

COSEWIC
Assessment and Status Report

on the

Butler's Gartersnake
Thamnophis butleri

in Canada



THREATENED
2024

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada



COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report(s):

COSEWIC. 2010. COSEWIC assessment and status report on the Butler's Gartersnake *Thamnophis butleri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 51 pp. (<https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html>).

COSEWIC. 2001. COSEWIC assessment and status on report on Butler's Gartersnake *Thamnophis butleri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 20 pp. (<https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html>).

Sandilands, A.P. 2001. COSEWIC status report on the Butler's Gartersnake *Thamnophis butleri* in Canada, in COSEWIC assessment and status on report on Butler's Gartersnake *Thamnophis butleri* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-20 pp.

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COSEWIC would like to acknowledge Jonathan Choquette for writing the status report on Butler's Gartersnake (*Thamnophis butleri*) in Canada, prepared under contract with Environment Canada and Climate Change. This report was overseen and edited by Pamela Rutherford, Co-chair of the COSEWIC Amphibians and Reptiles Specialist Subcommittee.

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Butler's Gartersnake from Crystal Island, Amherstburg, Ontario, May 2009; photo by Daniel W.A. Noble.

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COSEWIC Assessment Summary

Assessment Summary –November 2024

Common name

Butler's Gartersnake

Scientific name

Thamnophis butleri

Status

Threatened

Reason for designation

Subpopulations of this small, specialized snake occur in small, scattered, isolated habitat remnants in southern Ontario. Fragmentation of urban landscapes from roads in Windsor-Essex and Sarnia-Lambton prevents movement of individuals between subpopulations. Surveys since 2012 have not detected the species at two sites where they were formerly known. The species is threatened by the cumulative threats of residential and commercial development, transportation and service corridors, natural systems modifications, and the negative genetic effects of small population size and demographic stochasticity.

Occurrence

Ontario

Status history

Designated Special Concern in April 1999. Status re-examined and designated Threatened in November 2001. Status re-examined and designated Endangered in November 2010. Status re-examined and designated Threatened in November 2024.



COSEWIC Executive Summary

Butler's Gartersnake *Thamnophis butleri*

Wildlife Species Description and Significance

Butler's Gartersnake (*Thamnophis butleri*) is a small gartersnake approximately 40 cm long with three distinct and vibrant yellow stripes along the length of its dark brown back. This snake is easily confused with two other species of gartersnake (i.e., Eastern Gartersnake, *T. sirtalis*, and Eastern Ribbonsnake, *T. sauritus*); however, Butler's Gartersnake is shorter in length, has a smaller head, and has side stripes centred on the 3rd scale row. The conservation of Butler's Gartersnake in Canada contributes to the global persistence of this species and provides a unique opportunity for urban youth to observe and become interested in native reptiles.

Aboriginal (Indigenous) Knowledge

All species are significant and are interconnected and interrelated. There is no species-specific ATK in the report.

Distribution

Butler's Gartersnake is confined to the Great Lakes Region, and has one of the most restricted global ranges of any snake in North America. Its distribution is patchy and limited to three small areas in southwestern Ontario, and parts of four U.S. states (Wisconsin, Ohio, Michigan, and Indiana). The Canadian distribution of Butler's Gartersnake occupies approximately 16% of its global distribution.

Habitat

Characteristic habitat of Butler's Gartersnake primarily includes meadows, old fields, and tallgrass prairie, with nearby permanent or ephemeral wetlands or drainage features. This species is also found in urban areas within naturalized portions of city parks, industrial lands, commercial sites, and abandoned properties. Essential habitat components include a dense cover of grasses or forbs with a thick layer of thatch and an abundance of earthworms as prey. Overwintering sites include small mammal burrows, ant mounds, loose fill, foundations, and crayfish burrows. Gravid females gestate in open-canopy habitat and move to low-lying areas with moist soils to give birth.

Biology

In southwestern Ontario, Butler's Gartersnake is generally active from April to October. Mating occurs in early spring and 8–10 young are born live, typically in July. Sexual maturity is reached after 2 years, and generation time is approximately 4 years. This snake feeds primarily on earthworms, and its predators are presumably the same as those of other snakes of the same genus (*Thamnophis*). Most individuals at study sites exhibited limited movements, with a maximum activity range of less than 1 ha and a mean movement distance of 300 m. However, a small number of individuals have been observed moving more than 500 m.

Population Sizes and Trends

Using recent abundance and density estimates from four sites in the Windsor-Essex and Sarnia-Lambton regions, and extrapolating these across the range of this species, the total Canadian population size of Butler's Gartersnake is estimated at 6,560–23,600 adults. Results of targeted and incidental surveys indicate a recent decline of ~ 29% in the number of historically occupied sites in Windsor-Essex and Sarnia-Lambton since the previous status assessment in 2010. Range-wide, the index of area of occupancy has declined by 20% since the previous assessment. This species' ongoing occurrence at one relatively large historically occupied site is unknown.

Threats

Agricultural practices, forest succession, and urbanization have historically contributed to the loss and fragmentation of Butler's Gartersnake habitat in Canada. Currently, the three main threats to this species and its habitat are transportation and service corridors, residential and commercial development, and natural system modifications. The overall threat impact for *Butler's Gartersnake* is considered to be medium. Habitat loss is ongoing in the Windsor-Essex and Sarnia-Lambton regions, but not in Luther Marsh.

Protection, Status, and Recovery Activities

Butler's Gartersnake is listed as Endangered under both the federal *Species at Risk Act*, 2002 and the Ontario *Endangered Species Act*, 2007. This species is also a specially protected reptile under the Ontario *Fish and Wildlife Conservation Act*, 1997. A federal recovery strategy for Butler's Gartersnake was completed in 2018, which identified Critical Habitat in 97-1 km² grid squares. In the United States, this species is only afforded legal protection in Indiana, where it is listed as Endangered. Globally, Butler's Gartersnake is ranked G4 (secure).

TECHNICAL SUMMARY

Thamnophis butleri

Butler's Gartersnake

Couleuvre à petite tête

Indigenous names: unknown

Range of occurrence in Canada: Ontario

Demographic Information:

| | | |
|---|---|--|
| Generation time (usually average age of parents in the population) | Approximately 4 years | Based on IUCN method (IUCN 2010). |
| Is there an [observed, estimated, inferred, or projected] continuing decline in number of mature individuals? | Yes | Inferred based on decline in number of historically occupied sites, EOO and IAO squares (assumed to be equivalent to a decline in number of mature individuals). |
| [Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within 3 years [or 1 generation; whichever is longer up to a maximum of 100 years] | Yes | Estimated decline in number of mature individuals of >55% at one well-studied site. |
| Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within 5 years [or 2 generations; whichever is longer up to a maximum of 100 years] | Yes | Estimated decline in number of mature individuals of >55% at one well-studied site. |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years [or 3 generations; whichever is longer] | 20–34% reduction over ~3 generations (12 years) | Inferred based on 20–34% decline in number of occupied IAO squares and 31% decline in the EOO estimate since the 2010 status report (assumed to be equivalent to a decline in number of mature individuals). |
| [Projected, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, up to a maximum of 100 years] | 3–30% reduction over ~ 3 generations (12 years) | Projected based on results of threats calculator. |
| [Observed, estimated, inferred, projected, or suspected] percent [reduction or increase] in total number of mature individuals over any period of 10 years [or 3 generations; whichever is longer, up to a maximum of 100 years], including both the past and future (up to a maximum of 100 years in future) | 20–34% reduction over ~ 3 generations | Inferred based on 20–34% decline in number of occupied IAO squares and 31% decline in the EOO estimate since the 2010 status report (assumed to be equivalent to a decline in number of mature individuals). |

| | | |
|--|--|--|
| Are the causes of the decline clearly reversible? | Yes, in certain cases for impacts caused by IUCN threats 1, 2, 3, 4, and 7 | Species can colonize adjacent sites where habitat was previously removed or unavailable, after naturalization or habitat restoration. |
| Are the causes of the decline clearly understood? | Yes and no | Residential and Commercial Development (IUCN 1) clearly linked to extirpations from many sites. Natural System Modifications (IUCN 7) presumed linked to extirpations from protected or undeveloped sites. |
| Are the causes of the decline clearly ceased? | No | Ongoing, mostly due to IUCN threats 1, 4, and 7. |
| Are there extreme fluctuations in number of mature individuals | No | Reduction in number of mature individuals due to population decline, not fluctuation. |

Extent and Occupancy Information:

| | | |
|---|-----------------------|--|
| Estimated extent of occurrence (EOO) | 7,025 km ² | Calculated based on minimum convex polygon around known observation occurrences (2002–2021). The EOO estimate excluded all historical observation records, except historical records from Walpole Island First Nation (WIFN), where the status of Butler’s Gartersnake is uncertain. |
| Index of area of occupancy (IAO), reported as 2x2 km grid value | 288 km ² | Calculated based on known observation occurrences (2002–2021). The IAO estimate excluded all historical observation records, except historical records from WIFN, where the status of Butler’s Gartersnake is uncertain, and two IAO squares from Luther Marsh that still contain suitable habitat but where the species’ status is uncertain. |
| Is the population “severely fragmented”, i.e., is >50% of individuals or >50% of the total area “occupied” (as a proxy for number of individuals) in habitat patches that are both (a) smaller than required to support a viable subpopulation, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | a. No b. No | Only 25% of area occupied meets both criteria. |

| | | |
|--|---------------|--|
| Number of “locations” (use plausible range to reflect uncertainty if appropriate) | >10 locations | Based on the medium threat of Transportation and Service Corridors (IUCN 4) and the low threat of Natural System Modifications (IUCN 7), there may be as few as 3 locations, but >10 locations is most likely. Based on the low threat of Residential and Commercial Development (IUCN 1), there are 17 locations. |
| Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? | Yes | Observed based on a 31% decline in the EOO estimate from the 2010 status report |
| Is there an [observed, inferred, or projected] continuing decline in area of occupancy? | Yes | Observed based on a 20–34% decline in the IAO estimate from the 2010 status report |
| Is there an [observed, inferred, or projected] continuing decline in number of subpopulations? | Yes | Inferred based on extirpations from Parkhill Creek and Skunk’s Misery since the 2010 status report, and assumption that those sites represent extinct subpopulations. |
| Is there an [observed, inferred, or projected] continuing decline in number of “locations”? | Yes | Observed based on ~ 20 locations lost to development since the 2010 status report (see Number of Threat Locations). |
| Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat? | Yes | Observed decline in area, extent and quality, based on ~ 83 ha of potential habitat lost to development since the 2010 status report (see Number of Threat Locations) |
| Are there extreme fluctuations in number of subpopulations? | No | Fluctuation less than one order of magnitude |
| Are there extreme fluctuations in number of “locations”? | No | Fluctuation less than one order of magnitude |
| Are there extreme fluctuations in extent of occurrence? | No | Fluctuation less than one order of magnitude |
| Are there extreme fluctuations in index of area of occupancy? | No | Fluctuation less than one order of magnitude |

Number of Mature Individuals (by subpopulation):

| | | |
|---|-------------------------|---|
| Windsor-Essex Sarnia-Lambton Luther Marsh | 7,544 5,618 1,926 | Assuming each IAO grid square supports at least one average-sized Butler's Gartersnake site with an average adult density. Abundance not estimated for WIFN given the uncertainty around the status of Butler's Gartersnake there. Assumes 3 extant subpopulations. |
| Total (nearest 10) | 15,090 (6,560–23,600) | Uncertainty around the abundance estimate reflects the reported range in adult densities across sites. |

Quantitative Analysis:

| | | |
|--|---------|-------------------------|
| Is the probability of extinction in the wild at least 20% within 20 years [or 5 generations], or 10% within 100 years] | Unknown | Analysis not conducted. |
|--|---------|-------------------------|

Threats:

| | | |
|---|-----|--|
| Was a threats calculator completed for this species? | Yes | Overall assigned threat impact: Medium (2023). |
| Key threats were identified as: i. Transportation and Service Corridors (IUCN 4): Medium impact ii. Residential and Commercial Development (IUCN 1): Low impact iii. Natural System Modifications (IUCN 7): Low impact | | |
| What limiting factors are relevant? <ul style="list-style-type: none"> • Low vagility (ability to move and migrate) • Reliance on specific habitat features to survive the winter | | |

Rescue Effect (from outside Canada):

| | | |
|--|--------|--|
| Status of outside population(s) most likely to provide immigrants to Canada. | Stable | Apparently Secure (S4) in Michigan. |
| Is immigration known or possible? | Yes | Snakes from the U.S. are interacting with adjacent Canadian populations. |
| Would immigrants be adapted to survive in Canada? | Yes | See above. |
| Is there sufficient habitat for immigrants in Canada? | Yes | On islands and some shoreline sites only. Inland sites are isolated from islands and shoreline sites due to development. |
| Are conditions deteriorating in Canada? | Yes | Evidence of ongoing genetic fragmentation in both Windsor-Essex and Sarnia-Lambton. |

| | | |
|--|----|--|
| Are conditions for the source (i.e., outside) population deteriorating? | No | Apparently Secure (S4) in Michigan. |
| Is the Canadian population considered to be a sink? | No | Relatively high abundance at some island sites in the Detroit River. |
| Is rescue from outside Canada likely, such that it could lead to a change in status? | No | Immigrants from Michigan are likely adapted to survive in Canada, given that there are interactions between snakes from the U.S. and Canada across the Detroit and St. Clair rivers, either via passive or active dispersal. However, little to no connectivity was found between Detroit River shoreline sites and those further inland, possibly due to development and roads (Snetsinger <i>et al.</i> 2022). |

Wildlife Species with Sensitive Occurrence Data (general caution for consideration):

| | | |
|---|------------------------|---|
| Could release of certain occurrence data result in increased harm to the Wildlife Species or its habitat? | Unknown, but possible. | Capture/harvest of individuals may occur but presumed a negligible risk relative to main threats. Intentional destruction or damage of habitat may occur in preparation for development, prior to ecological assessment. |
|---|------------------------|---|

Current Status:

| | |
|------------------------|--|
| COSEWIC Status History | Designated Special Concern in April 1999. Status re-examined and designated Threatened in November 2001. Status re-examined and designated Endangered in November 2010. Status re-examined and designated Threatened in November 2024. |
|------------------------|--|

Status and Reasons for Designation:

| | |
|-----------------------------------|--|
| Status | Threatened |
| Alpha-numeric codes | Qualifies as Special Concern but designated Threatened because the wildlife species may become Endangered if the cumulative threats are not managed. |
| Numeric code for change in status | Vii (a change in the application or interpretation of assessment criteria definitions of location, severely fragmented since the last assessment). |

| | |
|-------------------------|--|
| Reasons for designation | Subpopulations of this small, specialized snake occur in small, scattered, isolated habitat remnants in southern Ontario. Fragmentation of urban landscapes from roads in Windsor-Essex and Sarnia-Lambton prevents movement of individuals between subpopulations. Surveys since 2012 have not detected the species at two sites where they were formerly known. The species is threatened by the cumulative threats of residential and commercial development, transportation and service corridors, natural systems modifications, and the negative genetic effects of small population size and demographic stochasticity. |
|-------------------------|--|

Applicability of Criteria:

| | |
|--|--|
| A: Decline in Total number of Mature Individuals: | |
| Not applicable. | Insufficient data to reliably infer, project, or suspect population trends. |
| B: Small Range and Decline or Fluctuation | |
| Not applicable | IAO of 288 km ² is below the threshold for Endangered, but at present, the population is not severely fragmented, likely occurs at >10 locations, and does not experience extreme fluctuations. |
| C: Small and Declining Number of Mature Individuals | |
| Not applicable. | The total number of mature individuals is unknown. |
| D: Very Small or Restricted Population | |
| Not applicable. | The number of mature individuals is unknown, the IAO is larger than 20 km ² and there are currently more than five locations. |
| E: Quantitative Analysis | |
| Not applicable. | Analysis not conducted. |
| <i>(If a species is proposed as Special Concern, Data Deficient, Extirpated or Extinct, list the applicable guidelines, examples, or other considerations from O&P Appendix E3.)</i> | |

PREFACE

Butler's Gartersnake (*Thamnophis butleri*) is a small, docile gartersnake with one of the most restricted ranges of any snake in Canada, being found only in southwestern Ontario. Knowledge of its current and historical distribution is based largely on range-wide surveys completed in 1976 and 2009; however, its demography at most sites remains largely unstudied. New information is presented on extant subpopulation structure, element occurrence ranks, range, abundance, and trends. Since the 2010 status assessment, Butler's Gartersnake has not been found at a majority of historical sites and is declining within its current Canadian range. Major threats to the persistence of Butler's Gartersnake and its habitat have been reassessed and classified according to IUCN standards. These threats include transportation and service corridors, residential and commercial development, and natural system modifications. In Wisconsin, this species was downlisted from Threatened to Special Concern in 2014, and its legal protection under state law was removed. In Canada, Butler's Gartersnake was assessed as Endangered by the Committee on the Status of Species at Risk in Ontario (COSSARO) in 2011 and is legally protected in Ontario. A federal recovery strategy for Butler's Gartersnake, which included the identification of critical habitat, was completed by the Government of Canada in 2018 and adopted by the Government of Ontario in 2019. Additionally, a new national urban park in Windsor and LaSalle is in the planning phase, which may increase protection of Butler's Gartersnake habitat.



COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2024)

| | |
|------------------------|--|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species is likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. |
| Not at Risk (NAR)** | A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.



Environment and
Climate Change Canada
Canadian Wildlife Service

Environnement et
Changement climatique Canada
Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Butler's Gartersnake

Thamnophis butleri

in Canada

2024

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Current classification (NatureServe 2023b):

Class: Reptilia

Order: Squamata

Family: Colubridae

Genus: *Thamnophis*

Species: *Thamnophis butleri* (Cope 1889)

Subspecies in Canada: n/a

Taxonomic changes since previous report (for reassessments): n/a

Common names (NatureServe 2023b):

English: Butler's Gartersnake

French: Couleuvre à petite tête

Indigenous: Unknown

Synonyms and notes:

Butler's Gartersnake (couleuvre à petite tête, *Thamnophis butleri*) was first described as a distinct species by E.D. Cope (1889) and named in honour of the early Indiana naturalist Amos Butler (Cope 1889; Conant and Collins 1991). Subsequently, Boulenger (1893) considered it to be a variety of the Eastern Gartersnake, *Thamnophis sirtalis*. Cope (1900) restored it to a full species as *Eutaenia butlerii*, and Ruthven (1908) used *Thamnophis* as the genus. Smith (1949) reduced it to a subspecies of the Plains Gartersnake (*Thamnophis radix*), but Conant (1950) restored it to full species status. No subspecies of Butler's Gartersnake are recognized.

Butler's Gartersnake is closely related to two other North American *Thamnophis* spp.: the Plains Gartersnake and the Short-headed Gartersnake (*T. brachystoma*) (de Queiroz *et al.* 2002). Butler's Gartersnake is located in the geographic centre of the region where the three species are found, and together these species form an east-to-west cline of increasing range size, body size, dorsal spotting, vividness of dorsal stripes, scale numbers, and relative head size (Ruthven 1908; Smith 1945, 1949; Conant 1950; Conant and Collins 1991; Rossman *et al.* 1996). Some of these trends are also expressed within populations of Plains Gartersnake and Butler's Gartersnake (Ruthven 1904, 1908; Davis 1932; Planck and Planck 1977; Noble *et al.* 2013).

Description of Wildlife Species

Butler's Gartersnake is a small, short-headed gartersnake with three yellowish stripes, which never exceeds 69 cm in total length (Wright and Wright 1957; Burghardt 1968; Conant and Collins 1991). The combined average for males and females of all ages is 25 and 29 cm in snout-vent length, and 13 and 24 g in weight, respectively (Shonfield *et al.* 2019). Neonates weigh as little as 4 g, whereas adult females can weigh as much as 82 g (Shonfield *et al.* 2019). The dorsal stripe may be yellow, white, or cream in colour. The two lateral stripes are generally centred on the third scale row up from the ventrum, spilling onto half of scale rows 2 and 4. All three stripes are clean with defined edges, and the lateral stripes are usually separated from the whitish underbelly by a broad chestnut-coloured band. The dorsum is black, brown, or olive brown and may have dark checkering (see Logier 1958 for detailed illustration).

Unique morphological variants of Butler's Gartersnake have been recorded in Ontario. These include melanism (Amherstburg: Catling and Freedman 1977), albinism (Windsor: Reid 1985), wide variations in dorsal scale counts (Windsor and Sarnia regions: Planck and Planck 1977), and dorsal or labial scale counts consistent with the Short-headed Gartersnake (Luther Marsh: Smith 1945; Schueler and Westell 1976; Planck and Planck 1977; Sandilands 1984; Oldham and Sutherland 1986; Harding 1997). Using seven microsatellite DNA loci, Noble *et al.* (2013) found no evidence that Short-headed Gartersnake occurred at Luther Marsh; rather, they concluded that the variation in scale counts observed in Butler's Gartersnake stemmed from the convergence of morphological traits in the two species. Two other *Thamnophis* spp. in Ontario are easily confused with Butler's Gartersnake: Eastern Gartersnake and Eastern Ribbonsnake (see Harding and Mifsud 2017 for a detailed comparison).

Designatable Units

In Canada there are no distinguishable subspecies or varieties (see **Name and Classification**) or subpopulations that meet the COSEWIC criteria for both *discreteness and evolutionary significance*; therefore, a single designatable unit is proposed.

Designatable Units (DUs):

Canadian population

Recognized subspecies or varieties in Canada:

n/a

Evidence for discreteness:

The Luther Marsh subpopulation appears discrete from other extant Canadian subpopulations. It is isolated from others by ~ 170 km with no contemporary gene flow (Snetsinger *et al.* 2022), is the only subpopulation within the Great Lakes / St. Lawrence faunal province, is characterized as a unique genetic subpopulation based on nuclear DNA (F_{ST} ranging from 0.17 to 0.24), and includes snakes with unique morphology (see **Description of Wildlife Species; Canadian Range; Population Structure**). Luther Marsh could therefore be considered a discrete unit based on heritable traits (criterion D1: unique genetics and morphology) and its historical geographic disjunction from the rest of the Canadian population (criterion D2).

Evidence for evolutionary significance:

Although there are fairly large differences in nuclear DNA among the snakes at Luther Marsh and those at other extant subpopulations, there is no variation in mitochondrial DNA (mtDNA) (see **Population Structure**). The differences in nuclear DNA, but not mtDNA, presumably arose from rapid post-glacial colonization of Ontario by Butler's Gartersnake, followed by habitat loss post-European settlement, resulting in impeded gene flow and isolation (Placyk *et al.* 2012; Noble *et al.* 2013; Snetsinger *et al.* 2022). There is no compelling evidence to suggest that the Luther Marsh subpopulation has been on its own independent evolutionary trajectory for an evolutionarily significant period; therefore criterion S1 is not met. Furthermore, there is no direct evidence that snakes at Luther Marsh have developed specific adaptive, heritable traits that are absent elsewhere in Ontario; therefore, criterion S2 is also not met.

Special Significance

In Ontario, the range of Butler's Gartersnake overlaps with that of two congeneric species: Eastern Gartersnake and Eastern Ribbonsnake (Cook 1984). This is the only area in Canada east of western Saskatchewan where three congeneric snakes occur in the same region (see Cook 1984; Conant and Collins 1991). The region's unique diversity is therefore of biological and conservation interest, particularly for investigations of ecological niche partitioning (Casbourn *et al.* 1976). Butler's Gartersnake is also part of a North American species complex that includes two other closely related species (*T. radix* and *T. brachystoma*; see **Name and Classification**). Studies of its population genetics, morphology, and phylogeography in Canada contribute to resolving evolutionary and biogeographic questions.

The Canadian population of Butler’s Gartersnake occupies approximately 16% of the global range of this geographically restricted species (see **Distribution**) and therefore represents a significant proportion of the global population (IUCN 2016). Also, unique morphological variants of Butler’s Gartersnake are found in Canada (see **Description of Wildlife Species**). As a result, the conservation of Canadian subpopulations of Butler’s Gartersnake contributes to the global persistence of this species and its phenotypic variability. As Butler’s Gartersnake is the dominant reptile species present at some urban sites (see **Biology and Habitat Use**), it provides a unique opportunity for city-dwelling Canadians, especially youth, to observe and become interested in native reptiles.

ABORIGINAL (INDIGENOUS) KNOWLEDGE

Aboriginal traditional knowledge (ATK) is relationship-based. It involves information on ecological relationships between humans and their environment, including characteristics of species, habitats, and locations. Laws and protocols for human relationships with the environment are passed on through teachings and stories, and Indigenous languages, and can be based on long-term observations. Place names provide information about harvesting areas, ecological processes, spiritual significance, or the products of harvest. ATK can identify life history characteristics of a species or distinct differences between similar species.

Cultural Significance to Indigenous Peoples

There is no species-specific ATK in the report. However, Butler’s Gartersnake is important to Indigenous Peoples who recognize the interrelationships of all species within the ecosystem.

DISTRIBUTION

Global Range

Butler’s Gartersnake is restricted globally to one bioregion in North America, with most of its range concentrated within a single ecoregion therein (Ricketts *et al.* 1999; Olson *et al.* 2001; Figure 1). Its occurrence was recently substantiated in southwestern Ontario (4 counties), southeastern Wisconsin (4 counties), northwestern Ohio (4 counties), and the Lower Peninsula of Michigan (17 counties) (iNaturalist 2023; MHA 2023; OHA 2023; WHA 2023). It historically occupied north-central Indiana (Smith and Minton 1957; Minton *et al.* 1982; IHA 2023), but its current distribution there is unclear (Harding and Mifsud 2017; iNaturalist 2023). The global range of this species is estimated at 20,000–200,000 km² and comprises 21–300 occurrences (NatureServe 2023b). Throughout its range, Butler’s Gartersnake has a very patchy area of occupancy, but is sometimes locally abundant (Conant 1951; Conant and Collins 1991; Rossman *et al.* 1996). The occupancy patterns of this species point to its historical association with a prairie corridor in the Great Lakes region during the Hypsithermal period, 5,000–7,000 years ago (Schmidt 1938; Smith 1957; Bleakney 1958).

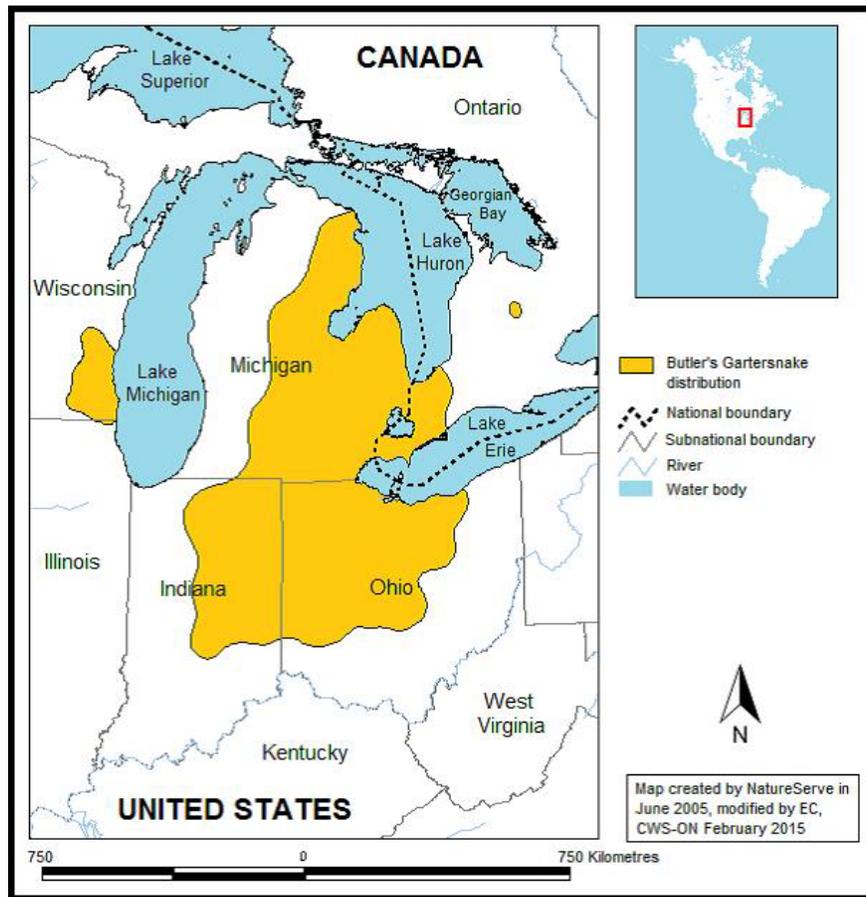


Figure 1. Approximate global distribution of Butler's Gartersnake (*Thamnophis butleri*), based on maximum historical range extent (from ECCC 2018a). Note that the current range of Butler's Gartersnake in all states/provinces is substantially smaller than depicted, particularly in Indiana and Ohio (see **Global Distribution**).

Canadian Range

The Canadian distribution of Butler's Gartersnake occupies an estimated 16% of its global range, based on broad-scale area of occupancy (NatureServe 2023b), and falls within the Carolinian and Great Lakes / St. Lawrence faunal provinces. The current Canadian range of Butler's Gartersnake is restricted to three geographically disjunct regions in southwestern Ontario: Windsor-Essex, Sarnia-Lambton, and Luther Marsh (Figure 2; see **Population Structure**). Separation distances between these regions range from ~ 55 to 175 km (straight-line distance). The Windsor-Essex region supports the largest abundance of Butler's Gartersnake in Canada. As part of this status assessment, the species is considered extirpated from Chatham-Kent and Middlesex County. Its ongoing presence at Walpole Island First Nation (WIFN) in Lambton County, where it was historically documented, is uncertain (Figure 2).

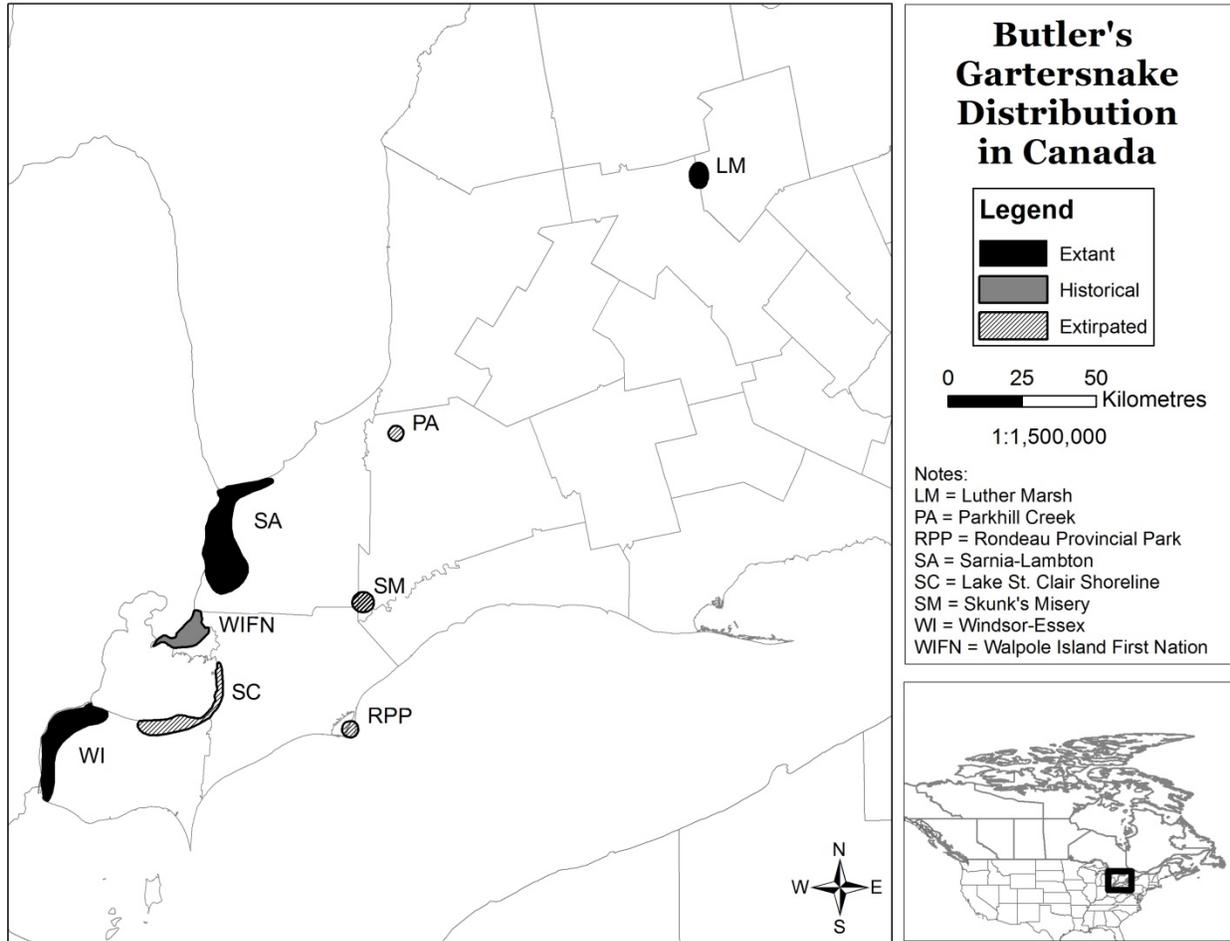


Figure 2. Distribution of Butler's Gartersnake (*Thamnophis butleri*) in Canada. Regions in solid black represent extant subpopulations (WI = Windsor-Essex, SA = Sarnia-Lambton, LM = Luther Marsh). As part of this status assessment, Butler's Gartersnake was considered extirpated from Parkhill Creek (PA), Rondeau Provincial Park (RPP), Skunk's Misery (SM), and sites along the Lake St. Clair shoreline (SC) (Appendix 2). This species may also be extirpated from Walpole Island First Nation (WIFN); however, it was classified as historical because its status there remains uncertain (Appendix 2). Coordinate system: NAD 83, UTM Zone 17N. Permission to reproduce granted by J. Choquette.

Range-wide surveys targeting Butler's Gartersnake were conducted in 1976 (Planck and Planck 1977) as part of the Ontario Herpetofaunal Survey which began in the mid-1980s (Oldham and Weller 2000), and again in 2009 by the authors of the 2010 status assessment (Appendix 1). Extensive targeted searches were previously conducted in areas outside of known sites (e.g., between Skunk's Misery and Sarnia-Lambton: Plank and Planck 1977; Oldham pers. comm. 2010), and searches were conducted at some historically occupied sites since the previous status assessment (Appendix 2). Purported recent observations from outside the current Canadian range were investigated as part of this status assessment, rejected based on inadequate evidence, and excluded from range estimates (Appendix 2).

Population Structure

The Canadian population of Butler's Gartersnake is represented by a single mitochondrial DNA (mtDNA) haplotype. Placyk *et al.* (2012) obtained complete ND2 mtDNA sequences (985 base pairs) for > 300 individuals from across the North American range of Butler's Gartersnake, including samples from Windsor-Essex, Sarnia-Lambton and Luther Marsh. Noble *et al.* (2013) analyzed genetic samples from 90 individuals from across the Canadian range of Butler's Gartersnake, and found that all individuals had the same mtDNA haplotype.

Within the Canadian population of Butler's Gartersnake, three geographically and genetically distinct groups (i.e., subpopulations) have been delineated based on two population genetic studies and the presence of geographic disjunctions. Noble *et al.* (2013) used seven microsatellite DNA loci from 112 Butler's Gartersnake samples from across Ontario and conducted two model-based assignment tests to identify population structure. Their results suggested that there were 4–5 genetically distinct clusters of Butler's Gartersnake: Luther Marsh, Sarnia-Lambton, and Windsor-Essex (which was itself composed of 2–3 clusters). The Luther Marsh cluster appeared quite distinct, whereas evidence was found for genetic admixture between the other clusters. Snetsinger *et al.* (2022) sampled 233 Butler's Gartersnakes from across Ontario and southern Michigan, and used 15 microsatellite DNA loci, two model-based assignment tests, and discriminant analysis of principal components to examine population structure. Their results suggested 4 distinct genetic clusters in Ontario with limited gene flow among them: Luther Marsh, Lambton County, and Essex County (composed of 2 clusters). The Luther Marsh cluster was highly distinct from the other three, having a pairwise F_{ST} ranging from 0.17 to 0.24. Despite the evidence for genetic substructure in Essex County, it is considered a single subpopulation in this report because of the small separation distances between recent observations therein (< 5 km) relative to the size of other gaps among extant subpopulations in Ontario (> 50 km). Additional subpopulations may have existed in the past based on separation distances from nearby sites (e.g., Skunk's Misery and Parkhill Creek), but these have since become extirpated (see **Fluctuations and Trends**, Appendix 2).

The three extant subpopulations are described below.

Windsor-Essex (City of Windsor and Essex County):

Extensive fieldwork targeting Butler's Gartersnake first occurred in this region in the late 1970s (Planck and Planck 1977; Freedman and Catling 1978) and its regional status was first assessed in the early 1980s (see Choquette and Jolin 2018). This subpopulation is represented by eight extant element occurrences (see Table 1 for details and a definition of element occurrence), all within 10 km of the Detroit River, and includes parts of the towns of Amherstburg, LaSalle, and Tecumseh, and the City of Windsor (see Appendix 1 for a list of sites). During range-wide surveys for Butler's Gartersnake in 2009 (see **Population Sizes and Trends**), relatively high densities of this species were observed at survey sites in

Windsor-Essex compared to other regions. There is evidence of additional genetic substructure within this subpopulation, presumably the result of dispersal barriers imposed by inhospitable habitat (Noble *et al.* 2013; Snetsinger *et al.* 2022). Individuals from southwest Windsor and LaSalle were distinct ($F_{ST} = 0.06$) from other Windsor-Essex snakes (Snetsinger *et al.* 2022). This subpopulation is found within the Carolinian faunal province and is isolated from the nearest extant subpopulation (Sarnia-Lambton) by ~ 55 km.

Table 1. Complete list of NHIC element occurrences of Butler’s Gartersnake (*Thamnophis butleri*) in Canada An element occurrence (EO) represents a group of individuals in a particular geographic area that are collectively separated from other EOs by 1–5 km, depending on landscape permeability. Each EO may be composed of one or more sites (a site is a non-standardized term for an area where snakes were observed). Historical EOs are not included within the boundaries of extant subpopulations due to separation distances > 10 km, absence of records for > 20 years, and because samples were not available for recent genetic studies. EO ranks are from the NHIC, except where noted. B = Good estimated viability, C = Fair estimated viability, CA = conservation area, D = Poor estimated viability, E = verified extant, H = historical, NHIC = Natural Heritage Information Centre.

| EO name | EO rank | Notes on rank |
|-------------------------------------|---------|---|
| <i>Windsor-Essex subpopulation</i> | | |
| Amherst Pointe | E | |
| Amherstburg vicinity | C | |
| Fighting Island | E | |
| North Windsor | E | |
| Ojibway Park vicinity | B | |
| Peche Island | E | |
| Tecumseh | E | |
| Windsor Airport vicinity | E | |
| <i>Sarnia-Lambton subpopulation</i> | | |
| Bear Creek | E | Current rank is H from 2009. Should be E based on records from 2011–2017. |
| Bright’s Grove area | E | |
| Canatara Park | E | |
| Clay Creek area | C | |
| Holt Line Bridge | E | |
| Point Edward | E | |
| Sarnia Vicinity | E | Current rank is H from 2010. Should be E based on records from 2013–2021. |
| <i>Luther Marsh subpopulation</i> | | |
| Luther Marsh | E | |
| <i>Historical</i> | | |
| Belle River vicinity | H | Rank updated from D to H in 2009. |
| Parkhill Creek | H | Current rank is D from 1998. Should be H since no records in > 20 years. |

| EO name | EO rank | Notes on rank |
|-----------------------------|---------|--|
| Seaway Island | H | Rank updated from D to H in 2011. Part of Walpole Island First Nation. |
| Skunk's Misery vicinity | H | Rank updated from C to H in 2011. |
| Tremblay Beach CA | H | Rank updated from D to H in 2009. |
| Walpole Island First Nation | H | Rank updated from B to H in 2011. |

Sarnia-Lambton (Lambton County):

Butler's Gartersnake was first reported here circa 1969 by Campbell (1971a) and later by Planck and Planck (1977). This subpopulation is represented by seven extant element occurrences (Table 1), all within 15 km of the St. Clair River and Lake Huron, and includes parts of St. Clair Township, City of Sarnia, Village of Point Edward, and Town of Plympton-Wyoming (see Appendix 1 for a list of sites). Some evidence suggests additional genetic substructure may exist in this subpopulation, but further analyses are required (Snetsinger 2017). Sarnia-Lambton is within the Carolinian faunal province and is isolated from the nearest extant subpopulation (Windsor-Essex) by ~ 55 km.

Luther Marsh (Dufferin and Wellington counties):

Butler's Gartersnake was first reported here in the mid-1970s by Schueler and Westell (1976). Subsequent surveys increased the number of known collection sites locally (Planck and Planck 1977; Coulson and Peluch 1984; Oldham and Sutherland 1986; Sandilands 1988a; b; COSEWIC 2010). Predictions based on conditional occupancy models suggest this trend may continue with expanded search efforts (Paterson *et al.* 2021). Several specimens from this subpopulation are held at the Royal Ontario Museum (ROM) and the National Museums of Canada. The Luther Marsh subpopulation is represented by a single element occurrence (Table 1) within a managed marsh wetland complex ~ 45 km north of Guelph and is isolated from the nearest extant subpopulation (Sarnia-Lambton) by ~ 175 km. Luther Marsh snakes contained the smallest number of mean alleles per locus (Snetsinger *et al.* 2022), suggesting they had relatively low genetic variation compared to snakes from the other two extant subpopulations. Luther Marsh is situated within the Great Lakes / St. Lawrence faunal province.

Extent of Occurrence and Area of Occupancy

Most Butler's Gartersnake observation records were retrieved from the Natural Heritage Information Centre (NHIC) database in August 2022, and these were supplemented with data from the Global Biodiversity Information Facility and ROM databases as well as targeted solicitations from individual observers (e.g., through iNaturalist). Database records were assumed to be vetted for accuracy. Data were sorted by date and a 20-year timeframe was used for recent records (2002–2021; although a couple of records from 2022 were available and included in this dataset). Only records with a geographic location accuracy of ~ 2,000 m or less were used, and efforts were made to resolve low accuracy records via solicitation of additional information. Observation

coordinates were converted to UTM format as needed using Google Earth Pro (v. 7.3), and all records were mapped in ArcGIS (v. 9.2). Records lacking observation dates, site names/descriptions, and coordinates were removed. Duplicate records were removed opportunistically. In total, 4,704 recent observation records were used to estimate the current EOO. The current EOO estimate excluded all historical observation records, except historical records from WIFN, where the status of Butler's Gartersnake is uncertain (Appendix 2).

Observations were considered historical (COSEWIC 2021) if they were recorded prior to 2002. Historical records were scrutinized as above; however, low accuracy records were retained when needed to ensure representation of historically occupied sites. In total, 162 records were used to estimate historical range. Outside of extant subpopulation boundaries (see **Population Structure**), Butler's Gartersnake was considered extirpated from sites represented only by historical records when recent search effort was deemed adequate and failed to detect the species (NatureServe 2023a; Appendix 2). The species was not considered extirpated from historical sites when suitable habitat remained and when some searches occurred without detection, as these were not thorough enough to presume extirpation with a high level of confidence (NatureServe 2023a; Appendix 2).

Current EOO:

The estimated extent of occurrence (EOO) in Canada is 7,025 km² (Figure 3), based on a minimum convex polygon that encompasses all verified records from 2002–2021 (as described above). Note that the EOO estimate includes WIFN (considered historical: Appendix 2).

Current IAO:

The estimated index area of occupancy (IAO) in Canada is 288 km² (Figure 3), calculated using a 2 x 2 km grid drawn over all verified records from 2002–2021 (as described above). At Luther Marsh, two IAO squares containing only historical records were included in the estimate because, based on satellite imagery, they still contain suitable habitat.

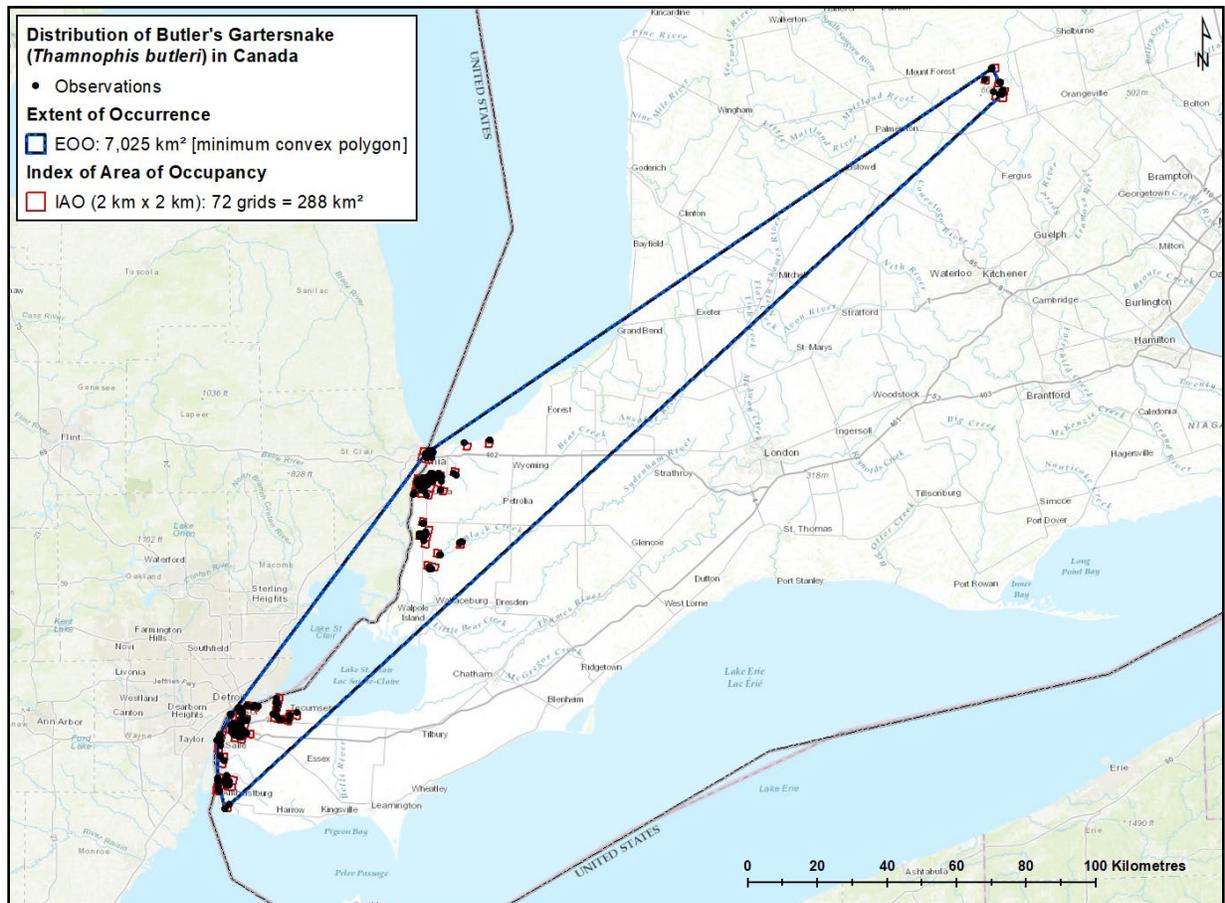


Figure 3. Current extent of occurrence (EOO) and index area of occupancy (IAO) of Butler's Gartersnake (*Thamnophis butleri*) in Canada. Extant subpopulations are in Windsor-Essex (WI), Sarnia-Lambton (SA), and Luther Marsh (LM). Butler's Gartersnake may be extirpated from Walpole Island First Nation (WIFN); however, it was classified as historical and included in the IAO estimate because its status there remains uncertain (see Appendix 2). Coordinate system: NAD 83, UTM Zone 17N. Map produced by COSEWIC Secretariat (Amit Saini).

Fluctuations and Trends in Distribution

The extent of occurrence (EOO) of Butler's Gartersnake in Canada was estimated as 10,248 km² in the 2010 status report; at that time, the Skunk's Misery and Lake St. Clair shoreline sites were included in the EOO estimate (the relevant element occurrences were still considered extant [rank C or D] by NHIC). The current EOO is 3,223 km² (31%) smaller than the previous estimate due to the exclusion of the Skunk's Misery and Lake St. Clair shoreline sites. Despite targeted searches, Butler's Gartersnake is now considered extirpated from these sites because the species has not been detected there since the mid-to-late 1980s (relevant element occurrences now classified as historical by NHIC; Appendix 2).

The index of area of occupancy (IAO) of Butler's Gartersnake in Canada was estimated in the 2010 status report as 360 km² (90 IAO squares) and included the WIFN, Skunk's Misery, Lake St. Clair shoreline, and Parkhill Creek sites. Butler's Gartersnake is now considered extirpated at all of these sites except WIFN (Appendix 2), which collectively represent a 72 km² reduction in the IAO (18 squares). Although no changes have been documented in the IAO at Luther Marsh since the 2010 status report, in both the Windsor-Essex and Sarnia-Lambton subpopulations, Butler's Gartersnake has been found in new IAO squares and is considered extirpated from others. Because of differences in estimation methods, as well as new knowledge regarding the species' distribution, a direct comparison between the 2010 report and the current IAO estimate is not very informative.

To address this issue, IAO maps from the 2010 status report and the current assessment were directly compared at the subpopulation level, using the same method as in the 2010 report (i.e., the size of each occupied IAO square was standardized to 4 km² regardless of the location of the international border). Currently, Butler's Gartersnake is considered extirpated from 14 historical IAO squares that had been included in the IAO estimate from the 2010 status report (8 squares in Windsor-Essex and 6 squares in Sarnia-Lambton). However, 26 new IAO squares where the species was recently observed, but which were not included in the previously reported IAO estimate, have been added since 2010 (7 squares in Windsor-Essex and 19 squares in Sarnia-Lambton). Due to the heavily modified nature of the landscape and the preponderance of dispersal barriers in the Windsor and Sarnia regions, the new squares likely reflect increased knowledge about Butler's Gartersnake distribution resulting from expanded search effort rather than range expansions. By the same logic, and because recent search effort has been relatively high in the Windsor and Sarnia areas, in these areas Butler's Gartersnake is considered extirpated from squares with historical observations only. The IAO estimate in the 2010 status report was thus readjusted from 90 to 116 IAO squares (464 km²) to account for the 26 squares where Butler's Gartersnake was likely present historically (but missed during the 2010 status assessment).

Thus, Butler's Gartersnake has been extirpated from 26 historical IAO squares (14 Windsor-Essex and Sarnia-Lambton squares and all of the Skunk's Misery, Lake St. Clair shoreline, and Parkhill Creek squares). The current IAO estimate for Butler's Gartersnake in Canada is 22% smaller ($[26/116]*100$) than the adjusted estimate provided in the 2010 status assessment. However, if Butler's Gartersnake is in fact extirpated from WIFN (see Appendix 2), then the current IAO could be as much as 34% ($[39/116]*100$) smaller than the previous estimate.

BIOLOGY AND HABITAT USE

Life Cycle and Reproduction

Butler's Gartersnake generally emerges from hibernation in late March to late April (Conant 1951; Wright and Wright 1957) and begins hibernating again in late September to mid-October (AECOM 2009; Shonfield *et al.* 2019). The activity period at Luther Marsh, which is the northernmost subpopulation, may be shorter than in the Windsor-Essex or Sarnia-Lambton regions. Mating occurs in early spring (April) and 8–12 young are born in early to mid-July (Logier 1939; Freedman and Catling 1978; Shonfield *et al.* 2019). There are three recognized distinct age classes: neonates (recently born and prior to 1st hibernation), yearlings (after 1st hibernation but prior to 2nd hibernation), and adults (after 2nd hibernation) (Hileman 2014; Shonfield *et al.* 2019). Apparent annual survival in Wisconsin for a combined group of yearlings and adults was estimated at 0.42–0.54 (Hileman 2014). A long-term study in Windsor found no snakes over 3 years old (LGL 2010), but longevity in captivity can be as high as 10–14 years (Crowe 2012). Generation time (IUCN 2010) for Butler's Gartersnake is approximately 4 years (age at maturity + [1/ annual adult mortality rate] = 2 + [1/0.54] = 3.9).

Habitat Requirements

Butler's Gartersnake habitat consists mainly of open meadow, old field, tallgrass prairie, thicket and savannah habitat, with nearby drainage swales, ephemeral wetlands, or other small bodies of water (Logier 1939; Planck and Planck 1977; Conant and Collins 1991; DRIC 2008). When open-canopy habitat succeeds to closed-canopy forest, it becomes unsuitable for this species. In the Windsor-Essex and Sarnia-Lambton regions, Butler's Gartersnake also occurs in naturalized urban parks and industrial or commercial sites (Appendix 1). Recent studies have described detailed habitat use, including gestation and birthing habitat, and the use of habitat dominated by invasive grasses, near Milwaukee, Wisconsin, and in the Windsor-Essex and Sarnia-Lambton regions (AECOM 2009; Kapfer *et al.* 2013a; AECOM 2019; Shonfield *et al.* 2019). Females use open-canopy habitat for gestation, and move to lowland wet areas with greater canopy cover to give birth (Shonfield *et al.* 2019). A description of Critical Habitat, including hibernacula and corridor habitat, has been completed (ECCC 2018a).

Butler's Gartersnake shows a preference for areas with a dense cover of grasses or herbaceous vegetation, and a thick layer of thatch, for foraging and basking, regardless of the dominant plant community. As a result, this species will inhabit native tallgrass prairies, as well as meadows dominated by non-native grasses and forbs (Shonfield *et al.* 2019). For example, at Luther Marsh, it was commonly found in areas dominated by Smooth Brome (*Bromus inermis*) (COSEWIC 2001). Also, in Windsor-Essex and Sarnia-Lambton, Butler's Gartersnake was abundant in sites dominated by unmowed, non-native grasses (Ecologistics Ltd. 1976; Kamstra pers. comm. 2009).

From late fall to early spring, Butler's Gartersnake requires suitable overwintering habitat. In the Windsor area, recorded hibernation sites include Digger Crayfish (*Creaserinus fodiens*) burrows, small mammal burrows, spaces under log piles, and other underground sites (ECCC 2018a). In Michigan, Butler's Gartersnakes hibernated with other snakes in small mammal burrows, ant mounds, and crayfish burrows up to 68 cm deep (Carpenter 1953). In Wisconsin, Butler's Gartersnake overwintered in structures such as old building foundations, sinkholes, and improperly capped landfills (ECCC 2018a). In Ohio, Butler's Gartersnake was found hibernating in rocky dikes along the Lake Erie shoreline with Eastern Gartersnake, Northern Watersnake (*Nerodia sipedon*), and Eastern Foxsnake (*Pantherophis gloydi*) (Rossman *et al.* 1996). Suitable overwintering sites are generally limited across the landscape (e.g., in wetlands, wet meadows, and drainage ditches), requiring seasonal movements in spring and fall (Shonfield *et al.* 2019).

Movements, Migration, and Dispersal

All mark-recapture studies to date indicate that Butler's Gartersnake exhibits limited movements. In Amherstburg, Freedman and Catling (1979) found that 88% (n = 24) of recaptures occurred within 90 m of their initial capture sites, and of these, 46% were found within 0–10 m. In southern Michigan, this species has a recorded maximum distance of 305 m and has an estimated activity range of 0.8 ha (Carpenter 1952; Oliver 1955). In Sarnia, 77% of 30 recaptured snakes moved ≤ 300 m, and some were repeatedly encountered under the same cover object (AECOM 2009).

Butler's Gartersnake was often found actively moving during the spring egress and mating season, whereas in the summer this species was seldom seen on the move and found almost exclusively singly or in small groups sheltering under debris or cover objects (COSEWIC 2010). Butler's Gartersnakes will shelter and forage under rocks, concrete, plywood, roofing shingles, metal tins, and rubber (Planck and Planck 1977; Catling and Freedman 1980b; Sandilands 1988b; Johnson 1989). Logier (1939a) found that, in the summer, Butler's Gartersnake was more active in the evenings, whereas in Sarnia, Butler's Gartersnake was found mostly under cover, regardless of season or time of day (Kamstra pers. comm. 2009). In a multi-year mark-recapture study in Windsor using artificial cover objects that marked 3,840 snakes from 2011 to 2020, two periods of elevated activity were observed in each year: spring to early summer, and again in late summer (Wood 2020).

Although most individuals in a subpopulation are relatively sedentary, a small percentage of snakes are transient. At a site in Amherstburg, 82% of marked snakes in the upland area (n = 14) did not emigrate during the dry midsummer months, whereas 12% of recaptured individuals (n = 3) had dispersed between 160 m and 515 m to lower, wetter areas (Freedman and Catling 1979). At a site near Sarnia, one snake was recaptured 1,200 m from where it was marked, which was a clear outlier compared to all other recaptured snakes (Kamstra pers. comm. 2009). Such transient behaviour may occur in response to dry summer conditions and a lack of available food, birthing, or aestivation sites.

Dispersal events by transient individuals may result in the colonization of unoccupied and nearby habitat patches, and the maintenance of genetic connectivity (see **Rescue Effect**). This process would explain colonizations of islands and former industrial areas, some of which would have necessitated dispersal across inhospitable habitat, including open water and roads (see **Physiological, Behavioural, and Other Adaptations**). Butler's Gartersnake occupies numerous islands in the Detroit River (Appendix 1), some of which are artificial (Leverette 1976), suggesting that this species is capable of traversing open water to colonize new habitat. Individuals were observed in the Detroit River swimming across open water in 2006 and in floating debris in 2010 (Jones pers. comm. 2009; Preney pers. comm. 2010). Also, Butler's Gartersnake has colonized former industrial lands, including naturalized areas that were previously considered inhospitable. For example, one colonized site in Windsor-Essex was used for disposal of industrial chemicals (Leverette 1976) and another in Sarnia-Lambton was used for stockpiling of aggregates (Kamstra pers. comm. 2010) (Appendix 1).

Interspecific Interactions

Diet:

Butler's Gartersnake is a facultative vermivore, feeding predominantly on earthworms (Casbourn *et al.* 1976; Gray 2010). Reynolds (1977) examined the gut contents of Butler's Gartersnake collected in Essex and Lambton counties, and identified three species of earthworm, *Allolobophora chlorotica* (Green Worm), *Aporrectodea tuberculata* (Canadian Worm), and *Lumbricus terrestris* (Common Earthworm), all of them exotic species. When extracts from worms, amphibians, fish, leeches, slugs, and mice were presented to neonate Butler's Gartersnake, earthworms elicited the highest tongue flicking scores, suggesting that the snakes prefer earthworms as prey (Burghardt 1968). Butler's Gartersnake does occasionally feed on leeches, small frogs, insects, mice, salamanders, and fish; however, these are minor prey items (Ruthven *et al.* 1912; Conant 1951; Carpenter 1952; Oliver 1955; Wright and Wright 1957; Casbourn *et al.* 1976; Catling and Freedman 1980a; Rossman *et al.* 1996).

Predators and competitors:

Predators of Butler's Gartersnake may vary, but are likely similar to those of other *Thamnophis* spp. These may include mice, voles, shrews, crows, hawks, owls, raccoons, skunks, foxes, weasels, dogs, cats, and other snake species (Harding 1997). During range-wide surveys conducted in 2009 by Choquette and Noble (pers. obs. 2009), numerous individuals were found with extensive scarring and/or portions of the tail missing, suggesting frequent predation attempts. Butler's Gartersnake will rarely strike or bite when handled, but will often defecate when handled, which may function as an anti-predator response.

Host/parasite/disease interactions:

In a study of snake fungal disease in Canada, *Ophidiomyces ophiodiicola* was suspected to have infected 7% (1/15) of the Butler's Gartersnake individuals sampled (Davy *et al.* 2021). Infection with *O. ophiodiicola* was found to be relatively common in free-ranging Nearctic snakes, but the available data did not suggest that mortality rates were high or that infections were increasing over time (Davy *et al.* 2021). Still, future research is recommended in order to determine the potential impacts of *O. ophiodiicola* infection on snake fecundity and behaviour.

Other interactions:

Butler's Gartersnake will hybridize with *T. sirtalis* and Plains Gartersnake (*T. radix*) in the wild (Placyk *et al.* 2012; Kapfer *et al.* 2013b); however, hybridization events appear to be uncommon (1.5% of 411 *Thamnophis* spp. sampled in Wisconsin: Kapfer *et al.* 2013b). There appears to be a stable hybrid zone with *T. radix* in Wisconsin (Placyk *et al.* 2012).

Physiological, Behavioural, and Other Adaptations

Butler's Gartersnake density was found to correlate with earthworm density (Casbourn *et al.* 1976). The present reliance of Butler's Gartersnake on earthworms as a prey source, which is greater than for any other Canadian *Thamnophis* spp., is of interest because most earthworm species currently found in Ontario are exotic, originating primarily from Eurasia (Reynolds 1977; *but see* Gray 2010 for a detailed review of Butler's Gartersnake distribution in relation to native and exotic earthworms). Few native earthworms inhabited the northern regions of North America at the time of European colonization, and exotic earthworms were likely brought over in soil and plant roots by European settlers (Gray 2010). Presumably, Butler's Gartersnake in Canada had a different diet before European settlement, likely consisting of leeches, lungless salamanders, or small frogs, and then a shift to earthworms occurred within the last 500 years (Catling and Freedman 1980b; Gray 2010).

Butler's Gartersnake can colonize, persist, and achieve sizeable numbers at sites that have become naturalized following intensive disturbance, to the point where it can become the locally dominant snake species. This is especially true at sites in developed landscapes and may be partly due to the complete dietary reliance of Butler's Gartersnake on earthworms, which are ubiquitous even in urban disturbed soils. At a highly disturbed site in the Sarnia-Lambton area, a 2008–2009 study yielded ~500 Butler's Gartersnake observations, but only a single *T. sirtalis* observation and no recorded observations of other snake species (AECOM 2009). Moreover, Butler's Gartersnake was the only snake (22 individuals) found along three separate rail corridors in Windsor after 18 person-hours of searching (Choquette pers. obs. 2009). On an artificial island in the Detroit River, seven Butler's Gartersnake but only one *T. sirtalis* and one *Storeria dekayi* were found in 6.75 person-hours during surveys conducted in 2009 by Choquette and Noble (pers. obs. 2009). At another island in the Detroit River, which was used as an industrial waste site and is being restored, 17 Butler's Gartersnakes were captured and 10 more were seen during a

15-minute search; this site appeared to support the greatest density of Butler's Gartersnake observed during the 2009 surveys by Choquette and Noble (pers. obs. 2009). Butler's Gartersnake may therefore play an important ecological role as a primary colonizer and as a locally abundant reptilian mesopredator at newly restored or naturalized sites, providing a readily available prey base that might otherwise be lacking for mammals and birds.

Limiting Factors

Limiting factors are generally not human-induced and include intrinsic characteristics that make the species less likely to respond to conservation efforts. Limiting factors may become threats if they result in population decline. The main limiting factors for Butler's Gartersnake are its generally low vagility (ability to move and migrate), which can result in snakes becoming isolated within fragmented habitat patches (see **Movements, Migration and Dispersal**), and its reliance on specific habitat features to survive the winter (see **Habitat Requirements**). Due to these limiting factors, small-scale site-level disturbances at any time of year (e.g., land clearing for development) can have immediate and devastating consequences for the snakes occupying a distinct location (see **Fluctuations and Trends; Number of Threat Locations**).

POPULATION SIZES AND TRENDS

Data Sources, Methodologies, and Uncertainties

In 2009, Choquette and Noble (pers. obs. 2009) conducted extensive visual encounter surveys for Butler's Gartersnake across its Canadian range to assess occupancy and availability of habitat at historical sites (Appendix 1). A total of 319 person-hours of search effort was invested (including placement of artificial cover objects at three sites), resulting in 185 Butler's Gartersnake observations. Results were compared to those from historical surveys (Planck and Planck 1977; Oldham and Weller 2000) to infer trends in number of sites occupied. The first range-wide survey for Butler's Gartersnake in Ontario occurred in 1976 and yielded a total of 405 observations with a search effort of 878 person-hours (visual encounter surveys and cover objects placed at four sites; Planck and Planck 1977).

The five sites with the greatest search effort (in person-hours) during the 2009 surveys were: 1) Luther Marsh (61.1 h; 29 Butler's Gartersnake); 2) Point Edward Marina (18.4 h; 25 Butler's Gartersnake); 3) Windsor Airport (16.5 h; 0 Butler's Gartersnake); 4) Tremblay Beach (12.0 h; 0 Butler's Gartersnake); and 5) Skunk's Misery (8.5 h; 0 Butler's Gartersnake). For the 20 sites where Butler's Gartersnake was detected using visual encounter surveys, the median amount of search effort invested per snake detection was 1.3 person-hours (range = 0.2–22.2).

During the 1976 surveys, the five sites with the greatest search effort were Devonwood Conservation Area (123.0 h; 39 Butler's Gartersnake), Ojibway Prairie (102.0 h; 23 Butler's Gartersnake), Spring Garden (72.5 h; 15 Butler's Gartersnake), Windsor Airport (50.0 h; 10 Butler's Gartersnake), and Pike Creek (42.5 h; 0 *T. butleri*). For

the 17 sites where Butler's Gartersnake was detected using visual encounter surveys, the median amount of search effort invested per snake detection was 4.5 person-hours (range = 0.3–29.0). Surveys were also conducted by multiple individuals across multiple sites as part of the Ontario Herpetofaunal Survey beginning in the mid-1980s, but details on search effort are unavailable (Oldham and Weller 2000). Finally, results from recent targeted occupancy surveys were used in the reassessment of historical sites (e.g., Choquette and Barden 2020; Appendix 1, 2).

From 2008–2014, four sites in the Windsor and Sarnia areas were subjected to intensive multi-year mark-recapture studies as part of pre-construction mitigation work for transportation and residential development projects (AECOM 2009, 2019; LGL 2010; LGL and URS 2010; Kamstra pers. comm. 2022). Abundance estimates from these projects were used to calculate an average snake density and average number of snakes per site, which were then extrapolated across the current Butler's Gartersnake range (see **Abundance**).

As part of a highway expansion project in the Windsor-Essex region (the Rt. Hon. Herb Gray Parkway), and to fulfill requirements of the *Endangered Species Act, 2007*, construction and post-construction Butler's Gartersnake population monitoring occurred from 2011 to 2020 (Wood 2020). Construction activities and vegetation clearing occurred in fall 2011. The monitoring program evolved through project phases (e.g., pre-construction, construction and post-construction). Several types of monitoring were implemented (e.g., baseline, implementation, effectiveness and compliance monitoring) and data were gathered using targeted salvage, artificial cover object (ACO), visual encounter, and radio telemetry surveys. In total, 3,840 Butler's Gartersnakes were marked (scale-clipped or PIT tagged) within the study area from 2011 to 2020, and an additional 335 juveniles were captured but not marked (Wood 2020). Despite the various survey methods used, abundance was estimated using only data obtained from consistent search efforts to avoid violating population model assumptions. Analyses were conducted in program MARK using only ACO data from baseline areas surveyed approximately weekly throughout the study period, across all years. Although the exact size of the overall study area, including the baseline areas used in abundance estimates, was not available, annual abundance estimates were used to provide additional evidence of a past decline in the number of mature individuals.

Abundance

Abundance estimates were completed at four study sites in the Windsor-Essex and Sarnia-Lambton subpopulations from 2008 to 2014 (Appendix 3). The average size of study sites was 9.3 ha (range = 3.7–13.5 ha), and each was situated within a unique IAO square. Combined abundance for the four sites was 822 adults, and average density was 23 adult snakes/ha (range = 10–36). Limited survey effort at Luther Marsh suggested adult density there was at least within the range reported for the four sites above (Appendix 3). Assuming that each 2 x 2 km IAO grid square (i.e., 4 km²) supports at least one average-sized Butler's Gartersnake site with an average adult density (i.e., 214 adults), then abundance in each subpopulation was approximated as follows: 1) Windsor-Essex (141 km²) = 7,544

adults, 2) Sarnia-Lambton (105 km²) = 5,618 adults, 3) Luther Marsh (36 km²) = 1,926 adults. Given the uncertainty around the status of Butler's Gartersnake at WIFN, abundance was not estimated for that site. The estimated abundances of each extant subpopulation were summed for a total Canadian population size of ~ 15,088 adults. Given the range in adult densities that was reported above, there is considerable uncertainty around the population size estimate (i.e., 6,557–23,603 adults).

Fluctuations and Trends

Most individual sites, except one, have been too poorly studied to provide reliable trend estimates of abundance. Despite this shortcoming, changes in the number of historically occupied sites and IAO squares have provided some insight into trends in the number of mature individuals (assuming the number of mature individuals has declined in proportion to the number of occupied sites or IAO squares). Results of targeted and incidental surveys indicate a recent decline of ~ 29% in the number of historically occupied sites in Windsor-Essex and Sarnia-Lambton since the last status assessment (2010). There was no evidence of decline at Luther Marsh. Range-wide, the estimated number of occupied IAO squares has declined by 20–34% since the 2010 assessment. Also, the number of extant Butler's Gartersnake subpopulations in Canada is 40% smaller than the number considered extant in the 2010 status assessment.

Continuing decline¹ in number of mature individuals:

There is an inferred, continuing decline in the number of mature individuals, given that the species is considered extirpated from historical sites and IAO squares as part of this status assessment (see below). A decline in IAO squares and historical sites is assumed to be equivalent to a decline in the number of mature individuals. This change is the result of a population decline, as opposed to a natural population fluctuation, because the species is unable to recolonize isolated sites that are a considerable distance from where it has become extirpated (see **Movement, Migration and Dispersal; Rescue Effect**).

Evidence for past decline (3 generations = 12 years) that is continuing:

Range-wide, the estimated number of occupied IAO squares has declined by 20–34% since the previous assessment (see **Fluctuations and Trends in Distribution**). The range of estimates reflects the uncertainty around the ongoing status of the species at WIFN. A decline in IAO squares is assumed to be equivalent to a decline in the number of mature individuals.

¹ A recent, current, or projected future decline (which may be smooth, irregular or sporadic), which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines.

Furthermore, at one site in the Windsor-Essex region where a multi-year mark-recapture study was conducted from 2011–2020, a > 55% decline in abundance of mature individuals is inferred following highway construction activities. A peak abundance of ~ 1,200 (95% CI ~ 1175–1325) subadults/adults was estimated in the study area in 2011 (Wood 2020). Construction activities occurred in Fall of 2011. The following year, 2012, the abundance estimate declined to ~ 400 (95% CI ~ 390–420) subadults/adults, and then fluctuated annually thereafter between ~ 400 to 800 subadults/adults (Wood 2020). The average annual abundance estimate for the 2012 to 2020 period was ~ 535 subadults/adults (i.e., 44.6% lower than the 2011 estimate).

Evidence for projected or suspected future decline (next 3 generations = 12 years):

Suspected at the rate of between 3% and 30% (see **Threats**).

Extinction risk based on quantitative analysis:

A population viability analysis (PVA) for the Canadian population has not been completed.

Long-term trends:

The 1976 survey by Planck and Planck (1977) identified 18 sites occupied by Butler's Gartersnake in the Windsor-Essex and Sarnia-Lambton subpopulations. The species was reported from an additional 13 sites in the 1980s, for a total of 31 historical sites (Appendix 1). The 2009 survey by Choquette and Noble (pers. obs. 2009) confirmed or presumed that Butler's Gartersnake was still present at or near 24 of the historical sites (including 4 sites that were not surveyed) but could not be found at or was considered extirpated from seven of the sites (Appendix 1). For example, the colony at Windsor Airport appeared to be the largest in Ontario in the late 1970s (Ecologistics Limited 1976; Planck and Planck 1977); yet, by 2009, it had become extirpated due to land clearing for expanding airport operations. The six other sites had been impacted by residential or a combination of residential and commercial development. The loss of the species from seven out of 31 historical sites represents a ~ 23% decline in occupied sites in the Windsor-Essex and Sarnia-Lambton subpopulations from 1976 to 2009 (33 years; 8.5 generations).

To assess potential changes in occupancy of Butler's Gartersnake since the 2009 surveys, evidence was compiled from standardized surveys (Choquette and Barden 2020; TGO 2022; Trowbridge pers. comm. 2023), a review of satellite imagery (see **Number of Threat Locations**), and the year of the most recent observation (Appendix 1). There was a high likelihood that Butler's Gartersnake had become extirpated from another seven of the original 31 historical sites, which represented a recent decline of ~ 29% (7/24) in the number of historically occupied sites since the last status assessment in 2010 (~ 12 years; 3 generations). Note, that this trend is based on the assumption that site extirpations occurred recently, however, the exact year of each of these events is unknown.

Population fluctuations, including extreme fluctuations:

A decline in the number of extant Butler's Gartersnake subpopulations is inferred given that the species is considered extirpated from Parkhill Creek and Skunk's Misery as part of this status assessment (Appendix 2), whereas the species was considered extant at those sites in the previous status assessment (COSEWIC 2010). Both sites are now considered historical element occurrences (Table 1), and both are separated from the nearest extant subpopulation by ~ 42 km. No snakes from these element occurrences were available to be included in recent genetic studies (see **Population Structure**), so their past genetic makeup is unknown. Given that both extirpated element occurrences were isolated from others by a similar distance as the extant subpopulations (42 km versus 55 km, respectively), it seems reasonable to assume that they once represented distinct subpopulations. Therefore, the number of extant Butler's Gartersnake subpopulations in Canada (3) is 40% smaller than the number considered extant in the previous status assessment (5). A decline in the number of subpopulations is assumed to be equivalent to a decline in the number of mature individuals. This reduction in number of mature individuals is due to population decline, not a fluctuation.

Severe Fragmentation

Butler's Gartersnake is not considered to be severely fragmented because most (> 50%) of the total area occupied (as a proxy for number of individuals) is not in habitat patches that are both (a) smaller than would be required to support a viable population and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse. This conclusion is based on the following: 1) The use of maps presented by Environment and Climate Change Canada (ECCC 2018a) showing Butler's Gartersnake's area of occupancy using 1 km² squares, 2) Results from a Butler's Gartersnake PVA in Wisconsin indicating that sites with less than 40–50 adult females (i.e., 80–100 adults) had a disproportionately high risk of extinction (Hyde *et al.* 2007), 3) The assumption that sites in Windsor-Essex and Sarnia-Lambton that consist of 1–3 adjacent and isolated clusters of 1 km² squares are smaller than would be required to support a viable population (i.e., abundance < 80–100 adults), and 4) that only 25% (i.e., 24 km²) of the total Butler's Gartersnake area of occupancy constitutes habitat patches that are both smaller than would be required to support a viable population, and are separated from other habitat patches by a distance larger than the species can be expected to disperse. This conclusion is different than the one presented in the 2010 status assessment, wherein the Windsor-Essex and Sarnia-Lambton regions were considered to represent a single subpopulation which was severely fragmented.

Rescue Effect

Butler's Gartersnake may be able to repopulate Ontario from Michigan, where the species is considered Apparently Secure. For example, Snetsinger *et al.* (2022) found that snakes from Wayne County, Michigan, Macomb County, Michigan, and adjacent Essex County, Ontario, formed a single genetic cluster. Similarly, snakes from St. Clair County, Michigan, and adjacent Lambton County, Ontario, also formed a single genetic cluster

(Snetsinger *et al.* 2022). Both examples indicate that snakes from the U.S. were interacting with adjacent Canadian subpopulations across the Detroit and St. Clair rivers, either via passive or active dispersal (Snetsinger *et al.* 2022; see **Movements, Migration and Dispersal**), which suggests that immigrants are adapted to survive in Canada. The St. Clair and Detroit rivers are ~ 260 m and 600 m wide, respectively, at their narrowest points (with shorter distances between the mainland and some islands). Most of the Canadian islands contain open vegetation communities suitable for Butler's Gartersnake (based on aerial imagery); thus, habitat would be available for immigrants. Little to no connectivity, however, was found between Detroit River shoreline sites and those further inland, possibly due to development and roads (Snetsinger *et al.* 2022). Furthermore, genetic fragmentation may be ongoing at sites near the Canada–U.S. border (e.g., Crystal Island in Windsor-Essex and Aamjiwnaang First Nation in Sarnia-Lambton), taking into account the evidence of additional substructure there (Snetsinger *et al.* 2022). Rescue effect might contribute to the recovery of declining Butler's Gartersnake sites on islands or along the Detroit and St. Clair rivers, but will probably not affect inland Butler's Gartersnake sites due to habitat fragmentation.

THREATS

Historical, Long-term, and Continuing Habitat Trends

The range of Butler's Gartersnake in Ontario coincides closely with the historical ranges of tallgrass prairie and savannah (Figure 2), which have declined in area by more than 97% compared with historical estimates (Bakowsky and Riley 1992; Bakowsky 1993; TGO 2009). The disjunct distribution of Butler's Gartersnake therefore suggests that it occupied a much wider range prior to extensive landscape modification following European settlement. Outside the areas occupied by extant subpopulations, habitat loss and degradation due to agriculture, recreational activities, and forest succession may have contributed to the extirpation of Butler's Gartersnake from as much as 81% (83/103 km²) of its historical IAO range (Appendix 2).

For example, at Walpole Island First Nation (WIFN), tallgrass prairie declined from 730 ha in 1972 to 470 ha in 1998 due to expansion of agriculture, housing, and forest succession (Crow *et al.* 2003; Bowles 2005); Butler's Gartersnake has not been reported from WIFN in more than 30 years (Appendix 2). At Rondeau Provincial Park, a ~ 3,250 ha complex of Carolinian forest, marsh, and shallow bay, extensive recreation-based disturbances in the middle of the 1900s presumably caused the extirpation of Butler's Gartersnake there (Woodliffe pers. comm. 2010; see Hecnar and Hecnar 2004 for documented reptile extirpations from a protected area). At Skunk's Misery, the open habitats, secondary forests, brush, and meadows of the 1930s (Logier 1939a) were largely replaced by a ~ 1,200 ha complex of mature forest (NCC 2009) surrounded by a matrix of intensive agriculture with a marked absence of open grassy habitat (Choquette and Noble pers. obs. 2009). Butler's Gartersnake has not been seen there in more than 30 years (Appendix 2).

At Luther Marsh, available open meadow habitat has increased since the acquisition of surrounding agricultural land by the Grand River Conservation Commission in the 1950s. The total area of existing or potentially suitable grassland habitat is ~ 225 ha, with additional expanses of open habitat types such as marsh, bog, fen, hedgerow, and shrubland (GRCA and OMNRF 2010; Zammit pers. comm. 2022). Many old farmhouse and barn foundations were left scattered throughout, creating numerous potential hibernation sites. Open habitat has been maintained and expanded through prescribed burns and farmland restoration (Bell pers. comm. 2009), and Butler's Gartersnake has been regularly observed there since the 1970s.

The Windsor-Essex and Sarnia-Lambton subpopulations represent the most extensive areas occupied by Butler's Gartersnake in Canada. Butler's Gartersnake habitat continues to be replaced or isolated by residential and commercial development, as evidenced by a past and recent decline in the number of occupied Butler's Gartersnake sites and available habitat (see **Fluctuations and Trends; Number of Threat Locations**). Also, three of the four sites where abundance was estimated (see **Abundance**) have recently been impacted by residential and highway development projects. Some relatively large occupied sites (i.e., those representing > 1 location; see **Number of Threat Based Locations**) continue to be threatened by recent and proposed developments, resulting in ongoing loss and isolation of habitat (e.g., South Cameron Woodlot and Spring Garden Natural Area).

Current and Projected Future Threats

Butler's Gartersnake is vulnerable to the cumulative effects of various threats, especially residential and commercial development, transportation and service corridors, and natural system modifications. The nature, scope, and severity of these threats are detailed in Appendix 4, following the IUCN-CMP (International Union for Conservation of Nature – Conservation Measures Partnership) unified threats classification system (see Salafsky *et al.* 2008 for definitions and Master *et al.* 2012 for guidelines). A threats calculator assessment was conducted by a panel of experts in July 2023. This process consisted of assessing impacts for each of the 11 main categories of threats and their subcategories, based on the scope (proportion of population exposed to the threat over the next 10-year period), severity (predicted population decline within the scope during the next three generations), and timing of each threat. The overall threat impact was calculated by considering the individual impacts of each threat category and was adjusted by species experts participating in the threats evaluation.

The overall threat impact for Butler's Gartersnake was medium, corresponding to an anticipated further decline of between 3% and 30% over the next 12 years. These values should be interpreted with caution, as they are based, in part, on subjective information, such as expert opinion, although efforts have been made to corroborate the scores with available studies and quantitative data.

The nature and extent of ongoing threats was determined with the assistance of a 2022 analysis of the *Species at Risk Act, 2002* (SARA) public registry (species-registry.canada.ca), the Environmental Registry of Ontario (ero.ontario.ca; ero.ontario.ca/archive/), and solicitation from various experts and public service employees. This process identified 80 projects impacting Butler's Gartersnake or its habitat that have occurred in the last 12 years (2010–2022): 53 requiring permits under the *Fish and Wildlife Conservation Act, 1997*, 12 requiring permits/amendments under the SARA, 12 requiring permits under the *Endangered Species Act, 2007*, and 3 other projects. At least 98 Butler's Gartersnake individuals were salvaged and translocated as a mandate of these projects, and at least 91 ha of habitat were impacted (these are certainly underestimates as data were not available for all projects). Impacts were categorized into the following threats:

- 50 Human Intrusions and Disturbance: 46 for scientific monitoring/research and 4 for accidental captures (14 in Sarnia-Lambton; 36 Windsor-Essex)
- 12 Residential and Commercial Development: 5 for commercial and industrial area development, 6 for housing and urban area development, and 1 for recreational trail development (3 Sarnia-Lambton, 9 Windsor-Essex)
- 12 Transportation and Service Corridors: 9 for pipeline excavation, maintenance, and construction, 1 for transmission line/tower maintenance, and 2 for overpass/highway construction (10 Sarnia-Lambton, 1 Windsor-Essex, 1 unknown)

Transportation and Service Corridors (IUCN 4)

The overall impact of this threat was medium. Relevant level two threats are as follows: roads and railroads (4.1) and utility and service lines (4.2). Butler's Gartersnake habitat is directly impacted during maintenance, excavation, and construction of pipelines, maintenance of hydro transmission lines and towers, and highway construction and maintenance (e.g., habitat is partially removed via linear mowing and excavation, and individuals are directly killed by mowers and heavy machinery). Butler's Gartersnake is particularly sensitive to these activities because it tends to congregate at high densities in the open grassy habitats associated with utility and transportation rights-of-way (Choquette unpub. data; Gould pers. comm. 2022). As of November 2022, there were at least two ongoing or proposed transportation and service corridor projects in Sarnia-Lambton (pipeline maintenance or construction), potentially impacting an estimated 4.8 ha of Butler's Gartersnake habitat in the near future (2 IAO grid squares affected). Outside of human settlement areas, transportation corridors (major roads and highways) will continue to affect Butler's Gartersnake in ways similar to roadways in settled areas (see IUCN 1, below). Not all rural sites, however, will be impacted (e.g., ~ 10 IAO grid squares overlaying Detroit River islands and a portion of Luther Marsh contain no roads).

Fragmentation of urban landscapes resulting from roads in Windsor-Essex and Sarnia-Lambton is also problematic. Although no detailed studies have investigated the population-level effects of roads on Butler's Gartersnake, road mortality has been observed or documented across this species' contemporary range in Canada (Campbell 1971a; Sandilands 1984; Oldham and Sutherland 1986; Choquette pers. obs. 2009; Nadhee pers.

comm. 2009; Schueler pers. comm. 2009; Choquette and Valliant 2016). Roadways separating habitats in urban areas may restrict snake movement via road aversion or may increase mortality due to road kills (Andrews and Gibbons 2005). Roadways will continue to isolate sites and exacerbate impacts on small populations (~ 28 IAO grid squares affected within densely settled areas). Several studies have found road mortality poses a significant threat to population viability or connectivity in snakes (Row *et al.* 2007, and references therein).

Residential and commercial development (IUCN 1)

The overall impact of this threat was low. Relevant level two threats are as follows: housing and urban areas (1.1), commercial and industrial areas (1.2), and tourism and recreation areas (1.3). Butler's Gartersnake habitat is completely removed via site grubbing, mowing, and excavation, and individuals are directly killed by heavy machinery. Urban development for housing and commercial areas has resulted in the documented loss of Butler's Gartersnake sites in Michigan and Ontario (Cox pers. comm. 2009; Appendix 1) and is a continuing threat to Butler's Gartersnake in Canada (Markham pers. comm. 2022). Harding (1997) noted that "it takes only a few minutes for a bulldozer to totally destroy a thriving colony" of Butler's Gartersnake. As of November 2022, there were at least eight proposed and five ongoing urban development projects (mostly housing) in Windsor-Essex and Sarnia-Lambton, potentially impacting an estimated 7.3 ha of Butler's Gartersnake habitat in the near future (~ 12 IAO grid squares affected, mostly in Windsor-Essex).

Although Butler's Gartersnake can persist and be abundant in some small habitat patches in urban landscapes (Harding 1997; Choquette pers. obs. 2009), such sites are subject to the effects of cumulative threats. The small amounts of available habitat in conjunction with collective impacts from housing, commercial and industrial development, isolation by roads, frequent mowing (IUCN 7.3), and dogs and cats (IUCN 8.1) increase extirpation risk at small urban sites and reduce the potential for recolonization of those sites. A PVA for Butler's Gartersnake in Wisconsin found that sites with less than 40–50 adult females have a disproportionately high risk of becoming extirpated (Hyde *et al.* 2007).

Natural System Modifications (IUCN 7)

The overall impact of this threat was low. The relevant level two threats are as follows: fire and fire suppression (7.1), and other ecosystem modifications (7.3). Natural succession is a threat to the persistence of Butler's Gartersnake as it results in the reduced availability of open-canopy habitat; therefore, active management is required to maintain vegetation communities suitable for this species (Kamstra and Smith pers. comms. 2023). For example, succession and lack of early successional habitat was blamed for the extirpation of Butler's Gartersnake from Skunk's Misery (see **Historical, Long-term, and Continuing Habitat Trends**). Despite also being isolated, Luther Marsh has maintained a population of Butler's Gartersnake, because prescribed fire and seasonal mowing are used to maintain open habitat there (Zammit pers. comm. 2023). Other problematic ecosystem modifications include frequent mowing in habitat during the active season, which causes direct mortality

(Markham pers. comm. 2023), and the lack of Common Reed (*Phragmites australis*) control, which leads to a decline in availability of open-canopy habitat, and possibly changes to hydrology and prey availability (Kamstra and Smith pers. comms. 2023).

Other Threats

Three threats were considered as part of the threats assessment and deemed to have a negligible impact: agriculture and aquaculture (IUCN 2.1), biological resource use (IUCN 5.1; but see IHA 2023), and human intrusions and disturbance (IUCN 6.1 and 6.3). Three other potential threats were deemed to have unknown impacts, and these require further study before appropriate threat levels can be assigned: invasive and other problematic species and genes (IUCN 8.1, and 8.2), pollution (IUCN 9.1, 9.2, and 9.3), and climate change and severe weather (IUCN 11.2, 11.3, and 11.4).

Number of Threat Locations

A threat-based location, as per the COSEWIC definition, is a geographically or ecologically distinct area in which a single threatening event can affect all individuals present, resulting in the elimination of, or severe reduction in a population within one generation (i.e., 4 years for Butler's Gartersnake), and the size of a location depends on the area covered by the threatening event. For the purposes of this status assessment, threatening events include the direct and indirect impacts of road construction and maintenance, and direct impacts of road mortality; the complete loss of habitat from residential and commercial development, impacts of natural systems modifications, and synergistic effects of all three categories of threats (see **Current and Projected Future Threats**).

With respect to the threat of transportation and service corridors, a location was defined as a subpopulation that experiences similar threat levels from transportation impacts (road construction, road maintenance, and road mortality). This was determined by considering road density and traffic levels, which vary among the 3 subpopulations: Windsor-Essex, Sarnia-Lambton, and Luther Marsh. In addition, genetic data from Snetsinger et al. (2020) identified limited gene flow between these 3 subpopulations, which could be a result of habitat loss, possibly exacerbated by high road densities. Therefore, the number of threat-based locations taking into account transportation and service corridors could be as low as 3, but it is unlikely that a single threatening event relating to transportation and service corridors could affect all individuals within one generation.

With respect to the threat of residential and commercial development, a location was defined as an area where a single development project can rapidly (e.g., within four years) eliminate or severely reduce the colony of snakes present in that area. To determine a reasonable size to use for the identification of locations, an analysis of satellite imagery was conducted to estimate the average area of Butler's Gartersnake habitat that was lost to a single threatening event (e.g., a residential development project). At least 30 distinct threatening events that impacted Butler's Gartersnake habitat were known to have occurred in the Windsor-Essex (n = 25) and Sarnia-Lambton (n = 5) regions between the

1980s and 2023. The area of available Butler's Gartersnake habitat was mapped using aerial imagery from before and after each threatening event in Google Earth Pro, and the area of lost or severely altered habitat was calculated. Butler's Gartersnake habitat was identified coarsely as the area of natural vegetation within the IAO range of the species that was undeveloped prior to the threatening event. The average size of each threatening event was 5.8 ha (range = 0.5–21.7 ha), and 20 of the 30 locations have been lost to development since the 2010 status assessment (representing 82.8 ha of land). The current number of threat-based locations was estimated to be 17 through the process outlined above combined with a review of the number of occupied sites (Appendix 1).

With respect to the threat of natural system modifications, a location was defined as a subpopulation that experiences similar threat levels from fire and fire suppression, and natural succession impacts. These processes are managed at the same level as the 3 subpopulations: Windsor-Essex, Sarnia-Lambton, and Luther Marsh. Succession and lack of early successional habitat was blamed for the extirpation of Butler's Gartersnake from Skunk's Misery; therefore, it is possible that a single threatening event involving natural system modifications could affect all individuals within one generation. Therefore, the number of threat-based locations linked to natural system modifications could be as low as 3, if these processes (e.g. fire and fire suppression, and maintenance of early successional habitat) are not actively managed.

Considering the synergistic impacts of transportation, development, and natural system modifications, the number of threat-based locations could be estimated as 3–17. It is likely that there are greater than five locations when the threat levels and likelihood of a single-threatening event are considered.

PROTECTION, STATUS, AND RECOVERY ACTIVITIES

Legal Protection and Status

Butler's Gartersnake is listed as Endangered under Schedule 1 of the federal *Species at Risk Act*, 2002. Under the general prohibitions of SARA, it is unlawful to kill, harm, harass, or capture individuals of this species or damage or destroy the species' Critical Habitat on federal lands. Butler's Gartersnake is also listed as Endangered under Ontario's *Endangered Species Act, 2007*, which provides legal protection to individuals and their habitat (see OMNRF 2018). Butler's Gartersnake is considered a Specially Protected Reptile (Schedule 9) under the Ontario *Fish and Wildlife Conservation Act, 1997*, which regulates hunting and trapping of this species.

Butler's Gartersnake is not listed under the U.S. *Endangered Species Act, 1973* (NatureServe 2023b), nor is it protected by state legislation in Ohio or Michigan. In Wisconsin, the status of this species was downlisted from Threatened to Special Concern in 2014, and its legal protection under state law was removed (WDNR 2022). Butler's Gartersnake is listed as State Endangered in Indiana and is therefore protected there under state law (IDNR 2023).

Non-Legal Status and Ranks

Butler's Gartersnake was listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada in 1999, as Threatened in 2001, and as Endangered in 2010 (COSEWIC 2001; COSEWIC 2010). In Canada, this species is listed as Imperilled (N2) nationally, and Vulnerable (S2) in Ontario (NatureServe 2023b). Provincially, Butler's Gartersnake was listed as Vulnerable by the Committee on the Status of Species at Risk in Ontario in 1999, elevated to Threatened in 2001, and elevated again to Endangered in 2011 (Oldham 2001; MECP 2023).

In the United States, Butler's Gartersnake is ranked Apparently Secure (N4) nationally, Critically Imperilled (S1) in Indiana, Vulnerable/Apparently Secure (S3/S4) in Wisconsin, Apparently Secure (S4) in Michigan, and unranked in Ohio (SNR) (NatureServe 2023b; only the Michigan range of Butler's Gartersnake directly borders the Ontario range). Globally, Butler's Gartersnake is Apparently Secure (G4: NatureServe 2023b) and is listed as Least Concern by the IUCN (Hammerson 2007).

Land Tenure and Ownership

Of the 16 extant Butler's Gartersnake element occurrences (Table 1), seven (44%) occur predominantly within protected areas (conservation areas, municipal natural environment parks, or provincial parks and wildlife management areas). No part of the Canadian range of Butler's Gartersnake occurs within a national park; however, the study area of the proposed national urban park in Windsor (as of June 2024) overlaps with portions of the current IAO squares.

Protection of Butler's Gartersnake habitat is proportionately highest at Luther Marsh, which is designated as a Provincial Wildlife Management Area (WMA), a Provincially Significant Wetland, a Life Science Area of Natural and Scientific Interest, and a Nationally Important Bird Area. Luther Marsh WMA covers 5,900 ha and is jointly owned and managed by the Grand River Conservation Authority and the Ontario Ministry of Natural Resources and Forestry (OMNRF). Maintenance of the open habitat preferred by Butler's Gartersnake is encouraged at Luther Marsh as part of waterfowl management efforts. The current IAO at Luther Marsh is 11% to 13% of the Canadian total. Luther Lake makes up a large part of the WMA (1,400 ha), and the management plan is largely concerned with creating habitat for ducks and other avian game species (GRCA 2007).

In the Sarnia-Lambton subpopulation, there are some noteworthy Butler's Gartersnake sites under public ownership. Bickford Oak Woods Conservation Reserve is a 314-ha site owned by the Ontario Ministry of the Environment, Conservation and Parks (MECP), but it consists predominantly of closed-canopy forest, swamp, and thicket. Canatara Park is a 48-ha park owned by the City of Sarnia, with portions maintained as a tallgrass prairie (AECOM 2019). The W. Darcy McKeough Conservation Area is owned and managed by the St. Clair Region Conservation Authority. The Aamjiwnaang First Nation supports a sizeable amount of Butler's Gartersnake habitat in close proximity to Sarnia. Butler's Gartersnake has been found along Highway 40 on lands owned by the Ontario Ministry of Transportation (Choquette and Noble pers. obs. 2009). The current IAO of the Sarnia-Lambton subpopulation represents 32% to 37% of the Canadian total.

The Windsor-Essex subpopulation covers the largest geographic area (current IAO is 42% to 50% of the Canadian total). Several protected sites with Butler's Gartersnake habitat exist in this region, such as the Ojibway Prairie Complex, which is owned and managed by the City of Windsor, Ministry of Natural Resources (MNR), and MECP. The St. Clair College Environmentally Significant Area (ESA), Gateway Kiwanis Riverside Park, and Peche Island are owned by the City of Windsor; LaSalle Woods ESA is owned by the Town of LaSalle; McAuliffe Woods Conservation Area is owned by the Essex Region Conservation Authority; and parts of Crystal Bay Island and Bois Blanc Island are owned by the Government of Canada.

Approximately 120 ha of land was purchased by the Ontario Ministry of Transportation to mitigate losses from the development of the Herb Gray Parkway (Highway 401) in Windsor. A national urban park (NUP) was proposed for the Ojibway Prairie Complex and Greater Park Ecosystem, which may increase the amount of public land in Windsor and LaSalle. The pre-feasibility phase of the NUP process was completed in 2022, the planning phase began in 2023, and designation may occur in 2025. An increase in the amount of land under public ownership/management, however, may not guarantee persistence of Butler's Gartersnake if suitable open habitat is allowed to succeed to mature forest, or if intensive recreation-based development or disturbance takes place (see **Threats**).

Recovery Activities

A federal recovery strategy for Butler's Gartersnake was completed by the Government of Canada in 2018, which provided detailed guidance on necessary recovery activities and identification of critical habitat (ECCC 2018a). Critical habitat was identified in 97-1 km² grid squares, spread across the three extant subpopulations as follows: 61-1 km² squares in Windsor-Essex, 28-1 km² squares in Sarnia-Lambton, and 8-1 km² squares in Luther Marsh (ECCC 2018a). The Province of Ontario adopted the federal recovery strategy for Butler's Gartersnake in 2019 (MECP 2019) and subsequently published a government response statement (GRS) for Butler's Gartersnake in 2020 (MECP 2020). The GRS outlined the government's recovery goal for the species and identified and prioritized actions deemed necessary to support its protection and recovery in Ontario. ECCC (2018a) summarized extensive mitigation efforts required as part of the Highway 401 extension in Windsor, as well as other recovery efforts targeting Butler's Gartersnake in Windsor and at

Aamjiwnaang First Nation near Sarnia. The Ontario Ministry of Natural Resources and Forestry (OMRNF, 2016) provided guidance for mitigating the effects of roads on amphibians and reptiles in Ontario, including Butler's Gartersnake. OMNRF (2018) provided guidance on habitat creation and enhancement activities for snakes, including birthing, basking, and gestation sites for Butler's Gartersnake. At the time of writing, organizations conducting mitigation, recovery, or restoration projects targeting or benefiting Butler's Gartersnake include the Grand River Conservation Authority (www.grandriver.ca), the Ojibway Nature Centre (www.ojibway.ca) and Wildlife Preservation Canada (www.wildlifepreservation.ca).

There are no ex situ populations maintained for conservation purposes in Canada or the USA (Winton *et al.* 2021), and the effectiveness of conservation translocations for reintroduction or population augmentation is unknown. Mitigation translocations are often conducted with Butler's Gartersnake in Ontario to mitigate direct impacts of development projects (see **Threats**); however, outcomes are largely unknown due to a lack of standardized post-release monitoring and the fact that results of mitigation translocations are not often published (Miller *et al.* 2014).

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COLLECTIONS EXAMINED

No physical collections were examined for the preparation of this report. Observation data on Butler's Gartersnake held by the Ontario Natural Heritage Information Centre (Ontario Ministry of Natural Resources), The Canadian Museum of Nature's Amphibian and Reptile collection, the Global Biodiversity Information Facility, the Royal Ontario Museum, and iNaturalist.com were consulted.

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Because this Status Report Update is a “living document,” much information from the previous status reports has been retained. Authorities that previously contributed information are listed in COSEWIC (2010).

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Jonathan Choquette is a conservation biologist based in Windsor, Ontario, with 15 years of professional experience working with herpetofauna in Canada. He holds a B.Sc. in Biology (2007), a Master's in Landscape Architecture (2011), and a Ph.D. in Boreal Ecology - Conservation and Restorative Ecology (2024). In addition to this COSEWIC Status Report update on Butler's Gartersnake, Jonathan has co-authored or authored five other COSEWIC status reports on snakes in Canada. He is currently the Lead Biologist on the Ojibway Prairie Reptile Recovery program with Wildlife Preservation Canada, and Principal of SCC Ecological. His research interests include urban herpetology and conservation biology, and his career is dedicated to the recovery of Canadian reptiles.

APPENDIX 1. Presence (1) or absence (0) of Butler’s Gartersnake (*Thamnophis butleri*) at historical sites within the Windsor-Essex and Sarnia-Lambton subpopulations based on results of range-wide surveys in 2009.

Surveys were completed in 1976 by Planck and Planck (1977), and in the 1980s by a variety of surveyors (e.g., Ontario Herpetofaunal Survey: Oldham and Weller 2000). The majority of surveys in 2009 were conducted by J. Choquette and D. Noble, but presence at some sites (*) was confirmed based on verified observations by others from 2007–2009. Recent verified observation records (recent obs.) are from NHIC and include results from recent targeted surveys (e.g., Choquette and Barden 2020). Sites that were not surveyed during a particular survey period are indicated by ‘-’. A cross (†) indicates sites that were impacted entirely or partially by development, based on site visits or a review of satellite imagery (e.g., sites that were completely or mostly developed). The most recent observation record was based on verified recent observations from all sources. Sites were defined as specific geographical areas where one or more snakes were observed or collected and were generally based on details contained within historical observation records or survey reports. Some sites are large enough to contain multiple locations, as defined by the IUCN (2010; see **Number of Threat Based Locations**). This list is not a comprehensive accounting of all new Butler’s Gartersnake sites identified after the 1980s. Abbreviations are as follows: ANSI = Area of Natural and Scientific Interest, CA = Conservation Area, ENE = East North-East, ESA = Environmentally Significant Area, LSU = Louisiana State University, CMNAR = Canadian Museum of Nature Amphibian and Reptile collection, OHS = Ontario Herpetofaunal Summary, OPC = Ojibway Prairie Complex; ROM = Royal Ontario Museum, S = South, SW = South-West, UMMZ = University of Michigan’s Museum of Zoology, USNM = United States National Museum.

| Site name | Recent obs. | Hist. surveys | 2009 survey | 2022 survey | References and museum specimens used to validate historical and/or recent observations of Butler’s Gartersnake |
|---------------------------------------|-------------|---------------|-------------|-------------|--|
| <i>Windsor-Essex subpopulation</i> | | | | | |
| Spring Garden Natural Area (OPC) | 2021 | 1 | 1 | 1 | Planck and Planck 1977 (site 1); OPC: Oldham and Sutherland 1986; Sandilands 1988a; Oldham and Weller 1989; Campbell pers. comm. 2009; Jones pers. comm. 2009; OHS; ROM; CMNAR 29389; |
| Devonwood CA | 1976 | 1 | 0† | 0 | Planck and Planck 1977 (site 2) |
| Tallgrass Prairie Heritage Park (OPC) | 2020 | 1 | 1* | 1 | Planck and Planck 1977 (site 5: "Windsor Prairie North"); NHIC; OPC: Oldham and Sutherland 1986; Sandilands 1988a; Oldham and Weller 1989; Campbell pers. comm. 2009; Jones pers. comm. 2009; OHS; ROM; CMNAR 29389; |
| South Cameron Woodlot and vicinity | 2021 | 1 | 1† | 1 | Planck and Planck 1977 (site 6: "Windsor Centennial High School"); OHS; CMNAR (21234, 21337) |
| Ojibway Prairie PNR (OPC) | 2020 | 1 | 1 | 1 | Planck and Planck 1977 (site 8); OPC: Oldham and Sutherland 1986; Sandilands 1988a; Oldham and Weller 1989; Campbell pers. comm. 2009; Jones pers. comm. 2009; OHS; ROM; CMNAR 29389; |

| Site name | Recent obs. | Hist. surveys | 2009 survey | 2022 survey | References and museum specimens used to validate historical and/or recent observations of Butler's Gartersnake |
|---|-------------|---------------|-------------|-------------|---|
| Windsor Airport | 1976 | 1 | 0† | 0 | Planck and Planck 1977 (site 9) |
| Turkey Creek | 1976 | 1 | 0† | 0 | Planck and Planck 1977 (site 10); Town of LaSalle 1996 |
| Tecumseh Auto Wreckers | 2009 | 1 | 1 | 0† | Planck and Planck 1977 (site 12); CMNAR 30771; ROM |
| Amherstburg Quarry area | 2016 | 1 | 1 | 1 | Planck and Planck 1977 (site 16: "Amherstburg"); Catling and Freedman (1977, 1980b, 1980a); Freedman and Catling (1978, 1979); Sandilands (1988a, 1988b); Oldham and Sutherland 1986; Oldham and Weller 1989; CMNAR (17686, 21351, 22401, 25986, 30821); LSU (39653-57, 39884); OHS |
| LaSalle Woods ESA | 2016 | 1 | 1 | 0 | Planck and Planck 1977 (site 20: "Normandy Rd."); Sandilands 1988a; Oldham and Weller 1989; Jones pers. comm. 2009; OHS |
| Amherst Pointe | 2009 | 1 | 1 | 0 | Planck and Planck 1977 (site 25); Jones pers. comm. 2009 |
| Railway line, Wellington Ave | 2021 | 1 | 1 | 1 | Planck and Planck 1977 (site 52: "Windsor, Amtrack"); OHS |
| Peche Island | 2008 | 1 | 1* | 1 | Planck and Planck 1977 (site 55); Sandilands 1988a; P. Pratt pers. comm. 2009; OHS |
| Fighting Island | 2009 | 1 | 1 | 1 | Wormington and Fraser 1985; OHS |
| River Canard Marshes | 2009 | 1 | 1 | 1 | Wormington and Fraser 1985, 1988; OHS |
| St. Clair College vicinity | 2007 | 1 | 1* | 0† | OHS; Yagi pers. comm. 2009 |
| Detroit River Shoreline & Mill St. Park | 2010 | 1 | 1 | 1 | Weller and Oldham 1988; Wylie pers. comm. 2009; OHS |
| Black Oak Heritage Park (OPC) | 1982 | 1 | - | 0 | OHS; OPC: Oldham and Sutherland 1986; Sandilands 1988a; Oldham and Weller 1989; Campbell pers. comm. 2009; Jones pers. comm. 2009; ROM; CMNAR 29389; |
| Railway line, Janette Ave | 2021 | 1 | 1 | 1 | OHS |
| <i>Sarnia-Lambton subpopulation</i> | | | | | |
| Bright's Grove area | 2013 | 1 | 1 | 1 | Planck and Planck 1977 (site 73: "Crabbie's Golf Course ") |
| Clearwater Sentry, Sarnia | 1982 | 1 | 0† | 0 | Planck and Planck 1977 (site 76: "Sarnia, Sentry "); A. Harris pers. comm. 2009; OHS; CMNAR 22959 |
| Murphy Rd., Sarnia | 1976 | 1 | † | 0 | Campbell 1971a; Planck and Planck 1977 (site 77) |
| Colborne Rd. Dairy Queen, Sarnia | 1976 | 1 | † | 0 | Planck and Planck 1977 (site 78: "Sarnia Dairy Queen ") |
| Sarnia Bluewater Bridge | 2018 | 1 | 1 | 1 | Planck and Planck 1977 (site 79); Kamstra pers. comm. 2009; OHS; CMNAR (22950, 22953) |
| Errol | 2009 | 1 | 1 | 1 | OHS; CMNAR 22850 |

| Site name | Recent obs. | Hist. surveys | 2009 survey | 2022 survey | References and museum specimens used to validate historical and/or recent observations of Butler's Gartersnake |
|---|-------------|---------------|-------------|-------------|--|
| Bickford Oak Woods Conservation Reserve, aka. Clay Creek ANSI, and vicinity | 2012 | 1 | 1 | 1 | Campbell 1971a; Oldham and Weller 1989; Gould pers. comm. 2009; OHS; NHIC; CMNAR 30668; |
| Bear Creek (6 km SW Brigden) | 1986 | 1 | - | 0 | OHS |
| Canatara Park, Sarnia | 2019 | 1 | 1 | 1 | OHS; ROM |
| Indian Rd. at Devine St. area, Sarnia | 1982 | 1 | † | 0 | Campbell 1971a; Oldham and Weller 1989; Pratt pers. comm. 2009; OHS; ROM; CMNAR (229671, 30667) |
| Point Edward, 1.5 km S of Canatara Park | 2012 | 1 | - | † | OHS; Jongsma pers. comm. 2022 |
| Aamjiwnaang First Nation | 2021 | 1 | - | 1 | Oldham and Weller 1989; OHS; CMNAR 30667; |

APPENDIX 2. Classification of extirpated and historical Butler's Gartersnake (*Thamnophis butleri*) sites and element occurrences for the purpose of estimating its Canadian range.

Notes are included on total search effort, and last dates of observation are presented in parentheses beside site names. Extirpated sites are those where no verified observation records have occurred in at least 20 years, and where habitat no longer exists and/or recent search effort was deemed adequate. Historical sites are those where no verified observation records have occurred in at least 20 years, but where habitat still exists and recent search effort was deemed inadequate (i.e., greater uncertainty exists regarding the status of the species). Extirpated sites were included in historical range estimates only, but historical sites were included in both historical and recent range estimates. Rejected sites were excluded from both the current and historical range estimates due to a lack of verifiable evidence documenting the species' presence, coupled with either negative searches, known misidentifications, and/or no records found in the provincial database or elsewhere.

Extirpated sites:

Chatham-Kent, Mitchell's Bay (1881):

John H. Garnier collected a specimen of Hoy's Gartersnake, *Eutaenia radix*, along the St. Clair flats (Garnier 1881; Mitchell's Bay, USMN 10532). *E. radix* is a synonym of *T. radix*, the Plains Gartersnake. Garnier noted in 1888 that "various specimens of *E. radix* have been obtained from the 'marshy lands' near Lake St. Clair." (Rowell pers. comm. 2009) and a remark by Nash (1905) that *T. radix* occurred "not abundantly" in western Ontario was presumably based on the Garnier report (Campbell 1971a). The specimen in question was later reclassified as Butler's Gartersnake on October 20th, 1992, by P. Ostermeier, a USMN visitor (Wynn pers. comm. 2009). Following a detailed examination of specimen photographs in 2009 (courtesy of A. Wynn, USNM), J. Choquette and D. Noble agreed with the 1992 re-classification (Interestingly, Campbell [1971b] noted that an old ROM record of Butler's Gartersnake from the St. Clair flats had not been substantiated by specimens). The reclassification of the 1881 specimen from *E. radix* to *T. butleri* makes it the first record of Butler's Gartersnake from Canada. Although erroneously labelled at first as *T. radix*, *T. butleri* had not yet been described as a species (Cope 1889) at the time of Garnier's collection, with *T. radix* being the closest named species. This record confirms the collection of Butler's Gartersnake in Canada over half a century (57 years) prior to later reports (Logier 1939). No other records of Butler's Gartersnake have been produced from the Mitchell's Bay area since the 1881 specimens (>140 years ago). A visit by C. Campbell in circa late 1960s did not result in any specimens (Campbell 1971a), but the site was not searched in 2009 (Appendix 1). No contemporary records exist for the Mitchell's Bay region, or for elsewhere along the southern and eastern Lake St. Clair shoreline despite searches (see below); therefore, Butler's Gartersnake was considered extirpated from Mitchell's Bay for the purposes of this status assessment. The IAO for this site is 4 km² and it has not been assigned to an element occurrence.

Chatham-Kent, Rondeau Provincial Park (RPP) (1940):

Logier and Toner (1955, 1961) listed this locality based on a personal communication from F.C. Blanchard, University of Michigan. Two specimens in the University of Michigan's Museum of Zoology (UMMZ 90193) are labelled "Rondeau Provincial Park, near Blenheim, Ontario, Ruth Gilbreath and William Stickel, 23 July 1940." F.R. Cook examined these in 1966 and substantiated them as Butler's Gartersnake (courtesy of C.F. Walker, UMMZ). Campbell (1971a) stated that "Stickel does not recall where in, or near, the park they took them, but guesses it was in lakeshore marshes under boards." Other UMMZ numbers in the same series are assigned to specimens from Long Point and north of there, from 7 miles east of Blenheim, and from Rondeau Provincial Park (RPP). No other records of Butler's Gartersnake have been produced from RPP. Field surveys at this site and in the vicinity conducted by H. Milnes (1938; as cited by Rowell 2012), Campbell (1971a), Planck and Planck (1977), and others found Eastern Gartersnake (*T. sirtalis*) and Northern Ribbonsnake (*T. sauritus*) to be common there but encountered no Butler's Gartersnake. If the species were present in 2001, it would have likely been observed during an extensive herpetological study, employing cover boards and drift fence trapping, but it was not recorded (Gillingwater 2001). Based on multiple negative searches, and length of time since the 1940 records (> 80 years), Butler's Gartersnake was considered extirpated from RPP for the purposes of this status assessment. The IAO for this site is 4 km² and it has not been assigned to an element occurrence.

Two opposing views emerged regarding the validity of the 1940 RPP specimens, so additional justification is provided herein. The first hypothesis was that RPP was not historically occupied by Butler's Gartersnake and the specimens in question were not collected from RPP, but from Skunk's Misery, and were later mislabelled as being from RPP. Since the American collectors (Gilbreath and Stickel) travelled from RPP to Long Point, their route may have taken them past Skunk's Misery on Highway 2. They may have been aware of Logier's (1939a) report of Butler's Gartersnake published in *Copeia* the year before. Collection at Skunk's Misery, followed by a labelling error made in the haste of fieldwork, or in processing the collections afterwards, would explain this view (Campbell pers. comm. 2009). The opposing view was that RPP was in fact historically occupied by Butler's Gartersnake, and this species had since been extirpated there due to extensive human disturbance within the park in the middle part of the last century (Woodliffe pers. comm. 2010). Following an in-depth debate among herpetological experts and historical investigations as part of the 2010 status assessment, it was decided to accept that Butler's Gartersnakes historically occupied RPP.

Essex County, Lake St. Clair shoreline (1986):

Historical observation records have been reported for three sites along the south shore of Lake St. Clair: Belle River, Duck Creek, and Tremblay Beach (Planck and Planck 1977; Oldham and Sutherland 1986; Oldham and Weller 1989). At least one specimen from Belle River is housed at the National Museums of Canada. Butler's Gartersnake has not been documented at any of the sites since 1986 (NHIC) despite targeted searches in the

vicinity of historical observations and nearby natural areas. Based on multiple negative searches, residential development of at least one site (Duck Creek), length of time since the 1986 record (>35 years), and results of conditional occupancy predictions (Paterson et al. 2021), Butler's Gartersnake was considered extirpated from the Lake St. Clair shoreline sites for the purposes of this status assessment. The IAO of these combined sites is 12 km² (3 IAO grid squares), and collectively these are represented by two element occurrences ranked as historical. A review of total search effort is provided:

- 1) A targeted snake survey in 2004 at the federally owned St. Clair National Wildlife Area (355 ha), which is situated on the southeast shore of Lake St. Clair ~ 9 km south of Mitchell's Bay (see above) and ~ 9 m northeast of Tremblay Beach, did not generate any Butler's Gartersnake observations (ECCC 2018b).
- 2) J. Choquette and D. Noble, as part of the 2010 status reassessment, conducted visual encounter surveys targeting Butler's Gartersnake at all three historical Lake St. Clair shoreline sites from 1 to 23 May 2009, all with negative search results. A total of 18.5 person-hours were invested, and only nine *T. sirtalis* individuals were found.
- 3) As part of a genetic study (Snetsinger et al. 2022), M. Snetsinger searched for Butler's Gartersnake in circa 2016 along the southeast shore of Lake St. Clair at historical sites but did not find any specimens. Search effort was one survey per site, and two people per survey (Snetsinger pers. comm. 2022).
- 4) Choquette and Barden (2020) reported on the results of standardized repeat artificial cover object surveys in 2019 targeting Butler's Gartersnake at historical sites in Essex County (including Belle River and Tremblay Beach; the Duck Creek site had since been developed into residential housing), and at one occupied site for reference (Ojibway Prairie). Surveys were conducted within 2 ha study sites wherein nine 2' x 4' cover objects were placed. At Tremblay Beach, 19 surveys were conducted across two study sites, and at Belle River, 20 surveys were conducted across two study sites. However, Butler's Gartersnake was only detected at the reference site. Occupancy analysis suggested that the species was not present at the Belle River and Tremblay Beach sites.
- 5) As of August 2022, no recent observations of Butler's Gartersnake were reported on iNaturalist along the Lake St. Clair shoreline between the Tecumseh area in Essex County and the Wallaceburg area in Lambton County. Additionally, all 16 Eastern Gartersnake records from iNaturalist collected along the Lake St. Clair shoreline between Tecumseh and Wallaceburg were assessed in 2022 by J. Choquette for misidentifications, and all were confirmed to be this species (Note: no *T. sauritus* observations were submitted for the same area).

Middlesex and Lambton counties, Skunk's Misery wetland complex (1989):

Butler's Gartersnake was first reported at Skunk's Misery in 1938 (Logier 1939), when 27 snakes were observed in two days, which at the time was considered to be the first record of the species in Canada (Butler's Gartersnake was previously collected at Mitchell's Bay in 1881 but its identity was not confirmed until 1992; see above). Skunk's Misery is a forest-wetland complex between Chatham and London (also known as the Mosa Forest) wherein Butler's Gartersnake was historically reported at multiple sites across an area spanning ~ 28 km² (Mills 1948; Logier and Toner 1955, 1961; McBride 1967; Campbell 1971a, b; Oldham and Sutherland 1986; Figure 2). Several specimens from this site are held at the Royal Ontario Museum and the National Museums of Canada. F. Schueler and R. Rankin observed 12 snakes in three days at Skunk's Misery in 1981, but the species has not been documented there since 1989 (NHIC) despite targeted searches at and near historical collection sites. Based on multiple negative searches by various groups, length of time since the 1989 record (>30 years), and results of conditional occupancy predictions (Paterson *et al.* 2021), Butler's Gartersnake was considered extirpated from Skunk's Misery for the purposes of this status assessment. The IAO of this site is 28 km² (seven IAO grid squares), and it is represented by a single element occurrence ranked historical. Skunk's Misery is assumed to have represented a distinct subpopulation due to its isolation from other subpopulations. A review of total search effort is provided:

- 1) Butler's Gartersnake was not found during targeted searches in 2001 and 2006 by F. Schueler, who noted a substantial reduction in availability of debris and cover objects since 1981 (Schueler pers. comm. 2009). Amount of search effort invested was not available.
- 2) J. Choquette and D. Noble, as part of the 2010 status reassessment, conducted visual encounter surveys targeting Butler's Gartersnake at multiple sites in the Skunk's Misery area from 18 May to 27 September 2009, all with negative search results. A total of 8.5 person-hours were invested and 74 snakes of four species were observed, including one Eastern Hog-nosed Snake.
- 3) As part of a genetics study (Snetsinger *et al.* 2022), M. Snetsinger searched for Butler's Gartersnake in circa 2016 at Skunk's Misery but did not find any specimens. Search effort was one survey with two people (Snetsinger pers. comm. 2022).
- 4) As of August 2022, no recent verified observations of Butler's Gartersnake were reported near Skunk's Misery on iNaturalist; however, one unverified record was reported in 2019. No photo or detailed description had been submitted with the unverified record and attempts to contact the observer for additional details were unsuccessful. Moreover, all 16 *T. sirtalis* records on iNaturalist from the Skunk's Misery area were assessed in 2022 by J. Choquette for misidentifications, and all were confirmed to be this species (Note: no *T. sauritus* observations were submitted for the same area).

- 5) A targeted visual encounter survey was conducted by Wildlife Preservation Canada at one site within the Skunk's Misery complex in late June 2023. A total of 2.5 person-hours were invested by five surveyors covering an area of ~ 1.5 ha. The general area was characterized as being dominated by agricultural land and forests, with some small patches of meadow. The team observed one snake (*T. sirtalis*) and two frog species, but no Butler's Gartersnake (Trowbridge pers. comm. 2023).

Middlesex County, Parkhill Creek (1992):

This historical site is represented by a single specimen collected in an old field habitat northwest of the Town of Parkhill, and north of Parkhill Creek, by M. J. Oldham in August 1992 (MJO 14174; CMNAR 35265). No Butler's Gartersnake have been documented in the area since 1992. Considering the search effort from general and targeted surveys, the length of time since the single 1992 observation record (30 years), and results of conditional occupancy predictions (Paterson *et al.* 2021), Butler's Gartersnake was considered extirpated from the Parkhill Creek area for the purposes of this status assessment. The IAO of this site is four km², and it is represented by a single element occurrence ranked historical. Parkhill Creek is assumed to have represented a distinct subpopulation due to its isolation from other subpopulations. A review of total search effort is provided:

- 1) Ausable Bayfield Conservation Authority (ABCA) stewardship staff frequent the ABCA properties in the Parkhill area (e.g., Parkhill Conservation Area and McGillivray Tracts), but have not recorded Butler's Gartersnake there or elsewhere in the watershed. ABCA staff members, however, were not trained in identification of Butler's Gartersnake and were not conducting targeted surveys for this species (Watt pers. comm. 2022). ABCA staff members were not aware of any recent reptile surveys conducted in the Parkhill area (Watt pers. comm. 2022).
- 2) A request was made in 2022 to solicit Butler's Gartersnake observations from the members of two field naturalist clubs operating nearest to Parkhill (Nature London and Lambton Wildlife) but no records were forthcoming.
- 3) No recent observations of Butler's Gartersnake were reported on iNaturalist in the Parkhill area. Also, the five *T. sirtalis* and three *T. sauritus* records on iNaturalist from within ~ 5 km of Parkhill were assessed in 2022 by J. Choquette for misidentifications, and all were confirmed to be the species reported.
- 4) A targeted visual encounter survey was conducted by Wildlife Preservation Canada at two sites in proximity to the 1992 observation over two days in late June 2023. A total of 3.75 person-hours were invested by five surveyors covering an area of ~ 3.33 ha, mostly within grassy roadsides. The general area was characterized as being dominated by agricultural land and forests, with some patches of natural or restored meadows adjacent to the sites surveyed. The team observed 22 snakes of two species (*T. sirtalis* and *Storeria dekayi*), and two frog species, but no Butler's Gartersnake (Trowbridge pers. comm. 2023).

Historical sites:

Lambton County, Walpole Island First Nation (1990):

Walpole Island First Nation (WIFN) is represented by numerous historical Butler's Gartersnake observation records across an area of ~ 44 km² (Schueler and Westell 1976; Oldham and Sutherland 1986; Sandilands 1988a; Oldham and Weller 1989). Multiple specimens from this site are housed by the Royal Ontario Museum and the Canadian Museum of Nature. This species has not been documented at WIFN since 1990 (NHIC), despite limited but targeted search efforts recently. Considering the amount of search effort, and the length of time since the 1990 record (>30 years), Butler's Gartersnake may be extirpated from WIFN. However, given the ongoing presence of apparently suitable habitat across an expansive area (based on satellite imagery), and results of conditional occupancy predictions (Paterson et al. 2021), there may still be a chance of the species being detected with additional targeted search effort. The IAO for this historical site is 51 km² (see **Distribution**), and it is represented by two element occurrences ranked as historical. A review of total search effort is provided:

- 1) J. Choquette and D. Noble, as part of the 2010 status reassessment, conducted visual encounter surveys targeting Butler's Gartersnake at various sites at WIFN on June 1, 2009, with negative search results. A total of nine person-hours were invested, resulting in 11 observations of *T. sirtalis* and one observation of a Five-Lined Skink.
- 2) During a range-wide survey to collect Butler's Gartersnake tissues for genetic analysis in circa 2016 (Snetsinger *et al.* 2022), WIFN was not surveyed, and the study authors did not learn of any recent observation records from that site (Snetsinger pers. comm. 2022)
- 3) As of August 2022, no recent verified observations of Butler's Gartersnake were reported at WIFN on iNaturalist; however, there was a single *T. sirtalis* observation from 2020 that was originally misidentified as a Butler's Gartersnake and later corrected (Note: no *T. sauritus* observations were submitted for the same area).

Rejected sites:

Huron County, Lucknow (1883–1893):

A series of five specimens from Lucknow held at the U.S. National Museum (1890–1893, USNM 56086 – 90, collected by J. Hurter), were originally labelled as Butler's Gartersnake (one record in ROM database). All five were later re-identified as *T. sirtalis* by museum staff and by J. Choquette and D. Noble via examination of specimen photographs (courtesy of A. Wynn, USNM). Dr. Garnier's original collection catalogue in the ROM (# 246) lists a specimen of '*E. radix*' collected on August 23, 1883, from the "Environs of Lucknow" (Rowell pers. comm. 2009). Although Garnier's '*E. radix*' from Mitchell's Bay, Ontario was re-identified as Butler's Gartersnake (USNM 10532), all of Garnier's *Thamnophis* spp. from the Lucknow area were confirmed as *T. sirtalis* (MacCulloch pers. comm. 2009). This site was the most northwestern data point on the Ontario Herpetofaunal Summary (OHS) map, to the west of Luther Marsh and adjacent to Lake Huron (Oldham and Weller 2000).

Regional Municipality of Hamilton–Wentworth, Dundas area (Mills 1948):

R. Mills reported observing Butler's Gartersnake in the Hamilton District at the Hamilton York Street Cemetery and close to the banks of the Desjardins Canal (Mills pers. comm. 1966). Mills based his identification of Butler's Gartersnake on the observation that the snakes had red colouration (Mills pers. comm. 1967). Butler's Gartersnake is reported to sometimes have orange lateral stripes (Conant and Collins 1991) but is not characterized by red, a trait more common in *T. sirtalis*. It is likely that the two species were confused. Mills failed to provide any specimens to CMNAR or ROM (Campbell 1971a) from the Dundas area. It was not until a 1966 visit to Skunk's Misery with R.C. Bothner that Mills produced a valid specimen of Butler's Gartersnake.

Searches of the cemetery referred to by Mills on April 3, 1967 by F.R. Cook with R.C. Mills (unpublished data), by C.A. Campbell and P.D. Pratt in October 1971 (Campbell 1971a) and casually by F.W. Schueler in 1981 and 1994 (Schueler pers. comm. 2009) were without success. No Butler's Gartersnake were found in the region during the intensive herpetofaunal atlas conducted over a nine-year period by the Hamilton Naturalists' Club. Lamond (1994), author of the Hamilton herpetofaunal atlas summary, and Logier and Toner (1955; 1961) omitted Mills' record and made no specific attempts to substantiate his sighting with field searches (Cook pers. comm. 2009). Some claim that more field-based evidence is needed to reject the Mills record (Schueler and Cook pers. comms. 2009). Finally, due to lack of data, number of past surveys, and the likelihood of misidentification by Mills, this record was rejected.

Middlesex County, "20 miles west of London" (1966):

Dr. William (R.C.) Bothner's collection at the Buffalo Museum of Science (personal catalogue # 1314) contains one Butler's Gartersnake labelled "20 miles west of London, R.C. Bothner and R.C. Mills, 24 August 1966" (Leacock pers. comm. 2009). The specimen was examined by F.R. Cook in February 1967 and confirmed as Butler's Gartersnake (courtesy of R.C. Bothner). Dr. Bothner stated that "the locality data are approximate" and confirmed that the specimen was in fact collected at Skunk's Misery (Mills pers. comm. 1966; Bothner pers. comm. 1967). Skunk's Misery is ~ 60 km (~ 37 miles) southwest of the City of London.

Middlesex County, City of London (1971 to circa 1984):

A personal letter from G. Waldron to C. Campbell states that a "breeding population" of Butler's Gartersnake was found in July 1971 near Saunders Pond, during a botanical survey in the Westminster Ponds Environmentally Significant Area (ESA), City of London. The colony seemed to "centre on a pile of cardboard and other rubbish" at the site (Waldron pers. comm. 1971). A visit by C. Campbell on April 15, 1973 (6 person-hours) yielded only *T. sirtalis* and *S. dekayi*. Later, frequent visits and surveys of the Pond Mills area, including Saunders Pond, from 2002 to 2006 revealed only *T. sirtalis*, *S. dekayi* and *Lampropeltis triangulum* (Gillingwater pers. comm. 2010). G. Waldron (pers. comm. 2009)

admitted that he was not very experienced with herpetology at the time and that it is possible that the identification was made in error.

The apparent misidentification of the snakes from Westminster Ponds has been perpetuated in recent planning documents for the site. For example, the City of London's 2005 Master Plan for the Westminster Ponds ESA listed 9 species of reptiles observed since 1984, including Butler's Gartersnake (Tchir 2005). Also, a public presentation on the Master Plan update in October 2012 continued to list "9 species of reptiles" as being present in the ESA (UTRCA 2012). Finally, a 2015 biological inventory report for the ESA made reference to Butler's Gartersnake having been recorded previously at the site (NSE 2015). Regardless, no new evidence has surfaced to suggest that Butler's Gartersnake historically (or recently) occupied the site. A biological inventory was conducted in 2014 and reptiles were the primary or secondary target group for seven of the 18 surveys (snakes were searched for incidentally each visit), but only *T. sirtalis* and *S. dekayi* were found (NSE 2015). A species at risk biologist with the Upper Thames River Conservation Authority confirmed that he was not aware of any verified Butler's Gartersnake observations at the site and suggested that the species was likely perpetuated in planning documents based on historical misidentified observations and not new information (Gillingwater pers. comm. 2019; 2022).

Lambton County, Pinery Provincial Park (1971 to circa 2000):

Campbell (1971a) stated that the 1971 Lands and Forests (the predecessor of the Ontario Ministry of Natural Resources) Master Plan for Pinery Provincial Park notes the capture of a Butler's Gartersnake there in a wet meadow and the subsequent release of captive-born young. Campbell obtained notes and colour photographs (September 11, 1971) of both adult and young from T. Beechey of the Nature Reserves Section of Lands and Forests and determined that all were *T. sirtalis* (Campbell 1971a). The confusion arose owing to docility, rich olive-brown dorsal colour, the orange-brown lateral stripes, and appropriate habitat where the adult snake was found (Campbell pers. comm. 2009). Later, in the early 2000s, H. Casbourn (pers. comm. 2009) suspected that a snake labelled 'Eastern Gartersnake' in the interpretive centre of the park was Butler's Gartersnake. This snake was later sent to the Toronto Zoo by Pinery staff and confirmed to be *T. sirtalis*.

Essex County, Point Pelee National Park (1971):

C. Campbell and P.D. Pratt investigated an alleged Butler's Gartersnake sighting from the base of Point Pelee. No Butler's Gartersnake were found but the habitat looked suitable (Campbell 1971a). Point Pelee is an area heavily surveyed by herpetologists, and a Butler's Gartersnake would likely have been spotted by now. P.D. Pratt mentioned having never come across a substantiated report of Butler's Gartersnake from Point Pelee or the central portion of Essex County, despite receiving submissions of numerous reptile sightings while working at the Ojibway Nature Centre. Planck and Planck (1977) also failed to discover a specimen from the central part of the county during their 1976 surveys. Furthermore, extensive searches by C. Campbell did not turn up any Butler's Gartersnake on Pelee Island, the Ohio Islands, or any other Lake Erie Islands.

Niagara Region, Short Hills Provincial Park (1970s–2022):

T. Beechy, who was with the Ontario Ministry of Natural Resources, reported Butler's Gartersnake from the area; however, the snakes he photographed were all identified as *T. sirtalis* by C. Campbell. Field surveys were conducted by C. Campbell and P. Pratt in the 1970s near Font Hill, but no Butler's Gartersnake were found despite the presence of suitable habitat (Campbell pers. comm. 2009). As of 2009 (and into mid-2022), the website of the Friends of Short Hills Provincial Park listed the "Butler Snake" as one of the reptiles inhabiting the park (FSHP 2009). Representatives from both the Friends of Short Hills Park and Ontario Parks confirmed that Butler's Gartersnake had not been observed in Short Hills Provincial Park and that the website, which has since been corrected, listed the species in error (Fraser pers. comm. 2022).

Huron County, Point Farms Provincial Park (circa 1970s):

C. Campbell (pers. comm. 2009) reported one Butler's Gartersnake found dead-on-road just outside of Point Farms Provincial Park and mentioned the presence of a very grassy, meadow-like habitat just north of the park gates. No detailed descriptions, specimens, or photos were available for scrutiny and the sighting was not reported to the OHS or NHIC. Although the area surrounding the park was characterized by successional farm fields and meadow habitat, no Butler's Gartersnake were observed during general species surveys at the 307-ha park in the 1960s and in 2008 (Peck pers. comm. 2009). In his detailed book on Ontario snakes, Rowell (2012) listed the locality as an "unconfirmed record," and in their updated field guide to the amphibians and reptiles of the Great Lakes Region, Harding and Mifsud (2017) excluded this area from the Butler's Gartersnake historical range map. In 2022 Ontario Parks staff members indicated that no Butler's Gartersnake were observed in the park, although no targeted reptile surveys were conducted in recent years (Schwartzentruber, Kaija, and Gould pers. comms. 2022). The Assistant Park Superintendent shared photos of four different gartersnakes observed recently and all were verified as *T. sirtalis* by J. Choquette.

Simcoe County, Canadian Forces Base (CFB) Borden (1992):

A. Sandilands reported an unidentified gartersnake "side-winding" like a Butler's Gartersnake across Simcoe County Road 20 (near CFB Borden), but the snake was not captured or photographed to verify identification (Sandilands pers. comm. 2009). CFB Borden has sand barren and savannah habitats, and as of 2010, no verified reports of Butler's Gartersnake existed for the area despite a 2007 species at risk inventory by NHIC biologists (Oldham pers. comm. 2010). More recently, M. Frawley, with the Canadian Department of National Defence, confirmed that several reptile surveys were conducted at CFB Borden from 2020 to 2021 (targeting turtles), and that the base kept a record of incidental snake observations (targeting *L. triangulum*), but that no Butler's Gartersnake were documented (Frawley pers. comm. 2022).

Region of Waterloo, Erbsville (1995):

C. Campbell reported an unidentified gartersnake near Erbsville which looked and behaved like Butler's Gartersnake; however, the snake was not captured or photographed to verify identification (Campbell pers. comm. 2009). As of 2022, two relatively large natural areas remain in the area: Laurel Creek Conservation Area and Forested Hills Environmentally Sensitive Protection Area. A watershed ecologist with the Grand River Conservation Authority confirmed that there have been several planning studies in the Erbsville area, including cover board and/or visual encounter surveys for snakes in 2008–2011, 2013–2014, and 2019–2021, but that no Butler's Gartersnake were observed (Zammit pers. comm. 2022). An inquiry sent to the field naturalists' club (Waterloo Region Nature) uncovered no noteworthy observations (Quinn pers. comm. 2022). As of August 25, 2022, the iNaturalist database contained zero verified records and one unsubstantiated Butler's Gartersnake record from near Kitchener/Waterloo (includes area near Erbsville; 2020). No photo or detailed description was submitted with the unsubstantiated record, and attempts to contact the observer for details were unsuccessful; therefore, it was rejected.

Grey County, Mount Forest (2002):

A local naturalist suspected Butler's Gartersnake inhabited his property in Mount Forest, north of Luther Marsh. A photo of his specimen was erroneously labelled 'Butler's Gartersnake' in the ROM Field Guide to Reptiles and Amphibians (p. 135M, MacCulloch 2002). F. Cook (pers. comm. 2009) made note of this in a 2002 unpublished review of the field guide, and others with Butler's Gartersnake experience took a similar view (Jones and Preney pers. comms. 2009). Additional photos of the specimen viewed by J. Choquette and D. Noble in 2009 were identified as *T. sirtalis*. The confusion seemed to exist with the position of the lateral stripes near the head.

Brant County (2009):

Unconfirmed sightings were reported from two separate sites in Brant County. Dr. C. Crombie reported observing Butler's Gartersnake in summer 2009 along the banks of Kenny Creek (east of Cathcart and south of old Highway 53), and C. Campbell reported observing Butler's Gartersnake near a quarry area off the Waterloo/Brant County Townline Road. Detailed descriptions, specimens, or photos of both unconfirmed observations were unavailable for scrutiny, and both observers are now deceased. A species-at-risk biologist with the Province of Ontario who visited the Kenny Creek site in circa 2013 determined that the habitat looked suitable for the species and completed a series of site visits wherein he searched existing cover objects in the roadside ditches and searched the road surface for dead snakes. Butler's Gartersnake was not found at the Kenney Creek site (Buck pers. comm. 2022). Both Brant County sites were assumed to be occupied by *T. sirtalis* and *T. sauritus*, but not Butler's Gartersnake (Buck pers. comm. 2022).

Misc. counties (2019–2021):

As of August 25, 2022, there were five Butler's Gartersnake observations reported on iNaturalist, all without photos or detailed descriptions (i.e., they cannot be verified): one near Skunk's Misery (2019), one near Midland (2020), one near Collingwood (2020), one near Kitchener/Waterloo (2020; includes the area near Erbsville), and one near Port Rowan (2021). Efforts to solicit additional observation details or photos from observers were unsuccessful.

APPENDIX 3. Additional details on abundance and density of Butler's Gartersnake (*Thamnophis butleri*) at study sites in Windsor-Essex, Sarnia-Lambton, and Luther Marsh.

Recent abundance estimates were based on multi-year mark-recapture studies conducted between 2008 and 2014 as part of pre-construction mitigation work for transportation and residential development projects (AECOM 2009; 2019; LGL 2010; LGL and URS 2010).

Sarnia-Lambton:

At a proposed development site in Sarnia-Lambton, a mark-recapture study was conducted in 2008 and 2009 (site 41: Appendix 1). Abundance was estimated based on a total of 169 adults captured and marked during the study, with an additional 55 neonates and 105 juveniles that were not marked (AECOM 2009). Using the Lincoln-Peterson Index, the estimated population size was 240 adults (AECOM 2009). With an estimated 13.5 ha of undeveloped land, and with variable snake habitat quality, the average snake density was estimated at 18 adults/ha (AECOM 2009).

A second mark-recapture study was conducted in Sarnia-Lambton at a municipal park in 2013 and 2014, and in connection with the project described above (site 35: Appendix 1). A total of 70 individuals were captured in 2013 (61 adults) and 153 individuals in 2014 (104 adults). Using the Lincoln-Peterson Index, the estimated population size was 387 adults (AECOM 2019; Kamstra pers. comm. 2022). With an approximated 10.7 ha of suitable Butler's Gartersnake habitat at the site, snake density was estimated at 36 adults/ha (AECOM 2019; Kamstra pers. comm. 2022). Both Sarnia-Lambton sites were ~ 1.75 km apart and separated by an inhospitable urban matrix.

Windsor-Essex:

In preparation for a highway expansion near the Ojibway Prairie Complex in Windsor-Essex, a Butler's Gartersnake mark-recapture study was conducted from 2008 to 2010 (site 22: Appendix 1; LGL 2010). In the 2010 field season, surveys were conducted from April to October at a 9.34 ha site, and all subadults (yearlings) and adults (snakes aged ≥ 2 years) were marked. Four different population estimation methods were employed to estimate average abundance, generated using data from three population counts in May and June 2010. Based on the 205 snakes marked during the field season, abundance estimated using the program MARK was 258 subadults/adults (95% CI [204,312]). Assuming 38% of the marked group was mature (LGL 2010), abundance was approximately 98 adults. Average density across the 9.34 ha site was 10 adults/ha.

A second mark-recapture study was conducted in Windsor-Essex as part of the same highway expansion project discussed above. The same estimation methods were used for a 7.0 ha study area in 2010, and surveys were conducted from June to October (LGL 2010; LGL and URS 2010). Estimates were based on 32 marked subadults/adults for a 3.65 ha subsection of the study area due to low recapture rates elsewhere (within site 21:

Appendix 1). Abundance was estimated at 256 subadults/adults (95% CI [156,357]). Assuming 38% of the marked group was mature (LGL 2010), abundance was approximated to be 97 adults. Average density across the 3.65 ha site was 27 adults/ha. This site was ~ 3.0 km from the first study site described above and both were isolated from each other by residential development and busy collector roads.

Luther Marsh:

Abundance estimates for the Luther Marsh subpopulation were not available, and only minimal information could be gleaned from past and recent surveys. In a 1988 survey, 75 individuals (incl. 45 adults) were captured within a ~ 4 ha study area with zero recaptures, which suggested a large population size and a minimum density of 11 adults/ha (Sandilands pers. comm. 2009). During a 2009 survey, J. Choquette and D. Noble captured 28 individuals (incl. 25 adults), including two recaptures, but abundance and density were not estimated. A cover board survey in 2012 resulted in a single individual being captured (GRCA 2012; Zammit pers. comm. 2022). Finally, multiple verified observations were submitted to iNaturalist as recently as 2021. Collectively, these observations only confirm the ongoing presence of Butler's Gartersnake at Luther Marsh, and suggest that the historical density was at least 11 adults/ha.

APPENDIX 4. Threats assessment worksheet for Butler’s Gartersnake (*Thamnophis butleri*) in Canada, completed by a group of species experts via teleconference on 18 July 2023.

| THREATS ASSESSMENT WORKSHEET | | | | | |
|---|-----------|--|------------------------------|-----------|--|
| Species or Ecosystem Scientific Name | | <i>Thamnophis butleri</i> Butler's Gartersnake | | | |
| Element ID | | Elcode | | | |
| Date (Ctrl + ";" for today's date): | | 18 July 2023 | | | |
| Assessor(s): | | Dwayne Lepitzki (Facilitator), Dean Whitehead (ECCC), Jaclyn Charlton (MTO, Environmental Planner), Joe Crowley (Ministry of Environment, Conservation, and Parks), Gabrielle Rimok (Amphibians and Reptiles SSC member), Purnima Govindarajulu (Amphibians and Reptiles SSC member), Jessus Karst (Amphibians and Reptiles SSC member), Jonathan Choquette (Status Report Writer), James Kamstra (AECOM), Katherine Yagi (Amphibians and Reptiles SSC member), Kathryn Markham (Ministry of Environment, Conservation, and Parks), Pamela Rutherford (Amphibians and Reptiles SSC Co-Chair), Daniel Priest (WSP), David Smith, Tom Herman (Amphibians and Reptiles SSC Co-Chair), Tony Zammit (Grand River Conservation Authority). | | | |
| References: | | draft calculator prepared by report writer using draft report, telecon 18 July 2023 | | | |
| Overall Threat Impact Calculation Help: | | | Level 1 Threat Impact Counts | | |
| Threat Impact | | high range | | low range | |
| A | Very High | 0 | | 0 | |
| B | High | 0 | | 0 | |
| C | Medium | 1 | | 1 | |
| D | Low | 2 | | 2 | |
| Calculated Overall Threat Impact: | | Medium | | Medium | |
| Assigned Overall Threat Impact: | | C = Medium | | | |
| Impact Adjustment Reasons: | | | | | |
| Overall Threat Comments | | generation time = 4 years therefore timeframe for severity and timing is 12 years; Essex, Lambton, Dufferin & Wellington Co.; 24-26% decline last ~46 years (=~11.5 gens); Windsor-Essex = 7,828 (55%); Sarnia-Lambton = 3,502 (25%), Luther Marsh = 1,854 (13%); Parkhill Creek & Walpole = 1,050 (7.4% if still extant). Assigned Overall Threat Impact undoubtedly conservative, due to three Unknown Level One threats (Invasive & problematic species and genes, Pollution, Climate change & severe weather), all pervasive in Scope and high in Timing, but of unknown severity. | | | |

| Threat | Impact (calculated) | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--|---------------------|---------------------|-----------------------------|-------------------|--|
| 1 Residential & commercial development | D Low | Small (1-10%) | Extreme (71-100%) | High (Continuing) | Assumed the level 2 threats were non overlapping (cumulative), but chose the highest level 2 threat because scope for 1.1 (43%) is at the lower end of the large category, and most if not all squares impacted by 1.2 and 1.3 are already accounted for in scope of 1.1 (largely due to presence of roads in settled areas). Severity left unchanged under the assumption that most squares are impacted by roads only. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--------|-------------------------------------|---------------------|------------|---------------------|-----------------------------|-------------------|--|
| 1.1 | Housing & urban areas | D | Low | Small (1-10%) | Extreme (71-100%) | High (Continuing) | Urban development for housing and commercial areas has resulted in the documented loss of Butler's Gartersnake sites in Michigan and Ontario and is a continuing threat to Butler's Gartersnake in Canada. As of Nov. 2022, the author was aware of 13 ongoing or proposed development projects (most are for housing) in Windsor-Essex and Sarnia-Lambton, potentially impacting an estimated 7.3 ha of Butler's Gartersnake habitat in the near future. For Threat 1.1, an estimated 7/65 IAO squares are affected (=10.8%), mostly in Windsor-Essex). Furthermore, Butler's Gartersnake are impacted by habitat fragmentation and road mortality from roads within urban areas; roads occur within 28/65 IAO (43%) squares in densely settled areas. The ongoing/proposed development affects a subset of these same squares. Severity presumed based on extreme impacts at squares with ongoing/proposed development combined with road impacts, but probably moderate impact at squares with roads but no development. Removal of habitat caused by urban development including residential roads scored here - severity score assumes snakes don't migrate to adjacent suitable habitat. High residential development throughout Butler's Gartersnake habitat. Many of the Windsor-Essex populations occur along existing urban fringe which is looking to expand (Ron Gould). Low impact of construction of new development (Joe Crowley, David Smith). There are some mitigations for housing developments - with no mitigation then extreme severity would be most appropriate (Tony Zammit). Often there are not effective mitigations and non-compliance (Joe Crowley, Kathryn Markham). May be on the lower end of Extreme Severity, if mitigations are effective. |
| 1.2 | Commercial & industrial areas | D | Low | Small (1-10%) | Extreme (71-100%) | High (Continuing) | |
| 1.3 | Tourism & recreation areas | | Negligible | Negligible (<1%) | Moderate - Slight (1-30%) | High (Continuing) | As of Nov. 2022, the author was aware of 2 ongoing or proposed recreational trail developments in occupied Butler's Gartersnake habitat in Windsor-Essex (2/65 IAO squares = 3.1%). Severity considered serious as one proposed trail would pave a large hibernation area. Lower severity for trails (Joe Crowley). The issue is the one trail that impacts the hibernaculum but this specific trail is no longer planned (James Kamstra). |
| 2 | Agriculture & aquaculture | | Negligible | Negligible (<1%) | Serious (31-70%) | High (Continuing) | |
| 2.1 | Annual & perennial non-timber crops | | Negligible | Negligible (<1%) | Serious (31-70%) | High (Continuing) | Additional potential threat suspected of having a low or negligible impact. Risk is for Walpole only, although missing detailed information for this population (Ron Gould). Possibly extirpated from Walpole as there are no confirmed records in 30 years (Jonathan Choquette). Some fallow areas in Lambton may be cultivated but these would be small (James Kamstra). Conversion to agriculture can happen without mitigation, unlike with development (Kathryn Markham). |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | No risk of trampling by cattle. |
| 2.4 | Marine & freshwater aquaculture | | | | | | |
| 3 | Energy production & mining | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--------|------------------------------------|---------------------|--------|---------------------|-----------------------------|-------------------|---|
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | | | | | There are gravel pits but no expansion happening (Jonathan Choquette). A new quarry has been approved close to Luther Marsh but no Butler's Gartersnake known from that site (Tony Zammit). |
| 3.3 | Renewable energy | | | | | | Some solar farms have been established (James Kamstra). They have been in areas that were agriculture (Jonathan Choquette). |
| 4 | Transportation & service corridors | C | Medium | Pervasive (71-100%) | Moderate (11-30%) | High (Continuing) | Assumed the level 2 threats were non-overlapping, but chose the highest level 2 threat because scope for 4.1 (39%) is at the lower end of the large category, and both 4.1 and 4.2 severity were deemed somewhat subjectively. |
| 4.1 | Roads & railroads | C | Medium | Pervasive (71-100%) | Moderate (11-30%) | High (Continuing) | Butler's Gartersnake habitat is directly impacted during highway construction and maintenance. Butler's Gartersnake is particularly sensitive to these activities because the snakes tend to congregate at high densities in the open grassy habitats associated with transportation right-of-ways. Outside of human settlement areas, roadways will continue to affect Butler's Gartersnake in similar ways as they do within settled areas (see Threat 1); however, their impact on habitat fragmentation may be reduced in relation to their lower density. As of Nov. 2022, an estimated 10/64 IAO squares (16%) are affected outside of densely settled areas and across the current range (while only ca. 10 IAO squares overall are absent of roads, the impact of roads is reflected within two threat categories: Threat 1 and Threat 4). Scope is based on existing highways, and although there may be new construction, severity was presumed based on impact to habitat from maintenance activities for existing infrastructure (e.g., roadsides). Roadkill included here but Butler's Gartersnake typically don't disperse long distances or sun on roads. Moderate Severity seems appropriate given that Butler's Gartersnake do not move as much; therefore, roads have less of an impact than on larger-bodied snakes (which are impacted 30%; Joe Crowley). |
| 4.2 | Utility & service lines | D | Low | Small (1-10%) | Moderate - Slight (1-30%) | High (Continuing) | Butler's Gartersnake habitat is directly impacted during maintenance, excavation, and construction of pipelines, and maintenance of hydro transmission lines and towers. Butler's Gartersnake is particularly sensitive to these activities because they tend to congregate at high densities in the open grassy habitats associated with utility right-of-ways. As of Nov. 2022, the author was aware of two ongoing or proposed transportation and service corridor projects in Sarnia-Lambton (pipeline maintenance/construction), potentially impacting an estimated 4.8 ha of Butler's Gartersnake habitat in the near future (2/64 IAO squares affected = 3.1%). Severity was presumed based on impact to habitat from maintenance activities for existing infrastructure. Predominantly pipeline and high voltage maintenance occurs in Butler's Gartersnake habitat (Jonathan Choquette). Perhaps higher than Small Scope, if impacts are for maintenance (David Smith). May be activities that are happening without permits (Joe Crowley). Maintenance of lines can damage habitat but also enhance habitat by removing trees and opening habitat (James Kamstra, David Smith). |
| 4.3 | Shipping lanes | | | | | | |
| 4.4 | Flight paths | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--------|--|---------------------|------------|---------------------|-----------------------------|-------------------|---|
| 5 | Biological resource use | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | Additional potential threat that was considered as part of the draft status report update, and suspected of having a low or negligible impact. Box 34: "capture/harvest of individuals may occur, but presumably low risk relative to main threats." Lethal research, persecution, pet trade all scored here. Low intensity (David Smith, Joe Cowley). Some evidence of collecting at some sites by Wayne King but overall it is low intensity (Jaclyn Charlton, James Kamstra). |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | | | | | | |
| 6 | Human intrusions & disturbance | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | Some impact by ATVS and mountain biking but would be small (David Smith). |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | The impact of scientific monitoring and research on Butler's Gartersnake is probably low compared to other threats; however, it is not benign. Some individuals will become stressed, injured and, to a lesser extent, killed incidentally during monitoring, mitigation or other research work. Assuming the spatial extent of research and monitoring work will be like that of the recent past, then ca. 18/64 IAO squares (28%) will be impacted by this threat in the near future. Severity presumed based on very minimal to no impacts to habitat and minor injury/death resulting from research activities. Effects of translocation scored here too. Most of the translocations are related to other impacts (e.g. mitigation measures from development); therefore, they are already considered (Joe Crowley). It is possible that some IAO squares are double-dipped because people apply for a translocation permit at same time as for a development permit (Kathryn Markham). |
| 7 | Natural system modifications | D | Low | Small (1-10%) | Moderate (11-30%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | D | Low | Small (1-10%) | Moderate (11-30%) | High (Continuing) | Additional potential threat suspected of having a low or negligible impact. Succession at Skunk's Misery may have caused this population to disappear. Luther Marsh is managed with prescribed burns and mowing (Jonathan Choquette, Tony Zammit). Succession is definitely an issue without any management activities (David Smith). |
| 7.2 | Dams & water management/use | | | | | | |
| 7.3 | Other ecosystem modifications | D | Low | Restricted (11-30%) | Slight (1-10%) | High (Continuing) | Additional potential threat (e.g., mowing in parks outside settlement areas) suspected of having a low or negligible impact. Mowing is happening on private lands with some mortality (Kathryn Markham). There are also benefits of mowing to open the habitat (James Kamstra). Common Reed (Phragmites) is degrading the habitat but not sure of its effect on Butler's Gartersnake (James Kamstra). This plant species is also causing changes in hydrology and changes in earthworm availability (David Smith). |

| Threat | | Impact (calculated) | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--------|--|---------------------|---------------------|-----------------------------|-------------------|---|
| 8 | Invasive & other problematic species & genes | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 8.1 | Invasive non-native/alien species/diseases | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Cats and dogs are impacting snakes, especially in Windsor and other urban areas (Joe Crowley). |
| 8.2 | Problematic native species/diseases | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Large populations of Raccoons in these areas (Joe Crowley). Snake fungal disease not having negative effect, although may negatively affect basking behaviour (Jonathan Choquette). |
| 8.3 | Introduced genetic material | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | |
| 8.6 | Diseases of unknown cause | | | | | |
| 9 | Pollution | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.1 | Domestic & urban waste water | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | There are possible effects of road salt, but the severity is unknown. The plant communities occupied by Butler's Gartersnake are often very tolerant of salt and roadside contributions (David Smith). |
| 9.2 | Industrial & military effluents | Unknown | Small (1-10%) | Unknown | High (Continuing) | There are industrial and military effluents at Talford Creek (Jonathan Choquette). |
| 9.3 | Agricultural & forestry effluents | Unknown | Large (31-70%) | Unknown | High (Continuing) | Planck and Planck (1977) suggested that pesticides and herbicides may negatively affect earthworms and therefore Butler's Gartersnake (Jonathan Choquette). |
| 9.4 | Garbage & solid waste | | | | | "After spring emergence, these snakes are virtually impossible to find in their preferred habitat without the presence of debris." But these features are not an essential component of habitat use as the species often occurs in areas without large amounts of debris. |
| 9.5 | Air-borne pollutants | | | | | |
| 9.6 | Excess energy | | | | | |
| 10 | Geological events | | | | | |
| 10.1 | Volcanoes | | | | | |
| 10.2 | Earthquakes/tsunamis | | | | | |
| 10.3 | Avalanches/landslides | | | | | |
| 11 | Climate change & severe weather | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Timing is high if snake habitat is experiencing any of the various effects of climate change. |
| 11.1 | Habitat shifting & alteration | | | | | |
| 11.2 | Droughts | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Additional potential threat suspected of having a low or negligible impact. Snakes are less detectable during hot, dry weather but not sure if that means fewer snakes (David Smith). Ontario is experiencing droughts. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|--|----------------------|---------------------|---------|---------------------|-----------------------------|-------------------|---|
| 11.3 | Temperature extremes | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Additional potential threat suspected of having a low or negligible impact. Ontario is experiencing temperature extremes. |
| 11.4 | Storms & flooding | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.5 | Other impacts | | | | | | |
| Classification of Threats adopted from IUCN-CMP, Salafsky et al. (2008). | | | | | | | |