

# Management Plan for the Oldgrowth Specklebelly Lichen (*Pseudocyphellaria rainierensis*) in Canada

## Oldgrowth Specklebelly Lichen



© Stephen Sharnoff

2016



**Recommended citation:**

Environment Canada. 2016. Management Plan for the Oldgrowth Specklebelly Lichen (*Pseudocyphellaria rainierensis*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. 3 pp. + Annex.

For copies of the management plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)<sup>1</sup>.

**Cover illustration:** © Stephen Sharnoff

Également disponible en français sous le titre  
« Plan de gestion pour la pseudocyphellie des forêts surannées  
(*Pseudocyphellaria rainierensis*) au Canada [Proposition] »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2016. All rights reserved.

ISBN

Catalogue no.

*Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.*

---

<sup>1</sup> <http://www.registrellep-sararegistry.gc.ca>

MANAGEMENT PLAN FOR THE OLDGROWTH  
SPECKLEBELLY LICHEN (*Pseudocyphellaria rainierensis*)  
IN CANADA

2016

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia* (Part 2) under section 69 of the *Species at Risk Act* (SARA). Environment Canada has included a federal addition (Part 1) which completes the SARA requirements for this management plan.

The federal management plan for the Oldgrowth Specklebelly Lichen in Canada consists of two parts:

Part 1 – Federal Addition to the *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia*, prepared by Environment Canada.

Part 2 – *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia*, prepared by British Columbia Ministry of Environment.

## Table of Contents

Part 1 – Federal Addition to the *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia*, prepared by Environment Canada

Preface .....	2
Additions and Modifications to the Adopted Document.....	3
1.0 Effects on the Environment and Other Species.....	3

Part 2 – *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia*, prepared by B.C. Ministry of Environment

**Part 1 – Federal Addition to the *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia*, prepared by Environment Canada.**

## Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)<sup>2</sup> agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c. 29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Oldgrowth Specklebelly Lichen and has prepared the federal component of this management plan (Part 1) as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with the British Columbia (B.C.) Ministry of Environment. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for the content. The B.C. Ministry of Environment led the development of the attached management plan for the Oldgrowth Specklebelly Lichen (Part 2) in cooperation with Environment Canada and the Parks Canada Agency.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this management plan and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Oldgrowth Specklebelly Lichen and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

---

<sup>2</sup> <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

## Additions and Modifications to the Adopted Document

The following section has been included to address specific requirements of SARA that are not addressed in the *Management Plan for the Oldgrowth Specklebelly (Pseudocyphellaria rainierensis) in British Columbia (Part 2)* and/or to provide updated or additional information.

Under SARA, there are specific requirements and processes set out regarding the protection of species and their habitats. Therefore, statements in the provincial management plan referring to protection of species and their habitats may not directly correspond to federal requirements, and are not being adopted by the competent ministers as part of the federal management plan.

### 1.0 Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)<sup>3</sup>. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s<sup>4</sup> (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of management plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but are also summarized below in this statement.

The provincial management plan for Oldgrowth Specklebelly Lichen contains a short section describing the effects of management activities on other species (i.e., Section 8). The competent ministers adopt this section of the provincial management plan as the statement on effects of management activities on the environment and other species. The distribution of Oldgrowth Specklebelly Lichen overlaps with that of several other federally-listed species at risk on old-growth forests throughout coastal British Columbia including Vancouver Island and Haida Gwaii. Conservation planning activities for Oldgrowth Specklebelly Lichen will be implemented with consideration for all co-occurring species at risk, such that there are no negative impacts to these species or their habitats. Some management actions for Oldgrowth Specklebelly Lichen (e.g., inventory and monitoring, threat mitigation, habitat conservation, education, and research) may promote the conservation of other species at risk that overlap in distribution and rely on similar habitat attributes.

<sup>3</sup> <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

<sup>4</sup> <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1>

**Part 2 - *Management Plan for the Oldgrowth  
Specklebelly (Pseudocyphellaria rainierensis) in  
British Columbia*, prepared by British Columbia  
Ministry of Environment**



# Management Plan for Oldgrowth Specklebelly (*Pseudocyphellaria rainierensis*) in British Columbia



Prepared by the B.C. Ministry of Environment



September 2015

## **About the British Columbia Management Plan Series**

This series presents the management plans that are prepared as advice to the Province of British Columbia. Management plans are prepared in accordance with the priorities and management actions assigned under the British Columbia Conservation Framework. The Province prepares management plans for species' that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

### **What is a management plan?**

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that the target species does not become threatened or endangered. A management plan summarizes the best available science-based information on biology and threats to inform the development of a management framework. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

### **What's next?**

Direction set in the management plan provides valuable information on threats and direction on conservation measures that may be used by individuals, communities, land users, conservationists, academics, and governments interested in species and ecosystem conservation.

### **For more information**

To learn more about species at risk recovery planning in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

**Management Plan for Oldgrowth Specklebelly  
(*Pseudocyphellaria rainierensis*) in British Columbia**

**Prepared by the B.C. Ministry of Environment**

**September 2015**

## **Recommended citation**

B.C. Ministry of Environment. 2015. Management plan for oldgrowth specklebelly (*Pseudocyphellaria rainierensis*) in British Columbia. B.C. Ministry of Environment, Victoria, BC. 18pp.

## **Cover illustration/photograph**

Ryan Batten

## **Additional copies**

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

## **Disclaimer**

The B.C. Ministry of Environment has prepared this management plan as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent oldgrowth specklebelly populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and management approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the conservation of oldgrowth specklebelly.

## **ACKNOWLEDGEMENTS**

Brenda Costanzo (B.C. Ministry of Environment [MOE]) prepared this management plan. Additional assistance was provided by Trevor Goward (Enlivened Consulting Ltd.); Jenifer Penny and Marta Donovan (B.C. Conservation Data Centre); Peter Fielder, Dave Fraser, and Leah Westereng (MOE); and Byron Woods (Ministry of Forests, Lands and Natural Resource Operations). Additional comments by: Paul Johanson [Environment Canada (EC) –Canadian Wildlife Service (CWS) – National Capital Region (NCR), Kella Sadler (EC-CWS-Pacific Yukon Region (PYR), Matt Huntley (EC-CWS-PYR)]. Funding for technical review and threats assessment was provided by the Land Based Investment Strategy.

## EXECUTIVE SUMMARY

Oldgrowth specklebelly (*Pseudocyphellaria rainierensis*) is a leafy lichen, typically found growing on amabilis fir trees, in close association with yellow cedar, in old-growth rainforests of western North America.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated oldgrowth specklebelly as Special Concern due to the loss of old-growth forests. As well, the species has low dispersal ability and is restricted to nutrient hotspots such as dripzones under old yellow-cedars, toe slope positions, and sheltered seaside forests. It is listed as Special Concern in Canada on Schedule 1 of the *Species at Risk Act* (SARA). In British Columbia, oldgrowth specklebelly is ranked S2S3 (imperiled to vulnerable) by the B.C. Conservation Data Centre and is on the provincial Blue list. The B.C. Conservation Framework ranks oldgrowth specklebelly as a priority 2 under goals 1 and 3 (1 = contribute to global efforts for species and ecosystem conservation; 3 = maintain the diversity of native species and ecosystems).

The greatest current threat is from logging and wood harvesting.

The management goal is to maintain all known extant populations and any future populations of oldgrowth specklebelly that may be found in British Columbia.

The following management objectives will guide work in the near term:

1. to secure long-term protection<sup>1</sup> for the known populations and habitats of oldgrowth specklebelly;
2. to determine the levels of real and potential threats to this species and its habitat and to mitigate their effects; and
3. to confirm the distribution of oldgrowth specklebelly (including new locations) and to reliably determine population trends through monitoring.

---

<sup>1</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	iii
EXECUTIVE SUMMARY .....	iv
TABLE OF CONTENTS .....	v
1 COSEWIC* SPECIES ASSESSMENT INFORMATION.....	1
2 SPECIES STATUS INFORMATION .....	1
3 SPECIES INFORMATION.....	2
3.1 Species Description.....	2
3.2 Populations and Distribution .....	2
3.3 Habitat and Biological Needs of Oldgrowth Specklebelly .....	8
3.4 Ecological Role.....	8
3.5 Limiting Factors .....	8
4 THREATS .....	9
4.1 Threat Assessment.....	10
4.2 Description of Threats .....	11
5 MANAGEMENT GOAL AND OBJECTIVES .....	13
5.1 Management Goal.....	13
5.2 Rationale for the Management Goal .....	13
5.3 Management Objectives.....	13
6 APPROACHES TO MEET OBJECTIVES.....	14
6.1 Actions Already Completed or Underway .....	14
6.2 Recommended Management Actions.....	15
7 MEASURING PROGRESS.....	16
8 EFFECTS ON OTHER SPECIES.....	16
9 REFERENCES.....	17

## LIST OF TABLES

<b>Table 1.</b> Summary and description of oldgrowth specklebelly populations in B.C. ....	5
<b>Table 2.</b> Threat classification table for oldgrowth specklebelly in British Columbia.....	10
<b>Table 3.</b> Recommended management actions and suggested implementation schedule for oldgrowth specklebelly. ....	15

## LIST OF FIGURES

<b>Figure 1.</b> Oldgrowth specklebelly distribution in North America including the range of amabilis fir and yellow-cedar for comparison (COSEWIC 2010).....	3
<b>Figure 2.</b> Oldgrowth specklebelly distribution in British Columbia (BC CDC 2014). ....	4



# 1 COSEWIC\* SPECIES ASSESSMENT INFORMATION

**Assessment Summary** – April 2010  
**Common Name:** Oldgrowth Specklebelly  
**Scientific Name:** *Pseudocyphellaria rainierensis*  
**Status:** Special Concern  
**Reason for Designation:** This foliose, tree-inhabiting lichen is endemic to old-growth rainforests of western North America. In Canada, it is limited to coastal or near-coastal areas of southern British Columbia. Recent discoveries of additional records have only slightly expanded the known range of occurrence, and the lichen remains threatened by ongoing loss of old growth forests through clear-cut logging. The low dispersal ability of its heavy propagules contributes to its rarity, as does its restriction to nutrient hotspots, such as dripzones under old yellow-cedars, toe slope positions, and sheltered seaside forests. It tends to occur discontinuously and on very few trees in the stands where it is established.  
**Occurrence:** British Columbia  
**Status History:** Designated Special Concern in April 1996. Status re-examined and confirmed April 2010.

\* Committee on the Status of Endangered Wildlife in Canada.

\*\*Common and scientific names reported in this management plan follow the naming conventions of the B.C. Conservation Data Centre, which may be different from names reported by COSEWIC.

# 2 SPECIES STATUS INFORMATION

<b>Oldgrowth specklebelly<sup>a</sup></b>		
<b>Legal Designation:</b>		
<a href="#">FRPA:</a> <sup>b</sup> No	B.C. <i>Wildlife Act</i> : <sup>c</sup> No	<a href="#">SARA:</a> <a href="#">Schedule 1</a> – Special Concern* (2012)
<a href="#">OGAA:</a> <sup>b</sup> No		
<b>Conservation Status<sup>d</sup></b>		
B.C. List : Blue	B.C. Rank: S2S3 (2010)	<a href="#">National Rank:</a> N2N3 (2013)      Global Rank: G3G4 (2006)
Other <a href="#">Subnational Ranks</a> : <sup>e</sup> OR (S3); WA (S2)		
<b>B.C. Conservation Framework (CF)<sup>f</sup></b>		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority: <sup>g</sup> 2 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 2 (2009)
<b>CF Action Groups:</b> <sup>f</sup>	Inventory; Compile Status Report; List under <i>Wildlife Act</i> ; Planning; Send to COSEWIC; Habitat Protection; Species and Population Management; Private Land Stewardship	

<sup>a</sup> Data source: B.C. Conservation Data Centre (2015) unless otherwise noted.

<sup>b</sup> No = not listed in one of the categories of wildlife that requires special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the impacts of oil and gas activities on Crown land under the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).

<sup>c</sup> No = not designated as wildlife under the B.C. *Wildlife Act* (Province of British Columbia 1982).

<sup>d</sup> S = subnational; N = national; G = global; T = refers to the subspecies level; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable.

<sup>e</sup> Data source: NatureServe (2015).

<sup>f</sup> Data source: B.C. Ministry of Environment (2010).

<sup>g</sup> Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

### 3 SPECIES INFORMATION

#### 3.1 Species Description

Oldgrowth specklebelly is a large, blue-gray foliose (leafy) lichen 5–12 cm across with lobes 1.5–3 cm wide. The vegetative body of the lichen including the lobes comprises the thallus. The upper surface is pale greenish-blue, turning creamy brown in the herbarium. The lobes may be slightly dimpled and the margins have small lobules (small outgrowths) and occasionally coral-like isidia (asexual reproductive structures). The lower surface is dull, white to pale brown, with small hairs and numerous white breathing pores. Oldgrowth specklebelly exists as a symbiotic relationship between a fungi and two algal components, the latter being a cyanobacterium (*Nostoc* sp.) and a green algae (COSEWIC 2010). The green algae grows in a continuous layer within the lichen whereas the cyanobacteria form localized nodes.

#### 3.2 Populations and Distribution

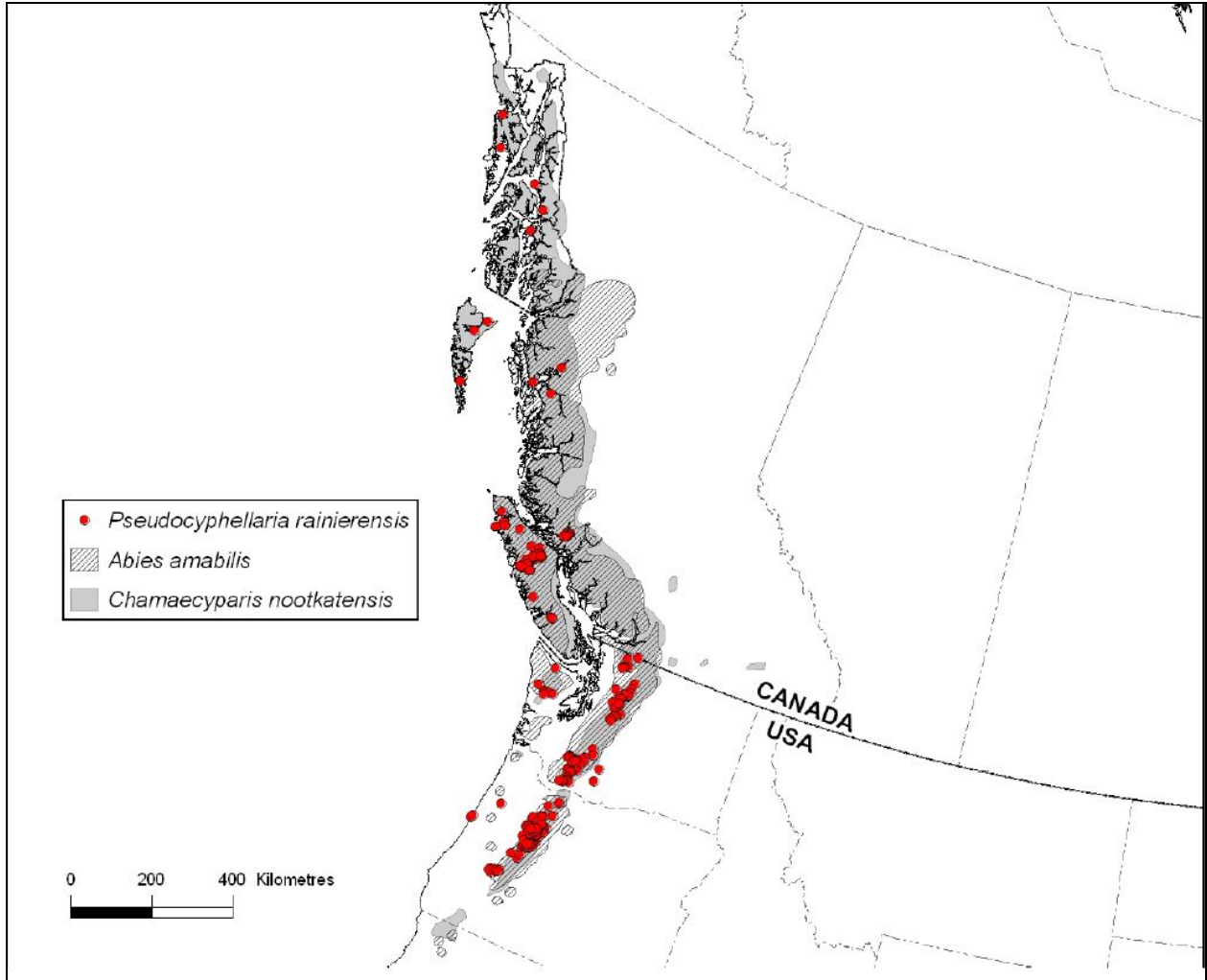
##### Distribution

Oldgrowth specklebelly is endemic to western North America. It occurs in cool, humid coastal regions from southeast Alaska to northern Oregon. In Alaska it is restricted to within a few kilometres of the ocean, though elsewhere it extends inland to the windward slopes of the Insular Mountains and Cascade Ranges. In British Columbia there are approximately 52 populations occurring within the wet cool subzones of the Coastal Western Hemlock zone (CWH) within the distribution areas of *Abies amabilis* (amabilis fir) and *Xanthocyparis nootkatensis* (= *Chamaecyparis nootkatensis*; yellow-cedar) (Figures 1 and 2) (COSEWIC 2010), which are frequently its host tree and/or closely associated species.

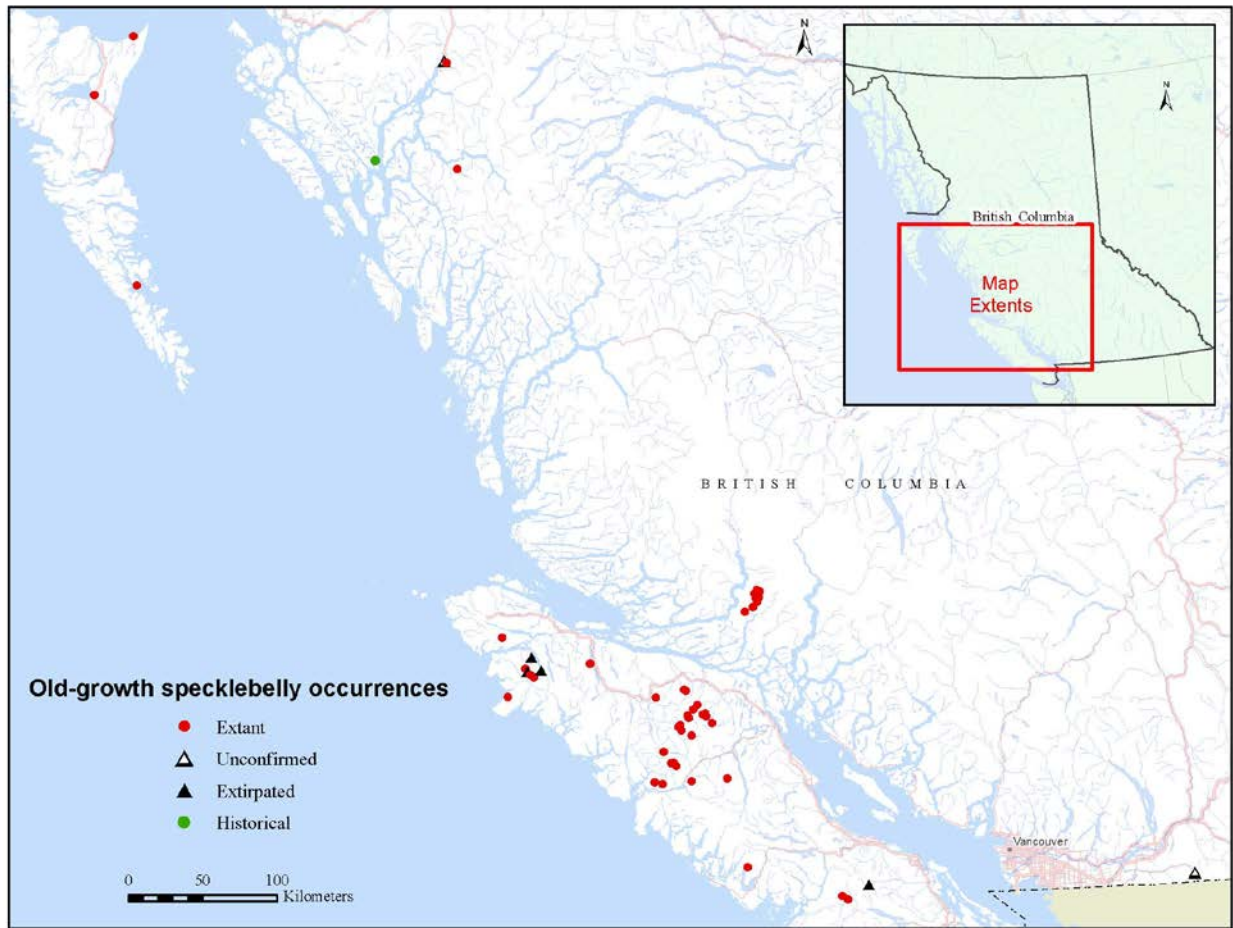
##### Population size

There are 56 reported populations of oldgrowth specklebelly within British Columbia. Four of these populations (EO42, EO44, EO46 and Nanaimo Lakes) are considered extirpated, and one population (Hartley Bay (EO6) is considered historical. Therefore, the current total extant number of known populations is 52. Of the 52 current populations, two have been discovered since the 2010 COSEWIC report: Wolf River in Strathcona Park (EO55) on Vancouver Island and near Kitimat at Minette Bay Creek (EO 54). Two previously known populations one east of Kitimat (EO4) and the other at Chilliwack Lake, Provincial Park (EO2) have not been relocated since surveys for the 2010 COSEWIC status report, and their status is unconfirmed.

Most populations of oldgrowth specklebelly consist of 10–30 thalli, with the exception of two populations Caycuse Creek (EO44) and one 0.3 km west of White River (EO31) that have over 500 thalli each on one or two host trees (COSEWIC 2010). Total thalli count for current populations is 2277.



**Figure 1.** Oldgrowth specklebelly distribution in North America including the range of amabilis fir and yellow-cedar for comparison (COSEWIC 2010).



**Figure 2.** Oldgrowth specklebelly distribution in British Columbia (BC CDC 2014).

**Table 1.** Summary and description of oldgrowth specklebelly populations in B.C.<sup>2</sup>

Geographic Location	Population name (BC CDC occurrence name)	Population status	B.C. CDC EO# <sup>a</sup>	COSEWIC site #	Dates observed/ Number of thalli	Land tenure
Haida Gwaii	Tow Hill Area, Graham Island	Extant	EO5	1	1971; size unknown	Provincial Park
	Kumdis Bay, Graham Island	Extant	EO52	2	2000; size unknown	Unknown
	Bischof Islets, Haida Gwaii	Extant	EO50	3	2003; 15 thalli	National Park
Kitimat	Kitimat, east of	Extant	EO4	4	1970 – 13 thalli; 2008 – 13 thalli	Unknown
	Minette Bay Creek	Extant	EO54	N/A	2013; no count made	Unknown
	Europa Creek	Extant	EO51	5	2007; 6 thalli	Crown land
	Hartley Bay	<b>Historical<sup>b</sup></b>	EO6	50	Unknown	Unknown
Stafford Valley	Mount St. John, west slope	Extant	EO7	39	2009; 172 thalli	WFP TFL 25
	Stafford Lake, 400 m west of	Extant	EO8	40	2009; 10 thalli	WFP TFL 25
	Stafford River, .5 km east of	Extant	EO9	41	2009; 6 thalli	WFP TFL 25
	Stafford River, 1.3 km east of	Extant	EO13	42	2009; 32 thalli	WFP TFL 25
	Stafford River, 0.5 km west of	Extant	EO14	43	2009; 50 thalli	WFP TFL 25
	Stafford River, 0.37 km east of	Extant	EO12	44	2009; 40 thalli	WFP TFL 25
	Stafford River, 1.75 km east of	Extant	EO11	45	2009; 59 thalli	WFP TFL 25
	Stafford River, 0.5 km east of	Extant	EO15	N/A	2009; 4 thalli	WFP TFL 25?
	Stafford River, 0.38 km west of	Extant	EO22	N/A	2009; no counts	WFP TFL 25?
	Stafford River, 0.23 km east of	Extant	EO23	N/A	2009; no counts	WFP TFL 25?
Chilliwack Lake Provincial Park	Chilliwack Lake	Extant	EO2	6	1992 – 3 thalli; 2006 – unknown	Provincial Park
Holberg	Koprino River, 0.73 km south of	Extant	EO47	7	2008; 20 thalli	WFP TFL <sup>c</sup> 6
Port Alice	Kewquodie Creek, 0.6 km east of	Extant	EO45	8	2008; 45 thalli	WFP TFL 6
	Caycuse Creek, 0.1 km west and 1.0 km east of	Extant	EO41	10	2008; 515 thalli	WFP TFL 6
	Teeta Creek	Extant	EO43	9	2005 – 82 thalli; 2006 – 80 thalli	WFP TFL 6
	Port Alice	Extant	N/A	46	2005; 50 thalli	WFP TFL 33
	Coqueis Creek, 0.95 km north of	<b>Extirpated<sup>d</sup></b>	EO46	49	2005; 1 thallus	WFP TFL 43
	Caycuse Creek, 1.2 km east of	<b>Extirpated</b>	EO44	47	2006; no thalli	WFP TFL 33
	Kloutchlimmis Creek, 0.65 m east of	<b>Extirpated</b>	EO42	51	2005: 150 thalli	WFP TFL 33-966

<sup>2</sup> The B.C. Conservation Data Centre has information on 52 element occurrences (EOs), seven of which (EOs 15, 22, 23, 32, 34, 54 and 55) do not match up with the data from the COSEWIC status report population localities (51 in total). Also, four populations from the 2010 status report (COSEWIC populations 26, 36, 46, and 48) do not have enough locational information to match up to an element occurrence record in the B.C. Conservation Data Centre database.

<b>Geographic Location</b>	<b>Population name (BC CDC occurrence name)</b>	<b>Population status</b>	<b>B.C. CDC EO#<sup>a</sup></b>	<b>COSEWIC site #</b>	<b>Dates observed/ Number of thalli</b>	<b>Land tenure</b>
Brooks Peninsula	Kingfisher Cr., Brooks Peninsula	Extant	EO3	11	1977; unknown	Provincial Park
Mt. Waddington	Karmutzen Creek, Vancouver Island	Extant	EO53	12	2010; no counts	WFP TFL 37
Gold River	Kleptee Creek, 3.5 km northwest of	Extant	EO18	13	2008; 5 thalli	WFP TFL 18
	Kleptee Creek, 2 km east of	Extant	EO19	14	2008; 30 thalli	WFP TFL 19
	Bull Lake, 0.3 km east	Extant	EO21	15	2008; 13 thalli	WFP TFL 19
	Upana River, 0.7 km south of	Extant	EO25 partial; EO24	16	2008; 23 thalli	WFP TFL 19
	Upana Lake, 0.5 km south of					
	Upana River, 0.7 km south of	Extant	EO25 partial	17	2008; 12 thalli	WFP TFL 19
	Ucona River, 1.0 km south of	Extant	EO20	18	2008; 45 thalli	WFP TFL 19
	Muchalat River, 5 m west of	Extant	EO49	19	2009; no counts	WFP TFL 19
	Mount Cain	Mount Cain, southwest slopes of	Extant	EO1	20	2006; 30 thalli
Sayward	Compton River, 3.5 km north of	Extant	EO36	21	2009; 15 thalli	WFP TFL 39
	Adam River/Compton Cr., 3.5 km northwest of	Extant	EO35	22	2009; 6 thalli	WFP TFL 39
	Middle Memekay River, 1.4 km south of	Extant	EO39	23	2009; 12 thalli	WFP TFL 39
	White River, 300 m east of	Extant	EO33	24 and 29	2009; 40 thalli	White River Park <b>or</b> WFP TFL 39
	Middle Memekay River, 50 m north of	Extant	EO37	25	2009; 10 thalli	WFP TFL 39
	Sayward (general)	Extant	N/A	26	2009; 30 thalli	WFP TFL 39
	Middle Memekay River, 1.4 km south of	Extant	possibly EO39,	27	2009; 12 thalli	WFP TFL 39
	Memekay River, 1.3 km southeast of		part of EO40			
	Middle Memekay River, 0.75 km north of	Extant	EO38, possibly	28	2009; 50 thalli	WFP TFL 39
	Memekay River, 1.3 km southeast of		part of EO40			
	White River, 0.3 km west of	Extant	EO31	30	2009; 524 thalli	WFP TFL 39
	White River, 1.5 km east of	Extant	EO30	31	2009; 27 thalli	WFP TFL 39
	White River, 0.8 km east of	Extant	EO29	32	2009; 16 thalli	WFP TFL 39
White River, Moakwa Creek, 3 km west southwest of	Extant	EO32	N/A	2008; no counts	WFP TFL 44?	
White River, 30 m west of, White River Prov. Park	Extant	EO34	N/A	2009; 12 thalli	WFP TFL 39	
Gold River	Twaddle Lake, north of	Extant	EO26	33	2007; 10 thalli	WFP TFL 19
	Twaddle Lake, north of	Extant	EO26	34	2008; 41 thalli	WFP TFL 19
	Elbow Creek, 0.5 km west of	Extant	EO27	35	2007; 10 thalli	WFP TFL 19
Wolf River	Wolf Creek, Strathcona Park	Extant	EO55	N/A	2014	Provincial Park

<b>Geographic Location</b>	<b>Population name (BC CDC occurrence name)</b>	<b>Population status</b>	<b>B.C. CDC EO#<sup>a</sup></b>	<b>COSEWIC site #</b>	<b>Dates observed/ Number of thalli</b>	<b>Land tenure</b>
Clayoquot	Clayoquot River	Extant	N/A	36	1996; no counts	Unknown
Port Alberni	Little Nitinat River, 30 m southwest of	Extant	EO16	37	2009; 20 thalli	WFP TFL 44
	Nitinat River, 2.5 km east of	Extant	EO17	38	2009; 105 thalli	WFP TFL 44
	Nanaimo Lakes (Fourth lake)	<b>Extirpated</b>	N/A	48	1950; no counts	WFP TFL 33

<sup>a</sup> Element occurrence: the area of land and/or water in which a species or natural community is, or was present, and represents the fundamental unit of information in the NatureServe methodology (NatureServe 2015). Note: For this species there are no EOs assigned for the numbers 10, 28, or 48.

<sup>b</sup> Historical: Presence has not been verified in the past 20-40 years; effort has been made to relocate occurrences (NatureServe 2015).

<sup>c</sup> Western Forest Products Tree Farm Licence.

<sup>d</sup> Extirpated: Species is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered (NatureServe 2015).

### 3.3 Habitat and Biological Needs of Oldgrowth Specklebelly

Oldgrowth specklebelly occurs in the Coastal Western Hemlock (CWH) BEC zone. It lives on tree branches and trunks of conifers in old-growth forests, particularly in nutrient-rich localities and microsites. Often it occurs in the dripzones of old yellow-cedar trees, at the base of hillsides, and in seaside coves sheltered from strong winds. Other tree species it colonizes are: amabilis fir, subalpine fir (*Abies lasiocarpa* var. *lasiocarpa*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), western red-cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*), mountain hemlock (*Tsuga mertensiana*) and western yew (*Taxus brevifolia*) (COSEWIC 2010). Oldgrowth specklebelly requires open, humid, forest ecosystems; however, both full sunlight exposure and deep shade are harmful to the species.

Oldgrowth specklebelly is nutrient-demanding and establishes exclusively on the bark of conifers with a pH greater than about 5.0. The primary host tree over most of its range is amabilis fir. Yellow-cedar (*Xanthocyparis nootkatensis* = *Chameacyparis nootkatensis*) enhances the nutrient status of trees growing within its dripzone and thus promotes the establishment of oldgrowth specklebelly in habitats where it would otherwise be unlikely to occur (COSEWIC 2010). Yellow-cedar itself rarely acts as a host tree.

Oldgrowth specklebelly exists as a symbiotic relationship between a fungus and two algal components (green algae and cyanobacteria). The fungal component protects the algal component by enveloping it with tissue layers, and provides a steady supply of moisture by conducting water within its cell walls. In turn, the algal or cyanobacteria, through the process of photosynthesis produces sugar and carbohydrates that are used by itself and the fungal partner as an energy source (Brodo et al., 2001).

### 3.4 Ecological Role

Oldgrowth specklebelly may contribute marginally to the nitrogen cycle due to the nitrogen-fixing blue-green algae found on the lobules (COSEWIC 2010).

### 3.5 Limiting Factors

Oldgrowth specklebelly occurs in Canada only in coastal temperate rainforests with trees greater than 200–300 years old and therefore is dependent on old-growth forests (COSEWIC 2010).

Another limitation for oldgrowth specklebelly is its growth form; lichens represent a symbiotic relationship between fungus and algal or cyanobacterial components. It is likely to establish only on trees with a bark pH of greater than 5.0 to facilitate production of nitrogen in an accessible form (COSEWIC 2010). Nutrient enrichment is a rather localized phenomenon within the winter-wet rainforests colonized by Oldgrowth Specklebelly, owing to the tendency of heavy rains to remove nutrients from the system. Only in a small number of nutrient-retentive hotspots do nutrients routinely accumulate to levels likely to promote the establishment of tree-dwelling cyanolichens. Such hotspots tend to arise in one or both of two ways, that is, either from the



interception of marine aerosols, or from the uptake of nutrients from nutrient-rich soil or bedrock. Both mechanisms operate according to the dripzone phenomenon (Goward and Arsenault 2000).

Dispersal of lobules and isidia (outgrowth of thallus containing algal components) is only within short distances, which may be a limiting factor for distribution (COSEWIC 2010; Sillett and Goward, 1998). Reproduction occurs exclusively through the formation and dispersal of lobules or sometimes isidia. These asexual structures must land on and then affix to a branch segment or trunk that is in a location which provides the optimal combination of light, exposure to wetting, ecological stability and (in the case of conifers) nutrient enrichment. The first three requirements are easily met in most oldgrowth forests, but the fourth – nutrient enrichment – is limiting for this species and must further account for its highly discontinuous distribution. Possibly the relative rarity of oldgrowth specklebelly in the northern portions of its range – including Haida Gwaii – is related at least in part to the absence here of its primary host tree, amabilis fir, as well as to the comparatively recent arrival of its primary facilitator, yellow-cedar (COSEWIC 2010).

## 4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.<sup>3</sup> Threats do not include limiting factors, which are presented in Section 3.5.<sup>4</sup>

---

<sup>3</sup> Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are taken into consideration when determining long- and/or short-term trend factors (Master *et al.* 2012).

<sup>4</sup> It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts (e.g., inbreeding depression, small population size, and genetic isolation).

### 4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre. For a detailed description of the threat classification system, see the Open Standards website (Open Standards 2014). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from scope and severity. For information on how the values are assigned, see [Master et al. \(2012\)](#) and table footnotes for details. Threats for the oldgrowth specklebelly were assessed for the entire province (Table 2).

**Table 2.** Threat classification table for oldgrowth specklebelly in British Columbia.

Threat #	Threat description	Impact <sup>a</sup>	Scope <sup>b</sup>	Severity <sup>c</sup>	Timing <sup>d</sup>	Population(s)
3	Energy production & mining	Negligible	Negligible	Extreme	High-moderate	
3.2	Mining & quarrying	Negligible	Negligible	Extreme	High-moderate	One population Europa Creek (EO 51)
3.3	Renewable energy	Negligible	Negligible	Extreme	High-moderate	One population Europa Creek (EO 51)
4	Transportation & service corridors	Low	Small	Extreme	High	
4.1	Roads & railroads	Low	Small	Extreme	High	All except 4–5 sites located in parks
4.2	Utility & service lines	Negligible	Negligible	Extreme	High	One population Europa Creek (EO 51)
5	Biological resource use	Medium	Restricted	Extreme	High	
5.3	Logging & wood harvesting	Medium	Restricted	Extreme	High	All except 4–5 sites located in parks
10	Geological events	Low	Small	Extreme	Moderate	
10.2	Earthquakes/tsunamis	Low	Small	Extreme	Moderate	Coastal sites on Vancouver Island and Haida Gwaii
10.3	Avalanches/landslides	Negligible	Negligible	Extreme	High	Coastal sites on Vancouver Island
11	Climate change & severe weather	Low	Small	Serious-slight	High	
11.4	Storms & flooding	Low	Small	Serious-slight	High	Coastal sites on Vancouver Island

<sup>a</sup> **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on severity and scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment time (e.g., timing is insignificant/negligible (past threat) or low (possible threat in long term); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

<sup>b</sup> **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species’ population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

<sup>c</sup> **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. For this species a generation time of 30 years [T. Goward, pers. comm., 2014] was used resulting in severity being scored over a 100-year timeframe. Usually measured as the degree of reduction of the species’ population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

<sup>d</sup> **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [ $< 10$  years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

## 4.2 Description of Threats

The overall province-wide Threat Impact for this species is High.<sup>5</sup> This overall threat considers the cumulative impacts of multiple threats. The greatest threat is from logging and wood harvesting (Table 2). Details are discussed below under the Threat Level 1 headings.

### IUCN-CMP Threat 3. Energy production & mining

#### 3.2 Mining & quarrying

Aggregate mining may occur at one locality near Kitimat at Europa Creek (EO51) (COSEWIC 2010). As well, if any mining did occur, the area would likely be logged first, host trees for oldgrowth specklebelly would be removed, and fragmentation of habitat increased.

#### 3.3 Renewable energy

Numerous independent power projects (IPPs) have been applied for across the province, which could potentially affect oldgrowth specklebelly in several ways. One is the removal of waterfall mist, which is known to provide essential habitat for rare lichens through a combination of nutrient enhancement, thermal moderation, and ongoing moisture supply (Bjork *et al.* 2009). As well, building of the IPPs would involve removal of trees, which could include host trees for oldgrowth specklebelly. Currently one locality at Europa Creek (EO51) has a hydroelectric development (COSEWIC 2010). Because IPPs generally occur in valley bottoms, tree removal associated with road building has a potential to curtail dispersal by this species. The resulting increased fragmentation could decrease the ability of the species to disperse into adjacent forests due to increased edge effect (T. Goward, pers. comm., 2014). As well, the increase in edge effect would raise the light levels and decrease humidity, thereby decreasing the amount of suitable habitat.

### IUCN-CMP Threat 4. Transportation & service corridors

#### 4.1 Roads & railroads

Roads that are developed for logging will affect oldgrowth specklebelly, in particular since both the species and mainline logging roads generally occur in valley bottoms. On the north part of Vancouver Island, recent logging roads in this area of high incidence of the species could have removed thousands of individual lichens. Fragmentation of the habitat by logging roads decreases the ability of the species to disperse into adjacent forests, and also decreases the amount of suitable habitat available for the species to colonize (T. Goward, pers. comm., 2014).

#### 4.2 Utility & service lines

As every IPP will have a utility corridor associated with it, the establishment of such a corridor could potentially remove habitat of oldgrowth specklebelly and would increase the edge effects

---

<sup>5</sup> The overall threat impact was calculated following Master *et al.* (2012) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 1 Medium, 3 Low (Table 2). The overall threat considers the cumulative impacts of multiple threats.

as described above when it occurs in that same area.

## **IUCN-CMP Threat 5. Biological resource use**

### 5.3 Logging & wood harvesting

Although some proportion of the locations are in old growth management areas (six populations), in wildlife tree retention areas<sup>6</sup> (WTRAs) (six populations), and riparian reserve zones (six populations), these areas have no legislated protection<sup>7</sup> at this time under the *Forest and Range Practices Act*. As such, of the 52 extant populations, all but 4–5 are on public lands and subject to logging. Most populations are localities on northern Vancouver Island under an active tree farm license. Logging and wood harvesting will remove host trees as well as habitat-creating trees (e.g., yellow cedar) and therefore reduce suitable habitat for oldgrowth specklebelly. These populations should be monitored from time to time to assess rates of decline from future logging operations (T. Goward, pers. comm., 2014).

## **IUCN-CMP Threat 10. Geological events**

### 10.2 Earthquakes/tsunamis

Low elevation populations along the coast are vulnerable to habitat loss or salt water immersion if a tsunami occurs (e.g., related to predicted strong seismic activity off southern Vancouver Island (Province of B.C. n.d.). The Haida Gwaii populations on Graham Island (Tow Hill area - EO5 and Kumdis Bay - EO52) would likely be extirpated by such an event.

### 10.3 Avalanches/landslides

On mainland localities landslides could be caused by torrential rain events as well as by slope destabilization in connection with logging road construction. The coastal locations are already exposed to drenching winter storms and with climate change these events are expected to increase in frequency and severity (Gayton 2008). Avalanches or landslides would remove the habitat for the host trees and therefore would be no habitat for oldgrowth specklebelly growth and reproduction.

## **IUCN-CMP Threat 11. Climate change & severe weather**

### 11.4 Storms & flooding

Loss of host trees during storms and flooding has a potential to negatively impact oldgrowth specklebelly. As well, field observations suggest that oldgrowth specklebelly is sensitive to continuous exposure to rainwater during prolonged winter storms. Increasing severity of winter storms along the coast has a potential to result in its loss from some locations (T. Goward, pers. comm., 2014).

---

<sup>6</sup> Note that WTRAs can be patches or single trees/clumps of trees.

<sup>7</sup> These OGMAs are “non-legal” as they have not been declared in an old-growth order under FRPA.

## 5 MANAGEMENT GOAL AND OBJECTIVES

### 5.1 Management Goal

To maintain all known extant populations and any future populations of oldgrowth specklebelly that may be found in British Columbia.

### 5.2 Rationale for the Management Goal

The overall goal is to maintain all known extant populations of the species within British Columbia. This includes the current extant populations as well as any populations that are found in the future. No quantitative management goal is possible for oldgrowth specklebelly as basic population demographics and trends are unknown for all populations. As with many other rare plant species, we lack adequate information about the historical distribution of oldgrowth specklebelly, however, it was likely never more widespread. Given this species' dependence on fragmentation for dispersal (i.e., it's a very slow disperser), and given that it grows more or less exclusively in oldgrowth forests not prone to large-scale disturbance, it has likely been expanding its range gradually over the past 10,000 years since deglaciation( T. Goward, pers. comm. 2015).

This lichen is endemic to western North America. All 56 reported populations in Canada occur in British Columbia in a limited area along coastal areas of the southern portion of the province. Habitat loss is likely to result from logging and wood harvesting, and the low dispersal ability of this lichen contributes to its rarity. As well, habitats containing nutrient hotspots, such as dripzones that occur under old yellow cedar in sheltered seaside forests are limited (COSEWIC 2010).

Conservation of this species should focus on improving the probability that it will persist in the wild. However, to prevent oldgrowth specklebelly from becoming threatened or endangered, all known extant populations should be maintained. Once the knowledge gaps have been fulfilled, the goal can be refined.

### 5.3 Management Objectives

The following management objectives will guide work in the near term:

1. to secure long-term protection<sup>8</sup> for the known populations and habitats of oldgrowth specklebelly;
2. to determine the levels of real and potential threats to this species and its habitat and to mitigate their effects; and

---

<sup>8</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas.

3. to confirm the distribution of oldgrowth specklebelly (including any new populations) and to reliably determine population trends through monitoring.

## 6 APPROACHES TO MEET OBJECTIVES

### 6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2010). Status of the action group for this species is given in parentheses.

#### **Compile Status Report (complete)**

- COSEWIC report completed (COSEWIC 2010). Update due 2020.

#### **Send to COSEWIC (complete)**

- Oldgrowth specklebelly assessed Special Concern (COSEWIC 2010). Re-assessment due 2020.

#### **Planning (complete)**

- B.C. Management Plan completed (this document, 2015).

#### **Habitat Protection and Private Land Stewardship (in progress)**

- Three or four localities are within provincial parks and have some protection under the provisions of the B.C. *Park Act*.
- One locality is within a national park and is afforded habitat protection under the *National Parks Act*.
- Eighteen localities on northern Vancouver Island have partial protection within: (1) wildlife tree retention areas (six localities); (2) old-growth management areas (six localities); and (3) riparian reserve zones (six localities).

## 6.2 Recommended Management Actions

**Table 3.** Recommended management actions and suggested implementation schedule for oldgrowth specklebelly.

<b>Recovery objective</b>	<b>Actions to meet objectives</b>	<b>Threat<sup>a</sup> or concern addressed</b>	<b>Priority<sup>b</sup></b>
1	Determine land tenure	ALL	Essential
	Establish appropriate protection mechanisms depending on type of ownership	ALL	Essential
1, 2	Encourage landowners and land managers to steward and manage lands for the persistence of the species.	4,1; 5.3	Essential
	Inform landowners and land managers on the location of this species on their lands.	4.1; 5.3	Essential
	Develop best management practices for mitigating threats.	4.1; 5.3	Essential
	Determine appropriate measures to protect habitat at an ecosystem-level approach. When the species is recorded on Crown lands, initiate protection measures under existing legislation and government policy.	4.1; 5.3	Essential
	Monitor locations to assess the status of populations and the effects of any management activities taken to protect habitat.	4.1; 5.3	Necessary
2	Assess and monitor the threats to determine if they are potential or real.	4.1; 5.3; 10.3; 11.4	Necessary
3	Survey potentially suitable locations and extant populations in B.C.	Inventory	Necessary
	Develop and implement a monitoring protocol that provides reliable estimates of population size (including thallus size) and detects threats at each known location.	4.1; 5.3; 10.3; 11.4	Necessary
	Monitor status of population and threats at extant locations every 5 years.	4.1; 5.3; 10.3; 11.4	Necessary
	Report monitoring results and implement threat mitigation if necessary.	4.1; 5.3; 10.3; 11.4	Beneficial

<sup>a</sup> Threat numbers according to the IUCN-CMP classification (see Table 2 for details).

<sup>b</sup> Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

## 7 MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the management goal and objectives. Performance measures are listed below for each objective with the target of achieving each stated measureable within the next five years.

### Measurable(s) for Objective 1

- Mechanisms have been initiated to protect the habitat of locations.
- At least five locations have stewardship agreements or management plans in place for the protection of the species.

### Measurable(s) for Objective 2

- The main threats have been assessed and a plan developed to implement the mitigation of threats.

### Measurable(s) for Objective 3

- Extant locations have been inventoried and monitored for population size and trend.

## 8 EFFECTS ON OTHER SPECIES

Conservation planning and management for this species is not anticipated to effect other species, either positively or negatively, in the near term. Potentially co-occurring species at risk include the provincially red-listed Northern Goshawk laingi subspecies (*Accipiter gentilis laingi*), blue-listed Marbled Murrelet (*Brachyramphus marmoratus*) and red-listed Dromedary Jumping Slug (*Hemphillia dromedarius*). Conservation and management activities for oldgrowth specklebelly will be implemented with consideration for all co-occurring species at risk, such that there are no negative impacts to co-occurring species at risk for their habitats.



## 9 REFERENCES

- B.C. Conservation Data Centre. 2015. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <<http://a100.gov.bc.ca/pub/eswp/>> [Accessed July 7, 2014]
- B.C. Ministry of Environment. 2010. Conservation framework. B.C. Min. Environ., Victoria, BC. <<http://www.env.gov.bc.ca/conservationframework/index.html>> [Accessed July 7, 2014]
- Brodo, I.M., S.D. Sharnoff, S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven and London.
- Bjork, C.R., T. Goward, and T. Spribille. 2009. New records and range extensions of rare lichens from waterfalls and sprayzones in inland British Columbia, Canada. *Evansia* 26(4):219–224.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2010. COSEWIC assessment and status report on the Oldgrowth Specklebelly *Pseudocyphellaria rainierensis* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii +38 pp. <[www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)> <[www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)> [Accessed July 7, 2014]
- Gayton, D. 2008. Impacts of climate change on British Columbia's biodiversity – a literature review. FORREX publications, Kamloops, BC. <[http://www.forrex.org/sites/default/files/forrex\\_series/FS23.pdf](http://www.forrex.org/sites/default/files/forrex_series/FS23.pdf)> [Accessed Oct. 22, 2014]
- Goward, T. and A. Arsenault. 2000. Cyanolichen distribution in young unmanaged forests: a dripzone effect? *The Bryologist* 103: 28-37.
- Master, L.L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. NatureServe conservation status assessments: factors for evaluating species and ecosystems at risk. NatureServe, Arlington, VA. <[http://www.natureserve.org/sites/default/files/publications/files/natureserveconservation\\_statusfactors\\_apr12\\_1.pdf](http://www.natureserve.org/sites/default/files/publications/files/natureserveconservation_statusfactors_apr12_1.pdf)> [Accessed July 10, 2014]
- NatureServe. 2015. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, VA. <<http://www.natureserve.org/explorer>> [Accessed March 19, 2015]
- Open Standards. 2014. Threats taxonomy. <<http://cmp-openstandards.org/using-os/tools/threats-taxonomy/>> [Accessed July 10, 2014]
- Province of B.C. n.d. Emergency management B.C. Tsunami-safe. <<http://embc.gov.bc.ca/em/tsunamis/impact.htm>> [Accessed October 20, 2014]
- Province of British Columbia. 1982. Wildlife Act [RSBC 1996] c. 488. Queen's Printer, Victoria, BC. <[http://www.bclaws.ca/EPLibraries/bclaws\\_new/document/ID/freeside/00\\_96488\\_01](http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01)> [Accessed July 7, 2014]
- Province of British Columbia. 2002. Forest and Range Practices Act [RSBC 2002] c. 69. Queen's Printer, Victoria, BC. <[http://www.bclaws.ca/EPLibraries/bclaws\\_new/document/ID/freeside/00\\_02069\\_01](http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01)> [Accessed July 7, 2014]

- Province of British Columbia. 2008. Oil and Gas Activities Act [SBC 2008] c. 36. Queen's Printer, Victoria, BC.  
<[http://www.bclaws.ca/EPLibraries/bclaws\\_new/document/ID/freeside/00\\_08036\\_01](http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_08036_01)> [Accessed July 7, 2014]
- Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H.M. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. *Conserv. Biol.* 22:897–911.
- Sillett, S.C. 1995. Branch epiphyte assemblages in the forest interior and on the clearcut edge of a 700-year-old Douglas-fir canopy in Oregon. *Bryologist* 98(3):301–312. In Bureau of Land Management. ND. Management recommendations for *Pseudocyphellaria rainierensis* Imshaug. Version 2.0.  
<[http://www.blm.gov/or/plans/surveyandmanage/MR/Lichens/PSRA\\_V2.pdf](http://www.blm.gov/or/plans/surveyandmanage/MR/Lichens/PSRA_V2.pdf)> [Accessed July 7, 2014]
- Sillett, S.C. and T. Goward. 1998. Ecology and conservation of *Pseudocyphellaria rainierensis*, a Pacific Northwest Endemic Lichen. Pages 377-378 in M.G. Glenn, R.C. Harris, R. Dirig and M.S. Cole (eds.) *Lichenographia Thomsoniana: North American Lichenology in Honour of John W. Thomson*. Mycotaxon, Ltd., Ithaca, New York.

### **Personal Communications**

Trevor Goward, Enrichened Consulting Ltd., Clearwater, BC.