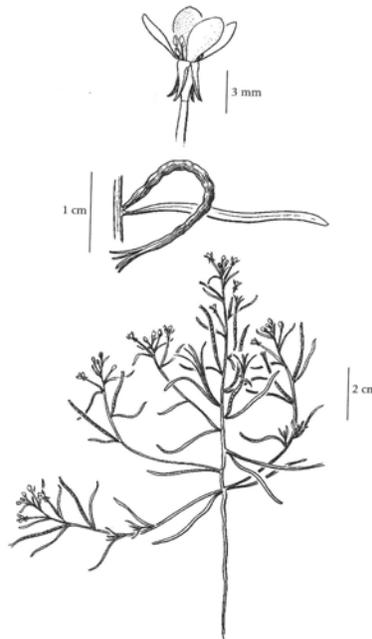


# COSEWIC Assessment and Status Report

on the

## Contorted-pod Evening-primrose *Camissonia contorta*

in Canada



**ENDANGERED  
2006**

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 2006

**Common name**

Contorted-pod evening-primrose

**Scientific name**

*Camissonia contorta*

**Status**

Endangered

**Reason for designation**

An annual herb restricted to several dry, open and sandy coastal habitats of very small size. The small fragmented populations are impacted by ongoing habitat loss, high recreational use and competition with several invasive exotic plants.

**Occurrence**

British Columbia

**Status history**

Designated Endangered in April 2006. Assessment based on a new status report.



**COSEWIC**  
**Executive Summary**

**Contorted-pod evening-primrose**  
*Camissonia contorta*

**Species information**

The contorted-pod evening-primrose (*Camissonia contorta*) is a member of the evening-primrose family. It is a diminutive, slender herb, up to 40 cm long, arising from a slender taproot. Its stem is wiry, usually branched, peeling below and often sprawling. It bears small flowers with four yellow petals. Its fruits are small, twisted pods that contain several small seeds. The stems, leaves and capsules are often deep red, particularly in unshaded environments.

**Distribution**

Contorted-pod evening-primrose ranges from British Columbia to California, east to Idaho and western Nevada. In Canada, it is restricted to coastal areas along southeastern Vancouver Island and the adjacent Gulf Islands, an area of approximately 750 km<sup>2</sup>. Within this area, the plants occupy seven small areas totalling about 8 ha.

**Habitat**

In Canada, it is restricted to semi-stable sandy flats and dunes no more than 15 m above sea level. Such habitats are naturally fragmented, but have become more so with the degradation of sandy coastal habitats within its Canadian range.

**Biology**

The contorted-pod evening-primrose is a short-lived annual. Plants typically germinate from March to May, and flower in April or May and disperse seeds in May or June. Most plants die with the onset of the summer drought in June. In unusual years, with significant rainfall events during the summer, a small proportion of plants may survive until late summer or early autumn. These plants may show renewed vegetative growth, flowering and fruiting following major rainfall events.

The seeds of contorted-pod evening-primrose lack any apparent adaptations to assist in long-distance dispersal. Most seeds likely remain in the immediate vicinity of the parent plant. The short distances of seed dispersal and the strong tendency

towards self-pollination suggest that there is little potential for a rescue effect, even over short distances.

### **Population sizes and trends**

There are seven extant populations and one extirpated population in Canada. Individual populations vary from 20 to 2,000 plants and the total Canadian population is estimated to consist of 3,500-4,500 mature plants. One population has recently disappeared and another has declined by an estimated 95%. Overall, the total Canadian population is estimated to have declined by approximately 35% in recent years.

### **Limiting factors and threats**

Several major factors threaten extant populations and potential habitat. The most serious threat is posed by recreational activities, particularly those associated with vehicle use and beach activities on the remaining areas of suitable habitat that have, themselves, undergone losses over recent decades. A number of exotic, invasive shrubs and herbs are severely altering the ability of sites to support the species. Six of the seven populations are so small that they face a moderate to serious threat of demographic collapse. Herbivory, apparently by introduced eastern cottontails, has had a minor impact on several mature plants. It does not appear to pose a serious threat to the species.

### **Existing protection or other status designations**

In British Columbia, the only area of Canada where the species occurs, it has been ranked S1 (critically endangered). There is no provincial legislation protecting contorted-pod evening-primrose at the species level. None of the populations occur within provincially protected areas, but there is one very small population in a national park reserve. Two populations, one large (about 2,000 individuals) and one medium-sized (<1,000), occur in Capital Regional District Parks. They are protected by park policy; however, there is considerable recreational activity even within the small areas occupied by these populations.



## 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<sup>th</sup> 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 (2006)

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 it 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

## **Contorted-pod evening-primrose**

*Camissonia contorta*

**in Canada**

2006

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## SPECIES INFORMATION

### Name and classification

Scientific name: *Camissonia contorta* (Dougl. ex. Hooker) Kearney  
Synonyms: *O. cruciata* (S. Wats.) Munz.; *Oenothera contorta* Dougl. ex. Hooker  
Common names: Contorted-pod evening-primrose; Contorted evening-primrose;  
Contorted primrose; Bentpod desert primrose; Twisted suncup;  
Douglas' evening primrose; Contorted suncup; Dwarf contorted  
suncup; onagre à fruits tordus  
Family: Onagraceae (evening primrose family)  
Major plant group: Eudicot flowering plant

Macoun originally identified specimens of *Camissonia contorta* collected in BC in the late 1880s as *Oenothera strigulosa* (Fischer and Meyer) Torrey and A. Gray. All three of his specimens have been annotated as *Camissonia contorta* by reliable taxonomists.

*Camissonia contorta* is a distinct taxon and there are no infraspecific taxa recognized in Canada. *Camissonia pubens* (S. Wats.) Raven is a closely-related species that is occasionally treated as *C. contorta* var. *pubens* Kearney. *Camissonia pubens* is restricted to California and Nevada.

### Morphological description

*Camissonia contorta* (Figure 1) is a slender, usually diminutive annual herb, occasionally growing to 40 cm long, arising from a slender taproot. Its stem is wiry, usually branched, peeling below and often sprawling. The stem bears coarse, spreading hairs and the plant may be glandular-hairy in the inflorescence. Its leaves are linear to narrowly elliptic, 5-30 mm long and entire to remotely toothed. The flowers are arranged in a leafy-bracted, nodding, terminal raceme. The flowers are borne on a short stalk or are unstalked. Each flower consists of a hypanthium 1.5-2.0 mm long that bears four sepals, four petals, eight anthers and an inferior ovary. The sepals are 2.5-4.0 mm long and are reflexed at maturity. The petals are 3-5 mm long and yellow, fading to red. The stamens are noticeably unequal, the longer set nearly twice the length of the shorter. The ovary is 4-chambered and matures into a linear, 2-4 cm long capsule scarcely 1 mm thick. The unstalked capsule is cylindrical and swollen about the seeds and varies from nearly straight to arching almost into a coil. There is 1 row of seeds per chamber and the seeds are 0.7-0.9 mm long, shiny and minutely pitted (Douglas and Meidinger 1999). The stems, leaves and capsules are often deep red, particularly in unshaded environments.

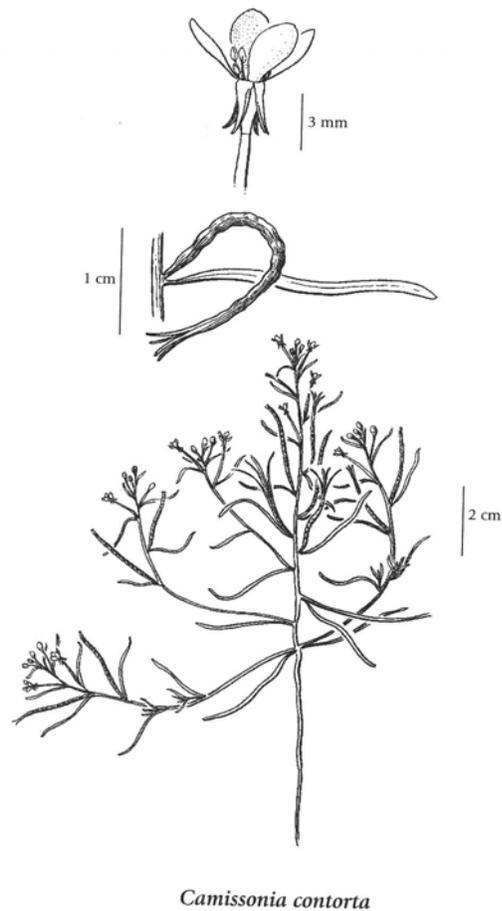


Figure 1. *Camissonia contorta*; flower, fruit and general plant habit (Illustrated by Jeanne R. Janish with permission from University of Washington Press).

## Genetic description

The genus *Camissonia* has a base chromosome number of  $x=7$ . Aneuploidy is almost unknown in *Camissonia*, but occurs in other genera in the Onagraceae. *Camissonia contorta* is the only hexaploid species in the section *Camissonia* ( $n=21$ ), based on chromosome counts from 40 populations, including specimens from two locations in British Columbia. This species may form sterile hybrids with the diploid *C. campestris* and the tetraploid *C. strigulosa* (neither of which occur in Canada) and may be an allopolyploid derived from hybridization between these two taxa. Alternatively, it may have arisen from the fertilization of unreduced gametes in a tetraploid species such as *C. strigulosa* (autopolyploidy). There is no evidence of intergradation between *C. contorta* and any other species throughout its range (Raven 1969).

## DISTRIBUTION

### Global range

*Camissonia contorta* ranges from British Columbia to California, east to Idaho and western Nevada (Figure 2).

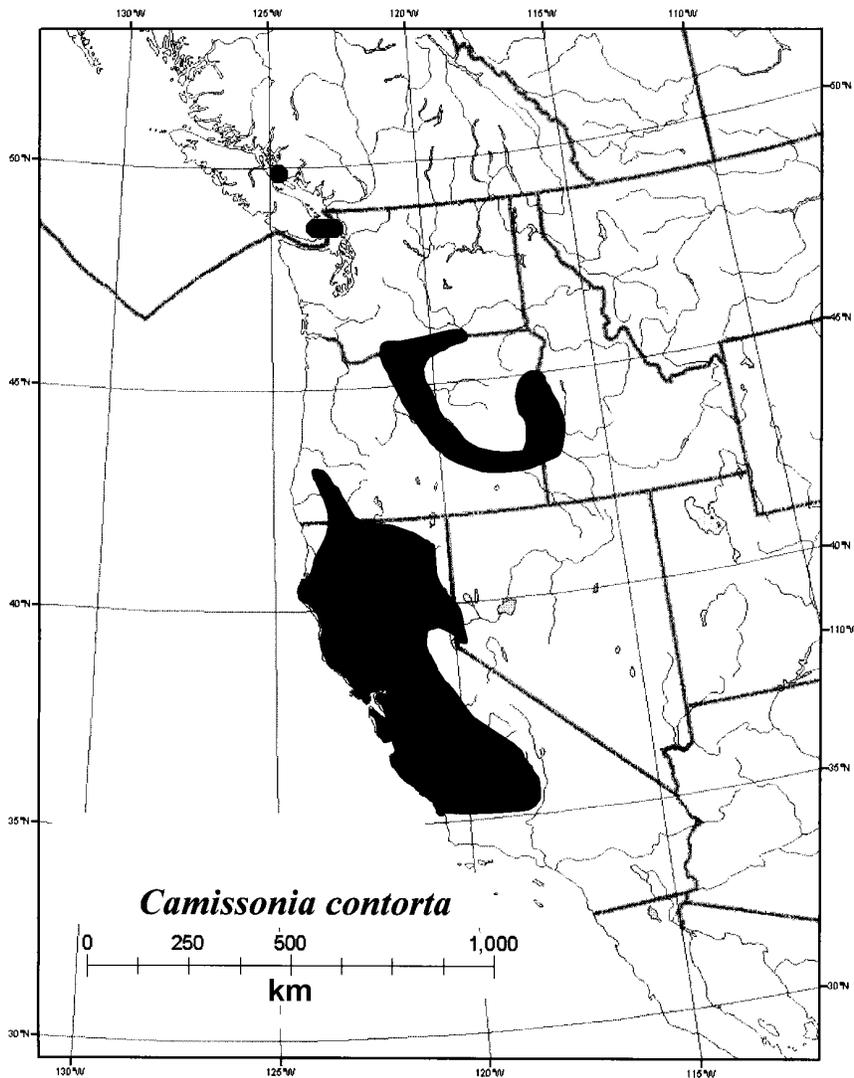


Figure 2. Global range of *Camissonia contorta*.

NatureServe reports *Camissonia contorta* for Vermont but this is based on record(s) of *Oenothera cruciata* Nutt. var. *sabulonensis* Fern. (B. Popp pers. comm. 2003). This biennial or short-lived perennial, in the section *Euoenothera* of the genus *Oenothera*, now most commonly called *Oenothera parviflora* L. (Kartesz 1999), is a common plant in eastern Canada and the northeastern United States. It is a very different taxon from *O. cruciata* (S. Wats.) Munz (a synonym for *Camissonia contorta*).

## Canadian range

In Canada, *Camissonia contorta* has a restricted distribution occurring only near sea level, in the Georgia Basin (Figure 3). It is restricted to the coastal Douglas-fir biogeoclimatic zone.

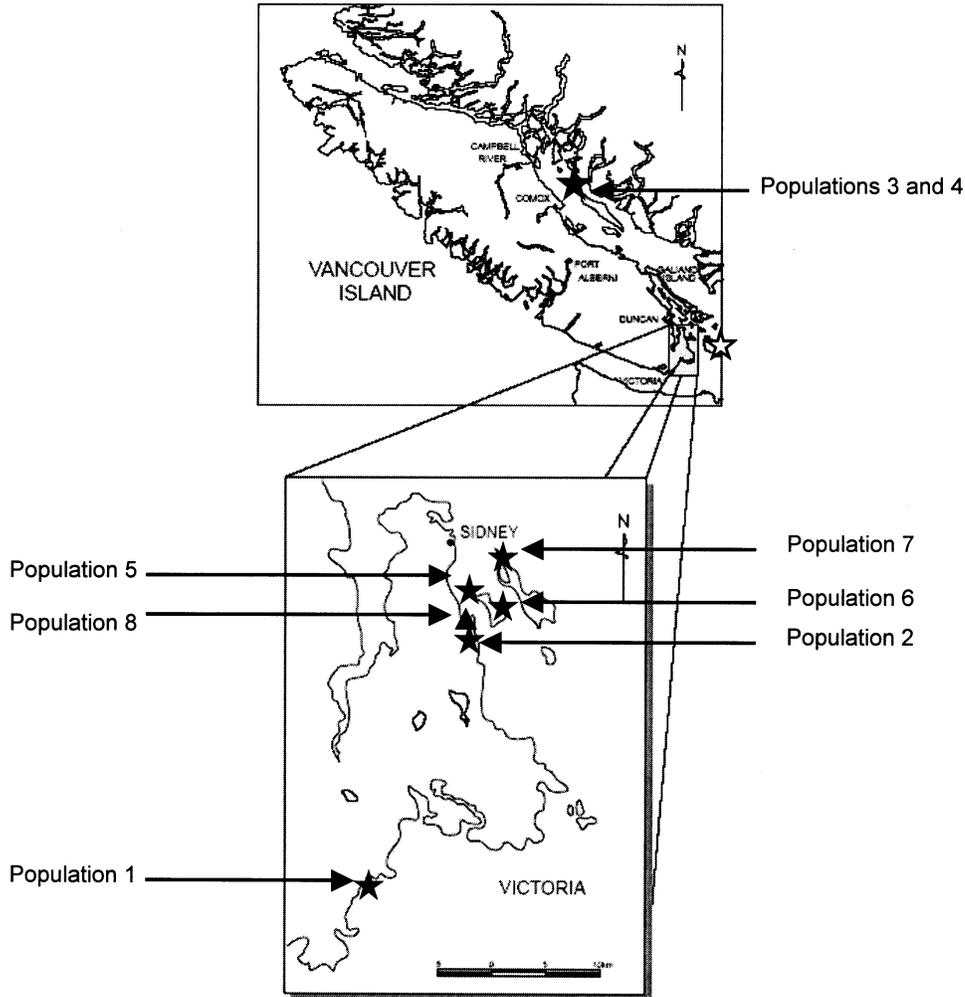


Figure 3. Range of *Camissonia contorta* in Canada. Extant populations shown by solid stars, extirpated population shown by solid triangle, nearest U.S. population shown by hollow star. At the scale used for this map, Northern Gulf Island populations 3 and 4 cannot be shown as separate symbols.

It is known from eight populations, based on a minimum separation of about 1 km, seven extant and one historic. The extant populations include two on Savary Island in the Strait of Georgia, four on the Saanich Peninsula and nearby offshore islands near Victoria, and one southwest of Victoria (Figure 3). The Canadian distribution is heavily fragmented: the northern pair of populations is more than 150 km from the others and the southwestern population is more than 30 km from its nearest neighbour. This

fragmentation is largely a result of natural features. The intervening areas consist of marine environments, forested ecosystems or unsuitable substrates (non-sandy). Heavy residential development in the southern portion of the Canadian range has overlain an anthropogenic level of fragmentation. The Canadian population, plus a single nearby population on San Juan Island (Washington State) is widely disjunct from the species' main range. The Canadian range constitutes less than 1% of the species' global distribution.

Currently the plants occur over an area measuring approximately 1,500 km<sup>2</sup>. Approximately 50% of this area is open ocean, so the effective extent of occurrence is generously estimated at about 750 km<sup>2</sup>. The current area of occupancy totals 78,400 m<sup>2</sup>.

## HABITAT

### Habitat requirements

*Camissonia contorta* is a habitat specialist, restricted to dry, open, sandy areas throughout its range. It has been found in sparsely vegetated open areas, grasslands, chaparral and woodlands. In the Pacific Northwest it is restricted to low elevations but in California it occurs up to 2,300 m (Peck 1941; Hitchcock and Cronquist 1961; Raven 1969; Atkinson and Sharpe 1993; Wagner 1993).

In Canada, *Camissonia contorta* has even more specialized habitat requirements. Here, it is restricted to semi-stable sandy flats and dunes no more than 15 m above sea level. It occurs on five level sites near Victoria (populations 1, 2, 5, 6, and 7) and south-facing slopes of up to 50% on Savary Island (populations 3 and 4). All seven extant populations occur on sites that are xeric and rapidly drained, with bare sand and little or no surface organic material or rock. The sites have negligible tree or shrub cover, although Scotch broom (*Cytisus scoparius*) sometimes grows nearby and shades sites during part of the day. *Camissonia contorta* tends to occupy sparsely vegetated sites and is absent from areas where there is a high cover of grasses and forbs. It is scarce or absent from continuous carpets of mosses such as *Racomitrium canescens*, *Tortula princeps* and *Polytrichum piliferum*, which often grow at the edges of populations. It can tolerate light levels of sand erosion and deposition and may require such disturbances in order to escape competition. It is absent from more active areas of sand dunes and other sites with unvegetated sand.

Such habitats are highly fragmented within its extent of occurrence in Canada. The fragmentation is fundamentally due to the natural distribution of shoreline sand deposits although this has been exacerbated by residential and tourist development in many fragments which were once suitable. Contemporary and historical records indicate *Camissonia contorta* is naturally infrequent and even among fragments of suitable habitat, it only occupies small patches.

## Habitat trends

There is no quantitative information on the overall decline in quality and extent of sand dune and beach locations on southeastern Vancouver Island and the adjacent Gulf Islands. There is considerable anecdotal and qualitative information documenting a rather serious trend of habitat degradation (see subsequent section on limiting factors and threats).

At the Saanich C population, however, scattered patches of *Camissonia contorta* are found in fragments of intact habitat throughout recently roughed-in fairways of a 40,000-m<sup>2</sup> proposed golf course extension. The roughed-in fairways have been heavily altered and it appears the existing population is a remnant of a once-continuous and far more abundant population. An adjacent 140,000-m<sup>2</sup> area of former sand-plain was developed into groomed fairways more than a decade ago. *Camissonia contorta* probably once occurred on much of this area as well. It thus appears that suitable habitat for the species at Saanich C has declined by more than 75% over the past few decades.

## Habitat protection/ownership

Populations 1 and 2 occur within Capital Regional District Parks. The habitat is protected by policies laid out in a general master plan for all parklands administered by the agency (Capital Regional District Parks 2000). In reality, both populations occupy habitat that receives moderate to high foot traffic by park visitors. Rustic trails have been laid out in the vicinity of population 2 and these serve to reduce the amount of foot traffic that might otherwise affect the population. Capital Regional District Parks has indicated an interest in developing and implementing measures to protect both populations.

Populations 3 and 4 are on a right-of-way belonging to the BC Ministry of Transportation. That agency has not developed legislation or policies with respect to species at risk or the habitats they occupy (Greg Czernick, pers. comm. 2004). The Province of BC has no legislation protecting *Camissonia contorta* habitat on provincial lands.

Populations 5 and 6 occur on private land managed for recreational use. Most or all of population 6 occurs on roughed-in fairways of a proposed golf development.

Population 7 occurs in Gulf Islands National Park Reserve and is protected by federal legislation; however, the population is threatened by invasive shrubs and, to a lesser degree, by visitor activities.

The extirpated population occurred on municipal parklands at Cordova Spit. This park, which is accessible by boat or through Indian Reserve lands, receives little or no management from the municipality. There is no current master plan for this site, or for Central Saanich Parks in general. Instead, management is guided by the Official

Community Plan (Hope Burns, pers. comm. 2004). This policy document encourages the maintenance of natural erosion and deposition processes that maintain beach environments. It also encourages the conservation of rare, threatened or endangered ecosystems and species. It does not indicate what priority natural history values, or rare species occurrences in particular, should have when resolving conflicting land use interests.

## BIOLOGY

Little has been written about the biology of *Camissonia contorta*, apart from the taxonomic treatment Raven (1969) provides for the genus. The following information, unless otherwise cited, is based on unpublished field observations and garden experiments conducted by Matt Fairbarns.

### Life cycle and reproduction

*Camissonia contorta* is a short-lived annual. In natural populations, germination begins in March or April and appears to end in May. Garden experiments demonstrated that current-year seeds are capable of germinating in mid-summer if watered. Despite frequent visits in 2003 and 2004, no seedlings were observed in the field later than May in either population 1 or 2.

Flowering begins in April and peaks in June. Raven (1969) describes *Camissonia contorta* as self-fertilizing but provides no supporting evidence. *Camissonia contorta* is a polyploid annual with small and inconspicuous flowers and such plants tend towards self-fertilization. On the other hand, it has perfect flowers and a relatively large stigmatic surface, features often associated with cross-fertilization. At one of the survey sites, a small beetle bearing abundant pollen on its body was observed crawling over the stigmatic surface of *C. contorta*, suggesting cross-pollination is possible. In fact, almost all angiosperm plants, including many described as self-fertilizing, are capable of at least low levels of cross-fertilization. Based on this evidence, it appears that most flowers of *Camissonia contorta* are probably self-pollinated but cross-pollination occurs fairly regularly.

Seed dispersal begins in early May and most plants have shed their seed by late July. All of the Canadian populations have similar fecundity. Plants tend to produce between 3 and 10 capsules, although some reproductive plants produce as few as 1 or as many as 17 capsules. Most capsules contain 10-20 ripe seeds at maturity.

*Camissonia contorta*, as a taprooted and usually short-lived annual, is incapable of clonal growth or asexual reproduction.

Plants continue to grow until they succumb to summer drought. Mortality normally occurs in June or July but summer rainfall events may trigger renewed vegetative growth, flowering and fruiting. In favourable years, a small proportion of plants may continue to flower until October, when cool weather appears to end growth.

## **Herbivory**

There was no information available on herbivory during the seedling stage. Light levels of foliar herbivory were noted in established plants but non-native herbivores appeared to be responsible; such observations are discussed in the section dealing with “Limiting Factors and Threats”.

## **Physiology**

*Camissonia contorta* survives summer drought and winter cold by persisting as seeds.

## **Dispersal/migration**

Seeds of *Camissonia contorta* lack any apparent adaptations to assist in long-distance dispersal. Observations of dehiscent fruit suggest that most seeds likely remain in the immediate vicinity (within 20 cm) of the parent plant. The species persists in the same location year after year, rather than forming source-sink populations or metapopulations. Seeds may be transported in sand during blow-out events, which may result in occasional dispersal for several metres. The short distances of seed dispersal and the strong tendency towards autogamy suggest that there is little potential for a rescue effect, even over the short distances between populations.

## **Interspecific interactions**

There are no known interspecific interactions that increase the susceptibility of *Camissonia contorta* to extirpation in Canada.

## **Adaptability**

*Camissonia contorta* is poorly adapted to moving sand, as the plants are low and can be quickly buried by shifting sand. Its tiny seeds lack abundant endosperm reserves (pers. obs.) so it is unlikely to establish if they are covered by more than a few millimetres of sand. The same limitations render the species susceptible to human disturbances that lead to shifting sand. Propagation experiments (pers. obs.) revealed that a high proportion of seeds germinate readily; however, seedling mortality was high. Transplanting has not been attempted. The species’ reliance on a very deep taproot, the fact that it is an annual, and its specialized habitat requirements suggest that transplantation from horticultural sources would be unsuccessful.

## **POPULATION SIZES AND TRENDS**

### **Search effort**

A total of approximately 100 hours (not including travel time) were spent searching for *Camissonia contorta* at 30 locations in 2002, 2003 and 2004 (Figure 4). The

principal surveyors were Matt Fairbarns, Phil Henderson, Frank Lomer, Erica Wheeler, Heidi Guest, Adolf Ceska and Oldriska Ceska, all of whom are familiar with the species.

The surveys were conducted throughout the known extent of occurrence. Surveys were also conducted on sand dunes and flats at coastal locations in the Gulf Islands and along the southwest coast of Vancouver Island, where rare associates such as yellow sand-verbena (*Abronia latifolia*) were already known to occur and *Camissonia contorta* might have been overlooked.

Botanists unfamiliar with the species may have difficulty spotting the diminutive plants, especially on cloudy days and in late afternoon when most flowers are closed. Plants may also be hard to find on very bright days when glare off bare sand may be troublesome. Nevertheless, botanists familiar with the species had little trouble finding the plants because of their high habitat specificity, the scarcity of appropriate habitat and the sparse nature of the associated vegetation. This held true even when the plants are not in flower, since the deep red foliage present on most plants is relatively easy to detect. Typically, if plants were present on a site they were found within the first 30 minutes of searching.

### **Abundance**

In 2004 there were an estimated 3,500-4,500 mature individuals of *Camissonia contorta* in Canada (Table 1). Non-reproductive plants were very short-lived and could not be counted before they died. The number of mature individuals per population varied from approximately 20 at site 7 to as many as 2,000 at site 5.

### **Fluctuations and trends**

Past records of *Camissonia contorta* are not sufficiently detailed to determine fluctuations or declines, overall, in the Canadian population. However, some inferences can be made from known habitat losses. The most extensive occurrence, Saanich C, now consists of about 100 widely scattered plants restricted to small, intact areas within a recently roughed-in golf course. About 95% of the area is now so heavily altered that it provides very poor quality habitat for *C. contorta*. The former population size at Saanich C is estimated at 2,300 plants according to an extrapolation assuming the same density observed at Saanich B (a similar, nearby site). The smaller population at Saanich E completely disappeared in recent years. Overall, the Canadian population of *C. contorta* has declined by an estimated 30-35% in recent years.

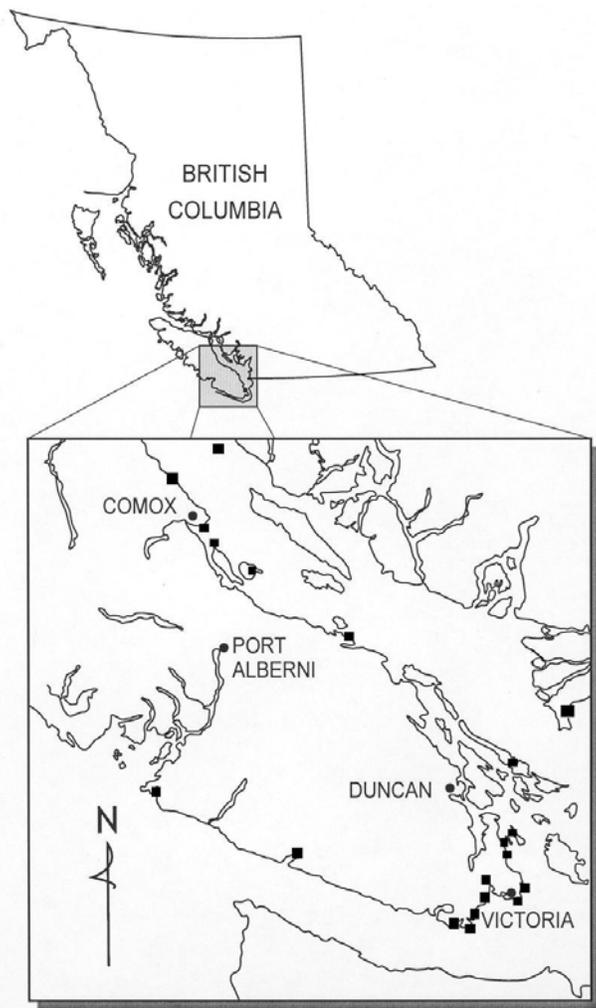


Figure 4. Search effort for *Camissonia contorta*. Black squares indicate location of one or more sites searched within the known range of the species and in other seemingly suitable sites along the southwest coast of Vancouver Island.

**Table 1. Population data.**

Population Number and Name	Area of Occupancy	Number of Mature Individuals		
		Observed	Estimated	Total
1 Metchosin	100 m <sup>2</sup>	253		253
2 Saanich A	2,000 m <sup>2</sup>		500-1,000	500-1,000
3 Northern Gulf Island A	500 m <sup>2</sup>	190	200-250	200-250
4 Northern Gulf Island B	800 m <sup>2</sup>	696	700-750	700-750
5 Saanich B	35,000 m <sup>2</sup>		2,000	2,000
6 Saanich C	40,000 m <sup>2</sup>		100	100
7 Saanich D	1 m <sup>2</sup>	20		20
8 Saanich E	extirpated	extirpated	extirpated	extirpated
Total	78,400 m <sup>2</sup>			3,500 - 4,500

## Rescue effect

The only nearby extra-territorial population occurs on San Juan Island in Washington State. There, it occurs as a healthy population sporadically distributed along a 10-km stretch of sand dunes and glacial outwash deposits. This extended population is more than 10 km from the nearest point in Canada and about twice that distance from the nearest Canadian population of *Camissonia contorta*. The intervening area is open ocean. Given the very limited dispersal distance of this species, there is negligible likelihood that seeds from the San Juan populations would be able to migrate to Canada. There is negligible likelihood of a natural rescue effect from Washington populations should the Canadian populations become extirpated.

## LIMITING FACTORS AND THREATS

### Habitat loss

Golf course development has resulted in a major loss of suitable habitat at the Saanich C population.

### Recreational activities

Recreational use has had the most significant impact on sand flats within the Canadian range of *Camissonia contorta*. Recreational use is concentrated on suitable *Camissonia* sites due to the relative scarcity of sandy shores in the area. Seven of the eight extant/extirpated populations have been moderately to heavily and extensively altered by recreational activities, including:

- Heavy trampling associated with hiking, dog-walking, sunbathing and picnicking at populations 1,2,4, 7 and 8
- Heavy 4-wheel drive traffic in populations 5, 6 and 8. Over the past decade there has been a significant increase in the area destabilized by vehicle ruts at the site where population 8 formerly occurred. Such activities almost certainly led to the extirpation of the population, which was last seen in 2002 (Adolf Ceska, pers. comm. 2004).

### Invasive plants

*Camissonia contorta* is a stress-tolerator, thriving in xeric, sandy habitats where other native species are stunted or absent. A number of alien, invasive species have entered these ecosystems in the past century and a half, and many of them now dominate habitats otherwise suited to *C. contorta*. The major threats came from *Cytisus scoparius*, *Bromus rigidus*, *B. tectorum*, *B. sterilis*, *Aira praecox*, *A. caryophyllea* and *Rumex acetosella*. *Cytisus scoparius* was present immediately adjacent to or within all seven extant populations and has presumably invaded areas formerly suited to *Camissonia contorta*. Given one or two decades, *Cytisus scoparius* has the ability to

completely stabilize semi-active sand areas by forming dense thickets. This will eventually allow further succession and eliminate open habitats. Page (2003) calculated that the combined area of open dune and grass/bryophyte cover near population 2 declined by over 15%, from 6.3 ha in 1932 to 5.3 ha in 1995 (unfortunately the decline was not partitioned among the two cover types and the loss of grass/bryophyte cover does not reflect a direct loss of habitat for *C. contorta*).

Other invasive species that posed a serious threat at one or more sites included *Allium vineale*, an aggressive onion, which is spreading rapidly in areas where it has become established (especially at population 5), and *Ammophila arenaria*, which tends to stabilize dunes and thereby alter substrate dynamics in the vicinity of *Camissonia contorta* (especially at population 7).

**Table 2. Threat matrix for surveyed sites. Sites numbered as in Table 1.**

Location	Habitat Loss	Recreation	Invasive Plants	Herbivores	Demographic Collapse
pop. 1 Metchosin	medium	heavy	heavy	medium	moderate
pop. 2 Saanich A	medium	medium	heavy	medium	minor to moderate
pop. 3: Northern Gulf Island A	light	light	light	light	moderate
pop. 4: Northern Gulf Island B	light	medium	medium	light	moderate
pop. 5 and 6 Saanich B and C	heavy	heavy	heavy	medium	minor
pop. 7 Saanich D	medium	heavy	heavy	medium	major
pop. 8 Saanich E	light	heavy	heavy	medium	extirpated

### Introduced herbivores

Plants in populations 1, 2, 5, 6 and 7 experience light to moderate levels of herbivory, and eastern cottontail droppings are abundant at most of these sites as well as in the location where population 8 formerly occurred. The impact of rabbit grazing on competing vegetation appears to outweigh the minor impacts of grazing on *Camissonia contorta* itself.

### Demographic collapse

Some populations of *Camissonia contorta* are threatened simply by their small size. Pavlik (1996) suggests that the minimum population size for plants varies from as few as 50 plants for some life forms to as many as 2,500 plants for others. *C. contorta*, as an annual herb which does not produce ramets and occurs as a stress-tolerant species in highly variable environments, fits the profile of a species that would have a high minimum viable population size according to Pavlik's criteria. Accordingly, six of the seven extant populations of *C. contorta* with fewer than 1,000 individuals are apparently threatened by the possibility of demographic collapse, and the threat is

moderate (750 or fewer individuals) or major (100 or fewer individuals) in four or five sites.

### **SPECIAL SIGNIFICANCE OF THE SPECIES**

Hitchcock and Cronquist (1961) mention the horticultural potential of several large-flowered species in the genus *Camissonia*. Species such as *C. contorta*, which bear inconspicuous flowers, have little horticultural interest.

No traditional knowledge, including First Nations use for crafts or for medicine, has been documented for *Camissonia contorta* or any other members of the genus (Goulet, pers. comm. 2004).

### **EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS**

*Camissonia contorta* is ranked G5 by NatureServe. It is ranked S1 in British Columbia (the only Canadian province/territory where it occurs). It is also ranked S1 in Vermont but that record is based on a taxonomic error (see Global Range). It has not been ranked in the other five jurisdictions where it occurs (Washington, Idaho, Oregon, Nevada and California) (NatureServe 2004).

British Columbia does not have an Endangered Species Act, and *Camissonia contorta* is not protected under the provincial Wildlife Act.

Only one of the Canadian populations (population 7) is protected within national or provincial parks, wildlife areas or ecological reserves. It is the smallest of the known populations and faces imminent threat of encroachment by *Cytisus scoparius*. Populations 1 and 2 are protected in Capital Regional District Parks. They are covered by a policy of protecting rare, threatened and endangered plants, but there is no specific legislation or regulations to support this policy, apart from prohibition of motorized vehicles, bicycles and camping. Neither is there any specific policy protecting *Camissonia contorta* or the critical habitat attributes where it occurs. Both of these populations experience continued impacts from recreational activity. The best habitats for *C. contorta* in Canada, as well as the largest population, occur on private land. The total number of individuals on private land is slightly larger than the number on all other sites combined.

## TECHNICAL SUMMARY

### ***Camissonia contorta***

contorted-pod evening-primrose

onagre à fruits tordus

Range of Occurrence in Canada: British Columbia

<b>Extent and Area Information</b>	
<ul style="list-style-type: none"> <li>Extent of occurrence (EO)(km<sup>2</sup>)</li> </ul>	750 km <sup>2</sup>
<b>Area enclosing all populations excluding ocean</b>	
<ul style="list-style-type: none"> <li>Specify trend in EO</li> </ul>	stable
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in EO?</li> </ul>	no
<ul style="list-style-type: none"> <li>Area of occupancy (AO) (km<sup>2</sup>)</li> </ul>	<< 1 km <sup>2</sup>
<b>Sum of areas occupied by extant populations</b>	
<ul style="list-style-type: none"> <li>Specify trend in AO</li> </ul>	declining
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in AO?</li> </ul>	no
<ul style="list-style-type: none"> <li>Number of known or inferred current locations</li> </ul>	seven
<ul style="list-style-type: none"> <li>Specify trend in #</li> </ul>	decreasing
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of locations?</li> </ul>	no
<ul style="list-style-type: none"> <li>Specify trend in area, extent or quality of habitat</li> </ul>	decreasing
<b>Population Information</b>	
<ul style="list-style-type: none"> <li>Generation time (average age of parents in the population)</li> </ul>	5 months
<ul style="list-style-type: none"> <li>Number of mature individuals</li> </ul>	3,500-4,500
<ul style="list-style-type: none"> <li>Total population trend:</li> </ul>	declining
<ul style="list-style-type: none"> <li>% decline over the last/next 10 years or 3 generations.</li> </ul>	estimated at 35%
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of mature individuals?</li> </ul>	unknown
<ul style="list-style-type: none"> <li>Is the total population severely fragmented?</li> </ul>	yes
<ul style="list-style-type: none"> <li>Specify trend in number of populations</li> </ul>	decline
<ul style="list-style-type: none"> <li>Are there extreme fluctuations in number of populations?</li> </ul>	no
<ul style="list-style-type: none"> <li>List populations with number of mature individuals in each</li> </ul>	
1: 253	
2: 500-1,000	
3: 200-250	
4: 700-750	
5: 2,000	
6: 100	
7: 20	
<b>Threats (actual or imminent threats to populations or habitats)</b>	
<p>Actual threats: significant recent habitat conversion; recreational activities such as beach activities and ATV use; invasive plants; introduced herbivores (eastern cottontail)</p> <p>Potential threats that are likely: altered dune dynamics; demographic collapse due to small size of some populations</p>	
<b>Rescue Effect (immigration from an outside source)</b>	
<ul style="list-style-type: none"> <li>Status of outside population(s)?</li> </ul>	
<b>USA:</b> NatureServe	secure
<ul style="list-style-type: none"> <li>Is immigration known or possible?</li> </ul>	no
<ul style="list-style-type: none"> <li>Would immigrants be adapted to survive in Canada?</li> </ul>	probably
<ul style="list-style-type: none"> <li>Is there sufficient habitat for immigrants in Canada?</li> </ul>	yes
<ul style="list-style-type: none"> <li>Is rescue from outside populations likely?</li> </ul>	no
<b>Current Status</b>	
COSEWIC: Endangered (2006) British Columbia: Red-listed; S1	

### Status and Reasons for Designation

<b>Status:</b> Endangered	<b>Alpha-numeric code:</b> B1ab(ii, iii, iv, v) + 2ab(ii, iii, iv, v)
<p><b>Reasons for Designation:</b>            An annual herb restricted to several dry, open and sandy coastal habitats of very small size. The small fragmented populations are impacted by ongoing habitat loss, high recreational use and competition with several invasive exotic plants.</p>	
<p><b>Applicability of Criteria</b></p>	
<p><b>Criterion A:</b> (Declining Total Population): Meets Threatened A2ce + 3c e due to the suspected past and inferred future decline in populations of at least 30% based on habitat loss and decline in habitat quality due to recreational use of the plant's habitat and expansion of invasive plants over a period of 10 years.</p> <p><b>Criterion B:</b> (Small Distribution, and Decline or Fluctuation): Meets Endangered B1ab(ii, iii, iv,v) + 2ab(ii, iii, iv, v) due to the very small extent of occurrence and area of occupancy, the highly fragmented populations and decline due to a recent population loss, reduction of area of occupancy, as well as decline in quality of habitat and number of individuals.</p> <p><b>Criterion C:</b> (Small Total Population Size and Decline): Not applicable. Population size is &lt;10,000 but no additional criteria are met to apply criterion C.</p> <p><b>Criterion D:</b> (Very Small Population or Restricted Distribution): Meets Threatened D2 due to an area of occupancy &lt;20 km<sup>2</sup> and ongoing threats are present from recreational use of the plant's habitat and spread of exotic invasive plants.</p> <p><b>Criterion E:</b> (Quantitative Analysis): None available.</p>	

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The author greatly appreciated the contributions from two botanists who surveyed two sites on his behalf: Nick Page surveyed Goose Spit and Frank Lomer surveyed Centennial Park (Tsawwassen). Several other biologists assisted him in surveys of potential sites, including Dr. Robb Bennett (Garry Oak Ecosystems Recovery Team), Jenifer Penny, Marta Donovan and Shane Ford (BC Conservation Data Centre), Erica Wheeler and Heidi Guest (University of Victoria), and Brian Reader (Parks Canada).

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### Authorities contacted

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## **BIOGRAPHICAL SUMMARY OF REPORT WRITER**

Matt Fairbarns has studied the conservation biology of plants for over 25 years. He has a special interest in the flora and vegetation of British Columbia and Alberta. He was a botanist with the British Columbia provincial government until 2003 and now

manages Aruncus Consulting, an independent biological conservation research company.

### **COLLECTIONS EXAMINED**

Collections were examined at the herbarium of the Royal British Columbia Museum (V). The herbarium of the University of Victoria (UVIC) was visited but had no collections of *Camissonia contorta*. Collections from the University of British Columbia (UBC) and the National Museums of Canada (CAN) were not examined, because label data from their collections were available from the British Columbia Conservation Data Centre database. Curatorial staff confirmed that there were no Canadian collections at either institution, apart from those documented by the CDC (O. Lee, pers. comm. July 2004; M. Shchepanek, pers. comm. July 2004). The herbarium of the Eastern Cereal and Oilseed Research Centre (DAO) has no collections of *C. contorta* (G. Mitrow, pers. comm. 2004).