

**COSEWIC**  
**Assessment and Status Report**

on the

**Bearded Owl-clover**  
*Triphysaria versicolor*

in Canada



**ENDANGERED**  
**2011**

**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 – November 2011

**Common name**

Bearded Owl-clover

**Scientific name**

*Triphysaria versicolor*

**Status**

Endangered

**Reason for designation**

This small hemiparasitic annual plant is known from vernal pools and seeps in the endangered Garry Oak ecosystems of southern Vancouver Island. Its small range, fluctuations in number of mature individuals and few locations coupled with destruction of individuals and degradation of habitat through recreational use, grazing by introduced Canada Geese, competition from invasive plant species, and residential development put it at ongoing risk.

**Occurrence**

British Columbia

**Status history**

Designated Endangered in April 1998. Status re-examined and confirmed in May 2000 and November 2011.



**COSEWIC**  
**Executive Summary**

**Bearded Owl-clover**  
*Triphysaria versicolor*

**Wildlife species description and significance**

Bearded Owl-clover (*Triphysaria versicolor*) is an annual herb with a single, smooth, slender stem bearing finely divided leaves. Mature plants are usually 3-35 cm tall. The white, two-lipped flowers are arranged in a dense, prominently bracted, terminal raceme. The fruits are ellipsoid capsules, 6-9 mm long, containing numerous seeds.

**Distribution**

The main range of Bearded Owl-clover lies primarily in coastal regions from central California to central Oregon. In Canada, Bearded Owl-clover is narrowly restricted to a small area of southeastern Vancouver Island disjunct by over 400 km north from its main range. The Canadian populations represent less than 1% of the total range of the species.

**Habitat**

In Canada, Bearded Owl-clover is a habitat specialist, restricted to vernal moist maritime meadows and seeps as well as the margins of vernal pools. It is restricted to coastal areas, where it occurs on shallow soils generally underlain by bedrock.

**Biology**

Bearded Owl-clover is an annual species that germinates in early spring, flowers in April and May, and dies in late May or June as the summer drought deepens. It is incapable of vegetative propagation or asexual reproduction. The capsules of Bearded Owl-clover begin to open to release seed in late May or June and the seeds are gradually dispersed through the summer and autumn, as they are shaken out of the partially open capsules. Most seeds are shed in the immediate vicinity of the parent plant.

Bearded Owl-clover is a root parasite extracting water and nutrients from host plants but producing most of its own photosynthates. It is capable of parasitizing a broad spectrum of host species.

## **Population sizes and trends**

The number of mature Bearded Owl-clover plants in Canada fluctuates greatly among years, from 3,820 to 104,400 mature individuals. There are seven populations in Canada. As well, two historical populations appear to be extirpated. Approximately 88% of the Bearded Owl-clover plants in Canada belong to a single population. Population trends are unknown.

## **Threats and limiting factors**

The survival of existing populations and the availability of habitat for the recovery of Bearded Owl-clover are threatened by ongoing habitat loss caused by the impacts of recreation, invasion by exotic plants, grazing by introduced geese, and habitat degradation associated with changes in water regime.

## **Protection, status, and ranks**

Bearded Owl-clover was previously assessed by COSEWIC in 2000 and is listed as Endangered under Schedule 1 of the federal *Species at Risk Act*. One of the seven populations of Bearded Owl-clover occurs on federal lands. This species is included in the multi-species recovery plan for Garry Oak Ecosystem, but there is as yet no action plan, nor have management plans been established to protect populations. The recovery strategy proposes eight objectives specific to Bearded Owl-clover and there has been progress toward meeting two of these objectives (engaging cooperation and identifying critical habitat). None of the populations are protected under provincial, regional or municipal legislation. The only subspecies of Bearded Owl-clover found in Canada—*Triphysaria versicolor* subsp. *Versicolor*—has a NatureServe global rank of G5T5 (secure) but is ranked as S1 (critically imperilled) in British Columbia.

## TECHNICAL SUMMARY

*Triphysaria versicolor*

Bearded Owl-clover

*Triphysaire versicolore*

Range of occurrence in Canada (province/territory/ocean): British Columbia

### Demographic Information

Generation time: <i>Individuals live &lt;1 year, and the half life of the seeds in the seedbank is also expected to be short with most seeds germinating in the first year.</i>	1-2 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? <i>Trends are obscured by population fluctuations.</i>	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] <i>In the absence of long-term monitoring, trends are unknown.</i>	n/a
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	n/a
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	n/a
[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.	n/a
Are the causes of the decline clearly reversible and understood and ceased? <i>There has been no evidence of decline over the past 3 generations.</i>	n/a
Are there extreme fluctuations in number of mature individuals? <i>The seedbank for this species is very short lived. Mature individuals are required to frequently replenish the seedbank.</i>	Yes

### Extent and Occupancy Information

Estimated extent of occurrence <i>The calculated EO is 5 km<sup>2</sup> but the IAO cannot exceed the EO under COSEWIC convention.</i>	24 km <sup>2</sup>
Index of area of occupancy (IAO)	24 km <sup>2</sup>
Is the total population severely fragmented?	no
Number of "locations"	5
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] continuing decline in number of populations? <i>Several populations are very small and continue to experience a number of threats.</i>	Possibly
Is there an [observed, inferred, or projected] continuing decline in number of locations? <i>Some locations may be lost.</i>	Possibly
Is there an [observed, inferred, or projected] continuing decline in quality of habitat?	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	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
Mary Tod Island (1 population)	6-300
Uplands Park (3 subpopulations)	415-6,500
Glencoe Cove (2 subpopulations)	2,500-89,600
Discovery Islands (2 subpopulations)	500-1,000
Harling Point (1 population)	49-207
Gonzales Point (1 population)	300-3,441
Ten Mile Point (2 subpopulations)	50-3,400+
Total: 7 populations, 12 subpopulations	3,820-104,400

**Quantitative Analysis**

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not done
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**Threats (actual or imminent, to populations or habitats)**

Species are threatened by habitat loss and loss of individuals due to recreational activities, introduced and invasive species, and residential development.
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**Rescue Effect (immigration from outside Canada)**

Status of outside population(s)? Secure (G5T5)	
Is immigration known or possible?	Unlikely
Would immigrants be adapted to survive in Canada?	Unknown
Is there sufficient habitat for immigrants in Canada? <i>Although the quality of the remaining habitat is declining.</i>	Yes
Is rescue from outside populations likely?	No

**Current Status**

COSEWIC: Endangered (November 2011)
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**Status and Reasons for Designation**

<b>Status:</b> Endangered	<b>Alpha-numeric code:</b> B1b(iii)c(iv)+2b(iii)c(iv)
<b>Reasons for designation:</b> This small hemiparasitic annual plant is known from vernal pools and seeps in the endangered Garry Oak ecosystems of southern Vancouver Island. Its small range, fluctuations in number of mature individuals and few locations coupled with destruction of individuals and degradation of habitat through recreational use, grazing by introduced Canada Geese, competition from invasive plant species, and residential development put it at ongoing risk.	

### Applicability of Criteria

<b>Criterion A</b> (Decline in Total Number of Mature Individuals): Not applicable – Declines may be masked by extreme fluctuations of individuals.
<b>Criterion B</b> (Small Distribution Range and Decline or Fluctuation): Meets B1b(iii)c(iv)+2b(iii)c(iv) as the EO is <5000 km <sup>2</sup> and IAO is <500 km <sup>2</sup> , there is a declining habitat quality trend (primarily from invasive plants) and it experiences extreme fluctuations of mature individuals with a short-lived seedbank.
<b>Criterion C</b> (Small and Declining Number of Mature Individuals): Not applicable – Continuing decline is not demonstrated.
<b>Criterion D</b> (Very Small or Restricted Total Population): Meets Threatened D2 as the plants are found in 5 locations and may rapidly decline due to numerous ongoing threats.
<b>Criterion E</b> (Quantitative Analysis): Not done.



## PREFACE

Since Bearded Owl-clover was last assessed as Endangered in May 2000, two new populations have been discovered and much larger population sizes have been reported in peak years. However, there has been no active management for this species. The change in population sizes may be the result of natural environmental fluctuations or improved search effort and cannot be concluded to reflect population trends based on the available evidence. Previously, COSEWIC and SARA decisions have been applied specifically to subspecies *versicolor*, however, because this is the only subspecies reported from Canada, this update status report applies at the full species level.



### 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 (2011)

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.



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

# **COSEWIC Status Report**

on the

## **Bearded Owl-clover**

*Triphysaria versicolor*

**in Canada**

2011

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## WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

### Name and classification

Scientific Name: *Triphysaria versicolor* Fischer & C.A. Meyer

Synonyms: *Orthocarpus faucibarbatu*s A. Gray ssp. *albidus* Keck.

Common Names: Bearded Owl-clover, Bearded Owl's-clover, Yellowbeak Owl's-clover, Yellowbeak False Owl's-clover, Triphysaire versicolore

Family Name: Orobanchaceae (Broom-rape Family); formerly placed in the Scrophulariaceae (Figwort Family)

There are two subspecies (*faucibarbatu*s and *versicolor*) of Bearded Owl-clover in North America, but only subspecies *versicolor* occurs in Canada and all further information in this report refers to that subspecies unless otherwise specified.

### Morphological description

Bearded Owl-clover (Figures 1, 2) is an annual herb with a single, smooth, slender stem that, in larger individuals, is branched. Mature plants are usually 10-50 cm tall (Douglas *et al.* 2000) although Canadian plants are usually 3-35 cm tall (Fairbarns pers. obs.). The leaves are hairless, alternate, unstalked, spear-shaped and pinnately divided into five to nine narrow, elongate lobes. The flowers are arranged in a dense prominently bracted terminal raceme. The space between flowers increases as they develop into fruit such that the fruiting raceme is elongate. The lower floral bracts resemble the upper leaves but the bracts above become gradually less divided and the bract lobes wider. The flowers, white at first but fading to pink, are two-lipped. The upper lip is beaked and slightly longer than the lower lip. The lower lip is swollen, 3-pouched and minutely 3-toothed. The fruits are ellipsoid capsules, 6-9 mm long, containing numerous seeds. The seeds have a tight-fitting, netted seed coat (Douglas *et al.* 2000). As one of the alternate common names indicates, the beak on the upper lip is yellow (Fairbarns pers. obs.).

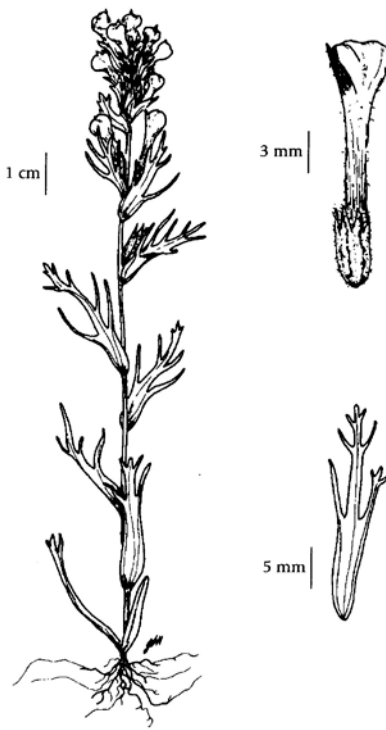


Figure 1. Illustration of Bearded Owl-clover. Illustration: from Douglas *et al.* 2000 with permission.



Figure 2. Photographs of Bearded Owl-clover. Flowering plants on left showing the white flowers fading to pink. Upper portion of flowering shoots on right showing deeply lobed leaves grading into flower bracts. Photographs: Matt Fairbarns.

Bearded Owl-clover is the only species of *Triphysaria* in Canada with white flowers. Its white flowers also distinguish it from other Canadian species of owl-clovers in the genera *Castilleja* and *Orthocarpus*.

## **Population spatial structure and variability**

No studies of spatial variation in morphology, ecology or genetics have been conducted for this species. No geographic or ecological barriers to movement are known that might create genetic structure or strong demographic isolation between Canadian populations. However, Canadian populations, which are highly disjunct from the core distribution in the U.S., may be genetically distinct. The nearest population in the U.S.—in Lane County, Oregon is over 400 km away (Douglas *et al.* 2000).

## **Designatable units**

The Canadian populations belong to a single designatable unit because they belong to a single infraspecific taxon and they all occur within a very restricted geographic area within a single COSEWIC Ecological Area (Pacific).

## **Special significance**

The highly disjunct nature of the Canadian populations of Bearded Owl-clover is of ecological and biogeographic significance. In Canada, the species occurs in conditions very different from those that prevail in its main range in the U.S. These habitat differences, along with the geographic separation between the Canadian population and its main range, may have led to genetic differentiation.

In Canada, the Bearded Owl-clover is a member of the highly restricted and nationally threatened maritime meadow Garry Oak Ecosystem.

There are no reported cultural uses of Bearded Owl-clover (Moerman 2009).

## **DISTRIBUTION**

### **Global range**

Bearded Owl-clover occurs in coastal regions from central California to central Oregon with disjunct populations in the foothills of the Sierra Nevada Mountains and on southeastern Vancouver Island (Figure 3). Apart from the Sierra Nevada populations, it is primarily a coastal species found at elevations of less than 500 m (Peck 1941; Chuang and Heckard 1993; Kartesz 2003; CalFlora 2009). Less than 1% of the global range lies within Canada.



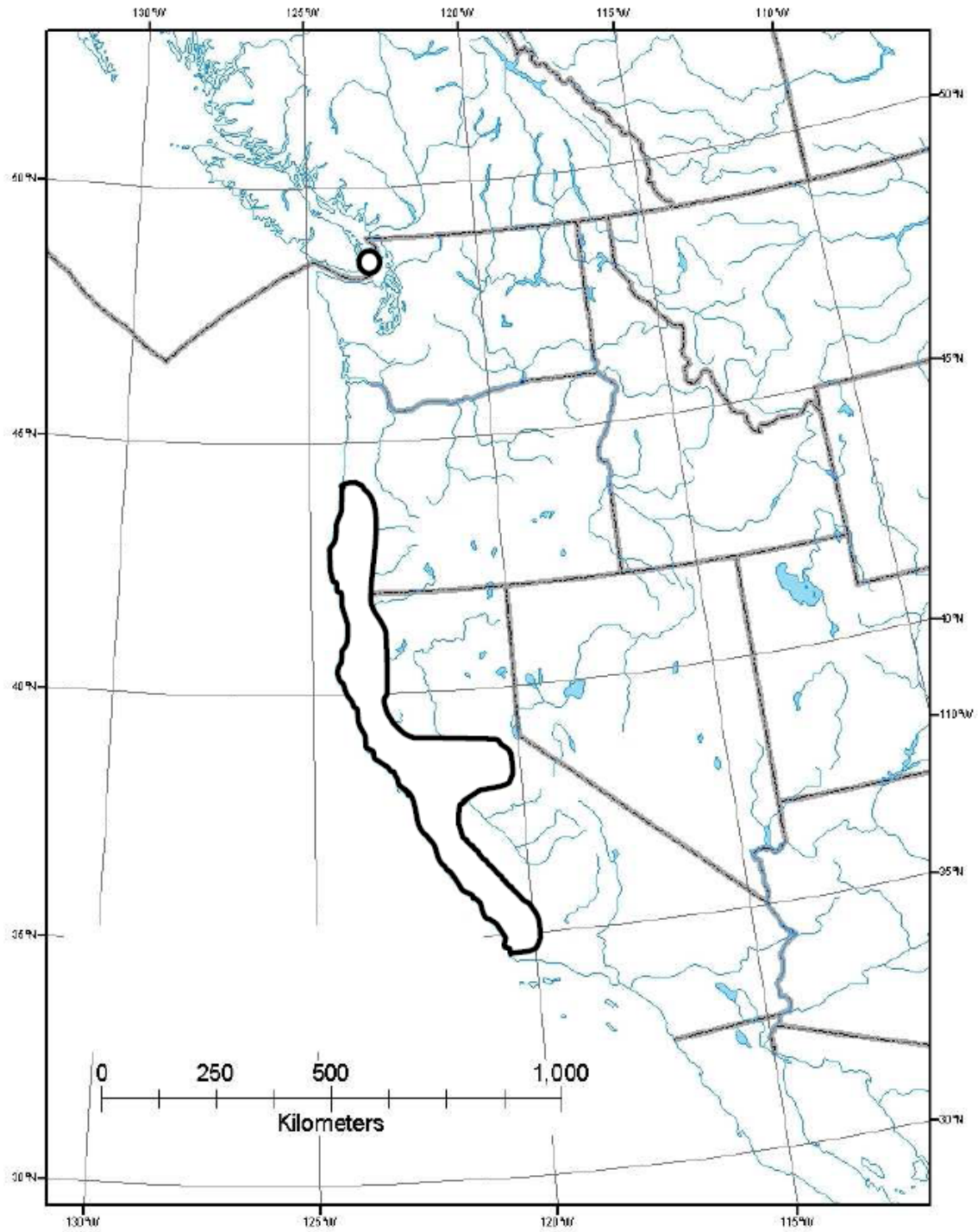


Figure 3. Global range of Bearded Owl-clover (subspecies *versicolor*).

## Canadian range

In Canada, Bearded Owl-clover is narrowly restricted to a small area of southeastern Vancouver Island (Figure 4) within the Coastal Douglas-fir Biogeoclimatic zone (Douglas *et al.* 2000). Keck (1927) assumed that it was introduced into Canada in the late 19<sup>th</sup> century and this assertion was taken up in subsequent publications including Taylor and MacBryde (1977) and Scoggan (1979). Douglas *et al.* (2000) rejected the suggestion that *Triphysaria versicolor* is introduced to Canada. The argument that this species is not native appears to be based solely on the disjunct nature of the Canadian population from the main range of the species. This is a weak argument considering that:

1. The Canadian portion of its range is more climatically similar to conditions in the northern part of its main range than to the intervening areas,
2. Numerous other species show similar distribution patterns, and
3. There is a continuous record of occurrence since 1887, during the early days of collecting in the region.

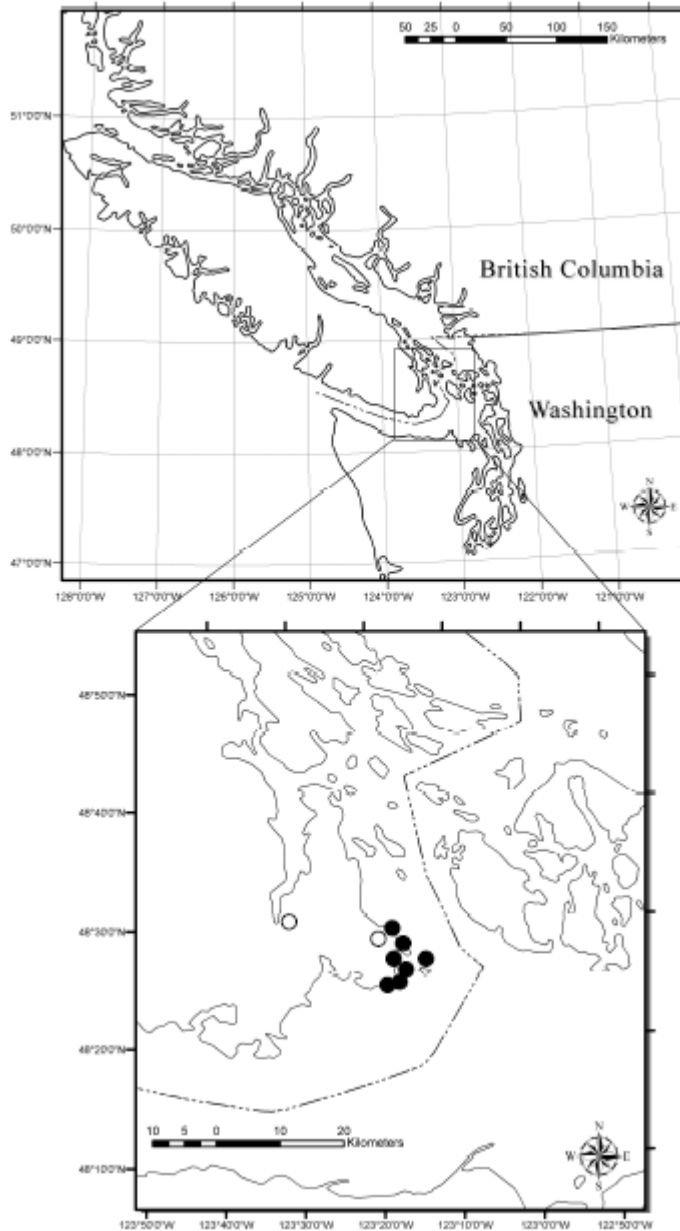


Figure 4. Canadian Range of Bearded Owl-clover. Solid circles indicate extant populations and open circles indicate extirpated populations.

There are seven extant populations of Bearded Owl-clover in Canada and at least two other populations appear to have been extirpated.

Locations are defined by threat (Table 1). Because the greatest threats to four of the sites are through recreation it is recommended that all be considered a single location. The Mary Tod Island population occurs in a small area and is threatened by grazing by introduced populations of Canada Geese.

**Table 1. Populations**

Population	Location number	Threat	Ownership	First/last Observation	Abundance	Area Occupied (ha)
Mary Tod Island	1	Introduced geese	Municipal	2001/2009	6-300	<1
Uplands Park	2	Trampling	Municipal Park	1914/2009	415-6,500	<1
Glencoe Cove			Municipal Park	1987/2009	2,500-89,600	<1
Harling Point			private	1990/2009	49-207	<1
Gonzales Point			private	1949/2009	300-3,441	<1
Discovery Islands	3	Invasive plants	First Nation	2003	500-1,000	<1
Ten Mile Point	4	Residential development	private land	1938/2009	30-1,500+	<1
	5	Invasive plants	public land		20-1,900+	<1
Mount Douglas	n/a	n/a	Municipal Park	1897	presumed extirpated	
Mount Finlayson	n/a	n/a	Provincial Park	1908/1969	presumed extirpated	

The Discovery Island population are less threatened by recreation so the greatest threats are from competition by invasive plants. For this reason it is treated as a distinct location. Finally, the Ten Mile Point population also consists of two subpopulations, each under different management and experiencing different threats and is thus considered to be two locations.

In summary, Bearded Owl-clover is still known from seven populations corresponding to five locations. There have been no recent fluctuations in the number of populations or locations. See **THREATS**, below, for further details and rationale for designating locations.

Two historical populations, both in the Victoria area, have not been observed for many years. One of these, at Mount Finlayson, was last reported in 1969. The other, at “Cedar Hill” (probably the area now known as Mount Douglas), was last reported in 1897. Collection records are not detailed enough to determine whether the populations were at the top, the flanks or the base of the mountains. Both Mount Douglas and Mount Finlayson are frequently searched by botanists so the absence of recent records suggests that both populations have been extirpated. Both sites have suffered heavily from trampling by hikers and by severely damaging invasions of non-native shrubs, grasses and forbs—particularly over the past 40 years.

The index of area of occupancy (IAO) is 24 km<sup>2</sup> using a 2 km x 2 km grid. The actual area occupied by the species is < 5 ha.

The current Canadian extent of occurrence (EO) of Bearded Owl-clover was estimated using OziExplorer. The smallest polygon measures 32.4 km<sup>2</sup>. Approximately 50% of the polygon consists of ocean and most of the terrestrial portion of the polygon consists of areas that appear to be too far inland for the species and therefore constitute “obviously unsuitable habitat”. Excluding such unsuitable areas of habitat, the EO of the species in Canada is approximately 5 km<sup>2</sup>. The historical range of the species in Canada, based on collections from extirpated populations, was approximately 15 km<sup>2</sup>. By convention, if the EO is less than the value of its IAO, the EO is adjusted to equal the latter. Accordingly, the EO of Bearded Owl-clover is considered to be 24 km<sup>2</sup>.

The Canadian population of Bearded Owl-clover is not severely fragmented. More than half of the individuals and more than half of the occupied habitat area belong to a single population (Glencoe Cove) that is considered viable.

### **Search effort**

Bearded Owl-clover is relatively easy to detect when in flower. 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 southeastern 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/were familiar with the plant. Over 1,000 ha of vernal pool, seepage and wet maritime meadow habitat at 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. Fairbarns (2008-2009) re-examined many sites that had other rare plants often associated with Bearded Owl-clover (Figure 5). The searches have resulted in two new populations being discovered and much larger population sizes have been reported in peak years.

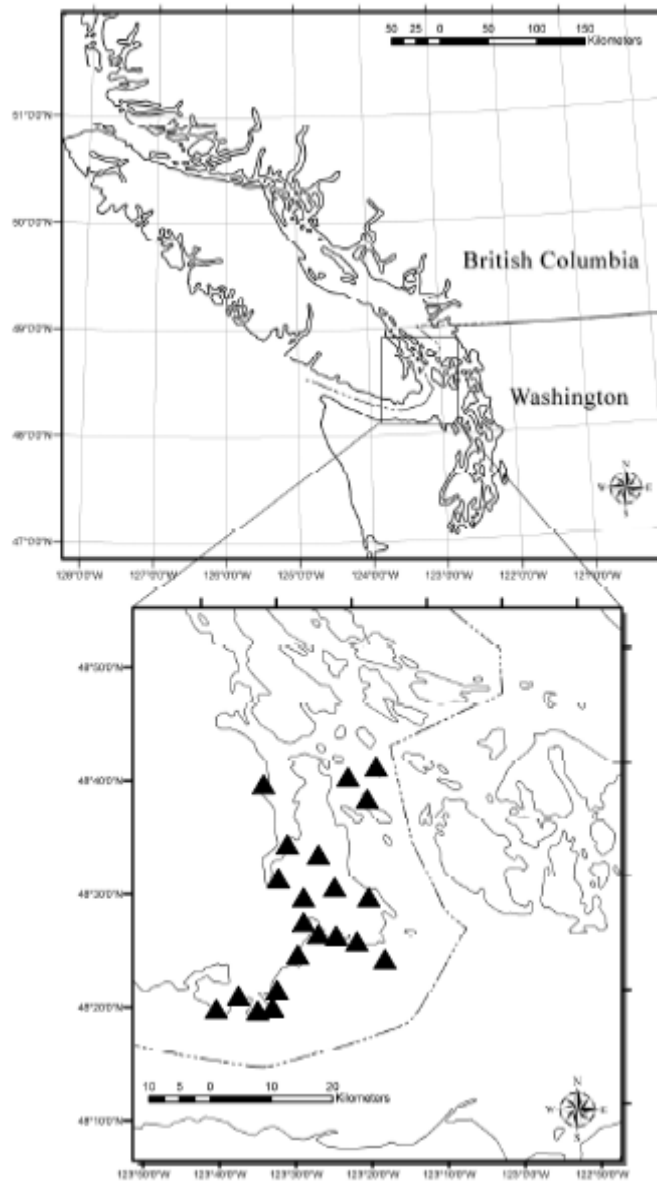


Figure 5. Negative search results: 2008-2009. Triangles each indicate one or more sites surveyed without success.

Researchers in Washington State have conducted intensive surveys of suitable sites in the San Juan Islands from 2005-2009 and have not found any populations (Giblin pers. comm. 2009).

## HABITAT

### Habitat requirements

In Canada, Bearded Owl-clover is limited to a macroclimate only found in the vicinity of Victoria, British Columbia and requires microclimatic conditions only found within 50 m of the shoreline. This habitat specialist is restricted to vernal moist maritime meadows and seeps, as well as the margins of vernal pools. It is restricted to landscapes of level to hummocky bedrock along shorelines, where it occupies level to gently sloping microhabitats bearing a thin, stable veneer of marine lacustrine materials overlying gneissic bedrock. The processes and attributes of Sombric Brunisols prevail but the surficial materials are often too thin (< 10 cm) to meet the definition of soil (Soil Classification Working Group 1998). The microhabitat is moderately well to imperfectly drained. The small area of southeastern Vancouver Island where Bearded Owl-clover occurs has mild winters, dry cool summers, and has the greatest annual amount of sunshine in British Columbia. The scarcity of snow and rarity of hard frosts allows vegetation to remain green throughout the winter. Strong moisture deficits turn the meadows brown in mid-summer (Fairbarns pers. obs.). All well-documented reports of Bearded Owl-clover in British Columbia refer to sites within 50 m of the shoreline, where oceanic influences lessen the frequency and severity of winter frosts.

Bearded Owl-clover occurs in unshaded areas and the Canadian populations occur in open meadows dominated by low grasses and forbs with little or no cover of native trees or shrubs (Fairbarns pers. obs.). The use of fire by First Nations may have maintained some sites clear of shrubs and trees (Turner 1999) but the majority of the Canadian habitat occupied by Bearded Owl-clover remains free of native woody species as a result of the contrasting combination of waterlogged soils in winter and severe moisture deficits in summer (Fairbarns pers. obs.).

Bearded Owl-clover is a hemiparasite (see **Interspecific interactions**, below). It forms root grafts with a wide variety of plants (Atsatt 1970; Thurman 1966 ex Matvienko *et al.* 2001), which suggests that the species composition found in its microhabitat has little influence on its ability to form parasitic connections.

### Habitat trends

Potential habitat for Bearded Owl-clover is naturally quite fragmented because of the specific habitat conditions described above. Much of the potential habitat that remains has been heavily altered as the result of invasions by non-native plant species.

The amount of potential habitat has declined greatly over the past century as coastal areas in southeastern Vancouver Island have been developed for residential and recreational use. Because 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. Bearded 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. Bearded 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 Bearded Owl-clover is probably even higher.

The distribution of Bearded 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 Bearded Owl-clover and both of the extirpated populations. The population of metropolitan Victoria has increased from approximately 180,000 in 1966 to 353,928 in 2009 and is projected to increase to 407,600 by 2026 (CRD 2006, 2009). As the human population grows, recreational use has increased on the sites where Bearded Owl-clover grows.

There is no specific information on trends in habitat for Bearded Owl-clover in its main range. It is reasonable, however, to assume that its habitat has faced declines similar to those experienced in Canada because at least 90% of historical vernal pools along the Central California coast have been destroyed and most remaining vernal pools have been degraded (Ferren and Pritchett 1988).

The private lot on Ten Mile Point, which contains a subpopulation of Bearded Owl-clover, is currently vacant and, because of its valuable ocean frontage, is likely to be redeveloped to utilize the entire legal building envelope within the property.

The actual area occupied by Bearded Owl-clover is likely to decline as the result of continued habitat loss through development and habitat degradation by trampling and weedy plant invasion (see below). There is, however, little likelihood that there will be a decline in the calculated index of area of occupancy or the extent of occurrence over the next 10 years or three generations.

## **BIOLOGY**

### **Life cycle and reproduction**

Bearded Owl-clover is an annual species (adults live less than one year) that germinates in early spring, flowers in April and May and completes its life cycle in late May or June as the summer drought deepens. The generation time (the juvenile period plus the half-life of seeds in the seed bank) is unknown but data from an unpublished study of Golden Paintbrush (*Castilleja levisecta*)—a related species with quite similar seeds—suggest that the seedbank is largely transitory (i.e., with almost all seeds germinating or dying within the first year) (Fairbarns pers. comm.). Bearded Owl-clover has bisexual flowers.



Bearded Owl-clover is an outcrossing species (i.e., it must be fertilized by pollen from a different individual). Pollen tube growth experiments indicate that self-incompatibility is controlled by a system with multiple recognition alleles (Yoder 1998). The two-lipped flower structure found in Bearded Owl-clover is often associated with bee pollination, and bees in the family Andrenidae have been found to pollinate Bearded Owl-clover in California (Chuang and Heckard 1991).

As an annual plant, Bearded Owl-clover is incapable of vegetative propagation or asexual reproduction.

### **Physiology and adaptability**

Bearded Owl-clover has no known adaptations to fire, temperature extremes, severe weather conditions or anthropogenic disasters apart from its ability to bank seed in the soil during adverse conditions. Seed longevity in the natural (soil) seedbank has not been described but many related annual hemiparasitic plants have very short-lived seedbanks (Svensson and Carlsson 2004). Bearded Owl-clover is a generalist that invades a broad spectrum of host species (Atsatt and Strong 1970; Press and Graves 1995; Estabrook and Yoder 1998).

Jamison and Yoder (2001) provide methods for germinating and growing Bearded Owl-clover in a growth chamber (16°C, 12-h light regimen). The seeds germinated after 7 to 10 days.

### **Dispersal and migration**

The capsules of Bearded Owl-clover begin to dehisce in late May or June and the seeds are gradually dispersed from dried plants through the summer and autumn, as they are shaken out of the partially open capsule. Seed dispersal virtually ceases when autumn storms break down the dead shoots. Kuijt (1969) and Chuang and Heckard (1983) suggest that reticulations on the seed coat of owl-clovers 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. The consistent appearance of Bearded Owl-clover at the same set of vernal seeps and pools over several decades suggests that dispersal resulting in the establishment of new subpopulations is a very rare event.

## Interspecific interactions

Bearded Owl-clover is a hemiparasite (root parasite) that extracts water and nutrients from host plants, but produces most of its own photosynthates and is considered a facultative hemiparasite in its ability to mature without host connections, though it is much more vigorous when grown in the presence of other plants (Thurman 1966 *ex* Jamison and Yoder 2001). As with most related facultative hemiparasites, Bearded Owl-clover is a generalist that invades a broad spectrum of host species (Atsatt and Strong 1970; Press and Graves 1995; Estabrook and Yoder 1998). As an annual, Bearded Owl-clover must be able to parasitize new hosts each year. The ability to infect a diversity of host species is thought to help annual hemiparasites persist (McNaughton 1968), especially in sites such as those where Bearded Owl-clover occurs in British Columbia, which are dominated by annual plants whose relative abundance varies greatly among years and that have become increasingly dominated by non-native species.

Not all hosts are equally beneficial to the parasites (Gibson and Watkinson 1989; Matthies 1996 and Marvier 1998a) and the growth and reproduction of owl-clovers and other hemiparasitic species may even be reduced when attached to certain hosts (Atsatt and Strong 1970). A single owl-clover plant may invade multiple host plants of the same or different species (Marvier 1998b). Attachment of a single hemiparasite to multiple host species may enhance growth of the hemiparasitic plant due to the increased variety of nutrients available to the parasite and enhanced resistance to herbivory (Marvier 1998a). Conversely, natural densities of a closely related species of owl-clover have been shown to significantly reduce the dry mass production of favoured hosts (grasses) while having no significant effect on the productivity of less beneficial hosts (including Smooth Cat's-ears [*Hypochaeris glabra*]); furthermore, the magnitude of these differences may confer a competitive advantage to Smooth Cat's-ears where owl-clovers are abundant (Marvier 1998b).

Some hemiparasites, including some species closely related to Bearded 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).

## POPULATION SIZES AND TRENDS

### Sampling effort and methods

In 2009, populations at Mary Tod Island, Uplands Park, Glencoe Cove, Harling Point and Gonzales Point, as well as the portion of the Ten Mile Point population occurring on public lands, were censused and mapped (Table 1). Precise counts were made at Harling Point, Gonzales Point, and the public portion of the Ten Mile Point. A range estimate is provided for the population at Mary Tod Island because it was difficult to accurately count plants that had already died.

In 2009, the populations at Uplands Park and Glencoe Cove were extremely large and very dense in places. In both cases, to gain a reliable estimate, the entire population was subdivided into areas of between one m<sup>2</sup> and 200 m<sup>2</sup> depending on the density of Bearded Owl-clover (which occasionally exceeded 3,000 plants/square metre). The number of plants per patch was estimated by counting plants, in groups of approximately ten. A small number of representative patches were recounted with great care, revealing a systematic underestimation by about 15%. The total number of plants counted in each of these two populations was tallied, rounded down to the nearest 100, and served as the lower boundary of a range estimate. The upper boundary of the estimate was set at 15% higher than the lower boundary and then rounded up to the nearest 100.

Due to the fact that the surveyors were unable to get landowner permission to survey the portion of the Ten Mile Point population on private lands or the Discovery Islands population, data from the most recent surveys are provided instead.

### Abundance

Based on the most recent survey data, the Canadian population of Bearded Owl-clover numbers between 3,820 and 104,400. The range in abundance estimates reflects both the uncertainty associated with individual counts and uncertainty due to year-to-year fluctuations in population size. Approximately 88% of the Canadian population occurs at Glencoe Cove.

## **Fluctuations and trends**

For those sites that have been surveyed repeatedly, reported population sizes vary considerably among years. The original status report estimates a Canadian population of approximately 4,000 mature individuals (Penny *et al.* 1996). Some early, low population estimates must be treated with caution because the survey methods and accuracy are poorly documented, and large populations might be greatly underestimated by rapid surveys. The 2009 survey at Glencoe Cove, which took five person-days to complete, provided a population estimate far greater than reported by the two earlier surveys. In 2011, populations at Glencoe Cove (from 90,000 in 2009 to 1,000-5,000 in 2011) and Uplands Park (from 6,500 in 2009 to 200-400 in 2011) were quite evidently more than an order of magnitude lower than in 2009 (Fairbarns pers. comm. 2011). This suggests that low population estimates in past years likely represented similar extreme fluctuations rather than simply measurement errors.

Current population trends cannot be determined because of the lack of consistent, reliable counts and the sizable fluctuations in the number of mature individuals.

## **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. 2009). Despite the intensive survey effort, no populations of Bearded Owl-clover have been found in Washington State. It therefore appears that there is negligible opportunity for unassisted genetic immigration (seed or pollen) from the U.S. Because the nearest populations are more than 400 km to the south, it is unknown whether they would be sufficiently adapted to local conditions. In the unlikely event that immigration did occur, some suitable habitat remains although the amount of suitable habitat is declining.

## **THREATS AND LIMITING FACTORS**

Recreational activities are a major threat to occurrences of Bearded Owl-clover and to habitat suitable for the recovery of the species (Table 1). The Uplands, Glencoe Cove, Gonzales Point and Harling Point populations receive extremely heavy foot traffic in spring and summer. Substantial portions of all of these populations are regularly crushed before they can produce ripe fruit. The recreational use has also led to habitat degradation, as soils in the vernal seeps are both compacted and eroded. The Discovery Islands populations are only lightly affected by foot traffic. The Ten Mile Point and Mary Tod Island populations are also damaged by foot traffic in the spring and summer, although the damage tends to be less severe. Ironically some trampling may reduce competition of invasive plants and stop some sites from being completely overrun.

Perhaps the greatest threat to the Mary Tod Island population is due to grazing by a non-migratory introduced population of Canada Geese (*Branta canadensis*) growing rapidly throughout the region (Isaac-Renton *et al.* 2010). As an example, until 2004 there were no breeding pairs of geese on Trial Island (a representative area of vernal seeps and meadows). Since then the breeding populations of geese have increased rapidly and over 50 breeding pairs were observed in 2011 (Fairbarns pers. comm.). Not only does grazing by Canada Geese lead to trampling damage and loss of plant tissue, they also deposit an abundance of faeces (Fairbarns pers. obs.) which has been implicated in an explosion of exotic annual grasses on grazed meadow sites of Bearded Owl-clover (Isaac-Renton *et al.* 2010). The population is also susceptible to damage associated with District of Oak Bay's use of the island as a launching pad for fireworks displays and is close enough for local residents to swim to in the summer.

Almost all habitat occupied by Bearded Owl-clover, and habitat suitable for its recovery, has been heavily altered due to invasion by alien plants. On the Discovery Islands and a portion of the Ten Mile Point population, competition from invasive plants is the most serious threat to the persistence of Bearded Owl-clover. The most common invasive plants include several grasses such as Early Hairgrass (*Aira praecox*), Silver Hairgrass (*A. caryophylla*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Soft Brome (*Bromus hordeaceus*), Common Velvet Grass (*Holcus lanatus*), Perennial Ryegrass (*Lolium perenne*), Annual Bluegrass (*Poa annua*), Squirrel-tail Fescue (*Vulpia bromoides*) and Hedgehog Dogtail (*Cynosurus echinatus*); and a number of forbs including Crow Garlic (*Allium vineale*), Smooth Cat's-ear, Hairy Cat's-ear (*Hypochaeris radicata*), Ribwort Plantain (*Plantago lanceolata*), Sheep Sorrel (*Rumex acetosella*), Small-flowered Catchfly (*Silene gallica*), Common Vetch (*Vicia sativa*), Tiny Vetch (*V. hirsuta*) and Small Hop-clover (*Trifolium dubium*). The driest microsites where Bearded Owl-clover occurs, if the soil is deep enough or the bedrock sufficiently fissured, have often been invaded by exotic shrubs—primarily Scotch Broom (*Cytisus scoparius*).

The invasive, exotic species appear to have displaced a native bunchgrass community dominated by California Oatgrass (*Danthonia californica*) and Tufted Hairgrass (*Deschampsia cespitosa*), which was characterized by many open microsites between the bunchgrasses where Bearded Owl-clover likely once thrived. More generally, invasive alien plants impede the survival and recovery of Bearded Owl-clover through suppression, competition and the pre-emption of space. Suppression occurs when shrubs and medium to tall grasses and forbs reduce the amount of light reaching the leaves of Bearded Owl-clover, thereby reducing its ability to produce photosynthates. Competition occurs when the roots of invasive alien plants capture moisture and nutrients and thereby reduce the availability of these resources to Bearded Owl-clover. The availability of safe germination sites suited to Bearded Owl-clover is directly reduced when invasive alien plants (particularly perennial rosette and mat-forming species) pre-empt space. The availability of safe germination sites may also be indirectly reduced by alien species when the litter they produced creates an impenetrable thatch.

Altered hydrological regimes also threaten Bearded Owl-clover because it is dependant upon winter seepage. Any actions that disrupt the hydrological regime, whether due to construction or soil compaction, may eliminate this essential process. The portion of the Ten Mile Point population that occurs on public land is fed from seepage originating in a residential lot and any actions taken to change seepage patterns, such as redevelopment of the lot or the construction of retaining walls, may lead to the loss of Bearded Owl-clover at the site.

Climate change may have devastating effects on vernally moist environments. Small, shallow vernal seeps including those which support Bearded Owl-clover are at greatest risk, particularly to changes in precipitation and evaporation losses which determine the duration of continuous inundation, the frequency of inundation events suited to the reproduction of vernal pool/seepage species, and the seasonal distribution of inundation (Pyke 2005). While the loss of some vernal seepage environments may be offset by the improved quality of currently marginal habitats, the latter are unlikely to develop populations of Bearded Owl-clover without human intervention because of the species' apparently weak powers of dispersal.

The extreme population fluctuations represent a significant limiting factor, particularly as it seems likely that Bearded Owl-clover provides a transitory seed bank.

## **PROTECTION, STATUS, AND RANKS**

### **Legal protection and status**

Bearded Owl-clover is currently listed as Endangered and is protected under the federal *Species at Risk Act* under Schedule 1. A strategy has been developed for the recovery of Bearded Owl-clover (Parks Canada Agency 2006) as part of the multispecies Garry Oak Recovery Strategy; however, there is no action plan nor have management plans been established to protect populations. The recovery strategy proposes eight objectives specific to Bearded Owl-clover, and there has been progress toward meeting two of these objectives (engaging cooperation and identifying critical habitat). Efforts to engage cooperation include the delivery of plants at risk workshops to staff in both of the municipalities that have populations of Bearded Owl-clover on park lands, and landowner contact with two of the three landowners who have Bearded Owl-clover on their private property. Proposed critical habitat mapping is being prepared.

None of the populations are protected under provincial, regional or municipal legislation.

## **Non-legal status and ranks**

Bearded Owl-clover is not covered under the Convention on International Trade in Endangered Species (CITES), the *Endangered Species Act* (U.S.) or the IUCN Red List (IUCN 2011).

Bearded Owl-clover (*Triphysaria versicolor* subsp. *versicolor*) has a NatureServe global rank of G5T5 (secure) but is ranked as S1 (critically imperilled) by the British Columbia Conservation Data Centre. The other two jurisdictions where it occurs—Oregon and California—have not determined a conservation status rank for the species in their states (NatureServe 2009). Bearded Owl-clover has a NatureServe National rank of N1 (critically imperilled), in Canada and General Status ranks of 1 (at risk) in Canada and in British Columbia (CESCC 2006).

## **Habitat protection and ownership**

One of the populations occurs on federal land (an Indian Reserve) but there are no measures in place to monitor the condition of the population, to protect its critical habitat, or to counter any threats it may face.

Four (Mary Todd Island, Uplands Park, Glencoe Cove and Ten Mile Point) of the other six populations occur partially or entirely within municipal parks, where there is protection from residential development. The parks designation, however, encourages recreational use with the attendant threat of trampling. The two remaining populations occur within a cemetery and a private golf course.

## **ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED**

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- David F. Fraser. Endangered Species Specialist, Ecosystem Branch, Conservation Planning Section. Ministry of Environment, Government of British Columbia. Victoria, British Columbia.
- Sonia Schnobb. Administrative Assistant, COSEWIC Secretariat. Canadian Wildlife Service. Environment Canada. Ottawa, Ontario.
- Reader, Brian. Chair. Garry Oak Ecosystems Recovery Team. Victoria, British Columbia.
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This report is an update of an original status report prepared by Jenifer Penny, George Douglas and Geraldine Allen.

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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)