PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Spring Blue-eyed Mary (*Collinsia verna*) in Canada

Spring Blue-eyed Mary

2010

Environment Canada Environnement Canada

Canada

About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/approach/act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. A period of three to four years is allowed for those species that were automatically listed when SARA came into force.

What's next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

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DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the spring blue-eyed Mary. Environment Canada has reviewed and accepts this document as its recovery strategy for the spring blue-eyed Mary as required under the *Species at Risk Act* (SARA). This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

There are unknowns regarding the feasibility of recovery of the spring blue-eyed Mary in Canada. In keeping with the precautionary principle, a recovery strategy has been prepared as would be done when recovery is determined to be feasible.

This feasibility determination will be re-evaluated as warranted in response to changing conditions and /or knowledge.

RESPONSIBLE JURISDICTIONS

Province of Ontario
Environment Canada

CONTRIBUTORS

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STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, and are also summarized below.

This recovery strategy will have no effect on the environment as recovery actions are not considered necessary at this time for the spring blue-eyed Mary in Canada.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry:
www.sararegistry.gc.ca/sar/recovery/residence_e.cfm

PREFACE

The spring blue-eyed Mary (*Collinsia verna*) is under the management jurisdiction of the Province of Ontario and Environment Canada. The *Species at Risk Act* (SARA, Section 37) requires the competent minister to prepare recovery strategies for listed extirpated, endangered, or threatened species. The spring blue-eyed Mary was listed as Extirpated under SARA in June 2003. The Canadian Wildlife Service – Ontario Region, Environment Canada, led the development of this recovery strategy. The Ontario Ministry of Natural Resources cooperated in the document's development. All responsible jurisdictions reviewed and acknowledged receipt of the strategy.

EXECUTIVE SUMMARY

The spring blue-eyed Mary (*Collinsia verna*) is a winter annual that inhabits portions of the eastern and midwestern United States and has been found in only three locations within Canada. It was designated as Extirpated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2000 and was listed as extirpated under the *Species At Risk Act* (SARA) in June 2003. Little is understood about the specific biological requirements of this species, which grows in open, rich woods located on floodplains.

The only three known occurrences of the spring blue-eyed Mary were in southwestern Ontario, in Elgin, Middlesex, and Oxford counties. The species was last reported in 1954. The threats that could have led to the species' extirpation include logging and conversion of forest habitat to agriculture. Other possible threats include invasive species and natural succession.

There are unknowns regarding the feasibility of recovery of the spring blue-eyed Mary in Canada. This species has not been seen in Canada since the 1950s and is globally secure with a widespread distribution in the United States. The recovery objective for this recovery strategy is to follow the progress and findings of the ongoing cultivation and reintroduction studies in the United States.

The recovery approach is to monitor research and recovery initiatives in the United States for new information on the species and its potential cultivation and reintroduction. This information will be evaluated as to whether it will be of benefit to the recovery of spring blue-eyed Mary in its historic range in Canada.

This recovery strategy will be updated if an extant population of spring blue-eyed Mary is found in Ontario or as warranted in response to changing conditions and /or knowledge.

Given the lack of information on suitable habitat, critical habitat is not identified in this recovery strategy.

An action plan will be developed if an extant population of spring blue-eyed Mary is found in Ontario

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1. BACKGROUND

1.1 Species Assessment Information from COSEWIC

Date of Assessment: May 2000

Common Name (population): Spring Blue-eyed Mary

Scientific Name: *Collinsia verna*

COSEWIC Status: Extirpated

Reason for Designation: Plants only known from three old historic sites with no recent sightings in spite of regular field surveys within the region of former occurrence.

Canadian Occurrence: Ontario

COSEWIC Status History: No site records since 1954. Designated Extirpated in April 1987. Status re-examined and confirmed in May 2000. Last assessment based on an existing status report.

1.2 Description of the Species

The spring blue-eyed Mary is a winter annual that reaches 20–40 cm in height (COSEWIC 2000). The leaves are entire with an ovate to lanceolate shape and are 1–6 cm long (COSEWIC 2000). The plant's stem tends to be weak and lined with hairs. The leaves often clasp the upper portions of the stem (COSEWIC 2000).

There are typically 1–3 whorls of 4–6 flowers, although solitary flowers occasionally emerge from the axils of the upper leaves (COSEWIC 2000). The flowers are bell-shaped, composed of five lobes, and approximately 1.5 cm long (COSEWIC 2000; Canadian Wildlife Service 2006). The bottom two lobes are blue, whereas the upper two lobes are bright white. The fifth lobe forms a pouch that is often hidden beneath the lower lobes of the flower (COSEWIC 2000). Seed capsules are 4–5 mm in length and contain up to four seeds (Canadian Wildlife Service 2006). Seeds are round and flat when immature but become thickened with a central concavity when mature. Seeds tend to be 1.5–3 mm long (COSEWIC 2000).

The seed capsules containing up to four seeds separate the species from the Violet Blue-eyed Mary (*Collinsia violacea*), a southern species that looks very similar to the spring blue-eyed Mary but has 6–12 seeds per capsule (COSEWIC 2000).

1.3 Populations and Distribution

The spring blue-eyed Mary is found throughout the eastern and midwestern United States (NatureServe 2006). It occurs “mainly north of the southern limit of the Wisconsin glaciation with only a few isolated populations found south of that limit” (COSEWIC 2000).

The species ranges from New York, Pennsylvania, and Virginia west to Wisconsin, Indiana, and Kansas and south to Louisiana (COSEWIC 2000; NatureServe 2006). In Canada, the historic range of the spring blue-eyed Mary was limited to southern Ontario (COSEWIC 2000).

The spring blue-eyed Mary is considered “globally secure” (G5). In the United States, the species is not yet ranked for conservation purposes (NNR) (NatureServe 2006). It is extirpated (SX) from one state, considered historic (SH) in another state, critically imperilled (S1) in five states and not yet ranked (SNR) in another five states (NatureServe 2006) (see Appendix 1). In Canada, the species is designated as Extirpated by COSEWIC and in Ontario it is listed as extirpated on the Species at Risk in Ontario List (Ontario Regulation 230/08) under the *Endangered Species Act*, 2007. It is ranked as nationally historic (NH) and provincially historic (SH) (NatureServe 2006) (Appendix1).

In Ontario, there are currently no known extant populations of this species. It was historically found in three locations in southwestern Ontario, in the counties of Elgin, Middlesex, and Oxford (COSEWIC 2000). The last observation of the spring blue-eyed Mary in Ontario was reported in 1954 in Elgin County (COSEWIC 2000). The other two populations were last seen in 1894 (Middlesex) and 1896 (Oxford) (COSEWIC 2000). The Middlesex site was cleared prior to 1970 and was converted into a farm field (COSEWIC 2000).

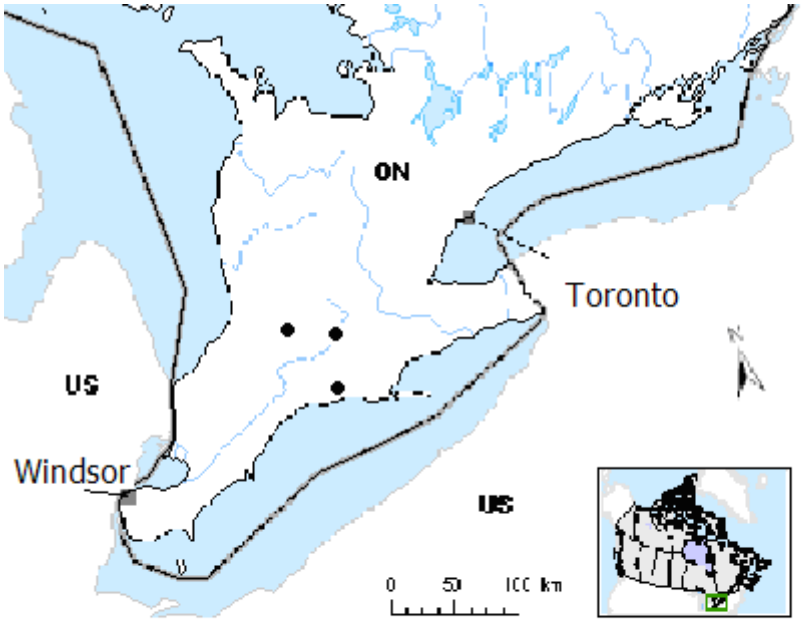

Figure 1. Former occurrences of the spring blue-eyed Mary in Ontario

1.4 Needs of the Spring Blue-eyed Mary

1.4.1 Habitat and biological needs

The spring blue-eyed Mary is "one of only a few native winter annuals that grows in rich deciduous woodlands in the eastern United States and Canada, and is one of only a few Scrophulariaceae occurring in eastern North America that is a spring ephemeral" (COSEWIC 2000). The spring blue-eyed Mary is restricted to the mesic temperate region of eastern North America (COSEWIC 2000). It is often found in open, rich woods located on floodplains (Baskin and Baskin 1983; COSEWIC 2000). The species prefers moist rich soils associated with alluvial bottoms (COSEWIC 2000). This understory herb is most often associated with Sugar Maple (*Acer saccharum*) and White Oak (*Quercus alba*) (COSEWIC 2000). Ontario populations were found near waterways and once in a second-growth forest where the plants received high light levels due to the open canopy (COSEWIC 2000). As a winter annual, the spring blue-eyed Mary germinates in the fall. Two to four leaves develop prior to the suspension of growth for the winter (Baskin and Baskin 1983; COSEWIC 2000). Growth resumes in later winter or early spring (Baskin and Baskin 1983; COSEWIC 2000). Flowering begins in April and continues through May (Baskin and Baskin 1983). In Ontario, plants tend to flower by late May (COSEWIC 2000). Unpollinated flowers remain intact for 7–10 days. Flowers are pollinated by native bees, bumblebees, honey bees, and occasionally lepidopterans and dipterans, and wilt within 48–72 hours of pollination (Kalisz et al. 1999; COSEWIC 2000).

The spring blue-eyed Mary is capable of self-pollination. Some studies suggest that spring blue-eyed Mary has developed delayed selfing as one way to reproduce in variable environments (Kalisz et al. 1999). Natural populations exhibit significant variation in outcrossing rates which suggest that seeds are produced by a combination of selfing and outcrossing each year (Kalisz et al. 1999; Kalisz 1989).

Seeds are dispersed by late June (COSEWIC 2000). It is unknown how the seeds of this species are dispersed; however, it has been suggested that seeds simply fall from the capsules to the ground beneath the parent plant (Kalisz et al. 1997). It has also been suggested that seeds could be carried by water in creeks and streams during flooding events (Kalisz et al. 1997). Most species of Scrophulariaceae are wind dispersed, having wind ballasts attached to the seeds so this may be another way for seeds to be dispersed (COSEWIC 2000). The plants senesce immediately after seed dispersal has occurred and rapidly decompose (Baskin and Baskin 1983). Therefore, the best time to search for the species in Ontario ranges from mid-April to early June (COSEWIC 2000).

Seeds are dormant throughout the summer. They require high temperatures and high relative humidity during these months to break their dormancy (COSEWIC 2000). The species is cued to germinate by diurnal temperature changes that occur at the soil surface during the autumn months (Kalisz 1989). Optimum temperature regimes for germination were found to be between 15 and 20°C during the day and between 6 and 10°C at night (Baskin and Baskin 1983). Thus, germination in the central and southern portions of the range typically occurs in late September to October. However, in Ontario, at the northerly limit of the species' range, germination occurs from late August to early September onwards (COSEWIC 2000). Seedling emergence dates can be highly variable and appear to be negatively correlated with overall survivorship and with seed production (Kalisz 1989).

Results from experimental and natural seed banks of an Illinois, U.S. population of *C. verna* indicated that seeds can persist in the soil for at least three years, however, on average 36% of the seeds emerged in the autumn following their production, 6% emerged two autumns later and 3% emerged three autumns later (Kalisz 1991). Kalisz (1991) also concluded that the likelihood of entering into, persisting in, or emerging from the seed bank were found to be affected by spatial and temporal variations for the site, with some locations supporting longer term seed persistence than others. Studies have shown that variation in the general autumn weather between years will determine the fraction of seeds that emerge, while site conditions such as soil type and aspect, will determine survival and persistence of dormant seeds (Kalisz 1991).

"Based on the results of genetic studies, it was concluded that the pattern of spread for the genus is probably from the west coast of the United States eastward. And that the eastern species of *Collinsia*, specifically *C. verna*, are more recently evolved than the California species" (COSEWIC 2000).

1.4.2 Limiting factors

A limiting factor for this species is the short viability of seeds as indicated by studies that show reduced seedling emergence from seeds buried for two to four years (Kalisz 1991, COSEWIC 2000). One study found that planted seeds germinated only during the first autumn after planting (Baskin and Baskin 1983). This limits the species' ability to develop a viable seed bank and thus repopulate any area after a catastrophic event.

The species requires ample light conditions in order to grow and flower, limiting its growing season to the early part of the spring and the autumn months of the year (COSEWIC 2000).

It has been indicated that the spring blue-eyed Mary is often outcompeted by other vegetation unless a disturbance is applied to the area and therefore is dependent on dynamic factors for its survival (COSEWIC 2000). This may reduce the available habitat suitable for the spring blue-eyed Mary.

Spring blue-eyed Mary experiences dramatic annual fluctuations in fecundity and population growth rates (Kalisz, et al. 1999). This could affect the survival of the populations if there are a number of poor growing years in a row.

1.5 Threats

1.5.1 Threat classification

Table 1. Threat Classification Table

Threat		**Threat Attributes**		
1	**Logging**			
Threat category	Habitat loss and degradation	**Extent**	Unknown	
			Local	***Range-wide***
General threat	Logging	**Occurrence**	Historic	
		Frequency	Unknown	
Specific threat	Alteration of habitat	**Causal certainty**	Unknown	
		Severity	Unknown	
Stress	Reduced population size or reduced population viability	**Level of concern**	Unknown	

Threat		Threat Attributes		
2	**Agriculture**			
Threat category	Habitat loss and degradation	**Extent**	Localized	
			Local	***Range-wide***
General threat	Crop production	**Occurrence**	Historic	Historic
		Frequency	One time	One time
Specific threat	Habitat conversion	**Causal certainty**	High	High
		Severity	High	Medium
Stress	Reduced population size	**Level of concern**	High	
3	**Invasive species**			
Threat category	Exotic or invasive species	**Extent**	Unknown	
			Local	***Range-wide***
General threat	Potential invasion of habitat	**Occurrence**	Unknown	Unknown
		Frequency	Unknown	Unknown
Specific threat	Resource competition	**Causal certainty**	Unknown	Unknown
		Severity	Unknown	Unknown
Stress	Reduced population size or reduced population viability	**Level of concern**	Unknown	
4	**Natural succession**			
Threat category	Natural processes	**Extent**	Unknown	
			Local	***Range-wide***
General threat	Succession	**Occurrence**	Unknown	Unknown
		Frequency	Unknown	Unknown
Specific threat	Alteration of habitat	**Causal certainty**	Unknown	Unknown
		Severity	Unknown	Unknown
Stress	Reduced population size	**Level of concern**	Unknown	

1.5.2 Description of threats

The main threats that led to the extirpation of the species from Ontario are habitat loss and degradation through forest clearing and agricultural development (Canadian Wildlife Service 2006).

Most of the historic sites were logged at some point in the past, as is evident by the second-growth forests in the areas surrounding these sites (COSEWIC 2000). The impact of logging on the species is unknown (COSEWIC 2000); however, logging might have led to changes in

habitat that the plants were not able to overcome. This might have been due to soil compaction, altered light levels and altered hydrology.

In the past, the species preference for habitat with rich soil and proximity to fresh water was the same habitat desired for farming. In the United States, forest fragments containing the species are embedded in a matrix of agricultural fields (Kalisz, et al. 1997). Therefore, this habitat fragmentation has led to a decline in the number of populations. It is also likely that habitat fragmentation has significantly reduced population sizes relative to historical numbers (Kalisz et al. 1997). This is similar to what has occurred in southern Ontario. The preferred habitat of the spring blue-eyed Mary in southern Ontario is of prime agricultural potential (COSEWIC 2000). The historic site in Middlesex County was cleared for farmland, destroying the potential for the population to survive (COSEWIC 2000).

Another potential threat to the species is invasive species. If a population of the spring blue-eyed Mary were to exist in Canada, it could be outcompeted by invasive species that enter the area, such as Garlic Mustard.

As well, natural succession may be a threat to the species. It is believed that the species may be dependent on dynamic factors to prevent competition from other plants (COSEWIC 2000). If these factors were removed and natural succession allowed to take place, the spring blue-eyed Mary could be outcompeted.

1.6 Actions Already Completed or Underway

To date, no recovery actions have been undertaken for this species in Canada.

1.7 Knowledge Gaps

Further information is required to assess the recovery feasibility of spring blue-eyed Mary and to gain additional knowledge of its ecology that may increase the likelihood of recovery success. These include:

Information needed for assessment of recovery feasibility

- Reintroduction techniques (effectiveness of reintroduction projects and techniques and their usefulness in reintroducing the species to Canada)
- Species biological and habitat needs
- Habitat suitability at former and potentially available sites in Ontario
- Impact of reintroduction on other species
- Habitat restoration techniques
- Impacts of logging
- Dynamic factors that may play a role in the species' survival

Other knowledge gaps

- Critical habitat requirements
- Mechanism of seed dispersal
- Impact of suppressing disturbance factors (e.g. fire)

- Impacts of deer browse
- Associations with mychorrhizal fungi and the impact of threats on the fungi
- Soil nutrient enrichment from direct or indirect agricultural activities
- Impacts of seed predation

2. RECOVERY

2.1 Recovery Feasibility

Based on the following four criteria outlined in Environment Canada (2009), there are unknowns regarding the feasibility of recovery of the spring blue-eyed Mary. In keeping with the precautionary principle, a recovery strategy has been prepared as would be done when recovery is determined to be feasible.

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

There are extant populations of the spring blue-eyed Mary in the United States. These populations are capable of reproduction and may be capable of aiding in the reintroduction of the species to Canada.

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

It is currently unknown whether sufficient suitable habitat is available to support the species in Canada. It is speculated that there may be enough suitable habitat for a number of small populations; however, studies are necessary to confirm this.

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

While the main threats that led to extirpation of the species from Ontario (i.e. forest clearing and agricultural development) may be avoided or mitigated, the impacts and effects of other current threats (e.g. invasive species, succession, habitat fragmentation) are poorly understood, and may not be avoided or mitigated through recovery actions.

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

The necessary techniques for cultivation and reintroduction of this species are currently being studied in the United States. It is unclear whether these techniques will be of benefit to the recovery of the spring blue-eyed Mary in Canada.

This feasibility determination will be re-evaluated as warranted in response to changing conditions and/or knowledge.

2.2 Population and Distribution Objectives

This species has not been seen in Canada since the 1950s and is globally secure with a widespread distribution in the United States.

The recovery objective for this recovery strategy is to follow the progress and findings of the ongoing cultivation and reintroduction studies in the United States.

This recovery strategy will be updated if an extant population of spring blue-eyed Mary is found in Ontario or as warranted in response to changing conditions and /or knowledge.

2.3 Critical Habitat

Given the lack of information on suitable habitat, critical habitat is not identified in this recovery strategy. It may be identified in an updated version of this recovery strategy or in an action plan, if an extant population of spring blue-eyed Mary is found in Ontario or as warranted in response to changing conditions and /or knowledge.

2.4 Conservation Approach

Research and recovery initiatives in the United States will be monitored for new information on the species and its potential cultivation and reintroduction. This information will be evaluated as to whether it will be of benefit to the recovery of spring blue-eyed Mary in its historic range in Canada.

Currently, as spring blue-eyed Mary is extirpated in Ontario, the general habitat provisions under the Ontario *Endangered Species Act*, 2007 do not apply.

2.5 Statement on Action Plans

An action plan will be developed if an extant population of spring blue-eyed Mary is found in Ontario or as warranted in response to changing conditions and/or knowledge.

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4. SPECIES CONTACT

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APPENDIX 1

Subnational ranks for the spring blue-eyed Mary (NatureServe 2006)

S rank	State/province
S1 – Critically imperilled	Arkansas, Iowa, Kansas, Oklahoma, Tennessee
S1S2 – Critically imperilled to imperilled	Virginia
S4 – Apparently secure	Kentucky, Pennsylvania, West Virginia
SH – Historic	New York
SX – Extirpated	Wisconsin, Ontario
SNR – Not yet ranked	Illinois, Indiana, Michigan, Missouri, Ohio
SU – Unrankable (data deficient)	Louisiana