COSEWIC
Assessment and Status Report

on the

Hibberson's Trillium
Trillium hibbersonii

in Canada

THREATENED
2023

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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Hibberson's Trillium — Carrina Maslovat (April 2022, Clanninick Creek).

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COSEWIC
Assessment Summary

Assessment Summary – May 2023

Common name
Hibberson's Trillium

Scientific name
Trillium hibbersonii

Status
Threatened

Reason for designation
This Canadian endemic perennial plant is globally restricted to a small area on the west coast of Vancouver Island in British Columbia. It is distributed in seven subpopulations, most with less than a few hundred individuals, on rocky outcrops and cliffs with seasonal seepages near ocean, river, and lake shorelines. It is threatened by the continuing decline of its habitat from landslides, severity of storms and flooding due to climate change and, indirectly, from forest-harvesting activities increasing erosion and altering seepage patterns. The limited population size and number of subpopulations makes the species vulnerable to these stochastic events.

Occurrence
British Columbia

Status history
Designated Threatened in December 2023.

COSEWIC
Executive Summary

Hibberson's Trillium
Trillium hibbersonii

Wildlife Species Description and Significance

Hibberson's Trillium is a small perennial herb with three broadly ovate leaves. The flowers grow on a short pedicel and have three pink petals that are offset with three green, fully divided sepals.

Hibberson's Trillium is endemic to the west coast of Canada. Its showy flowers and diminutive stature have made it a sought-after horticultural species.

Aboriginal (Indigenous) Knowledge

All species are significant and are interconnected and interrelated. There is no species-specific Aboriginal Traditional Knowledge in the report.

Distribution

Hibberson's Trillium occurs only in British Columbia and is known from seven subpopulations on the west coast of Vancouver Island, in the vicinity of Kyuquot Sound, Hesquiat Lake and Sydney Inlet.

Habitat

Hibberson's Trillium is found in the Coastal Western Hemlock biogeoclimatic zone. Most subpopulations occur at low elevations in thin, poorly developed soils next to the ocean or a lake. Six of the subpopulations are found in thick layers of moss and lichen on open rocky ledges, outcrops, and cliffs with seasonal seepage. The seventh subpopulation occurs in small mossy clefts in rock in a riparian area that is inundated during peak flows.

Biology

Hibberson's Trillium has been grown from offsets, and has flowered in three or four years from seed sown in pots; reproduction in the wild has not been studied. In a garden setting, Hibberson's Trillium can persist for at least 35 years. The stems emerge annually from a rhizome in the spring and bloom in early April. Pollinators of other *Trillium* species include flies, bees and beetles. Dispersal agents of other *Trillium* species include ants, wasps, ground beetles and banana slugs, which are attracted to a lipid-rich attachment on the seeds and help to disperse the seeds. Plants are eaten by bears and deer, which may also act as seed dispersers. Seeds and seedlings may also be dispersed by water.

Population Sizes and Trends

A summation of the most recent survey data (2014–2023) for all seven subpopulations provides an estimated total of 1,220–1,370 mature flowering Hibberson's Trillium individuals. The number of flowering plants per subpopulation ranges from approximately 20 plants to 400–450 plants. No monitoring or population modelling data are available for determining fluctuations and trends.

Hibberson's Trillium has persisted in four subpopulations, which have had repeat visits since they were first documented in 1938, 1958, 1981 and 2001. The three other subpopulations were discovered in 2019, and two of these were re-surveyed in 2023. Ongoing habitat loss is occurring in unprotected areas, which may contain undocumented subpopulations.

Threats and Limiting Factors

The overall threat impact for Hibberson's Trillium is considered Medium - Low. Timber harvesting in both Hibberson's Trillium habitat and upslope areas may alter seepage patterns, cause erosion and result in landslides. Storms and flooding associated with extreme precipitation events may trigger landslides. Climatic shifts may cause the premature drying of seepage areas, extreme weather events and sea-level rise, all of which could impact the species.

Protection, Status, and Recovery Activities

Hibberson's Trillium is ranked S3 (Vulnerable) provincially, N3 (Vulnerable) nationally, and G3 (Vulnerable) globally. The species does not currently benefit from legal protection and is not listed under the *Species at Risk Act*; nor is it listed under the Convention on International Trade in Endangered Species (CITES).

The International Union for Conservation of Nature (IUCN) currently considers Hibberson's Trillium to be a sub-taxon of Western Trillium (listed as Least Concern on the Red List), but has recognized that Hibberson's Trillium requires designation as a full species. As a separate species, Hibberson's Trillium will likely be categorized as Vulnerable under category D1 (very small or restricted population), but data were lacking at the time of assessment.

Four of the known Hibberson's Trillium subpopulations are in B.C. provincial parks, and the remaining three are on provincial Crown land.

TECHNICAL SUMMARY

Trillium hibbersonii

Hibberson's Trillium

Trille de Hibberson

Range of occurrence in Canada: British Columbia

Demographic Information:

Generation time (usually average age of parents in the population)	10–20 years	Based on inferred average age of parents
Is there an [observed, estimated, inferred, or projected] continuing decline in number of mature individuals?	Yes	Inferred continuing decline based on ongoing threats
[Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within 3 years [or 1 generation; whichever is longer up to a maximum of 100 years]	Unknown	Unknown
Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within 5 years [or 2 generations; whichever is longer up to a maximum of 100 years]	Unknown	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years [or 3 generations; whichever is longer]	Unknown	No long-term surveys have been done to determine population trends, and there have been no consistent re-counts of known subpopulations.
[Projected, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, up to a maximum of 100 years]	Unknown	Unknown
[Observed, estimated, inferred, projected, or suspected] percent [reduction or increase] in total number of mature individuals over any period of 10 years [or 3 generations; whichever is longer, up to a maximum of 100 years], including both the past and future (up to a maximum of 100 years in future)	Unknown	Unknown
Are the causes of the decline clearly reversible?	Unknown	Unknown
Are the causes of the decline clearly understood?	Unknown	Unknown
Are the causes of the decline clearly ceased?	Unknown	Unknown

Are there extreme fluctuations in number of mature individuals	Unknown	Inferred generation time and observed persistence of plants in four subpopulations that have been revisited suggest relative stability, but it is unknown if fluctuations occur.

Extent and Occupancy Information:

Estimated extent of occurrence (EOO)	448 km^2	Calculated based on minimum convex polygon around all known occurrences
Index of area of occupancy (IAO), reported as 2x2 km grid value	40 km^2	Based on data collected in 2014–2023
Is the population "severely fragmented", i.e., is >50% of individuals or >50% of the total area "occupied" (as a proxy for number of individuals) in habitat patches that are both (a) smaller than required to support a viable subpopulation, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. Yes	The persistence of plants in four subpopulations since they were first recorded suggests these habitat patches are of sufficient size to support viable subpopulations. Subpopulations are widely separated from other habitat patches by a distance larger than the species can be expected to disperse.
Number of "locations" (use plausible range to reflect uncertainty if appropriate)	7	Based on threats, each subpopulation is a single location.
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No	Inferred based on persistence of all known subpopulations
Is there an [observed, inferred, or projected] continuing decline in area of occupancy?	No	Inferred based on persistence of all known subpopulations
Is there an [observed, inferred, or projected] continuing decline in number of subpopulations?	No	Inferred based on persistence of all known subpopulations since first recorded
Is there an [observed, inferred, or projected] continuing decline in number of "locations"?	No	Inferred based on persistence of all known locations/subpopulations since first recorded
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes	All known subpopulations have persisted, but there is an inferred decline due to ongoing logging in areas outside of protected areas, impacting the quality and area of habitat.
Are there extreme fluctuations in number of subpopulations?	No	Inferred based on persistence of all known subpopulations
Are there extreme fluctuations in number of "locations"?	No	Inferred based on persistence of all known locations/subpopulations
Are there extreme fluctuations in extent of occurrence?	No	Inferred based on persistence of all known subpopulations
Are there extreme fluctuations in index of area of occupancy?	No	Inferred based on persistence of all known subpopulations

Number of Mature Individuals (by subpopulation):

Numbers correspond to latest count of flowering plants listed in Table 1.		
Sydney Inlet, Vancouver Island Hesquiat Lake, Vancouver Island Rae Lake, near Boat Basin Clanninick Creek, Kyuquot Sydney Inlet/Sydney River, 1.3 km S Sydney Inlet Provincial Park, SW Pretty Girl Cove, Vancouver Island	280+ 83+ 150–250 87 Estimate of 20? 400–450 200+	Dunning *et al.* (2023) Penny *et al*. (2019) Roemer *et al.* (2014) Dunning *et al.* (2022) Penny *et al.* (2019) Dunning *et al.* (2023) Dunning *et al.* (2023)
Total	1,220–1,370+	Based on Penny *et al.* (2019), Roemer *et al.* (2014), Dunning *et al.* (2022) and Dunning *et al.* (2023)

Quantitative Analysis:

Is the probability of extinction in the wild at least 20% within 20 years [or 5 generations], or 10% within 100 years]	Unknown	Analysis not conducted

Threats:

Was a threats calculator completed for this species?	Yes (see Appendix 1)	Overall assigned threat impact: Medium - Low (2023)
Key threats were identified as: i. Biological Resource Use: Logging & Wood Harvesting (IUCN 5.3) – Medium - Low ii. Geological Events: Avalanches/Landslides (IUCN 10.3) – Medium - Low iii. Climate Change & Severe Weather: Storms & Flooding (IUCN 11.4) – Low		
What limiting factors are relevant? • Restricted habitat • Low fecundity • Limited dispersal		

Rescue Effect (from outside Canada):

Status of outside population(s) most likely to provide immigrants to Canada.	N/A	Does not occur outside of Canada
Is immigration known or possible?	No	Does not occur outside of Canada
Would immigrants be adapted to survive in Canada?	N/A	Does not occur outside of Canada
Is there sufficient habitat for immigrants in Canada?	N/A	Does not occur outside of Canada
Are conditions deteriorating in Canada?	Yes	Habitat is limited, and logging occurs in areas that may have undocumented subpopulations outside of protected areas.
Are conditions for the source (i.e., outside) population deteriorating?	N/A	No outside source population
Is the Canadian population considered to be a sink?	N/A	Does not occur outside of Canada

Is rescue from outside Canada likely, such that it could lead to a change in status?	N/A	Does not occur outside of Canada

Wildlife Species with Sensitive Occurrence Data (general caution for consideration):

Could release of certain occurrence data result in increased harm to the Wildlife Species or its habitat?	No	Sites are remote and challenging to access; maps are not at a scale that identifies specific sites.

Status History:

COSEWIC:	Designated Threatened in December 2023.

Status and Reasons for Designation:

Status	Threatened
Alpha-numeric codes	B1ab(iii)+2ab(iii); C2a(i)
Reason for change in status	Not applicable
Reasons for designation	This Canadian endemic perennial plant is globally restricted to a small area on the west coast of Vancouver Island in British Columbia. It is distributed in seven subpopulations, most with less than a few hundred individuals, on rocky outcrops and cliffs with seasonal seepages near ocean, river, and lake shorelines. It is threatened by the continuing decline of its habitat from landslides, severity of storms and flooding due to climate change and, indirectly, from forest-harvesting activities increasing erosion and altering seepage patterns. The limited population size and number of subpopulations makes the species vulnerable to these stochastic events.

Applicability of Criteria:

A: Decline in Total number of Mature Individuals:	
Not applicable.	Insufficient data to reliably infer, project or suspect population trends
B: Small Range and Decline or Fluctuation	
Meets Threatened, B1ab(iii)+2ab(iii).	The EOO of 448 km² and the IAO of 40 km² are below the threshold for Endangered but the population occurs at > 5 locations, is not severely fragmented and does not undergo extreme fluctuations. However, it meets the criteria for Threatened because there is an inferred continuing decline in the extent of habitat, and it occurs at only seven locations.
C: Small and Declining Number of Mature Individuals	
Meets Threatened, C2a(i).	The population of mature individuals (1,220–1,370+) is below the threshold for Endangered, however other sub-criteria are not met. All subpopulations are well below 1,000 mature individuals, and there is an inferred continuing decline in mature individuals due to habitat loss.

D: Very Small or Restricted Population	
Not applicable.	The population of 1,220–1,370+ mature individuals is above the threshold for Threatened (criterion D1). The IAO of 40 km² exceeds the guideline of 20 km² for Threatened (criterion D2) and, with the occurrence at seven locations, the susceptibility to effects of stochastic storm events impacting the population significantly within a very short time is reduced.
E: Quantitative Analysis	
Not applicable.	Analysis not conducted

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
(2023)

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 is 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

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Trillium hibbersonii

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2023

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Current classification:
Trillium hibbersonii (T.M.C. Taylor & Szczawinski) D. O'Neill & S.B. Farmer
Class: Liliopsida
Order: Liliales
Family: Melanthiaceae
Genus: *Trillium* L.
Species: *Trillium hibbersonii*

Subspecies in Canada: none

Common names:
English: Hibberson's Trillium, Dwarf Trillium, Dwarf Western Trillium (VASCAN 2022)
French: Trille de Hibberson (VASCAN 2022)

Synonyms and notes:
Trillium ovatum var. *hibbersonii* (T.M.C. Taylor & Szczawinski) G.W. Douglas & Pojar
Trillium ovatum forma *hibberson*ii (Hibberson 1938) (Holotype UBC: V73131)

Hibberson's Trillium was first collected from Boat Basin (Rae Lake subpopulation) in 1938 by Jack Arthur Hibberson (Holotype UBC 73131). In 1968, it was published as *Trillium hibbersonii* in Rare Wild Flowers of North America (Wiley 1968), but the name was declared to be an invalid *nomen nudum* by Taylor and Szczawinski (1974), because it did not include a Latin description and did not cite a nomenclatural type (Taylor and Szczawinski 1974; O'Neill 1995; O'Neill *et al.* 2020). In 1975, Taylor and Szczawinski (1974) reviewed the taxonomic status and published the taxon as *Trillium ovatum* forma *hibbersonii,* believing that it forms an intergrading complex with Western Trillium (*Trillium ovatum*) (Taylor and Szczawinski 1974). The name *T. ovatum* var. *hibbersonii* was subsequently proposed by Douglas and Pojar (2001), who also considered it a dwarf variant of *T. ovatum*.

A review of cytology and morphology and a flavonoid analysis of wild and cultivated plants indicated that Hibberson's Trillium should be raised to specific status (O'Neill 1995). According to O'Neill et al. (2020), the data obtained by Lampley et al. (unpublished *in* O'Neill *et al.* 2020) suggest that this is not only a full species, but a member of a different *Trillium* clade than *T. ovatum*. Further verification is required to confirm the relational status to other *Trillium* species (Allen pers. comm. 2023).

Hibberson's Trillium maintains its short stature when planted in gardens, regardless of nutrient and soil conditions (Guppy 1968; O'Neill 1995; Douglas and Pojar 2001); gardeners have long believed it to be a distinct species (Guppy 1968; Ware 2014). Plants grown from seed collected from a single whitish flowering specimen collected at Sydney Inlet resulted in plants with pale pink flowers, and there were no colour forms that were transitional to Western Trillium (Roemer 2015). Morphological intermediates with Western

Trillium have not been observed at the University of British Columbia native plant garden, despite the spatial proximity of the two species for 19 years; furthermore, crosses between Western and Hibberson's trillium do not produce viable offspring (O'Neill 1995). However, morphological intermediates exist in the wild, with some plants reaching a larger stature (Batten pers. obs. 2014).

Description of Wildlife Species

Hibberson's Trillium is a small (10–27 cm) perennial herb that grows from a stout, fleshy rhizome (Figure 1) (Douglas *et al*. 2001, 2002; O'Neill 1995). Mature individuals bear three stem leaves in a whorl below the flower. Leaves are broadly ovate, unstalked and with smooth margins. Leaf blades are 3.3–5.3 cm long and 1.3–2.5 cm wide (O'Neill 1995; Lomer pers. comm. 2019 *in* Penny 2019). There are no basal leaves. The terminal flowers are borne on a short pedicel and have three pink petals (rarely white with pale pink tinge, but darkening to pink when dried) (Figures 2 and 3) that are offset with three green, fully divided sepals. The seeds develop in an egg-shaped capsule (O'Neill 1995; Douglas *et al*. 2001, 2002).

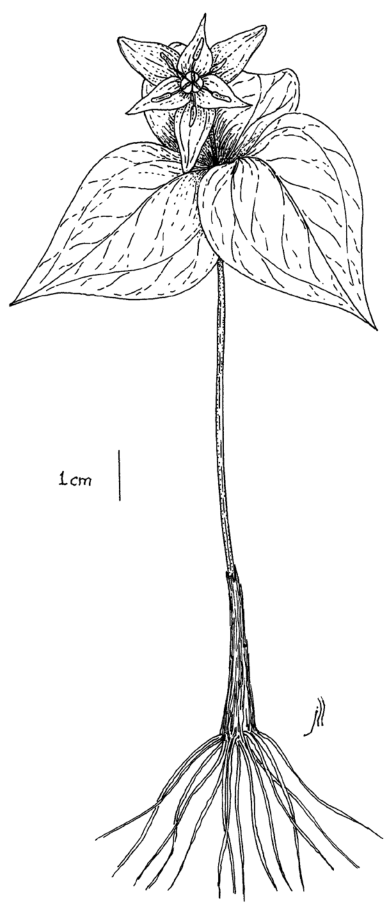

Figure 1. Illustration of Hibberson's Trillium (reprinted with permission from Douglas *et al.* 2002).

Figure 2. Hibberson's Trillium with scale bar in cm. Photo: C. Maslovat (April 9, 2022, Clanninick Creek).

Figure 3. Flowering Hibberson's Trillium showing pink venation on petals. Photo: R. Batten (April 14, 2014, Rae Lake)

The only other *Trillium* species in British Columbia, Western Trillium, occurs from southern British Columbia (including Vancouver Island) south to California and east to Alberta, Montana, Wyoming and Colorado (CPNWH 2022; NatureServe 2022). In British Columbia, Western Trillium is larger (20–45 cm tall) than Hibberson's Trillium and has flowers that are white when they open, often becoming pink as they age (Douglas *et al*. 2001; Douglas and Pojar 2001). Western Trillium is found in rich soils in moist, shady sites under the forest canopy (Douglas *et al*. 2001; Douglas and Pojar 2001), while Hibberson's Trillium occurs in seasonally wet seepage areas on rocky slopes—and, in one locality, in a creek bed—and is restricted to the northern and central portions of the west coast of Vancouver Island (Douglas and Pojar 2001; O'Neill *et al*. 2020).

Designatable Units

There are no recognized subspecies/varieties or discrete/evolutionary significant populations to be recognized as designatable units for the Canadian population. Consequently, the occurrence of Hibberson's Trillium in Canada is considered as one designatable unit.

Recognized subspecies or varieties in Canada: None

Designatable Units (DUs): One

Special Significance

Hibberson's Trillium is endemic to Canada. The species' large showy flowers and diminutive stature have inspired interest in it as a horticultural species for alpine rock gardens (Guppy 1968; Douglas and Pojar 2001; Clarke 2006; Whitehead 2009; Ware 2014). Offspring from plants collected in 1938 by Hibberson have been widely grown by gardeners (Guppy 1968; Taylor and Szczawinski 1974). Hibberson's Trillium can be propagated *ex situ* from seed and offsets (Guppy 1968), but trilliums are difficult to propagate, so supplying sufficient plants to meet the horticultural demand may be challenging (Case and Case 1997 *in* Chauhan *et al*. 2019; Klest 2002). Fraser's Thimble Farms on Saltspring Island, B.C., has offered Hibberson's Trillium for sale in the past, but it is not currently available (Fraser's Thimble Farms 2022).

Species in the *Trillium* genus are rich in bioactive phytochemicals and are used extensively in traditional medicine (Rahman *et al*. 2017; Chauhan *et al*. 2018, 2019; Rathore *et al*. 2020). Over 40 secondary metabolites have been isolated in the genus, including steroids, saponins and flavonoids that may have pharmacological applications due to their anti-cancer, anti-fungal, anti-inflammatory and analgesic properties (Rahman *et al*. 2017; Chauhan *et al*. 2019). The leaves of other *Trillium* species are eaten raw or cooked as a pot herb (Alternative Nature Online Herbal 2022; Deane 2022; Edible Wild Food 2022).

Trillium seeds have lipid-rich structures (elaiosomes) that are eaten by insects, gastropods and mammals, which help disperse the seeds (Mesler and Lu 1983; Ohara and Higashi 1987; Ohara 1989; Jules 1996; Kalisz *et al*. 1999; Miller and Kwit 2018). Deer eat the seed pods and may also disperse the seeds (Vellend *et al*. 2003).

ABORIGINAL (INDIGENOUS) KNOWLEDGE

Aboriginal Traditional Knowledge (ATK) is relationship-based. It involves information on ecological relationships between humans and their environment, including characteristics of species, habitats, and occurrences. Laws and protocols for human relationships with the environment are passed on through teachings and stories, and Indigenous languages, and can be based on long-term observations. Place names provide information about harvesting areas, ecological processes, spiritual significance, or the products of harvest. ATK can identify life history characteristics of a species or distinct differences between similar species.

Cultural Significance to Indigenous Peoples

There is no species-specific ATK in the report. However, Hibberson's Trillium is important to Indigenous Peoples who recognize the interrelationships of all species within the ecosystem.

DISTRIBUTION

Global Range

Hibberson's Trillium is endemic to British Columbia's Vancouver Island (Figure 4).

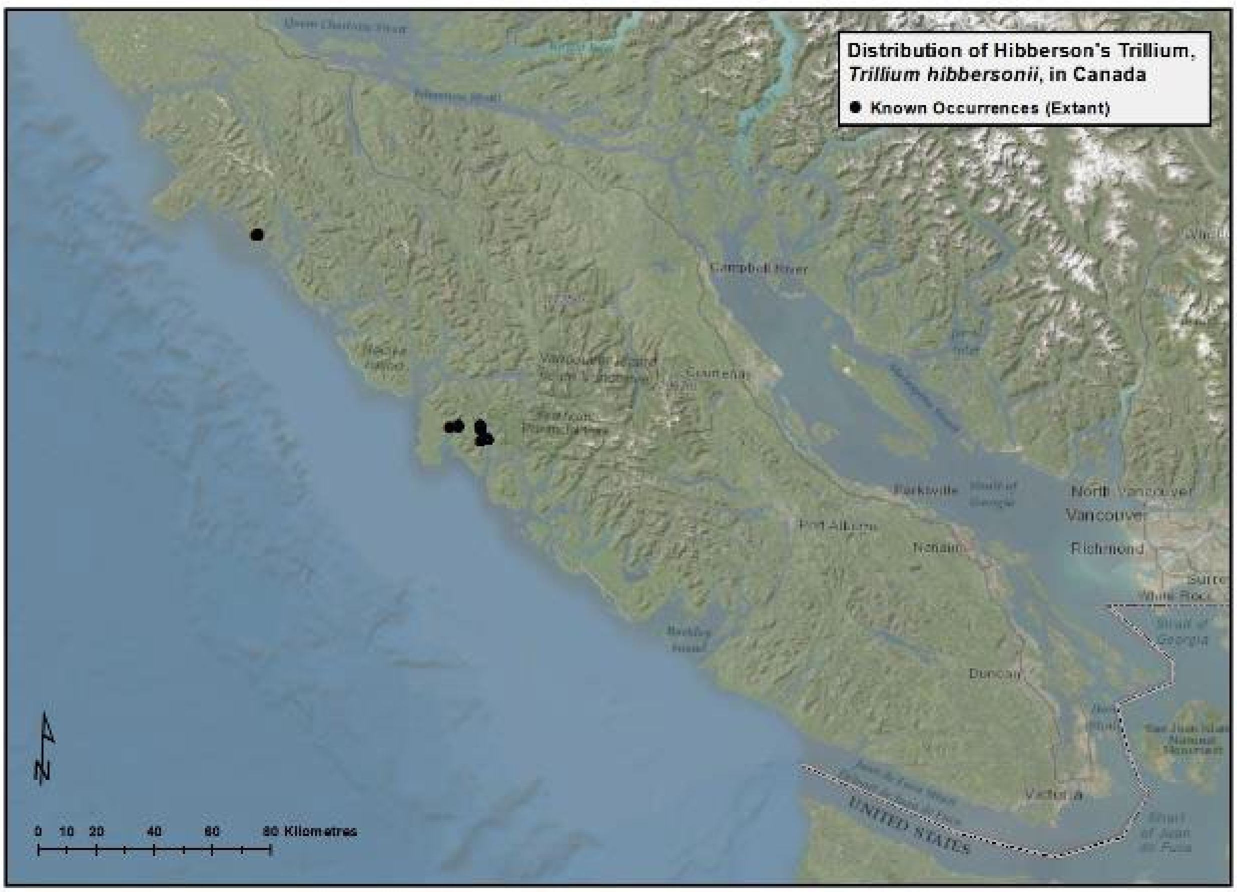

Figure 4. Global distribution of Hibberson's Trillium (map prepared by Alain Filion).

Canadian Range

The entire global range of Hibberson's Trillium is in Canada; it is known from seven subpopulations in the northern and central portions of the west coast of Vancouver Island (Figure 4). The most northerly subpopulation is along Clanninick Creek off Kyuquot Sound, while two subpopulations are near Hesquiat Lake, and four are located close to Sydney Inlet. Western Vancouver Island is extremely remote and difficult to access, and the survey coverage for this species has significant gaps, including vast areas that may contain suitable habitat.

Search effort has been extremely limited since the species was first recorded at Rae Lake by Hibberson in 1938. The Rae Lake subpopulation was re-surveyed in 1947 and more recently in 1981, 1997, 2001 and 2014, but detailed counts were not performed (Table 1).

Table 1. Subpopulation[2] size and survey history of Hibberson's Trillium subpopulations.

CDC EO #	BC CDC EO name	Survey history	Number of plants counted
1	Sydney Inlet, Vancouver Island	Dunning, Johnson, Kreutzenstein and Cruickshank (2023); Penny, Lomer, McClaren, Grandbois and Patterson (2019); Bruhwiler (2014); Roemer (2001)	More than 13 flowering + "many flowering" (129–150 total plants) (2019) "Hundreds flowering" plus 80+ flowering (2023)
2	Hesquiat Lake, Vancouver Island	Penny, Lomer, McClaren, Grandbois and Patterson (2019); Roemer (2001); UBC Herbarium (1992); Ceska (1981)	More than 83 flowering (194 total plants) (2019)
3	Rae Lake, near Boat Basin	Roemer, Batten and Spriggs (2014); Roemer (2001); Ceska, Ceska, Ogilvie and Roemer (1981); UBC (1947); UBC (1938)	150–250 flowering plants (2014)
4	Clanninick Creek, Kyuquot	Batten and Maslovat (2022); Dunning, Spriggs, Johnson and Kreutzenstein (2022) VanDieren (197X); Taylor (1958);	87 flowering (146–153 total plants) (2022)
5	Sydney Inlet/Sydney River, 1.3 km south of confluence	Dunning, Johnson, Kreutzenstein and Cruickshank (2023); Penny, Lomer, McClaren, Grandbois and Patterson (2019)	"Mostly flowering" (< 10) + "Some flowering" (< 50) (estimate 20? flowering/60 total plants) (2019)
6	Sydney Inlet Provincial Park, southwest side, Vancouver Island	Dunning, Johnson, Kreutzenstein and Cruickshank (2023); Penny, Lomer, McClaren, Grandbois and Patterson (2019)	More than 100 flowering (241 total plants) (2019) 400–450 flowering plants (2023)

CDC EO #	BC CDC EO name	Survey history	Number of plants counted
7	Pretty Girl Cove, Vancouver Island	Dunning, Johnson, Kreutzenstein and Cruickshank (2023); Penny, Lomer, McClaren, Grandbois and Patterson (2019)	“Many flowering (< 334)” (329–334 total plants) (2019) “Hundreds in flower with many more seedlings” (2023)
Total			1,220–1370+ Flowering plants

[1] Subpopulation names are consistent with B.C. Conservation Data Centre Element Occurrence names.

The Clanninick Creek subpopulation was documented in 1958 by Taylor and Szczawinski. In the 1970s, a loose piece of turf containing a single Hibberson’s Trillium plant was found washed down to the estuary by William van Dieren; the plant was planted in a pot by Oluna Ceska (Roemer 2015). This subpopulation was re-confirmed in 2022 during the fieldwork prior to this status report (Table 1).

The Hesquiat Lake subpopulation was first documented by Adolf and Oluna Ceska in 1981. In 2001, a BC Parks officer discovered a new subpopulation at Sydney Inlet, which was confirmed by Hans Roemer, A. Ceska and O. Ceska the same year.

In 2019, Penny, Lomer, McClaren, Grandbois and Patterson documented three new subpopulations (two at Sydney Inlet and one at Pretty Girl Cove), and the subpopulations at Sydney Inlet and Hesquiat Lake were re-surveyed the same year (Penny 2019). The 2019 survey increased the number of known subpopulations by 63%, suggesting that more survey effort is required to determine the species’ full distribution and abundance (Penny 2019). During surveys in 2023, an additional eight sites were found within 1 km of the original Sydney Inlet subpopulation (Dunning et al. 2023). Owing to the large expanse of unsurveyed area, further search effort will likely find new subpopulations.

Population Structure

For Hibberson’s Trillium, the COSEWIC term “subpopulation,” defined as “geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange” (COSEWIC 2019), corresponds well to an element occurrence as identified in NatureServe’s (2020) habitat-based plant element occurrence delimitation standards, which require a default separation distance of 1 km except in riparian corridors, dynamic landscape mosaics and continuous apparently suitable habitat. There has been no research on genetic structure within the population.

Extent of Occurrence and Area of Occupancy

The Extent of Occurrence (EOO) and Index of Area of Occupancy (IAO) were estimated by the COSEWIC Secretariat based on all known records, as all subpopulations are extant.

Current EOO:

The EOO in Canada is 448 km^2, calculated using a minimum convex polygon that encompasses the known records during the 2014–2022 period.

Current IAO:

The IAO in Canada is 40 km^2, calculated using a 2 km x 2 km grid drawn over known records during the 2014–2022 period. Although it seems likely that additional sites will be found, the upper range for IAO is not known but is certainly less than 2,000 km^2, based on our knowledge of the range and the habitat.

Fluctuations and Trends in Distribution

No long-term monitoring has been carried out, and reliable repeat counts of the number of mature individuals have not been performed at any of the known subpopulations; therefore, the available data are not sufficient to infer trends in distribution. All the previously documented subpopulations are still extant, so there have been no observed declines in EOO or IAO. A recent increase in the number of known subpopulations is the result of an expanded search effort, and does not reflect a genuine increase in population size.

BIOLOGY AND HABITAT USE

Life Cycle and Reproduction

Information on the biology and ecology of Hibberson’s Trillium is limited. The information presented below has been compiled primarily from research on related species, the small number of studies on Hibberson’s Trillium, grey literature and the report writers’ personal observations.

Trilliums reach maturity in 4–20 years depending on the species and growing conditions; the age of the plant can be determined by counting the annual rhizome scars (Ohara 1989; Hanzawa and Kalisz 1993; Case and Case 1997 *in* NatureServe 2022). In the wild, the average reproductive age of White Trillium (*T. grandiflorum*) was 23 years, with a minimum reproductive age of 17 years (Hanzawa and Kalisz 1993). In a garden setting, Hibberson's Trillium flowered three and four years after being sown in pots (Carolyn 2015), but age to maturity in the wild is not known. Other *Trillium* species can reproduce both vegetatively through rhizomes and sexually, although asexual reproduction is uncommon or absent in many species (Ohara 1989; Hanzawa and Kalisz 1993; Chauhan *et al*. 2019). Horticulturally, Hibberson's Trillium has been grown from offsets (Guppy 1968; Miskelly pers. comm. 2023), but it is not known if asexual reproduction occurs in the wild.

A member of a rock garden forum suggested that, in a garden setting, Hibberson's Trillium can live for at least 35 years (Whitehead 2009), but it is possible that plants are persisting in the same locality from offsets. The average age of parents in the population (generation time) for Hibberson's Trillium is estimated to be 10–20 years, which is greater than the minimum of three years to maturity and less than the maximum suggested age of 35 years.

Hibberson's Trillium blooms in early April. Pollinators are discussed in **Interspecific Interactions.** It is unknown how many seeds are produced per plant, and there have been no studies on juvenile and adult survival rates or recruitment. White Trillium seedlings develop roots in the first growing season, with the cotyledon emerging in the second growing season and a single leaf emerging in the third growing season (Hanzawa and Kalisz 1993), while, in other species, seedlings emerge within the year (Case and Case 1997 *in* Chauhan *et al*. 2019). It is likely that Hibberson's Trillium emerges after a single year, because only a single cold period is required; in contrast, Western Trillium exhibits double dormancy, requiring two winters and one summer for germination (O'Neill 1995). When planted in pots, Hibberson's Trillium seeds germinated the first spring after sowing and produced linear cotyledons (Leena 2019).

Trillium stems emerge annually from the rhizome in the spring, with usually only one stem produced per year (Hanzawa and Kalisz 1993; Case and Case 1997 *in* Chauhan *et al*. 2019). Following the cotyledon stage, there are three stages in the Trillium life cycle: one-leaf vegetative, three-leaf vegetative and three-leaf reproductive. A minimum size and/or age must be attained for flowering to occur (Ohara 1989; Hanzawa and Kalisz 1993; Chauhan *et al*. 2018). Not all plants above the size threshold for reproduction flower each year (Hanzawa and Kalisz 1993).

Hibberson's Trillium is diploid (2n = 10) (O'Neill 1995). In other *Trillium* species, seeds are more likely to be produced from cross-fertilization, whereas self-fertilized seeds may exhibit poor germination, establishment and growth (Kalisz *et al*. 1999; Irwin 2000).

Habitat Requirements

Hibberson's Trillium occurs in the Coastal Western Hemlock zone (CWH), in the very wet hypermaritime biogeoclimatic subzone (CWHvh) and nearby very wet maritime biogeoclimatic subzone (CWHvm) (habitat description in Table 2; Figures 5 to 7). Most subpopulations are found at low elevations (as low as 3 m; Specimen UBC V250699), next to the ocean or a lake, but plants have been discovered at elevations as great as 340 m (Penny 2019; BC CDC 2022). Soils are thin and poorly developed (Penny 2019; O'Neill *et al*. 2020; Dunning *et al*. 2022; Maslovat and Batten 2022), sometimes occurring over talus (Specimen UBC V250698).

Table 2. Summary of essential functions, habitat and detail of habitat of Hibberson's Trillium in Canada by life stage.

Life Stage[a]	Habitat Function[b]	Habitat[c]	Detail of Habitat[d]
All life history stages	Growing, reproduction, dispersal	Open to shaded sites on rocky ledges, outcrops, cliffs, rock walls, or partly exposed rocks with spring seepage, or creek beds, in Coastal Western Hemlock forests	Soils: thin, poorly developed over talus or in rock crevices Chemistry: unknown Canopy coverage: may be shaded, but requires sun for flowering. Elevation: 3–340 m Aspect: east to southwest Associated species: Thick moss layers include Haleakala Firmoss (*Huperzia haleakalae*), Red-stemmed Feathermoss (*Pleurozium schreberi), Campylopus* spp. and *Racomitrium* spp. on rock and Streamside Moss (*Scouleria aquatica*) next to creeks. Associated species vary between subpopulations. Associated forbs include Timber Oatgrass (*Danthonia intermedia*), Dune Bentgrass (*Agrostis pallens*), Pink Fawn Lily (*Erythronium revolutum*), Small-flowered Alumroot (*Heuchera micrantha*), Rusty Saxifrage (*Micranthes ferruginea*), Cushion Miner's-lettuce (*Claytonia rubra*), Many-flowered Woodrush (*Luzula multiflora*), Ross' Sedge (*Carex rossii*), Tapered Panicgrass (*Dichanthelium acuminatum*), Wallace's Spikemoss (*Selaginella wallacei*), Davidson's Beardtongue (*Penstemon davidsonii*), Twinflower (*Linnaea borealis*), American Parsley Fern (*Cryptogramma acrostichoides*), Licorice Fern (*Polypodiumn glycyrrhiza*), Deer Fern (*Struthiopteris spicant)* and Western Sword Fern (*Polystichum* munitum). Shrubs and trees are uncommon and include Evergreen Huckleberry (*Vaccinium ovatum*), Salal (*Gaultheria shallon*), Western Red Cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*) and Lodgepole Pine (*Pinus contorta*). *Cladonia* spp. and other lichens are also found in the habitat.

[a] Life Stage: Stage of the life cycle of the species (e.g., seed, egg, seedling, juvenile, larva, pupa, adult)

[b] Habitat function: How the habitat supports a life-cycle process of the species (e.g., habitat that supports spawning, breeding, denning, nursery, rearing, feeding/foraging, migration, flowering, fruiting, seed dispersing, germinating, seedling development)

[c] Habitat: The structural or biological features of the area or type of site needed for a species to carry out its life processes

[d] Habitat details: Detailed information such as measurable properties or characteristics of the habitat

Figure 5.   Hibberson’s Trillium habitat at Rae Lake. Photo: R. Batten (April 14, 2014, Rae Lake).

Figure 6. Aerial view of Rae Lake, showing the limited rock outcrop habitat in the landscape. Photo: R. Batten (April 14, 2014, Rae Lake).

Figure 7. Hibberson's Trillium habitat at Sydney Inlet. Photo: E. McClaren (April 16, 2019, Sydney Inlet).

For six of the subpopulations, the habitat ranges from east to southwest facing, from full sun to semi-shade. Sites include open rocky ledges, outcrops and cliffs, crevices of rock walls and partly exposed rocks with seasonal seepage (Penny 2019). Seepages range from moist to fully saturated by falling water in April (Dunning *et al*. 2023). At Sydney Inlet Provincial Park, plants growing in semi-shade were less vigorous than plants growing in full sun (Dunning *et al*. 2023).

The Clanninick Creek subpopulation is found in a riparian area next to the creek, in areas that are inundated during peak flows. The plants grow in small clefts in the rock with soil deposits, on mossy banks or steep cliffs on the side of the creek or on boulders in the centre of the creek (Dunning *et al*. 2022; Maslovat and Batten 2022). Sand deposits are 2.5–4 cm deep and are overgrown by moss, primarily Streamside Moss (*Scouleria aquatica*) (Dunning *et al*. 2022; Maslovat and Batten 2022). The sites are shaded by dense Sitka Spruce (*Picea sitchensis*) and Western Red Cedar (*Thuja plicata*) stands and by deep canyon walls, with plants receiving direct sunlight only at midday (Dunning *et al*. 2022; Maslovat and Batten 2022). In 2022, one of the sites that did not receive direct sunlight had no flowering plants (Dunning *et al*. 2022).

Movements, Migration, and Dispersal

Hibberson's Trillium seeds have an elaiosome (O'Neill 1995), a lipid-rich attachment that attracts animals and serves as a dispersal mechanism. In other *Trillium* species, ants (Ohara and Higashi 1987; Kalisz *et al*. 1999; Miller and Kwit 2018) and wasps (Jules 1996) carry the seeds to their nests, eat the elaiosomes and discard the seeds. Ground beetles (Carabidae) (Ohara and Higashi 1987; Ohara 1989) and the Pacific Banana Slug (*Ariolimax columbianus*) (Mesler and Lu 1983) also eat the elaisomes, facilitating short-distance seed transportation. *Trillium* seeds are also eaten by deer, and remain viable in the animals' digestive tracts, possibly enabling long-distance dispersal (Vellend *et al*. 2003).

Studies of dispersal in Western Trillium show dispersal over limited distances, with 67% of recruitment occurring within 1 m of a potential parent (Kahmen and Jules 2005). Experimental studies have observed ants carrying the seeds of other *Trillium* species up to 10 m from the parent plant, with the average dispersal distance ranging from 0.5 m to 2.4 m (Kalisz *et al*. 1999), while yellow jackets (*Vespula* spp.) carried seed an average of 1.4 m (Zettler *et al*. 2001). Hibberson's Trillium could also be gravity dispersed, in the case of plants on ledges and cliff faces. It is unknown if Trillium seeds are buoyant and if dispersal occurs by water.

Interspecific Interactions

<u>Predators and competitors:</u>

Instances of herbivory on Hibberson's Trillium occur, possibly by the American Black Bear (*Ursus americanus*); in 2014, many freshly grazed plants were observed in the Rae Lake population (Roemer pers. comm. 2018 *in* BC CDC 2018). Trilliums are a preferred food of deer, which eat both the leaves and flowers, leaving an unproductive stem that does not re-sprout until the following year (Jules 1998; Knight 2003; Leege *et al*. 2010). Herbivory can result in regression to a vegetative stage in the next season and decreased reproductive success (Knight 2003; Leege *et al*. 2010). Deer are not hyper-abundant on the west coast and do not impact Hibberson's Trillium beyond typical natural levels.

<u>Other interactions:</u>

No studies have been carried out on the pollinators of Hibberson's Trillium, but pollinators of other *Trillium* species include flies, bees and beetles (Case and Case 1997 *in* Chauhan *et al*. 2019; Jules 1998; Irwin 2000). A beetle in the family Chrysomelidae was observed on Hibberson's Trillium plants at the University of British Columbia Botanical Garden (O'Neill 1995), and several species of Diptera were observed pollinating Hibberson's Trillium at Clanninick Creek (Figure 8; Dunning *et al*. 2022).

Ants, wasps, ground beetles, Pacific Banana Slug and deer are known dispersal agents for seeds of other *Trillium* species (see **Movements, Migration, and Dispersal**).

Figure 8. Pollinator on Hibberson's Trillium at Clanninick Creek. Photo: J. Dunning (April 16, 2022, Clanninick Creek).

Physiological, Behavioural, and Other Adaptations

Hibberson's Trillium has high levels of anthocyanin, which may provide protection from ultraviolet radiation (O'Neill 1995). Numerous secondary metabolites are found in other *Trillium* species (Rahman *et al*. 2017; Chauhan *et al*. 2019; Rathore *et al*. 2020). The physiological adaptations and potential adaptive advantages for the plants are not known.

Limiting Factors

Limiting factors are generally not human-induced and include intrinsic characteristics that make the species less likely to respond to conservation efforts. Limiting factors may become threats if they result in population decline. The main limiting factors for Hibberson's Trillium are the scarcity of suitable habitat and its distribution in isolated patches, low fecundity rates and limited mechanisms for long-distance dispersal. Other *Trillium* species are susceptible to climate-change-related impacts because they have low fecundity and limited recruitment (Chauhan *et al*. 2019). There have been no studies on Hibberson's Trillium fecundity and recruitment.

POPULATION SIZES AND TRENDS

Data Sources, Methodologies, and Uncertainties

The population size was calculated by summing the most recent count data for all subpopulations. Five of the seven subpopulations were surveyed in 2019 during fieldwork conducted by biologists from the B.C. Conservation Data Centre and BC Parks, as well as a biological consultant. The number of flowering mature plants was estimated in the five subpopulations, and two of the subpopulations were re-surveyed in 2023. The Rae Lake subpopulation was not surveyed, but its size was estimated by biologists on an unpaid excursion (so the survey may have been incomplete). In the Clanninick Creek subpopulation, two different surveys were conducted within days of each other, survey routes were compared, and the highest count number was used for population estimates. None of the subpopulations has had consistent monitoring or systematic recounts, so no data are available for estimating or inferring population trends.

Abundance

Hibberson's Trillium has probably always been rare because of the limited availability of habitat in its range. It is known from seven subpopulations collectively supporting an estimated total of 1,220–1,370 mature flowering individuals (Table 1). It is possible some of the non-flowering plants were mature, but did not flower in the survey year; however, this is impossible to determine without excavation, so the number of flowering plants is presumed to be the number of mature individuals. The estimated number of plants per subpopulation ranges from 20 to 400–450 flowering plants, plus non-flowering plants. Although some additional sites will likely be found, the total number of mature individuals is expected to be well below 10,000.

Fluctuations and Trends

No monitoring or population modelling data are available in order to determine fluctuations and trends. Hibberson's Trillium is a long-lived species and, in the absence of habitat destruction, subpopulation numbers are expected to remain relatively stable over time. The presence of plants at Rae Lake since 1938 and at Clanninick Creek since 1958 suggests that the subpopulations are viable and persistent over the long term. Subpopulations have also persisted at Hesquiat Lake since 1981 and at Sydney Inlet since 2001.

Continuing decline[1] in number of mature individuals:

Although there is no direct evidence of a continuing decline in the number of mature individuals due to the lack of consistent surveys, this continuing decline is likely as a result of the ongoing threats of logging and landslides. It is also possible that subpopulations have been lost due to these activities before these subpopulations were documented.

Evidence for past decline (3 generations or 10 years, whichever is longer) that has either ceased or is continuing (specify):

There is no evidence for a past decline in the number of mature individuals, due to the lack of consistent surveys.

Evidence for projected or suspected future decline (next 3 generations or 10 years, whichever is longer, up to a maximum of 100 years):

There is no evidence for a projected future decline in the number of mature individuals, due to the lack of consistent surveys. Future decline is suspected as a result of ongoing threats.

Long-term trends:

There are no data on long-term trends due to a lack of repeated surveys. Habitat destruction associated with logging is ongoing on Vancouver Island, and it is inferred from these habitat trends that subpopulations may be destroyed before they are recorded.

[1] A recent, current, or projected future decline (which may be smooth, irregular or sporadic), which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines.

Population fluctuations, including extreme fluctuations:

There is no evidence of fluctuations in numbers of mature individuals or subpopulations due to the lack of consistent surveys. The recent increase in the number of known subpopulations results from a greater search effort rather than a genuine increase in population size. It is inferred that extreme fluctuations in the number of plants are unlikely, because individuals are presumed to be long-lived and all known subpopulations have persisted since they were first observed.

Severe Fragmentation

Although there is a lack of long-term monitoring for this species, all known subpopulations have persisted since they were first recorded, suggesting that habitat patches are of sufficient size to support viable subpopulations. Rock outcrops or cliffs with seepage and creek habitats are naturally rare in the landscape and are isolated in dense coniferous forests (Figure 6). Separation distances between habitat patches are greater than the species' dispersal potential, given its limited dispersal mechanisms (primarily insects and gastropods).

Rescue Effect

There is no possibility of rescue because Hibberson's Trillium is endemic to Canada and restricted to Vancouver Island, British Columbia.

THREATS

Historical, Long-term, and Continuing Habitat Trends

The survey coverage and the data available are insufficient to assess habitat trends. Habitat extent and quality are believed to have declined due to ongoing logging, which may have destroyed suitable habitat and possibly undocumented subpopulations. On Vancouver Island, 243,000 ha of forest was logged between 2004 and 2015, of which 100,000 ha was old growth (Wieting 2016). All known subpopulations occur in riparian areas or on rocky ledges, outcrops or cliff habitat that would not be directly impacted by logging; however, timber harvesting and road building in adjacent areas may indirectly cause habitat destruction through landslides or altered hydrology.

Current and Projected Future Threats

Hibberson's Trillium is vulnerable to the cumulative effects of various threats. The nature, scope, and severity of these threats are assessed in Appendix 1, following the IUCN-CMP (International Union for the Conservation of Nature – Conservation Measures Partnership) unified threats classification system (see Salafsky *et al*. 2008 for definitions and Master *et al*. 2012 for guidelines). The threat assessment process consists of assessing the impacts of each of 11 main categories of threats and their subcategories, based on the scope (proportion of population exposed to the threat over the next 10-year period), severity (predicted population decline within the scope during the next 10 years or 3 generations, whichever is longer, up to ~100 years) and timing of each threat. The overall threat impact is calculated by taking into account the separate impacts of all threat categories, and can be adjusted by the species experts participating in the threats evaluation.

The overall threat impact for Hibberson's Trillium is considered Medium - Low, corresponding to an anticipated further decline of between 1% and 30% (Low indicates a range of 1–10% and Medium, of 3–30%) over the next three generations (30 – 60 years). These values are to be interpreted with caution, as they may be based on subjective information such as expert opinion, although efforts have been made to corroborate the scores with the available studies and quantitative data.

<u>The primary threats to Hibberson's Trillium are:</u>

Biological Resource Use: Logging & Wood Harvesting (IUCN 5.3; overall threat impact Medium - Low)

All known Hibberson's Trillium subpopulations occur on open rocky ledges, outcrops or cliff habitat or in riparian areas, and are not likely to be directly impacted by timber harvesting. However, timber harvesting or access road construction in adjacent areas may alter seepage patterns, cause erosion, or inadvertently destroy all or part of a subpopulation. Wood harvesting activities are known to increase landslide frequency, especially in association with extreme precipitation events; this is evaluated under threat **10.3 Avalanches/Landslides**.

Four of the seven subpopulations occur in B.C.'s provincial parks, which are protected from wood harvesting but could be impacted by logging on upslope Crown land. The remaining three subpopulations (53% of the total population) occur on provincial Crown land, which could be directly impacted by wood harvesting.

The Clanninick Creek subpopulation may be vulnerable to erosion associated with logging, because the plants are next to a creek and are submerged during high water events. However, the plants have persisted at this site for over 60 years and appear to be able to survive under water after heavy spring rains. They grow in the compacted sand in boulder crevices, where they are anchored by long roots, so they are unlikely to be washed away. Clanninick Creek Ecological Reserve is upslope of the subpopulation and is protected from logging.

There is no information on the possible timing of harvesting. However, it is unlikely that harvesting would occur in all three unprotected subpopulations at the same time and, even if harvesting or habitat destruction related to harvesting activities occurred, some plants would likely survive. It is possible that other undocumented subpopulations exist in the suitable forest habitat in the region.

Geological Events: Avalanches/Landslides (IUCN 10.3; overall threat impact Medium - Low)

Tsunamis and landslides associated with geological events could affect this species, but the impact is difficult to determine (Penny 2019). Landslides do occur naturally on the west coast of Vancouver Island, and their frequency increases with forest harvesting. A landslide in Sydney Inlet Provincial Park from natural causes opened up a large tract of land and exposed new cliff faces (Dunning *et al*. 2023). Landslides occur very infrequently in natural situations and only affect small areas; however, if one occurred in the vicinity of Hibberson's Trillium, it could have a serious impact.

In the nearby Artlish River watershed, the natural rate of landslides appears to be about one per year. The average rate post-logging is 3.25 landslides per year, or about a threefold increase in frequency (Guthrie 2002). Landslides have occurred on the slopes above Hesquiat Lake and, in 2018, seven major slides occurred on Mount Seghers, filling the lake with woody debris; it is unclear if the slides were caused by logging 40 years prior (Titian 2018). At Hesquiat Lake, Hibberson's Trillium grows on rock outcrops close to the lake and could be dislodged by woody debris and slide events in areas across from and north of the previous landslides (Penny 2019).

Landslides may also increase in frequency and size with the increasing severity and frequency of storms associated with climate change.

Climate Change & Severe Weather: Storms & Flooding (IUCN 11.4; overall threat impact Low)

This threat category applies to subpopulations in protected areas that are not subject to increased landslide activity due to logging, but that could be affected by the impacts of increasingly frequent storms and flooding associated with climate change, including storm surges along the seashore.

Most subpopulations occur in areas with steep terrain that is vulnerable to erosion from storms and flooding associated with extreme precipitation events. The west coast of Vancouver Island is subject to naturally occurring, variable, high precipitation events; however, these extreme events appear to be increasing in frequency and intensity along with climate change.

The sea-level rise associated with storms may also be a concern for some subpopulations that are at low elevations (Penny 2019).

Number of Threat Locations

There are seven element occurrences, as defined by the B.C. Conservation Data Centre using the default minimum separation distance of 1 km (NatureServe 2020), corresponding to the seven subpopulations presented in this status report. Based on the threat evaluation, each of these represents a geographically distinct location where a single threatening event, such as a landslide, can rapidly affect all individuals present (Table 3). The number of clumps of plants in each location ranges from one to ten, and it is not possible to consider multiple threat locations in any subpopulation due to the spatial separation of threats. There is no information on trends or fluctuations in the number of locations.

Table 3. Subpopulations, ownership and primary threats.

BC CDC EO #	BC CDC EO name/ subpopulation name	Ownership	Site description	Primary threat
1	Sydney Inlet, Vancouver Island	Provincial	Sydney Inlet Provincial Park	Storms & Flooding
2	Hesquiat Lake, Vancouver Island	Provincial	Hesquiat Lake Provincial Park	Avalanches/ Landslides; Storms & Flooding; Logging & Wood Harvesting (upslope)
3	Rae Lake, near Boat Basin	Unsurveyed Provincial Crown land	Above Hesquiat Harbour - 3 km southwest of Hesquiat Lake Provincial Park	Logging & Wood Harvesting; Avalanches/ Landslides
4	Clanninick Creek, Kyuquot	Unsurveyed Provincial Crown land	Along the creek southwest of Clanninick Creek Ecological Reserve	Logging & Wood Harvesting
5	Sydney Inlet/Sydney River, 1.3 km south of confluence	Provincial	Sydney Inlet Provincial Park	Storms & Flooding
6	Sydney Inlet Provincial Park, southwest side, Vancouver Island	Provincial	Sydney Inlet Provincial Park	Storms & Flooding; Avalanches/ Landslides
7	Pretty Girl Cove, Vancouver Island	Unsurveyed Provincial Crown land	West side of Pretty Girl Inlet	Storms & Flooding; Logging & Wood Harvesting

PROTECTION, STATUS, AND RECOVERY ACTIVITIES

Legal Protection and Status

Hibberson's Trillium currently has no legal protection or status, and is not listed under the *Species at Risk Act.* Although Western Trillium is protected under the *Dogwood, Rhododendron and Trillium Protection Act*, Hibberson's Trillium is not, even after it was elevated to specific status (King's Printer 1998).

The species is not listed under the Convention on International Trade in Endangered Species (CITES 2022). The International Union for Conservation of Nature currently considers Hibberson's Trillium to be a sub-taxon of Western Trillium, which is designated as Least Concern on the Red List (Meredith *et al.* 2020, 2022). Following the elevation of Hibberson's Trillium to the species level, it will likely be categorized as Vulnerable under criterion D1 (very small or restricted population) (Meredith *et al.* 2022). The Red List assessment was carried out prior to the findings of the 2019 fieldwork.

Non-Legal Status and Ranks

Provincially, Hibberson's Trillium is ranked S3 (Vulnerable) by the B.C. Conservation Data Centre and is ranked N3 (Vulnerable) nationally (NatureServe 2022). In 2019, it was globally ranked G3 (Vulnerable) based on the NatureServe rank calculator (NatureServe 2022).

Land Tenure and Ownership

Four of the known Hibberson's Trillium subpopulations are protected from development due to their location in B.C. provincial parks; however, the remaining three subpopulations are on unsurveyed provincial Crown land (Table 3).

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The following collections were examined and/or databases queried for the preparation of this report:

- Canadian Museum of Nature (CAN): No specimens
- Consortium of Pacific Northwest Herbaria Specimen Database (accessed online): Specimens listed under herbarium of origin.
- Department of Agriculture, Ottawa (DAO): No specimens available
- Royal British Columbia Museum (V): V176607 (Ceska 1981); V190823 (Roemer 2001); V190824 (Roemer 2001)
- University of British Columbia (UBC): V73131 (Hibberson 1938-holotype); V250698 (Lomer 2019); V250699 (Lomer 2019)

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

Carrina Maslovat is a species-at-risk biologist, focused on botany in plant communities at risk. She has a master's degree from the University of Victoria where she studied native grasses and Garry Oak ecosystem restoration. 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, formulated best management practices to minimize impacts to species at risk, and has designed ecological restoration projects to provide habitat for species at risk. She has written six COSEWIC status reports, four status report updates, and several recovery planning documents. She is the owner and lead biologist of Maslovat Consulting.

Ryan Batten is a botanist and plant ecologist with 15 years of experience, specializing in rare plants, wetlands and biodiversity inventories. He brings a broad floristic knowledge from conducting fieldwork in British Columbia, Alberta, Saskatchewan, Ontario and Nunavut. He is an active member of the B.C. Flora Update Committee and has been affiliated with the Royal BC Museum Herbarium for the last decade. In 2019, he prepared the status ranks for all of B.C.'s vascular plants for the federal government's General Status of Wild Species in Canada program. Ryan frequently works with the B.C. Conservation Data Centre, where he spends the majority of his time drafting conservation status reports, mapping the ranges of rare species and providing training on the NatureServe methodology for status assessment. His current research interests include geospatial floristics, human-mediated dispersal, and traits of rarity.

Appendix 1. Threats assessment for Hibberson's Trillium

THREATS ASSESSMENT WORKSHEET				
Species or Ecosystem Scientific Name	Hibberson's Trillium - *Trillium hibbersonii*			
Element ID			**Elcode**	
Date (Ctrl + ";" for today's date):	2022-12-02			
Assessor(s):	Del Meidinger (facilitator), (Co-chair) & Bruce Bennett (Co-chair); Carrina Maslovat (report writer); Jenifer Penny, Brenda Costanzo, Danna Leaman & David Mazzerole (SSC members); and Alyssa Pogson (COSEWIC Secretariat).			
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	2	0
	D	Low	1	3
Calculated Overall Threat Impact:			Medium	Low
Assigned Overall Threat Impact:			**CD = Medium - Low**	
Impact Adjustment Reasons:				
Overall, Threat Comments			Generation time 10–20 years; three generations 30–60 years; likely more sites exist between southern and northern subpopulations; although about 40% of population in parks now, new sites less likely to be.	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						
1.2	Commercial & industrial areas						
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						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use	CD	Medium - Low	Restricted - Small (1-30%)	Serious - Moderate (11-70%)	Moderate - Low	
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants		Negligible	Negligible (<1%)	Serious (31-70%)	Moderate (Possibly in the short term, < 10 yrs/3 gen)	Has been a horticultural species for some time, but not currently available on Vancouver Island, and as such, there are established practices for growing. Concern that "trophy hunters" will want to collect it to add to their collections. Evidence of unauthorized lily harvesting on island off coast of Vancouver Island, so collection is possible. Plant is known as a "desirable species" in rock and alpine garden blogs. No evidence to date that it is being harvested at this time. Sites are difficult to access.
5.3	Logging & wood harvesting	CD	Medium - Low	Restricted - Small (1-30%)	Serious - Moderate (11-70%)	Moderate - Low	The three known occurrences in B.C.'s forest land base are 53% of population; no information on possible timing of harvesting in areas around sites; unlikely that harvesting would occur around all three occurrences at the same time. All known sites are in riparian areas or open rocky ledge, outcrop and cliff habitats that would not be harvested, but there could be harvesting nearby and site access for harvesting could impact sites. It is likely that other sites exist in the forest land base. Even if there is some potential for harvesting, some plants may survive, depending on harvesting plan and method.
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance						
6.1	Recreational activities						No camping sites in Sydney Inlet Park, no backcountry camping, so limited recreation in B.C. provincial parks.
6.2	War, civil unrest & military exercises						
6.3	Work & other activities						
7	Natural system modifications		Not calculated (unknown timing)	Small (1-10%)	Serious - Slight (1-70%)	Unknown	
7.1	Fire & fire suppression						Fires are extremely rare in the climatic area where plants occur, however a fire could have significant impacts on plants due to erosion that occurs as a result of the burning of humus layer that protects the soil or an increase in landslides.
7.2	Dams & water management/use						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.3	Other ecosystem modifications		Not calculated (unknown timing)	Small (1-10%)	Serious - Slight (1-70%)	Unknown	Kyuqout sites are along streams; considerable logging is taking place in the area, but resulting increases in flooding have not impacted known subpopulations; there is an ecological reserve upstream that somewhat protects the sites from increased flow. Considerable uncertainty over possible impact.
8	Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species/diseases						
8.2	Problematic native species/diseases						Deer browsing has been observed but there is no reason to expect browsing to increase above natural rate. Possible bear browsing also identified on plants.
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin						
8.5	Viral/prion-induced diseases						
8.6	Diseases of unknown cause						
9	Pollution						
9.1	Domestic & urban wastewater						
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	CD	Medium - Low	Restricted - Small (1-30%)	Serious - Slight (1-70%)	High (Continuing)	
10.1	Volcanoes						
10.2	Earthquakes/tsunamis		Not calculated (unknown timing)	Large (31-70%)	Serious - Slight (1-70%)	Unknown	Tsunamis are likely at some point, and could impact lower-elevation subpopulations; however, timing is unknown.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
10.3	Avalanches/landslides	CD	Medium - Low	Restricted - Small (1-30%)	Serious - Slight (1-70%)	High (Continuing)	Landslides naturally occur on the west coast of Vancouver Island and their frequency increases with forest harvesting. Several subpopulations occur in areas of forest harvesting, so are subject to this higher frequency of landslides. Landslides may also increase in size and frequency due to an increase in extreme precipitation events. In a nearby watershed, the Artlish River, the natural rate of landslides appears to be about one per year. The post-logging average rate is 3.25 landslides per year, about a threefold increase in frequency (Guthrie 2002). All subpopulations are at some risk from increased landslide frequency; however, there is considerable uncertainty over what proportion of the population could be subject to landslides in the next 10 years. The scope is restricted to the proportion of the population at the most likely site for landslides—Rae Lake (about 25% of mature individuals at this site).
11	Climate change & severe weather	D	Low	Restricted - Small (1-30%)	Moderate - Slight (1-30%)	Moderate - Low	
11.1	Habitat shifting & alteration		Not Calculated (outside assessment timeframe)	Pervasive (71-100%)	Moderate - Slight (1-30%)	Low (Possibly in the long term, >10 yrs/3 gen)	Plants are susceptible to impacts associated with climate change because they have low fecundity and limited recruitment. Drying trends in coastal areas may create conditions that no longer support this species, including alteration of seepage habitat. Sea-level rise may be a concern for some subpopulations that are at low elevations. The severity, and resulting impact, is likely to be Moderate to Slight based on the next 10 years of climate change, even though the longer-term impact of climate change could be more severe.
11.2	Droughts		Not Calculated (outside assessment timeframe)	Pervasive (71-100%)	Unknown	Low (Possibly in the long term, >10 yrs/3 gen)	May increase fire hazard.
11.3	Temperature extremes						
11.4	Storms & flooding	D	Low	Restricted - Small (1-30%)	Moderate - Slight (1-30%)	Moderate - Low	Increased extreme precipitation events may increase the possibility of erosion at sites. However, the west coast of Vancouver Island does get extreme events often and their frequency is naturally variable. Included in this threat category are subpopulations that are in protected areas and are not subject to increased landslide activity due to forestry but may be impacted by increased frequency of storms and flooding due to climate change, including storm surges.
11.5	Other impacts						

Classification of Threats adopted from IUCN-CMP, Salafsky et al. (2008).