COSEWIC
Assessment and Status Report

on the

Coastal Wood Fern
Dryopteris arguta

in Canada

SPECIAL CONCERN
2021

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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Previous report(s):

COSEWIC. 2001. COSEWIC assessment and status report on the coastal wood fern *Dryopteris arguta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 16 pp.

Jamieson, J.A. and G.W. Douglas. 1998. COSEWIC status report on the coastal wood fern *Dryopteris arguts* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-14 pp.

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COSEWIC
Assessment Summary

Assessment Summary – April 2021

Common name
Coastal Wood Fern

Scientific name
Dryopteris arguta

Status
Special Concern

Reason for designation
This Pacific North American fern reaches its northern limit on the Gulf Islands of southwestern British Columbia where it occurs in small subpopulations within rugged and forested coastal habitat. Although the species occurs in a very geographically restricted area, the population appears to be relatively stable and is not currently at high risk of decline due to natural or anthropogenic means. Invasive plants and unintentional trampling by recreationalists have been noted. Although the threat impact is presently considered to be low, introduced fungal pathogens, and increased drought and intensive fire associated with climate change are possible future threats.

Occurrence
British Columbia

Status history
Designated Special Concern in April 1998. Status re-examined and confirmed in November 2001 and May 2021.

COSEWIC
Executive Summary

Coastal Wood Fern
Dryopteris arguta

Wildlife Species Description and Significance

Coastal Wood Fern is an evergreen fern, 25-90 cm tall, that grows from a thick, creeping rhizome. The leathery blades are twice divided with deeply cut pinnae and the pinnules have small teeth along the margin. There are lance-shaped, chestnut-coloured scales on the rhizomes, stipes, and underside of the pinnae.

Coastal Wood Fern is at the northern limit of its range in Canada and it forms a unique community element in northern Garry Oak ecosystems. The thick rhizomes provide important erosion control on steeply sloping habitat.

Distribution

Globally, Coastal Wood Fern is found from southwestern British Columbia, through Washington, Oregon and California, inland in Arizona and Nevada, and south into northern Mexico. In Canada, the distribution of Coastal Wood Fern is limited to Denman and Hornby islands and several smaller islands in the Ballenas-Winchelsea group off the coast of Nanoose, with one subpopulation on southeastern Vancouver Island.

Habitat

Coastal Wood Fern grows in coastal wooded slopes under forest canopies and in shrub-dominated areas along rocky coastal bluffs. Most subpopulations are found on sandstone, sedimentary rocks, marine clay or middens with very dry to moderately dry and rapidly drained soils. The aspect is usually southwest to southeast although on the smaller islands, the aspect is more variable. Elevation ranges from 1 m to 115 m, with most plants occurring less than 20 m above sea level. On Denman and Hornby islands, most subpopulations occur on steep slopes (up to 75%), whereas on the smaller islands, slopes are more gentle.

Biology

Coastal Wood Fern plants take 1 to 5 years to reach maturity and each fertile frond can produce up to 15 million wind-dispersed spores. Spores likely form persistent soil spore banks and remain viable for three years or more. Most spores are dispersed over short distances but with favourable conditions, long-range dispersal can occur. Primary

reproduction is via elongation of the rhizome. Coastal Wood Fern can survive drought conditions because of its high tolerance for low water potentials (resistance to drought-induced embolism) and the presence of tracheids, which act as back-up xylem transport system.

Population Sizes and Trends

Population size is difficult to determine for this species because of the rhizomatous growth form. In 2018, the number of mature individuals in Canada was estimated to be between 10,445-16,780 crowns. There is no obvious increase or decrease in the area or number of plants since the plants were last surveyed in 2007, prior to the preparation of the management plan. There are 13 known subpopulations in Canada.

Threats and Limiting Factors

Many Coastal Wood Fern subpopulations are on steep terrain and difficult to access: threats associated with development are minimal although upslope activities may cause erosion on downslope banks. Recreational impacts are limited because of the terrain and because public land managers are aware of these subpopulations. Non-native invasive species including Periwinkle and English Ivy are present at two subpopulations but in most areas, there are few invasive plant species directly next to the ferns. The potential impact of fungal pathogens, Ramorum Blight and Dieback and Phytophthora Root Rot, is unknown. Future outcomes associated with climate change including drought, atypically intensive wildfires, and rising sea level may impact plants.

Protection, Status and Ranks

Coastal Wood Fern is listed as Special Concern on Schedule 1 of the *Species at Risk Act* (SARA). Provincially, it is ranked Vulnerable (S3) by the BC Conservation Data Centre. Four subpopulations occur at least partially in provincial parks, one subpopulation is managed by the Department of National Defence with restricted access, and one island subpopulation is unsurveyed provincial crown land. All of the remaining subpopulations are on privately owned land.

TECHNICAL SUMMARY

Dryopteris arguta

Coastal Wood Fern

Dryoptéride côtière

Range of occurrence in Canada: British Columbia (Southern Vancouver Island and the Gulf Islands)

Demographic Information

Generation time (estimate of age to maturity)	10+ years The average age of parents in the population is expected to be greater because of high longevity
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	No
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	n/a
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	No decline. Inferred stable population
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	No decline. Projected percent in total number of mature individuals stable
[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.	No decline. Inferred percent total number mature individuals stable
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	Not applicable
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	293 km²
Index of area of occupancy (IAO) (Based on a 2 km x 2 km grid over extant observations).	76 km²

Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. No
Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	Concept of locations does not apply.
Is there an [observed, inferred, or projected] decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] decline in number of subpopulations?	No
Is there an [observed, inferred, or projected] decline in number of “locations”*?	No
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes, due to invasive plants at some sites
Are there extreme fluctuations in number of subpopulations?	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 subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
1. Dorcas Point, Vancouver Island	600-1000
2. Amelia and Gerald islands	1200-1700
3. South Ballenas Island	400-600
4. Denman Island, Denman/Buckley Bay Ferry Landing	25-50
5. Denman Island, North of Metcalf Bay	550-750
6. Denman Island, 1 km SSE of Metcalf Bay	250-300
7. Denman Island, Boyle Point, South tip of	400-500
8. Denman Island, Repulse Point	1750-3000
9. Denman Island, Denman Road	180-280
10. Hornby Island, Mount Geoffrey	70-80
11. Hornby Island, Tribune Bay	1200-1500
12. Hornby Island, Downes Point	3800-7000+

* See Definitions and Abbreviations on COSEWIC website and IUCN (Feb 2014) for more information on this term

13. Mistaken Island (last surveyed 1998)	20
Total	10,445-16,780+

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]?	Not known

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes (2019)
The calculated threats impact was Low.

i. Invasive Non-native/Alien Species/Diseases (8.1)
ii. Problematic species/diseases of unknown origin (8.4)
iii. Fire and Fire Suppression (7.1)
iv. Droughts (11.2)

What additional limiting factors are relevant? None

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Secure in Washington state
Is immigration known or possible?	Not known, unlikely in short term; nearest site is about 300 km away
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Are conditions deteriorating in Canada?[+]	No
Are conditions for the source (i.e., outside) population deteriorating?[+]	Unlikely
Is the Canadian population considered to be a sink?[+]	No
Is rescue from outside populations likely?	Unlikely

Data Sensitive Species

Is this a data sensitive species?	No

Status History

COSEWIC Status History: Designated Special Concern in April 1998. Status re-examined and confirmed in November 2001 and May 2021.

[+] See Table 3 (Guidelines for modifying status assessment based on rescue effect)

Status and Reasons for Designation:

Status:	**Alpha-numeric codes:**
Special Concern	Not Applicable

Reasons for designation:
This Pacific North American fern reaches its northern limit on the Gulf Islands of southwestern British Columbia where it occurs in small subpopulations within rugged and forested coastal habitat. Although the species occurs in a very geographically restricted area, the population appears to be relatively stable and is not currently at high risk of decline due to natural or anthropogenic means. Invasive plants and unintentional trampling by recreationalists have been noted. Although the threat impact is presently considered to be low, introduced fungal pathogens, and increased drought and intensive fire associated with climate change are possible future threats.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Although insufficient data to reliably infer, project, or suspect population reduction, the population does not appear to be in decline.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. EOO of 293 km^2 and IAO of 76 km^2 are below the threshold for Endangered, but population is not severely fragmented, does not experience extreme fluctuations, and as most of the distribution of the species is not impacted by significant threats, the concept of location does not apply.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Number of mature individuals is greater than 10,000, exceeding thresholds, and there does not appear to be a continuing decline in the number of mature individuals.
Criterion D (Very Small or Restricted Population): Not applicable. Estimate of greater than 10,000 mature individuals exceeds thresholds for D1, and population is not facing the extremely high risk of extinction required for D2.
Criterion E (Quantitative Analysis): Not applicable. Analysis not conducted.

PREFACE

The previous COSEWIC assessment and status report (COSEWIC 2001) listed 16 subpopulations of Coastal Wood Fern in Canada. In this report, some of the former subpopulations have been lumped together, either because Coastal Wood Fern plants have been observed between subpopulations resulting in more or less continuous distribution or because sites are close enough together that they are now not considered to be distinct subpopulations. The 16 former subpopulations are now considered to be nine. Four new subpopulations have been confirmed since the 2001 COSEWIC report resulting in a total of 13 subpopulations. The discovery of the new subpopulations is thought to represent increased search effort rather than an increase in the distribution of the species.

The current total number of mature individuals is estimated at over 10,445, an increase from the over 5,366 plants documented in the previous status report. The increased number of mature individuals is a direct result of increased search effort rather than an increase in numbers at previously known subpopulations. The higher number of individuals is also related to differences in counting techniques; the previous status report did not outline how individuals of this rhizomatous species were determined. The discovery of new subpopulations has resulted in a slight increase in the extent of occurrence and area of occupancy.

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 (2021)

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.

Environment and Climate Change Canada
Canadian Wildlife Service
Environnement et Changement climatique Canada
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Canada

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

COSEWIC Status Report

on the

Coastal Wood Fern

Dryopteris arguta

in Canada

2021

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Scientific Name: *Dryopteris arguta* (Kaulf.) Watt

Synonyms: *Aspidium argutum* Kaulfuss; *Apsidium rigidum* Hoffm. var. *argutum* D.C. Eaton

Common Name: Coastal Wood Fern, Coastal Shield Fern, Coastal Woodfern, California Wood Fern, Western Wood Fern

Common French Name: Dryoptère Côtière

Family: Dryopteridaceae (Wood Fern Family)

Major Plant Group: Pteridophyte

There are no taxonomic uncertainties but there is confusion over the scientific authority for this species. Morton (1968) suggests *Dryopteris arguta* (Kaulf.) Maxon is the proper authority and it is used by the Flora of North America (Montgomery and Wagner 1993) and the Database of Vascular Plants of Canada (Vascan 2018). However, *Dryopteris arguta* (Kaulf.) Watt is used by ITIS (2018), USDA NRCS (2018), and the BC Conservation Data Centre (2018) and they appear to be correct according to the International Code of Botanical Nomenclature (Turland *et al.* 2018). The Code states that the authorities for the first legitimate designation of a binomial remain unchanged; even though Watt placed the species in *Aspidium* with *Dryopteris* as a section*,* he was the first to describe the species *arguta,* recombining it as a binomial within the previously legitimately described *Dryopteris* (Brunton pers. comm. 2018).

Morphological Description

Coastal Wood Fern is an evergreen, tufted fern, 25-90 (100+) cm tall, that grows from a thick creeping rhizome (Figures 1 and 2) (Montgomery and Wagner 1993; Smith 2012). The petiole is 1/4 to 1/3 the length of the leaf with scattered, light brown scales at the base (Montgomery and Wagner 1993). The leathery blades are twice divided with deeply cut pinnae (primary divisions of a pinnate leaf) and small spreading teeth along the margin of the pinnules (secondary divisions of a pinnate leaf) (Figure 3) (Montgomery and Wagner 1993).

The range of Coastal Wood Fern overlaps with other *Dryopteris* species: Male Fern (*Dryopteris filix-mas*) and Spiny Wood Fern (*Dryopteris expansa*). The fronds are similar to Male Fern and it is sometimes confused with that species. Male Fern has scales on the rhizomes and stipes (stalks) but has linear or hairlike scales on the underside of the pinnae whereas Coastal Wood Fern has lance-shaped, usually chestnut coloured, scales on the rhizomes, stipes, and underside of the pinnae. Male Fern also lacks spines on the teeth of

the pinnules (Montgomery and Wagner 1993; COSEWIC 2001). The sori (cluster of spore-producing receptacles) of Coastal Wood Fern are between the midvein and the pinnule margins and lack glands on the indusia (the thin membrane covering the sorus) (Figure 4) (Montgomery and Wagner 1993).

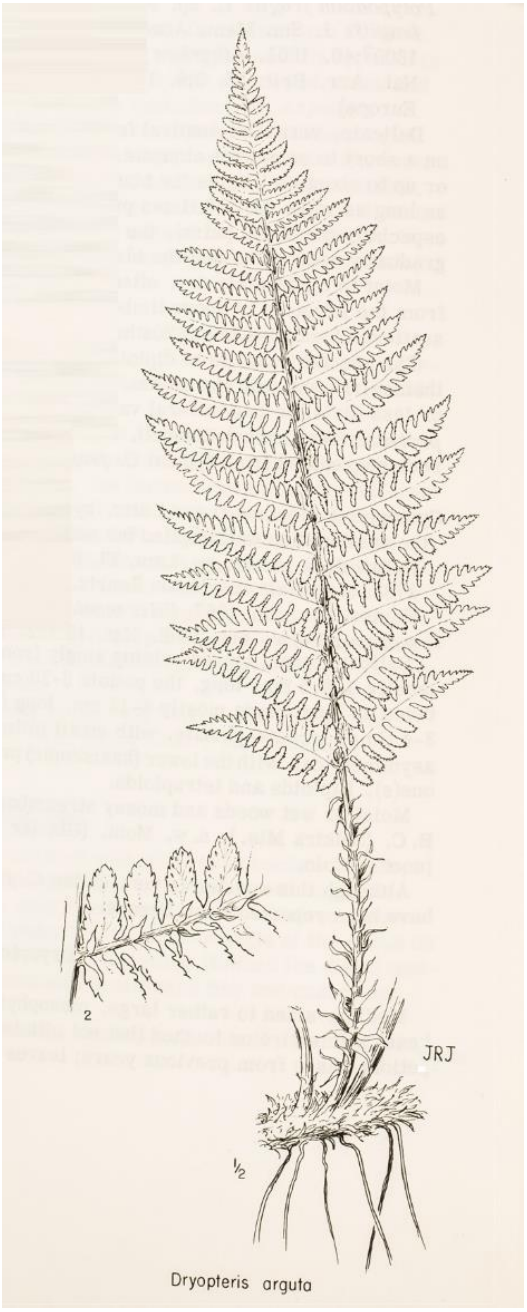

Figure 1. Coastal Wood Fern (*Dryopteris arguta*) by Jeanne R. Janish. Hitchcock, L.C., A. Cronquist and M. Ownbey. Vascular Plants of the Pacific Northwest: Part 1 Vascular Cryptogams, Gymnosperms and Monocotoledons. Pp. 72. © 1969. Reprinted with permission of the University of Washington Press.

Figure 2. Thick rhizome of Coastal Wood Fern linking two ramets. Photo: C. Maslovat (May 28, 2018).

Figure 3. Close up of Coastal Wood Fern blade showing small teeth along the margin of the pinnules. Photo: C. Maslovat (August 28, 2018).

Figure 4. Underside of the pinnae of Coastal Wood Fern showing sori. Photo: C. Maslovat (August 28, 2018).

Population Spatial Structure and Variability

There are 14 species of *Dryopteris* in North America north of Mexico (Montgomery and Wagner 1993). Genetic studies indicate the genus arose 42 million years ago and the North American species evolved over the last 15 million years from multiple, independent geographical separations, either long-distance dispersal events from Asia to Eastern North America or from geographic separation (vicariance) (Sessa *et al.* 2012). Coastal Wood Fern is closely related to the eastern North American species Marginal Wood Fern (*D. marginalis*) (Juslén *et al.* 2001).

Coastal Wood Fern is somewhat variable and it is has been suggested that there may be more than one taxon involved (Montgomery and Wagner 1993). Other *Dryopteris* species are prone to hybridization, but hybrids are not known for Coastal Wood Fern (Montgomery and Wagner 1993).

For Coastal Wood Fern, the COSEWIC term “subpopulation” (COSEWIC 2015) corresponds well to the habitat-based plant element occurrence delimitation standards (NatureServe 2020) where a subpopulation is defined as a group of occurrences that are separated by less than 1 km; or if separated by 1 to 3 km, with no break in suitable habitat between them exceeding 1 km.

Designatable Units

There are no recognized subspecies/varieties or discrete/evolutionary significant populations to be recognized as designatable units. The occurrence of Coastal Wood Fern in Canada is considered one designatable unit.

Special Significance

In Canada, Coastal Wood Fern is at the northern periphery of its range, and it forms a unique community element in northern Garry Oak ecosystems. The cluster of Canadian occurrences is disjunct from the closest confirmed occurrence in Washington State.

The ferns often grow in areas with steep, eroding soils and the thick rhizomes hold soil in place, reducing erosion.

Rhizomes of other *Dryopteris* species were eaten by Northwest Coast Indigenous peoples (Kuhnlein and Turner 1991), but it is unknown if Coastal Wood Fern was used as a traditional food source. Coastal Wood Fern, like all species, is important to Indigenous peoples who recognize all interrelationships within an ecosystem.

DISTRIBUTION

Global Range

Coastal Wood Fern is found in North America from southwestern British Columbia, south through Washington, Oregon, and California, inland in Arizona and Nevada (NatureServe 2018), and south into northern Mexico (Sessa *et al.* 2015) (Figure 5).

The BC population is approximately 300 km disjunct from the closest confirmed population in Thurston County, Washington State (University of Washington Herbarium 2018). The discontinuity was first noted in 1944 (Ewan 1944) and likely represents a real gap in the distribution, rather than a lack of field investigation.

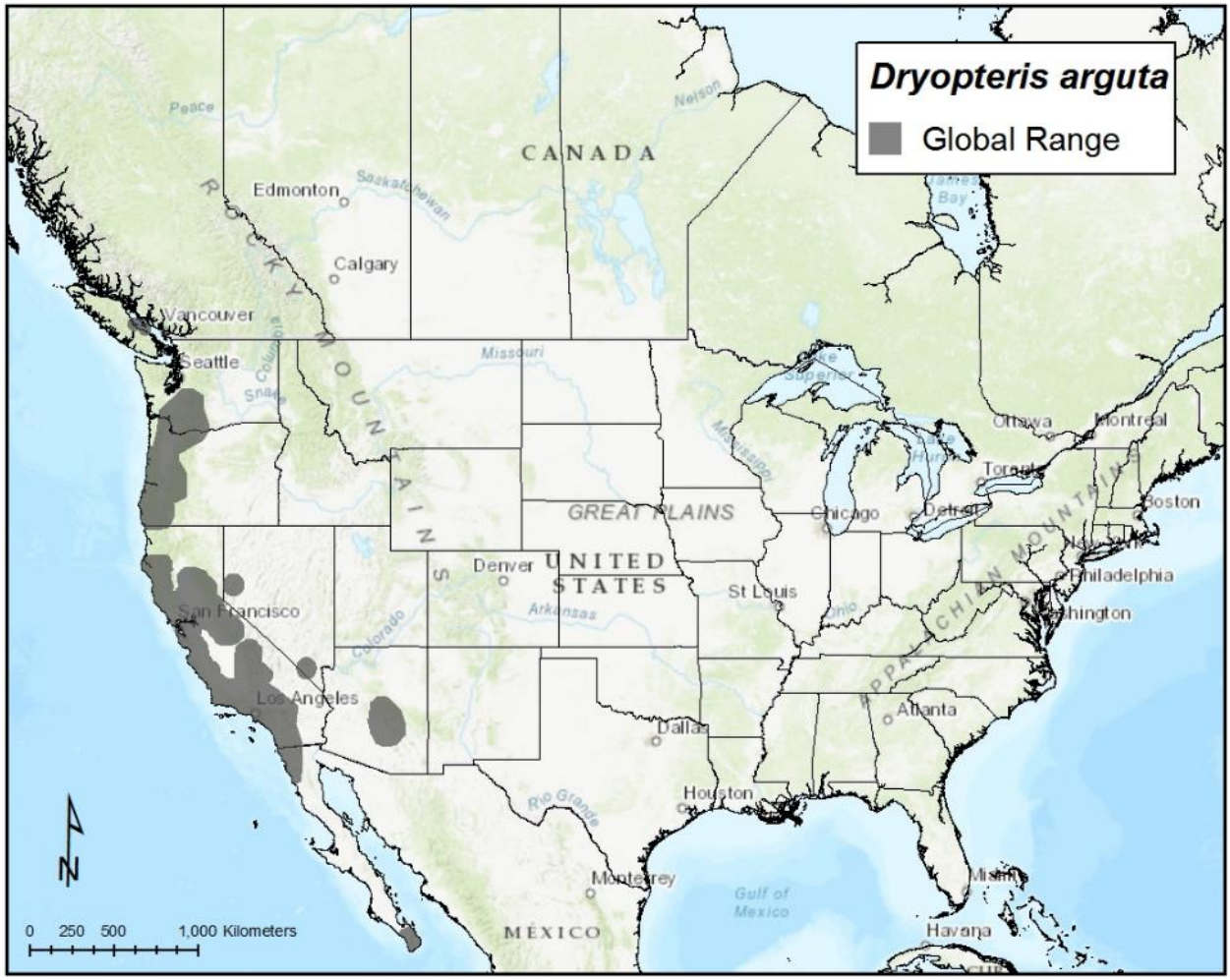

Figure 5. Global distribution of Coastal Wood Fern.

Canadian Range

The earliest confirmed observation of Coastal Wood Fern in Canada is from a herbarium collection on Norman Point, Hornby Island in 1941 by R. Connell (V13644). Ewan (1944) refers to a collection by Anderson dated from 1915 from Mt. Finlayson in Goldstream Provincial Park but this subpopulation was not verified with either a herbarium specimen or later observations. Mt. Finlayson is outside the current Coastal Wood Fern range, and because the subpopulation lacks confirmation it is not included in this report.

In Canada, the distribution of Coastal Wood Fern is limited to Denman and Hornby islands and several smaller islands in the Ballenas-Winchelsea group off the coast of Nanoose. There is one subpopulation on southeastern Vancouver Island at Dorcas Point, opposite South Ballenas Island (Figure 6) (Cody & Britton 1989; BC Conservation Data Centre 2018; Maslovat 2018).

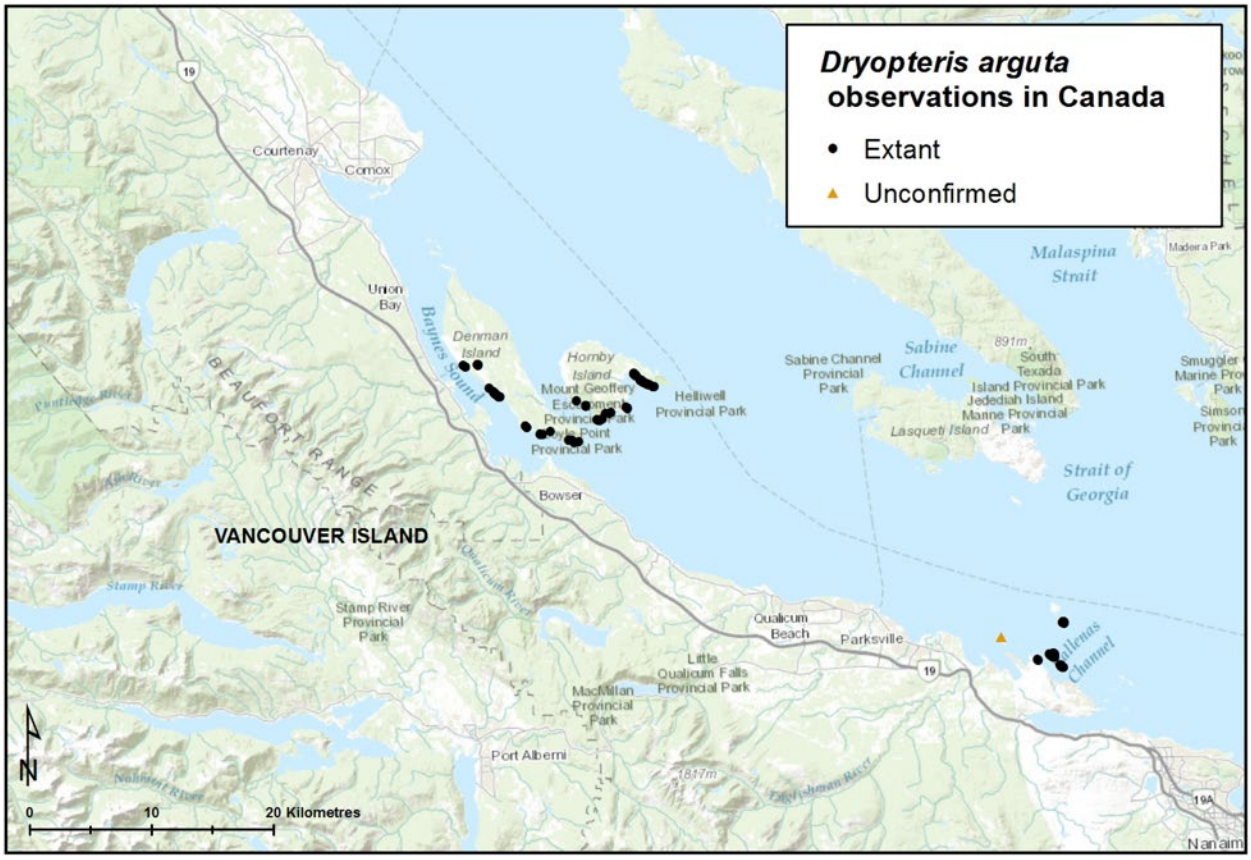

Figure 6. Canadian distribution of Coastal Wood Fern.

Reports of Coastal Wood Fern from mainland British Columbia (e.g., Cody & Britton 1989; Schofield 1991 herbarium collection) have been determined to be misidentifications. There are two herbarium collections from gardens: one from a live specimen sent to University of British Columbia collected from a garden in Victoria (UBC-V38160) and a second collection from a garden on Millstream Road in Victoria (European Nucleotide Archive 2019).

Extent of Occurrence and Area of Occupancy

The extent of occurrence (EOO), based on a minimum convex polygon around extant observations, is 293 km^2. There are large expanses of water between subpopulations. The index of area of occupancy (IAO) based on a 2 km x 2 km grid over the extant observations is 76 km^2 (19 grids).

Search Effort

Within the known EOO, Coastal Wood Fern is limited to specific habitat, which is common on Denman and Hornby islands and in the Ballenas-Winchelsea group but is uncommon on the other Gulf Islands. There has been substantial survey effort for rare plants on southeast Vancouver Island and the Gulf Islands since the early 1980s that would have detected this species if it were present, so it is unlikely that plants will be found outside the current EOO.

Known subpopulations were surveyed in 1996 prior to the preparation of the 2001 COSEWIC Status Report (COSEWIC 2001) and most subpopulations were re-surveyed in 2007 prior to the preparation of the 2010 management plan (Garry Oak Ecosystems Recovery Team 2010). Eleven of the twelve known subpopulations were surveyed in 2018. The landowner for one subpopulation on private land did not respond to a request for surveys. One additional subpopulation was found on Denman Island through contact with the Denman Conservancy Association, for a total of thirteen subpopulations. New clumps of plants were found next to many known subpopulations. Search effort included surveys in other suitable habitat on islands in the Ballenas/Winchelsea archipelago and along the shorelines of Denman and Hornby islands (Maslovat 2018). The total targeted search effort in 2018 included 59.8 km along coastlines with suitable habitat and 80 search hours in potential habitat (Maslovat 2018).

Coastal Wood Fern can be observed year round, although it may be mistaken for other fern species if not examined closely. The steep habitat is often difficult to survey, and it is possible, although unlikely, that there are more undocumented plants in areas that are difficult to access. Potential habitat mapping has not been done.

HABITAT

Habitat Requirements

In Canada, Coastal Wood Fern is limited to the Coastal Douglas-fir Biogeoclimatic Zone Moist Maritime subzone (CDFmm). It grows in coastal wooded slopes under forest canopies of Douglas-fir (*Pseudotsuga menziesii*), Garry Oak (*Quercus garryana*), Big-leaved Maple (*Acer macrophyllum*) or Pacific Arbutus (*Arbutus menziesii*), and in shrub-dominated areas along rocky coastal bluffs. It is often found in the transition between Garry Oak and Douglas-fir communities. Many subpopulations have exposed bare soil in the understorey. Associated plants in the forested subpopulations include Pacific Sanicle (*Sanicula crassicaulis*) and Pink Honeysuckle (*Lonicera hispidula*) and in the more open sites associates include Saskatoon (*Amelanchier alnifolia*) and Oceanspray (*Holodiscus discolor*).

Most subpopulations are found on sandstone, marine clay, or shell middens. Soils are usually very dry to moderately dry and rapidly drained but the fern microsites usually retain more moisture than adjacent sites. The sites (including middens) are often situated below

rock cliffs/outcrops, in areas with subsurface seepage or sites with clay soils (Maslovat pers. obs. 2018). They may also receive moisture from hydraulic lift, which occurs when deep-rooted plants take up water from lower soil layers and release the water into dryer layers closer to the surface (Brooks *et al.* 2006). Plants growing on rocky outcrops and coastal cliffs show more signs of stress, including smaller leaf blades and chlorosis, than plants found in coastal wooded habitats (COSEWIC 2001; McIntosh and Sadler 2011).

Elevation ranges from 1 m to 115 m, with most sites occurring less than 20 m above sea level. Most plants on Denman and Hornby islands occur on steep slopes (50-80%) with southwest to southeast aspects while those on smaller islands generally occur on gentler slopes (0-30%) with variable aspects. For the Vancouver Island subpopulation, the slope ranges from 15-25% and the aspect is northeast (COSEWIC 2001; Maslovat 2018).

In the United States, Coastal Wood Fern is found in a wider range of habitats. It occurs in open to closed canopy forests with Douglas-fir, Pacific Arbutus, Garry Oak, and Big-leaved Maple. It is associated with cliff faces, steep sites, chaparral and next to streams. It is found on granite substrate, on loam or clay soils. It is found at higher elevations (up to 2500 m) than sites in British Columbia (Smith 2012; University of California 2018; University of Washington Herbarium 2018).

Habitat Trends

In Canada, the habitat is naturally fragmented, occurring on islands of varying size. Land use conversion may result in a net decrease in available habitat over time; however, many sites are steep and difficult to develop. There has been no appreciable change in habitat availability since surveys were done in 2007 prior to the preparation of the management plan (Garry Oak Ecosystems Recovery Team 2010; Maslovat pers. obs. 2018).

BIOLOGY

Life Cycle and Reproduction

Coastal Wood Fern is a sexual diploid (2n=82) (Montgomery and Wagner 1993). Some *Dryopteris* species can have high rates of self-fertilization (Tyron 1986; Flinn 2006) but other species maintain mixed or outcrossing mating systems (Barker and Willmot 1985; Soltis and Soltis 1992). Because the species spreads vegetatively, it is difficult to determine the number of genets at each subpopulation and the mating system will determine overall sexual reproductive rates.

Based on the size of the rhizomes and the large number of old petiole bases, Coastal Wood Fern colonies are expected to be long-lived, possibly well over 20 years. The generation length, based on the expected average age of mature plants, is at least 10 years. Plants take 1-5 years to reach maturity and each fertile frond can produce up to 15 million wind-dispersed spores (COSEWIC 2001) with estimates of up to 330 million spores

per plant (Peck *et al.* 1980). In other *Dryopteris* species, the sporangia mature at different times: some of the spores are retained on the fronds and dispersed over the winter and into the following spring (Farrar 1976). In the majority of ferns that release non-green spores (including *Dryopteris*), spore viability averages three years or more (COSEWIC 2001). Ferns typically require moisture and warm temperatures (optimum temperature varies with species) for spore germination (Miller 1968). In other fern genera, spore germination, early gametophyte development and gamete fusion occur when soils are moist in early spring (COSEWIC 2001). *Dryopteris* species can require specific microsites for establishment, created by small-scale changes in microtopography (Flinn 2007).

Dryopteris species can form persistent, widespread soil spore banks and fern spores can remain viable for at least a year buried in the soil (Dyer and Lindsay 1992).

Coastal Wood Fern reproduces vegetatively through elongation of the thick rhizome (COSEWIC 2001). It is difficult to propagate *ex situ* from spores (Fraser pers. comm. 2007; Furman pers. comm. 2007; Wilson pers. comm. 2007) and horticultural propagation is primarily by division of rhizome offshoots in the spring or autumn (Leigh 1999; Furman pers. comm. 2007; Wilson pers. comm. 2007).

Physiology and Adaptability

Coastal Wood Fern is able to survive severe drought conditions (Pitterman *et al.* 2013; Baer *et al.* 2015). Adaptations to drought include a high tolerance for low water potentials (resistance to drought-induced embolism) and the presence of tracheids, which act as back-up xylem transport system during drought stress (Pitterman *et al.* 2013; Baer *et al.* 2015; Holmund *et al.* 2016). It is unknown if the thick rhizome stores water.

Coastal Wood Fern has deep roots (up to 36 cm), which allows plants to access water in deep soil horizons during extreme drought conditions. In southern California, the fronds are drought-deciduous and go dormant in the summer although in other regions they are evergreen all year (Hoshizaki and Wilson 1999).

Dispersal

Most fern spores in temperate forests settle to the ground over relatively short distances (<100 m) (Raynor *et al.* 1976; Peck *et al.* 1990). With favourable conditions, (strong wind, good atmospheric mixing) spores of other *Dryopteris* species may be dispersed long distances to oceanic islands isolated from mainland sources by thousands of kilometres (Tyron 1970; Geiger and Ranker 2005).

Interspecific Interactions

There are no known interspecific interactions for Coastal Wood Fern. The species does not require pollinators and no herbivory was observed during field surveys. There are no known fungal associates in British Columbia.

POPULATION SIZES AND TRENDS

COSEWIC defines population size as the total number of mature individuals of the taxon (COSEWIC 2015). Subpopulations are defined as "geographically or otherwise distinct groups in the population where there is little demographic or genetic exchange" (COSEWIC 2015). For Coastal Wood Fern, the subpopulation definition used is consistent with habitat-based plant element occurrence delimitation standards and is defined as a group of occurrences that are separated by less than 1 km as outlined above (NatureServe 2020).

Sampling Effort and Methods

Surveys were conducted at previously known sites (Table 1) and in adjacent suitable habitat from April to August 2018. Additional areas that appear to have suitable habitat were observed but they were either inaccessible or on private property and permission was not granted. It is possible that additional subpopulations in difficult to access terrain or on private property will be found on currently occupied islands in future.

Table 1 compares the subpopulation names and number of plants counted in 1996 for the previous status report (COSEWIC 2001) and in 2007 for the management plan (Garry Oak Ecosystems Recovery Team 2010) with the most recent data compiled for this report.

Table 1. Comparison of subpopulations and number of plants from previous surveys. Counts prior to 2018 are taken from the Management Plan for the Coastal Wood Fern (*Dryopteris arguta*) in British Columbia (Garry Oak Ecosystems Recovery Team 2010).

Number	Subpopulation Name	COSEWIC 2001 Site Name (#)	Subpopulation Status	Survey History
	Vancouver Island			
n/a	Mount Finlayson, Vancouver Island	Not noted	Not verified	Henry (1915): not verified with herbarium specimen or later observations.
1	Dorcas Point, Nanoose Bay	Dorcas Pt. (#1)	Extant	Taylor (1963): Herbarium specimen Britton and Britton (1978): Herbarium specimen Jamison (1996) observed 7 plants over 10 m^2 Maslovat (2007) observed 2 subpopulations 130 plants over 27 m^2 Maslovat (2018): 600-1000 plants
	Nanaimo District Islands			
2a	Amelia and Gerald islands Site: Gerald Island	Gerald Island (#2)	Extant	Jamison (1996): 300+ plants over 1.5 km^2 Douglas *et al.* (1998): 475 plants in 8 subpopulations over 1540 m^2 Maslovat (2018): 700-100 plants
2b	Amelia and Gerald islands Site: Amelia Island	Not noted but was known (#3)	Extant	Douglas *et al.* (1998): 250 plants in 4 subpopulations over 1500 m^2 Maslovat (2018): 500-700 plants
3	Ballenas Islands, South Ballenas Island	East Ballenas Island (#4)	Extant	Ceska (1995; 1996): no count Jamison (1996): 70+ plants over 50 m^2 Douglas *et al.* (1998): 500 plants in 3 subpopulations Fairbarns and Miller (2005): several thousand fronds over 4000-6000 m^2 Maslovat (2018): 400-600 plants

Number	Subpopulation Name	COSEWIC 2001 Site Name (#)	Subpopulation Status	Survey History
13	Mistaken Island, North End of	Not noted but was known (#5)	Unconfirmed, not surveyed	Douglas *et al.* (1998): 20 plants over 2 m^2
	Denman Island			
4	Denman Island, Denman/Buckley Bay Ferry Landing	South of Buckley Bay ferry landing (#6)	Extant	1952 Brayshaw (1968): Herbarium specimen Taylor (1968): Herbarium specimen Jamison (1996): 67 plants over 100 m^2 Maslovat (2007): 73-93 plants in 2 patches over 100 m^2 Balke (2007): 105+ plants observed over 578 m^2 Maslovat (2018): 30 plants
5	Denman Island, North of Metcalf Bay = North and south of Millard Road	South of Millard Rd (#7)	Extant	Jamison (1996): 150+ plants over 400 m^2 Maslovat (2007): 75 plants over 270 m^2 Balke (2007): 328+ plants over 1180 m^2. Maslovat (2018): 550-750 plants
6	Denman Island, 1 km southeast of Metcalf Bay Site: Below Lacon Road, north of Hinton	South of Metcalf Bay (#8)	Extant	Balke (1993): Herbarium specimen Jamison (1996): 40+ plants over 100 m^2 Maslovat (2007): 175 plants over 250 m^2 Balke (2007)[1]: At least 345 plants over 2,503 m^2 Maslovat (2018): 250-300 plants
7	Denman Island, Boyle Point, South tip of	West of Boyle Point, including Cedar Creek (#9)	Extant	Roemer (1982): Herbarium specimen Jamison (1996): 120 plants in 25 clusters, 2 subpopulations over 250 m^2 Williston (2006): 22-270 plants in 3 subpopulations over 260 m^2 Balke (2007): 2,238+ plants over 6,470 m^2 (in the park) Maslovat (2018): 400-500 plants
8	Denman Island, Repulse Point, West and east of Reginald Road	Repulse Point (#10)	Extant	Jamison (1996): 300+ plants over 800 m^2 Maslovat (2007): 500 plants over 435 m^2 in 2 subpopulations Balke (2007): 2,997+ plants over 10,061 m^2 (includes entire EO #20) Maslovat (2018): 1000-2000 plants
9	Denman Island, Denman Road	Not known *(new)*	Extant	Maslovat (2018): 180-280 plants
	Hornby Island			
10	Hornby Island, Mount Geoffrey	Not known *(new)*	Extant	Janszen (1982): Herbarium specimen Maslovat (2018): 70-80 plants
11	Hornby Island, Tribune Bay	High Salal Ranch, E of Tribune Bay Park boundary; Bluffs NW of Helliwell Park boundary (#11)	Extant	Pojar (1976): Herbarium specimen Ceska and Ceska (1976): Herbarium specimen Jamison (1996): 160+ plants in 2 sites over 920 m^2 Douglas *et al.* (1998): 3000-6000 plants in 48 clumps over 50-200 m^2 Maslovat (2007): 1000+ plants over 800 m^2 (incomplete survey) Maslovat (2018): 1200-1500 plants
12a	Hornby Island, Downes Point Site: SW of Ford's Cove	Norman Pt. SW of Ford's Cove marina (#12)	Unconfirmed, not surveyed	Jamison (1996): 28 plants over 20 m^2
12b	Hornby Island, Downes Point Site: Norman Point	Norman Pt Heron Rocks (#13)	Extant	Connell (1941): Herbarium specimen Brayshaw (1968): Herbarium specimen Taylor (1968) Jamison (1996): 500+ plants over 1 km^2 Maslovat (2007): 250 plants over 100 m^2 Maslovat (2018): 1200-1500 plants

[1] Note – higher numbers of plants and area covered are not reflected in the totals above in the body of the report, nor in the Technical Summary due to differences in surveyors and potential for inconsistencies in how mature individuals were distinguished.

Number	Subpopulation Name	COSEWIC 2001 Site Name (#)	Subpopulation Status	Survey History
12c	Hornby Island, Downes Point Site: Downes Point SW	SW of Downes Pt (#14)	Extant	Jamison (1996): 21 plants over 60 m^2 Maslovat (2007): 33 plants over 15 m^2 Maslovat (2018): 100 plants
12d	Hornby Island, Downes Point Site: Downes Pt.	Downes Pt. (#15)	Extant	Jamison (1996): 110+ plants over 50 m^2 Maslovat (2007): 85 plants over 30 m^2 Maslovat (2018): 500 plants
12e	Hornby Island, Downes Point Site: Central Road	Slope above central, Rd. north of Heron Rocks (#16)	Extant	Jamison (1996): 3500+ plants over 1.4 km^2 Maslovat (2007): 1000s of plants over an area larger than 525 m^2 Maslovat (2018): 2000-5000 plants

Abundance

COSEWIC defines the number of mature individuals as the number of individuals known, estimated, or inferred to be capable of reproduction. For clonal subpopulations, reproducing units within the clone should be counted as individuals if they are capable of surviving alone (COSEWIC 2015).

It is difficult to determine the number of mature individuals for Coastal Wood Fern because it is a rhizomatous species that grows in dense patches. Without excavation, it is difficult to know if a single patch represents a single genet. Crowns of plants, where fronds emerged from a central point, that were greater than 30 cm apart were assumed to meet the COSEWIC definition of mature individuals because spores were observed on the fronds and it was presumed that if the rhizome was severed, these ramets could survive independently (Figure 7). It was presumed that fronds closer than 30 cm would not have sufficient resources in a severed rhizome to be considered a mature individual.

Figure 7. Pink flags placed 30 cm or more apart to facilitate counting of mature individuals on Gerald Island. Photo C. Maslovat (May 16, 2018).

In 2018, the Canadian population was counted to be between 10,445-16,780 crowns, which are inferred to be mature individuals (Table 1). The previous status report estimated the total population to be over 5366 but no details were provided on how individuals were counted so these counts can not be considered comparable. Furthermore, four of the subpopulations included in this report were not included in the previous status report.

Fluctuations and Trends

It is difficult to determine fluctuations and trends because of the high margin of error in estimating the number of mature individuals and differences in counting techniques between surveys (Table 1).

In 2007, plants were counted by the same surveyor as in 2018 in preparation for the management plan (Garry Oak Ecosystems Recovery Team 2010). Eight of the subpopulations were counted with a total of 5673 plants (compared to 7830 for the same subpopulations when counted in 2018). The difference between years is a reflection of difference in counting techniques because the definition of mature individuals was not used in 2007 counts.

Habitat destruction was not observed at any of the known sites and the current area occupied is similar to previous observations. Coastal Wood Fern is a long-lived species and is not subject to population fluctuations. It is inferred that there has been no significant increase or decrease in the number of plants since the 2007 survey prior to the management plan (Garry Oak Ecosystems Recovery Team 2010).

Rescue Effect

Coastal Wood Fern has a limited distribution in Canada. Although long-distance dispersal events do occur in other *Dryopteris* species, they are infrequent and require ideal conditions. It is possible, but unlikely, there would be short-term rescue from naturally dispersing US populations should extirpation of the Canadian population occur.

THREATS AND LIMITING FACTORS

Direct threats facing Coastal Wood Fern assessed in this report were organized and evaluated based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system (Master *et al.* 2012). Threats are defined as the proximate activities or processes that directly and negatively affect the population. Results on the impact, scope, severity, and timing of threats are presented in tabular form in Appendix 1. The overall calculated and assigned threat impact is Low for Coastal Wood Fern.

Threats

1.1 Residential and commercial development: housing and urban areas (Negligible impact)

Most of the habitat for Coastal Wood Fern on Denman and Hornby Islands is in steep, inaccessible sites or too close to the shoreline to develop. Development activities upslope may cause erosion downslope along the banks. Many sites are on small, privately owned, waterfront lots and some landowners have built stairs to access the shoreline through Coastal Wood Fern sites. The ferns continue to grow and appear unperturbed by the short-term disturbance.

6.1 Recreational Activities (Negligible impact)

Impacts from recreational activities are limited because at most subpopulations the terrain is steep or the sites are only accessible by boat, making development of any kind, including trails, unlikely. One site on Hornby Island is a camping co-operative and there is impact from public use including trampling, clearing of vegetation and placing tents on or next to the ferns. In one regional park, fencing has been installed to prevent trampling next to Coastal Wood Fern. At sites managed by BC Parks, Department of National Defence, and the regional park, land managers are aware of the plants and are working to protect them.

7.1 Fire and fire suppression (Unknown impact)

The impact of wildfires on Coastal Wood Fern is unknown. Although the species would have been adapted to natural wildfires, there is potential for atypically intensive natural fires to occur because of fire suppression and climate change. Fire may degrade habitat by causing increased erosion in the steep habitat where the species occurs. Spores in soil spore banks can survive fire that destroys all surface vegetation and may act as a survival strategy for fires and other landscape disturbances (Dyer and Lindsay 1992). The dense rhizome network and depth of rhizomes may protect the plants from fire.

8.1 Invasive non-native/alien species/diseases (Low impact)

Non-native invasive species including Greater Periwinkle (*Vinca major*) and English Ivy (*Hedera helix*) are found in some of the subpopulations and Himalayan Blackberry (*Rubus bifrons*) grows close by. On Gerald Island, the invasion is severe in some areas but at most sites the Coastal Wood Fern does not appear to be negatively impacted. The future impact is expected to be low.

8.4 Problematic species/diseases of unknown origin (Unknown impact)

Coastal Wood Fern is a proven host plant for the fungal pathogen *Phytophthora ramorum* that causes 'sudden oak death' (Garbelotto and Rizzo 2005; Cave *et al.* 2008). The pathogen, also called Ramorum Blight and Dieback, causes leaf blight on the fronds and the severity ranges from foliar symptoms including leaf dieback, to plant mortality (Garbelotto and Rizzo 2005). Sudden Oak Death is currently established in localized areas of California and Oregon, mainly in forested areas or remnants of mature forests (Province of British Columbia 2018). Ramorum Blight and Dieback was reported in 2003 on infected ornamental plants in a British Columbia plant nursery (Province of British Columbia 2018) but there are no indications of this disease near natural occurrences of Coastal Wood Fern. Coastal Wood Fern is listed as a plant regulated for Ramorum Blight and Dieback; other plants that are associated with Coastal Wood Fern that are regulated include Douglas-fir, Big-leaved Maple, Pacific Arbutus, and Pink Honeysuckle (Canadian Food Inspection Agency 2013).

Western Swordfern (*Polystichum munitum*) die-off has been observed in the Puget Sound area of Washington over large areas (up to 1000 m^2) (Coats *et al.* 2017; Alexander *et al.* 2018) and similar die-off has been noted on Hornby Island (Alexander *et al.* 2018). Phytophthora Root Rot (*Phytophthora cinnamomi*) has been isolated from discoloured roots, crowns, and fronds of dying swordferns and from soil in infested sites (Tidwell and Kosta 1984). It is unknown if root rot will impact Coastal Wood Fern.

11.2 Droughts (Unknown impact)

Studies of Coastal Wood Fern in California have noted significant dieback of fronds as a result of drought stress: Coastal Wood Fern may lose fronds during droughts but the plants recover when soil moisture increases (Baer *et al.* 2015). Withered fronds at some sites were observed during August surveys in Canada. The impact of frond dieback on overall fitness and reproduction is not known.

11.4 Storms and flooding (Negligible impact)

A small proportion (<1%) of the plants occur within several metres of the high tide line and may be impacted by rising sea levels and storm surge associated with climate change. In the Puget Sound, sea levels are projected to rise over the next century but variation in local land movement due to uplift and subsidence will affect the amount of sea level rise (Mauger *et al.* 2015). Increased sea levels will result in higher storm surge reach and rising seas are expected to increase the impact of erosion (Mauger *et al.* 2015).

Limiting Factors

Small, isolated subpopulations can suffer from limited genetic diversity and inbreeding depression (Ilves *et al.* 2003; Reed and Frankham 2003; Leimu *et al.* 2006; Szczecińska *et al.* 2016). The impacts on Coastal Wood Fern associated with limited genetic diversity and inbreeding depression are unknown.

Number of Locations

The 13 subpopulations (Table 1) are grouped into eleven element occurrences as defined by the BC Conservation Data Centre, plus one new site (Table 2).Table 2 splits element occurrences based on ownership type (some of these have multiple private landowners). Climate change caused drought is the only threat that would act more broadly on the whole population, but as Coastal Wood Fern is drought tolerant, the impact is likely negligible (rated as Unknown). Invasive species could impact habitat quality at two sites: Hornby Island, Downes Point, Heron Rocks 1 and Gerald Island. Two sites could be influenced by storms or flooding: Amelina Island, and South Ballenas Island, although the impact is Unknown. Overall, the most serious plausible threats at other sites were considered to have a negligible impact overall in the threats assessment. As such, most of the distribution is not impacted by any significant threat and therefore the concept of locations was not applied.

Table 2. Ownership of sites within B.C. Conservation Data Centre occurrences.

BC CDC Occurrence Name and Number	Site	Ownership	# of Mature Indiv.
#3. Denman Island, 1 km southeast of Metcalf Bay	Below Lacon Road, north of Hinton	Private (2 landowners)	250-300
#5. Hornby Island, Downes Point	Downes Point	Private (strata owned)	500
#5. Hornby Island, Downes Point	Downes Point SW	Private	100

BC CDC Occurrence Name and Number	Site	Ownership	# of Mature Indiv.
#5. Hornby Island, Downes Point	Heron Rocks 1	Private	45
#5. Hornby Island, Downes Point	Heron Rocks 2	Private (4 landowners)	2000-5000
#5. Hornby Island, Downes Point	Norman Point	Private	1200-1500
#8. Hornby Island, Mount Geoffrey	Mount Geoffrey Escarpment Park	BC Parks	70-80
#9. Amelia and Gerald islands	Amelia Island	Unsurveyed crown	500-700
#9. Amelia and Gerald islands	Gerald Island	BC Parks	700-1000
#11. Ballenas Islands, South Island	South Ballenas Island	Department of National Defence	400-600
#13. Mistaken Island, North End of	Mistaken Island	Private	20
#16. Hornby Island, Tribune Bay	Helliwell Provincial Park	BC Parks	5
#16. Hornby Island, Tribune Bay	West of Helliwell	Private (strata): most sites on foreshore outside property line	1200-1500
#17. Dorcas Point, Nanoose Bay	Moorecroft Regional Park (undeveloped road right of way)	Regional District of Nanaimo	300-500
#17. Dorcas Point, Nanoose Bay	Dorcas Point	Private	300-500
#18. Denman Island, North of Metcalf Bay	North and south of Millard Road	Private (4 landowners)	550-750
#20. Denman Island, Boyle Point, South tip of AND Denman Island, Repulse Point, East of	Boyle Point Provincial Park West and east of Reginald Road	BC Parks Private (4 land owners)	400-500 1000-2000
#21. Denman Island, Denman/Buckley Bay Ferry Landing	South of ferry landing, Denman Island	Private (1 landowner)	25-50
Not mapped	Denman Island, Denman Road	Private	180-280

PROTECTION, STATUS AND RANKS

Legal Protection and Status

Coastal Wood Fern was designated Special Concern by COSEWIC in April 1998 and the status was re-examined and confirmed in 2001. In 2003, it was listed on Schedule 1 of the *Species at Risk Act* (SARA) as Special Concern (Government of Canada 2018).

It is not listed under the Convention on International Trade in Endangered Species (CITES) or the *Endangered Species Act* (United States) and is not assessed by the International Union for Conservation of Nature (IUCN) (CITES 2018; IUCN 2018; US Fish and Wildlife Service 2018).

Non-Legal Status and Ranks

Provincially, Coastal Wood Fern is ranked vulnerable (S3) by the BC Conservation Data Centre. It is not ranked in Washington, Oregon, or California (which usually means that the species has not been considered of conservation concern by these jurisdictions). In Arizona and Nevada, it is ranked S1 (Critically Imperilled); it is rare in Pinal and Gila counties in Arizona, and in Clark County, Nevada (NatureServe 2018).

Habitat Protection and Ownership

Four of the known element occurrences are in provincial parks (Gerald Island, Boyle Point, Geoffrey Escarpment, and Helliwell). Due to the terrain and limited access, trail development or other recreational activities next to the plants is unlikely. BC Parks has been made aware of the presence of these plants. South Ballenas Island is managed by the Department of National Defence and has restricted public access. Amelia Island is unsurveyed provincial crown land. A small site occurs within an undeveloped road right of way next to a regional park. All of the remaining sites are on privately owned land.

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INFORMATION SOURCES

Alexander, C.M., P. Shannon, and P. Talbert. 2018. Die-off on Hornby Island's Helliwell Provincial Park. October 31, 2017. Seward Park Sword Fern Die-off. Website: http://sewardparkswordferndieoff.blogspot.com/2017/10/die-off-on-hornby-islands-helliwell.html [accessed October 2018].

Balke, J.M.E. 2008. Coastal Shield Fern *Dryopteris arguta* (Kauf.) Watt.on Southern Denman Island. Report submitted to Dr. K. Dunster for GOERT. 11 p.

Barker, J., and A. Willmot. 1985. Preliminary studies on the breeding systems of *Dryopteris filix-mas* (L.) Schott and *D. dilatata* (Hoffm) A. Gray. Proceedings of the Royal Society of Edinburgh 86:455-456.

Baer, A., J.K. Wheeler, and J. Pitterman. 2015. Not dead yet: the seasonal water relations of two perennial ferns during California's exceptional drought. New Phytologist. Website: http://doi.org/10.1111/nph.13770 [accessed October 2018].

British Columbia Conservation Data Centre. 2018. BC Species and Ecosystems Explorer. Province of British Columbia. Website: http://a100.gov.bc.ca/pub/eswp/ [accessed September 2018].

Brooks, J.R., F.C. Meinzer, J.M. Warren, J. Domec, and R. Coulombe. 2006. Hydraulic redistribution in a Douglas-fir forest: lessons from system manipulations. Plant, Cell and Environment 29:138-158.

Brunton, D., pers. comm. 2018. *Email correspondence to D. Meidinger.* Member of COSEWIC Vascular Plants SSC and Research Associate, Canadian Museum of Nature. Ottawa, Ontario.

California Native Plant Link Exchange. 2018. Plant Information: *Dryopteris arguta*-Wood Fern. Website: http://www.cnplx.info [accessed September 2018].

Canadian Food Inspection Agency. 2013. Appendix 1 – Plants Regulated for *Phytophthora ramorum* (Sudden Oak Death). Date modified: 2013-03-12. Website: http://www.inspection.gc.ca/plants/plant-pests-invasive-species/directives/horticulture/d-01-01/appendix-1/eng/1363039571899/1363039666772 [accessed April 2019].

Cave, G.L., B. Randall-Schadel, and S.C. Redlin. 2008. Risk analysis for *Phytophthora ramorum* Werres, de Cock & Man in't Veld, causal agent of Sudden Oak Death, Ramorum Leaf Blight, and Ramorum Dieback. United States Department of Agriculture, Animal and Plant Inspection Service, Plant Protection and Quarantine. Raleigh, North Carolina.

Cody, W. J., and D. M. Britton. 1989. Ferns and Fern Allies of Canada. Research Branch, Agriculture Canada, Ottawa, Ontario. 430 p.

Convention on the Trade of Endangered Species (CITES). 2018. Checklist of CITES Species. Website: http://checklist.cites.org/#/en [accessed October 2018].

COSEWIC. 2001. COSEWIC Assessment and Status Report on the Coastal Wood Fern *Dryopteris arguta* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 16pp.

COSEWIC. 2015. Instructions for preparing COSEWIC status reports. Website: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/instructions-preparing-status-reports.html [accessed October 2018].

Dyer, A.F., and S. Lindsay. 1992. Soil spore banks of temperate ferns. American Fern Journal 82:89-123.

Elliott, M., K. Coats, L. Rollins, and J. Glass. 2017. Progress report: Examination of the role of soilborne plant pathogens in restored, undisturbed, and die-off sites in the decline of western sword fern, *Polystichum munitum*, in Seward Park. Website: https://pnwhandbooks.org/plantdisease/host-disease/sword-fern-polystichum-munitum-die [accessed October 2018].

European Nucleotide Archive (EMBL-EBI). 2019. *Dryopteris arguta* (Kaulf.) Watt. Geographically tagged INSDC sequences. Occurrence dataset. Website: https://www.gbif.org/occurrence/1942498496 [accessed April 2019].

Ewan, J. 1944. Annotations on West American Ferns-III. American Fern Journal 34: 107-120.

Farrar, D.R. 1976. Spore retention and release from overwintering fern fronds. American Fern Journal 66:49-52.

Flinn, K.M. 2006. Reproductive biology of three fern species may contribute to differential colonization success in post-agricultural forests. American Journal of Botany 93:1289-1294.

Flinn, K.M. 2007. Microsite-limited recruitment controls fern colonization of post-agricultural forests. Ecology 88:3103-3144.

Fraser, D. pers. comm. 2007. *Email correspondence to C. Maslovat.* Scientific Authority Assessment, Ecosystems Protection and Sustainability Branch, Species and Ecosystems at Risk Section, Ministry of Environment and Climate Change Strategy. Victoria, BC. *In* Garry Oak Ecosystems Recovery Team 2010.

Furman, P. pers. comm. 2007 *Email correspondence to C. Maslovat.* Horticulturalist, Bay Natives Nursery, San Francisco, CA. *In* Garry Oak Ecosystems Recovery Team 2010.

Garbelotto, M., and D.M. Rizzo. 2005. A California-based chronological review (1995-2004) of research on *Phytophothora ramorum,* the causal agent of sudden oak death. Phytopathology Mediterranean 44:127-143.

Garry Oak Ecosystems Recovery Team (GOERT). 2010. Management Plan for the Coastal Wood Fern (*Dryopteris arguta*) in British Columbia. Prepared for the BC Ministry of Environment. Victoria, BC. 23 pp.

Geiger, J.M.O., and T.A. Ranker. 2005. Molecular phylogenetics and historical biogeography of Hawaiian *Dryopteris* (Dryopteraceae). Molecular Phylogenetics and Evolution 32:392-407.

Government of Canada. 2018. Species at Risk Public Registry. Website: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html [accessed December 2018].

Hitchcock, L.C., A. Cronquist, and M. Ownbey. 1969. Vascular Plants of the Pacific Northwest: Part 1 Vascular Cryptogams, Gymnosperms and Monocotyledons. University of Washington Press. Seattle, WA.

Hoshizaki, B.J., and K.A. Wilson. 1999. The cultivated species of the fern genus *Dryopteris* in the United States. American Fern Journal 89:1-98.

Holmund, H.I., V.M. Lekson, B.M. Gillespie, N.A. Nakamatsu, A.M. Burns, K.E. Sauer, J. Pitterman, and S.D. Davis. 2016. Seasonal changes in tissue-water relations for eight species of ferns during historic drought in California. American Journal of Botany 103:1607-1617.

Ilves, A., K. Lanno, M. Sammul, and K. Tali. 2003. Genetic variability, population size and reproduction potential in *Ligularia sibirica* (L.) populations in Estonia. Conservation Genetics 14:661-669.

Integrated Taxonomic Information System (ITIS). 2018. *Dryopteris arguta* Search Results. Website: https://www.itis.gov/servlet/SingleRpt/SingleRpt [accessed October 2018].

International Union for Conservation of Nature and Natural Resources (IUCN). 2018. The IUCN Red List of Threatened Species (2018-1). Website: http://www.iucnredlist.org [accessed October 2018].

Juslén, A., H. Väre, and N. Wikström. 2011. Relationships and evolutionary origins of polyploid *Dryopteris* (Dryopteridaceae) from Europe inferred using nuclear *pgiC* and plastid *trnL-F* sequence data. Taxon 60:1284-1294.

Kuhnlein, H.V., and N.J. Turner. 1991. Traditional plant foods of Canadian indigenous peoples: nutrition, botany and use. *In* Food and Nutrition in History and Anthropology. Ed: S.H. Katz, University of Pennsylvania, Volume 8. Gordon and Breach Publishers.

Leigh, M. 1999. Grow your own native landscape. Washington State Univ. Press, Olympia, WA.

Leimu, R., P. Mutikainen, J. Koricheva, and M. Fischer. 2006. How general are positive relationships between plant population size, fitness and genetic variation? Journal of Ecology 94:942-952.

Manton, I. 1950. Problems of Cytology and Evolution in the Pteridophyta. Cambridge University Press, Cambridge, UK.

Maslovat, C. 2018. Field Work Summary Report: Coastal Wood Fern (*Dryopteris arguta*). Unpublished report submitted to Committee on the Status of Endangered Wildlife in Canada, September 15, 2018.

Master 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 risk. NatureServe, Arlington, Virginia. Website: http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusfactors_apr12_1.pdf [accessed October 2018].

Mauger, G.S., J.H. Casola, H.A. Morgan, R.L. Strauch, B. Jones, B. Curry, T.M. Busch Isaken, L. Whitely Binder, M.B. Krosby, and A.K. Snover. 2015. State of Knowledge: Climate Change in Puget Sound. Report prepared for the Puget Sound Partnership and the National Oceanic and Atmospheric Administration. Climate Impacts Group, University of Washington, Seattle. doi:10.7915/CIG93777D.

McIntosh, T., and K. Sadler. 2011. Results from a 2010 Rare Plant Survey at the Canadian Forces Maritime Experimental Test Ranges (CFMETR), Vancouver Island. Unpublished report prepared for Natural Resources Canada.

Miller, J.H. 1968. Fern gametophytes as experimental material. Botanical Review 34:361-440.

Montgomery, J.D., and W.H. Wagner. 1993. *Dryopteris*. *In* Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford. Volume 2.

Morton, C.V. 1968. The proper authorities and citations for *Dryopteris arguta* and *D. spinulosa.* American Fern Journal 58:182-183.

NatureServe. 2020. Habitat-based plant element occurrence delimitation guidance. Revised May 2020. Website: https://www.natureserve.org/sites/default/files/eo_specs-habitat-based_plant_delimitation_guidance_may2020.pdf [accessed February 2021]

NatureServe 2018. NatureServe Explorer. Website: http://explorer.natureserve.org/ [accessed September 2018].

Page, C.N. 1979. Experimental aspects of fern ecology. *In* The Experimental Biology of Ferns (Ed. A.F. Dyer), pp. 551-589. Academic Press, London.

Peck, J.H., C. Peck, and D.R. Farrar. 1990. Influences of life history attributes on formation of local and distant fern populations. American Fern Journal 80(4):126-142.

Pitterman, J., C. Brodersen, and J.E. Watkins. 2013. The physiological resilience of fern sporophytes and gametophytes: advances in water relations offer new insights into an old lineage. Frontiers in Plant Science. Website: https://doi.org/10.3389/fpls.2013.00285 [accessed September 2018].

Province of British Columbia. 2018. Ramorum Blight and Dieback. British Columbia Ministry of Agriculture. May 2018. Website: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/animal-and-crops/plant-health/phu-ramorumblight-diebackss.pdf [accessed April 2019].

Raynor, G.S., E.C. Ogden, and J.V. Hayes. 1976. Dispersion of fern spores into and within a forest. Rhodora 78:473-487.

Reed, D.H., and R. Frankham. 2003. Correlation between fitness and genetic diversity. Conservation Biology 17:230-237.

Sessa, E.B., E.A. Zimmer, and T.J. Givnish. 2012. Phylogeny, divergence times, and historical biogeography of New World *Dryopteris* (Drypopteridaceae). American Journal of Botany 99:730-750.

Sessa, E.B., L.B. Zhang, H. Vare, and A. Juslen. 2015. What we do (and don't) know about ferns: *Dryopteris* (Dryopteridaceae) as a case study. Systematic Botany 40:387-399.

Smith, A.R. 2012. *Dryopteris arguta.* Jepson Flora Project (eds.) Jepson eFlora. Website: http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=23524 [accessed October 2018].

Soltis, D.E., and P.S. Soltis. 1992. The distribution of selfing rates in homosporous ferns. American Journal of Botany 79:97-100.

Szczecińska, M., G. Sramko, K. Wolosz, and J. Sawicki. 2016. Genetic diversity and population structure of the rare and endangered plant species *Pulsatilla patens* (L.) Mill in East Europe. PLoS One 11(3): e015730. Doi:10.137/journal.pone.015173.

Tidwell, T.E., and K.L. Kosta. 1984. Root rot of western swordfern caused by *Phytophthora cinnamomi* in California. American Phytopathological Society. Plant Disease Notes 68:536.

Turland, N.J., J.H. Wiersema, F.R. Barrie, W. Greuter, D.L. Hawksworth, P.S. Herendeen, S. Knapp, W.H. Kusber, D.Z. Li, K. Marhold, T.W. May, J. McNeill, A.M. Monro, J. Prado, M.J. Price, and G.F. Smith (eds.) 2018: International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books. DOI. Website: https://doi.org/10.12705/Code.2018 [accessed October 2018].

Tyron, R. 1986. The biogeography of species, with special reference to ferns. Botanical Review 52:117-156.

Tyron, R. 1970. Development and evolution of fern floras on oceanic islands. Biotropica 2:76-84.

University of California. 2018. Consortium of California Herbaria. Website: http://ucjeps.berkeley.edu/consortium/ [accessed October 2018].

University of Washington Herbarium. 2018. Consortium of Pacific Northwest Herbaria. Website: http://www.pnwherbaria.org/data/search.php [accessed October 2018].

USDA, NRCS. 2018. The PLANTS Database. National Plant Data Team, Greensboro, NC 27401-4901 USA. Website: http://plants.usda.gov [accessed November 2018].

US Fish and Wildlife Service. 2018. Endangered Species. Website: https://www.fws.gov/endangered/laws-policies/ [accessed October 2018].

Vascan. 2018. *Dryopteris arguta* (Kaulfuss) Maxon. Website: http://data.canadensys.net/vascan/taxon/5383?lang=en [accessed October 2018].

Wilson, P. pers. comm. 2007. *Email correspondence with C. Maslovat.* Gentian Botanical Research. Smithers, BC. *In* Garry Oak Ecosystems Recovery Team 2010.

BIOGRAPHICAL SUMMARY OF REPORT WRITER

Carrina Maslovat works as a botanist in plant communities at risk, primarily Garry Oak Ecosystems. She has inventoried rare plants in regional, municipal, federal and provincial parks, finding new subpopulations of species at risk and monitoring rare plant populations' abundance and vitality over time. She has developed management plans for nature reserves and created Best Management Practices to minimize impacts to species at risk. She is the author of three COSEWIC status reports, four status report updates, and several recovery planning documents. Recently, she has been working on wetland restoration projects to provide habitat for species at risk.

COLLECTIONS EXAMINED

Canadian Museum of Nature (CAN): CAN593560 (J.A. Jamison, 1996); CAN593561 (J.A. Jamison, 1996); CAN593563 (J.A. Jamison, 1996); CAN593564 (J.A. Jamison, 1996); CAN602835 (G.W. Douglas & S. Hartwell, 1998)

Consortium of Pacific Northwest Herbaria (accessed online)

Department of Agriculture, Ottawa (DOA): DOA 824932 (J.A. Jamison, 1996); DOA 824931 (J.A. Jamison, 1996); DOA 824930 (J.A. Jamison, 1996); DOA 824929 (J.A. Jamison, 1996); DOA 824902 (J.A. Jamison, 1996); DOA 824928 (J.A. Jamison, 1996); DOA 824988 (J.A. Jamison, 1996); DOA 592865 (D.H. Britton and B. Britton, 1978); DOA 272329 (T.M.C. Taylor, 1968); DOA 387937 (W.H.C. Taylor, 1946)

Royal British Columbia Museum (V): V13644 (R. Connell, 1941); V44110 (T.M.C. Taylor, 1963); V52612 (T.C. Brayshaw, T.M.C. Taylor & W. Crawford, 1968); V52621 (T.C. Brayshaw, T.M.C. Taylor & W. Crawford, 1968); V94520 (J. Pojar, 1976); V173038 (A. Ceska & O. Ceska, 1976); V120056 (H. Janszen, 1982); V166854 (H. Roemer & J. Pinder-Moss, 1982); V166855 (H. Roemer & J. Pinder-Moss, 1982); V167874 (L. Pavlick, 1985); V156281 (J. Balke, 1993); V173170 (A. Ceska & O. Ceska, 1995); V168216 (J.A. Jamison, 1996); V168217 (J.A. Jamison, 1996); V168218 (J.A. Jamison, 1996); V168219 (J.A. Jamison, 1996); V168220 (J.A. Jamison, 1996); V168221 (J. Jamison, 1996); V168222 (J.A. Jamison, 1996); V168223 (J.A. Jamison, 1996); V168224 (J.A. Jamison, 1996); V168225 (J.A. Jamison, 1996); V168226 (J.A. Jamison, 1996); V168227 (J.A. Jamison, 1996); V168228 (J.A. Jamison, 1996); V168229 (J.A. Jamison, 1996); V168230 (J. Jamison, 1996); V168231 (J.A. Jamison, 1996); V168232 (J.A. Jamison, 1996); V168233 (J.A. Jamison, 1996); V174028 (J.A. Jamison, 1996); V174029 (J.A. Jamison, 1996); V174030 (J.A. Jamison, 1996); V174031 (J.A. Jamison, 1997); V174036 (J.A. Jamison, 1996); V177263 (G.W. Douglas & S. Hartwell, 1998); V177264 (G.W. Douglas & S. Hartwell, 1998); V177265 (G.W. Douglas & S. Hartwell, 1998); V177266 (H. Janszen and J.L. Penny, 1998); V178755 (J.L. Penny, 1998); V198700 (C. Maslovat, 2007); V198701 (C. Maslovat, 2007); V198702 (C. Maslovat 2007); V198703 (C. Maslovat, 2007); V198704 (C. Maslovat, 2007).

University of British Columbia (UBC): UBC:V214231 (J.A. Jamison, 1996); UBC:V214229 (J.A. Jamison, 1996); UBC:V215134 (Pavlick, 1985); UBC:V214422 (G.W. Douglas and S. Hartwell, 1998); UBC:V214421 (G.W. Douglas and S. Hartwell, 1998); UBC:V214423 (G.W. Douglas and S. Hartwell, 1998); UBC:V214424 (H. Janszen & J.L. Penny, 1998); UBC:V214225 (J.A. Jamison, 1996); UBC:V213953 (J.A. Jamison, 1996); UBC:V214234 (J.A. Jamison, 1996); UBC:V214224 (J.A. Jamison, 1996); UBC:V213951 (J.A. Jamison, 1996); UBC:V214226 (J.A. Jamison, 1996); UBC:V213946 (J.A. Jamison, 1996); UBC:V214223 (J.A. Jamison, 1996); UBC:V158119 (J.A. Jamison, 1996); UBC:V214222 (J.A. Jamison, 1996); UBC:V214333 (J.A. Jamison, 1996); UBC:V214235 (J.A. Jamison, 1996); UBC:V214228 (J.A. Jamison, 1996); UBC:V214068 (J.A. Jamison, 1996); UBC:V213952 (J.A. Jamison, 1996); UBC:V214227 (J.A. Jamison, 1996); UBC:V214166 (J.A. Jamison, 1996); UBC:V121533 (J. Pojar, 1976); UBC:V38190 (T.M.C. Taylor, 1946); UBC:V239054 (V.C. Brink, 1952); UBC:V104230 (T.M.C. Taylor, 1963); UBC:V14317 (T.M.C. Taylor, 1968); UBC:V14320 (T.M.C. Taylor, 1968); UBC:V223764 (J.L. Penny & H. Janszen, 1998); UBC:V234388 (F. Lomer, 1999); UBC:V235538 (T.C. Brayshaw, T.M.C. Taylor & W. Crawford, 1968); UBC:V243558 (T. McIntosh, D. Hanna & S. Joya, 2010); UBC:V243559 (T. McIntosh, D. Hanna & S. Joya, 2010); UBC:V245343 (Fenneman, 2005)

Appendix 1. Threat Calculator for Coastal Wood Fern.

THREATS ASSESSMENT WORKSHEET				
Species or Ecosystem Scientific Name	*Dryopteris arguta*			
Element ID		**Elcode**		
Date :	2019-10-29			
Assessor(s):	Carrina Maslovat, Ryan Batten, Marta Donovan, Brenda Costanzo, Dan Brunton, Jenifer Penny, Greg Wilson, Eric Gross, Del Meidinger			
References:				
Overall Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**		
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	0	0
	C	Medium	0	0
	D	Low	1	1
Calculated Overall Threat Impact:			Low	Low
Assigned Overall Threat Impact:			**D = Low**	
Impact Adjustment Reasons:				
Overall Threat Comments			Generation length is taken as the estimated age of maturity, and plants have been known to live to at least 20-30 years. The Bryophyte Committee of IUCN determines generation length by life strategy, with long-lived species assigned a generation length of 11-25 years, and 3 generations = 50 years. For the purposes of the threats calculator, a generation length of 10+ years was used and a three generation time of >30 years. This was considered to likely be a conservative estimate.	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development		Negligible	Large (31-70%)	Negligible (<1%)	Moderate - Low	
1.1	Housing & urban areas		Negligible	Large (31-70%)	Negligible (<1%)	Moderate - Low	Most of the habitat is in steep inaccessible sites or is too close to the shoreline to develop, although development activities upslope may cause erosion. Some building is possible on top of subpopulations; but the main impact is as a result of development, but not direct. Could be dealt with elsewhere, e.g., 6.3, but dealt with here. Large scope as many sites privately owned but sites are not where one would build a house. Possible restrictions on development along shorelines (Islands Trust).
1.2	Commercial & industrial areas						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.3	Tourism & recreation areas						
2	Agriculture & aquaculture						
2.1	Annual & perennial non-timber crops						
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching						
2.4	Marine & freshwater aquaculture						
3	Energy production & mining						
3.1	Oil & gas drilling						
3.2	Mining & quarrying						
3.3	Renewable energy						
4	Transportation & service corridors						
4.1	Roads & railroads						
4.2	Utility & service lines						
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use						
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	Impacts are low because of steep terrain or because occurrences are located on isolated islands that can only be accessed by boat. The species is hardy, so difficult to kill from light use.
6.2	War, civil unrest & military exercises						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6.3	Work & other activities						
7	Natural system modifications		Negligible	Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	
7.1	Fire & fire suppression		Negligible	Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	There is potential for atypically intensive natural fires due to fire suppression and climate change, however spores in the soil spore bank appear to be fire resistant and thick rhizomes may persist after fire. There may be impacts with soil erosion associated with fire.
7.2	Dams & water management/use						
7.3	Other ecosystem modifications						
8	Invasive & other problematic species & genes	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	
8.1	Invasive non-native/alien species/diseases	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Non-natives are only present in a few of the subpopulations but at some sites invasive species form dense cover.
8.2	Problematic native species/diseases						
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin		Unknown	Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	Impacts of Sudden Oak Death pathogen on fern die off are unknown. Introduced root rot pathogen impact also unknown at this time.
8.5	Viral/prion-induced diseases						
8.6	Diseases of unknown cause						
9	Pollution						
9.1	Domestic & urban waste water						
9.2	Industrial & military effluents						
9.3	Agricultural & forestry effluents						
9.4	Garbage & solid waste						
9.5	Air-borne pollutants						
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						Sites are usually very steep, Although landslides have not been observed, they could occur.
11	Climate change & severe weather		Unknown	Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	
11.1	Habitat shifting & alteration						
11.2	Droughts		Unknown	Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	Drought stress can cause frond dieback which may impact overall fitness and reproduction; species is drought tolerant based on range and sites as far south as California.
11.3	Temperature extremes						
11.4	Storms & flooding		Negligible	Negligible (<1%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs/3 gen)	A small proportion of plants occur within several metres of the high tide line and may be impacted by rising sea levels and storm surge
11.5	Other impacts						
Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).							