COSEWIC
Assessment and Status Report

on the

Victoria's Owl-clover
Castilleja victoriae

in Canada

ENDANGERED
2010

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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COSEWIC
Assessment Summary

Assessment Summary – April 2010

Common name
Victoria's Owl-clover

Scientific name
Castilleja victoriae

Status
Endangered

Reason for designation
This small annual herb is confined to a very small area of British Columbia and one site in adjacent Washington State. The species is restricted to seasonally wet microhabitats within the highly fragmented and declining Garry Oak ecosystem. Five of the nine Canadian populations disappeared before 1957 and one other population may have been recently extirpated. The three to four extant populations are subject to ongoing competition with several invasive exotic plants and two of the populations are very small and occur in areas used for recreational activities where trampling is a continuing problem.

Occurrence
British Columbia

Status history
Designated Endangered in April 2010.

COSEWIC
Executive Summary

Victoria's Owl-clover
Castilleja victoriae

Species information

Victoria's Owl-clover (*Castilleja victoriae*) is a newly described species, previously misidentified as Paintbrush Owl-clover (*C. ambigua* ssp. *ambigua*). It is a small herb of the broomrape family with alternate, hairy, lobed stem leaves and no basal rosette. The wider and more deeply lobed upper leaves grade into the floral bracts. The sepals are fused into a five-lobed calyx, and the petals are fused into a 2-lipped flower 10-18 mm long. The lower lip is lemon-yellow with minute white tips on each of the three lobes. The upper lip is slightly longer than the lower lip and creamy white. The fruits are brown, 2-celled capsules that split at the tip when the seeds are ripe. Each capsule bears 30-70 brown seeds with a sculptured seed coat.

Distribution

Victoria's Owl-clover is only found in a small area extending from southeast Vancouver Island east to the San Juan Islands of Washington State. Its range in Canada encompasses a narrow strip of coastline totalling about 9 km^2.

Habitat

Victoria's Owl-clover occurs in vernal seeps and along the margins of vernal pools within 50 m of the ocean. The sites are wet to inundated in autumn, winter and spring but dry during the summer. The actual total area of habitat occupied is only 600 m^2.

Biology

Victoria's Owl-clover is a bee-pollinated annual that flowers and fruits in late spring and early summer. Seeds appear to delay germination until their dormancy is broken by cool weather.

Population sizes and trends

In 2006, the global population consisted of four or five populations with a sum of 7,000-8,000 mature individuals. Approximately 98% of the global population is found on one Canadian site. Three other Canadian populations have been reported in recent years. One of these may have become extirpated as no plants have been observed over the past three years and the population numbered less than 10 plants in each of the two previous years. Two Canadian populations each consisted of less than 150 individuals in the past four years and occupy patches of less than 10 m^2. Only one population has ever been found in the United States. It consisted of 164 individuals in 2006 and many of these plants may have died from drought before they had a chance to flower and set seed.

Extensive urban and residential development occurred in the primary habitat of Victoria's Owl-clover before the species was recognized so the magnitude of long-term population trends is unknown. Nevertheless, five or six of the nine populations reported in Canada have become extirpated since the species was first collected in the late 19th century.

Limiting factors and threats

The primary threats to Victoria's Owl-clover are posed by habitat loss and/or degradation due to urban/residential development, recreational activities and invasive species. Two populations have disappeared due to habitat loss, two other populations are small and affected by trampling, and one population has been lost due to trampling.

Special significance of the species

Canadian populations of Victoria's Owl-clover have a high conservation value because they represent almost the entire global population of what is a narrowly distributed endemic. No specific ATK is known for this recently recognized species.

Existing protection or other status designations

Victoria's Owl-clover is not currently protected by any species at risk legislation. Part of one population occurs within a provincial Ecological Reserve.

TECHNICAL SUMMARY

Castilleja victoriae
Victoria's Owl-clover castilléjie de Victoria
Range of occurrence in Canada: British Columbia

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines(2008) is being used)	Likely < 3 years
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? Oak Bay Population #3 may be extirpated, but if no longer extant, the possible loss of its small numbers of plants cannot be rationalized to represent an overall decline in the total population due to the fluctuations in numbers at other locations.	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] Unknown due to fluctuations	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. Unknown due to fluctuations	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. Unknown due to fluctuations	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. Unknown due to fluctuations	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	Likely understood but not readily reversible and not ceased.
Are there extreme fluctuations in number of mature individuals? One small population (Oak Bay Population #2) has been so documented but the overall total population has not been demonstrated to undergo extreme fluctuation although considerable fluctuations do occur.	No

Extent and Occupancy Information:
The answer to most questions in this section hinges on whether Oak Bay Population #3 (Cattle Point) has been extirpated since it was last observed in 2004.

Estimated extent of occurrence	9 km²
Index of area of occupancy (IAO) (Always report 2x2 grid values; other values may also be listed if they are clearly indicated (e.g., 1x1 grid, biological AO)).	4-8 km² (3-4 km^2 in 1x 1 km grid, biological AO = 600 m^2)
Is the total population severely fragmented?	No
Number of "locations" (as per definition, in relation to threat)	3-4
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? Mainly historic losses of populations and uncertainty over the extirpation of the Oak Bay population # 3 (Cattle Point).	Unknown

Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy? Depends on whether Oak Bay population #3 is extirpated or not.	Unknown but possible
Is there an [observed, inferred, or projected] continuing decline in number of populations? Depends on whether Oak Bay population #3 is extirpated or not, and future losses could possibly be inferred due to extensive recreational pressures impacting some populations.	Unknown but possible
Is there an [observed, inferred, or projected] continuing decline in number of locations? Uncertainty over extirpation of Oak Bay population #3; perhaps future declines could be inferred based on recreational pressures at some populations.	Unknown but possible
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes in quality
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations (as per definition, in terms of threat)?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Oak Bay Population #1	7,000-8,000
Oak Bay Population #2	31
Oak Bay Population #3	Possibly extirpated
Oak Bay Population #4	119
Total	7,000-8,000

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not applicable

Threats (actual or imminent, to populations or habitats)

Existing threats: habitat loss, recreational activities, invasive alien species, altered hydrological regimes but with recreational activities and invasive species the primary current threats.

Rescue Effect (immigration from an outside source)

Status of outside population(s)? USA: N1 (single small population)	
Is immigration known or possible?	No
Would immigrants be adapted to survive in Canada?	Likely
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	No

Current Status

COSEWIC: Endangered (April 2010)

Status and Reasons for Designation

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

Reasons for designation:
This small annual herb is confined to a very small area of British Columbia and one site in adjacent Washington State. The species is restricted to seasonally wet microhabitats within the highly fragmented and declining Garry Oak ecosystem. Five of the nine Canadian populations disappeared before 1957 and one other population may have been recently extirpated. The three to four extant populations are subject to ongoing competition with several invasive exotic plants and two of the populations are very small and occur in areas used for recreational activities where trampling is a continuing problem.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Historic losses are known but percent declines cannot be readily determined due to fluctuations in populations.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(iii)+2ab(iii) with EO and IAO within limits and with only 3-4 locations extant where habitat quality continues to decline.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Continuing declines cannot be demonstrated with certainty due to fluctuations in population size but perhaps can be inferred for future losses based on recreational impacts on some populations, but such declines are likely <10%.
Criterion D (Very Small Population or Restricted Distribution): Meets Threatened D2 with only 3-4 locations and IAO <20km²; ongoing severe recreational threats are present at two populations, one of which may already be extirpated due to such impacts.
Criterion E (Quantitative Analysis): None available.

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 (2010)

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 / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune
Canada

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

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Victoria's Owl-clover

Castilleja victoriae

in Canada

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SPECIES INFORMATION

Name and classification

Scientific name: *Castilleja victoriae* Fairbarns and Egger (2007)
Common name: Victoria's Owl-clover
Family: Orobanchaceae (formerly placed in the Scrophulariaceae)
Major plant group: Eudicot flowering plant

Victoria's Owl-clover is one of four closely related members of the genus *Castilleja* subgenus *Colacus* found in the Pacific Northwest. The three previously described species include: Paintbrush Owl-clover (*C. ambigua ssp. ambigua*), Narrow-leaved Owl-clover (*C. attenuata*), and Hairy Owl-clover (*C. tenuis*). Specimens of what is now known as Victoria's Owl-clover were first collected by Macoun in 1893 from two separate locations in the area of Victoria, British Columbia. A number of collections have been made in the Victoria area since then. Early collectors identified the material as *Orthocarpus hispidus* (*Castilleja tenuis*), a species not otherwise reported from southwestern British Columbia or adjacent areas of Washington State. Keck (1927), an authority on the genus *Orthocarpus,* examined some collections in 1941 and re-identified them as *Orthocarpus castillejoides* (*Castilleja ambigua*). In 2005, Fairbarns prepared a note contrasting morphological and ecological characteristics of fresh material from the Victoria area with fresh material of *Castilleja ambigua ssp. ambigua* on western Vancouver Island. Egger (pers. comm. 2005), an authority on the genus, agreed that the Victoria material, including the Macoun collections, appeared to differ from *Castilleja ambigua ssp. ambigua*, the name applied to these collections. Based on morphological analysis of herbarium specimens and site visits to all three known extant populations, Fairbarns and Egger (2007) concluded that material from the Victoria area constitutes a previously undescribed species within the subgenus *Colacus* and have provided a formal description of the species.

Morphological description

Victoria's Owl-clover (Figure 1) is a taprooted annual, 0.2-2.0 dm tall. Most plants are unbranched or obscurely branched but larger plants often bear ascending branches below. The herbage is pubescent throughout with a mix of short gland-tipped hairs and longer soft hairs. The surface of leaves and bracts is often slightly sticky.

Figure 1. Victoria's Owl-clover (photo by Matt Fairbarns)

There are no basal leaves. The stem leaves are alternate and generally reddish-purple but the upper leaves and all of the floral bracts may be green at the stem and purplish at the tip, or occasionally green throughout. The leaves are generally 10-20 mm long. The lower leaves are narrowly lance-shaped and entire to narrowly egg-shaped and slightly lobed, often withering by the time the plant is in flower. The leaves are progressively wider and more deeply 3 to 5-lobed towards the top of the stem, eventually grading into the floral bracts. These lobes are 8-12 mm long and 1-2 mm wide at mid-length and much narrower than the mid-blade.

The flowers are borne in prominently bracted spikes. The calyx is approximately 10 mm long, deeply two-cleft into 5-6 mm long primary lobes and again divided into 2 acute secondary lobes 3-4 mm in length. The calyx bears a mix of gland-tipped and glandless hairs similar to those of the foliage. The calyx lobes are purple-tipped or greenish throughout.

The corolla is two-lipped, club-shaped and approximately 10-18 mm long. The lower lip is three-lobed, somewhat expanded, approximately 4 mm long and hairy. The lower lip is lemon-yellow with inconspicuous whitish teeth 0.5-0.8 mm long. The upper lip bears a long, straight beak that surpasses the lower lip by 0.4-0.8 mm. The beak is white (sometimes with purple markings) and hairy. Its lobes are united to the tip and enclose the anthers.

There are four stamens with 4.5-6.0 mm long filaments attached near the summit of the corolla tube.

The fruits are brown, 2-celled capsules that split at the tip when the seeds are ripe. Each capsule bears 30-70 small brown seeds with a sculptured seed coat.

A more detailed description is provided by Fairbarns and Egger (2007). Victoria's Owl-clover can be distinguished from Paintbrush Owl-clover by its compact, generally unbranched form, its largely uniform "root-beer" brown herbage, the absence of a pale marginal band on its floral bracts and its distinctively bicoloured, unspotted corolla.

Genetic description

Victoria's Owl-clover has a chromosome count of 2n=24 (Fairbarns and Egger 2007).

DISTRIBUTION

Global range

Victoria's Owl-clover is a narrow endemic, restricted to the area of Victoria, British Columbia, and the nearby San Juan Islands in Washington State (Fairbarns and Egger 2007).

Canadian range

In Canada, Victoria's Owl-clover is restricted to southern Vancouver Island and small islands nearby (Figure 2). It occurs in a narrow coastal strip never more than 50 m inland. The historical extent of the strip was estimated to cover approximately 15 km^2 (using GIS tools to calculate the area of a 50 m wide polygon clipped to the edge of the shoreline). The Canadian range of what is now known as Victoria's Owl-clover has decreased considerably since the species was first discovered in 1893. Detailed surveys have failed to rediscover populations in the Shawnigan area (from where it had been reported in 1957) and several populations in the Victoria also do not likely still exist. Accordingly, the current extent of occurrence, using the mapping conventions described above, is approximately 9 km^2.

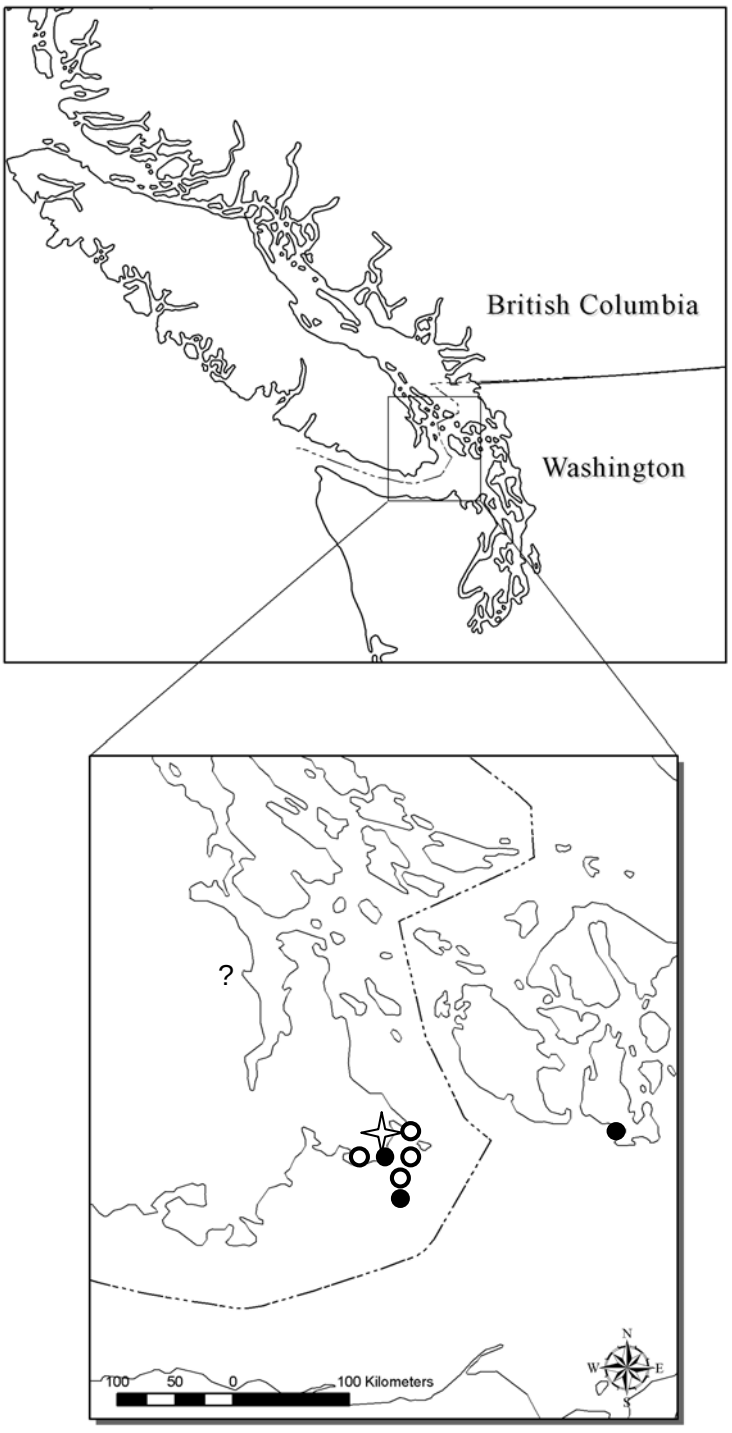

Figure 2. Global Distribution of Victoria's Owl-clover. Solid circles indicate extant populations; open circles indicate extirpated populations, four-point star indicates location of Oak Bay Population #3, which may have recently become extirpated (see text). The solid circle below the star indicates the location of two adjacent populations, which can't be distinguished at this scale.

Using a 2 km grid, the index of the area of occupancy is 4 km^2 (8 km^2 if one includes the Oak Bay #3 population (Cattle Point) despite the fact that it appears to have been extirpated). Using a 1 km grid, the index of the area of occupancy is 3 km^2 (4 km^2 if one includes Oak Bay #3). The latter grid size is likely best applied because the actual area of habitat occupied by populations and subpopulations is generally in the order of a few square metres. The actual total area occupied by the populations is approximately 600 m^2.

There is little doubt that Victoria's Owl-clover is a native element of the Canadian flora. It was known from Vancouver Island since early European settlement through initial botanical studies in the area. Victoria's Owl-clover was first collected from the vicinity of Victoria in 1893 by Macoun (collection CAN acc. no. 97,244) and is endemic to the Victoria area.

HABITAT

Habitat requirements

In Canada, Victoria's Owl-clover is restricted to a small area of southeastern Vancouver Island. This area, which is highly correlated with the distribution of Garry Oak, has mild winters and dry, cool summers.

Victoria's Owl-clover is restricted to vernal seeps and the margins of vernal pools within 50 m of the shoreline, where oceanic influences lessen the frequency and severity of winter frosts. These sites are saturated or inundated for much of the winter and early spring and are very dry by early summer. The extreme growing conditions, and the shallow soil in which Victoria's Owl-clover grows, greatly restrict competition from native species. The most common native plants that co-occur with Victoria's Owl-clover are spring ephemeral annual herbs. A number of non-native species have become common and often dominate the habitat type favoured by Victoria's Owl-clover.

Southeast Vancouver Island has mild winters and dry summers and the greatest annual amounts of sunshine in British Columbia. The scarcity of snow and rarity of hard frosts allows vegetation to remain green throughout the winter. Moisture deficits turn the meadows brown in mid-summer.

Edaphic factors strongly limit the distribution of Victoria's Owl-clover within southeastern Vancouver Island and the adjacent Gulf Islands. The low-elevation band of coastal environments is narrow and quickly gives way to uplands that lack the necessary mesoclimatic conditions. Broken terrain over much of the lowland band creates many cool north- and east-facing slopes where forest plants have a comparative advantage. Well to moderately-well drained soils favour forests; consequently, potential habitat for Victoria's Owl-clover is quite patchy due to natural conditions. This natural level of patchiness is exacerbated by the extensive human development in the area (see below).

The extent of suitable habitats within the Canadian range of Victoria's Owl-clover has not been measured but has probably never exceeded 100 ha.

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.

Since there are no accurate estimates of the historical or current extent of suitable habitat, the rate of habitat loss and degradation cannot be estimated directly. Victoria's Owl-clover typically occurs within a matrix of Garry Oak ecosystems, so the decline of these ecosystems provides an indirect measure of habitat loss. Overall, Garry Oak systems have, over the past century, been reduced to less than 5% of their original extent in the Victoria area (Lea 2002). Garry Oak ecosystems persist largely as isolated communities that are heavily fragmented and lack connections that would allow substantial genetic interchange. Victoria's Owl-clover prefers shoreline situations, which are also sought after for residential development. However, as Garry Oak ecosystems are more broadly distributed, the actual decline in suitable habitat for Victoria's Owl-clover is probably even higher.

Much of the remaining habitat suitable for Victoria's Owl-clover has been heavily altered due to invasion by alien weeds including several grasses [Colonial Bentgrass (*Agrostis capillaris*), Early Hairgrass (*Aira praecox*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Soft Brome (*Bromus hordeaceus*), Orchard Grass (*Dactylis glomerata*), Common Velvet Grass (*Holcus lanatus*) Annual Foxtail Barley (*Hordeum* spp.), Perennial Ryegrass (*Lolium perenne*), Annual Bluegrass (*Poa annua*), Squirrel-tail Fescue (*Vulpia bromoides*)] and a number of forbs including English Daisy (*Bellis perennis*), Dovefoot Geranium (*Geranium molle*), Hairy Cat's-ear (*Hypochaeris radicata*), Smooth Cat's-ear (*H. glabra*), Ribwort Plantain (*Plantago lanceolata*), Sheep Sorrel (*Rumex acetosella*), Small-flowered Catchfly (*Silene gallica*) and Red Sand-spurry (*Spergularia rubra*).

The distribution of Victoria's Owl-clover in Canada lies at the heart of one of North America's fastest growing regions. The Victoria Metropolitan Area includes all extant populations of Victoria's Owl-clover and all but one of the apparently extirpated populations. The population of metropolitan Victoria has increased from approximately 180,000 in 1966 to 338,738 (188%) in 2005 and is projected to increase to 407,600 (226%) by 2026 (CRD 2006). As the population grows, recreational use has increased on the sites where Victoria's Owl-clover grows.

Two historic populations (Dallas Hotel and Ten Mile Point) have apparently disappeared as a result of habitat loss. Populations on Chain Islands and Lesser Trial Island likely disappeared due to habitat degradation. The population at Oak Bay #3 (Table 1) has not been seen for three years and its decline is apparently the result of habitat degradation by park visitors.

Table 1. Victoria's Owl-clover Population Data.			
Population	**Observer & Dates**	**Population Extent (total area of occupancy)**	**Number of Individuals**
Dallas Road	Macoun 1893	extirpated	extirpated
Chain Islands	Newcombe 1923	extirpated	extirpated
Ten Mile Point	Melburn 1954	extirpated	extirpated
Shawnigan Area	Melburn 1957	extirpated	extirpated
Lesser Trial Island	Hardy 1953	extirpated	extirpated
Oak Bay 1 (Trial Island)	Fairbarns 2006	600 m^2	7,000-8,000
Oak Bay 2 (Harling Point)	Fairbarns 2006	8 m^2	31
	Fairbarns 2007	2 m^2	7
	Fairbarns 2009	8 m^2	167
Oak Bay 3 (Cattle Point)	Ryan 1993	Area not recorded	85
	Fairbarns 2003-04	<10 m^2	up to 10
	Fairbarns 2005-09	None	None (extirpated?)
Oak Bay 4 (Gonzales Point)	Fairbarns 2009	4 m^2	119

Habitat protection/ownership

Oak Bay Population #1 (Table 1) consists of a number of small subpopulations including some on lands in a provincial Ecological Reserve. British Columbia's Parks and Protected Areas do not have a management plan with specific protection for Victoria's Owl-clover, although under the *Parks Act* native plants may not be collected in Provincial Parks or Protected Areas. Some of the other subpopulations are on federal lands managed by the Canada Coast Guard, but as the species is not listed in the federal *Species at Risk Act* (SARA) or the BC Conservation Data Centre, it receives little protection. Canada Coast Guard has mapped the locations of these populations, assessed threats and concluded that no management changes are necessary (Fairbarns 2000). The balance of Oak Bay Population #1 occurs on provincial Crown lands under a communications lease and is not protected.

Oak Bay Population #2 is on private land and is not protected, although the location is a National Historic Site and the owners manage it with guidance from Parks Canada.

Oak Bay Population #3 is/was in a municipal park. The municipality of Oak Bay supports an initiative to map and protect rare plants in this park, but there is no legal basis for its protection and the site receives heavy visitor use. The population has declined precipitously and may have become extirpated.

Oak Bay Population #4 is on a privately owned golf course and is not protected.

BIOLOGY

There is little published information relevant to reproduction and dispersal, germination, seedling ecology, survivorship, herbivory or physiology of Victoria's Owl-clover in Canada. The following notes are based primarily on observations and experiments conducted by Fairbarns, many of which have been documented (Fairbarns 2005).

General

Victoria's Owl-clover is an annual. Seeds evidently persist in the soil seedbank at least from the time of dispersal to the following germination period (approximately 9 months). It is not known what proportion of seeds, if any, persist long enough to germinate in later years but it is plausible that the generation time is less than three years.

Reproduction and dispersal

Victoria's Owl-clover is an outbreeder, pollinated by bumblebees and perhaps other insects. It blooms in May and June and seed ripens in late June or July. The capsules begin to dehisce in June and the seeds are gradually dispersed through the summer and autumn, as they are shaken out of the partially open capsule. Seed dispersal ends abruptly when autumn storms break down the dead shoots. Chuang and Heckard (1983) and Kuijt (1969) suggest that reticulations on the seed coat of closely related species may play a role in dispersal, perhaps by increasing surface roughness and thereby adhering to passing animals, by 'catching' wind a bit better than a smooth surface, or by trapping air to provide buoyancy in pool environments. Detailed studies of occupied and unoccupied sites at Oak Bay Population #2 suggest that seed dispersal is quite limited and most seed remains close to the parent plant.

Germination

Seeds appear to require a period of cold weather before they germinate. Close study of Oak Bay Populations #1 and #2 revealed that neither fresh nor banked seed germinate after late summer rains, even if temperatures remained warm (Fairbarns 2005. Young (2001) recommends cold-stratifying seeds of a closely related species prior to sowing.

Seedling ecology and survival

Victoria's Owl-clover may begin to germinate in early April, although most seedlings do not appear until late April or early May. The seedlings grow slowly in the cool, wet soil. Mortality appears to be high among young seedlings but most plants reaching the 6-leaf stage survive until summer drought kills the entire cohort. Time from germination to end of flowering and death is about four months.

Herbivory

No foliar herbivory was observed in any of the populations. Insects occasionally bore through subtending bracts but none of 380 capsules examined by the author in 2002 and 2003 was perforated. No fungal or insect damage was observed in any plants in detailed studies of two populations over three years.

Physiology

As with other owl-clovers, Victoria's Owl-clover is a hemiparasite. It forms root grafts with other species via haustoria—hemispherical, lateral swellings on the parasite's roots that penetrate the host root cortex and connect the two vascular systems. A hemiparasite extracts water, minerals and organic compounds from the host, but it is not a complete parasite because it has functional chlorophyll and can meet some or all of its photosynthate requirements by itself (Kuijt 1969). Some hemiparasites, including closely related species of owl-clover, also extract alkaloid substances from host plants and translocate them to their leaves and outer floral tissues. These alkaloids may reduce insect herbivory but because they do not accumulate in pollen or nectar they do not appear to reduce pollination (Adler 2000; Adler and Wink 2001; Boros *et al*. 1991).

The association between hemiparasite and host is a relatively random process and a broad range of species may be parasitized. A single owl-clover plant may form haustorial connections with more than one host and populations may collectively form a complex network of interconnected root systems with many host plants across a wide range of species. Alternative host plants may have different effects on their hemiparasite's growth and reproduction, and some hosts may actually reduce the parasite's success (Atsatt and Strong 1970).

While all owl-clover species can function as hemiparasites, this appears to be a facultative rather than obligate condition. Plants of related species, cultured in the absence of a host, may develop and successfully reproduce although their stature and fecundity tends to be depressed. Germination itself is not dependant on the presence of host plants and in nature the seedlings may be free-living for several weeks as long as the soil remains continually moist.

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 in open meadows in southeast Vancouver Island and the Gulf Islands. The principal investigators included Adolf and Oldriska Ceska, Matt Fairbarns, Hans Roemer, Jenifer Penny, Chris Brayshaw, Harvey Janszen, Frank Lomer and George Douglas, all of whom are familiar with the plant.

Over 1,000 ha of suitable and marginally unsuitable habitat in over 80 sites have been investigated 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 plant species in suitable habitats.

Although Victoria's Owl-clover is a small plant easily overlooked during casual botanical inventories, this status report was only prepared after a directed survey. This survey effort includes four targeted annual searches (approximately 6 person-days in 2003, 2 person-days in 2004, 3 person-days in 2005 and 3 person-days in 2006). These efforts included unsuccessful surveys of the many sites that had other rare plants that have been associated with Victoria's Owl-clover (Figure 3). No new populations were discovered.

Researchers have conducted intensive surveys of suitable sites in the San Juan Islands, WA, in 2005 and 2006 and only found one population.

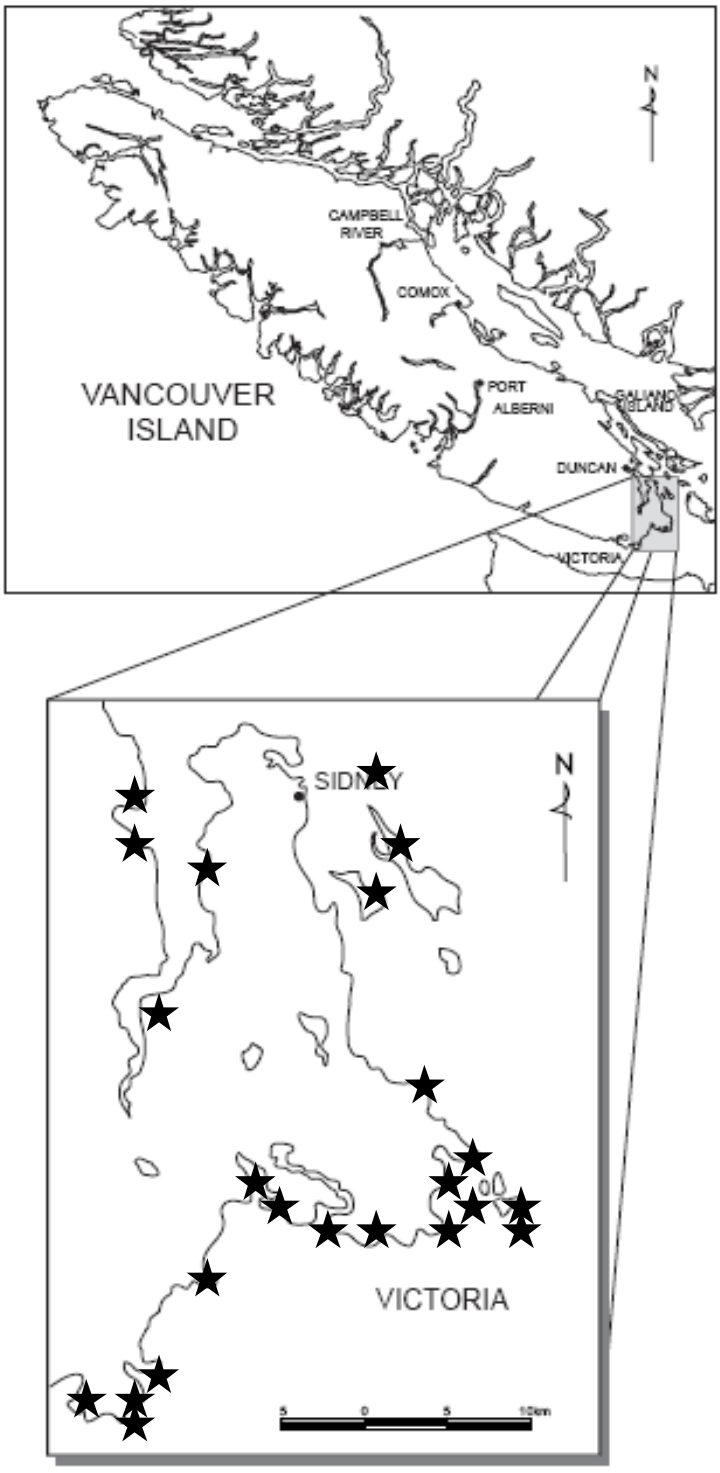

Figure 3. Negative Search Results: 2003-2006 Stars each indicate one or more sites surveyed without success.

Abundance

Based on 2006 data, and accepting the criterion that plants more than 1 km apart constitute separate populations there are three or four extant populations in Canada (Oak Bay Population #3 may be extirpated as discussed below; Table 1). In 2006, the Canadian population consisted of 7,000-8,000 flowering plants (almost entirely at Oak Bay Population #1). An additional population of 119 mature individuals was discovered in 2009. The single population known from the United States consisted of only 164 individuals in 2006 (Fairbarns, pers. obs.).

The 1957 report of Victoria's Owl-clover from the 'Shawnigan area' must be treated with caution. The site lies outside the otherwise compact range of the species and extensive surveys of Shawnigan Lake, Shawnigan Creek and Mill Bay (where Shawnigan Creek flows into the Straight of Georgia) revealed almost no habitat similar to that described for the species. The collector (M.C. Melburn) collected widely across southeast Vancouver Island but the majority of her collections came from the Victoria area where Victoria's Owl-clover is most abundant. The Shawnigan report may be based on a mislabelled collection but due to the loss of her collection records it cannot be verified.

Apart from the locations cited in Table 1, there are a handful of other vaguely worded sites on herbarium labels. These include three records from Oak Bay/Oak Bay District and a fourth from 'Fowl Bay' (likely signifying Foul Bay, which is in the municipality of Oak Bay). These specimens may have been collected from one or more of the locations cited in Table 1. However, since they predate significant residential and shoreline development in Oak Bay it is equally likely they represent one or more extirpated sites.

Fluctuations and trends

This species, like many other annuals, may experience significant natural fluctuations in population sizes (Harper 1977). Oak Bay Population #1 consists of up to nine subpopulations in favourable years. The largest of these consisted of approximately 4,200 individuals in 2001 but rose to 6,456 in 2006. Several of the smaller subpopulations completely disappear in poor years, presumably persisting in the soil seed bank. Oak Bay Population #2 has fluctuated by an order of magnitude once in the past four years. The entire Canadian population, however, has not been documented as fluctuating by as much as an order of magnitude. Oak Bay Population #3 consisted of 10 or fewer flowering plants over an area of <10 m^2 in 2003 and 2004, but no plants could be found in 2005, 2006, 2007, 2008 or 2009. Oak Bay Population #4 was discovered in 2009 so there is no information on fluctuations or trends. Due to the fluctuations noted in various populations, no obvious decline in numbers of plants can be clearly demonstrated.

Rescue effect

Extensive floristic surveys have been conducted in nearby areas of Washington State, including the Olympic Peninsula (Buckingham *et al.* 1995), the main islands of San Juan County (Atkinson and Sharpe 1993) and small islets in San Juan County (Giblin pers. comm. 2005). Despite the intensive survey effort, only one small population of Victoria's Owl-clover has been found. The population is small and separated from the nearest portion of the Canadian range by over 20 km of open water. The seeds lack any adaptations to facilitate long-distance dispersal by wind, water or animals. For these reasons, there is negligible opportunity for unassisted genetic immigration (seed or pollen) from the United States.

LIMITING FACTORS AND THREATS

Habitat loss

Habitat loss has been the leading factor in the disappearance of populations. The waterfront of Dallas Road, where Macoun first collected the species in 1893, has been heavily altered through the development of port facilities. Similarly, Ten Mile Point, where the species was collected four times in the 1940s and 1950s, has been developed into a residential neighbourhood.

Threat associated with recreational or other activities

Recreational activities are another major threat to Victoria's Owl-clover. Oak Bay Population #2 receives heavy foot traffic throughout the year, largely from local residents and weekend visitors from elsewhere in the Victoria area. Some plants have been crushed by walkers, others have been damaged when picnics have taken place on top of them, an illegal fire-pit was constructed on the population in 2004 and a local resident used the area to practise his golf swing in 2003 (removing large divots). Considering the small area occupied by the plants, this level of use poses a serious threat.

Oak Bay Population #3 receives extremely heavy foot traffic in spring and summer, when tour buses bring hundreds of visitors each day. There is also heavy foot traffic throughout the autumn and winter, along with dog-use and bicycle traffic. As a result, in 2002 and 2003 a significant proportion of the plants in this small population were crushed before they could produce ripe fruit. The recreational use has also led to habitat degradation, as soils in the vernal pools were both compacted and eroded.

Oak Bay Population #4 receives little or no impact from recreational activities despite occurring on a golf course. Similarly, the Oak Bay Population #1 (Trial Island), being on an island with limited access and visitor activity does not appear to be impacted by any severe imminent threat from visitor or site maintenance activities.

Threats associated with invasive alien plants

A number of alien plant species have invaded existing and potential habitat for Victoria's Owl-clover. Deeper microsites in vernal pool environments are often dominated by a carpet of Red Sand-spurry during flowering season. The margins of the vernal pools and seeps, where Victoria's Owl-clover tends to be most abundant, tend to be dominated by invasive annual grasses such as Early Hairgrass, Soft Brome, Foxtail Barley, Annual Bluegrass and Squirrel-tail Fescue.

Slightly drier areas tend to be dominated by a dense sward of invasive grasses including Sweet Vernal Grass, Orchard Grass, Common Velvet Grass and Perennial Ryegrass as well as introduced forbs such as Dovefoot Geranium, Hairy Cat's-ear, Ribwort Plantain, Sheep Sorrel and Small-flowered Catchfly. These exotic species appear to have displaced a native bunchgrass community dominated by California Oatgrass (*Danthonia californica*) and Tufted Hairgrass (*Deschampsia caespitosa*), and taken over open areas between the bunchgrasses where Victoria's Owl-clover may once have thrived.

The population at Chain Islands was probably lost as a result of invasive species, as most upland habitats on the islands have been overtaken by annual grasses such as *Poa annua*.

Threat associated with altered hydrological regimes

Victoria's Owl-clover is dependant upon winter seepage. Any actions that disrupt the hydrological regime, whether due to construction or simply soil compaction, may eliminate this essential process.

Threats and locations

The Oak Bay populations number either three or four, depending on whether the Cattle Point population (#3) is extant or not. The populations are spatially separated by distances beyond the limited dispersal ability of the species over the course of several generations or likely even decades. The populations at Harling Point (#2) and at Cattle Point (#3) occupy areas of only a few square metres each and are severely impacted by recreational activities. The Gonzales Point population (#4), found on a private golf course, appears to have limited impacts, and the Trial Island population (#1), consisting of a series of small and one larger subpopulation, do not appear to have severe imminent threats. Overall, there are at most 3-4 locations based on threats or their lack of severe impacts.

SPECIAL SIGNIFICANCE OF THE SPECIES

Canadian populations of Victoria's Owl-clover have a high conservation value because they represent almost the entire global population of a very narrowly distributed endemic. There is no information on Aboriginal Traditional Knowledge relating to Victoria's Owl-clover. The species is extremely rare and is a very small plant similar to many related species. It is unlikely to have had any significance to First Nations.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Victoria's Owl-clover is not covered under the Convention on International Trade in Endangered Species (CITES), the *Endangered Species Act* (USA) or the IUCN Red Data Book.

Victoria's Owl-clover has a global ranking of G1 and a provincial ranking of S1 (NatureServe 2009).

The Province of British Columbia does not provide any legal protection for Victoria's Owl-clover.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

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 25 years.

COLLECTIONS EXAMINED

The following collections were consulted:

- Royal BC Museum herbarium (V)
- University of Victoria herbarium (UVIC)
- University of British Columbia Herbarium (UBC)