COSEWIC
Assessment and Update Status Report

on the

Yellow Montane Violet
Viola praemorsa ssp. *praemorsa*

praemorsa subspecies

in Canada

ENDANGERED
2007

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 reports:

COSEWIC. 2000. COSEWIC assessment and status report on the yellow montane violet, *praemorsa* subspecies, *Viola praemorsa* ssp. *praemorsa,*in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 23 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Ryan, M. and G.W. Douglas. 1995. COSEWIC status report on the yellow montane violet, *praemorsa* subspecies, *Viola praemorsa* ssp. *praemorsa,*in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-23 pp.

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Yellow montane violet — by L.M. Richards in Douglas *et al.* 2000.

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COSEWIC
Assessment Summary

Assessment Summary – November 2007

Common name
Yellow montane violet *praemorsa* subspecies

Scientific name
Viola praemorsa ssp. *praemorsa*

Status
Endangered

Reason for designation
The species is only known in Canada from southeastern Vancouver Island and the adjacent southern Gulf Islands where it occurs as 14 mainly small, localized populations that are highly fragmented. This short-lived perennial is restricted to Garry oak woodlands and maritime meadows where habitat is continuing to decline in quality due to such factors as the spread of exotic invasive grasses as well as the spread of trees and shrubs as a result of fire suppression.

Occurrence
British Columbia

Status history
Designated Threatened in April 1995. Status re-examined and confirmed in May 2000. Status re-examined and designated Endangered in November 2007. Last assessment based on an update status report.

COSEWIC
Executive Summary

Yellow Montane Violet
Viola praemorsa ssp. *praemorsa*

praemorsa subspecies

Species information

Yellow montane violet (*Viola praemorsa* ssp. *praemorsa*) is a hairy, perennial herb with egg-shaped to lance-shaped basal leaves and a short stem that is leafless or bears a few reduced leaves. Its showy, yellow flowers are borne singly at the end of long stalks which emerge from the axils of leaves. Yellow montane violet also produces less conspicuous cleistogamous flowers, which lack showy petals and are borne on short stalks near the base of the shoot. In both conventional and cleistogamous flowers, the ovary ripens into a dry, 6-11 mm long capsule containing several dark-brown seeds.

Throughout this report the name yellow montane violet refers specifically to the subspecies *praemorsa* found in British Columbia and only includes the entire species when considering its global range.

Distribution

Yellow montane violet occurs from Vancouver Island to California, chiefly west of the Cascades. In British Columbia, yellow montane violet is found only along the southeast coast of Vancouver Island and on adjacent islands in the Strait of Georgia. The nearest non-Canadian population is about 100 km to the south, on the other side of Puget Sound. The current Canadian extent of occurrence is about 450 km^2. The historic extent of occurrence was approximately 2,400 km^2. The greatest decline in extent of occurrence occurred between 1960-1990. The area of occupancy as based on a 1x1 km grid is 14 km^2 and based on a 2x2 km grid is 56 km^2. The actual area of habitat occupied is < 20 ha.

Habitat

In British Columbia, yellow montane violet occurs in Garry oak woodlands and maritime meadows. Most microhabitats occupied by yellow montane violet have shallow soils over bedrock, are relatively level or south-facing, have little or no shrub cover and have an abundant cover of herbaceous species. In spring, the herb layer is dominated by native forbs. In summer, the native herbaceous layer is replaced by a diverse assemblage of forbs and grasses.

The amount of potential habitat has declined greatly over the past century as coastal areas in southeast Vancouver Island have been developed for residential and recreational use. Most of the remaining habitat has been heavily altered through invasion by exotic grasses and shrubs.

Three populations have been lost to property development. Most of the remaining populations are secure from development, at least over the next 10 years.

Biology

Shoot dormancy begins to break in March when the soil begins to warm up with the spring weather. Plants are fully leafed out by late April or early May. Foliage begins to wither by mid to late June and the shoots die back by mid to late July as the summer drought deepens. Plants often grow for several years before reaching flowering size. Fruit dispersal occurs as the desiccating capsules rupture abruptly, explosively dispersing seeds as much as 1 metre. The seeds are hard and shiny and bear pale terminal fat bodies (elaiosomes) that attract ants,that carry the seeds slightly further from the parent plant. Yellow montane violet is incapable of clonal growth or asexual reproduction.

Population sizes and trends

There are 14 extant populations and, based on recent data, approximately 32,000-49,000 flowering plants in British Columbia, with about 80-90% of the population of this subspecies concentrated in the two largest populations. The actual area of habitat occupied is < 1 km^2. The number of populations has been in slow decline – five populations have disappeared but none of these have been lost over the past 10 years.

Limiting factors and threats

The impacts of invasive species (particularly exotic grasses) and altered fire regimes pose the greatest threats to yellow montane violet. The absence of First Nations burning has shifted vegetation structure, favouring shrub and tree species that had been held in check by frequent ground fires used to stimulate production of food species. At some sites a fire-intolerant native shrub appears to have expanded into most of the habitat formerly available to yellow montane violet.

Trampling damage along human foot paths has affected a significant proportion of some populations. As well, several populations are so small that they are particularly vulnerable to stochastic events.

Special significance of the species

The British Columbia populations are of scientific interest because they are disjunct from the species' main range and may be genetically distinct as a result.

Existing protection or other status designations

Yellow montane violet was initially assessed by COSEWIC in 1995 as Threatened in Canada and the status was re-examined and confirmed in 2000. It was subsequently listed under schedule 1 of the federal *Species at Risk Act* (SARA). The British Columbia Ministry of Environment considers yellow montane violet to be a "Red-listed" (threatened/endangered) taxon in British Columbia. Yellow montane violet is the subject of a multi-species recovery strategy along with other Garry oak woodland species.

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 (2007)

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 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 Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

Canada

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

Update
COSEWIC Status Report

on the

Yellow Montane Violet
Viola praemorsa ssp. *praemorsa*

praemorsa subspecies

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2007

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SPECIES INFORMATION

Name and classification

Scientific name:	*Viola praemorsa* Dougl. *ex* Lindl. ssp. *praemorsa*
Common name:	yellow montane violet, canary violet, upland yellow violet, violette jaune des monts
Family:	Violaceae, violet family
Major plant group:	Eudicot flowering plant

Yellow montane violet has been treated as *Viola nuttallii* Pursh ssp. *praemorsa* Dougl. ex Lindl. but that synonym is no longer considered valid (ITIS 2006). It is a well-defined subspecies, one of three in the species. The closely related ssp. *linguifolia* (Nutt.) M.S. Baker & J.C. Clausen ex M.E. Peck, which occurs in southeast Alberta, has longer and narrower cauline leaves that tend to be less sharply serrated along the margin (Fabijan *et al.* 1987). The third subspecies, ssp. *flavovirens*, has not been reported from Canada.

Throughout this report the name yellow montane violet refers specifically to the subspecies *praemorsa* found in British Columbia and only includes the entire species when considering its global range.

Morphological description

Yellow montane violet is a 5-20 cm tall perennial herb from a fibrous root (Figure 1). The short stem is erect and partially underground. The basal leaves are egg-shaped to lance-shaped and with regular teeth along the margins. They are sparsely to densely hairy, 2-10 cm long, 1-3.5 cm wide and on leaf stalks 3-15 cm long. The short stem may be leafless or bear a few reduced leaves.

Figure 1. Illustration of yellow montane violet (L.M. Richards in Douglas *et al.* 2000)

The showy flowers are borne singly at the end of long stalks that emerge from the axils of leaves. The 5-15 mm long flowers are bilaterally symmetric, as in other species of violets. The outer ring of flower parts (calyx) consists of five lance-shaped sepals. The petals are yellow. The lowest petal is pencilled with brownish-purple markings and is spurred at the base, while the two lateral petals are bearded. The two upper petals are slightly smaller than the lower three and tend to be brownish on their back. There are two pairs of stamens (male parts), of unequal length. The female structure (pistil) bears a single style and stigma (receptive surface).

As with many other species in the genus, yellow montane violet also produces less conspicuous cleistogamous flowers. These are self-fertilized and do not open up to reveal showy petals, as in conventional flowers. The cleistogamous flowers of yellow montane violet are usually borne on short stalks near the base of the shoot and often escape attention.

In both conventional and cleistogamous flowers, the ovary matures into a dry, 6-11 mm long capsule containing several dark-brown seeds.

Genetic description

Yellow montane violet, at the species level, has a chromosome count of 2n=36 or 48 (Little 1993). No studies have been conducted on genetic differences among the subspecies of *Viola praemorsa*.

Designatable units

There are two designatable units for the species in Canada. The present update report deals with ssp. *praemorsa*, which only occurs in a geographically restricted region of British Columbia. A second designatable unit is the Alberta subspecies *linguifolia,* which is ranked as S2 (imperilled) in the province. This subspecies is also eligible for status report preparation.

DISTRIBUTION

Global range

Yellow montane violet, as a species, occurs from Vancouver Island to California (Figure 2), chiefly west of the Cascades (Hitchcock and Cronquist 1961).

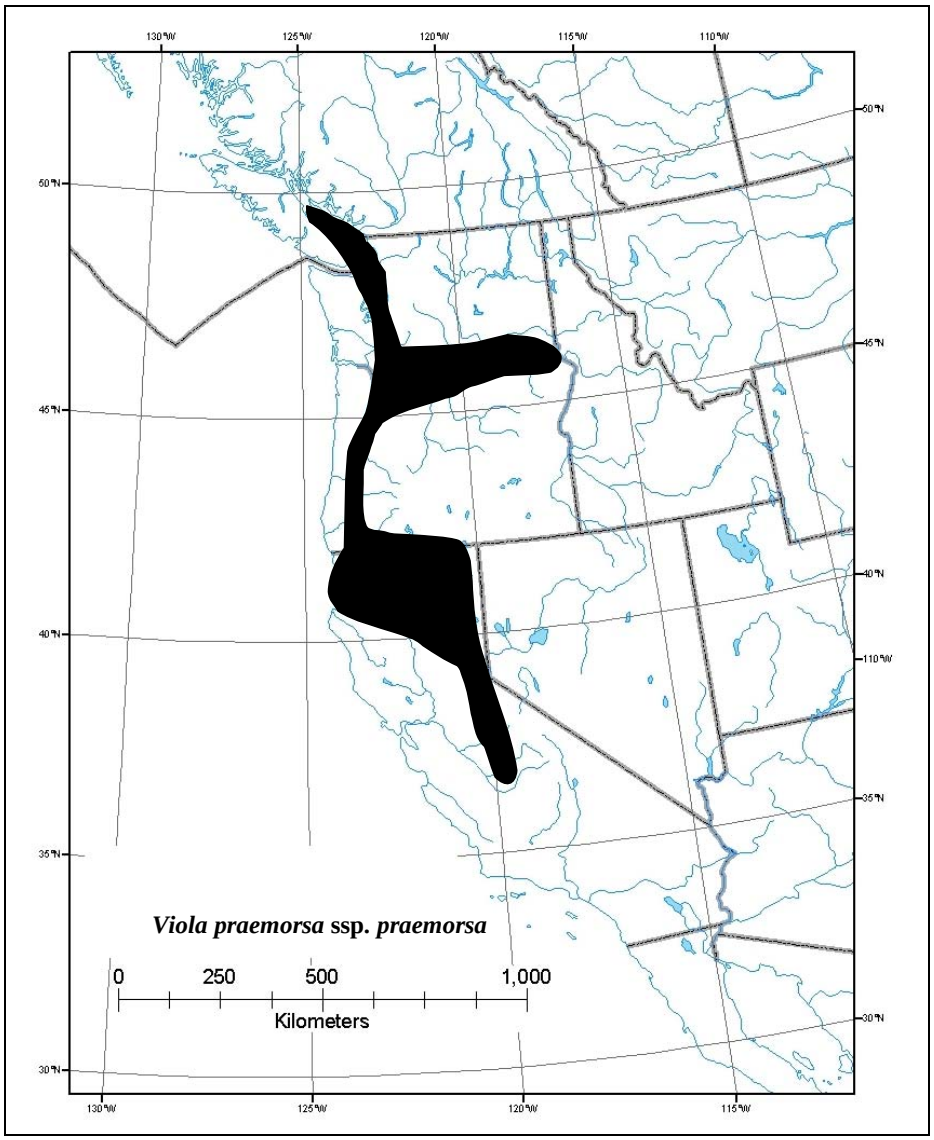

Figure 2. Global distribution of yellow montane violet.

Canadian range

In British Columbia, yellow montane violet is found only along the southeast coast of Vancouver Island and on adjacent islands in the Strait of Georgia (Figure 3). The extant extent of occurrence is about 450 km^2 (calculated using mapware program and subtracting large areas of open ocean). The historic extent of occurrence was approximately 2,400 km^2. The greatest decline in range occurred between 1960-1990. The area of occupancy as based on a 1x1 km grid is 14 km^2 and based on a 2x2 km grid is 56 km^2. The actual area of habitat occupied is < 20 ha.

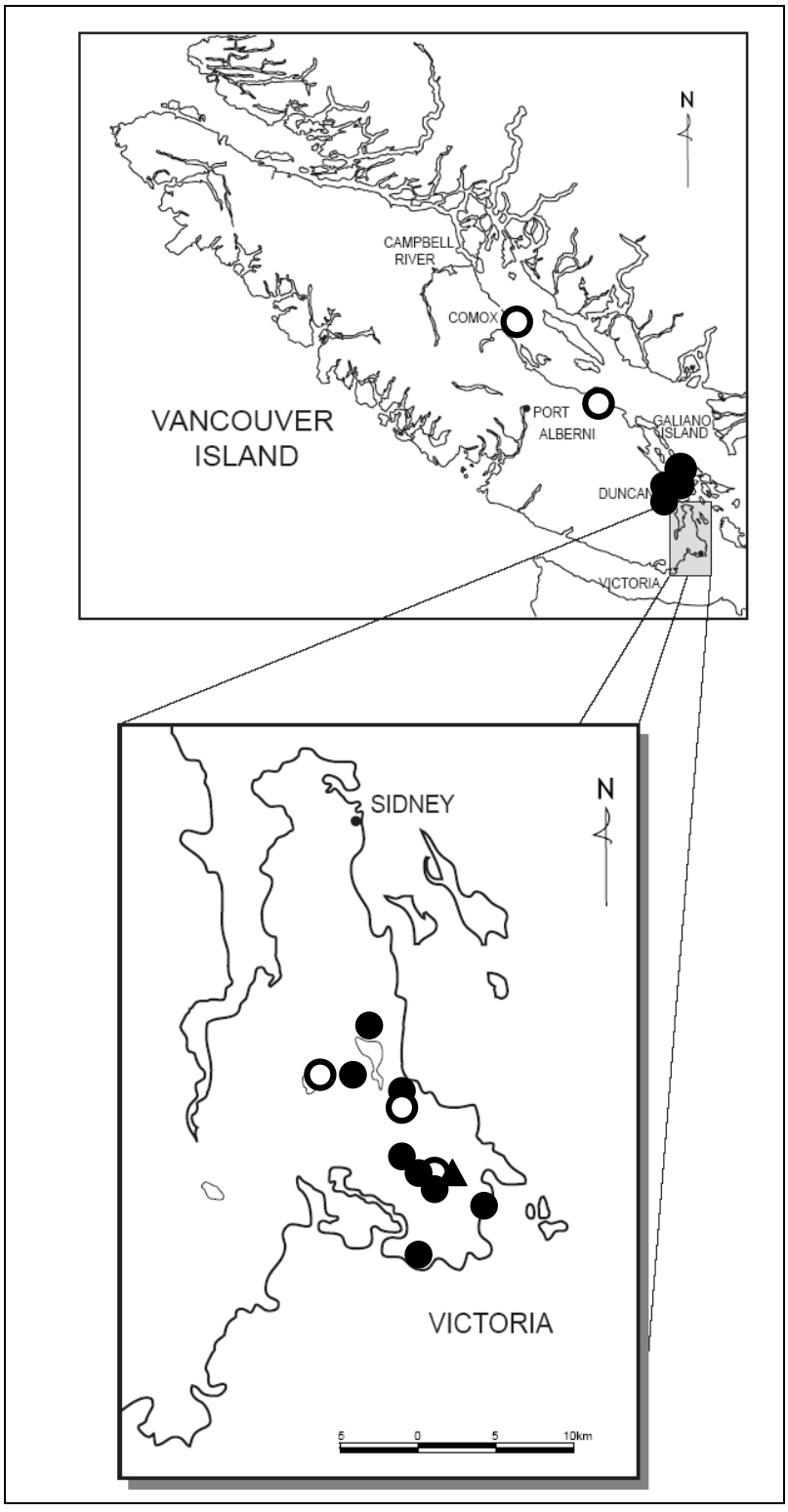

Figure 3. Distribution map of yellow montane violet in Canada. (Solid circles indicate extant locations. Open circles represent extirpated populations. Triangle represents a historic population with uncertain status. Some points represent multiple locations.)

HABITAT

Habitat requirements

In British Columbia, yellow montane violet occurs in Garry oak woodlands and maritime meadows. These low-elevation (< 30 m), herb-dominated ecosystems are largely confined to coastal situations (within 3 km of the shoreline) along south-eastern Vancouver Island and a subset of islands in the Straight of Georgia, Haro Strait and the Strait of Juan de Fuca. Summer and winter temperatures are greatly moderated by proximity to the ocean. Maritime meadows and Garry oak woodlands may be largely free of shrubby vegetation for a variety of reasons, including strong summer moisture deficits (particularly on wind-exposed sites and/or those with thin, coarse-textured soils), salt spray and a long history of First Nations burning. These forces may act alone or in concert, consequently some Garry oak woodlands and maritime meadows are subject to forest ingrowth while others remain open despite fire suppression (Parks Canada Agency2006). Most microhabitats occupied by yellow montane violet have shallow soils over bedrock, are relatively level or south-facing, have little or no shrub cover and have an abundant cover of herbaceous species. In spring, the herb layer is dominated by native forbs such as *Camassia quamash* and *Sanicula crassicaulis*. In summer, the native herbaceous layer is replaced by a diverse assemblage of forbs and grasses.

Habitat trends

The amount of potential habitat has declined greatly over the past century as coastal areas in southeast Vancouver Island have been developed for residential and recreational use. Less than 1% of the Coastal Douglas-fir biogeoclimatic zone remains in a relatively undisturbed state (Pacific Marine Heritage Legacy 1996). Garry oak ecosystems in the Victoria region have declined from 10,510 ha in 1800 to 512 ha in 1997 (Lea 2002); even more has been lost since then, and most of what remains has been heavily altered through invasion by exotic grasses and shrubs. The remaining Garry oak ecosystems persist largely as isolated communities that are heavily fragmented and lack connections that would allow substantial genetic interchange. Habitats suitable for yellow montane violet have probably suffered proportional declines in area and quality.

The distribution of yellow montane violet in British Columbia lies at the heart of one of North America's fastest growing regions, near Victoria British Columbia. The population of metropolitan Victoria has increased from approximately 180,000 in 1966 to 338,738 in 2005 and is projected to increase to 407,600 by 2026 (CRD 2006). The population of the Cowichan Valley Regional District, where the majority of the Canadian population occurs, grew by 16% between 1991 and 2001 (Cowichan Region Economic Development Commission 2001). This growth was concentrated in the eastern portion of the district, the only portion with suitable habitat for yellow montane violet.

Populations at the Saanich 3, Saanich 6 and Nanoose sites (see Table 1) have been lost to property development. The two Saanich populations probably disappeared before 1980; the population at Nanoose disappeared between 1973 and 1976. Most of the remaining populations are secure from development, at least over the next 10 years. The exception is Saanich 7 which occurs on an undeveloped private lot with an attractive view overlooking Victoria and the Sooke Hills and therefore has high development potential.

Protection/ownership

Of the 14 extant populations in Canada, seven are in municipal and/or regional parks where they are protected from development but face major threats from park users. Three populations are in provincial parks and ecological reserves where they receive legal protection, and where recreational activities tend to be less intensive. Two populations are in private conservancies and receive a high degree of protection involving measures to control invasive species and counteract the impacts of fire exclusion. The two remaining sites are not protected (Table 1).

One extirpated population (Nanoose) may have occurred on or near federal lands. One extant population (Saltspring 2) extends onto federal lands.

BIOLOGY

General

There is relatively little published literature on the biology of yellow montane violet . The following section draws heavily upon unpublished data from the author's ongoing phenological study of yellow montane violet in British Columbia except where otherwise noted. There is no information available on pharmacological or ethnobotanical uses of this species.

Life cycle and reproduction

Shoot dormancy begins to break in March when the soil begins to warm up with the spring weather. Plants are fully leafed out by late April or early May. Foliage begins to wither by mid- to late June and the shoots die back by mid- to late July as the summer drought deepens.

Plants may become large enough to flower within 2 years under favourable conditions, but more often they grow for several years before reaching flowering size. The average age of mature plants in Canada is unknown, but probably lies between 3-6 years. Chasmogamous flowering (flowers open for cross-pollination) occurs in late April and May and cleistogamous flowering (flowers remain closed and self-pollinate) occurs somewhat later. Chasmogamous flowers are rarely produced in late May or June but cleistogamous flowers continue to develop as long as the plants remain green. Most flowering plants produce 1-3 chasmogamous flowers and 0-5 cleistogamous flowers. Fruit dispersal occurs in June and July and all seeds are released by late July. The drying capsules rupture abruptly as they dry out, explosively dispersing seeds as much as 1 metre. Capsules produce an average of 8.8 seeds. Most early-developing seeds are well-formed and preliminary observations suggest that seed viability appears to be quite high. The seeds are hard and shiny and bear pale terminal fat bodies (elaiosomes) at either end. Pale, unfilled seeds are often present, especially in late-maturing capsules (pers. obs.).

The production of both chasmogamous and cleistogamous flowers may be a bet-hedging technique. Chasmogamous flowers enable a higher degree of recombination that may limit inbreeding depression. Cleistogamous flowers, which form later in the season when unpredictable rains may extend the life of a plant, may greatly increase fecundity by avoiding the high resource and time demands involved with the production of showy flowers.

The arrangement of the flower parts is such that most flowers are fertilized with pollen from other flowers, either on the same plant or from another (Baker 1935, Beattie 1969). Yellow montane violet is probably pollinated by the same species that pollinate closely related violets: flies, butterflies, solitary bees and thrips (Baker 1935, Beattie 1974 and Davidse 1976).

The elaiosomes are attractive to ants, which have been shown to disperse seeds of similar violet species over distances of 50 cm or more. Ant dispersal increases the overall dispersal distance of seeds (Ohkawara and Higashi 1994) and seeds in ant nests tend to have significantly higher germination rates (Culver and Beattie 1980). In another violet species, seeds from cleistogamous flowers tended to have slightly lower fitness than those from chasmogamous flowers but this is balanced by the much lower cost of production (Berg and Redbo-Torstensson 1999).

Yellow montane violet is incapable of clonal growth by asexual reproduction.

Herbivory

Insect herbivory is often observed on the leaves of British Columbia plants but damage is usually slight. Chasmogamous flowers are also sometimes damaged by insects (pers. obs.).

Livestock and wildlife grazing does not seem to cause a significant amount of direct damage. Grazing may reduce competition from taller-growing herbaceous and shrubby species but also appears to facilitate invasion by non-native grasses and forbs. Yellow montane violet avoids high competition environments by growing in areas with low biomass and/or by completing much of its life cycle before the biomass of more competitive species peaks.

POPULATION SIZES AND TRENDS

Search effort

Suitable sites have been surveyed repeatedly since the early 1980s in a series of projects designed to document the distribution of rare plants of Garry oak woodlands and maritime meadows on southeast Vancouver Island and the southern Gulf Islands. The principal investigators included Adolf and Oldriska Ceska, Matt Fairbarns, Hans Roemer, Jenifer Penny, Harvey Janszen, Frank Lomer and the late George Douglas, all of whom are/were familiar with the yellow montane violet. These investigators have examined a number of areas beyond the documented range of yellow montane violet but failed to document any significant range extensions.

Over 90 sites with Garry oak woodlands and maritime meadows have been investigated (Figure 4) and much of it has been surveyed more than once during this period. During the past decade alone, over 500 person-days have been spent searching for rare species in suitable habitats. Despite the concentrated effort, only one new population of yellow montane violet has been discovered, since 1997 (Duncan 4). Private lands and Indian reserves, which only constitute a small proportion of the apparently suitable habitat, have not been surveyed as thoroughly as public lands.

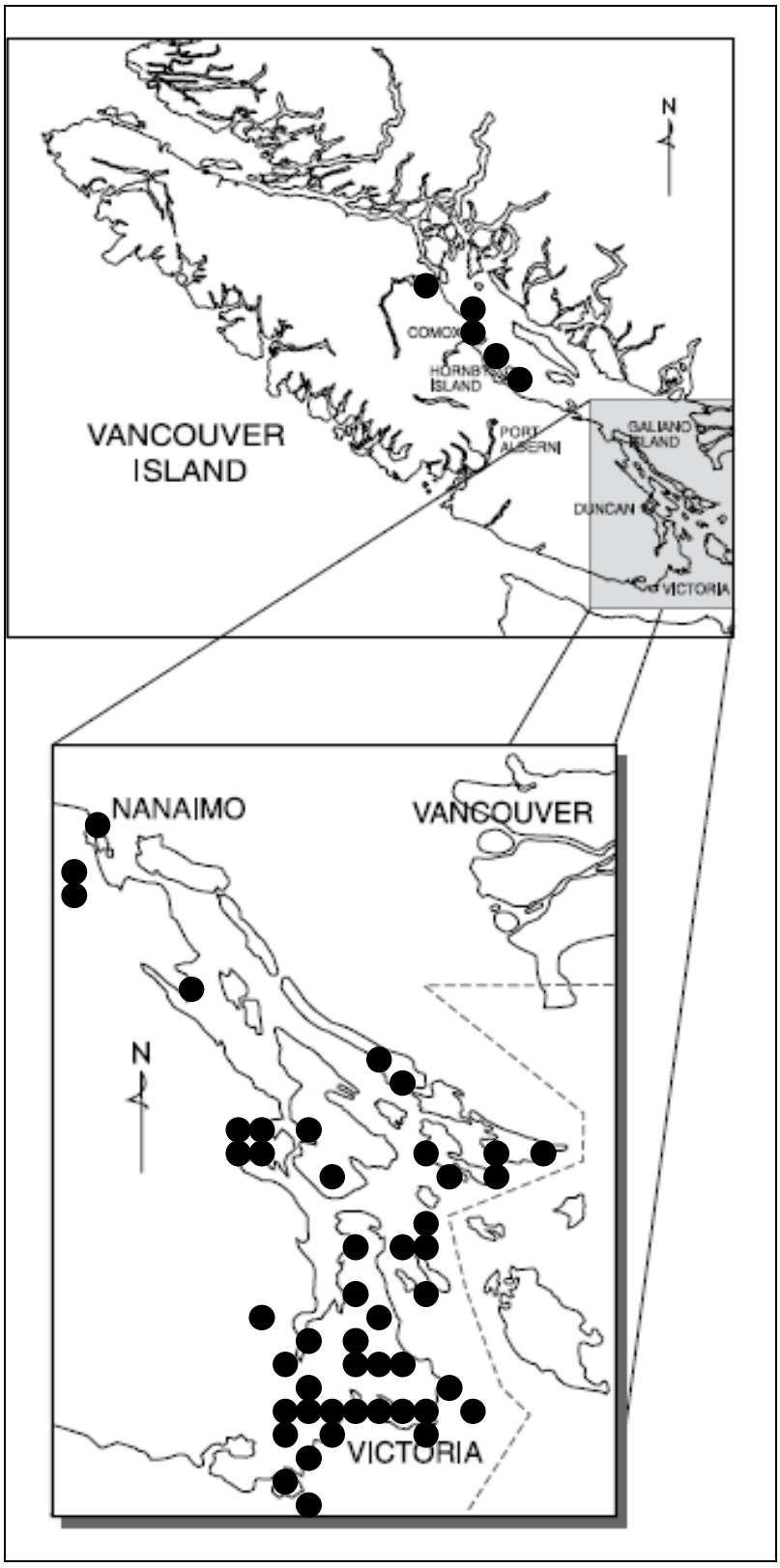

Figure 4. Search effort for yellow montane violet, 2001-2006.

Abundance

In the absence of information on rates of genetic exchange, occurrences of yellow montane violet more than 1,000 m apart are treated as separate locations. On this basis, it has been validly[1] reported from 18-19 locations in British Columbia (Table 1). The uncertainty lies in the fact that the populations at Saanich 3 and Saanich 6 are too vaguely reported to determine if they were more than 1,000 m apart (both appear to be extirpated). Fourteen populations are extant. Some populations consist of multiple subpopulations (*i.e.* patches separated by <1,000 m).

Table 1. Localities, population and land ownership for yellow montane violet [Table 1 cites first record, most recent observation, any other observations with reliable population estimates and (where applicable) subsequent unsuccessful surveys.]

Location	Year	Collector/ observer	Number of plants/area	Land ownership/notes
Victoria	1897	Henry	unknown	location too vague
Victoria 1	1913	Macoun	unknown	municipal park
	1993	Douglas	400-450/1,100 m^2	
	1994	Douglas	100-150/50 m^2	
	1997	Douglas	465/1,000 m^2	
	2006	Fairbarns	885/525 m^2	
Victoria 2	1972	Roemer	unknown	municipal park
	1993	Douglas	unknown	
	1994	Ryan & Douglas	500/?	
	1997	Douglas	490/435	
	2006	Fairbarns	304/2,500 m^2	
Oak Bay 1a	1994	Douglas	125/18 m^2	municipal park
	1997	Douglas	95/18 m^2	
	2004	Fairbarns	25-30/6 m^2	
	2006	Fairbarns	41/8 m^2	
Oak Bay 1b	2004	Fairbarns & Penny	10/5 m^2	municipal park
	2006	Fairbarns	2/6 m^2	
Oak Bay 2	1963	Young	unknown	municipal park
	1993	Ryan and Douglas	failed to find	
	2003	Ceska and Ceska	failed to find	
	2006	Fairbarns	failed to find	
Saanich 1	1971	Roemer	unknown	municipal park
	1995	Lee	2/1 m^2	
	2001	Penny	86/<100 m^2	
Saanich 2	1997	Roemer	unknown	municipal park
	2000	Douglas	282/305 m^2	
	2006	Fairbarns	297+/- 20/1,874 m^2	
Saanich 3	1887	Macoun	unknown	unknown

1 The Metchosin record has been rejected as explained in Table 1.

Location	Year	Collector/ observer	Number of plants/area	Land ownership/notes
Saanich 4	1994	Ryan	40/27 m^2	municipal park
	1996	Mothersill	20/2 m^2	
	1997	Douglas	59/10 m^2	
	1999	Mothersill	12/?	
	2000	Mothersill	15/?	
	2001	Mothersill	17/?	
	2002	Mothersill	17/?	
	2006	Fairbarns	7/20 m^2	
	2006	Roemer	7/5 m^2	
Saanich 5	1997	Fraser	111	regional park
	2000	Fraser	66	
	2001	Fraser	78/10 m^2	
	2006	Fairbarns	56/12 m^2	
Saanich 6	1947	Unknown	unknown	unknown
Saanich 7	1919	Newcombe	unknown	private property
	2003	Fairbarns & Roemer	1/27 m^2	
	2005	Fairbarns	3/27 m^2	
Saanich 8	1964	Hett	unknown	
	1987	Ring	unknown	
	1995	Golinksi	failed to find	
	2001	Hartwell	failed to find	
Duncan 1	1993	Douglas	unknown	ecological reserve
	1994	Douglas	25/100 m^2	
	1997	Douglas	56/120 m^2	
	2006	Fairbarns	33/50 m^2	
Duncan 2	1933	Newcombe	unknown	NGO conservation
	1997	Douglas	>6,400/1,000 m^2	reserve
	1998	Douglas	6,940/?	
	2000	Douglas	3,205/12,373 m^2	
	2006	MacDougall	1,736 +/-100/?	
Duncan 3	1992	Ceska	unknown	NGO conservation
	1993	Douglas	unknown	reserve
	1997	Douglas	45,000/5,700 m^2	
	2003	Roemer and Fairbarns	10,000	
	2004	Roemer and Fairbarns Roemer and Fleming	28,700/4,320 m^2	
	2005	Roemer and Fleming Fleming	16,300/3,100 m^2	
	2006		10,700/2,350 m^2	
	2007		20,400	
Duncan 4	2004	Douglas and Smith	5/?	church

Location	Year	Collector/ observer	Number of plants/area	Land ownership/notes
Saltspring 1	1985	Roemer	unknown	provincial park
	2006	McIntosh & Linton	14/100 m^2	
Saltspring 2	1993	Chatwin	>300/400 m^2	mixed (Transport Canada, provincial crown land and private land)
	1996	Penny	200/2,500 m^2	
	1999	Lomer	200-300/?	
	2005	Roemer[2]	200/50 m^2	
	2007	Annschild	19,278 plants: 14,096 on Transport Canada lands and 5,182 on provincial crown lands and private lands; population occupies approximately 10 ha	
Nanoose Hill	1976	Douglas	unknown	private or federal?
	1973	Douglas	failed to find	
	2005	Fairbarns	failed to find	
Comox	1961	Beamish	unknown	regional park?
	1993	Cadrin	failed to find	

Table 1 cites first record, most recent observation, any other observations with reliable population estimates and (where applicable) subsequent unsuccessful surveys.

Based on recent data from each of the sites, the total British Columbia population size is between 32,000 and 49,000 plants with approximately 80-90% of the subspecies' population concentrated in the two largest populations, at Duncan 3 and Saltspring 2.

Fluctuations and trends

The number of populations has been in slow decline – five to six populations have disappeared over the past century but none of these have been lost over the past 10 years. In most cases records are not adequate enough to determine when populations disappeared, but four of the populations appear to have been lost between 1961 and 1995.

Although Victoria 1 and Saltspring 2 appear to be increasing, the change in numbers is actually a result of the discovery of unreported subpopulations and more careful searches of known subpopulations. Anecdotal evidence suggests that the larger populations fluctuate substantially. The best documented fluctuation is at Duncan 3, where numbers have fluctuated between 10,000 and 28,000 (using a constant technique and coordinated observers) from 2003-2007. .

[2] Further surveys needed to determine if there are undiscovered subpopulations at this location.

There is no clear trend in the extent of the actual area of habitat occupied, probably because of inconsistencies in methods of estimation among observers. The quality of the area of occupancy is declining, primarily as the result of invasion by exotic plants.

Rescue effect

Yellow montane violet is not known from the nearby San Juan Islands (Atkinson and Sharpe 1993, D. Giblin pres. comm. 2006) or the Olympic Peninsula (Buckingham *et al.* 1995). The nearest population is about 100 km away, near Tacoma, Washington (Burke Museum of Natural History and Culture 2006). The status of the U.S. population of yellow montane violet is uncertain (see "Existing protection or other status", below). Given the very limited ability of this species to disperse over distances of more than a few metres, the British Columbia population is very unlikely to be rescued by natural circumstances.

LIMITING FACTORS AND THREATS

Table 2 provides an assessment of the severity of the major types of threat at each extant population.

Table 2. Threat matrix for extant populations of yellow montane violet

Name	Invasive Herbaceous Species	Invasive Alien Shrubs	Altered Fire Regime	Trampling	Stochastic Events (imminent)	Herbivory
Victoria 1	high	medium	low	medium	low	low
Victoria 2	high	high	low	medium	low	low
Oak Bay 1	high	high	medium	high	high	low
Saanich 1	high	high	medium	medium	medium	low
Saanich 2	high	medium	low	medium	low	low
Saanich 4	high	high	low	high	high	low
Saanich 5	high	high	medium	high	medium	low
Saanich 7	medium	high	low	low	high	low
Duncan 1	high	high	medium	medium	medium	low
Duncan 2	high	high	medium	low	medium	low
Duncan 3	high	high	high	low	medium	low
Duncan 4	medium	low	low	medium	high	low
Saltspring 1	high	medium	low	low	high	low
Saltspring 2	high	medium	low	medium	low	high

Threats associated with invasive plants

Roemer (pers. comm. 2006) reported that in one site, 42% of the vascular flora was introduced and that non-native species accounted for 88% of the cover of the herb layer. While the identity of the introduced species varies among sites, this degree of invasion is typical of many areas with yellow montane violet. Major invaders at one

or more sites include grasses (*Agropyron repens, Anthoxanthum odoratum, Bromus hordeaceus, B. sterilis, Cynosurus echinatus, Dactylis glomerata, Lolium perenne, Poa pratensis* and *Vulpia bromoides*) and, to a lesser extent, forbs (*Erodium cicutarium, Geranium molle, Lychnis coronaria, Trifolium repens* and *Vicia hirsuta*). Livestock grazing likely played a major role in the dispersal of the most serious invasive grasses although the impacts were not fully realized until grazing pressure was removed and the invasive species were able to form a taller and denser sward. In formerly grazed areas, yellow montane violet is scarce or absent from microsites with a high cover of invasive shrubs and coarse grasses but this likely represents a decrease in niche breadth due to competition and it may once have been common on such sites.

Scotch broom (*Cytisus scoparius*), a highly invasive shrub, poses one of the greatest threats to yellow montane violet and its habitat. The invasive shrub *Daphne laureola* has not yet been observed in large numbers at any of the sites but it is expanding its range and abundance rapidly. It favours the Garry Oak woodland habitat types suited to yellow montane violet, where it may achieve cover values in excess of 75%.

Threat associated with altered fire regimes

Pre-European fire regimes in the dry coastal belt of southeast Vancouver Island are probably more complex than is generally reported. There is no doubt that First Nations in the area used fire extensively to stimulate the growth of food species – particularly camas bulbs that provided a storable form of starch. Fire may also have been used to improve forage for game species (elk and deer) (Turner and Bell 1971).

Frequent low-intensity burns killed young red alder and Douglas-fir and checked the growth of trembling aspen and most shrub species – notably *Symphoricarpos albus* and *Rosa nutkana*. The resulting increase in light levels and decrease in competition favoured the growth of herbaceous plants such as yellow montane violet. Even the composition of the herb layer altered, since many highly competitive plants decrease under a regime of frequent burning.

First Nations fire management practices also played a significant role in the development (and therefore fertility) of soils. The organic component of the upper mineral horizon was not greatly reduced by low-intensity fires because it accumulated through the *in situ* decomposition of root material. In contrast, the surface organic materials did burn rather than accumulate, releasing nutrients. Since the main inputs of organic matter came from herbs rather than coniferous trees, the upper mineral horizon also had a relatively neutral reaction in sharp contrast to the acidic nature of soils under Douglas-fir forests (Broersma 1973). As well, the frequent fires provided a continuous supply of ‘safe sites’ where the small seeds of yellow montane violet may have been able to germinate and grow without the stifling influences of surface organic horizons.

At some sites, including Duncan 3 which has 30-40% of the Canadian population, the native shrub *Symphoricarpos albus* appears to have expanded into much of the habitat formerly available to yellow montane violet. *Symphoricarpos albus* is often abundant on sites where fire and grazing have been removed.

Trampling

Populations of yellow montane violet are often concentrated along paths, where the expansion of woody plant populations is held in check by frequent human foot traffic. In such circumstances, and on sites where woody plants are not a threat but footpaths still pass through populations of yellow montane violet, trampling damage is usually evident and often damages a significant proportion of the population.

Stochastic events

Some populations of yellow montane violet are threatened simply by their small size and area of occupancy, which predisposes them to stochastic events. Six populations are in very poor condition, with 50 or fewer mature plants, in most cases occupying less than 50 m^2. Saanich 4, Saanich 7 and Duncan 4 have fewer than 10 mature plants and appear to be especially vulnerable.

Herbivory

Herbivory poses a threat of uncertain impact on extant British Columbia populations of yellow montane violet. Two large populations (Duncan 2 and Duncan 3), which account for about 40% of the British Columbia population, occur in areas that were grazed by livestock until recently. The single largest population in British Columbia (Saltspring 2) received such heavy grazing pressure from native ungulates that the plants tend to be quite small and their flowers are often removed. The fact that this population remains high despite intense grazing pressure suggests that grazing by large mammals may not pose a serious threat to large populations. In some cases, yellow montane violet appears to benefit from the removal of taller competing vegetation, which likely compensates for direct tissue damage.

In or near gardens, yellow montane violet may be heavily damaged by non-native slugs (pers. obs.). Gardens provide high concentrations of seedlings and vegetables, which provide a high-quality food source. As well, gardens tend to have ample harbour sites such as boards and grass clippings. As a result, populations of yellow montane violet in the vicinity of gardens may suffer significant damage. This threat should not be overstated, however, since signs of significant slug damage were rarely encountered even in surveys of populations in urban environments (pers. obs.).

MacDougall (pers. comm. 2006) found that a significant number of seeds may be damaged by small, boring insects. It is not clear whether this is a common phenomenon or if it extends beyond Duncan 2.

SPECIAL SIGNIFICANCE OF THE SPECIES

Yellow montane violet has showy flowers and is not invasive, so it has some horticultural potential although it is susceptible to slug damage and therefore difficult to maintain (pers. obs.). No Aboriginal Traditional Knowledge has been documented for yellow montane violet. A number of other members of the genus have been used by First Nations peoples (Native American Ethnobotany Database 2006).

There is no evidence that yellow montane violet plays an important ecological role.

The British Columbia populations are of scientific interest because they are disjunct from the species' main range and may be genetically distinct as a result.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The Nature Conservancy of the US has globally ranked yellow montane violet (ssp. *praemorsa*) as "G5T3T5" (globally secure at the species level, vulnerable to secure at the subspecies level). The California, Oregon and Washington heritage programs rate it as SNR (NatureServe 2006). The SNR (status not ranked) designation indicates that no effort was made to formally rank it, which usually occurs with taxa that appear to be widespread and abundant in at least part of their range within the corresponding state. Yellow montane violet was initially assessed in 1995 as Threatened in Canada and the status was re-examined and confirmed in 2000. It was subsequently listed under schedule 1 of the federal Species at Risk Act (SARA)

The British Columbia Ministry of Environment considers yellow montane violet to be a "Red-listed" (threatened/endangered taxon) in British Columbia (Douglas *et al.* 2002). The British Columbia Conservation Data Centre ranks it as "S2" (imperilled) in British Columbia (BC Species and Ecosystems Explorer 2003).

Yellow montane violet is the object of a multi-species recovery strategy along with other Garry oak woodland species (Parks Canada Agency 2006).

TECHNICAL SUMMARY

Viola praemorsa* ssp. *praemorsa
yellow montane violet
(*praemorsa* subspecies)
Range of Occurrence in Canada: British Columbia

violette jaune des monts
(de la sous-espèce *praemorsa*)

Extent and Area information

• *Extent of occurrence (EO)(km²)*	450 km² using mapware tools to calculate non-marine areas within range of the variety in Canada
• *specify trend (decline, stable, increasing, unknown)*	decline
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	no
• *area of occupancy (AO)* [Actual area occupied is < 0.2 km^2]	14 km^2 based on 1x1 km grid; 56 km² based on a 2x2 km grid
• *specify trend (decline, stable, increasing, unknown)*	unknown
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	no
• *number of extant locations*	14
• *specify trend in # locations (decline, stable, increasing, unknown)*	long-term decline but stable for past three generations/last 10 years
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	no
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	decline in quality

Population information

• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	probably between 3 and 6 years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	32,000-49,000
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Unknown
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	no
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	yes

• *list each population and the number of mature individuals in each* populations tend to fluctuate	Victoria 1 885 Victoria 2 304 Oak Bay 1 43 Saanich 1 86 Saanich 2 297 Saanich 4 7 Saanich 5 56 Saanich 7 3 Duncan 1 33 Duncan 2 1,736 Duncan 3 20,400 Duncan 4 5 Saltspring 1 14 Saltspring 2 19,278
• *specify trend in number of populations (decline, stable, increasing, unknown)*	Decline mainly historical or prior to last 10 years
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	no

Threats (actual or imminent threats to populations or habitats)

Actual threats:
Invasive grasses
Shading and competition from the spread of trees and shrubs due to lack of burns
Trampling along foot paths through populations
Level of threat from herbivory uncertain, at least in the larger populations

Rescue Effect (immigration from an outside source)	Low
• *does species exist elsewhere (in Canada or outside)?*	yes
• *status of the outside population(s)?*	secure
• *is immigration known or possible?*	a very rare event
• *would immigrants be adapted to survive here?*	likely
• *is there sufficient habitat for immigrants here?*	yes

Quantitative Analysis

Current Status

COSEWIC: Threatened (2000)
Endangered (2007)

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Endangered	B1ab(iii)+2ab(iii)

Reasons for Designation:
The subspecies is only known in Canada from southeastern Vancouver Island and the adjacent southern Gulf Islands where it occurs as 14 mainly small, localized populations that are highly fragmented. This short-lived perennial is restricted to Garry oak woodlands and maritime meadows where habitat is continuing to decline in quality due to such factors as the spread of exotic invasive grasses as well as the spread of trees and shrubs as a result of fire suppression.

Applicability of Criteria

Criterion A (Declining Total Population): Not applicable. No recent declines noted and populations fluctuate.
Criterion B (Small Distribution, and Decline or Fluctuation): Endangered B1ab(iii)+2ab(iii). EO and AO are below maximum values and there are 14 severely fragmented extant populations with inferred continued decline of habitat quality due to such factors as spread of exotics and regeneration of woody plants that shade violet plants as a consequence of change in fire regimes.
Criterion C (Small Total Population Size and Decline): Not applicable. Population is too large.
Criterion D (Very Small Population or Restricted Distribution): Not applicable. Population size is too large; AO is > 50 km² based on a 2x2 km grid.
Criterion E (Quantitative Analysis): None available.

Rescue

Rescue effect is low. Although the species occurs outside of Canada and is secure, the nearest known populations are about 100 km distant and seeds lack adaptations for long-distance dispersal.

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Matt Fairbarns has a B.Sc. in Botany from the University of Guelph (1980). He has worked on rare species and ecosystem mapping, inventory and conservation in western Canada for approximately 20 years. He was a botanist with the British Columbia provincial government until 2003 and now manages Aruncus Consulting, an independent biological conservation research company.

COLLECTIONS EXAMINED

The following collections were consulted:

- Royal BC Museum herbarium
- University of Victoria herbarium