COSEWIC
Assessment and Status Report

on the

Batwing Vinyl Lichen
Leptogium platynum

in Canada

ENDANGERED
2011

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Batwing Vinyl Lichen — Photo courtesy Tim Wheeler ©2009.

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COSEWIC
Assessment Summary

Assessment Summary – May 2011

Common name
Batwing Vinyl Lichen

Scientific name
Leptogium platynum

Status
Endangered

Reason for designation
This leafy lichen occurs in western North America reaching the northern limit of its range in coastal southwestern British Columbia where it commonly occurs at three, possibly four, locations on Vancouver Island. The lichen grows on calcium/magnesium-rich rock outcrops and more than 80% of individuals occur at one location. It has been extirpated from three other locations. This lichen is vulnerable to stochastic events, competition from mosses and liverworts, pollution from industrial/agricultural activities, and increasingly frequent summer drought resulting from climate change.

Occurrence
British Columbia

Status history
Designated Endangered in May 2011.

COSEWIC
Executive Summary

Batwing Vinyl Lichen
Leptogium platynum

Wildlife species description and significance

The Batwing Vinyl Lichen (*Leptogium platynum*) is a distinctive rock-dwelling "jellyskin" lichen characterized by leafy, medium-sized lobes and a dark bluish upper surface usually bearing numerous fruit bodies and occasional tiny lobules which function as vegetative propagules. It is unusual among cyanolichens in its almost invariable production of both sexual and vegetative propagules. It has its northern limits in southern coastal British Columbia.

Distribution

The Batwing Vinyl Lichen is endemic to western North America, where it occurs at scattered locations in summer-dry coastal regions from southern California (32°N) northward to southern Vancouver Island, in British Columbia (49°N). Other populations have also been reported from Mexico, New Mexico and Texas.

Habitat

This species occurs at low elevations on rock outcrops where it colonizes inclined rock faces subject to periodic seepage. Only base-rich rock types appear to be colonized, often in association with a variety of mat-forming mosses and hepatics. The Batwing Vinyl Lichen is thus restricted by a requirement for substrata with a rather high pH.

Biology

Sexual reproduction imposes a requirement for thallus resynthesis at each generation, which may partly account for the highly disjunct distribution of the Batwing Vinyl Lichen throughout its range. The lobules are relatively heavy vegetative propagules which are unlikely to disperse more than a few metres from the parent thallus. The life cycle of the Batwing Vinyl Lichen thus involves persisting for long periods via vegetative maintenance at a given site, punctuated by very rare long-distance dispersal events resulting from the establishment of new thalli from fungal spores ejected from the lichen fruit bodies associating with compatible strains of cyanobacteria.

Population sizes and trends

The Batwing Vinyl Lichen has been documented in Canada from seven locations; two were found for the first time in 2009. Of the five historical locations, four were revisited in 2009 and one was not reachable. Only one of the historical sites was still found to support the Batwing Vinyl Lichen. Thus this species is currently confirmed to be extant in only three locations. Collectively these three locations have 370 thalli with a combined surface area of less than 9 m^2. Three hundred of these thalli are concentrated in a single location. The reasons for the disappearance of the Batwing Vinyl Lichen from more than half of the formerly known locations cannot be assigned with certainty.

Threats and limiting factors

The apparent loss of the Batwing Vinyl Lichen from three of the seven locations may be attributed to natural causes such as competition by mosses and increasingly dry summers as a result of climate change. This lichen is also vulnerable to stochastic events such as exceptionally heavy rainfall. The loss at one location is likely due to nutrient enrichment of the habitat from nearby intensive agricultural activity. The region where this lichen occurs also includes areas with a rapidly expanding human population which could lead to both loss of available habitat and increasing air pollution.

Protection, status, and ranks

All three Canadian locations currently known to support this species are situated in permanently designated protected areas. Of the four “historical” locations, two are also located in protected areas, whereas the other two are on private land. The Oregon Natural Heritage Information Center currently ranks the Batwing Vinyl Lichen as S1/S2.

TECHNICAL SUMMARY

Leptogium platynum
Batwing Vinyl Lichen — Leptoge à grosses spores
Range of occurrence in Canada: BC

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines(2008) is being used)	Unknown, but probably e.g. 10-20 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes, inferred, if generation time is 10-20 yrs
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unable to calculate the magnitude of reduction due to lack of data on former population sizes at extirpated sites
Are the causes of the decline clearly reversible and understood and ceased?	No
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence	507 km^2, including one location of unknown status
Index of area of occupancy (IAO)	16 km^2, including one location of unknown status
Is the total population severely fragmented?	Yes, in the sense of IUCN guidelines if spore transport together with successful establishment are discounted as they appear to occur very rarely. There are three extant habitat patches separated by long distance and two have very low thallus numbers.
Number of "locations∗"	4, including one location of unknown status
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Yes
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Unknown

∗ See definition of location.

Is there an [observed, inferred, or projected] continuing decline in number of populations?	Continuing decline can be inferred from inferred habitat loss with predicted climate change
Is there an [observed, inferred, or projected] continuing decline in number of locations?	Yes, of four visited historical locations, it is only now extant in one
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Continuing decline in habitat area, extent and/or quality can be inferred predicted from climate change impact of intensive agriculture, and moss succession
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations∗?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Three extant locations with 35, 35 and 300 thalli, respectively	370
Total	370 thalli based on inventory in 2009

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Unknown

Threats (actual or imminent, to populations or habitats)

Increasing summer drought as a result of climate change, air pollution, stochastic events affecting the few known sites, competition by mosses, air pollution from agricultural activity

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Apparently rare throughout global range.	
Is immigration known or possible?	Yes
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	Possible but unlikely since the degree of “rescue” would be determined by local climatic conditions

Current Status

COSEWIC: Endangered (2011)

∗ See definition of location.

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Endangered	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)
Reasons for designation: This leafy lichen occurs in western North America reaching the northern limit of its range in coastal southwestern British Columbia where it commonly occurs at three, possibly four, locations on Vancouver Island. The lichen grows on calcium/magnesium-rich rock outcrops and more than 80% of individuals occur at one location. It has been extirpated from three other locations. This lichen is vulnerable to stochastic events, competition from mosses and liverworts, pollution from industrial/agricultural activities, and increasingly frequent summer drought resulting from climate change.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable: data not available to calculate decline.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets thresholds for EN subcriterion B1 (EO < 5000 km², actual = 507 km²) and B2 (IAO < 500 km², actual = 16 km²). Meets thresholds for subcriterion a (# locations <= 5, actual = 3(possibly 4)) and subcriterion b, continuing decline of (i) EO, (ii) IAO, (iii) quality of habitat, (iv) number of locations, and inferred decline in number of mature individuals (v).
Criterion C (Small and Declining Number of Mature Individuals): Meets thresholds for EN C (# individuals < 2500, actual = 370), but does not meet threshold for subcriteria C1 or C2.
Criterion D (Very Small or Restricted Total Population): Meets criterion for TH D1 (numbers of individuals <1000 individuals, actual = 370).
Criterion E (Quantitative Analysis): Not available.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2011)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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Canada

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

COSEWIC Status Report

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Batwing Vinyl Lichen

Leptogium platynum

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2011

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and classification

Scientific name: *Leptogium platynum* (Tuck.) Herre
Bibliographic citation: Proc. Wash. Acad. Sci. 12:144. 1910.
Pertinent synonyms: *Leptogium californicum* var. *platynum* Tuck.
Common name: Batwing Vinyl Lichen or Leptoge à grosses spores
Family name: Collemataceae
Major group: lichenized ascomycetes

Leptogium is a cosmopolitan genus comprised of roughly 180 species. Sixty species are known to occur in North America (Esslinger 2009), of which 30 have been reported from Canada and 20 from British Columbia.

Morphological description

Leptogium platynum (Figure 1) is a loosely attached foliose “jellyskin” lichen about 4-5 (-7) cm across. The lobes are 4-6 mm wide, rounded to rather elongate, usually down-turned at the extreme tips. The upper surface is bluish grey or sometimes brown, shiny, hairless, finely wrinkled when dry, and bears few to many small lobules that are also down-turned at the tips. The upper surface also bears few to many, partly sunken, button-like apothecia 0.2-0.5 mm across. The internal portions of the thallus are dark, rather translucent and rubbery when moist. The thallus is usually more than 300µm thick (at least in part), and under the microscope consists of threadlike fungal strands and olive green cyanobacterial cells (*Nostoc*). The lower surface is paler than the upper surface, and is either hairless or bears scattered tufts of white hairs. In the apothecia, spores are produced: 8 spores per ascus, and these are ellipsoid, bricklike (muriform), and 35-50µm long x 9-15µm wide. No secondary substances have been reported for *L. platynum*. See also (Sierk 1964). Illustrations of this lichen are to be found in Goward *et al*. (1994), p. 66; Brodo *et al*. (2001), p. 408.

Figure 1. *Leptogium platynum*: Habit (Photo courtesy Tim Wheeler ©2009.)

Among the “jellyskin” lichens, *L. platynum* is easily recognized by its combination of a leafy habit, sharply wrinkled lobes, numerous partly-immersed, button-like apothecia, and especially its production of small lobules with down-turned tips. *L. platynum* could be confused with rock-dwelling forms of *L. polycarpum* (Peacock Vinyl Lichen), which is known from the U.S., but in Canada *L. polycarpum* has only been found colonizing trees. In addition, *L. polycarpum* is distinguished by its coarser wrinkles, the lack of lobules and the presence of only 4 spores per ascus. *Leptogium californicum* (California Vinyl Lichen) is also similar, but has thinner, scarcely wrinkled lobes that are invariably less than 200 µm thick. In Canada this species appears to be restricted to inland regions that are outside the range of *L. platynum*.

Population spatial structure and variability

Aspects of population and spatial structure are discussed below under Dispersal and migration.

Designatable units

Only one designatable unit is currently recognized for *L. platynum* in North America. There is no evidence for genetic or ecological differentiation of the species through its Canadian range.

Special significance

Leptogium platynum is (if as suspected the records from India refer to another species, see below) an endemic to western North America. It reaches its northern limits in southern coastal British Columbia where it is currently known from only three locations with a combined surface area of less than 9 m^2. Its simultaneous production of two types of reproductive propagules – spores and lobules – is unusual in cyanolichens. The presence of a cyanobacterial photopartner (*Nostoc*) confers an ability to fix atmospheric nitrogen. During thallus wetting and drying cycles, a proportion of this may be released and benefit other organisms in the immediate vicinity.

DISTRIBUTION

Global range

Leptogium platynum is reported as occurring both in western North America and in India (e.g., Jørgensen and Nash 2004). Such a disjunction, however, is practically unknown in lichens so the records from India may refer to a different species. Pending further study, *L. platynum* can be considered as endemic to western North America where it ranges north into southern coastal British Columbia, and south through coastal Washington, Oregon to southern California, as well as east and southeast to New Mexico, Texas (Sierk 1964), and the Chihauhua region of Mexico (Jørgensen and Nash 2004). Throughout its range, *L. platynum* appears to have a distinctly discontinuous distribution (Figure 2).

The current range of this species in California is uncertain. Tuckerman (1882) described *L. platynum* in the late 19th century, based on a specimen collected near the town of Auburn (38 00'N, 121 00'W), northeast of San Francisco. In the decades immediately following its description, several additional collections were made in the same general region, e.g., at Castle Rock (Herre 1910), as well as at Saratoga, Ukiah, Hastings Natural History Reserve, San Bernardino, and Black Mountain (Sierk 1964). In light of these and other early records, it is curious that no recent collections from this area have been reported (see for instance Tucker and Ryan 2006). Whether this reflects an actual contraction in the range of *L. platynum* is unknown; but certainly the Californian portion of the distribution area given in Figure 2 may be somewhat smaller than indicated.

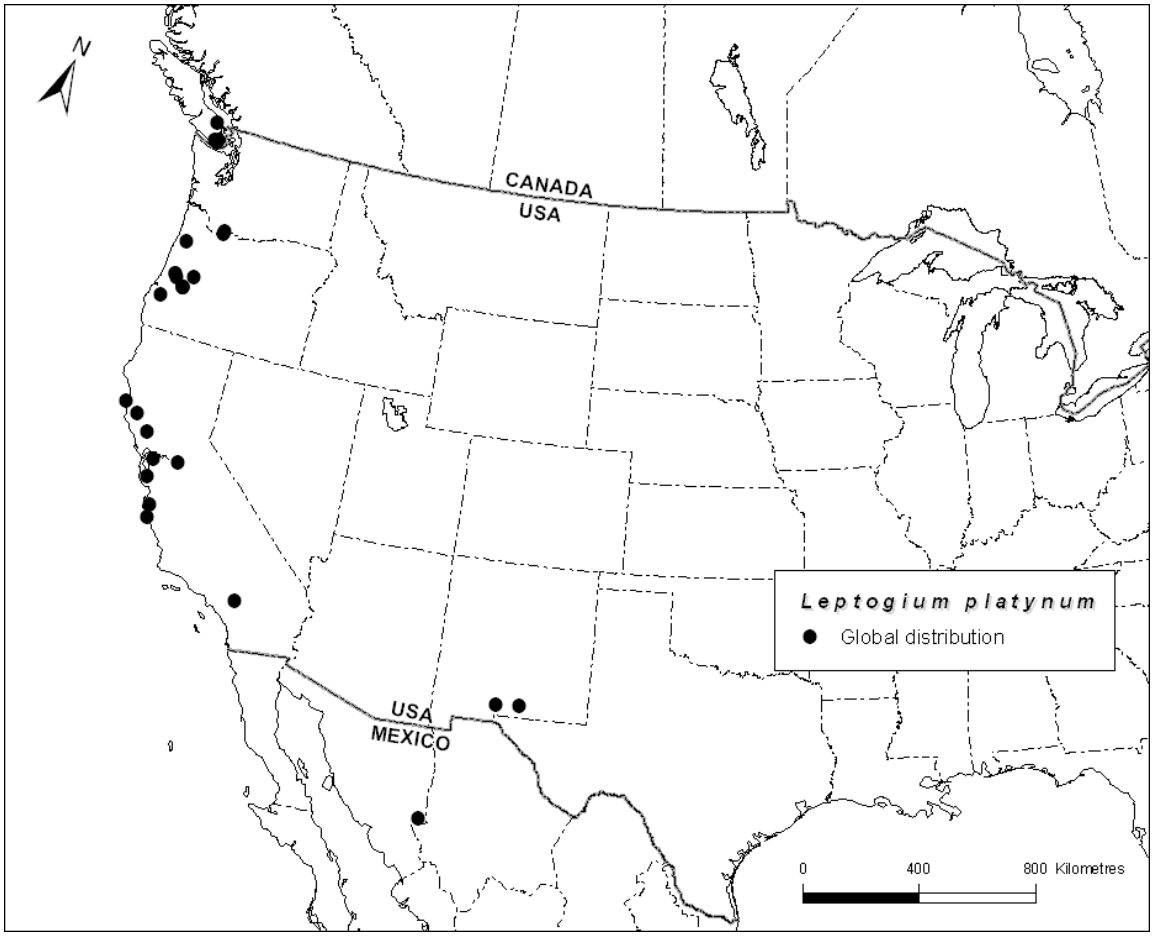

Figure 2. Global distribution of *Leptogium platynum* (extant locations only).

Canadian range

The first collection of *L. platynum* in Canada was made by Wilf Schofield in 1968, though it was not reported until some years later (Noble 1982). Currently this species is known in Canada exclusively from coastal British Columbia, where it is apparently restricted to Vancouver Island south of about 49°N (Figure 3). Three locations are in the Coastal Douglas-fir Zone (Biogeoclimatic classification system of the B.C. Ministry of Forests, Meidinger and Pojar 1991). This zone is characterized by a very narrow range of biogeoclimatic conditions, representing the northern edge of a Mediterranean-type climate that extends up the coast of British Columbia. It has warm, dry summers and mild, wet winters and represents only about 0.3% of the land base of B.C. Within this range, extant populations of *L. platynum* occur only on base-enriched open rock outcrops that have periodic seepage. One newly discovered location on Vancouver Island lies just within the Coastal Western Hemlock Zone in the Sooke area and a historical record from Sumas Mountain in the lower Fraser Valley also comes from the same zone.

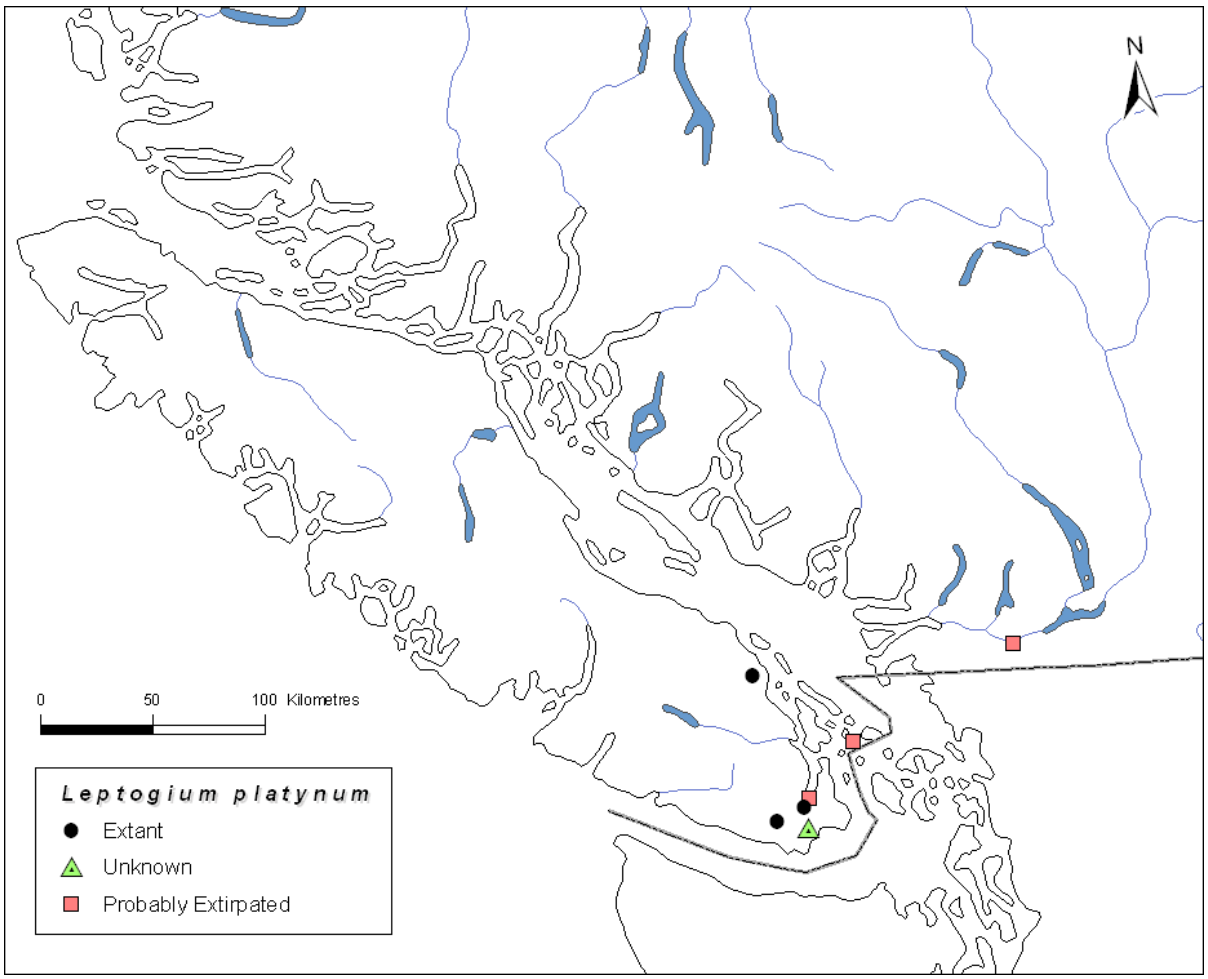

Figure 3. Canadian distribution of *Leptogium platynum*.

L. platynum has been found in Canada at seven locations (Table 1). (For the purposes of this report, “location” is defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon under consideration. Populations situated more than 1 km apart are treated as separate locations. Two of these locations are documented here for the first time, whereas the remaining five are “historical” in the sense that they predate this report (records date from 1968 to1975). Four of the five historical locations were revisited in 2009. The fifth, location 4, was inaccessible owing to a housing development.

HABITAT

Habitat requirements

In Canada, *L. platynum* occurs exclusively on rocky outcrops subject to some degree of periodic seepage. It seems to be absent from habitats exposed to frequent drying. In some cases it inhabits small runnels on cliff faces, while in others it appears to benefit from the prolonged slow release of water by mosses after rain.

In common with other “jelly” and “jellyskin” lichens having *Nostoc* as photobiont, *L. platynum* is restricted to substrates having a pH higher than about 5.0 (Gauslaa 1985, 1995). Its most frequent habitat in Canada is base-rich (or base-enriched) sandstones or conglomerate; acidic bedrock appears not to support this species.

So far as is known, *L. platynum* does not tolerate heavy shade. All populations visited by T. Goward and D. Woods in 2009 occupied open microsites exposed to good illumination. On the other hand; the requirement for periodic seepage appears to be integral to its distributional ecology in Canada.

Habitat trends

No evidence of habitat destruction was observed at any of the visited locations. However, only one of four historical locations visited was found still to support *L. platynum* (the fifth historical site was unaccessable). The loss of *L. platynum* from historical locations could be attributable to natural causes, especially competition from mosses (see “Fluctuations and trends”). However, Location 1 has probably been subject to a decline in atmospheric quality, owing to nitrogenous aerosols released into the atmosphere from poultry and pig farms in the general vicinity. The lichen flora in this area now consists of species that abound in hypertrophicated habitats. High concentrations of nitrogenous aerosols are detrimental to all but a number of nitrophilous lichens (e.g., van Herk 1999). The region where this lichen is found includes areas with a rapidly expanding human population that could also lead to both loss of available habitat and increasing air pollution.

BIOLOGY

Life cycle and reproduction

A great majority of macrolichens produce either sexual propagules (i.e., fungal ascospores) or asexual propagules (e.g., soredia, isidia, schistidia, lobules, etc.), but rarely both. By contrast *L. platynum* regularly produces both lobules and ascospores on the same thallus. Because the physiological expenditure required for the production of each propagule type is unlikely to occur in the absence of some sort of evolutionary benefit to the species, it can be inferred that both sexual and asexual reproduction play significant roles in the maintenance of *L. platynum* over time.

The highly fragmentary distribution of *L. platynum* throughout its range strongly suggests that successful resynthesis from (efficiently dispersing) sexual ascospores must be a rare event. If so, then a large majority of thalli extant at any one time are likely to have arisen as a result of short-distance dispersal by vegetative propagules. This theme is developed further under “Dispersal and migration” (see below). The fact that the available suitable habitat for *L. platynum* in B.C. is very limited and the species would appear to have a very limited ecological tolerance at the northern limit of its distribution adds further complexity to understanding its reproduction and dispersal.

No data are available on generation time in this species, but research on other cyanolichens suggests it is probably in the range of 10-20 years Larsson and Gauslaa, 2011).

Physiology and adaptability

The distributional ecology of *L. platynum* is controlled in large part by two physiological requirements common to all “jellyskin” lichens, in which the photopartner is a cyanobacterium. The first of these is a requirement for water in the liquid form (water vapour alone is sufficient to trigger photosynthetic activity in many lichens, but not in “jellyskin” and other cyanolichens). This requirement for liquid water may partly explain the close association of this rock-dwelling lichen with seepage areas. The second requirement is for base-rich substrates, usually with a pH > 5 (Gauslaa 1985, 1995) and this restricts *L. platynum* to base-rich rock types, especially in wetter portions of its Canadian range, where heavy winter rains can be expected to lower surface pH as a consequence of leaching. Intolerance to deep shade may constitute a third major limiting factor for this species, limiting it to habitats likely to remain open over long periods. These requirements, together with the fact that suitable habitat and microhabitat is in very limited supply in B.C., may account for its extraordinarily narrow distribution in Canada.

Dispersal and migration

The regular production in *L. platynum* of numerous apothecia and large, detachable vegetative lobules suggests that dispersal in this species is affected by two different mechanisms.

Apothecia bear the sexual spores of the fungal partner. Being microscopic, spores are capable of dispersing over enormous distances by wind. Presumably *L. platynum* depends on spores for medium- and long-distance dispersal, e.g., from one node of suitable habitat to another. Successful reproduction by spores ultimately requires resynthesis of a new thallus; and this in turn is likely to require very specific sets of environmental conditions and the availability of a suitable strain of cyanobacteria on the rock surface where an ascospore lands. That reproduction by spores must be a rare event in this species can be inferred, first, by the general absence of this lichen from many microsites that might be expected to support it (Goward, pers. obs.), and second, from its comparative rarity throughout its range (see below). The production of both numerous apothecia producing sexual ascospores as well as the formation of lobules for vegetative reproduction may be an adaptive strategy for coping with a narrow ecological tolerance range, particularly at its northern limit.

A much higher incidence of successful establishment might be predicted for this species, which produces vegetative propagules. These would have a much greater quantity of stored carbon available for thallus development. Owing to their large size, however, these propagules are unlikely to disperse very efficiently, probably only a few meters, though it is possible they are occasionally dislodged by strong winds to greater distances. Long-distance dispersal by birds seems unlikely owing to the steeply sloping nature of the outcrops normally colonized by *L. platynum*.

The pattern that emerges from these considerations is long periods of vegetative persistence at a given location, punctuated by very infrequent episodes of long-distance dispersal. Such a strategy might be considered highly adaptive for a species like *L. platynum*, which is especially suited to colonizing sloping rock surfaces.

Interspecific interactions

As a species principally of rock seeps, *L. platynum* frequently associates with *Scleropodium*, *Porella*, *Anacolia*, *Plagiomnium* and other mat-forming bryophytes that tend to occupy the same kinds of habitats. To some extent the presence of mosses and hepatics is likely to benefit *L. platynum* by providing a buffer against rapid and prolonged drying. On the other hand, the same bryophytes are clearly at a competitive advantage in this setting, and in time may tend to overgrow the lichen, hence potentially excluding *L. platynum* from a particular habitat. Much later, the mosses themselves may slough away, and so provide new habitat for *L. platynum*. It seems likely that the presence or absence of this lichen at a particular location at any one time is largely determined by a cyclic, largely stochastic process of this kind. The growth of trees and shrubs may also negatively affect the existence of *L. platynum* through increased shade or gradual alteration of the microclimate.

POPULATION SIZES AND TRENDS

Sampling effort and methods

The first Canadian collection of *L. platynum* was made in the lower Fraser Valley in 1968 by W. Schofield (Table 1). However it was Willa Noble, who in the 1970s conducted a thorough inventory of the lichens of southeastern Vancouver Islands and the adjacent Gulf Islands over about a five-year period who discovered the greatest number of sites for this lichen (Noble 1982). She collected 5,500 specimens that included a total of 448 species from 114 genera. Indeed, four of the seven known Canadian locations documented for *L. platynum* were originally discovered by Noble. This can largely be attributed to the very thorough survey by Noble. Since her study, numerous lichen inventories have been conducted in coastal British Columbia (Figure 4). Some of the most important ones have focused on Haida Gwaii (the Queen Charlotte Islands) (Brodo 1995), southwest Vancouver Island (Goward, unpublished collections), and Saltspring Island (Bird and Bird 1973). In 1970, Karl Ohlsson spent several weeks collecting along the British Columbia coast (Ohlsson 1973), while Trevor Goward in the early 1990s searched for rare cyanolichens in 145 rainforests located both in inland regions and along the coast of B.C. (Goward 1994). By studying the locations where Noble (1982) found *L. platynum,* Trevor Goward and Curtis Björk were able to characterize the habitat preferred by this lichen and conducted several additional lichen surveys within the potential range of *L. platynum*, including southwest Vancouver Island, central Vancouver Island, northern Vancouver Island, the Terrace area, the Kispiox Valley and South Moresby (Figure 4; Goward and Spribille 2005). Other lichenologists in recent years have also sought *L. platynum* in connection with floristic research, especially Curtis Björk in the Homathko, Southgate and Toba Valleys on the central mainland coast (C.R. Björk, pers. comm.). In spite of all these surveys, only two additional locations for *L. platynum* have been found for this very rare lichen, one by Goward and the other by Björk (Appendix Table 1).

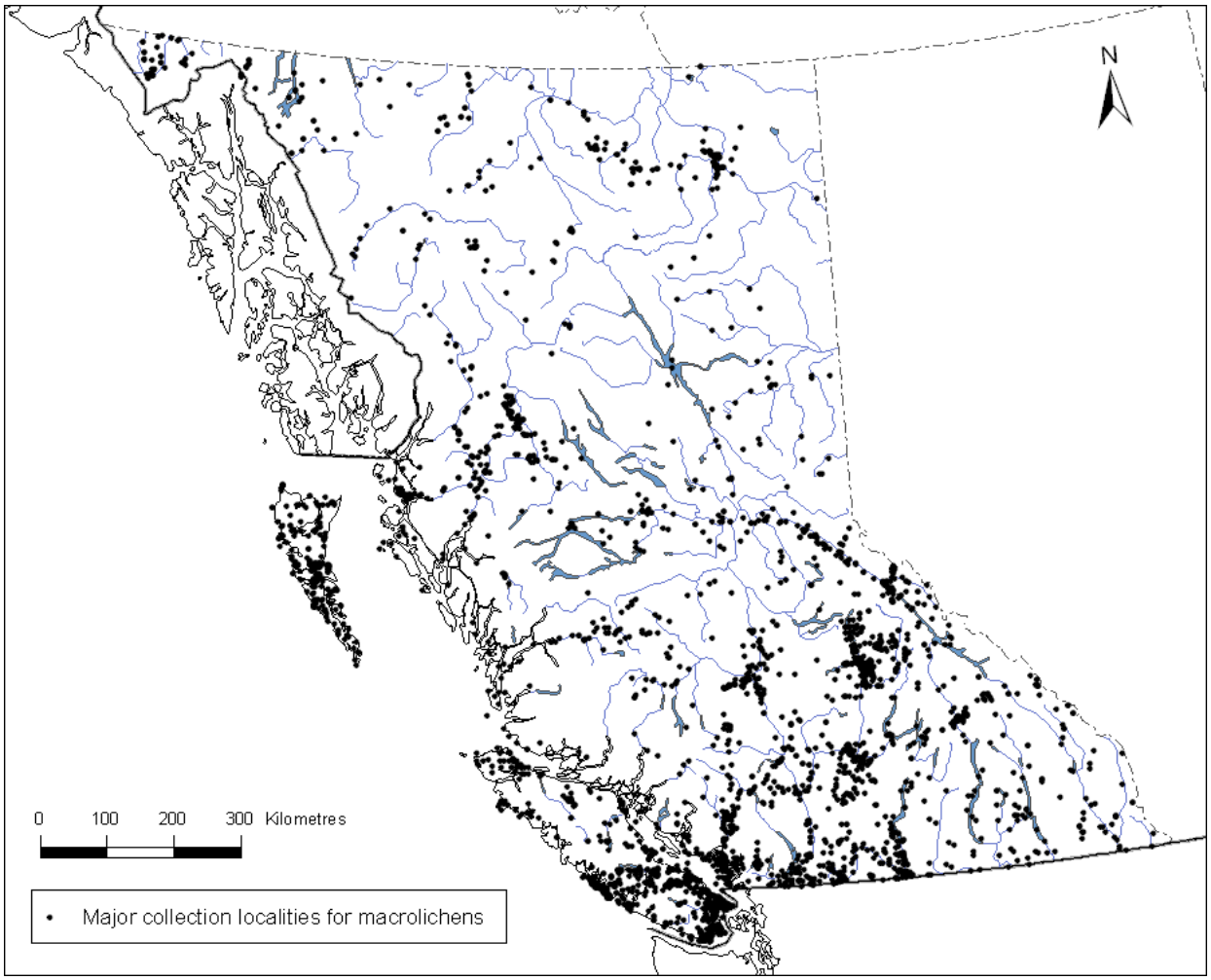

Figure 4. Major collection sites for macrolichens in British Columbia.

Table 1. Summary of the locations of Canadian populations of *Leptogium platynum* and their historical and current status. Note that all locations are located in coastal British Columbia. Specimens of *Leptogium platynum* from each location are lodged in the Herbarium of the University of British Columbia.

Location	Area	Ownership	Years Reported	Original population size (no. of thalli)	Population size (2004-2009) (no. of thalli)	Population trend (Population threat)
1	Lower Fraser Valley, Abbotsford Area Sumas Mountain	Regional Park	10 March 1968	unknown	0 thalli	Revisited in 2009, but not found. (Possibly extirpated by air pollution from nearby farms.)
2	Vancouver Island, North Pender Island: Bedwell Harbour	Private Land	23 May 1974	unknown	0 thalli	Revisited in 2009, but not found. (Climate change: increasing summer drough.t)
3	Vancouver Island, Saanich Peninsula: Lone Tree Hill.	Regional Park	5 June 1975	unknown	0 thalli	Revisited in 2009, but not found. (Climate change: increasing summer drought; competition from mosses.)
4	Vancouver Island, Metchosin area: Mount Metchosin	Regional Park	9 June 1975	unknown	N/A	Not revisited: Site only accessible through private property. (Climate change: increasing summer drought.)
5	Vancouver Island, Ladysmith area: Across harbour from Ladysmith	Woodley Range Ecological Reserve	24 June 1975, 26 August 2009	unknown	35 thalli	Revisited in 2009, and refound. (Climate change: increasing summer drought.)
6	Vancouver Island, Sooke area: Sooke Potholes:	Provincial Park	11 May 2009	35 thalli	35 thalli	N/A: visited only once (Climate change: increasing summer drought.)
7	Vancouver Island, Victoria area: Mt Finlayson	Provincial Park	13 May 2009	300 thalli	300 thalli	N/A: visited only once (Climate change: increasing summer drought.)

The studies, mentioned above, surveyed large areas of possible habitat for *L. platynum.* The object of the field studies by Trevor Goward in 2009, to support the current COSEWIC report, was to revisit the sites where Schofield and Noble had originally found the lichen. This was done to determine if *L. platynum* was still present and visits were also made to areas of similar habitat to look for new locations. The fieldwork was conducted in May 2009 and in August 2009. During this time, 40 locations throughout the known and predicted Canadian range of *L. platynum* were visited (Appendix Table 1). Four of the five "historical" locations, from which this species had previously been documented, i.e., locations 1, 2, 3, and 5 (Table 1) were visited. When *L. platynum* was found to be present, at least one hour of survey time was devoted to documenting its occurrence, with special emphasis both on the total area occupied and on the number of individual thalli present. While there may be additional locations found for this lichen on southeastern Vancouver Island, there can be little doubt that this species qualifies as among the rarest of rare cyanolichens in western Canada.

Abundance

Field studies in 2009 by Trevor Goward confirmed the presence of *L. platynum* at three locations (Table 1), with a total of 370 thalli. Two of these, locations 5 and 6, had only a small number of thalli. *L. platynum* was abundant at the third location, Location 7, with about 300 thalli, or slightly more than three-quarters of all thalli of *L. platynum* currently known to occur in Canada.

Probably more important than the actual number of thalli of *L. platynum* present at a given location is its areal extent. Here again the numbers are very low, estimated at 2 m^2 at Location 5, 2 m^2 at Location 6, and 5 m^2 at Location 7.

Fluctuations and trends

Due to lack of population records at historical sites, it is unclear whether Canadian populations of *L. platynum* are in decline, but currentlly this species is only known from three locations in Canada. *L. platynum* is thus exceedingly rare in the Canadian portion of its global range. Furthermore two of the three extant locations occur in the Coastal Douglas-fir Zone which constitutes a very small area of British Columbia, characterized by a unique set of biogeoclimatic conditions.

Past and current populations of *L. platynum* are summarized in Table 1. In total this species has now been documented from seven locations in Canada. Two of these locations are documented here for the first time. Of the remaining five "historical" locations, four were revisited in 2009 in connection with this report. At only one of these locations, however, was *L. platynum* found still to be present. The loss of *L. platynum* from Location 1 and its replacement by *Physcia adscendens* and other nitrophiles reflects an increase in nitrogenous aerosols from nearby pig and poultry farms; see van Herk (1999). The absence at the other three historical sites could be interpreted in two different ways. It could represent part of a natural habitat cycle, whereby encroaching moss mats have temporarily excluded *L. platynum* from some of its former locations – a process that may eventually reverse itself when the aging moss mats begin to slough off. On the other hand, the loss of *L. platynum* could be related to an increase in the episodes of summer drought (Rodenhuis *et al*., 2009). Overall, a declining trend of 43-57% over three generations could be calculated for *L. platynum* assuming that:

1) losses of sites represent declines and not fluctuations
2) the very small sample size of known sites reflects the actual trend for Canada
3) 3 generations (c.15 yr generation time) back from 2010 = 1965. This predates all of the "historical records" given (1968-1975).

Given these assumptions, the percentage loss would be 3/7 or 43% assuming that the "unknown" location still exists or 4/7 = 57% if the unknown location was lost. (Note: the reference to the older collections as "historical" could suggest that loss is outside the 3-generation window; however, it is inside that window, based on a 15-year generation estimate.)

Rescue effect

Recent advances in our understanding of long-distance dispersal in cryptogams make it clear that spores (presumably including the spores of lichens) may remain viable even after wind transport over many thousands of kilometres (Muňoz *et al*. 2004). This observation is significant in the case of a sexually reproducing lichen such as *L. platinum,* which is somewhat more common in the American portion of its range than in Canada. From this it seems to follow that any future decline in this species in Canada could be offset by recruitment from locations farther south. However, the apparent rarity of this lichen in Canada suggests that long-distance transport and establishment is almost never successful. This may be due to the scarcity of compatible cyanobacteria on the rock surfaces preferred by this lichen and to the rarity of suitable habitat (patches of base-rich rock outcrops with seeps) in B.C. Thus while rescue effect is possible assuming long-range dispersal, it is not probable.

This scenario, however, overlooks the fact that any such recruitment process must already be ongoing. This means that any future decline in *L. platynum* in Canada is likely to result from a decrease in the frequency of successful establishment below that of stochastic loss in existing locations. Thus, the rescue effect is unlikely to prevent future declines associated, for example, with increasing summer droughts related to predicted climate change (Rodenhuis *et al*., 2009).

THREATS AND LIMITING FACTORS

The most serious threat to *L. platynum* in British Columbia over the medium and long term is climate change (Redding *et al*., 2011, Rodenhuis *et al*., 2009). The predicted trend in coastal areas is warmer, drier summers and heavier winter rains. Indeed it has been estimated that the rate of warming has been more than twice the global average and that annual precipitation over the last 50-100 years has increased by 20%, but at the same time there have been longer summer droughts (Anon. 2011). Such trends could cause many of the rock seeps that currently support this lichen to contract or disappear during summer or the lichens to be flooded or overgrown by bryophytes following increased heavy rains. Bryophytes belonging to the genera *Scleropodium*, *Porella*, *Anacolia*, *Plagiomnium* compete with *L. platynum* on rock seeps and occupy the same habitats. Any factor that encourages these bryophytes, such as the greater winter rains, as a consequence of climate change, could be a threat to *L. platynum.* The bryophytes may eventually slough off and provide new habitat for *L. platynum* but not enough is known of the biology of either this rare lichen, or of the associated bryophytes, to assess the current threat posed by bryophyte succession.

Leptogium platynum is restricted to a small elevational range, below about 300 m, which generally coincides with the area where base-rich marine sediments were deposited during the Pleistocene. Any future climate warming that obliged *L. platynum* to retreat upwards to cooler, more humid, climates would very likely cause its demise owing to a lack of suitable base-rich rocks for it to colonize.

Finally, as mentioned earlier, the region where *L. platynum* occurs includes areas of rapidly expanding human population that could reduce the available habitat and enhance air pollution. In addition, emissions of ammonia and nitrogenous wastes from modern intensive farming practices pose a further threat to this species in some portions of its range.

PROTECTION, STATUS, AND RANKS

Legal protection and status

Leptogium platynum receives no legal protection at the present time – either in Canada or in the American portion of its range.

Non-legal status and ranks

In British Columbia, *L. platynum* has recently been ranked as S1S2 by the British Columbia Conservation Data Centre (BC CDC; Jenifer Penny, pers. comm. 2009). NatureServe currently accords it a global ranking of GU and a national ranking of NNR. In Oregon, it has received an S1S2 status from the Oregon Natural Heritage Program. No status summary for lichens is currently available from either the Washington or California Natural Heritage Programs.

Habitat protection and ownership

To date, *L. platynum* has been located in Canada from a total of seven locations, only three of which are currently known to support this species. All of the latter locations are located in protected areas. One of these (Location 5) is situated in Woodley Range Ecological Reserve, near Ladysmith – whereas the other two (6 and 7) are in provincial parks, i.e., Sooke Potholes Provincial Park, near Sooke, and Goldstream Provincial Park, near Victoria. *Leptogium platynum* has been documented also from two additional protected areas – Sumas Mountain Regional Park near Abbotsford (Location 1) and Lone Tree Hill Regional Park in Victoria (Location 3) – but seems to have disappeared from these locations in recent years. The two remaining locations (2 and 4) are located on private land. One of these locations (2) was revisited (with permission of caretakers), though *L. platynum* was not relocated. The other location (4) was not revisited.

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Trevor Goward began studying lichens in 1976, while completing an undergraduate degree in French and Latin at Mount Allison University, New Brunswick. Since then he has developed and maintained a broad interest in lichen taxonomy and distributional ecology, and has written or co-authored five books on lichens and published about 70 papers in refereed journals. Currently a consulting lichenologist based out of Clearwater, British Columbia, Trevor maintains a special interest in the lichens of oldgrowth forests as well as in the ecology of rare lichens. In 1989, he was appointed as curator of lichens at UBC, a position he has held ever since. Most of his 30,000+ lichen collections are on deposit with the UBC herbarium. Trevor has served on the lichen subcommittee of COSEWIC from 1995 to 2009.

Derek Woods has studied botany and English literature at the University of British Columbia, and is currently at work on a master's degree with a focus on environmental writing. He is an active naturalist and has assisted Trevor Goward on numerous lichenological projects. He lives in East Vancouver.

COLLECTIONS EXAMINED

All known collections of *Leptogium platynum* on deposit at public institutions have been examined in connection with this study. Specimens are listed in Appendix 1.

Appendix 1. Known Canadian collections of *Leptogium platynum.*

Location	Abundance (no. of thalli/ location)	Location Habitat Substrate	Collector Collecting# Date	Determined / Examined by
Location 1	Probably extirpated. (0 thalli)	Lower Fraser Valley, Abbotsford Area: west end of Sumas Mountain: on damp sandstone cliff. Alt: 25 m.	W.B. Schofield 35910 (10 March 1968)	D. Stone 2006, T. Goward 2009
Location 2	Revisited in 2009, but not found. (0 thalli)	Vancouver Island, North Pender Island: Bedwell Harbour, near Wallace Point, protected beach: on shale cliff among moss beside ocean. Alt: 0-2 m.	W.J. Noble 457b (23 May 1974)	W.J. Noble, T. Goward 2009
Location 3	Revisited in 2009, but not found. (0 thalli)	Vancouver Island, Saanich Peninsula: Lone Tree Hill, Highlands. Mainly moss-rock outcrops; very steep; some *Pseudotsuga* and *Quercus*; among moss on shaded and slanting igneous rocks. Alt: 360 m.	W.J. Noble 4073 (5 June 1975)	W.J. Noble, T. Goward 2009
Location 4	Not Revisited in 2009: accessible through private property. (N/A)	Vancouver Island, Metchosin area: Mount Metchosin, on *Pseudotsuga–Quercus* outcrop; on shaded cliff. Alt: 200 m	W.J. Noble 4195 (9 June 1975)	W.J. Noble, T. Goward 2009
Location 5	Revisited in 2009, and refound. (35 thalli)	Vancouver Island, Ladysmith area: Across harbour from Ladysmith, Woodley Range cliffs; among moss on vertical sandstone drip cliff. Alt: 150-180 m	W.J. Noble 4496, 4510 (24 June 1975) D. Woods 246 (26 August 2009)	W.J. Noble, D. Woods, T. Goward 2009
Location 6	Visited only once. (35 thalli)	Vancouver Island, Sooke area: Sooke Potholes: below lower parking area: Open mossy, seepy canyon outcrops on moderately calcareous rock. Alt: 30 m.	T. Goward 09-243, 09-251, 09-294 (11 May 2009)	T. Goward 2009
Location 7	Visited only once. (300 thalli)	Vancouver Island, Victoria area: Mt Finlayson: lower west slopes: Sparse woods on slopes, and open rock outcrops, calcareous rock. Alt: 100 m.	C.R. Björk 18213, 18219 (13 May 2009)	C. Björk, T. Goward 2009