Species at Risk Act Recovery Strategy Series Adopted under Section 44 of SARA

Recovery Strategy for the Small-mouthed Salamander (*Ambystoma texanum*) in Canada

Small-mouthed Salamander





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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 <u>Species at Risk (SAR) Public Registry</u>¹.

Cover illustration: Jim Bogart

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

RECOVERY STRATEGY FOR THE SMALL-MOUTHED SALAMANDER (*Ambystoma texanum*) 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 Small-mouthed Salamander* (Ambystoma texanum) *in Ontario* (Part 2) and the *Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) – Ontario Government Response Statement*² (Part 3) under Section 44 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this federal recovery strategy.

The federal recovery strategy for the Small-mouthed Salamander in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Small-mouthed Salamander (Ambystoma texanum) in Ontario*, prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Strategy for the Small-mouthed Salamander (Ambystoma texanum) in Ontario*, prepared by Stewart Hamill (2015) for the Ontario Ministry of Natural Resources and Forestry.

Part 3 – Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) – Ontario Government Response Statement, prepared by Ministry of the Environment, Conservation and Parks, 2019.

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.

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Part 3 – Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) – Ontario Government Response Statement, prepared by Ministry of the Environment, Conservation and Parks, 2019.

Part 1 – Federal Addition to the *Recovery Strategy for the Small-mouthed Salamander (Ambystoma texanum) in Ontario*, prepared by Environment and Climate Change Canada

Preface

The federal, provincial, and territorial government signatories under the <u>Accord for the</u> <u>Protection of Species at Risk (1996)</u>³ 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 is the competent minister under SARA for the Small-mouthed Salamander and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Ontario, as per section 39(1) of SARA. SARA section 44 allows the Minister 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)). The Ontario Ministry of Natural Resources and Forestry led the development of the attached recovery strategy for the Small-mouthed Salamander (Part 2) in cooperation with Environment and Climate Change Canada. 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, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Small-mouthed Salamander 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 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.

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

³ www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

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 area⁴ 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.

⁴ 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.

Acknowledgments

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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, individual citizens, and stakeholders who provided input and/or participated in consultation meetings.

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 Small-mouthed Salamander* (Ambystoma texanum) 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, with the exception of section 2.0, Recovery. In place of section 2.0, Environment and Climate Canada has established a population and distribution objective and performance indicators, and is adopting the province of Ontario's government-led and government-supported actions of the *Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) – Ontario Government Response Statement* (Part 3) as the broad strategies and general approaches to meet the population and distribution objective. Only those portions of the GRS pertaining to the Small-mouthed Salamander are adopted in this recovery strategy.

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

1. Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Small-mouthed Salamander. 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.

Unknown. Individuals capable of reproduction have been documented at the six extant sites on Pelee Island, Ontario. However, given that there are currently no population estimates for this species in Canada, it is not known whether the current number of Small-mouthed Salamanders in the Canadian population will be sufficient to ensure long-term population persistence. The Small-mouthed Salamander is ranked as Secure (N5) in the United States (although the nearest population, in Ohio, is not ranked; NatureServe 2015), so individuals may be available for re-introduction programs in the future, if deemed appropriate.

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

Unknown. Given that there are currently no population estimates for this species in Canada, it is difficult to estimate the amount of habitat needed to support a viable population. Availability of suitable habitat (including ephemeral⁵ breeding ponds) is recognized as a limiting factor for the species (Hamill 2015). In addition, suitable habitat is threatened by pollution, drainage activities, building or upgrading roads, climate change and development activities. Techniques for wetland creation/restoration exist, and may be considered where feasible and appropriate.

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

Unknown. The primary threats to the species, including habitat alteration, loss and fragmentation, may be avoided through stewardship activities, such as conservation of the remaining breeding ponds and surrounding forested habitat. Although breeding ponds for five of the six extant locations are on lands managed for conservation, off-site drainage activities can affect breeding ponds despite on-site conservation measures (Hamill 2015).

⁵ Exists for only a portion of the year or for a short period of time.

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

Yes. The population and distribution objective is to ensure the persistence of Small-mouthed Salamander at extant sites on Pelee Island and, where biologically and technically feasible, promote population expansion within its range on the island. Land management and stewardship techniques to achieve this objective – such as land use planning, wetland creation/restoration, and techniques to mitigate road mortality do exist and opportunities to to develop an integrated approach to managing species at risk with consideration of ecosystem values and sustainable resources on Pelee Island should be explored. Research is required to investigate the relative severity of threats to the Canadian population of Small-mouthed Salamander (COSEWIC 2014, Hamill 2015) and identify actions to mitigate those threats. Best management practices can be developed for the species in Canada and communicated to provide landowners with the information necessary to mitigate impacts to suitable habitat.

Due to its very limited distribution and the low probability of natural range expansion, the Small-mouthed Salamander will likely continue to be considered rare in Canada despite applying available recovery techniques and maintaining existing populations. In addition, based on the fact that the species inhabits a small island in Canada, it will likely always be vulnerable to human-caused stressors and natural, chance events (MacArthur and Wilson 1963).

2. COSEWIC* Species Assessment Information

Date of Assessment: May 2014

Common Name: Small-mouthed Salamander

Scientific Name: Ambystoma texanum

COSEWIC Status: Endangered

Reason for Designation: The Canadian distribution of this salamander is restricted solely to Pelee Island. The entire Canadian range is only about 40 km², and only three breeding sites are known. Although this species was first assessed as Endangered 10 years ago, there is little new information and new threats exist for this salamander. The continued existence of the population is precarious because of habitat degradation of wetland breeding sites. Predation and habitat destruction by recently introduced Wild Turkeys is a new threat to the existence of salamanders on Pelee Island.

Canadian Occurrence: Ontario

COSEWIC Status History: Designated Special Concern in April 1991. Status re-examined and designated Endangered in May 2004 and May 2014.

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

3. Species Status Information

Globally, the Small-mouthed Salamander is ranked Secure (G5) (NatureServe 2015). At the national scale, it is ranked as Critically Imperiled (N1) in Canada and Secure (N5) in the United States. At the sub-national level, it is ranked as Critically Imperiled (S1) in Ontario, and Critically Imperiled to Secure across its range in the United States (Appendix A).

The Small-mouthed Salamander is listed as Endangered⁶ under the Ontario *Endangered Species Act, 2007* (ESA), and is currently listed as Endangered⁷ on Schedule 1 of the federal SARA.

⁶ A species that is native to the wild in Ontario but is facing imminent extinction or extirpation.

⁷ A species facing imminent extinction or extirpation.

4. Species Information

4.1 Species Population and Distribution

The Small-mouthed Salamander occurs in North America, ranging from Ontario, Pennsylvania, and Michigan in the north, to Texas, Louisiana, Mississippi and Alabama in the south.

In Canada, the species only occurs on Pelee Island, at the southwestern end of Lake Erie in Ontario. Five breeding locations were identified in the 1991 COSEWIC Status Report (Bogart and Licht 1991), but two of those sites have since been lost (Bogart and Licht 2004); the 2014 COSEWIC species assessment and the *Recovery Strategy for the Small-mouthed Salamander (Ambystoma texanum) in Ontario* identifies three extant⁸ sites on Pelee Island (Hamill 2015). Since the publication of the last COSEWIC assessment and the provincial recovery strategy, Small-mouthed Salamanders have been documented at three additional locations on Pelee Island, bringing the total number of extant sites to six (Hossie and Murray 2017).

At the northern limit of its global range, the Canadian population of the Small-mouthed Salamander constitutes less than one percent of the species' global distribution (Bogart and Licht 2004).

Estimates of population size for the Small-mouthed Salamander in Canada are difficult to obtain because of the presence of unisexual polyploid salamanders⁹, which are morphologically¹⁰ similar to the Small-mouthed Salamander and comprise the majority of the *Ambystoma* salamander population sampled on Pelee Island. Intensive studies conducted from 1984 to 1991 found that approximately 78% of the Ambystoma salamander population was made up of unisexual polyploid individuals (Bogart and Licht 2004). A more recent study at various sites on Pelee Island found the overall proportion of unisexual polyploid individuals to be 98.5% (Hossie and Murray 2017). Some of this apparent increase in the proportion of unisexual polyploids may be due to differences in sampling locations or methodology (T. Hossie pers. comm. 2017), and more investigation is needed to determine if the apparent increase in proportion of unisexual polyploids represents a real decline in the abundance of Small-mouthed Salamanders on Pelee Island (J. Crowley pers. comm. 2017).

⁸ Population which is considered to be still in existence, i.e., not destroyed or lost (extirpated). ⁹ A unisexual polyploid salamander is a female member of the *Ambystoma laterale–texanum* complex that requires sperm from an *A. laterale* or *A. texanum* male to stimulate egg development but does not incorporate the male's genes into the genome of the offspring. See Hamill (2015) and COSEWIC (2004) for a more detailed account of the biology and genetics of the *Ambystoma laterale–texanum* complex.

¹⁰ Morphology is the size, shape, and structure of an organism or one of its parts.

5. Threats

As described in the provincial recovery strategy (Part 2, section 1.6), habitat alteration, loss and fragmentation, invasive and introduced species, climate change, pollution, predation, road mortality and competition and hybridization are considered threats to the Small-mouthed Salamander in Canada.

In addition to those threats identified in Part 2, additional threats may potentially affect this species.

The Small-mouthed Salamander in Canada could be particularly vulnerable in the face of pathogen introduction due to its small population size and geographic isolation. Pathogens like chytrid fungi Batrachochytrium dendrobatidis and Batrachochytrium salamandrivorans are introduced through regional and international trade of animals, and have caused important declines in amphibians and other ectotherms around the world (Duffus et al. 2015, Yap et al. 2015). Mortalities caused by Ranaviruses and B. dendrobatidis have been documented in various amphibian species of Canada. (Hughey et al. 2014; Duffus et al. 2015;). B. salamandrivorans, a pathogen specific to salamanders, has not yet been recorded in North America, but introduction is considered likely given considerable salamander imports from Asia, where the disease originates (Yap et al. 2015). Considering the limited and evolving understanding of these diseases, as well as the enforcement challenges associated with identifying different salamander species at Canada's numerous ports of entry, the Government of Canada recently implemented an import restriction prohibiting the import of all species of the order Caudata (such as salamanders, newts and mudpuppies) into Canada (unless otherwise authorized by Environment and Climate Change Canada). The restriction, implemented through an amendment to the federal Wild Animal and Plant Trade Regulations (WAPTR) was approved by the Governor in Council and came into effect on May 12, 2018.

Trematode parasites have been observed in Small-mouthed Salamanders in the United States (McAllister et al. 2008, 2010). However, the impact of this threat on the viability of the Canadian population is unknown (COSEWIC 2014).

Environmental contaminants (e.g., pesticides, de-icing salt) and potential habitation alteration and predation caused by Wild Turkeys may be additional threats to this species.

6. Population and Distribution Objectives

Under SARA, a population and distribution objective for the species must be established. Consistent with the goal provided in the provincial recovery strategy, Environment and Climate Change Canada's population and distribution objective for the Small-mouthed Salamander in Canada is to: Recovery Strategy for the Small-mouthed Salamander Part 1: Federal Addition

• Ensure the persistence of Small-mouthed Salamander at extant sites on Pelee Island and, where biologically and technically feasible, promote population expansion within its range on the island.

This objective is consistent with the province of Ontario's Government Response Statement developed under the provincial *Endangered Species Act*, 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 (Part 3) lists the following goal for the recovery of the Small-mouthed Salamander in Ontario:

• The government's goal for the recovery of the Small-mouthed Salamander is to ensure long-term viablitiy and persistence of the Ontario population by managing threats and increasing population abundance, distribution and connectivity.

Estimates of population size for the Small-mouthed Salamander are difficult to obtain because of the presence of unisexual polyploid salamanders, which are morphologically similar to the Small-mouthed Salamander, and comprise the majority of the sampled *Ambystoma* salamander population on Pelee Island (Bogart and Licht 2004, Hossie and Murray 2017). Adults are also difficult to observe or capture except at breeding ponds, where they may be present for only a few days. As a result, there is not enough information about population size and trends of the Small-mouthed Salamander in Canada to set a quantitative objective based on population abundance. Therefore, the population and distribution objective is based on ensuring persistence of the local populations at extant sites rather than targeting a specific population abundance.

Maintaining local populations of the Small-mouthed Salamander at extant sites on Pelee Island will require reducing and mitigating threats to this species, especially those related to a loss of suitable habitat (e.g., temporary or permanent loss of water from breeding sites during critical periods, the loss of ground cover and the loss of forest canopy cover). Suitable habitat for the Small-mouthed Salamander is limited within its Canadian range on Pelee Island (Hamill 2015). Conserving suitable habitat and promoting connectivity between important habitats is essential for the persistence of Small-mouthed Salamander population on Pelee Island. Provided other threats to Small-mouthed Salamander individuals (e.g., habitat loss, alteration and fragmentation) are managed and mitigated, populations would be expected to persist over long time frames where sufficient suitable habitat exists. Given the limited range and small population size of this species in Canada, a single catastrophic natural or humaninduced event could threaten the survival of the entire Canadian population. The natural expansion of the existing population to different areas of Pelee Island may be encouraged through the stewardship and management of potential recovery habitat (not currently occupied by the salamander). Approaches to recovery will focus on working in collaboration with the municipality, provincial government and local community to monitor current populations, manage current habitat effectively, increase the amount of suitable habitat available for the species, and increase our knowledge of potential threats to the species. Engaging landowners, residents and visitors in habitat

management and conservation will continue to be an important part of recovery for the Small-mouthed Salamander and its habitat in Canada. Therefore, this recovery strategy also provides direction for communication, outreach, and habitat management activities. Implementing those broad strategies adopted from the provincial *Recovery Strategy for the Small-mouthed Salamander in Ontario* (Part 2) will aid in the understanding and recovery of this species.

7. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported actions from *Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population) – Ontario Government Response Statement* (Part 3) applicable to Small-mouthed Salamander are adopted as the broad strategies and general approaches to address the threats and meet the population and distribution objectives for the species. Environment and Climate Change Canada is not adopting the approaches identified in section 2.0 of the *Recovery Strategy for the Smallmouthed Salamander (*Ambystoma texanum*) in Ontario* (Part 2).

8. Critical Habitat

8.1 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. Under the ESA, when a species becomes listed as endangered or threatened on the Species at Risk in Ontario List, it automatically receives general habitat protection. The Small-mouthed Salamander currently receives general habitat protection under the ESA; however, a description of the general habitat has not yet been developed. In some cases, a habitat regulation may be developed that replaces the general habitat protection. A habitat regulation is a legal instrument that prescribes an area that will be protected¹¹ as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for Small-mouthed Salamander under the ESA; however, the provincial recovery strategy (Part 2) contains a

¹¹ Under the federal *Species at Risk Act* (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.

recommendation on the area for consideration in developing a habitat regulation. This federal recovery strategy identifies critical habitat for the Small-mouthed Salamander in Canada to the extent possible based on this recommendation and on the best available information as of March 2016.

Critical habitat is identified for the six extant sites of Small-mouthed Salamander in Ontario, all occurring on Pelee Island (See Figure 1; see also Table 2). More precise boundaries may be mapped, and additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified (e.g., species dispersal into adjacent areas, or Small-mouthed Salamander presence is confirmed at other locations).

The identification of the Small-mouthed Salamander critical habitat is based on two criteria: habitat occupancy and habitat suitability, which are discussed in detail below.

8.1.1 Habitat Occupancy

The habitat occupancy criterion refers to areas where there is a reasonable degree of certainty of current use by the species. Occupancy is based on occurrence reports from the Natural Heritage Information Centre (NHIC, also known as the Ontario Conservation Data Centre), documented reports from targeted Small-mouthed Salamander surveys in 2015, and Environment and Climate Change Canada's Canadian Wildlife Service. These records must provide enough detail to be associated to a specific location (e.g., an individual's home range) to be considered adequate to satisfy the habitat occupancy criterion.

Habitat is considered occupied when:

- One or more Small-mouthed Salamander individuals (includes all life stages) have been observed, and
- The location has not been classified as extirpated by the NHIC.

In Canada, the population of Small-mouthed Salamanders includes only a small number of individuals (Bogart and Licht 2004, COSEWIC 2014). Therefore, a precautionary approach is used where a single observation (confirmed and unconfirmed individuals identified as Small-mouthed Salamander) may be indicative of a local population or important habitat features. While unisexual female polyploid *Ambystoma* salamanders are not protected under SARA, unisexuals can resemble the Small-mouthed Salamander which causes issues with species identification (Hamill 2015). Due to difficulties in providing genetic identification, it is possible that some observations of Small-mouthed Salamanders may actually be unisexual individuals. Therefore, taking the precautionary approach, observations of Small-mouthed Salamander individuals that are not genetically confirmed will also indicate habitat occupancy. The presence of unisexuals indicates that a pure breeding Small-mouthed Salamander or a pure Blue-spotted Salamander is present to act as a sperm donor (Hedges et al. 1992). Furthermore, unisexuals use the same habitats as pure Small-mouthed Salamanders and, therefore, a unisexual associated with a specific habitat (e.g., breeding pond) provides a good indication that pure Small-mouthed Salamanders may also use that habitat.

As two of the known breeding sites in Canada have been lost (Hamill 2015), only observations from extant occurrence reports (i.e., not extirpated) were considered in the application of the habitat occupancy criterion. If new observations become available, they will be considered for the identification of additional critical habitat.

8.1.2 Habitat Suitability

Habitat suitability refers to areas possessing a specific set of biophysical attributes that support individuals of the species to carry out essential life cycle activities (e.g., breeding, foraging, movement, growth, and hibernation). Suitable habitat for the Small-mouthed Salamander can therefore be described as a mosaic of habitats including core breeding areas and dispersal corridors between core breeding areas. Core breeding areas are comprised of breeding ponds as well as the terrestrial areas within 300 m of breeding ponds that provide suitable conditions for foraging, growth, and hibernation. The 300 m distance is based on data from telemetry studies of a similar species within Ontario, the Jefferson Salamander (Ambystoma jeffersonianum), and is the habitat area expected to support 90% of the adult population for each breeding site (Hamill 2015). Dispersal corridors include habitat that connect core breeding areas and provide suitable conditions for seasonal migrations and other movements. Within the area of suitable habitat, the biophysical attributes required by the Small-mouthed Salamander will vary over space and time with the dynamic nature of ecosystems. In addition, particular biophysical attributes will be of greater importance to salamanders at different points in time (e.g., during different life processes, seasons or at various times of the year).

The biophysical attributes of suitable habitat include the characteristics described in Table 1.

Life Stage and/or Need	Biophysical Attributes	Reference
Breeding (i.e., mating and egg-laying)	• Breeding habitat includes shallow bodies of water free of carnivorous fish and high pollutant concentrations, usually less than a metre in depth, including ephemeral ponds, swamps, and marshes. Breeding habitat contains suitable aquatic prey items such as small aquatic invertebrates. Features exist either temporarily or semi-permanently, but	• Bogart and Licht 2004, Trauth 2005, Hamill 2015

Table 1. Detailed biophysical attributes of critical habitat for specific life cycle activities of the Small-mouthed Salamander in Ontario.

	 must retain water throughout the egg and larval stages¹², and typically include: Woody debris, submerged grasses and reeds, or other vegetation (for shelter and attachment of egg masses). 	
All life processes (i.e., foraging, growth, breeding, hibernation and movement)	 Wetlands and mesic¹³ terrestrial habitats with soft soils that allow adults to find and use burrows (including those created by crayfish and rodents). Terrestrial habitats typically contain cover objects, including logs, rocks, and leaf litter, and contain suitable terrestrial prey items such as insects, earthworms, or other invertebrates. Habitat types may include, but are not limited to, the following examples: Wetlands, especially ephemeral ponds; tallgrass prairies, dense hardwood forests, and agricultural land. 	• Bogart and Licht 2004, Trauth 2005, Hamill 2015
Hibernation	• Woodlands, upland forests, swamps, successional areas, meadows, old fields or other vegetated areas that contain features that extend below the frost line, with sufficient humidity and soil moisture to prevent salamanders from drying out; may include deep rock fissures and rodent burrows.	• Spight 1967, Hamill 2015
Movement (including seasonal migrations)	 Areas that allow for movement between breeding, growth, and hibernation locations. Attributes include those listed for other life stages/needs, as well as non-vegetated open areas. 	Bogart and Licht 2004, Trauth 2005, Hamill 2015

At this time, breeding ponds that provide the basis for delineating critical habitat are represented using available wetland habitat mapping. Because small, temporal or ephemeral features are not well captured through existing land classification mapping, especially where field verification has not taken place, caution should be taken when biophysical attributes of suitable habitat are represented by available thematic data.

Critical habitat includes all of the biophysical attributes described in Table 1 above that extend radially 300 m from the edge of the breeding pond.

To support adult migration and juvenile dispersal between breeding wetlands, the present recovery strategy also includes connecting corridors as part of the critical habitat. These correspond to the areas of contiguous suitable habitat connecting two breeding wetlands that meet the habitat occupancy criteria and that are separated by a maximum distance of 1 km, which is based on the maximum migratory distance of adults of similar species (Hamill 2015). Should new information about the movements of the Small-mouthed Salamander become known, the criteria above may be refined.

¹² As conditions may vary year-to-year, breeding ponds that are temporary in nature may only contain ponded water for a sufficient duration in some years.

¹³ Habitat containing a moderate amount of moisture.

8.1.3 Application of Criteria to Identify Critical Habitat for Small-mouthed Salamander

Critical habitat for the Small-mouthed Salamander is identified as the extent of suitable habitat (section 7.1.2), where the habitat occupancy criterion is met (section 7.1.1). In applying the critical habitat criteria above to the best available data, critical habitat is identified for the six extant populations of the Small-mouthed Salamander in Canada (Figure 1, See also Table 2). The critical habitat identified is considered a full identification of critical habitat and is sufficient to meet the population and distribution objective for the Small-mouthed Salamander.

Newly created artificial habitat (i.e. created breeding ponds) will not be included in the identification of critical habitat until there is evidence of use. In addition, the following features are not considered suitable (do not meet the biophysical attributes described above) and are not part of critical habitat: existing houses, buildings, structures, quarries, and other pre-existing industrial land uses, and major roads.

Critical habitat identified for the Small-mouthed Salamander is presented using a 10 x 10 km UTM grid. The UTM grid squares presented in Figure 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. In addition to providing these benefits, the 10 x 10 km Standardized UTM grid respects data-sharing agreements with the province of Ontario. Critical habitat within each grid square occurs where the description of occupancy (section 7.1.1) and habitat suitability (section 7.1.2) is met. 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 <u>ec.planificationduretablissement-recoveryplanning.ec@canada.ca</u>.





Figure 1: Grid squares that contain critical habitat for the Small-mouthed Salamander in Canada. Critical habitat for the Small-mouthed Salamander occurs within these 10 x 10 km UTM grid squares (red squares), where the description of habitat occupancy (section 7.1.1) and habitat suitability (section 7.1.2) are met.

Table 2. Grid squares that contain critical habitat for the Small-mouthed Salamander in Canada. Critical habitat for the Small-mouthed Salamander occurs within these 10 x 10 km UTM grid squares where the description of critical habitat is met.

10 x 10 km Standardized UTM	UTM Grid Square Coordinates ² Easting Northing		UTM Grid Square Coordinates ²		Land tenure ³
grid square ID ¹			Eand tondro		
17TLG52	350000	4620000			
17TLG62	360000	4620000	Non-federal Land		
17TLG63	360000	4630000			

¹ Based on the standard UTM Military Grid Reference System (see <u>http://www.nrcan.gc.ca/earth-</u> <u>sciences/geography/topographic-information/maps/9789</u>), where the first 2 digits and letter represent 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 <u>www.bsc-eoc.org</u> for more information on breeding bird atlases).

 2 The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 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.

³ Land 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.

8.2 Activities Likely to Result in 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, and can occur at a variety of scales and in both aquatic and terrestrial habitats. It may occur from an activity taking place either within or outside of the critical habitat boundary and it may occur in any season of the year. Within the critical habitat boundary, activities may affect core breeding areas which include breeding ponds and the areas within 300 m of occupied breeding ponds that provide suitable conditions for foraging, dispersal, migration or hibernation (i.e., the areas described in Table 1). Activities may also affect dispersal corridors that connect core areas (i.e., areas that allow movement, described in Table 1). Within dispersal corridors it is most important to maintain habitat permeability (movement through connective habitat to access adjacent core areas) and, as a result, certain activities that are likely to cause destruction in core areas may not cause destruction in corridors, so long as sufficient habitat permeability is maintained. It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction.

Activities described in Table 3 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 3. Activities Likel	y to Result in the Destruction of Critical Habitat.

Description of	Description of effect in relation to function	Where activity may of destruction of critical Within critical habitat boundary		scription of effect in relation to function babitat bound		al habitat Outside	Details of effect
activity	loss	Core breeding areas	Dispersal corridor	critical habitat boundary			
Development activities (e.g. building construction) or other activities that alter site cover and/or hydrology (e.g., drainage for agriculture, tree harvesting, site clearing and grading, stormwater management, surface paving, etc.)	Tree harvesting, site clearing, and drainage (e.g., for agriculture) and activities that result in the net removal, disturbance or destruction of cover objects (e.g., rocks, logs or debris) may result in the direct loss of suitable terrestrial microhabitat characteristics which the species relies on for foraging, for maintaining hydration, for protective cover, and for overwintering. Site clearing and grading may alter the topography and the hydrology (drainage patterns, water table, groundwater flow) of the site. Stormwater management and increases in impervious surfaces (e.g. paving) may also alter site hydrology. These topographic and hydrologic changes may destroy or degrade breeding and/or foraging habitat by modifying or disrupting water flow, water balance, wetland hydroperiods ¹⁴ , which in turn could modify or disrupt soil moisture or wetland composition and function. Development may remove canopy, alter watercourses for snowmelt and runoff, and/or draw down the water table and therefore may result in the reduction of ephemeral ponds or premature drying of ponds, and thereby destroy, damage or fragment habitat.	Х	Х	Х	Activities within critical habitat core breeding areas that alter cover or the hydrologic regime are highly likely to result in direct destruction at any time of the year because they would degrade habitat required by all life stages for survival. If grading or other activities that alter water flows occur outside of critical habitat or in corridors, it could result in the indirect destruction of core breeding critical habitat by altering water regimes within critical habitat thereby reducing or eliminating breeding habitat. Large-scale developments within or adjacent to critical habitat may cause destruction of critical habitat at any time of year. If it occurs within critical habitat core breeding areas, it is highly likely to cause destruction; if it occurs in corridors or adjacent to critical habitat, effects would most likely be cumulative and whether or not they result in destruction would likely depend on the extent and location of the development.		

¹⁴ The duration of time in which water is present in a wetland.

		destruct	activity may		
Description of activity	Description of Description of effect in relation to function habita		Within critical O habitat boundary c		Details of effect
		Core breeding areas	Dispersal corridor	habitat boundary	
Complete or partial drainage or filling of wetlands and water management	Complete or partial draining (or other significant hydrological changes) or filling of wetlands (e.g., breeding ponds) at any time of the year may cause permanent loss of habitat or degradation of habitat (e.g., reduced soil moisture) required for all life stages (e.g., breeding, foraging, hibernation and movement).	x	х	х	If these activities were to occur outside the bounds of critical habitat, it could result in destruction of critical habitat if the wetland characteristics that contribute to critical habitat suitability are not maintained (e.g., sufficient soil moisture for hibernation). A single event could cause critical habitat destruction.
Activities that introduce exotic and/or invasive species (e.g., planting non-native species, moving fill)	Introduction of exotic and/or invasive species may lead to the reduction of wetland habitat. For example, dense stands of non-native Common Reed (<i>Phragmites australis</i>) can overgrow breeding sites, preventing the species from carrying out this life process. Such stands can also fill in wetland habitat and prevent salamanders from being able to forage easily for food.	x	х		Activities which introduce exotic and/or invasive species which occur within the bounds of critical habitat could lead to habitat destruction. A single event within critical habitat could lead to habitat destruction because once seeds are introduced it can lead to rapid expansion of invasive species.
Erecting barriers (e.g. silt fences or drainage ditches)	Temporary and permanent structures including silt fences erected during construction, or drainage ditches, create physical barriers within the habitat that may hinder or prevent migration of salamanders, thereby preventing movement and restricting access to habitats required to carry out life processes (e.g., breeding, growth, and hibernation) or to migrate among sites.	x	Х		This activity must occur within the bounds of critical habitat to cause its destruction, and the likelihood of it causing destruction would depend in large part on the configuration of the barrier and the time of year that it is in place. If this activity occurs within critical habitat core breeding areas, it could cause destruction if it prevents access to areas required by the Small-mouthed Salamander at one or more life stages. If this activity were to occur in early spring it could prevent or impair breeding, or

Description of activity	Description of effect in relation to function	nabitat boundary			Details of effect
		Core breeding areas	Dispersal corridor	habitat boundary	
					prevent or impair adults from returning to foraging habitat. If this activity were to occur in late summer/early fall, this activity could prevent or impede dispersal by juveniles from breeding habitat to foraging and overwintering habitat. If this activity occurs within critical habitat corridors, it may cause destruction if it eliminates the function of the corridor.
Building or upgrading roads	If it occurs within critical habitat, this activity could result in the loss or degradation of suitable habitat for all life stages through removal of vegetative cover. The construction or upgrading of roads can also 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 Small-mouthed Salamander from accessing habitats required to carry out life processes or to migrate among sites, and by increasing mortality (e.g., greater risk of desiccation, vehicle collision and predation). If this activity occurs within or near critical habitat, chemicals and pollutants from roads (e.g., salt, metals, products of combustion) can enter breeding ponds and alter pond water chemistry, reducing habitat suitability and altering the availability of suitable aquatic prey items.	X	X	X	The effects of this activity can be both direct (e.g., loss of cover, creation of a barrier that fragments habitat) and indirect or cumulative (e.g., pollution). If the effects of the activity are permanent (e.g., paving natural habitat), the activity is likely to cause destruction of habitat if undertaken at any time of the year. However, if activities do not have lasting effects (e.g., upgrading of a road that does not result in further reducing habitat permeability or increasing pollution), it may only cause destruction if conducted when the species is undertaking terrestrial movements. This activity is highly likely to cause destruction if it occurs within critical habitat core breeding areas, because it would reduce access to areas

		Where activity may cause destruction of critical habitat			Details of effect
Description of activity	Description of effect in relation to function	Within critical habitat boundary		Outside critical	
		Core breeding areas	Dispersal corridor	habitat boundary	
					required by the Small-mouthed Salamander at one or more life stages. If this activity occurs within critical habitat corridors, it is also highly likely to cause destruction by eliminating the function of the corridor. If this activity occurs outside of critical habitat, it may result in the indirect destruction of critical habitat through the introduction of chemical pollution (e.g., salt) into wetlands within critical habitat or changes to the hydrology
Intensification of agricultural practices near breeding wetlands	Increased runoff of pesticides and fertilizers into adjacent habitats can reduce water quality and lead to reduced prey availability.		Х	Х	If this activity occurs within critical habitat dispersal areas, it could cause destruction if it prevents access to areas required by the Small-mouthed Salamander at one or more life stages. If this activity occurs outside of critical habitat, it may result in the indirect destruction of critical habitat through the introduction of chemical pollution (e.g., pesticides and fertilizers) into wetlands within critical habitat.
Addition of carnivorous fish to breeding ponds	Addition of carnivorous fish to ponds would destroy breeding habitat because fish prey upon all life stages of salamanders and would therefore reduce the survival and reproductive success of Small-mouthed Salamander individuals.	х			If this activity occurs within critical habitat core breeding areas, at any time of the year, it is highly likely to result in its destruction because it would directly eliminate breeding habitat.

9. Measuring Progress

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

• The number of sites occupied by Small-mouthed Salamander in Canada has been maintained, and if feasible, increased.

10. Statement on Action Plans

One or more action plans will be completed for Small-mouthed Salamander by December 31, 2025.

11. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the <u>Cabinet Directive on the Environmental</u> <u>Assessment of Policy, Plan and Program Proposals¹⁵</u>. 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 <u>Federal Sustainable Development</u> <u>Strategy</u>'s¹⁶ (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.

Recovery efforts that are focused on the Small-mouthed Salamander will likely benefit species inhabiting extant breeding ponds and the surrounding habitat, including many Carolinian plant species, Blue-spotted Salamander (*Ambystoma laterale*), Eastern Foxsnake (*Pantherophis gloydi*) and Blue Racer (*Coluber constrictor foxii*). It is also expected to benefit the populations of unisexual polyploid salamanders on Pelee Island. No species of conservation concern are expected to be detrimentally affected.

¹⁵ www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmentalassessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

¹⁶ www.fsds-sfdd.ca/index.html#/en/goals/

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Appendix A: Subnational Conservation Ranks (S-Ranks) of Small-Mouthed Salamander (Ambystoma texanum) in Canada and the United States

S-rank	State/Province
S1 (Critically Imperiled)	Ontario, Michigan, Nebraska, West Virginia
S3 (Vulnerable)	Alabama, Iowa
S4 (Apparently Secure)	Indiana
S5 (Secure)	Arkansas, Illinois, Kansas, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, Texas
SNR (Unranked)	Ohio

Rank Definitions (NatureServe 2015)

S1: Critically Imperiled - At very high risk of extirpation in the jurisdiction (i.e., N - nation, or S - state/province) due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S3: Vulnerable - 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 – 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.

S5: Secure - 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.

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

Part 2 – Recovery Strategy for the Small-mouthed Salamander (Ambystoma texanum) in Ontario, prepared by Stewart E. Hamill (2015) for the Ontario Ministry of Natural Resources and Forestry



Small-mouthed Salamander (Ambystoma texanum) in Ontario

Ontario Recovery Strategy Series

Recovery strategy prepared under the Endangered Species Act, 2007

2015

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 (ESA) 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 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 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 was 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. 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 and Forestry Species at Risk webpage at: www.ontario.ca/speciesatrisk

RECOMMENDED CITATION

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John Urquhart Conservation Science Manager, Ontario Nature Toronto, ON

Allen Woodliffe District Ecologist (retired), OMNRF Chatham, ON

DECLARATION

The recovery strategy for the Small-mouthed Salamander was developed in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). 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 and Forestry Environment Canada – Canadian Wildlife Service, Ontario
EXECUTIVE SUMMARY

The Small-mouthed Salamander is a medium to large salamander classified as endangered on the Species at Risk in Ontario List. It spends most of its adult life in underground burrows or under leaf litter, or living under cover objects such as logs and rocks. In early spring the adults make an annual nocturnal overland migration to breeding wetlands for mating and egg-laying. The larvae remain in water until emergence as adults in mid-summer.

Habitat requirements include an integrated complex with:

- a shallow fish-free wetland which can retain water until mid-summer;
- surrounding habitat which provides cover for migration and adult life;
- shaded soft moist soils for burrowing; and
- habitat connections which permit dispersal and longer migrations of up to one km.

The Small-mouthed Salamander reaches the northern limit of its range in Michigan, Ohio and on Pelee Island in Ontario. On Pelee Island it is known from only three wetlands, two of which are protected. The third site is on private land. Due to the relative isolation of the island, monitoring and surveillance programs are not frequent, no comprehensive population census data are available and threat assessment is limited. Nevertheless, the abilities of the species to withstand temporary droughts and avoid predators mean that this salamander could continue to thrive in Ontario if its habitat is maintained.

Threats to the Small-mouthed Salamander in Ontario include:

- habitat alteration, loss, and fragmentation;
- invasive and introduced species, such as the European Common Reed (*Phragmites australis* ssp. *australis*), the Emerald Ash Borer (*Agrilus planipennis*) and fish introduced to breeding ponds;
- climate change, which could bring warmer, drier conditions with prolonged drought;
- pollution, which is a particular threat to salamanders due to their sensitivity;
- predation, particularly by the recently-introduced Wild Turkey (*Meleagris gallopavo*) which could be an effective salamander predator;
- mortality on roads from vehicles; and
- competition and hybridization, although the species appears to be capable of managing this threat.

The recovery goal is to ensure that threats to populations and habitat are sufficiently managed to allow for long-term persistence and expansion of the Small-mouthed Salamander population within its Ontario range on Pelee Island. The strategy describes protection and recovery objectives for this species in Ontario, including to:

• protect and maintain the quality and quantity of habitat on Pelee Island where the Small-mouthed Salamander occurs;

- implement a monitoring program for salamander populations, habitats, and threats on Pelee Island including surveys of suitable habitat;
- promote and carry out research on Small-mouthed Salamander genetics, populations and threats;
- investigate existing, former, and potential Small-mouthed Salamander habitats on Pelee Island to determine if restoration, re-introduction or population interventions would be appropriate; and
- implement education, stewardship and communication programs for private landowners, residents and visitors on Pelee Island.

This recovery strategy also recommends that a habitat regulation be developed which includes:

- all wetland habitats where the Small-mouthed Salamander is known to breed;
- any new locations found or any locations where the salamander is re-introduced;
- all suitable terrestrial areas and features that extend radially 300 m from the edge of any breeding wetland; and
- corridors that provide contiguous connections between breeding locations extending up to a maximum of one kilometre.

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1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Small-mouthed Salamander				
SCIENTIFIC NAME: Ambystoma texanum				
SARO List Classification: Endangered				
SARO List History: Endangered (2008), Endangered – Not Regulated (2005), Threatened (2004)				
COSEWIC Assessment History: Endangered (2004), Special Concern (1991)				
SARA Schedule 1: Endangered (July 27, 2005)				
CONSERVATION STATUS RANKINGS GRANK: G5	S: NRANK: N1	SRANK: S1		

The glossary provides definitions for technical terms, including the abbreviations above.

1.2 Species Description and Biology

Species Description

The Small-mouthed Salamander (*Ambystoma texanum*) is a typical member of the Mole Salamander family (*Ambystomatidae*), being a medium to large salamander (maximum length 18 cm) with prominent costal grooves, robust limbs and body and a broad head (Harding 1997). The head in this species, however, is noticeably smaller than that of other mole salamanders and the snout is short and blunt. The back is black or very dark brown and the belly is black with a few light spots. The flanks and the long tail are covered with light grey-blue flecking (Petranka 1998). The adult Small-mouthed Salamander resembles the sympatric Blue-spotted Salamander (*Ambystoma laterale*) adult although the latter species usually has blue spots rather than grey flecks on the body. The adult Small-mouthed Salamander also has a proportionally smaller head (MacCulloch 2002).

Larvae are much smaller than adults and have external gills and a large fin on the tail. Identification of larvae is difficult because adult colouring develops only when juveniles leave the water as adults (MacCulloch 2002).

Species Biology

The common family name "mole" salamander refers to the habit of usually staying underground or beneath cover objects except when breeding. In early spring (late

March or early April) the adults migrate overland at night to shallow fish-free bodies of water for mating and egg-laying. Fertilization is internal. The female lays 200 to 300 eggs individually or in small groups, on dead leaves and twigs on the bottom of the breeding pond. The eggs hatch after 9 or 10 days to aquatic gilled larvae that transform three months later, by mid-summer (June or July), to terrestrial adults. Adult salamanders reach breeding age two years after metamorphosis (Government of Canada 2012, Harding 1997). After breeding activities, the adults return to their underground or under cover haunts where they also spend the winter in hibernation.

The only location where the Small-mouthed Salamander is found in Canada is Pelee Island, in Ontario. This habitat is shared with another Ambystoma species, the Bluespotted Salamander, and with a group of unisexual female polyploid Ambystoma salamanders (King et al. 1997) which are more common than the pure Small-mouthed Salamander (Bogart and Licht 2004). These polyploids have a unique mode of reproduction involving heterosexual mating and asexual development of the egg, but with incorporation of the genome from the sperm which increases the chromosome complement to diploid (double), triploid (triple), or even tetraploid (quadruple) (Bogart and Licht 2004). Molecular studies (Bogart et al. 1985, Bogart and Licht 1986, Bogart et al. 1987, Bi and Bogart 2010) suggest that the original unisexual polyploids on Pelee Island were not produced through crosses involving the two species there (A. laterale and A. texanum). Apparently, they were isolated on the island at the same time as the two pure species and now exchange nuclear genomes with those two species. Smallmouthed Salamander DNA can make up anywhere from a minority to a majority of the unisexual polyploid genome, and unisexual salamanders can thus resemble the Smallmouthed Salamander. The polyploids on Pelee Island are all females and each must mate with a male Small-mouthed or Blue-spotted Salamander for reproductive success (Hedges et al. 1992). These Pelee Island polyploid hybrids are more correctly called 'unisexuals' as they are not true hybrids.

Unisexual salamander larvae are larger than Blue-spotted and Small-mouthed Salamander larvae (Wilbur 1972). These larger unisexual larvae have been observed to attack and bite the smaller larvae of both of those species in artificial ponds (Brodman and Krouse 2007). The result was reduced survival and growth of Smallmouthed Salamander larvae in the presence of unisexual larvae. However this effect was less than the effect of competition with other Small-mouthed Salamander larvae. When raised with unisexuals, Small-mouthed Salamander larvae spent more time concealed in vegetation and were able to minimize the effects of competition and predation (Brodman and Krouse 2007).

Adult Small-mouthed Salamanders feed on insects, slugs and earthworms, while larvae eat a variety of small aquatic invertebrates. The larvae are eaten by crayfish, predaceous aquatic insects, birds and snakes, while adults are consumed by snakes and other vertebrate predators (Harding 1997).

1.3 Distribution, Abundance and Population Trends

The Small-mouthed Salamander is primarily a central southern United States species, ranging from Texas, Louisiana, Mississippi and western Alabama north to extreme southeastern Michigan, northern Ohio (including islands in Lake Erie) and Pelee Island in Ontario (Bogart and Licht 2004).



Figure 1. Historical range of Small-mouthed Salamander in the United States (by county; may not reflect current distributions where local extirpations have occurred) (USGS 2012, map reproduced with permission from USGS).

The abundance and status of the species range from widespread, common and secure in southern portions of the range, to rare and endangered at its northern limit in Michigan and Ontario (Harding 1997). The only location for the species in Canada and Ontario is Pelee Island in Lake Erie.



Figure 2. Historical and current breeding sites of Small-mouthed Salamander in Ontario (as reported by Bogart and Licht 2004).

In 1991 the Small-mouthed Salamander occupied five breeding sites on Pelee Island (Bogart and Licht 1991). By the year 2000 two of these had been eliminated by development activities and the permanent loss of water (Bogart and Licht 2004). Three breeding locations with surrounding woodland habitat remain:

- a flooded woodlot within the provincial Fish Point Nature Reserve;
- a flooded woodlot on a nature reserve jointly owned by Ontario Nature, Essex Region Conservation Authority and the Nature Conservancy of Canada; and
- a pond on private land.

It is impossible to determine the density of "pure" populations of Small-mouthed Salamander or to assess trends due to the difficulties associated with identification in the field. Collections by J. Bogart and L. Licht on Pelee Island in 2000 indicate that unisexuals made up 78 percent of the population, but there are currently no population estimates (Government of Canada 2012).

1.4 Habitat Needs

In Ontario, the Small-mouthed Salamander is found in several types of moist habitats, including tall-grass prairies (Ecological Land Classification (ELC) unit TP), dense hardwood forests (ELC unit FOD) and agricultural lands (ELC unit CU) if such areas provide suitable breeding ponds (Government of Canada 2012). These habitats must also have soils soft enough to enable adults to find burrows, such as those created by crayfish.

Shallow fish-free bodies of water are needed by the Small-mouthed Salamander for breeding activities including mating and egg-laying. Suitable water bodies are usually less than a metre in depth and contain woody debris, submerged grasses and reeds, and emergent vegetation. These water bodies must retain water throughout the larval stage which normally lasts from March through July (Bogart and Licht 2004). At times other than the spring breeding season the adults generally remain hidden underground in soft moist (shaded) soils or beneath rotting logs, rocks or leaf litter (Harding 1997). Like other mole salamanders, adult Small-mouthed Salamanders retreat below the frost line into deep rock fissures and rodent burrows (Jefferson Salamander Recovery Team 2009) during the winter.

Radio-tracking studies and literature searches have documented that the migratory distance of adults of various pond-breeding salamander species can range from hundreds of metres up to one km from the breeding pond into surrounding habitat (Semlitsch 1998, Faccio 2003, Bériault 2005). Based on those studies (none of which included the Small-mouthed Salamander) the adult Small-mouthed Salamander is presumed to travel only this limited distance (up to one km, but usually not more than 300 m) from the breeding site. This is calculated as the habitat area utilized by 90 percent of the adult population for each breeding location based on the movements of tracked individuals. The combination of water connected to suitable terrestrial habitat is therefore essential. Adult Small-mouthed Salamanders do cross roads (Bogart and Licht 2004) and the road itself would therefore probably not be a habitat barrier although heavy traffic could be.

These habitat needs are similar to those of other mole salamanders (Spotted Salamander (*Ambystoma maculatum*), Blue-spotted Salamander, Jefferson Salamander, and Eastern Tiger Salamander (*Ambystoma tigrinum*)). The Blue-spotted Salamander is more likely to be found above ground during the warmer months and the Eastern Tiger Salamander is less dependent on forested habitats than most other *Ambystoma* (Harding 1997, Jefferson Salamander Recovery Team 2009).

1.5 Limiting Factors

Within its current range, the Small-mouthed Salamander is limited by the availability of shallow water bodies which hold water until mid-summer, the absence of fish (which eat all life stages of salamanders) in those water bodies and the presence of soft moist

shaded soils with burrows. Given the current fragmentation of wooded and wetland habitat on Pelee Island and the salamander's dispersal abilities, in Ontario the species is restricted to a few sites on the island. However it may occur in more locations there than where it has been found to date (R. Gould, pers. comm. 2013).

Climate change bringing warmer temperatures and drier conditions with less snow and less water in vernal pools could further shrink the number of suitable locations and the area of suitable habitat on Pelee Island.

1.6 Threats to Survival and Recovery

Threats to the Small-mouthed Salamander in Ontario are listed below.

Habitat Alteration, Loss and Fragmentation

Because of the very limited distribution of the Small-mouthed Salamander in Ontario, any change in habitat (pollution, drainage, permanent drier conditions or development activities) could have serious impacts on the Ontario population. Two of the five breeding sites on Pelee Island have already been lost. One of these was drained, cleared and filled for development (A. Woodliffe, pers. comm. 2013), which follows the general history of land use on the island: clearing and draining for agriculture and development (J. Crowley, pers. comm. 2013). Two of the remaining three breeding sites are on protected lands but the third is privately-owned. However, drainage of both private and public lands on the island is an ongoing concern for island residents as most of the island is below the average lake level. Continued drainage without sufficient consideration for natural processes could threaten the scattered wetland areas (A. Woodliffe, pers. comm. 2013).

Removal of tree cover and rotting logs is a particular threat. Trees keep the ground moist by providing shade and maintain water levels in breeding areas by retarding evaporation. Rotting logs provide habitat for adult salamanders and their invertebrate prey. Such removals not only eliminate habitat but also fragment remaining natural areas, making it more difficult for adult salamanders to travel. Loss of tree canopy has been shown to stop egg deposition in a mole salamander species (Felix et al. 2010) and to cause adult *Ambystoma* salamanders to move out of the area (Semlitsch et al. 2008).

Invasive and Introduced Species

The ongoing encroachment of European Common Reed (*Phragmites australis ssp. australis*) into wetlands and riparian areas on Pelee Island could degrade wetland habitat and reduce the availability of suitable egg placement sites (R. Gould, pers. comm. 2013). Although the specific impacts on salamanders are unknown, an analysis by Greenberg and Green (2013) has shown that population decline in Fowler's Toad (*Anaxyrus fowleri*) populations is associated with the spread of the European Common Reed. Uncontrolled growth of dense stands of Common Reed stems can effectively eliminate shallow, sparsely vegetated, aquatic areas which are needed by both Fowler's Toad and Small-mouthed Salamander.

The loss of shade due to the death of ash trees caused by the Emerald Ash Borer (*Agrilus planipennis*), an invasive, non-native species, may change wetland conditions, making them less suitable for salamanders (A. Woodliffe, pers. comm. 2013).

An incidental human threat is the introduction of carnivorous fish, which are predators on all life stages of salamanders, to breeding ponds, which could eliminate salamander populations.

Climate Change

If the Small-mouthed Salamander were unable to breed for a few years due to temporary low water levels, it is unlikely that significant population declines would result. However, if climatic changes (such as higher temperatures, less snow, lowered water table, less water in vernal pools) eliminate a breeding site, the population in that area would disappear. Bogart and Licht (2004) noted in their 2000 visit to Pelee Island that water levels had lowered at one of the breeding wetlands and that this could be related to a lower water level in Lake Erie. This could, however, have positive effects by reducing the possibilities of flooding and the invasion of fish from Lake Erie (J. Bogart, pers. comm. 2013).

Pollution

Salamanders have been shown to be particularly sensitive to various pollutants, which can kill outright but also induce sublethal affects in embryos, larvae and adults. Given the agricultural character of Pelee Island, agricultural pesticides are a particular threat as they can reduce survival and metamorphosis of *Ambystoma* larvae by killing zooplankton thereby reducing food resources (Metts et al. 2005). De-icing salt runoff from Pelee Island roads is another pollutant threat as experimental concentrations have been shown to cause mass loss in *Ambystoma* egg clutches (Karraker and Gibbs 2011). In addition to pollution and sometimes working synergistically with pollutants, increased ultraviolet radiation caused by reduction of ozone in the stratosphere is another widespread threat to amphibians in general leading to population declines (Blaustein et al 2003).

Predation

The Small-mouthed Salamander has evolved several strategies to avoid predation: adults live under cover or underground most of the year; above-ground movements during the breeding season are nocturnal; and larvae are aquatic and have hiding and avoidance strategies. These characteristics help to protect them from predators, including humans. However, a new potential predator with unknown impacts is now present on Pelee Island: the Wild Turkey (*Meleagris gallopavo*), introduced in 2002 (R. Gould, pers. comm. 2013). Wild Turkeys scratch to find food and in so doing, can disturb cover habitat for adult salamanders while eating any salamanders uncovered.

Road Mortality

Small-mouthed Salamanders travel overland every spring during the breeding season and every summer after transformation. On Pelee Island, as elsewhere, this means that they sometimes cross roads. Due to the low traffic levels on the island, it is thought that this is not currently a large threat to the species (R. Gould, pers. comm. 2013). However, the potential remains for mass mortality caused by traffic and subsequent population decline. Gibbs and Shriver (2005) showed that even a small annual road mortality risk can lead to local population extirpation of a mole salamander species. Beebee (2013) concluded from a literature review that the long-term effects of road mortality on populations of amphibians are often severe.

Competition and Hybridization

The threat of competition from unisexuals and the Blue-spotted Salamander was discussed by Bogart and Licht (2004) and examined by Brodman and Krouse (2007). It was concluded that competition is probably not a concern to the continued existence of the Small-mouthed Salamander. Although there is insufficient evidence to rule definitively on this, it is known that unisexuals require a pure male of either species to reproduce. Other details considered as part of this analysis include the following:

- the Small-mouthed Salamander is larger than the Blue-spotted Salamander;
- the Small-mouthed Salamander can produce more eggs than the Blue-spotted Salamander;
- the Small-mouthed Salamander can occupy a wider diversity of habitats than the Blue-spotted Salamander; and
- Small-mouthed Salamander larvae have strategies to avoid the larger unisexual larvae.

1.7 Knowledge Gaps

The isolated location of the Small-mouthed Salamander on Pelee Island has protected the species from human disturbance but has also limited visitation by naturalists and biologists. There are no monitoring programs on the island for water levels, habitat or salamander numbers, and no frequent enforcement or surveillance presence in the nature reserves. Without regular observations, identification and assessment of threats has been limited. In particular there has been little or no work done on the impact of introducing Wild Turkey to the island (R. Gould, pers. comm. 2013), the effects of European Common Reed on salamander habitat, the amount of road mortality on Pelee Island, or the potential future impacts of climate change on Pelee Island wetlands and salamander habitat.

Little scientific work has been done recently on the Small-mouthed Salamander in general and none in Canada. The density of "pure" populations of Small-mouthed Salamander is unknown and it has not been possible to assess trends in hybridization and polyploidy due to the difficulties associated with identification in the field (Bogart and Licht 2004). There are no size estimates for the Small-mouthed Salamander population. This information would be needed before any population restoration or re-introduction could be considered (J. Bogart, pers. comm. 2013).

1.8 Recovery Actions Completed or Underway

Various organizations have undertaken the acquisition and protection of land on Pelee Island in order to maintain species and habitat; Ontario Parks, Essex Region Conservation Authority, Ontario Nature and the Nature Conservancy of Canada are included. Each provides some level of infrequent visitation and surveillance. Ontario Nature has a local steward group that checks on the Stone Road site annually (J. Urquhart, pers. comm. 2013). No active management or regular monitoring programs are carried out on these nature reserves (Fish Point, Stone Road).

The Province of Ontario provides species and habitat protection for the Small-mouthed Salamander under the *Endangered Species Act, 2007*. Activities that may impact the species or its habitat are subject to provisions of the act and applicable regulations.

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal is to ensure that threats to populations and habitat are sufficiently managed to allow for long-term persistence and expansion of the Small-mouthed Salamander population within its Ontario range on Pelee Island.

2.2 **Protection and Recovery Objectives**

Table 1. Protection and recovery objectives

No.	Protection or Recovery Objective		
1	Protect and maintain the quality and quantity of habitat on Pelee Island where the Small- mouthed Salamander occurs.		
2	Implement a monitoring program for salamander populations, habitats and threats on Pelee Island including surveys of suitable habitat.		
3	Promote and carry out research on Small-mouthed Salamander genetics, populations and threats.		
4	Investigate existing, former and potential Small-mouthed Salamander habitats on Pelee Island to determine if restoration, re-introduction or population interventions would be appropriate.		
5	Implement education, stewardship and communication programs for private landowners, residents and visitors on Pelee Island.		

2.3 Approaches to Recovery

Table 2. Approaches to recovery of the Small-mouthed Salamander in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Protect a	and maintain t	he quality and quantity	of habitat on Pelee Island where the Small-mouthed S	Salamander occurs.
Critical	Ongoing	Protection	1.1 Develop a habitat regulation or habitat description to define the area protected as habitat for Small-mouthed Salamander in Ontario.	Habitat alteration, loss and fragmentation
Necessary	Ongoing	Protection, Management	 1.2 Engage landowners, residents and visitors to develop habitat management and protection programs, which might include: habitat improvement or restoration activities; implementation of conservation tools (e.g., easements, donations, land gifts); and monitoring or surveillance of management activities and protection programs. 	 Habitat alteration, loss and fragmentation
2. Impleme habitat.	ent a monitorin	ng program for salaman	der populations, habitats and threats on Pelee Island	including surveys of suitable
Necessary	Ongoing	Inventory, Monitoring and Assessment	2.1 Carry out regular inventory, monitoring, surveying and sampling activities for populations, reproduction, water levels, habitat quality, new locations and threats including road mortality, climate change, and European Common Reed invasion.	 Lack of information on threats, habitats and populations
Beneficial	Short-term	Inventory, Monitoring and Assessment	2.2 Survey suitable habitats to find unknown populations and locations which could be used in population interventions.	 Lack of information on threats, habitats and populations

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed		
3. Promote and carry out research on Small-mouthed Salamander genetics, populations and threats.						
Beneficial	Short-term	Research	3.1 Study the impact of Wild Turkey predation on salamanders in general, and on Small-mouthed Salamander in particular.	 Lack of information on the impact of Wild Turkey predation 		
Beneficial	Long-term	Research	3.2 Promote research on Small-mouthed Salamander genetics, hybridization, polyploidy and population structure.	 Lack of information on genetics and population structure 		
Beneficial	Long-term	Research	3.3 Investigate the impact of climate change on Small-mouthed Salamander populations.	Lack of information on the impact of climate change		
4. Investigate existing, former and potential Small-mouthed Salamander habitats on Pelee Island to determine if restoration, re- introduction or population interventions would be appropriate.						
Beneficial	Long-term	Management	4.1 Carry out investigations on existing, former and potential Small-mouthed Salamander habitats on Pelee Island in order to gather information on current conditions, human activities and land uses which would be needed to develop and implement programs for restoration or re-introduction, if appropriate.	 Habitat alteration, loss and fragmentation 		
5. Implement education, stewardship and communication programs for private landowners, residents and visitors on Pelee Island.						
Beneficial	Long-term	Education and Outreach, Communications, Stewardship	5.1 Develop and implement programs for residents, landowners and visitors to deal with land management, road mortality and disturbance to salamanders and habitat.	 Lack of awareness and knowledge 		

2.4 Area for Consideration in Developing a Habitat Regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of Natural Resources and Forestry 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 author will be one of many sources considered by the Minister when developing the habitat regulation for this species.

Breeding Habitat

All permanent and seasonal wetland habitats where the Small-mouthed Salamander is known to breed should be included in a habitat regulation. This would include vernal pools, ponds, flooded quarries, swamps and marshes, which at present totals only three locations. Any new locations found or any locations where the salamander is re-introduced should be added to the area regulated.

Terrestrial Habitat

The terrestrial component of Small-mouthed Salamander habitat consists of woodlands, upland forests, swamps, successional areas, meadows, old fields, agricultural fields and other vegetated areas that provide conditions required for foraging, seasonal migration, growth and hibernation. Terrestrial habitat includes all of the areas and features described above that extend radially 300 m from the edge of any breeding wetland. The 300 m distance is based on the findings of telemetry studies of other similar species (K. Bériault, pers. comm. 2013, as reported in Semlitsch 1998, Faccio 2003, Bériault 2005) and is calculated as the habitat area utilized by 90 percent of the adult population for each breeding location based on the movements of individuals tracked for three months. Terrestrial habitat that meets these requirements should be included within the habitat regulation, similar to that recommended for the Jefferson Salamander (Jefferson Salamander Recovery Team 2009).

Connecting corridors that provide continuous extensions of the terrestrial habitats listed above, between the edge of one wetland breeding location and another, can extend up to one kilometre, the maximum presumed travel distance of an adult Small-mouthed Salamander (based on studies of other similar salamander species, such as Bériault 2005). These contiguous corridors should also be included within the habitat regulation. Non-vegetated open areas such as cultivated fields should also be included if part of a dispersal corridor, as these areas are not known to be a barrier to Small-mouthed Salamander dispersal.

GLOSSARY

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee established under section 14 of the Species at Risk Act that is 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
- Costal grooves: Indentations in the skin corresponding to the location of ribs along the sides of salamanders.
- Ecological Land Classification (ELC): A system of classifying and describing land-units based on vegetation.
- *Endangered Species Act, 2007* (ESA): The provincial legislation that provides protection to species at risk in Ontario.
- Genome: A set of chromosomes containing the genetic material of an organism.
- Hybrid: An offspring of two individuals of different species.
- Metamorphosis: Change of physical form, structure or substance, such as the change from larva to adult.
- Polyploidy: The condition of having more than two sets of chromosomes (e.g., triploid three sets of chromosomes, tetraploid four sets of chromosomes, etc.).
- 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. 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.
- Sympatric: Occurring in the same area.
- Synergism: Cooperative action of discrete agents such that the total effect is greater than the sum of the effects taken independently.

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Part 3 – Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) – Ontario Government Response Statement, prepared by Ministry of the Environment, Conservation and Parks, 2019 Ministry of the Environment, Conservation and Parks 2019

Blue Racer, Lake Erie Watersnake and Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population)



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. *The Endangered Species Act, 2007* (ESA) is the Government of Ontario's legislative commitment to protecting and recovering species at risk and their habitats.

Under the ESA, the Government of Ontario 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 government on what is required to achieve recovery of a species.

Within nine months after a recovery strategy is prepared, the ESA requires the Ontario government to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The response statement is the government's policy response to the scientific advice provided in the recovery strategy. In addition to the strategy, the government response statement considered (where available) input from



Indigenous communities and organizations, stakeholders, other jurisdictions, and members of the public. It reflects the best available local and scientific knowledge, including Traditional Ecological Knowledge where it has been shared by communities and Knowledge Holders, as appropriate and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the government to determine what is feasible, taking into account social, cultural and economic factors.

The recovery strategies for the Blue Racer (Coluber constrictor foxii), the Lake Erie Watersnake (Nerodia sipedon insularum) and the Smallmouthed Salamander (Ambystoma texanum) in Ontario were completed on March 2, 2015. On May 30, 2018, an updated and expanded recovery strategy for Small-mouthed Salamander (Ambystoma texanum) and Unisexual Ambystoma (Small-mouthed Salamander dependent population) (Ambystoma laterale – texanum) was finalized. Unisexual Ambystoma (Small-mouthed Salamander dependent population) are also referred to as Small-mouthed Salamander dependent unisexuals in this document. Given their similar distribution and threats, the recovery efforts for the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander, and Small-mouthed Salamander dependent unisexuals are addressed collectively in a single government response statement, which has been updated following the completion of the updated recovery strategy noted above. The combined government response statement also recognizes the importance of collaborative implementation of recovery actions with partners on Pelee Island. This GRS does not aim to outline additional habitat protection for the four species; at this time, the general habitat protection under the ESA already in place will continue to apply.

The Blue Racer is a large, non-venomous snake that can grow up to 1.5 m in length. Adult Blue Racers are greyish-blue in colour with a white, cream or bluish-white belly and a characteristic black mask. Juveniles have dark blotches along their body that eventually fade completely.



Pelee Island

The Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander, and Smallmouthed Salamander dependent unisexuals are all found on Pelee Island. Within Canada, Blue Racer, Small-mouthed Salamander and Small-mouthed Salamander dependent unisexuals are known to occur exclusively on Pelee Island. Within Canada, the largest population of Lake Erie Watersnake occurs on Pelee Island. Pelee Island is located in the western basin of Lake Erie and has a vast amount of biodiversity and a rich cultural heritage. The community of Pelee Island celebrates its natural history. The Township of Pelee works with private landowners and partner organizations to create and expand nature reserves on the island and works to integrate other conservationfocused initiatives.

The Official Plan for the Township of Pelee outlines in the overall objectives the importance of understanding the value of the island's natural heritage, of fostering stewardship of the natural environment, and of protecting and enhancing the natural environment of the island. An environmental advisory committee for Pelee Island has also been formed to bring together representatives from the municipality, non-governmental organizations, the local conservation authority and provincial ministries to cooperate on issues of The Lake Erie Watersnake is a nonvenomous, highlyaquatic snake that is rarely found far from the shoreline. It averages between 59 and 88 cm and is pale grey to dark brown in colour, with ranging patterns of darker brown or reddish blotches on the back and sides that often connect to form a banding pattern.



environmental importance. The Pelee Island community actively collaborated to support the Nature Conservancy of Canada (NCC) in purchasing over 10% of the island (435 ha) for the proactive preservation of priority conservation lands. Additional lands owned by a variety of land owners and managers are also in conservation ownership for a total of 18% of the island set aside for conservation purposes. The municipality, private landowners and NCC have also taken multiple additional steps to protect and support biodiversity on Pelee Island:

- In order to reduce road impacts to species, the municipality has significantly lowered speed limits on almost all roads on the island.
- Through the updating of waste disposal methods, the Township of Pelee has allowed for previous retaining ponds that were constructed to progress into functioning wetlands.
- All municipal infrastructure projects include site-specific collaboration with the local conservation authority, local Indigenous communities and organizations, and pertinent provincial and federal ministries.
- The municipality has intentionally created endangered species habitat such as snake hibernacula.
- To benefit both terrestrial and aquatic species, many stretches of shoreline habitat are being actively preserved and restored using native vegetation and materials.

The Small-mouthed Salamander is a medium-sized, heavybodied salamander that is dark brown to greyish-black with gray-blue patches that resemble lichen on its tail and sides. It can grow to a maximum length of about 18 cm and has a relatively small head and a short, narrow snout.



Small-mouthed Salamander and Unisexual Amyostoma (Small-mouthed Salamand dependent population) habitat. Photo by Joe Crowley

- Many private landowners continue to preserve natural habitat, construct and protect wetlands, plant native species, and use low impact farming practices on their individual properties to support biodiversity and the natural heritage of Pelee Island.
- With the support of the municipality, NCC has secured key natural areas including three alvars, critical shoreline and forested swamp areas. NCC also continues to restore agricultural lands to create habitat corridors and buffers and enhance connectivity for species.
- NCC has implemented a community-based conservation plan to protect key biodiversity features and functions, while supporting continuation of existing land uses and expansion of the island's ecotourism-based economy.
- The municipality, community members, NCC and other partners collaborate to exchange knowledge, promote the island's unique wildlife, interpret the natural surroundings for visitors and promote natural heritage events.

There are a variety of land uses on Pelee Island, including agriculture, hunting, recreation and tourism. Given the island formation, a finite amount of land is available to carry out all activities, which may result in competing land uses. The community's health, as well as prosperity, fundamentally rely on biodiversity and the ecosystem services it provides, such as food, clean water, fresh air and fertile soil. All of these factors highlight the importance of mobilizing partnerships and collectively working to conserve biodiversity while supporting local economic sustainability.

Protecting and Recovering the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population)

The Blue Racer, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) are listed as endangered species under the ESA, which protects both the animals and their habitat. The ESA prohibits harm or harassment of endangered and threatened species and damage or destruction of their habitat without authorization. Such authorization would require that conditions established by the government be met.

The Lake Erie Watersnake is listed as special concern under the ESA. The species was downlisted provincially from endangered to special concern on June 2, 2017, based on the Committee on the Status of Species at Risk in

The Unisexual Ambystoma (Smallmouthed Salamander dependent population), which co-exist with Small-mouthed Salamanders, are intermediate in appearance to other mole salamander species it co-exists with but cannot be readily distinguished from these species without genetic testing.

Ontario's (COSSARO) assessment. The species is included in this GRS to foster continued stewardship and in recognition of the value of collective efforts to conserve biodiversity.

A collaborative, stewardship first approach that partners the municipality, the provincial and federal governments, and local partners is intended to meet both the needs of the community and of the species that help contribute to the island's biodiversity, including Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Small-mouthed Salamander dependent unisexuals.

Blue Racer

The historical distribution of the Blue Racer in North America ranges from extreme southwestern Ontario, west to Minnesota, south to Illinois and east to Ohio. In the United States, the only states with current populations of the Blue Racer are Ohio, Indiana, Illinois, Michigan, Wisconsin and Iowa. In Canada, Blue Racers have disappeared from the mainland in southwestern Ontario and this species is now known to only occur on Pelee Island. Blue Racers inhabit forest edges and dry, open to semi-open habitat types such as alvars, savannahs, grasslands and thickets. They exhibit high fidelity to hibernation sites, which are usually underground cavities that are accessed through cracks and fissures in the bedrock.

The primary threat to the Blue Racer is habitat loss, largely due to succession of vegetation communities. Historically, clearing of land for agriculture and development posed a major threat but has been less significant in recent years. As woody plants succeed in the ecosystem, suitable habitat features for the species disappear, such as open canopies, dry open to semi-open areas, and edge habitat. As is the case with most snake species, road mortality and persecution are also significant threats to the Blue Racer. Working together to reduce negative perceptions of snakes is an important component of conserving biodiversity and addressing these threats for all snake species. It is possible that chemical contamination poses a threat to the species and that introduced Wild Turkeys (*Meleagris gallopavo*) may pose a threat as a potential new predator, though the extent of these potential threats is currently unknown. Continuing to increase the level of knowledge and understanding of interactions between introduced Wild Turkeys and Blue Racers will be of value.

Population estimates for the Blue Racer have not been completed since 2002, when the combined population size for three study sites on Pelee Island was estimated to be approximately 140 adult Blue Racers. The possible population range identified through this study was 59 to 284. Hatchlings and juveniles have been observed as recently as 2015, suggesting that the population is successfully reproducing. However, anecdotal evidence from some research and site visits since 2002 suggest the Canadian population of the Blue Racer may have experienced further decline in recent years, and a decline in overall habitat quality and quantity has also been noted at several occupied sites on the island.

Given the small population size found in 2002, anecdotal evidence of potential decline since that time, and the threats to the Blue Racer and its habitat, approaches to recovery should focus on working together to increase the level of knowledge of the species, increase the amount of suitable habitat available for the Blue Racer and minimize threats to the species to enable natural increases in the species' population.

Government's Recovery Goal for the Blue Racer The government's goal for the recovery of the Blue Racer in Ontario is to maintain the species' distribution and ensure a viable, self-sustaining population.

Lake Erie Watersnake

The Lake Erie Watersnake is a subspecies of the Northern Watersnake (*Nerodia sipedon*) and is endemic to the islands of Lake Erie and a small peninsula on the Ohio mainland. Previously listed as endangered in Ontario, the species was downlisted to special concern in June 2017 based on updated information that informed COSSARO's assessment. In Ontario, Lake Erie Watersnakes are known to occur on Pelee, East Sister, and Middle Islands. This species was previously known to also occur on Hen, North Harbour and Middle Sister Islands. Recent data suggest that it is likely extirpated from North Harbour and Middle Sister Islands. However, surveys have not occurred on Hen Island, which is privately owned, since the early 1990s. As a result, the 2016 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report identifies that the species' status on Hen Island is currently unknown. Hen, East Sister, North Harbour, and Middle Sister Islands all lie northwest of Pelee Island in Lake Erie, while Middle Island lies south of the southwest corner of Pelee Island.

Lake Erie Watersnakes are highly aquatic and rarely travel inland more than 50 m from the shoreline during the active season, although they will travel greater distances inland to hibernation sites. Adult snakes may hibernate singly or communally, using underground cavities, burrows, or human-made structures such as old wells or building foundations.

As indicated in scientific literature, significant threats to snakes such as the Lake Erie Watersnake are road mortality and persecution. The colouration of Lake Erie Watersnakes can make them difficult to see against unpaved or dust covered roads. Additionally, fear or dislike of snakes can foster negative human behaviours that may result in harm to individual snakes. Habitat loss due to shoreline development, vegetation clearing, increased presence of shoreline invasive species such as Phragmites (European Common Reed) (*Phragmites australis* ssp. *australis*), and removal of winter hibernation habitat is also a significant threat to the species. Other possible threats to the Lake Erie Watersnake include environmental contaminants and adverse effects of high-density nesting or roosting areas of waterbirds, such as Double-crested Cormorants (*Phalacrocorax auritus*), on habitat.

Populations of the Lake Erie Watersnake experienced historical declines, but may have stabilized in recent years; there is insufficient data to document population trends of Lake Erie Watersnake in Canada. An increase in the abundance of the invasive Round Goby (*Neogobius melanostomus*), which has become an important food source for the Lake Erie Watersnake, has shown to have increased populations in the United States. It is unknown whether there has been a similar effect in Canada due to potential differences in the magnitude of threats that are faced by the species. In 2016, the Committee on the Status of Endangered Wildlife in Canada estimated the number of mature individuals on Pelee Island to be 3,286, and estimated approximately another 200 individuals inhabiting the other islands. Approaches to recovering the Lake Erie Watersnake will focus on minimizing the threats of accidental and intentional human-caused mortality by increasing public awareness and understanding on managing its habitat to support the current abundance and distribution of the species in Ontario.

Government's Recovery Goal for the Lake Erie Watersnake The government's goal for the recovery of the Lake Erie Watersnake is to maintain the current abundance and distribution of the species in Ontario.

Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population)

The Small-mouthed Salamander ranges from eastern Texas to western Alabama and across the central United States, reaching its northern range in Michigan, northern Ohio and Pelee Island in Ontario. The global population is thought to exceed 100,000 but is unknown. In Canada, the species is only known to occur on Pelee Island. Small-mouthed Salamander dependent unisexuals have been found in Michigan, Indiana and Ohio, and several Lake Erie islands. The full global distribution and population are uncertain because genetic testing is required to identify these animals and this has not occurred for many populations. In Canada, the Small-mouthed Salamander dependent unisexuals are only known to occur on Pelee Island.

Small-mouthed Salamanders, Unisexual Ambystoma (Small-mouthed Salamander dependent population) and Blue-spotted Salamanders (*Ambystoma laterale*) (not at risk) all co-occur on Pelee Island. Unisexual Ambystoma (Small-mouthed Salamander dependent population) is a genetically distinct, all-female salamander lineage that depends on the other two salamander species to carry out reproduction.

Small-mouthed Salamander and Small-mouthed Salamander dependent unisexuals in Ontario are known historically to occur at five breeding sites on Pelee Island, but the most recent survey efforts (2015-2017) found Small-mouthed Salamanders and Small-mouthed Salamander dependent unisexuals at only three of those five breeding sites. These surveys did, however, identify three additional breeding sites in use by the two species on Pelee Island for a total of six confirmed sites. The status of one additional breeding site, and the current population abundance, are unknown.

The Small-mouthed Salamander and Small-mouthed Salamander dependent unisexuals are members of the Mole Salamander family (*Ambystomatidae*), a family name that refers to the biological characteristic of spending most of their time underground or beneath cover except when breeding.

All Unisexual Ambystoma (Small-mouthed Salamander dependent population) salamanders are females and have a unique reproductive strategy whereby the sperm from male Small-mouthed Salamanders or Blue-spotted Salamanders is needed to initiate egg development. Their offspring are unique in that they are also all females and are all considered Unisexual Ambystoma (Small-mouthed Salamander dependent) regardless of what species' sperm initiated egg development. While the sperm may or may not be incorporated into the Small-mouthed Salamander dependent unisexual egg, the species does not appear to be able to reproduce in the absence of a Small-mouthed Salamander or Blue-spotted Salamander. Therefore, the persistence of the Unisexual species is dependent on the presence of the other salamander species.

It is thought that these three species that make up the salamander complex on Pelee Island were isolated together in the area roughly 4000 years ago. Small-mouthed Salamander dependent unisexuals vastly outnumber both Small-mouthed and Blue-spotted Salamanders, making up over 80 percent of all the Ambystoma salamanders on the island. Recent survey efforts examined more than 830 samples (adults and larvae) on Pelee Island collected from 2015 to 2017 and found that unisexuals made up over 95 percent of the sample (Hossie and Murray 2017).

The habitat needs of both species include: fish-free, shallow water bodies that retain water from March through July, used for breeding, and adjacent suitable terrestrial areas that are shaded and provide soft moist soils, logs, rocks and leaf litter that are used for cover, shelter and overwintering.

The main threats to the species are habitat degradation, loss and fragmentation. This includes the temporary or permanent loss of water from breeding sites during critical periods, and the loss of forest canopy cover, rotting logs and other ground cover. Small-mouthed Salamanders and Small-mouthed Salamander dependent unisexuals rely on wetlands site and ephemeral pools of water (i.e., temporary pools that form in the spring and typically dry up in the summer) for breeding; therefore, activities and climate conditions that affect the hydrology of the habitat and surrounding areas also pose a threat. Threats from invasive species, such as Phragmites, can also reduce suitable habitat conditions for the species. While environmental contaminants (e.g., pesticides, de-icing salt) are known to affect amphibians, the local impacts of environmental contaminants on Small-mouthed Salamander and Small-mouthed Salamander dependent unisexuals are unknown. Additional potential threats to the species include disease (e.g., ranaviruses, chytrid fungi) and predation and habitat alteration caused by Wild Turkeys. As the relative impacts of many of these potential and known threats on local populations are currently unknown, further research is necessary to support recovery actions for the species.

The Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent) populations on Pelee Island are small and the salamanders themselves are difficult to distinguish from other salamander species without the assistance of genetic testing. Continuing to manage the salamander complex will support recovery for all associated salamander species at risk. Given the lack of population estimates, there is a need to focus on conducting inventories of recent breeding sites and monitoring population trends and habitat usage. Approaches to recovery will focus on working in collaboration with the local community to monitor current populations, manage current habitat effectively, increase the amount of suitable habitat available for Small-mouthed Salamander and dependent unisexuals, and increase our knowledge of potential threats to the species.

Government's Recovery Goal for the Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population)

The government's goal for the recovery of the Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) is to ensure long-term viability and persistence of the Ontario populations by managing threats and increasing population abundance, distribution and connectivity.

Actions

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 inter-governmental co-operation and the involvement of many individuals, organizations and communities. In developing the government response statement, the government considered what actions are feasible for the government to lead directly and what actions are feasible for the government to support its conservation partners to undertake.

Government-led Actions

To help protect and recover the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) the government will directly undertake the following actions:

- Explore opportunities to work collectively with the Township of Pelee, including the Pelee Island Environmental Advisory Committee, the federal government and local partners to develop an integrated (landscape/ place-based) approach to managing species at risk with consideration of ecosystem values and sustainable resources on Pelee Island. This may include:
 - developing a strategic plan for species at risk and their habitats on Pelee Island;
 - continuing to implement the Ontario Invasive Species Strategic Plan to address the invasive species (e.g., Phragmites) that threaten Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population);
 - continuing to implement Ontario's Invasive Species Act to address the invasive species identified in the Act (e.g., Phragmites) that threaten Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population);

- supporting the coordination of provincial and federal species at risk legislation (i.e., ESA and Species at Risk Act (SARA)), in order to collaboratively continue to protect Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population) and their habitats; and,
- educating other agencies and authorities involved in planning and environmental assessment processes on the ESA.
- Explore opportunities to work collectively with the Township of Pelee, including the Pelee Island Environmental Advisory Committee, the federal government and local partners to integrate approaches to stewardship and implementation of recovery activities including:
 - encouraging collaboration, and establishing and communicating annual priority actions for government support in order to reduce duplication of stewardship efforts;
 - supporting conservation, agency, municipal and industry partners, and Indigenous communities and organizations to undertake activities to protect and recover Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population). Support will be provided where appropriate through funding, agreements, permits (including conditions) and advisory services;
 - undertaking communication and outreach to increase public awareness of species at risk in Ontario; and,
 - encouraging the submission of Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population) data to the Ontario's central repository through the citizen science projects that they receive data from (e.g., the Ontario Reptile and Amphibian Atlas) and directly through the Natural Heritage Information Centre.
- Continue to monitor, protect and manage habitat for the four species in protected areas on Pelee Island (e.g., Lighthouse Point and Fish Point Provincial Nature Reserves). Continue to work collaboratively with local partners to enhance and restore habitat for species at risk within these protected areas.

Government-supported Actions

The government endorses the following actions as being necessary for the protection and recovery of the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population). Actions identified as "high" may be given priority consideration for funding under the Species at Risk Stewardship Program. Where reasonable, the government will also consider the priority assigned to these actions when reviewing and issuing authorizations under the ESA. Other organizations are encouraged to consider these priorities when developing projects or mitigation plans related to species at risk.

Focus Area: Habitat Management

Objective: Work collaboratively to increase habitat quality for the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population).

Habitat loss and degradation is a significant threat to all four species. A landscape level approach to habitat management for the species recognizes the finite amount of land available on Pelee Island. Collectively working to develop and implement best management practices will support habitat management and restoration for the four species, particularly for the Blue Racer, Small-mouthed Salamander and Small-mouthed Salamander dependent unisexauls as habitat is very limited. Without active management of Blue Racer habitat, the open to semi-open habitat succeeds (e.g., shrubs and trees grow in) over time and becomes unsuitable for the species. In the case of Small-mouthed Salamander and the Small-mouthed Salamander dependent unisexuals, the species rely on ephemeral pools and wetlands and suitable adjacent terrestrial areas. As a result, activities impacting the hydrology or tree canopy of these areas could have substantial consequences for these species. Cooperative, preventative efforts to manage habitat for suitability over the long-term will greatly assist in reducing these impacts.

Actions:

- (High) Using community knowledge and species expertise, develop, promote and implement best management practices to manage existing habitat for the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) including:
 - prescribed burns to prevent woody succession in Blue Racer habitat, with consideration for the safety of neighbouring properties, snakes and other rare species present on-site;

- targeted removal of native or invasive woody vegetation in Blue Racer habitat, with consideration for other species at risk, using appropriate and approved methods;
- removal of invasive species such as Phragmites along shoreline habitat for Lake Erie Watersnake and at known breeding sites for Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population);
- managing vegetation to support suitable habitat conditions and maintaining appropriate wetland and forested habitat features such as cover objects and forest cover for Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population);
- buffering against potential site-level effects of environmental contaminants on water quality in Smallmouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population) breeding habitat; and,
- managing existing and new infrastructure, such as drainage works, in a way that reduces the negative effects on Blue Racer, Lake Erie Watersnake, Smallmouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) habitat, with additional consideration for neighbouring properties.
- 2. Collaborate with community members and organizations to strategically increase the amount of suitable habitat available for Blue Racer, Lake Erie Watersnake, Smallmouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population) by:

Blue Racer (High)

- identifying and assessing existing habitat and identifying candidate areas for habitat enhancement, restoration and creation where there are willing partners;
- creating a mosaic of suitable habitat types such as grassland, savannah and edge habitat, with a focus on increasing connectivity between suitable habitat patches;
- creating hibernation, nesting and shelter habitats and monitoring and documenting their effectiveness;

Lake Erie Watersnake

- identifying and assessing existing habitat and identifying candidate areas for habitat enhancement, restoration and creation where there are willing partners;
- restoring shoreline habitat and increasing structural heterogeneity, and increasing connectivity between areas of habitat;
- creating suitable hibernation and shelter habitats and monitoring and documenting their effectiveness;

Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) (High)

- identifying and assessing existing habitat and identifying sites adjacent to or between known locations for potential habitat enhancement, restoration and creation where there are willing partners; and,
- enhancing, restoring and creating suitable habitat such as ephemeral pools and surrounding forested areas in appropriate areas.
- 3. (High) Work with local partners to maintain adequate water levels and quality, and hydrology that sustain the breeding sites and migratory routes for Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population). This may include buffering for the potential effects of climate change on water levels in the future and exploring opportunities to support hydrology at a watershed scale (e.g., restoring riparian habitat).

Focus Area: Awareness and Threat Management

Objective: Work in partnership with the Pelee Island community to reduce threats to the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) through increasing public awareness, promoting local stewardship of the species and their habitats, and implementing threat mitigation techniques.

Landowners, local residents and visitors to Pelee Island have an important role to play in the protection and recovery of the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Smallmouthed Salamander dependent population). Increasing public awareness and promoting local stewardship are critical to addressing key threats such as road mortality and persecution. Efforts to increase awareness should build off of work completed to date by conservation partners and other jurisdictions, such as the resources and programs developed in the U.S. to support Lake Erie Watersnake recovery. Steps taken in the future to mitigate threats to the species and their habitat can build on research conducted in the coming years. A continued collaborative approach that focuses on stewardship of the species and their habitat will support the effective implementation of protection and recovery actions.

Actions:

- 4. (High) Collaborate with local organizations and initiatives to reduce threats to the species, including road mortality and persecution. For example:
 - developing programs to reduce road mortality, which may include installing signs and publicizing the need for cautious driving, particularly in areas of high mortality for these species;
 - producing educational materials to increase public awareness, such as promoting the need to share the shoreline with Lake Erie Watersnakes; and,
 - implementing techniques to reduce rates of road mortality (e.g., ecopassages, barrier fencing, traffic calming measures), particularly in areas of high mortality for these species.
- 5. Promote local stewardship of the Blue Racer and the Lake Erie Watersnake that includes:
 - developing social marketing strategies to help influence public perceptions and behaviours that negatively affect snake populations;
 - producing stewardship publications to highlight success stories and engage the public in snake conservation; and,
 - increasing awareness of incentive programs and how landowners can benefit from protecting and restoring Blue Racer and Lake Erie Watersnake habitat.

Focus Area: Inventory and Monitoring

Objective: Improve knowledge of species' population trends, habitat usage and distribution.

Little is known about the current abundance, local distribution, habitat usage, and population trends of Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population). A greater understanding of the four species' current population abundance is essential to support the ability to monitor progress and effectiveness of recovery actions and population trends over time. Further information on these topics, as well as additional surveying for potential presence at historical and potential locations would contribute to greater understanding of the status of the four species.

Actions:

- Collaborate with local partners and community members to develop and implement survey and monitoring programs to: Blue Racer (High) and Lake Erie Watersnake
 - estimate the population abundance and distribution of the Blue Racer and the Lake Erie Watersnake and monitor trends over time;
 - monitor changes in Blue Racer and Lake Erie Watersnake use and suitability of habitat;
 - identify areas with high rates of road mortality between occupied habitats;
 - survey for the Lake Erie Watersnake on other Lake Erie islands (e.g., Hen, Middle Sister and North Harbour Islands), where feasible, in order to determine if the species is still present in these areas;

Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) (High)

- estimate the population abundance and distribution of both salamander species at known sites;
- estimate the proportion of each species relative to the salamander complex;
- monitor suitability of habitat including terrestrial (e.g., canopy cover, soil moisture and cover object availability) and aquatic (e.g., water level, pH, pollutants and fish presence) features;
- monitor population trends and monitor changes in genetic composition and recruitment of the salamander complex over time;
- identify areas with high rates of road mortality between occupied habitats; and,
- survey for the two species at potential sites with suitable habitat in order to identify additional populations and refine knowledge on the distribution of the salamander species.

Focus Area:Research and Population ManagementObjective:Increase knowledge of threats to the species, species-specific
habitat requirements and ecological limitations.

Knowledge gaps related to specific habitat requirements and the significance of threats currently exist for all four species. Investigating and filling these knowledge gaps will help to better inform the implementation of recovery actions for these species, such as habitat management efforts and road mortality reduction techniques. Improving our knowledge of the salamander complex on Pelee Island, including genetic composition and any associated limitations, will support future recovery efforts. Increasing our understanding of potential emerging threats, such as disease and climate change, will also support effective mitigation if needed in the future. For both Blue Racer and the two salamander species, impacts of potential diseases could lead to significant impacts given their small population sizes.

Actions:

- 7. Investigate the structural, thermal and chemical properties of hibernation and nest/gestation sites to inform the creation and maintenance of these sites for the Blue Racer and the Lake Erie Watersnake. Assess the effectiveness of created hibernation habitats.
- 8. Research Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) habitat use (e.g., breeding sites, migration routes and overwintering sites) and habitat connectivity (including dispersal barriers).
- Investigate the effectiveness of techniques to create breeding ponds for the two salamander species, including the factors that influence the quality of created breeding habitats.
- Investigate the effects and severity of known and potential threats to Blue Racer and Lake Erie Watersnake, and identify potential mitigation measures as appropriate, including:
 - examining the potential effects of Double-crested Cormorants and Wild Turkeys on the species and/or their habitat; and,
 - investigating the potential effects of disease (e.g., Snake Fungal Disease) and other identified threats to the species and their habitat.

- 11. Investigate the effects and severity of known and potential threats to Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population), and identify potential mitigation measures as appropriate, including:
 - investigating the extent that environmental contaminants are directly or indirectly affecting the productivity and/or survival rates of the two salamander species;
 - examining the potential effects on the salamander complex of predation by Wild Turkeys and habitat alteration caused by the turkeys;
 - investigating the potential effects of climate change on the species and their habitat, and the relationship between habitat suitability and hydrology; and,
 - investigating the potential effects of disease (e.g., ranaviruses, chytrid fungi), and parasites (e.g., trematode) on Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population).
- Conduct assessments to determine population targets for achieving self-sustaining and genetically viable Blue Racer, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent) populations in Ontario.
- 13. Investigate the ecological relationships in the Ambystoma salamander complex on Pelee Island to assess potential demographic constraints to species' recovery (e.g., related to reproductive output, recruitment, and survival in the larval and adult life stages).
- 14. Investigate the potential need for, and feasibility of, assisted recruitment techniques to support the recovery goal for Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population). If found to be feasible and necessary, implement, evaluate, adapt and improve recruitment techniques with consideration for the species' ecology and the salamander complex as a whole. An example of a priority recruitment technique is:
 - exploring the potential benefits and need for a cost-effective head-starting protocol/program (e.g., reproductive monitoring, artificial incubation of eggs, and release of juveniles).

Implementing Actions

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with program staff. The Ontario government can also advise if any authorizations under the ESA or other legislation may be required to undertake the project.

Implementation of the actions may be subject to changing priorities across the multitude of species at risk, available 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 Ontario government 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 identify if adjustments are needed to achieve the protection and recovery of the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population).

Acknowledgement

We would like to thank all those who participated in the development of the recovery strategies for the Blue Racer, Lake Erie Watersnake, Small-mouthed Salamander and Unisexual Ambystoma (Small-mouthed Salamander dependent population) for their dedication to protecting and recovering species at risk.

For additional information:

Visit the species at risk website at ontario.ca/speciesatrisk Contact the Natural Resources Information Centre 1-800-667-1940 TTY 1-866-686-6072 mnr.nric.mnr@ontario.ca