

COSEWIC
Assessment and Status Report

on the

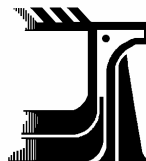
Alkaline Wing-nerved Moss
Pterygoneurum kozlovii

in Canada



THREATENED
2004

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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Production note:

COSEWIC would like to acknowledge Terry T. McIntosh for writing the status report on the alkaline wing-nerved moss *Pterygoneurum kozlovii* prepared under contract with Environment Canada, overseen and edited by René Belland, the COSEWIC Plants and Lichens (Mosses and Lichens) Species Specialist Subcommittee Co-chair.

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: (819) 997-4991 / (819) 953-3215
Fax: (819) 994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
<http://www.cosewic.gc.ca>

Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur la situation du Ptérygoneure de koslov (*Pterygoneurum kozlovii*) au Canada.

Cover illustration:

Alkaline Wing-nerved Moss — Mature plants and maturing capsules of *Pterygoneurum kozlovii*; mostly on left side of photograph. Photo supplied by Terry T. McIntosh.

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COSEWIC Assessment Summary

Assessment Summary – November 2004

Common name

Alkaline Wing-nerved Moss

Scientific name

Pterygoneurum kozlovii

Status

Threatened

Reason for designation

This species, restricted in North America to western Canada, is globally imperilled or rare. Canada possesses the great majority of documented locations. The species typically grows on soil among grasses and sedges along the margins of alkaline ponds and sloughs in semi-arid regions of Canada. It has been confirmed at only 13 sites from 24 reported in south central British Columbia. There is one unconfirmed site in Saskatchewan. About half of all the known sites are subject to impacts from people and domestic animals. Of the British Columbia sites, 6 have apparently been lost to urban development, highway improvement, and trampling by cattle, implying that decline in habitat quality and extent are presently impacting the species.

Occurrence

British Columbia and Saskatchewan

Status history

Designated Threatened in November 2004. Assessment based on a new status report.



COSEWIC
Executive Summary

Alkaline Wing-nerved Moss
Pterygoneurum kozlovii

Species information

Pterygoneurum kozlovii is one of four species of *Pterygoneurum* in North America. It is a rather inconspicuous moss that forms small to medium sized patches on soil along alkaline wetlands in dry environments. Its most distinctive features are the small flaps that are found on the upper mid-ribs of the leaves and the immersed spore sacs that do not have a lid for spore release.

Distribution

Globally, this moss is found in western North America, Europe, and western Asia. In Canada, it has been found in Saskatchewan and British Columbia. It is relatively widespread, but relatively uncommon, in south-central British Columbia.

Habitat

This species is restricted to seasonally wet, alkaline soils in open, and dry areas of British Columbia. Eight of the known sites are undisturbed to relatively undisturbed, and eight are moderately to heavily disturbed. Most of the extant populations appear to be on provincially owned lands, in particular Crown lands, although ownership needs to be confirmed for some sites.

Biology

Pterygoneurum kozlovii is a small, acrocarpous moss that usually grows in small to medium sized patches or turfs along the edges of seasonally wet, alkaline areas. Sporophytes and spores are common in Canadian populations, and are probably important in maintaining local populations.

Population sizes and trends

Pterygoneurum kozlovii is uncommon to rare in most sites, and common and widespread in only three locations. Population trends are uncertain, although four may be declining.

Limiting factors and threats

Impacts of grazing animals, urban development, road building, and human use of the habitat appear to be the main limiting factors and threats to *Pterygoneurum kozlovii*. Recent drought may also be a limiting factor.

Special significance of the species

Pterygoneurum kozlovii is restricted to Canada in North America. Although it is relatively widespread in southern British Columbia, it is usually not common. It is found in the endangered *Purshia tridentata* ecosystem in the south Okanagan Valley. The author has investigated the edges of more than 70% of the alkaline wetlands that have potential habitat for this species in British Columbia, and has confirmed the presence of this species at only 13 sites.

Existing protection and other status designations

No legislation, regulations, customs, or conditions protect Canadian populations of *Pterygoneurum kozlovii*. Globally this species is considered imperiled or rare, and it is Red-listed in British Columbia. It is considered endangered or rare in Mongolia.



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 agencies (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 members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The Committee meets to consider status reports on candidate species.

DEFINITIONS (NOVEMBER 2004)

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 atleast 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 wildlife species for which there is inadequate information to make a direct, or indirect, assessment of its 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.



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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

Alkaline Wing-nerved Moss

Pterygoneurum kozlovii

in Canada

2004

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SPECIES INFORMATION

Name and classification

Scientific name: *Pterygoneurum kozlovii* Laz.
Pertinent synonyms: *P. smardaeanum* Vanek
Common name: Alkaline Wing-nerved Moss
Family: Pottiaceae
Major plant group: Mosses (Musci)

The Pottiaceae is a large and diverse family of mosses with many of its species restricted to seasonally dry environments. It is a taxonomically difficult family and has been undergoing extensive review in recent times (Zander 1993). The genus *Pterygoneurum* is comprised of a group of relatively small, soil-inhabiting species that are characterized by wing-like flaps or lamellae on the upper side of their leaf costae (mid-ribs). There are three other species of *Pterygoneurum* in North America (Anderson *et al.* 1990): *P. lamellatum* (Lindb.) Jur., *P. ovatum* (Hedw.) Dix., and *P. subsessile* (Brid.) Jur., and they are all found in Canada (Ireland *et al.* 1987). Both *P. ovatum* and *P. subsessile* are relatively common throughout the driest portions of the interior of British Columbia. *Pterygoneurum lamellatum*, however, is rare, and has been found only twice in the province: adjacent to White Lake, south of Penticton, and at a recently discovered site in the northwest Cariboo Region (this site was discovered in 2002 while searching for *P. kozlovii*). In addition, *P. kozlovii* and *P. lamellatum* are restricted to seasonally wet and alkaline habitats, whereas the other two species are characteristically found only in much drier sites.

Pterygoneurum kozlovii differs from *P. lamellatum*, *P. ovatum*, and *P. subsessile* principally in that its capsules (spore sacs) are both hidden in the leaves at maturity (immersed) and lacking an operculum (a lid on the spore sac which allows for spore release; this condition is referred to as cleistocarpous). Of the other species, only *P. subsessile* has immersed capsules, but they are operculate, and its calyptra (a vegetative cap that covers part of the top of the mature spore sac) is mitrate (shaped like a bishop's cap) in contrast to the calyptra of *P. kozlovii*, which is cucullate (hood-like, with a split on one side). Also, the mature capsules of *P. subsessile* are usually exposed at maturity, whereas the capsules of *P. kozlovii* are usually somewhat hidden by rather tightly wrapped leaves.

Because of some distinct gametophytic (haploid, vegetative generation) and sporophytic (diploid, spore producing generation) differences between *Pterygoneurum kozlovii* and other members of the genus *Pterygoneurum*, as well as distinct differences between North American plants and those in Europe, this species may warrant a change in taxonomy, at both the species and genus level (McIntosh 1986).

Description

The following description has been derived principally from McIntosh (1986, 1989) and McIntosh and Paige (2001). These descriptions were based on Vanek (1952; as *Pterygoneurum smardaeum* Vanek) and Abramova *et al.* (1973). More details are provided here than is normal for status reports since much of this information is not yet readily available in North American literature.

Pterygoneurum kozlovii is a short, 2-3 mm tall, acrocarpous (producing female structures and sporophytes at the tips of the main stems) moss that usually grows in small (less than 1 cm²) to medium sized (2-4 cm²) patches, sometimes forming rather widespread, yet intermittent turfs. Mature plants have a bulbous appearance, as a result of the presence of sporophytes, whereas younger plants are relatively narrow. Most plants are characterized by twisted leaves (Figure 1 is a photograph of a cluster of plants with maturing sporophytes). Small bulbils, or vegetative propagules, are often present along the underground stems and these may develop into plants.



Figure 1. Mature plants and maturing capsules of *Pterygoneurum kozlovii*; mostly on left side of photograph (~X10).

The leaves of *Pterygoneurum kozlovii* are light green to yellow-green, and are about 1 mm long, ovate-lanceolate to ovate, concave, and taper rather abruptly towards the awn (Figure 2). Leaf margins are plain to weakly recurved and usually weakly toothed near the apex. The leaf costa is pale brown and has two large central or guide cells. The upper surface of the costa above mid-leaf is comprised of two to four cells that form a base to the characteristic flaps. These lamellae are usually two, rarely three and they average four to six cells in height. Their margins are usually irregular and their terminal cells papillose. The costa is usually long-excurrent, especially on the upper leaves, as a clear, smooth to weakly toothed awn, or hair-tip, giving larger colonies a somewhat hoary appearance.

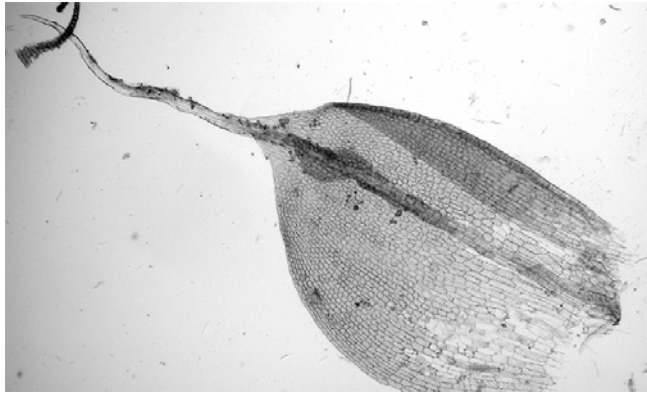


Figure 2. Upper stem leaf of *Pterygoneurum kozlovii* showing lamellae and leaf awn.

The middle and upper leaf cells are rhombic or oblong, to irregularly quadrate or rectangular, and mostly range in size from 10-20 μm wide by 15-35 μm long. These cells are usually smooth, although occasionally weakly, and rarely strongly, papillose (having small bumps on the cells' surface). In larger, mature leaves, the cells at the leaf apex towards the base of the awn are distinctly longer and somewhat narrower than those below. The basal leaf cells are rectangular to long-rectangular and larger than the upper cells. Also, they are clear and thin-walled, and appear weakly inflated in some leaves.

Pterygoneurum kozlovii is autoecious, with both male and female structures present on each plant. The leaves around the sporophyte usually number 3-4, and resemble the adjacent leaves, except they are usually longer (up to 1.5 mm long). They become paler and die as the sporophyte matures and often form a cover around the mature capsule. Sporophytes are common (Figure 1). Ovate to round, 0.8-1.0 mm capsules mature through the late autumn into the spring, when they often give fertile plants a golden-brown colour. Capsules lack a regular opening for spore release, although an apparently non-functional differentiated band of small cells is present near the top of the capsule in this species. A tiny apiculus is present at the top of the capsule. Spores are large, from 30-45 μm in size, and are weakly ovate to spherical, and roughly papillose. Spores are released as the capsule decomposes. The calyptrae cover much of the top half of the capsule.

Additional keys can be found in McIntosh (1986) and Savicz-Ljubitzkaja and Smirnova (1970, in Russian). Additional illustrations are found in Vanek (1952) and McIntosh (1989).

DISTRIBUTION

Global range

Pterygoneurum kozlovii has been reported from western Canada in North America (Figure 3; first reported by McIntosh 1986, 1989), central Europe (Czechoslovakia and

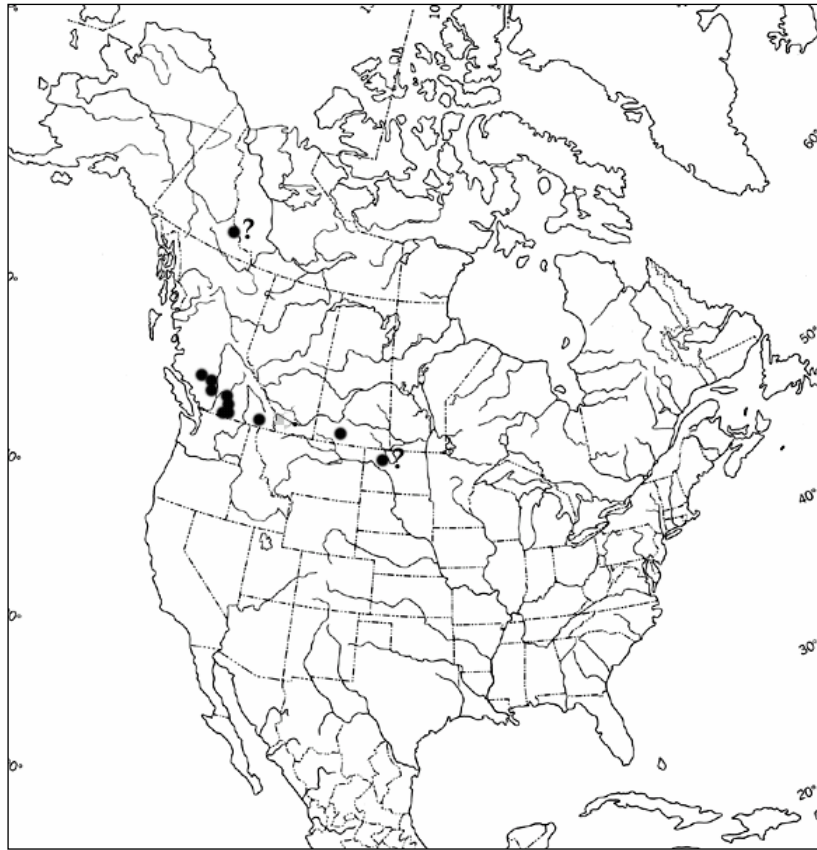


Figure 3. North American distribution of *Pterygoneurum kozlovii*.

the Ukraine), and China (Missouri Botanical Garden 2002). It has not, surprisingly, been reported yet from the United States, even though potentially supportive habitats are common (many of these habitats in adjacent areas in Washington State have been searched; it may also have been collected by T. McIntosh in 1990 from North Dakota, but this collection has been misplaced and it cannot be confirmed).

Canadian range

The species has a scattered distribution. One population of *Pterygoneurum kozlovii* has been reported from Saskatchewan (reported here for the first time; Collection Examined #10) and 24 populations have been reported from British Columbia (Figure 4; Table 1). In the latter province, it is restricted to the drier portions of the province where seasonally wet alkaline habitats are characteristic components of the local ecosystems. Twenty-two populations have been reported from three areas in the south-central part of the province: nine in the south Okanagan Valley, concentrated around Osoyoos, six in the North Thompson River valley from Kamloops to the Ashcroft area, and seven in the Cariboo Region west and south-west of Williams Lake. Two additional populations have been reported from the Rocky Mountain Trench.

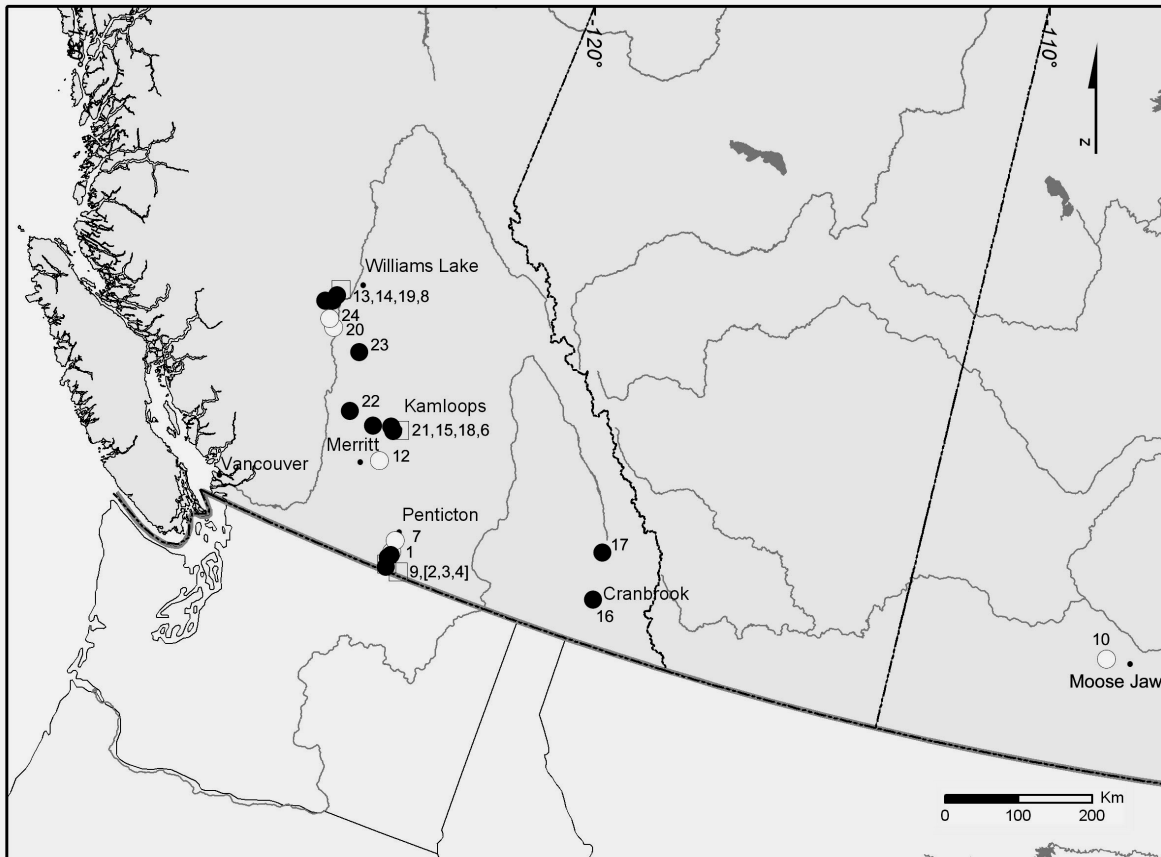


Figure 4. Canadian distribution of *Pterygoneurum kozlovii* (excluding the potential population in the Yukon). Numbered points correspond to the population numbers from Table 2. Filled circles represent locations that were confirmed in 2002, hollow circles are earlier records that were not confirmed in 2002, and hollow squares are locations that are possibly extirpated. In the cluster of dots south of Penticton, the numbers corresponding to filled circles are on the left side of the cluster only. Note also that populations 2, 3 and 4 are indistinguishable at this scale.

Major collection efforts contributing to our present knowledge of the Canadian distribution include the following: 1) surveys conducted as part of the Ph.D. research of T. McIntosh from 1980 to 1983, 2) a provincial arid-land survey conducted by T. McIntosh (1997-2001), and 3) field work conducted by T. McIntosh in 2002-2003, in support of a COSEWIC assessment.

Table 1. Estimated numbers of 'potential habitat' alkaline areas in British Columbia, including visitation and collection information. Potential sites are defined as sites separated by at least .5 km., (but usually much more) and separated by landscapes that do not contain the potential habitats.

Region	Number of potential sites ^a	Approximate number of sites visited	Numbers of known sites
Kootenay	8 - 10	7	2
Okanagan (from Osoyoos to the SE base of Richter Mountain westwards and to just north of Kaledon to the north)	20 - 25	18 - 20	9
Kamloops (from just east of the city to Spences Bridge/Cache Creek, and including the Pavilion and Clinton areas, although somewhat disjunct)	28 -32	22 - 25	6
Cariboo (mainly in areas along the Fraser and Chilcotin Valleys, but also north and east of Chasm north of Clinton)	37 - 44	28 -32	7

^a A number of individuals who have expert knowledge about the geographical extent and ecological condition of provincial alkaline areas were consulted, including Ray Coupe, Hans Roemer, Fred Knezevich, Don Gayton, and Kent Watson. See also section on Authorities Contacted.

HABITAT

Habitat requirements

Pterygoneurum kozlovii is restricted to the edges of open, seasonally wet and alkaline ponds, lakes, sloughs, and seepage slopes, where vegetation remains low and patches of soil are available. In this habitat, it grows on open or litter-covered soil amongst vascular plants, especially salt grass (*Distichlis stricta*), sedges (most commonly *Carex praegracilis*), and, sometimes, foxtail barley grass (*Hordeum jubatum*). It is most often found within a narrow band around the edges of the wetland where the topography is flat to very slightly sloping. It has not been found in alkaline sites where tall rushes and sedges dominate. The alkaline nature of these areas arises from evaporation of water during warmer months over many years, leaving minerals behind.

Alkaline wetlands are relatively common in the south-central portions of the province, along river valleys and adjacent lowlands. They are most common in a relatively large area south and west of Williams Lake, but are also fairly common in relatively narrow bands in the drier portions of the Fraser, Thompson, Nicola, Similkameen, and Okanagan Valleys. Scattered alkaline areas are also present in the

Rocky Mountain Trench.

Although alkaline wetlands probably number in the hundreds in British Columbia relatively few appear to have suitable habitat for *Pterygoneurum kozlovii*. Based on field experience, Terry McIntosh has defined 'potential habitat' for this taxon as:

1. In seasonally wet alkaline areas where bare soil is available; these alkaline areas are either distinct ponds, pocket complexes comprised of small ponds and seepage areas, or seepage slopes. The species appears to be most common near ponds and least common on seepage slopes.
2. On a flat to very gentle slope within a low-growing vegetation zone above, but not in, a zone defined by a complete alkaline-deposit crust; the low-growing vegetation is often defined by the presence of two graminoid species: *Carex praegracilis* and *Distichlis stricta*. The species has not been found where taller sedges and rushes predominate.
3. In open areas (no shade) at relatively low elevations in sagebrush, grassland, and open forested (ponderosa pine/Douglas-fir/lodgepole pine, although less commonly with the latter two species)
4. In areas where erect-growing moss species predominate; *P. kozlovii* has not been found in sites where creeping moss species, and in particular where *Drepanocladus* (probably *D. aduncus*) are present.

Table 1 gives estimates of potential sites, by regions. Potential sites are defined as sites separated by at least .5 km., (but usually much more) and separated by landscapes that do not contain the potential habitats. Based on examinations of maps and through field work, between 93 and 111 distinct sites (geographically isolated ponds, lakes, seepage slopes, or complexes) may provide suitable habitat for this species in the province. Although more work needs to be completed, this species appears to be restricted to those alkaline areas in warmer locations (lower elevation/more southerly latitude). This is supported by the concentration of this species in the Okanagan and Kamloops areas. Alkaline wetlands are found in the Bunchgrass, Ponderosa Pine, and dry Interior Douglas-fir Biogeoclimatic Zones.

Over the past seven years and during his Ph.D. work, T. McIntosh has investigated the edges of probably more than 75% of the alkaline wetlands that have potential habitat for this species in British Columbia (see Table 1), and has confirmed the presence of *Pterygoneurum kozlovii* at only 13 sites. However, the edges of many of these ponds and the potential habitat for this species are extensive, covering hectares in some sites, and, because of collection time constraints, this species could have been overlooked at some of the sample locations.

Trends

In 1997, T. McIntosh initiated a survey of provincial arid-land areas in order to complement his Ph.D. work (McIntosh 1986) in preparation for a research paper describing and providing keys for the bryophytes of these regions. From 1997 to 2001, some 45 alkaline wetlands of potential habitat for this species were visited at various locations throughout the semi-arid regions of south-central British Columbia (about 20 sites were visited in the Cariboo Region from north of Clinton to west of Williams Lake, and another 25 were visited in the Kamloops/Merritt/Okanagan areas, where this species appears to be more common; these sites were not documented with UTM information). The primary focus of these visits was to look for a number of rare bryophytes, including *Pterygoneurum kozlovii*. Five new populations were found for this species during this survey.

Thirteen populations were examined by T. McIntosh in 2002-03 (Table 2; the White Lake population, 25, was confirmed in the field and a collection not made due to paucity of material). Of the nine original populations in British Columbia (field work conducted 1980-83, McIntosh 1986), six may have been extirpated (Sites 2, 3, 4, 6, 8, and 9), four in the Osoyoos area, one west of Kamloops, and one near Riske Creek. The Saskatchewan population and Populations 20 and 24 southwest of Williams Lake were not visited in 2002.

Thirty additional alkaline wetland sites were also visited in the 2002-03 period, including an attempt at relocating the original sites found by McIntosh during field work for his Ph.D. (field work conducted 1980-83, McIntosh 1986). Only two of them were probably relocated (precise location information was not available for these earlier collections, and some sites were probably destroyed). The investigations during this survey were more intense than the earlier survey, and more time was spent at each site. Nine new populations were found.

Table 3 lists habitat condition and trends for each known population, as well as at the Spotted Lake area, although *Pterygoneurum kozlovii* was not found there in 2002. Habitat notes were made for Populations 20 and 24 south-west of Williams Lake in earlier years. There has been no monitoring of habitat condition trends for this species, since the earlier surveys were not designed to report on these factors. However, some general observations can be made based on the 2002 survey. Eight of the known sites are undisturbed to relatively undisturbed, and eight are moderately to heavily disturbed. Site monitoring is required in order to comment on habitat stability in most sites.

Table 2. Population Information for *Pterygoneurum kozlovii*. (Numbers in brackets following population number refer to collections examined; the White Lake population, #25, was confirmed in the field but a collection was not made due to paucity of material).

Population #	Location	Dates visited	Confirmed in 2002
1 (1)	Oliver	1980/2002	no
2 (2)	Osoyoos	1980/2002	population probably extirpated
3 (3)	Osoyoos	1981/2000/2002	population probably extirpated
4 (4)	Osoyoos	1980/2002	population probably extirpated
5 (5, 23)	NW of Osoyoos	1980/2002	yes
6 (6)	W. of Kamloops	1980/2002	population probably extirpated
7 (7)	Kaledon	1980/2002	no
8 (8)	Riske Creek	1981/1999/2002	population possibly extirpated
9 (9)	NW of Osoyoos (Spotted Lake)	1983/1999/2001/2002	population possibly extirpated
10 (10)	Saskatchewan	1989	not visited
11 (11)	Oliver	2002	yes
12 (12)	S. of Kamloops	1999/2002	no
13 (13)	S. of Riske Creek	2002	yes
14 (14)	Poison Lake	1999/2002	yes
15 (15)	W. of Kamloops	2002	yes
16 (16)	Cranbrook	2002	yes
17 (17)	Canal Flats	2002	yes
18 (18)	S. of Kamloops	2002	yes
19 (19)	W. of Williams Lake	2002	yes
20 (20)	S.W. of Williams Lake	2001	not visited
21 (21)	S. of Savona	2002	yes
22 (22)	S. of Ashcroft	2002	yes
23 (24)	N.W. of Clinton	2000/2002	yes
24 (25)	S.W. of Williams Lake	1997	not visited
25	White Lake	1998/2001/2002	yes

Protection/ownership

Most of the extant populations appear to be on provincially owned lands, in particular Crown lands, although ownership needs to be confirmed for some sites (Table 3). Populations 19 and 25 are protected within cattle exclosures. Although Site 20 is in the Churn Creek Protected Area, grazing by cattle occurs there. Site 11, an extensive population in apparently good condition, is in a horse paddock, but horse use of the area appears minimal.

Population 25 is found adjacent to White Lake in the southern Okanagan Valley. In the past, cattle and horses utilized the area around White Lake. However, the Nature Trust (J. Hope, pers. comm. 2002) recently signed a 99 year lease in order to establish a study area on federal lands at White Lake in accordance with their 2000 Biodiversity Ranch Management Plan. As part of this plan, White Lake and the surrounding riparian

vegetation, including the known location for *Pterygoneurum kozlovii*, have been permanently excluded from grazing and other potential large-scale disturbances through the construction and maintenance of a fence. It is expected that the habitat will improve in the riparian area, although data are lacking on how changes will affect the population of this species.

Table 3. Habitat and General Characteristics of Known Populations of *Pterygoneurum kozlovii* in British Columbia (from Table 2).

A Population	B Limiting Factors and Threats	C Habitat Condition and Trend	D Population Size and Trend	E Protection and Ownership
1	?	?	?	?
2	?	?	X	?
3	?	?	X	?
4	?	?	X	?
5	A, C	C, C	C, ?C	?Gp
6	?	?	X	?
7	?	?	?	?
8	?	?	X	?
9	A	C, C	X	P
10	?	?	?	?
11	(A)	A, B	A, ?	P
12	?	?	?	?
13	(A)	A, B	C, ?	Gp
14	none (protected by fence)	A, B	A, ?	Gp
15	A, C	C, (C)	C, C	Gp
16	B	C, C	C, C	?
17	(A)	A, B	A, ?	Gp
18	A	B, C	B, C	Gp
19	none (protected by fence)	A, B	C, ?	Gp
20	A	B/C, B	B, ?	Gp (Park)
21	?A	A, B	B, ?	Gp
22	A, C	B, B	C, ?	Gp
23	A	B, B	C, ?	?Gp
24	none (protected by fence)	A, B	C, ?	Gp
25	none (protected by fence)	A, B	C, ?	P

Notes (in all cases, '?' refers to 'unknown' or 'uncertain', and a letter in brackets refers to 'minor importance'):

1. With respect to **Column B: Limiting Factors and Threats**: A refers to grazing impacts, B refers to human impact, C refers to impact by burrowing animals.
2. With respect to **Column C: Habitat Condition**: A refers to relatively undisturbed, B refers to moderately disturbed, C refers to heavily disturbed; **Habitat Trend**: A refers to possibly improving, B refers to possibly stable, C refers to possibly degrading.
3. With respect to **Column D: Population Size**: A means widespread in area surveyed, B means uncommon across site, and C rare across site; **Population Trend**: A may be improving, B may be stable, C may be degrading, X possibly extirpated.
4. With respect to **Column E: Protection and Ownership**: P refers to private ownership and G refers to Government ownership, either municipal (m) or provincial (p, usually Crown land).

BIOLOGY

General

Pterygoneurum kozlovii is a small, acrocarpous moss that usually grows on soil in small to medium sized patches or turfs along the edges of seasonally wet, alkaline areas in semi-arid shrub-steppe and grassland environments.

Reproduction and dispersal

Sporophytes and spores are common in Canadian populations (Figure 1). Spores are probably important in maintaining populations, and in the dispersal of this species, at least into adjacent open areas. However, the spores of this species are relatively large, and probably do not readily disseminate beyond a short distance. The immersed capsules may also restrict dispersal to some degree, but this is unknown; they may also afford protection for the spores during the summer dry period. Spores may be dispersed by surficial water flows, insects, and birds. *Pterygoneurum kozlovii* should probably be considered a perennial species because of the presence of the small bulbils on the rhizoids, and because it has been found in some sites in the same location as earlier years. Vegetative growth is probably important in maintaining the population or in expanding it over short distances.

POPULATION SIZES AND TRENDS

Table 3 lists sizes and trends for each population. *Pterygoneurum kozlovii* is uncommon to rare in most sites, and common and widespread in only three locations. Population trends are uncertain, although four may be declining based on habitat observations. Site monitoring is necessary in order to confirm population trends.

LIMITING FACTORS AND THREATS

Table 3 lists limiting factors and threats for each site. The major limiting factor and threat to *Pterygoneurum kozlovii* appears to be the trampling of its habitat by domestic animals, usually cattle, but also, in a few cases, horses. Most alkaline areas in the province are not protected, and are used by cattle for drinking water, and heavy disturbance in these areas is frequent. Population 8 near Riske Creek may have been lost because of extensive trampling by cattle. Urban development has probably eliminated some alkaline ponds and their associated populations of this species (northwest of Osoyoos and west of Kamloops). Highway expansion has eliminated Population 4 west of Osoyoos. Population 16 near Cranbrook is threatened by the heavy recreational use of this site by vehicles, especially ATVs. Much of the area is denuded of vegetation, and only small patches of potential habitat for this species remains.

A further threat may be long periods of drought. The last four to five years have been particularly dry in some areas of interior British Columbia, and many populations may have declined because of this drought. They have been covered by more than usual plant litter or by soil from gopher or ground squirrel throws. It is possible that these animals are taking advantage of the drier conditions of these sites; burrows are common at the driest sloughs, and absent where some soil moisture exists.

SPECIAL SIGNIFICANCE OF THE SPECIES

Pterygoneurum kozlovii is restricted to Canada in North America. Also, although it is relatively widespread in southern British Columbia, it is usually not common, either at most sites where it is known, or across its range. Further, it is found in a number of threatened habitats, such as in the endangered *Purshia tridentata* ecosystem in the south Okanagan Valley; some populations of *P. kozlovii* have been eliminated in this area.

EXISTING PROTECTION OR OTHER STATUS

No legislation, regulations, customs, or conditions protect Canadian populations of *Pterygoneurum kozlovii*. Globally this species is considered imperiled or rare (G2G3), and it is Red-listed (S1) in British Columbia (BC Species and Ecosystem Explorer 2003). Ryan (1996) listed this species as S1 in the province. It is considered endangered or rare in Mongolia (Mongolian Tourism Board 2002). It is not listed by NatureServe Explorer (2002).

SUMMARY OF STATUS REPORT

The alkaline wing-nerved moss, *Pterygoneurum kozlovii*, is a small species that is restricted to Canada in North America. The species typically grows on soil among grasses and sedges along the margins of open alkaline wetlands in the drier regions of Canada. In Canada, it has been reported from 24 sites in south-central British Columbia, where it has been recently confirmed at 13 sites, and one site in Saskatchewan. Of the British Columbian sites, 6 may have been lost to urban development, highway improvement, and trampling by cattle. Its presence at the Saskatchewan site has not been confirmed. About half of the all known sites are subject to grazing or human impacts.

TECHNICAL SUMMARY

Pterygoneurum kozlovii

Alkaline wing-nerved moss

Range of Occurrence in Canada: BC, SK.

Ptérygoneure de Koslov

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	189,000 km ² (with SK); 71,000 km ² (BC only)
• <i>Specify trend in EO</i>	stable
• <i>Are there extreme fluctuations in EO?</i>	no
• <i>Area of occupancy (AO) (km²)</i> Based on estimate of areas searched.	<40 km ²
• <i>Specify trend in AO</i>	unknown
• <i>Are there extreme fluctuations in AO?</i>	no
• <i>Number of known or inferred current locations</i>	13 extant as of 2002 (see Table 2)
• <i>Specify trend in #</i>	6 extirpated(?); 13 extant of which 9 were first found in 2002; 3 not relocated; 3 not visited (See Table 2)
• <i>Are there extreme fluctuations in number of locations?</i>	Unknown
• <i>Specify trend in area, extent or quality of habitat</i>	?stable to declining
Population Information	
• <i>Generation time (average age of parents in the population)</i>	unknown
• <i>Number of mature individuals</i>	unknown
• <i>Total population trend:</i>	probably declining based on the loss of 1 in 4 sites
• <i>% decline over the last/next 10 years or 3 generations.</i>	about 25%
• <i>Are there extreme fluctuations in number of mature individuals?</i>	unknown
• <i>Is the total population severely fragmented?</i>	Yes. Locations are separated from each other by unsuitable habitat.
• <i>Specify trend in number of populations</i>	Unknown
• <i>Are there extreme fluctuations in number of populations?</i>	Unknown
• <i>List populations with number of mature individuals in each:</i>	unknown (refer to Table 3 for general comments)
Threats (actual or imminent threats to populations or habitats)	
Impacts of cattle; it is not known what level of disturbance the species can withstand and continue to persist at a site.	
Development, road building, off road vehicles.	
Rescue Effect (immigration from an outside source)	
• not known in North America except in Canada	
• <i>Is immigration known or possible?</i>	no
• <i>Would immigrants be adapted to survive in Canada?</i>	yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	yes
• <i>Is rescue from outside populations likely?</i>	no
Quantitative Analysis	
Not available	

Previous Status
COSEWIC: none imperiled in Mongolia

Status and Reasons for Designation

Alkaline Wing-nerved Moss	<i>Pterygoneurum kozlovii</i>
Status: Threatened	Alpha-numeric code: Met criteria for Endangered, B2ab(iii,iv), but designated Threatened, B2ab(iii,iv), because the species is known from several locations over a wide area, and not thought to be at imminent risk of extirpation.
<p>Reason for Designation: This species, restricted in North America to western Canada, is globally imperiled or rare. Canada possesses the great majority of documented locations. The species typically grows on soil among grasses and sedges along the margins of alkaline ponds and sloughs in semi-arid regions of Canada. It has been confirmed at only 13 sites from 24 reported in south central British Columbia. There is one unconfirmed site in Saskatchewan. About half of all the known sites are subject to impacts from people and domestic animals. Of the British Columbia sites, 6 have apparently been lost to urban development, highway improvement, and trampling by cattle, implying that decline in habitat quality and extent are presently impacting the species.</p>	
<p>Applicability of criteria</p> <p>Criterion A: (Declining Total Population): Does not meet thresholds for decline.</p> <p>Criterion B: (Small Distribution, and Decline or Fluctuation): Meets criteria for Threatened B1 (Area of Occupancy is estimated at < 40 km²). The Canadian population is severely fragmented (a), and there is a decline in the area, extent and /or quality of habitat (b iii), and number of locations (b iv).</p> <p>Criterion C: (Small Total Population Size and Decline): Information not available for total population size.</p> <p>Criterion D: (Very Small Population or Restricted Distribution): Does not meet requirements for this criterion. No population estimates.</p> <p>Criterion E: (Quantitative Analysis): Not available.</p>	

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

The late V. Krajina translated important portions of the papers by Abramova *et al.* (1973) and Vanek (1952). Wynne Miles made helpful comments on the manuscript. Fred Knezevich and Don Gayton provided field assistance. Bruce Bennett kindly collected mosses in the Yukon.

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Authorities contacted

John A. Christy
Wetland Ecologist, Oregon Natural Heritage Program
Herbarium Research Associate, Oregon State University

Ray Coupe
Ecologist, Ministry of Forests, Williams Lake, British Columbia

Don Gayton
Grassland Ecologist, Forest Research Extension Partnership (FORREX), Nelson,
British Columbia

Fred Knezevich
Private Consultant, range ecologist, Williams Lake, British Columbia

Hans Roemer
Ecologist, Victoria, British Columbia

W. B. Schofield
Professor Emeritus, Botany Department
University of British Columbia, Vancouver, British Columbia.

Kent Watson
Soils Expert, University College of the Cariboo,
Kamloops, British Columbia.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Dr. Terry McIntosh completed his Ph. D. in 1985 following a study of dry grassland and shrub-steppe bryophytes in the interior portions of British Columbia. Since then, he has been active collecting bryophytes from many parts of the province and in dryland areas of adjacent Washington State. He has been a primary identifier of bryophyte collections from various government and private surveys in the province. He has recently completed sixteen rare species accounts on bryophytes for the Wildlife Branch of the Province of British Columbia and two COSEWIC Status Reports on mosses.

COLLECTIONS EXAMINED

The information provided below is not always exactly as on herbarium packet; spelling mistakes have been changed and information has been generated here to follow an easier to use format for this document; numbers 1 to 6 are at UBC and numbers 7 to 25 will be deposited into the UBC Herbarium.

	Access'n no.	Location	Habitat	Collector	Coll. no.	Coll. date	Det.
1	B89051	N.N.W. of Oliver	On soil in dry grassy area adjacent to saline lake	T. T. McIntosh with A. Kruckeberg	4583	27 June 1980	T. T. McIntosh
2	B89053	Osoyoos	Frost disturbed turf	T. T. McIntosh	6783	11 Apr 1981	T. T. McIntosh
3	B89052	NW of Osoyoos	Hard soil near grassy salt pan	T. T. McIntosh with A. Kruckeberg	5875	20 Sept 1980	T. T. McIntosh
4	B109343	1.5 km NW of Osoyoos	Edge of former lake	T. T. McIntosh with A. Kruckeberg	4578	26 June 1980	T. T. McIntosh
5	B109340	Near Spotted Lake, Osoyoos area	Silty flat near slough, damp	T. T. McIntosh with A. Kruckeberg	4530	26 June 1980	T. T. McIntosh
6	B109440	Alkaline lake and steppe west of Kamloops	Sandy soil near salt pan	T. T. McIntosh	5794	22 Aug 1980	T. T. McIntosh
7		Penticton Indian Reserve 1, NNW of Kaleden	On soil of wet depressions	T. T. McIntosh with A. Kruckeberg	4229	9 June 1980	T. T. McIntosh
8		Riske Creek, BC	on crust near lake	T. T. McIntosh	7032	11 Aug 1981	T. T. McIntosh
9		Spotted lake area. Near Osoyoos	soil around edge of lake	T. T. McIntosh	7624	30 Apr 1983	T. T. McIntosh
10		+/- 30 km. W of Moose Jaw, SK	edge of alkaline slough	T. T. McIntosh	8051	June 1989	T. T. McIntosh
11		+/- 15 km south of Okanagan Falls NW of Oliver	along edge of alkaline lake on soil amidst <i>Distichlis</i> and sedges	T. T. McIntosh	8043	9 Oct 2002	T. T. McIntosh
12		Nicola Lake (NE of Merritt), BC	on soil along edge of alkaline slough	T. T. McIntosh	8044	June 1999	T. T. McIntosh
13		+/- 10.5 km south of Riske Creek along 2000 Rd. to Farwell Canyon; 980m elevation	on soil along edge of alkaline slough	T. T. McIntosh	8045	17 Oct 2002	T. T. McIntosh
14		Poison Lake, SW of Williams lake	on soil amongst grasses and sedges along edge of lake	T. T. McIntosh	8046	17 Oct 2002	T. T. McIntosh
15		Near Hwy. #1/Coquihalla turnoff, W of Kamloops	on soil along west edge of alkaline slough in <i>Distichlis</i> zone	T. T. McIntosh	8047	19 Oct 2002	T. T. McIntosh

Access'n no.	Location	Habitat	Collector	Coll. no.	Coll. date	Det.
16	Near Cranbrook	on soil in heavily degraded alkaline wetland	T. T. McIntosh and Don Gayton	8048	9 Nov 2002	T. T. McIntosh
17	W of Canal Flats, S end of Stinky Slough	on soil amongst grasses and sedges along edge of alkaline lake	T. T. McIntosh	8049	9 Nov 2002	T. T. McIntosh
18	S of Kamloops	scattered patches on soil along edge of alkaline lake	T. T. McIntosh	8050	19 Oct 2002	T. T. McIntosh
19	Jameson Exclosure, Cariboo Region, W of Williams lake	on soil amongst grasses and sedges	T. T. McIntosh	8052	17 Oct 2002	T. T. McIntosh
20	SW of Williams lake	on soil amongst rushes and sedges	T. T. McIntosh and K. Iverson	8053	27 May 2001	T. T. McIntosh
21	S of Savona (W of Kamloops)	scattered patches on soil along west edge of alkaline lake	T. T. McIntosh	8054	19 June 2002	T. T. McIntosh
22	S of Ashcroft; +/- 540 m elevation	scattered patches on soil on alkaline slope amidst <i>Distichlis</i> and small sedges	T. T. McIntosh	8055	Oct, 2002	T. T. McIntosh
23	NW of Osoyoos alongside Hwy. 3	on soil along edge of alkaline pond, NW of Spotted Lake	T. T. McIntosh with F. Knezevich	5875	21 Jan 2003	T. T. McIntosh
24	Alberta Lake, NW of Clinton, BC	scattered in tiny patches on soil along west edge of lake	T. T. McIntosh	8077	21 Aug 2000	T. T. McIntosh
25	SW of Williams Lake	on soil amongst grasses and sedges	T. T. McIntosh	8047	July 1997	T. T. McIntosh

RECORD OF FIELD WORK

Field work directly related to this report was completed in 2002 on the following dates and at the locations noted in brackets (sometimes field searches for *P. kozlovii* were made in addition to other work at these sites): May 15 - 18 (south Okanagan Valley), July 29 - 31 (Okanagan area), October 7 - 9 (Okanagan area), October 14 (Ashcroft area), October 16 - 20 (Cariboo Region and Kamloops area), November 9 - 10 (Cranbrook area), and December 22 - 24 (south Okanagan area). Field work was undertaken on one additional day, January 21, 2003, in order to confirm earlier locations in the south Okanagan area. An average of 1-2 hours was spent searching at each site in these areas.