loss of deciduous forest and forest-field mosaics are thought to be the key cause of the decline of the species throughout the Carolinian region of southwestern Ontario. Interestingly, the availability of suitable habitat in the Frontenac Axis is thought to have increased over the past 100 years, as much previously worked farmland is now fallow. However, any gains in this respect may have been counteracted by negative trends in other factors.

Direct Mortality

Increased encounter rates with humans will inevitably lead to higher rates of mortality for Gray Ratsnakes, both by intentional mortality (e.g., intentional persecution based on the mistaken belief that snakes are dangerous) and accidental mortality [e.g., due to agricultural and construction machinery, lawnmowers, all-terrain vehicles and boats (COSEWIC 2007b, COSEWIC 2008)].

Road Mortality

In a study on a secondary road in the Frontenac Axis region (Row et al. 2007), the road was found to be a significant source of mortality for the population. Row et al. (2007) extrapolated the known mortalities to the whole population based on the size of the study area and found the estimate of total road mortality for the population increased the probability of extinction to 99 percent over 500 years. It could be extrapolated that primary roads within the Gray Ratsnake range would be an even higher source of mortality.

Disturbance or Destruction of Hibernacula

Disturbance or destruction of traditional hibernacula could cause local extinctions. Aggregate extraction, road construction and high density residential construction are common threats to hibernacula for both Gray Ratsnake populations in Ontario. Increasing recreational development across the Frontenac Axis and resulting disturbance of hibernacula may jeopardize local sub-populations. This threat may be

particularly significant across the Carolinian region of Ontario where sub-populations may rely on only one or two communal hibernacula. Only one hibernaculum has been identified in the Carolinian region, leaving overwintering populations susceptible to disturbance. Unknown hibernacula may be destroyed or disturbed before they can be identified and thus protected.

1.7 Knowledge Gaps

Survey Requirements

For the southwestern Ontario (Carolinian) sub-populations: (1) population persistence needs to be confirmed; (2) hibernacula need to be located; (3) impacts of threats on persistence need to be quantified; and (4) the level of public awareness needs to be identified. This will need some level of organized survey effort. Additional information is needed for the population in the Frontenac Axis region regarding the effect of threats and genetic connectivity.

Biological and Ecological Research Requirements

More information is needed about population level habitat requirements and what conditions allow for population viability. An understanding of neonate and juvenile dispersal and mating patterns is needed to better determine how these mechanisms contribute to gene flow and population connectivity. More information is required on factors affecting egg mortality (e.g., availability of nests, egg parasitism and predation). The efficacy of mitigation and restoration practices is not known and should be designed (where necessary) and evaluated.

Threat Clarification Research Needs

It is important to know why Gray Ratsnake numbers are declining in protected areas. As indicated above, the relative impact that various threats have on population persistence should be quantified across all Ontario populations. The validity of methods for reducing significant threats is not well known. The extent to which habitat fragmentation and habitat composition impact population persistence needs to be thoroughly evaluated; this information may be used to guide management activities to retain habitat in some areas (e.g., Frontenac Axis) and restore habitat in others (e.g., Big Creek).

1.8 Recovery Actions Completed or Underway

- Systematic and on-going population monitoring is occurring at three locations in the Frontenac Axis: Queen's University Biological Station (22 hibernacula); St. Lawrence Islands National Park (5 hibernacula); and Murphys Point Provincial Park (2 hibernacula).
- Long-term research into habitat use and genetic structure continues at Queen's University Biological Station.

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- Research was completed in May 2005 investigating differences in habitat use and movement patterns between juveniles and adults in the Frontenac Axis population (information published in Blouin-Demers et al. 2007).
- Natural history interpretation and outreach programs (and/or dissemination of information) led by staff are ongoing at St. Lawrence Islands National Park, Charleston Lake, Frontenac and Murphys Point Provincial Parks.
- Baseline telemetry studies at Murphys Point and Charleston Lake Provincial Parks have provided some data on movement patterns, habitat use, hibernation locations and population characteristics for these two areas. A telemetry study was undertaken at Frontenac Provincial Park during the summer of 2001 which identified potential hibernaculum areas (Solomon 2003).
- Annual hibernacula monitoring was initiated at Murphys Point Provincial Park in 2003 and is ongoing (Lunn 2009).
- An education and resource booklet (Live and Let Slither) was completed by Ontario Ministry of Natural Resources in 2001. The booklet is being distributed and is now available through Parks Canada Agency as a bilingual document.
- An education and outreach program (including supporting education materials) has been developed and is being delivered throughout Lanark-Leeds County school boards and Stewardship Councils.
- Work has begun to establish a cooperative relationship with a Lanark County property owners association to enhance Gray Ratsnake awareness, apply best management practices (e.g., retain snags for basking, create artificial nests) and identify significant habitat features. To date this group has expressed interest in becoming involved in data collection to advance recovery goals.
- Conservation easement negotiations are underway with Rideau Valley Conservation Authority for lands supporting hibernacula.
- A survey to assess public awareness related to local large snakes was conducted in the early 1990's in the Big Creek population area.
- Ontario Ministry of Natural Resources is conducting a radio-telemetry study of the Oriskany population, located near Nelles Corners in Haldimand County of southwestern Ontario. A landowner contact program has begun as part of this study.
- Norfolk Field Naturalists developed and put up a booth dealing with snakes at the Norfolk Country Fair (this results in contact with several thousand people per year)
- Norfolk Field Naturalists produced a pamphlet specific to the area on snakes
- An educational video (Black Ratsnake Conservation in Ontario) was produced and distributed by the Friends of Murphys Point Provincial Park.

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal for the Gray Ratsnake in Ontario is to retain the current distribution, population size and connectivity among extant sub-populations within the Frontenac Axis population of eastern Ontario and to achieve self-sustaining sub-populations in the Carolinian population by increasing the distribution and size of the population.

2.2 Protection and Recovery Objectives

Table 1. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Develop and implement a coordinated monitoring plan focused on population indices and distribution, habitat stresses and efficacy of recovery actions
2	Conduct research to fill knowledge gaps including ecological studies of habitat, genetic connectivity and the impacts of various threats
3	Describe and map habitat required to meet recovery goals for each of the Ontario populations
4	Protect and manage the habitat of the species and mitigate priority threats
5	Improve the delivery and evaluation of stewardship and communications to increase awareness, land stewardship, application of best management practices and citizen science efforts

2.3 Approaches to Recovery

Table 2. Approaches to recovery of the Gray Ratsnake in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Develop and implement a coordinated monitoring plan focused on population indices and distribution, habitat stresses and efficacy of recovery actions				
Critical	Ongoing	Inventory, Monitoring and Assessment	1.1 Maintain current monitoring (e.g., of hibernacula) and develop monitoring plan to further extend monitoring efforts	<ul style="list-style-type: none"> • All
Critical	Short-term	Inventory, Monitoring and Assessment	1.2 Establish additional monitoring stations in the Carolinian region to fill gaps identified in the plan	<ul style="list-style-type: none"> • All
Critical	Short-term	Inventory, Monitoring and Assessment	1.3 Map existing location data and determine areas to collect additional information	<ul style="list-style-type: none"> • Habitat loss
Necessary	Short-term and Ongoing	Inventory, Monitoring and Assessment	1.4 Map detailed range occupancy to aid in connectivity analysis and as a surrogate for population size and update this map regularly	<ul style="list-style-type: none"> • Habitat loss
Necessary	Long-term	Inventory, Monitoring and Assessment	1.5 Develop process to analyze monitoring data and to feed this information to land management agencies and stewardship programs	<ul style="list-style-type: none"> • All
Critical	Long-term and Ongoing	Inventory, Monitoring and Assessment	1.6 Monitor efficacy of recovery actions and measures employed to reduce threats	<ul style="list-style-type: none"> • All

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Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
2. Conduct research in a number of areas to fill knowledge gaps including ecological studies of habitat, genetic connectivity and the impacts of various threats				
Critical	Long-term	Research	2.1 Determine data needs for population and habitat viability assessment (PHVA), how PHVA should be used for management and conduct analysis	<ul style="list-style-type: none"> • All
Necessary	Long-term	Research	2.2 Research, evaluate and collate data on all potential restoration practices for widespread use	<ul style="list-style-type: none"> • Habitat loss; direct disturbance of hibernacula
Beneficial	Long-term	Research	2.3 Determine how genetic connectivity among sub-populations is maintained. This includes the relative importance of different mechanisms such as juvenile dispersal, adult dispersal and multiple paternity	<ul style="list-style-type: none"> • Habitat loss; habitat degradation and fragmentation
Necessary	Long-term	Research	2.4 Research and implement methods for reducing significant threats in strategic regions and evaluate effectiveness	<ul style="list-style-type: none"> • All
3. Describe and map habitat required to meet recovery goals for each of the Ontario populations				
Critical	Long-term	Research	3.1 Refine the maps of habitat <ul style="list-style-type: none"> – clarify essential habitat features associated with specific life history stages (e.g., nesting and over-wintering sites); – assess the tolerance of habitat features to disturbance; – determine the permanence of habitat features to match the degree of protection; – extrapolate known individual habitat requirements to habitat requirements of viable populations 	<ul style="list-style-type: none"> • All
4. Protect and manage the habitat of the species and mitigate priority threats				

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Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Necessary	Short-term	Management	4.1 Develop and apply criteria for ranking habitat parcels or networks. Establish a priority list of key habitat parcels and networks for protection	<ul style="list-style-type: none"> Habitat loss
Necessary	Short-term	Management	4.2 Promote protection of high ranking habitat parcels or networks through partners (municipalities, The Nature Conservancy of Canada, Ontario Parks, Stewardship Councils) and initiate acquisition, agreements, easements, etc.	<ul style="list-style-type: none"> Habitat loss
Beneficial	Short-term	Management	4.3 Direct other types of management actions (e.g., restoration) toward key priority sites	<ul style="list-style-type: none"> Habitat loss
Beneficial	Short-term	Management	4.4 Review, summarize and map all potential threats throughout the species' range, including relative significance of each (e.g., Is road kill significant across the range?)	<ul style="list-style-type: none"> All
Critical	Short-term	Management	4.5 Mitigate significant threats through appropriate strategies	<ul style="list-style-type: none"> All
5. Improve the delivery and evaluation of stewardship and communications to increase awareness, land stewardship, application of best management practices and citizen science efforts				
Critical	Short-term	Communications, Education and Outreach	5.1 Develop a communications plan whose target audiences include landowners, land-use planners, natural resource managers and other affected stakeholders	<ul style="list-style-type: none"> Direct mortality
Necessary	Long-term	Communications, Education and Outreach	5.2 Develop strategy for delivery of communication program to appropriate schools, Stewardship Councils, cottage associations, etc.	<ul style="list-style-type: none"> Direct mortality
Necessary	Long-term	Communications, Education and Outreach	5.3 Refine and promote best management practices and land use guidelines for landowners and stewards	<ul style="list-style-type: none"> Habitat loss; direct disturbance of hibernacula

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Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	Long-term	Communications, Education and Outreach	5.4 Develop (or improve) and distribute school education kits and lesson plans to schools within the range of Gray Ratsnake and other targeted school districts	<ul style="list-style-type: none"> • Direct mortality
Beneficial	Long-term	Communications, Education and Outreach	5.5 Plan and develop stand alone resource presentation materials for adult audiences to be used by outreach extension volunteers	<ul style="list-style-type: none"> • Direct mortality
Beneficial	Long-term	Stewardship	5.6 Develop, promote and implement citizen science program	<ul style="list-style-type: none"> • All
Beneficial	Long-term	Communications, Education and Outreach	5.7 Identify training needs; develop and deliver training workshops and materials to train wildlife enforcement officers	<ul style="list-style-type: none"> • All

Supporting Narrative

Recovery actions should occur at multiple scales including point locations surrounding traditional sites of occupation (hibernacula, oviposition sites) and broad landscapes across which hibernacula and local populations interact. Recovery efforts should be coordinated with existing landscape conservation initiatives including Algonquin to Adirondacks (A2A), Eco-Regional Planning led by The Nature Conservancy of Canada, municipal planners, conservation authorities and local naturalists.

In order for the recovery of Gray Ratsnake to be successful in Ontario, it is recommended that a collaborative approach be implemented including the participation of government agencies, land resource managers, municipal planners, land developers and the public. Rural landscapes need to be used in ways compatible with the needs of Gray Ratsnake populations.

In the Carolinian region of southwestern Ontario, forest habitat will probably need to be actively restored (e.g., forest patches reconnected) so that Gray Ratsnakes can occupy the landscape in relative safety. By contrast, sensitive land use management and careful (restrained) land development may be sufficient to maintain large tracts of quality habitat and healthy, interacting populations on the Frontenac Axis.

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 authors will be one of many sources considered by the Minister when developing the habitat regulation for this species.

The baseline research used to generate the recommendations for the species was conducted by Weatherhead and Charland (1985) and Blouin-Demers and Weatherhead (2001a, b, c, 2002b).

Both Populations

Given the high fidelity to, and the communal nature of, hibernacula, and given the importance of oviposition sites to a species that reproduces every two to three years, it is recommended that hibernacula and oviposition sites be prescribed as habitat in a habitat regulation.

Hibernacula for this species are subterranean geologic formations with surface access and cannot be easily identified by above ground features (COSEWIC 2007). In order to protect the hibernaculum itself, potential entrances and exits, and basking/staging areas used by Gray Ratsnakes in the weeks before entering hibernation in the fall and after emerging in the spring, it is recommended that an area with a radius of 150 metres from the known entrance/exit be prescribed as habitat in a habitat regulation. Blouin-Demers

and Weatherhead (2002b) observed that Gray Ratsnakes were found within 150 metres (on average) of their hibernaculum for approximately 10 to 40 days prior to or following emergence from hibernacula. Since Gray Ratsnake hibernacula have a stable structure and are used repeatedly, it is recommended that hibernacula be protected indefinitely.

Oviposition occurs in manure piles, compost piles, rotting logs and masses of dead vegetation. In order to protect the site itself and nearby basking/resting sites used prior to or following oviposition, it is recommended that an area with a radius of 30 metres (i.e., average tree height) be prescribed as habitat in a habitat regulation for the species to ensure that thermal, vegetative and lighting features are retained around oviposition sites (e.g., rotting logs). These sites are ephemeral and are only suitable for oviposition for a few years. Therefore, it is recommended that oviposition sites be prescribed as habitat until two years after the last known use of the site.

Frontenac Axis Population

The Frontenac Axis is situated on the Canadian Shield and is characterized by strongly rolling topography, frequent outcrops of bedrock, mixed deciduous-coniferous forests and many lakes, rivers and wetlands in low lying areas (COSEWIC 2007). The dominant natural subsystem is Forested Uplands, which is described as upland communities with more than 60 percent canopy cover of trees occurring on substrates with less than 50 percent rock outcrop or shallow soil over bedrock (Reschke 1990).

Favourable habitat in this region is predominately deciduous mesic forest; however, Gray Ratsnakes require a mosaic of forest and open habitats such as water, wetlands, old fields and rock outcrops (Blouin-Demers and Weatherhead 2001a) at a fine enough scale to include edge habitat within individual home ranges (about 18.5 hectares). Gray Ratsnakes travel quite extensively through the landscape and populations are comprised of networks of interacting hibernacula (i.e., individuals from different hibernacula mate) (Prior et al. 1997, Blouin-Demers and Weatherhead 2002, Blouin-Demers et al. 2005). The maintenance of healthy Gray Ratsnake populations depends upon individual snakes from neighbouring hibernacula being able to interact and thus connectivity of forest habitat is important within approximately one to two kilometres surrounding a hibernaculum (Blouin-Demers and Weatherhead 2002b). Studies have confirmed gene flow between communal hibernacula at least eight kilometres apart (Lougheed et al. 1999, Howes et al. 2009).

Row (2006) used several digital land cover maps to quantify habitat and extrapolate known habitat preferences (derived from overlaying home ranges on the land cover maps) of the Gray Ratsnake in the Queens University Biological Station (QUBS) over the rest of the habitat of the Frontenac Axis population. Suitable habitat, road density, neighbourhood size (to measure connectivity) and likelihood of supporting existing populations were all quantified and ranked for each cell. An overall suitability rank between 0 and 1 was then calculated for each cell and the resulting grid was mapped (Figure 2). Row recommended that cells with a habitat suitability value of 0.5 or greater be delineated as habitat for this species.

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As this map is the result of a process using quantified data based on habitat use and preferences, it is recommended that cells on the map in Figure 2 with a value of 0.5 or greater within the range of the Frontenac Axis population of Gray Ratsnakes be prescribed as habitat in a habitat regulation.

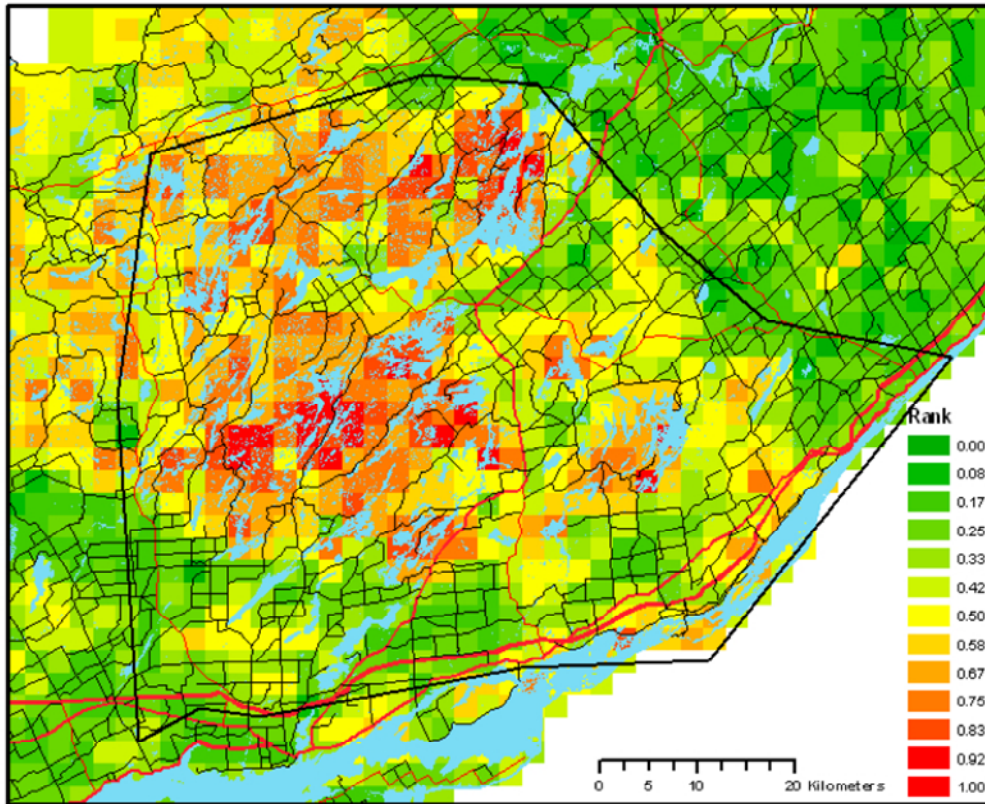


Figure 2. Rank of habitat inside 500 hectare grid squares overlaid across the Frontenac Axis. Habitat was ranked from least (0) to most (1) suitable. The black line indicates the Gray Ratsnake Frontenac Axis population range (COSEWIC 2007, from Row 2006)

Carolinian Population

The maximum distance traveled by a Gray Ratsnake from hibernaculum to nest (oviposition) site in a study by Blouin-Demers and Weatherhead (2002b) was slightly more than four kilometres; in the Frontenac Axis population the average was approximately 1 kilometre. Habitat in the Frontenac Axis region is more suitable and much less fragmented than that for the Carolinian population. Yagi and Tervo (2006) found that Gray Ratsnakes in a sub-population in the Carolinian region traveled nearly two kilometres during their study; one snake was in the process of moving away from the hibernaculum when the transponder was lost at that distance.

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Given the above and that the habitat available to this population is much more fragmented than that of the Frontenac Axis population, ratsnakes in the Carolinian population likely travel longer distances and have larger home ranges than snakes in the Frontenac Axis population. Therefore, all natural features (e.g., woodlands, wetlands, hedgerows, meadows) within five kilometres of known hibernacula, oviposition sites and locations at which a Gray Ratsnake has been observed (accurate to 100 metres) are recommended to be prescribed as habitat in a habitat regulation for the Carolinian population of Gray Ratsnake.

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

Element Occurrence (EO): A term used by Conservation Data Centres, including the Natural Heritage Information Centre (NHIC), to refer to an occurrence of an element of biodiversity (e.g., species or ecological community) on the landscape; an area of land and/or water on/in which an element is or was present.

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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Frontenac Axis populations) in Ontario

RECOVERY TEAM MEMBERS

NAME	AFFILIATION and LOCATION
Recovery Strategy Development Team	
Shaun Thompson (Co-Chair)	Ontario Ministry of Natural Resources, Kemptville District
Brian Hutchinson (Chair Emeritus)	Parks Canada Agency, Ontario Service Centre
Gabriel Blouin-Demers (Secretary)	Department of Biology, University of Ottawa
Corina Brdar	Ontario Ministry of Natural Resources, Ontario Parks, SE Zone
Mary Gartshore	Consultant
Jeff Leggo	Parks Canada Agency, St. Lawrence Islands National Park
Tobi Kiesewalter	Ontario Ministry of Natural Resources, Ontario Parks, Murphys Point Provincial Park
Kent Prior	Parks Canada Agency
Anne Yagi	Ontario Ministry of Natural Resources
Deb Jacobs	Formerly Ontario Ministry of Natural Resources
Rob Tervo	Formerly Ontario Ministry of Natural Resources
Rob Clavering	Formerly Ontario Ministry of Natural Resources,
Patrick Weatherhead	Natural Resources and Environmental Sciences, University of Illinois, USA
Advisors	
Don Cuddy	Consultant

**Part 3 – *Gray Ratsnake – Carolinian and Frontenac Axis Populations* – Ontario Government Response Statement,
prepared by the Ontario Ministry of Natural Resources**

Gray Ratsnake – Carolinian and Frontenac Axis 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 Gray Ratsnake was completed on September 10, 2010 (http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STDPROD_066840.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 Gray Ratsnake (also known as "Black Ratsnake") is non-venomous. It is Ontario's largest snake and can grow up to 2 metres long. Gray Ratsnakes are constrictors and feed mostly on rodents or birds.

MOVING FORWARD TO PROTECT AND RECOVER GRAY RATSNAKE

The Gray Ratsnake (Carolinian population) and the Gray Ratsnake (Frontenac Axis population) (together "Gray Ratsnake") 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 its habitat without authorization. Such authorization would require that conditions established by the Ministry be met.

In Ontario, Gray Ratsnakes are found only in the Carolinian forest region along the north shore of Lake Erie and in the Frontenac Axis region in southeastern Ontario. The Carolinian population is made up of sub-populations that are highly isolated and appear to be quite small. Major threats to the Gray Ratsnake include habitat loss and fragmentation, road mortality and human persecution.

The government's goal for the recovery of the Gray Ratsnake is to maintain a viable self-sustaining Frontenac Axis population and to halt the decline of the Carolinian population. The government supports investigating the feasibility of increasing the distribution and size of the Carolinian population.

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 Gray Ratsnake, the government will directly undertake the following actions:

- Develop a protocol to protect hibernating Gray Ratsnakes (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 Gray Ratsnakes.
- Conduct a monitoring program for Gray Ratsnake at priority Ontario Parks locations to determine species presence, distribution and habitat use.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.

- Encourage the submission of Gray Ratsnake 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 Gray Ratsnake 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 Gray Ratsnake. 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 efforts.

GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions for the protection and recovery of the Gray Ratsnake. 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:	Protection and Management
Objective:	Protect and manage the habitat of the species and mitigate priority threats.
	Actions: <ol style="list-style-type: none"> 1. (HIGH) Research and implement methods for reducing significant threats, including road mortality and human persecution, and evaluate their effectiveness. 2. (HIGH) Refine and promote best management practices for landowners and land managers. 3. Assess the tolerance of habitat features to disturbance. 4. As opportunities arise, support the securement of lands that contain Gray Ratsnake sub-populations through existing land securement and stewardship programs.
Focus Area:	Monitoring
Objective:	Develop and implement a co-ordinated monitoring program focused on population indices and distribution, habitat stresses and the effectiveness of recovery actions.
	Actions: <ol style="list-style-type: none"> 5. (HIGH) Identify locations of hibernacula, other habitat features and the extent of the species' distribution.

6. **(HIGH)** Maintain current monitoring activities (e.g., of hibernacula) and develop and implement a plan to extend monitoring activities, including establishing additional monitoring stations in the Carolinian region.
7. Develop a process for analyzing monitoring data to determine the effectiveness of recovery actions and to inform future management activities.

Focus Area: Awareness
Objective: Reduce human persecution of Gray Ratsnakes 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 Gray Ratsnake.

Focus Area: Research
Objective: Address knowledge gaps, including ecological studies of habitat and genetic connectivity.

Actions:

10. Undertake a population and habitat viability assessment (PHVA): determine data needs and use of PHVA, conduct research required for the PHVA and carry out the assessment once the information is available.
11. Research and collate data on habitat restoration practices, and evaluate their potential for widespread use.
12. Determine how genetic connectivity among sub-populations is maintained, including the relative importance of different mechanisms, such as juvenile dispersal, adult dispersal and multiple paternity.
13. Conduct additional studies into the habitat use and movement patterns of the Gray Ratsnake Carolinian population.
14. Investigate potential approaches to augmenting the Gray Ratsnake Carolinian population.

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 towards 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 Gray Ratsnake.

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We would like to thank all those who participated in the development of the "Recovery Strategy for Gray Ratsnake – Carolinian and Frontenac Axis 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
Contact the Natural Resources Information Centre
1-800-667-1940
TTY 1-866-686-6072
mnr.nric.mnr@ontario.ca
ontario.ca/mnr