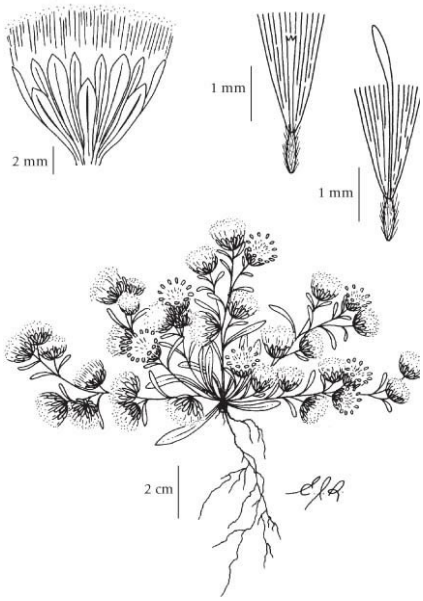
COSEWIC
Assessment and Status Report

on the

Short-rayed Alkali Aster
Symphyotrichum frondosum

in Canada



ENDANGERED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
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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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Production note:

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Short-rayed alkali aster — Douglas *et al*. 1998. Used with permission

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COSEWIC
Assessment Summary

Assessment Summary – April 2006

Common name
Short-rayed alkali aster

Scientific name
Symphyotrichum frondosum

Status
Endangered

Reason for designation
An annual herb of lake shorelines present at only a few remaining sites in restricted habitats. The small populations are subject to disruption from such activities as trampling, beach management, spread of invasive plants and potential development of a major facility at one of the primary sites.

Occurrence
British Columbia

Status history
Designated Endangered in April 2006. Assesment based on a new status report.

COSEWIC
Executive Summary

Short-rayed Alkali Aster
Symphyotrichum frondosum

Species information

The short-rayed alkali aster, *Symphyotrichum frondosum*, is a late emergent shoreline species reported primarily from lakeshore habitats in moist drawdown zones of sandy beaches and perimeters of alkali lakes and ponds in British Columbia. It is found primarily in the bunchgrass biogeoclimatic zone (Douglas *et al*. 1998) of the sagebrush steppe in the southern Okanagan Valley. A single ephemeral population in sand dredgings on the shore of the Fraser River in Surrey may represent the presence of the species upstream in the Fraser-Thompson drainage.

It is a small, many-branched annual herb 5-60 cm in height, arising from a taproot. The numerous flower heads support multiple flowers. Flowers are white to pink in colour, with both ray petals, and yellow disk flowers. Plants are generally submersed until late summer, with flowering occurring in August and early September.

Distribution

Globally, the short-rayed alkali aster is known only from Mexico, the US and Canada. In the US it is found in California, Arizona, New Mexico, Nevada, Colorado, Idaho, Montana, Utah, Oregon, Washington, and Wyoming. In Canada it is known only from British Columbia, primarily in the Okanagan Valley.

Habitat and biology

This shoreline species is adapted to fluctuating water levels and late summer drawdown. Dispersal is likely by wind, water, and small mammals. The species can withstand high pH and high salinity.

Population sizes and trends

Four extant stations for short-rayed alkali aster are confirmed in British Columbia. Limited data are available for all populations so trends cannot be fully assessed. One population was ephemeral. One sub-population has been extirpated, and one new sub-population is reported. The extent of occurrence (total area encompassed within a

convex polygon that includes all populations) is approximately 56 km^2. The combined area of occupancy (total area of suitable habitat over which the plants occur) is 900 m^2, but the area of occupancy for several sites is unknown.

Limiting factors and threats

Beach maintenance activities and heavy beach use (trampling and severe disturbance) limit the areal extent of populations at three stations, and threaten the persistence of the populations. Additionally, invasive plant species may be another serious threat.

Special significance of the species

In Canada, short-rayed alkali aster occurs at the northern limit of its range, and is important ecologically, biogeographically and genetically because of this.

Existing protection

One station occurs in a provincial park, and a second station occurs partly in a provincial park. This provides legal protection, but no formal protection exists. A third station occurs on lands with a conservation covenant. A fourth station (four reported sub-populations) occurs primarily in Indian Reserve lands.

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 5th 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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Canada

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

COSEWIC Status Report

on the

Short-rayed Alkali Aster

Symphyotrichum frondosum

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2006

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SPECIES INFORMATION

Name and classification

Scientific name:	*Symphyotrichum frondosum* (Nutt.) Nesom, *Phytologia*, 77 (3): 282. 1994
Basionym (Nesom 1994)*:*	*Aster frondosus* (Nutt.) Torr. & Gray, *A. Flora of North America:* 2(1): 165. 1841.
	Brachyactis frondosa (Nutt.) A. Gray, *Proc. Am. Acad. Arts* viii. (1873) 647.
	Tripolium frondosum Nutt., *Trans. Amer. Philos. Soc. N. S*. vii. (1841) 296.
Common name:	short-rayed aster or alkali aster (Douglas *et al*. 1998), short-rayed alkali aster (ITIS 2004)
Family name:	Asteraceae (aster family)
Major plant group:	Eudicot flowering plant

Kartesz (1999) lists this species as *Brachyactis frondosa*. *Aster frondosus* is the name used for this species in BC (Douglas *et al*. 1998). However, current research has shown that *Aster sensu stricto* does not apply to North American members of the tribe *Astereae* (Nesom 1994, Noyes and Rieseberg 1999, Semple *et al*. 2001). The single exception is *Aster alpinus* L. (Nesom 1994, ITIS 2004). *Aster frondosus* has been placed in the genus *Symphyotrichum* by Nesom (1994). It has clearly been demonstrated that the genus *Symphyotrichum* is unrelated to *Aster sensu stricto* (Noyes and Rieseberg 1999). The Integrated Taxonomic Information System (2002) lists *Aster frondosus* as "not accepted" and *Symphyotrichum frondosum* as the "accepted" taxonomic status of this species. Treatment of the genus *Symphyotrichum* for Flora of North America is currently being prepared by Luc Brouillet and others. They will be using the nomenclature outlined above (Brouillet pers. comm. 2003, Semple pers. comm. 2003). In this report, we follow Brouillet *et al*.

Morphological description

An annual herb 5 to 60 cm tall, much branching (Figure 1), usually decumbent (Wiggins 1980) but can be erect, arising from a tap-root (Douglas *et al.* 1998). Heads usually very numerous in spicately paniculate inflorescences (Munz and Keck 1970). Ray flowers 1.5-2 mm long, barely exceeding the disk flowers, conspicuous pink to white in living specimens, drying to inconspicuous white once pressed (Douglas *et al.* 1998, Lomer 1996). Involucral bracts 5-9 mm tall, subequal to moderately graduated, obtuse (St. John 1937). A similar species*, Symphyotrichum ciliatum* is distinguished from *S. frondosum* by its lack of ray petals.

Genetic description

Chromosome numbers for *S. frondosum* are reported as n=7 (Houle and Brouillet 1985).

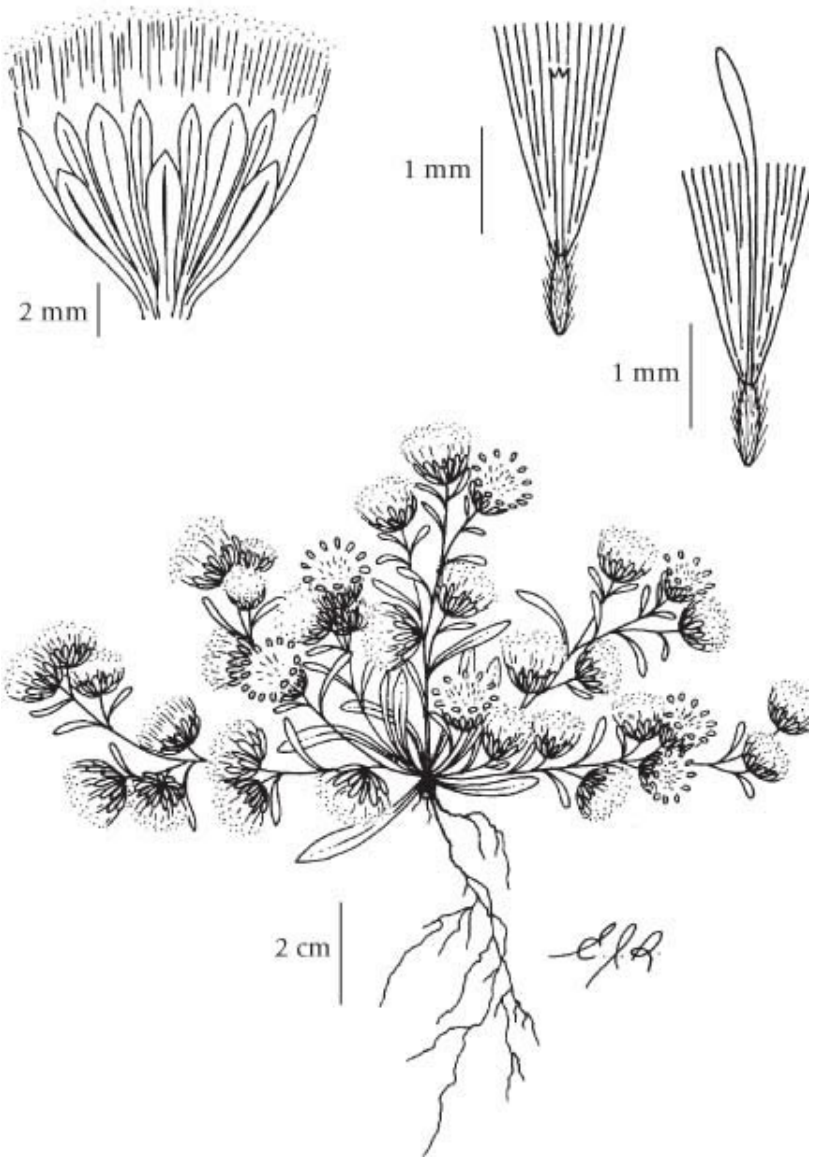

Figure 1. *Symphyotrichum frondosum* (Source: Douglas *et al*. 1998. Used with permission.)

DISTRIBUTION

Global range

Globally this species is known only from the United States, Mexico and Canada (Figure 2), from AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA, WY (USDA 2002), Northern Baja California (Houle 1988) and BC (Douglas *et al.* 1998). A report of the species (the synonym *Brachyactis frondosa*) from Maine (NatureServe 2004) is most likely an erroneous report.

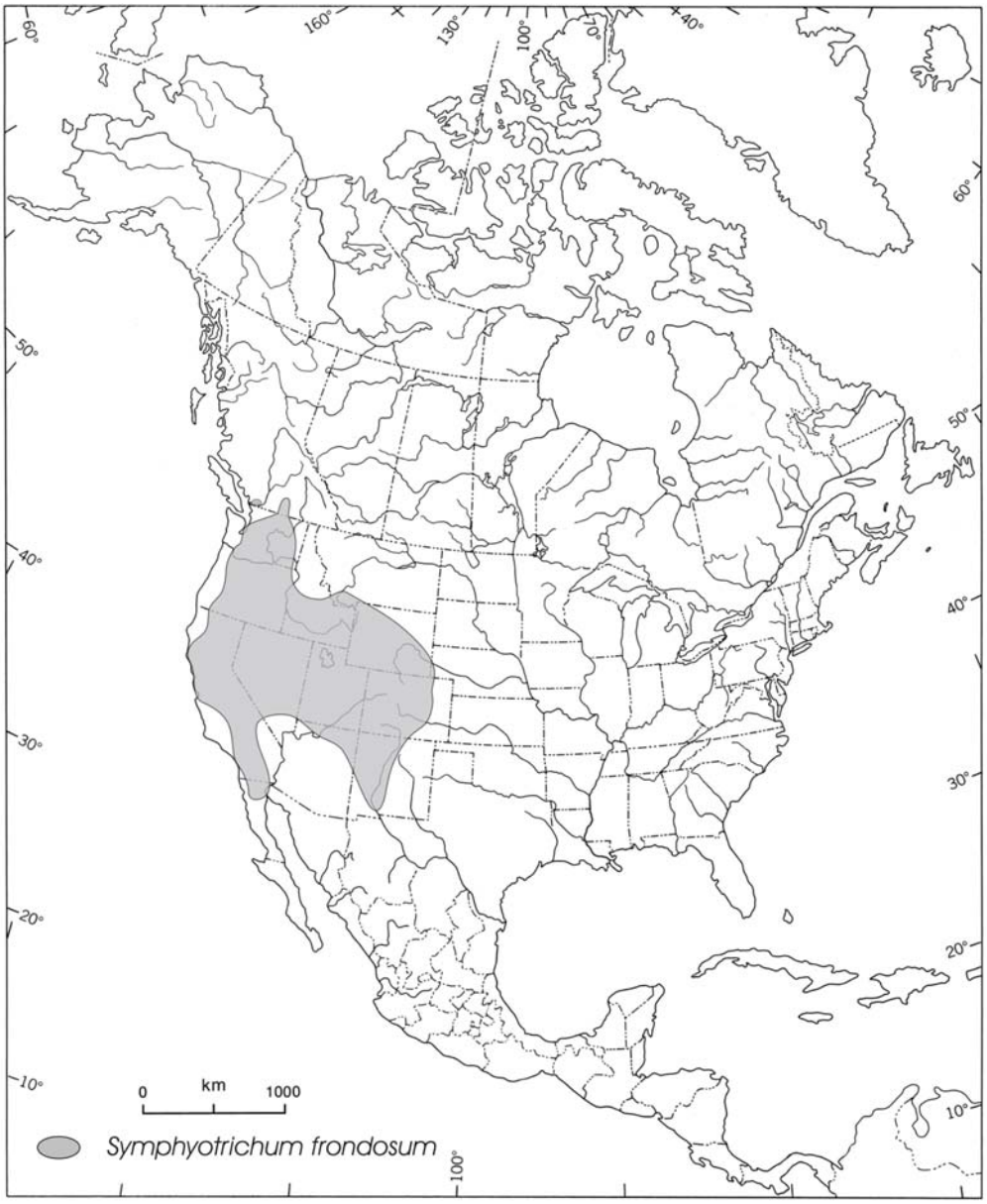

Figure 2. North American distribution of *Symphyotrichum frondosum*. (Distribution information generalized from Houle 1988, Figure 1).

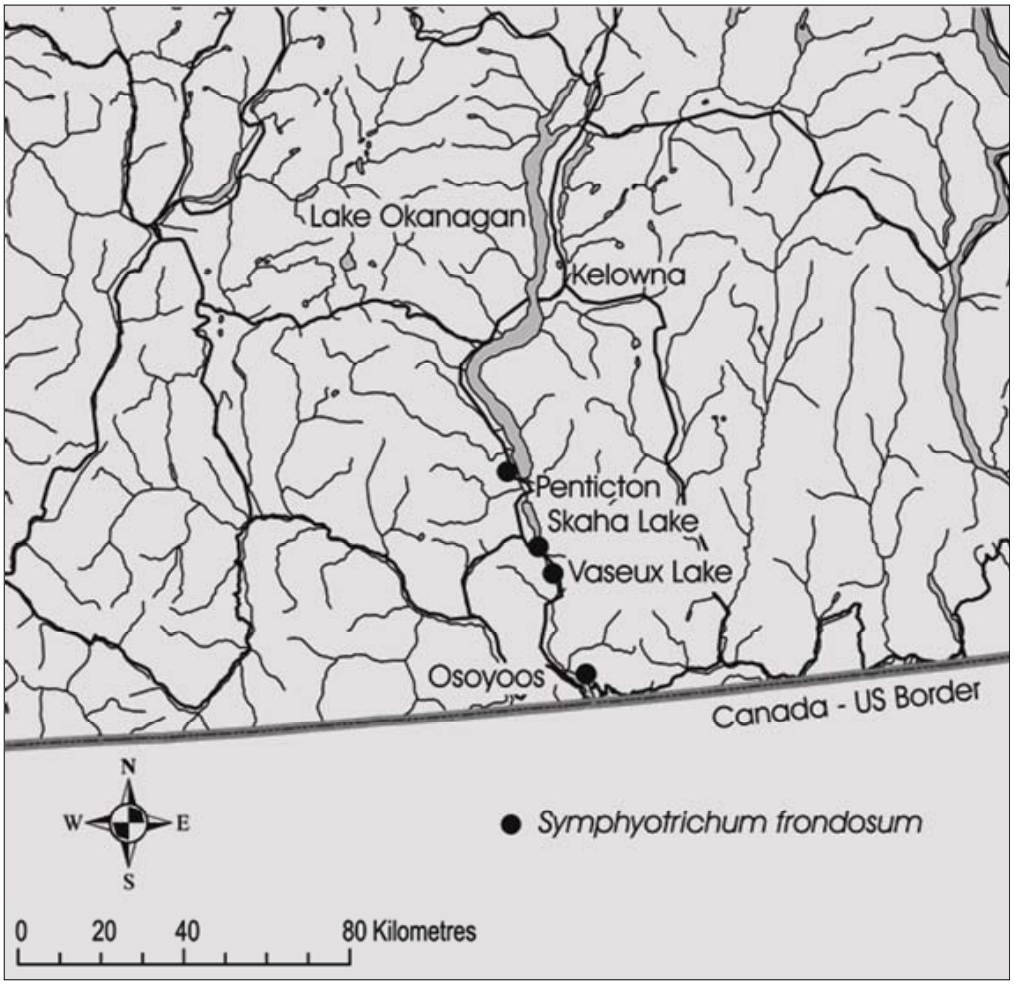

Figure 3. Distribution of *Symphyotrichum frondosum* in British Columbia, Canada. Note that the extirpated, ephemeral Surrey population has not been mapped.

Canadian range

In Canada, *Symphyotrichum frondosum* is known only from British Columbia where it has been found primarily on lakeshores in the bunchgrass zone in the Southern Okanagan Valley (Douglas *et al.* 1998). It is confirmed at four stations, one each at Osoyoos Lake, Vaseux Lake, Skaha Lake and Max Lake (Penticton). The Osoyoos Lake station supports four sub-populations: one confirmed sub-population, one extirpated sub-population, and two unconfirmed sub-populations. An ephemeral, disjunct population was reported from Surrey along the shore of the Fraser River in river dredgings. This site is now extirpated; however, Lomer (1996, 2001) feels that this indicates that the species most likely occurs upstream in the Fraser-Thompson drainage.

This species was first collected in BC by Eastham in 1939 from the edge of Osoyoos Lake. In his *Supplement to the Flora of Southern British Columbia* (1947), he

reports it from Penticton and Osoyoos. This may or may not be the same location as the Max Lake (Penticton) population, but Baumbrough (pers. comm. 2005) suspects it may represent plants at the south end of Lake Okanagan, a site that has since been developed.

In 1992, Lomer rediscovered *S. frondosum* on Osoyoos Lake and made a collection in 1993 (*Lomer collection # 93-281, UBC*). This site was confirmed by Douglas in 1995 (*Douglas collection # 13081, V*) and lastly by Lomer in 2000 (*Lomer collection # 3908, UBC*). Two new populations for Canada were reported by Lomer in 1999, one at Vaseux Lake (*Lomer collection # 99-260, UBC*) and another at Skaha Lake (*Lomer collection # 99-263, UBC*). A new sub-population on Osoyoos Lake is reported in this report (photo documentation).

The disjunct Surrey population was discovered by Lomer in 1994 (*Lomer collection # 94-228 UBC?*). The voucher specimen cannot be located at this time; however, it was verified by J. Semple from WAT as *S. frondosum* (Lomer 2001). While this may be an accidental occurrence, Lomer (1996) believes this species is almost certainly found in the Fraser River drainage. Populations in Washington State are found from Cowlitz County in the west to Spokane in the east, which indicates that it may be found in BC outside the Okanagan area.

A station reported for this species on Vancouver Island (Klinkenberg 2004) is based on a collection by Krajina in 1960, but was annotated by Lomer in 1993 to *A. chilensis.*

The extent of occurrence is approximately 56 km^2. The combined area of occupancy is 900 m^2, but the area of occupancy for several sites is unknown.

HABITAT

Habitat requirements

In Canada, *S. frondosum* is a late emergent shoreline species reported primarily from lakeshore habitats in moist drawdown zones of sandy beaches and perimeters of alkali lakes and ponds. It is found in the bunchgrass biogeoclimatic zone (Douglas *et al*. 1998) of the sagebrush steppe in the southern Okanagan Valley. In these sites, the water draws down in the late summer and early fall, exposing suitable shallowly sloping moist sites for flowering and seed dispersal. It has also been found in drier sand beach proximal to drawdown zones by the authors. In general, suitable habitat for this species is found throughout the southern portion of the Okanagan Valley. In California, this species is also known from granitic soil of meadows and mountain slopes, and from around moist alkaline flats, marshes, ponds and ditches (Munz and Keck 1970, Wiggins 1980).

The single ephemeral coastal station from Surrey BC was found along the shore of the Fraser River in river sand dredgings, but likely originated in material washed down the Fraser from the interior of BC (Lomer 1996, 2001).

Habitat in BC is typified by the following:

- *Symphyotrichum frondosum* was observed at Skaha and Vaseux Lakes in August 2002 and 2003 growing in moist sand in narrow bands of beach just below the mean summer water line, in the drawdown zone. Because of the disturbed nature of these sites, associate species included alien species such as *Plantago major*, *Poa annua*, *Chenopodium glaucum*, *Lythrum salicaria*, *Melilotus alba* and *Polygonum aviculare*. Associated native plants include alkali-tolerant *Symphyotrichum ciliatum* (*Aster brachyactis*) and *Distichlis spicata var. stricta* (personal observation, and Lomer collection # 3908).

- At Osoyoos Lake, the majority of the east shoreline and beach areas were not examined. *S. frondosum* was found in 2002 in a public campground on a low sand beach above, but proximal to, the drawdown zone, in part sun, under poplar trees. This may represent a relict of what was once a larger population that also occupied the drawdown zone.

- At Max Lake, *S. frondosum* was found on exposed saline lake edges following summer drawdown (Baumbrough 2003 pers. comm.). It is notable that this site has been predominantly dry over the last three years (Baumbrough pers. com. 2003).

- Lomer's 1994 collection from Surrey was from "a small patch found in temporary pilings of Fraser river sand dredgings…in compacted depressions that showed traces of salty deposits washed out from the surrounding sand" (Lomer pers. comm. 2002).

Habitat trends

Habitat at Vaseux Lake is in decline. Disturbance on the beach from park users presently limits the population to the less disturbed edges. Disturbance includes trampling, boat placement, and hole digging in the sandy beach. Additionally, in 2003, a heavy invasion of white sweet clover had moved in and was shading the spots where the aster grows.

At Skaha Lake, roto-tilling by maintenance personnel severely reduced numbers of plants in 2002. Roto-tilling has been occurring for years to maintain the beach for swimming (Harrison pers. comm. 2002), but timing and areal scope of the roto-tilling influences habitat suitability for the aster.

At Osoyoos Lake, no habitat trend information is available for the confirmed sub-population, but as with the other beach sites, lake management, heavy beach use and beach maintenance has no doubt resulted in habitat decline. An additional sub-population was extirpated as a result of site development.

No information is available on habitat changes at Penticton, but no active management is reported.

The site in Surrey was ephemeral, found on dredged sand landfill material in a development site.

Habitat protection/ownership

The Vaseux Lake site is a provincial park; however, no special protection measures are in place (Gunoff pers. comm. 2003) for the beach area. The site at Skaha Lake is owned by two jurisdictions: the provincial government (provincial park, provides legal protection) and the Regional District of Okanagan-Similkameen (regional park) (Harrison pers. comm. 2003). Neither agency was aware of any rare plants on their lands and had no management actions in place to protect any rare plants at the time they were contacted (Gunoff pers. comm. 2003 and Harrison pers. comm. 2003). The Osoyoos Lake population occurs in a public campground on a heavily used public beach. The campground is part of the adjacent Indian Reserve. The Penticton site is privately owned, but is protected now by a formal conservation covenant with the landowners because of the site's role as a valuable wildlife site.

BIOLOGY

Symphyotrichum frondosum is an annual species in the Asteraceae that is primarily found in the draw-down margins (Douglas *et al.* 1998) of alkali lakes (Munz and Keck 1970) in the bunchgrass zone (Douglas *et al*. 1998). Its ecology is tied to fluctuating lake levels. One Canadian (sub) population was found in a drier beach site proximal to the drawdown zone. Wiggins (1980) also reports that it can occur in drier sites.

No published accounts of flowering times could be found. However, based on site visits by the authors, and specimens examined at the UBC herbarium, the flowering time in British Columbia is from late July (Eastham collection # s.n, UBC) to early October (Lomer 93-181). Baumbrough (pers. com. 2003) indicates that plants sometimes appear earlier in drier years. He has seen plants as early as mid-July, and flowering plants as early as mid-August through to mid-September. Brouillet (2005) indicates that the species is autogamous, in part, with little genetic exchange among distant populations. This species can withstand high pH and high salinity, but prefers moist habitats (Munz and Keck 1970).

No specific literature was found on the dispersal mechanisms or strategies of *S. frondosum*; however, wind dispersal is common in aster species (Anderson 1992, Brouillet pers. comm. 2005). It is likely that seeds are dispersed by several additional means, including, under natural conditions, dispersal by wave action, lake currents and by waterfowl.

The occurrence of the ephemeral population in Surrey British Columbia suggests that long distance dispersal of *S. frondosum* occurs. Whether it came to this site by

wind, waterfowl or water is not known, but all three are possible. The latter possibility would suggest that a population exists upstream, east of the Coast Mountains, as is speculated by Lomer (1996).

The adaptability of *S. frondosum* is unknown. However, three populations occur on heavily used and managed beaches and, while more abundant in less trampled areas, it clearly can persist even with some trampling.

Meta-population dynamics may play a role in this species biology, but this requires investigation.

POPULATION SIZES AND TRENDS

Search efforts

Fieldwork was conducted in the Okanagan over a period of ten days in June and August, 2002, and over four days in 2003. Known populations were checked and confirmed at Vaseux and Skaha Lakes. Additionally, intensive targeted searching of most saline lake and pond shorelines was conducted from Osoyoos in the south Okanagan to Salmon Arm in the north. The exception was non-public areas of Indian Reserve lands on the east shoreline of Osoyoos Lake, where additional sub-populations of the species have been reported. Timing of these searches was important, so that sufficient drawdown would have occurred that would expose the species' habitat. For the most part, most lakes and ponds had receded considerably by the time searches were conducted in each year; however, additional drawdown could occur, and plants may yet be found in some spots. The discovery of the new Penticton population in the second week of September 2003 indicates additional searching for the species is warranted.

Sections of the shoreline of the following lakes were checked: Deadman Lake, Gallagher Lake, Mahoney Lake, Okanagan Lake (including Sun Oka Provincial Park), Osoyoos Lake, Prather Lake, Shannon Lake, Skaha Lake, Tugulnuit Lake, Twin Lakes, Vaseux Lake, White Lake, and others, plus associated wetlands.

Additionally, some limited searching for this species was conducted in the lower Fraser River valley (2002-2004).

Abundance

Abundance data are limited for this species and are summarized in Table 1 (below). Abundance for this species fluctuates with annual climatic variation and water levels so data from single years do not provide a true picture of the species.

(All counts are for mature plants, no seedlings are reported.)

Table 1. Summary of abundance data for *Symphyotrichum frondosum* in Canada (2005).											
Location	**Sub-population**	**1939**	**1992**	**1993**	**1994**	**1995**	**1999**	**2000**	**2002**	**2003**	**2004**
Osoyoos Lake		Collected by Eastham, label data indicates abundant									
	Douglas #1 1 km SE of Mica Creek					X (no data)	40+ plants over 200 m^2		no data	no data	no data
	Lomer #2 Cottonwood Park/ pump house		X (no data)					1 plant over 1 m^2	Extirpated		
	Lomer #3 Mica Creek			50-70 plants (no area given)					No data		
	Sears *et al*. #4	.							5 plants over 1 m^2		
Vaseux Lake							Approx.70 plants over 20 m^2		100 plants over 20 m^2	12 plants under white sweet-clover over 4 m^2	
Skaha Lake							4900 plants over 500 m^2		525 plants over 500 m^2	No count, but plants covered 7 m.	
Penticton*										8 plants, no area given	
Surrey					“small patch”				extirpated		

*This population was reported by Eastham (1947) as “locally abundant in wet saline soil, Penticton and Osoyoos”.

Fluctuations and trends

An assessment of the biogeographic patterns of this species leads the writers to believe that shoreline use (including recreational use and development, such as campgrounds, boating facilities, etc.), site maintenance activities, and managed lake levels at three sites have led to a decline in a species that was once more abundant within this region (Eastham 1947). Specifically: One reported sub-population at Osoyoos Lake is extirpated (Lomer pers. comm. 2003). The Skaha Lake population has declined in numbers since 2002 as a result of site maintenance. Decline was also noted in numbers at Vaseux Lake in 2003, where white sweet clover had invaded in 2003.

Note that most of the eastern shoreline of Osoyoos Lake was not searched, and additional populations may occur in this relatively undeveloped section. However, development proposals are evolving for this area.

Rescue effect

It is quite possible that meta-population dynamics are in play with this species, and that the BC populations are connected via currents, wind or wave action, or via dispersal by waterfowl. Given that the rivers that connect these populations flow south, and seed dispersal happens in the fall, the probability of long distance transport of seeds from populations in Washington into Canada is low.

LIMITING FACTORS AND THREATS

As a shoreline species of beach habitat that is dependent upon natural lake cycles and disturbance regimes, and recruitment and recovery in bad years from a seed bank, this species faces several key limitations and threats. Specifically, the following threats and limitations have been identified:

- Lake level management at three sites has imposed a continuing limitation on this species since 1927 because it has resulted in removal of much of the natural ecological dynamics of this species. The impacts from this management regime, however, likely have been primarily historic in action. Specific effects of lake management include:
    - Reduction of the narrow shoreline habitat occupied by this species, which is needed for population maintenance and expansion.
    - Reduction of the potential exposed seed bank in a given year resulting in reduced potential recruitment in years of reduced abundance and associated reduced annual recruitment. The effective seed bank for this species has been reduced; pre-management size of the seed bank was no doubt significantly larger.

As an ecological safety net that contributes to shoreline species populations on a yearly basis, the seed bank is critical for this species. Loss of seed bank availability alone could result in declining populations, as recruitment from the seed bank is critical in low reproductive years.

This species was described by Eastham (1947) as abundant at Osoyoos Lake, but this may be a relative abundance as compared with pre-lake management levels. Since 1947, the species has declined, possibly as a result of lower recruitment potential in 'off' (i.e., poor seed set) years.

The artificial management of the water levels of Osoyoos Lake is controlled by the Osoyoos Lake Dam in Oroville by the US under the International Joint Commission. Water levels of Skaha Lake are artificially managed at the Skaha Lake Dam by the Municipality of Okanagan Falls. Vaseux Lake is artificially managed by the McIntyre Dam by the Municipality of Oliver (Jubb pers. comm. 2003).

- Reduction of the narrow shoreline band of suitable habitat means that persisting suitable sites are fragmented: this has ecological implications.

- Smaller and fragmented populations of a rare species face other inherent problems and limitations, including reduced rescue affect, potentially declining genetic strength and potential for catastrophic loss.

- Site management activities represent a major current threat to this species at three sites, these activities include roto-tilling, sand sifting, lawn mowing, beach cleaning. Specifically:
    - Roto-tilling as part of beach management may pose a major threat to this species, yet could be considered a viable management tool.
    - The Skaha Lake site was roto-tilled twice in the summer of 2002 and was subjected to a sand sifter in the early spring. This was done to keep the weeds down, to keep the lawn from encroaching onto the beach and to loosen compacted sand, thus maintaining the positive aesthetic qualities of the beach (Gunoff pers. comm. 2003). In spite of this management activity, the population persisted.
    - Roto-tilling in 2003, however, severely impacted the population because of the timing and scope of the activity and caused a severe decline in population numbers.
    - In some instances, however, roto-tilling and sand sifting may be mimicking natural disturbance regimes, like wave and storm action, and generating the same shifting of the seed bank. This seed bank may be accessed and replenished during roto-tilling and sand sifting events, which bring the seeds back to the top few centimetres of sand where they can germinate. Dyer (pers. comm. 2005) has indicated that roto-tilling has continued at this site, but that timing was adjusted to benefit the plants.

- Site use is a major threat at 3 sites:
    - Excessive trampling by people and livestock is a definite threat. In 2002 and 2003, the writers observed that peripheral areas of the beaches at Vaseux Lake and Skaha Lake that had little trampling had higher densities of *S. frondosum*. Central, heavily used areas had low densities of plants to none. Trampling appears to severely affect the survivorship of *S. frondosum.*
    - Active use of the beach habitats by sunbathers, boaters, and children directly impacts the critical habitat for this species. Direct impact is caused by digging in the sand, boat launching and storage, trampling and compaction.
    - Encroachment of lawns over drawdown areas in recreation sites may be a concern. Lawns have been seeded in adjacent shoreline areas at Skaha, proximal to our populations. Lawn grass grows mixed with *S. frondosum*on along the periphery of the beach.

- Intensive site use and associated disturbance can increase threats from invasive species and competition from alien species suited to disturbed habitats. Invasive species and competition are a threat to this species, especially in the absence of naturally high seasonal water levels that can provide natural controls. A large component of associated species at three sites is alien species. Additionally, a particularly dense cover of the invasive white sweet clover at the Vaseux Lake site was observed in 2003. This competition may negatively affect the fecundity and survivorship of *S. frondosum* at these sites. Importantly, a plant community with an undisturbed, native cover is more resistant to invasive species than one with a disturbed, non-native component (Anderson and Inouye 2001, Levin 2000). Therefore, maintaining (or recovering) a native plant community to allow resistance to invasive species is important.

    - Proposed development on the eastern shores of Osoyoos Lake poses a serious potential threat at this site and will affect any remaining sub-populations.

- Competition from introduced alien plants poses a major threat.

- The potential for nutrient loading in these heavily used lakes may be a concern. This species' preferred habitat is low in nutrient availability. Increased nutrients will result in increased competition. No specific tests, however, have been documented that demonstrate such nutrient loading has occurred and impacted the plants.

SPECIAL SIGNIFICANCE OF THE SPECIES

This species is restricted to lakeshore habitats in the steppe sagebrush vegetation zone of western North America. As such, its global area of occurrence is very restricted. Our population represents its northern terminus, making it important ecologically, biogeographically and genetically.

No specific aboriginal uses of this species have been found to date.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

One population (possibly two sub-populations) for short-rayed alkali aster occurs on Indian Reserve Lands (Osoyoos IR 1). Two stations occur in municipal/provincial parks, but no formal protection exits although legal protection exists in a provincial park. The fourth station occurs in a site with a sound conservation covenant. The status of short-rayed alkali aster throughout its range is as follows (NatureServe 2005):

Global Heritage Status Rank: G4
Rounded Global Heritage Status Rank: G4
United States: National Heritage Status Rank: NNR
Canada: National Heritage Status Rank: NNR

Subnational Ranks: Arizona (SNR), California (SNR), Colorado (SNR), Idaho (SNR), Maine (SNR), Montana (S1), Nevada (SNR), New Mexico (SNR), Oregon (SNR), Utah (SNR), Washington (SNR), Wyoming (S2) British Columbia (S1)

TECHNICAL SUMMARY

Symphyotrichum frondosum
short-rayed alkali aster aster feuillu
Range of Occurrence in Canada: British Columbia

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* Estimate based on measuring distance from the most northerly station to the most southerly station, and assuming an average width of potential habitat of 1 km (e.g., shorelines on east/west sides of lakes, meandering rivers, adjacent lakes within valley).	56 km²
• *Specify trend in EO*	Unknown
• *Are there extreme fluctuations in EO?*	Unknown, but unlikely
• *Area of occupancy (AO) (km²)* Estimate based on actual areas of habitat known to be occupied.	Likely << 1 km² (900 m², based on limited field observations)
• *Specify trend in AO*	Possibly a small decline with loss of one very small sub-population
• *Are there extreme fluctuations in AO?*	Unknown
• *Number of known or inferred current locations*	4
• *Specify trend in #*	Stable
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Declining
Population Information	
• *Generation time (average age of parents in the population)*	Annual species
• *Number of mature individuals*	<1,000, but can fluctuate year-to-year
• *Total population trend:*	Declining
• *% decline over the last/next 10 years or 3 generations.*	Cannot determine.
• *Are there extreme fluctuations in number of mature individuals?*	Unknown, but there are year-to-year variations.
• *Is the total population severely fragmented?*	No
• *Specify trend in number of populations*	Stable
• *Are there extreme fluctuations in number of populations?*	Unknown
• List populations with number of mature individuals in each: -- see Table 1.	
Threats (actual or imminent threats to populations or habitats)	
Current main impacts are from trampling, beach management practices and invasive plants Potential major impact could result from the development of a shoreline facility at Osoyoos L.	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* USA: Montana: Critically Imperiled, Wyoming: Imperiled, SNR in 10 other states, including Washington	
• *Is immigration known or possible?*	possible, but unlikely
• *Would immigrants be adapted to survive in Canada?*	likely
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	Unlikely
Quantitative Analysis	Not applicable.
Current Status COSEWIC: Endangered (2006).	

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code**: B1ab (ii, iii, iv, v) + 2ab(ii, iii, iv, v)

Reasons for Designation:
An annual herb of lake shorelines present at only a few remaining sites in restricted habitats. The small populations are subject to disruption from such activities as trampling, beach management, spread of invasive plants and potential development of a major facility at one of the primary sites.

Applicability of Criteria

Criterion A: (Declining Total Population): Not applicable. No specific data to show decline versus fluctuation.

Criterion B: (Small Distribution, and Decline or Fluctuation): Meets Endangered B1ab (ii, iii, iv, v) + 2ab(ii, iii, iv, v) with very small extent of occurrence and area of occupancy, presence of only 4 localities and decline in area of occupancy, quality of habitat, number of populations and mature plants that can be inferred based on the current threat of shoreline development.

Criterion C: (Small Total Population Size and Decline): Not applicable. Although < 1,000 plants may be present during years of suitable water levels, a future loss of 20% cannot be inferred. At least one population is known to have > 250 mature plants in some years, and 95% of the plants may be in one population; however, this is difficult to determine with large fluctuations in population size.

Criterion D: (Very Small Population or Restricted Distribution): Meets Threatened D1 and D2 with likely <1,000 mature plants during years of high water levels and presence of only 4 localities and a very small area of occupancy with a series of current threats and a major potential threat known.

Criterion E: (Quantitative Analysis): Not available.

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

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Brian Klinkenberg is an Associate Professor in the Department of Geography, University of British Columbia, a Faculty Associate with the UBC Centre for Applied Conservation Biology Research and an honorary Research Associate with the UBC Herbarium. His research interests lie in GIS, conservation biology, biogeography and rare plants. He is author or co-author of several COSEWIC status reports on species at risk, including *Bidens amplissima, Lupinus rivularis, Cephalanthera austiniae, Opuntia humifusa, Celtis tenuifolia,* and others. He is project coordinator for E-Flora BC, and co-chair of the Streambank Lupine Recovery Team. Recent projects include the development of recovery strategies for *Cimicifuga elata* and *Cephalanthera austiniae* in Canada, and biogeographic analysis of rare plants in the Carolinian Zone.

Rose Klinkenberg is an ecologist formerly with the Ontario Ministry of Natural Resources where she worked on nature reserve site selection, natural areas inventories in provincial parks and reserves, and rare species status and assessments. She is author or co-author of several COSEWIC status reports, including those on *Bidens amplissima, Lupinus rivularis, Cephalanthera austiniae*, and *Isotria verticillata*.

Chris Sears is presently a Master's student in the Department of Botany, University of British Columbia, and is also Director of the West Coast Operations for Fundy Hiking and Nature Tours. Currently, he is on the inventory team for the ecological survey of the Lulu Island Bog. Past work has included assisting with the botanical survey and environmental impact assessment of the Rogersville Peat Bog. He is co-author of two additional COSEWIC status reports, including *Eleocharis atropurpurea* and *Astragalus spaldingii.*

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