

Management Plan for the Georgia Basin Bog Spider (*Gnaphosa snohomish*) in Canada

Georgia Basin Bog Spider



2021



Government
of Canada

Gouvernement
du Canada

Canada

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

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¹ www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

MANAGEMENT PLAN FOR THE GEORGIA BASIN BOG SPIDER (*Gnaphosa snohomish*) IN CANADA

2021

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

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the *Management Plan for Georgia Basin Bog Spider (Gnaphosa snohomish) in British Columbia (Part 2)* under Section 69 of the *Species at Risk Act (SARA)*. Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this management plan.

The federal management plan for the Georgia Basin Bog Spider in Canada consists of two parts:

Part 1 – Federal Addition to the *Management Plan for Georgia Basin Bog Spider (Gnaphosa snohomish) in British Columbia*, prepared by Environment and Climate Change Canada.

Part 2 – *Management Plan for Georgia Basin Bog Spider (Gnaphosa snohomish) in British Columbia*, prepared by the British Columbia Ministry of Environment and Climate Change Strategy.

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Part 1 – Federal Addition to the *Management Plan for Georgia Basin Bog Spider (Gnaphosa snohomish) in British Columbia*, prepared by Environment and Climate Change Canada

Preface

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

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Georgia Basin Bog Spider and has prepared the federal component of this management plan (Part 1), as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with the British Columbia (B.C.) Ministry of Environment and Climate Change Strategy as per section 66(1) of SARA. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if the Minister is of the opinion that an existing plan relating to wildlife species includes adequate measures for the conservation of the species. The Province of B.C. provided the attached management plan for Georgia Basin Bog Spider (Part 2) as science advice to the jurisdictions responsible for managing the species in British Columbia. It was prepared in cooperation with Environment and Climate Change Canada.

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

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

² www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the *Management Plan for Georgia Basin Bog Spider (Gnaphosa snohomish) in British Columbia* (Part 2 of this document, referred to henceforth as “the provincial management plan”) and/or to provide updated or additional information.

Under SARA, prohibitions regarding the protection of species and their habitat do not apply to species of special concern. Conservation measures in the provincial management plan dealing with the protection of individuals and their habitat are still adopted to guide conservation efforts but would not result in federal legal protection.

1. Species Status Information

This section replaces information on the SARA legal designation for Georgia Basin Bog Spider in Canada in Section 2 of the provincial management plan.

The legal designation of Georgia Basin Bog Spider on SARA Schedule 1 is Special Concern (2018).

2. Effects on the Environment and Other Species

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

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

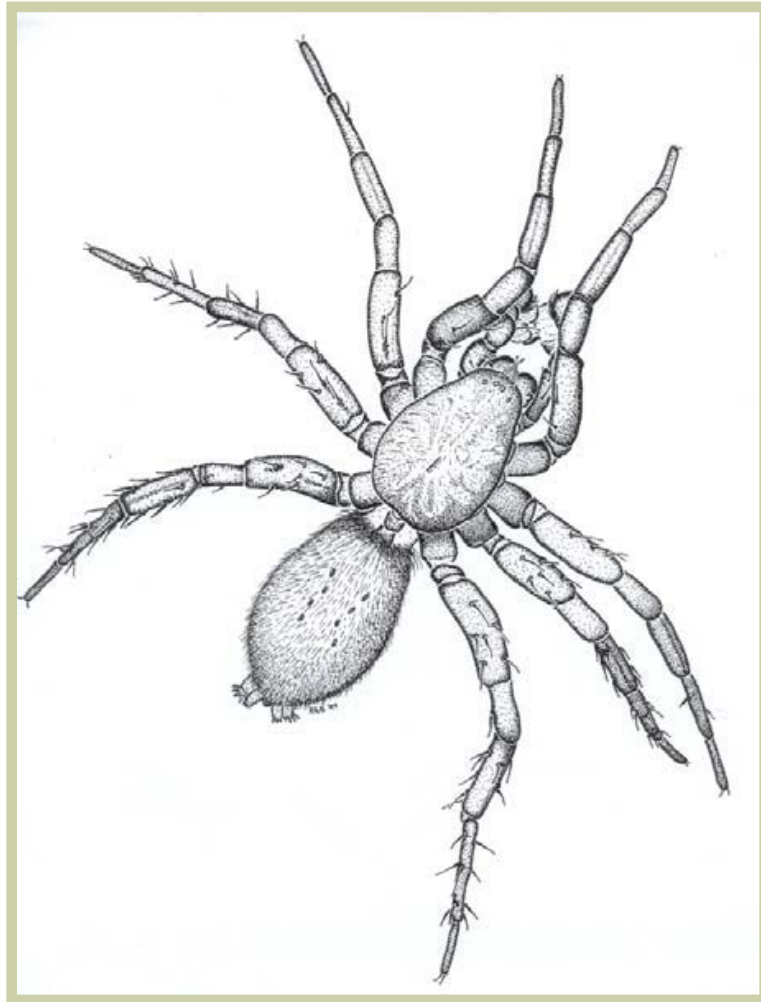
³ www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

⁴ www.fsds-sfdd.ca/index.html#/en/goals/

The provincial management plan for Georgia Basin Bog Spider contains a section describing the effects of management activities on other species (i.e., Section 8). Environment and Climate Change Canada adopts this section of the provincial management plan as the statement on effects of management activities on the environment and other species. The distribution or habitat requirements of Georgia Basin Big Spider may overlap with that of many other federally-listed species at risk including Oregon Spotted Frog (*Rana pretiosa*; Endangered), Western Painted Turtle – Pacific Coast Population (*Cherysemys picta bellii*; Threatened), and Oregon Forestsnail (*Allogona townsendiana*; Endangered). Conservation planning activities for Georgia Basin Bog Spider will be implemented with consideration for all co-occurring species at risk, such that there are no negative impacts to these species or their habitats. Some management actions for Georgia Basin Bog Spider (e.g., inventory and monitoring, threat mitigation, habitat conservation, education, and research) may promote the conservation of other species at risk that overlap in distribution and rely on similar habitat attributes.

**Part 2 – *Management Plan for Georgia Basin Bog Spider*
(*Gnaphosa snohomish*) *in British Columbia*, prepared by
the British Columbia Ministry of Environment and
Climate Change Strategy**

Management Plan for Georgia Basin Bog Spider (*Gnaphosa snohomish*) in British Columbia



Prepared by British Columbia Ministry of Environment and Climate Change Strategy



December 2018

About the British Columbia Management Plan Series

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

What is a management plan?

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

What's next?

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

For more information

To learn more about species at risk recovery planning in British Columbia, please visit the B.C. Ministry of Environment and Climate Change Strategy's Recovery Planning webpage at: <http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/recovery-planning>

**Management Plan for Georgia Basin Bog Spider
(*Gnaphosa snohomish*) in British Columbia**

**Prepared by the British Columbia Ministry of Environment and
Climate Change Strategy**

October 2018

Recommended citation

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Cover illustration/photograph

Robb Bennett, Saanichton, B.C.

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment and Climate Change Strategy's Recovery Planning webpage at:

<<http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/recovery-planning>>

Disclaimer

The British Columbia Ministry of Environment and Climate Change Strategy has prepared this management plan as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

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

The responsible jurisdictions have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals who reviewed the document.

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

ACKNOWLEDGEMENTS

This management plan was prepared by Jennifer Heron (Ministry of Environment and Climate Change Strategy [ENV]) with science advice and input from Claudia Copley (Royal British Columbia Museum [RBCM]), Darren Copley (RBCM), Robb Bennett (RBCM), and Rob Foster and Al Harris (Northern Bioscience) who prepared the status report for COSEWIC. It is based on information prepared by Matt Huntley (Environment and Climate Change Canada, Canadian Wildlife Service [ECCC–CWS], Pacific Region) and Aman Kanwar (Simon Fraser University) contained in an earlier draft of the management plan. Lea Gelling (B.C. Conservation Data Centre) and Claudia Copley participated in the updated threats assessment. Darren Copley provided the photographs shown in the management plan and Robb Bennett provided the front cover illustration. Paul Grant, Connie Miller-Retzner, and Grant Bletcher (Ministry of Forests, Lands, Natural Resource Operations and Rural Development); Leah Westereng, Excedera St. Louis, and Karen Stefanyk (ENV); and Eric Gross and Kim Borg (ECCC–CWS, Pacific Region), and Marie-Andrée Carrière (ECCC-CWS, Headquarters) provided science advice and reviews of this document.

EXECUTIVE SUMMARY

Georgia Basin Bog Spider (*Gnaphosa snohomish*) is a small, nocturnal, and cryptic ground spider in the family Gnaphosidae. The species is light to dark chestnut brown, has two claws, a body length of 7.5–12 mm that is covered with numerous long stout hairs, and distinctly separated anterior lateral spinnerets. Spiders in this genus are identified by their genitalia.

Georgia Basin Bog Spider was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2012. This semi-wetland spider has a limited distribution in North America, ranging in southwestern British Columbia and western Washington State. In Canada, the species is restricted to southwestern British Columbia and ranges in the lower mainland, southeastern Vancouver Island, and the southern Gulf Islands. Eight subpopulations occur in Canada, including one additional subpopulation since the 2012 COSEWIC status assessment. In British Columbia, Georgia Basin Bog Spider has not been assigned a conservation status rank by the B.C. Conservation Data Centre, nor assigned a rank under the B.C. Conservation Framework.

Little information is available on the biology, natural history, and specific habitat needs for Georgia Basin Bog Spider. The duration of adult female gestation, egg incubation, number of instars/moult, and duration to adult maturity are unknown. The species likely has a 1–2-year life cycle based on information inferred from pitfall trap captures. The species likely overwinters at the juvenile life stage and matures through the spring, although adult females are caught throughout most of the year. Adult males are less common by early summer, which suggests mating takes place sometime in the spring and early summer. The species likely takes cover during the day under or within leaf litter, bark, rocks, or in tubular web retreats (not observed for this species, but a behaviour in other related species). The species may exhibit courtship behaviours (based on behaviours in related species), and females potentially produce and guard one or more flattened silk egg sacs, containing up to 250 eggs each.

The management goal is to maintain subpopulations of Georgia Basin Bog Spider at all extant habitats in British Columbia, including any additional subpopulations that may be identified in the future. The management goal cannot currently be quantified because significant knowledge gaps exist related to the species' distribution and habitat requirements.

The management objectives for Georgia Basin Bog Spider are:

1. to secure protection (with no loss or degradation of habitat) for extant subpopulations of the species;
2. to confirm its distribution within its range in British Columbia;
3. to assess and mitigate threats to extant subpopulations and, more broadly, to potential habitats including peatland, bog, cattail marsh, and other wetlands within the species range;
4. to address knowledge gaps (e.g., specific wetland habitat requirements; associations and roles within these wetland plant communities; relationships with other organisms; and reproductive and other life history information) necessary to maintain subpopulations; and

5. to increase the public knowledge of Georgia Basin Bog Spider and its associated bog, peat, and wetland habitats.

Present and ongoing low-level threats include residential and commercial development, water management practices detrimental to healthy wetland maintenance, and habitat changes resulting from the cumulative effects of subsequent native and non-native vegetation succession; pollution of wetlands from domestic and urban waste water, agricultural and forestry effluents, garbage and solid waste; and climate change in the form of droughts, storms, and flooding. Historically, wetland habitat conversion, draining, peat mining and management has been extensive within the range of Georgia Basin Bog Spider. Approximately 85% of wetlands in the lower Fraser Valley were destroyed between 1827 and 1996.

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1 COSEWIC SPECIES ASSESSMENT INFORMATION

Assessment Summary: November 2012

Common name: Georgia Basin Bog Spider

Scientific name: *Gnaphosa snohomish*

Status: Special Concern

Reason for designation: This small (1 cm) wetland spider has a very limited global distribution, occurring in Georgia Basin and western Washington State. In Canada, it is known from only four sites in southern British Columbia. These subpopulations may become threatened over a very short time period. The greatest threat is inundation by sea water since three of the four known sites are less than 3 m above sea level and are at risk from projected increases in the frequency and severity of storms.

Occurrence: British Columbia

Status history: Designated Special Concern in November 2012.

COSEWIC = Committee on the Status of Endangered Wildlife in Canada

2 SPECIES STATUS INFORMATION

Georgia Basin Bog Spider ^a			
Legal Designation:			
FRPA : ^b No	OGAA : ^b No	B.C. <i>Wildlife Act</i> : ^c No	SARA : ^d No
Conservation Status^e			
B.C. List: N/A	B.C. Rank: SNR	<u>National Rank</u> : N2 (2011)	Global Rank: G2 (2011)
Other <u>Subnational Ranks</u> : ^f Washington: SNR			

^a Data source: B.C. Conservation Data Centre (2016) unless otherwise noted.

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

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

^d No = not on any Schedules under the *Species at Risk Act* (SARA; Government of Canada 2002).

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

^f Data source: NatureServe (2016).

3 SPECIES INFORMATION

3.1 Species Description

Georgia Basin Bog Spider (*Gnaphosa snohomish*) is one of 20 ground spiders in family Gnaphosidae in the Nearctic region (Bennett *et al.* 2006). The body is light to dark chestnut brown. It has two claws; a body covered with numerous large stout hairs that give it a somewhat shiny appearance; enlarged, cylindrical, separated anterior lateral spinnerets¹; and modified posterior median eyes. Spiders in this genus are identified by their genitalia. Males (7.44–9.92 mm from the tip of the head to the tip of the abdomen) are slightly smaller than females (7.44–11.78 mm) (Figures 1 and 2). Additional and more detailed morphological information is summarized in the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment and status report (2012), Platnick and Shadab (1975), Platnick and Dondale (1992), and Bennett *et al.* (2006).

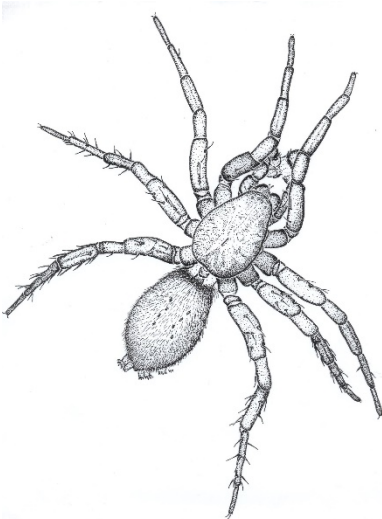


Figure 1. Georgia Basin Bog Spider (male) from Burnaby Marshlands, B.C. (Robb Bennett).



Figure 2. Georgia Basin Bog Spider (male) (Darren Copley).

In 2012, Georgia Basin Bog Spider was designated as of Special Concern by COSEWIC. In British Columbia, Georgia Basin Bog Spider has not been assigned a conservation status rank by the B.C. Conservation Data Centre (2018), or assigned a rank under the B.C. Conservation Framework (2009).

Little information is available on the biology, natural history, and specific habitat needs of Georgia Basin Bog Spider. The spider has only been passively captured within pitfall traps, which are cups buried flush with the ground and filled with a preservative which kills the invertebrate that falls into the trap. The objective of such traps is to capture ground-crawling arthropods, particularly those that are nocturnal or crepuscular. Because this species has only been caught with pitfall traps, rather than hand-collected or captured live, the species is likely nocturnal and considered cryptic. Where recorded, a subpopulation is inferred from a single

¹ Silk-spinning organ.

pitfall trap capture because the species, and more specifically the males, are likely territorial, establishing a home range and excluding other males from that territory. The home range of the species is unknown; however, the territories of males and females likely overlap, and juveniles are more likely to wander greater distances in search of establishing their own territory.

The duration of adult female gestation, egg incubation, number of instars/moult, and duration to adult maturity are unknown. The species has a 1–2-year life cycle, inferred from pitfall trap captures, which suggests the species overwinters at the juvenile life stage and matures in the spring; however, adult females are caught throughout most of the year, suggesting females may also overwinter as adults. Adult males are less common by early summer, suggesting that mating may occur in the spring months. Individuals likely take cover under leaf litter, bark, and rocks during the day. Although spiders in this family are known to construct tubular web retreats within or under such structures, this has not been observed for the Georgia Basin Bog Spider.

Based on the biology of other species in this family, Georgia Basin Bog Spider likely undergoes a display of courtship and females likely produce and guard one or more flattened silk egg sacs, each containing up to 250 eggs. Based on the presence of adult females in pitfall traps in May (see Section 3.2), adult females may hibernate, although this conclusion is speculative. The spider likely seeks shelter and is less active during the hot and dry summer months of late July and August. Hibernation and aestivation may occur in protected microsites and/or tubular structures. Cover objects include the bark of a fallen tree, leaf litter, or elevated grass clumps, or within thick moss mats or low shrub vegetation.

Aerial ballooning is a seasonal event that is common in most spider families. Aerial ballooning has not been observed for Georgia Basin Bog Spider, however, spiders in family Gnaphosidae are known to disperse by aerial ballooning (e.g., Greenstone *et al.* 1987). Aerial ballooning occurs when first instar spiderlings hatch and climb to an elevated perch, face into a light breeze, and extrude silk gossamer threads, which are caught in the breeze's updraft and carry the spider away (Foelix 1996). In general, adults do not balloon and spiders heavier than 1 mg are unlikely to use ballooning (Suter 1999). Information on the distance a spider can balloon is limited. Suter (1992) measured a spider's mass and posture and determined most ballooning events ended after a few metres of travel. The ability of a spider to balloon longer distances depends on the drag of the silk and parachute, the convection air currents and ability for the spider to catch the updraft wind and be able to move higher into the higher atmosphere and jet stream (Greenstone *et al.* 1987). The most common way for spiders to colonize islands and mountaintops is through aerial ballooning (Bilising 1920; Hormiga 2002).

Environmental conditions that limit successful dispersal by aerial ballooning include ambient temperature, wind speed and direction, relative humidity, rainfall, and the availability of structural items from which to balloon from. No data are available for genus *Gnaphosa* and the parameters of these environmental conditions are unknown. Ballooning spiderlings must also arrive at suitable habitat for future survival. Most spiders die during ballooning.

3.2 Populations and Distribution

The global distribution of Georgia Basin Bog Spider is restricted to the Gulf Islands and Georgia Basin areas of southwestern British Columbia and adjacent western Washington State (Figure 3). Approximately 10% of the species' range is in Canada.

In Canada, Georgia Basin Bog Spider ranges in southwestern British Columbia in the lower mainland, southeastern Vancouver Island, and the southern Gulf Islands (Table 1; Figure 4). Records of Georgia Basin Bog Spider in the province date from 1968 at Blaney Lake ([subpopulation] #7) to 2012 (Table 1), including a new record for Campbell Valley (#8) documented since the preparation of the COSEWIC (2012) status report.

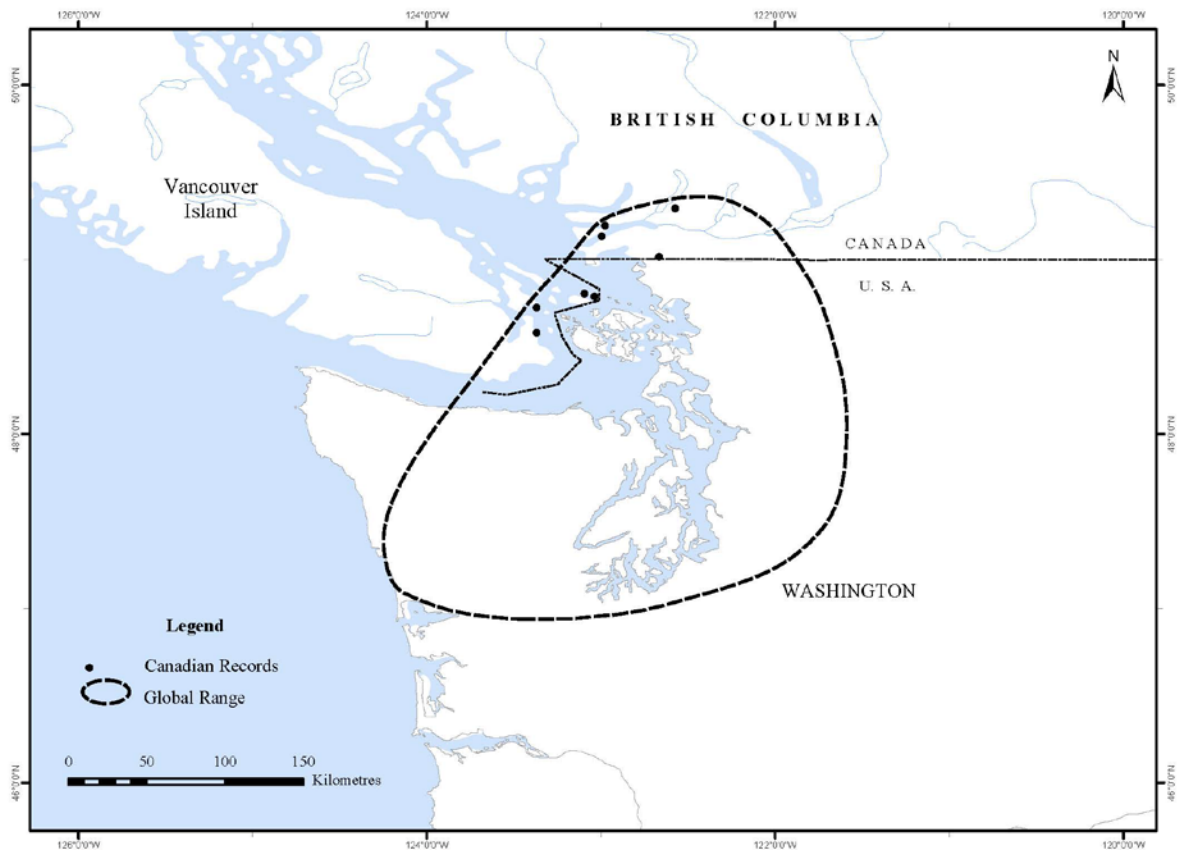


Figure 3. Global range and Canadian site specific records for subpopulations of Georgia Basin Bog Spider .

Table 1. Status and description of Georgia Basin Bog Spider subpopulations in British Columbia (subpopulations 1–7: COSEWIC [2012]; #8: J. Heron, unpubl. data).

Subpopulation	General location	Status^a and description	Land tenure
1. Island View Beach	Saanichton, southeastern Vancouver Island	<p>Extant. 2012: unknown number of specimens (males, females, juveniles) captured in pitfall traps set throughout the summer season.</p> <p>2003: 1 male captured in a pitfall trap set May 26–June 29.</p> <p>Description: 52-ha park adjacent to the seaside that was historically a maritime meadow, peat and wetland habitat that was converted to farmland in the late 1800s; subsequently diked to prevent shoreline erosion and is now managed by the Capital Regional District. The COSEWIC (2012) status report lists assessed this subpopulation as non-viable. Since the status report was written, additional specimens have been identified from this area which suggests there is an established subpopulation at the park. The COSEWIC (2012) status report also defines this species as a bog specialist, although since this initial report the species has been recorded from non-bog wetland habitats, suggesting its habitat preference may not be so specific. The habitat available for the spider includes smaller portions of the park, although the spatial extent of these portions is unknown and has not been mapped.</p>	Private; local government; Capital Regional District; Island View Beach Regional Park
2. Burnaby Marshlands	Lowland floodplain area of south Burnaby adjacent to Fraser River in the lower mainland	<p>Historical, likely extirpated; unlikely suitable habitat remaining at the specific collection locality [landowner]; potential habitat in adjacent unchecked habitats.</p> <p>1998: 211 specimens (total) captured in pitfall traps collected at various dates (May 21–September 5). Adult males, females, and juveniles were recorded throughout all capture events.</p> <p>Description: Specimens collected within a peat bog that was converted to cranberry field in 1999. Since then, extensive commercial and agricultural development has occurred. A small (~9 ha) nature reserve is adjacent to the northeast corner of the cranberry bog. This habitat is dominated by birches (<i>Betula</i> sp.), pines (<i>Pinus</i> sp.), hardhack (<i>Spiraea douglasii</i>), Himalayan blackberry (<i>Rubus armeniacus</i>), and fireweed (<i>Chamerion angustifolium</i>) (Bennett <i>et al.</i> 2006). It is unknown whether any suitable habitat remains. The spatial area of this habitat is unknown and no further spider sampling has been undertaken within the area.</p>	Private (multiple land owners)

Subpopulation	General location	Status^a and description	Land tenure
3. Burns Bog	Raised peat bog within the city of Delta located in the southwestern part of the lower mainland	<p>Extant.</p> <p>2010: 6 specimens (5 males and 2 females) collected in numerous pitfall traps May 26.</p> <p>Description: Raised peat bog of approximately 3000 ha. Portions were historically managed for peat and cranberry production. Most of this bog is now a conservancy area; portions at the periphery are not protected. Although the habitat is now protected and natural hydrology is undergoing restoration, slowing vegetation succession, this occurrence remains isolated from other subpopulations.</p>	Burns Bog Ecological Conservancy Area Conservation Covenant; jointly owned provincial, federal, and municipal property; managed by Metro Vancouver. Unsurveyed portion of the bog is owned by the Corporation of Delta.
4. Cabbage Island	Southern Gulf Island within the southern portion of the Strait of Georgia	<p>Unconfirmed, likely extant.</p> <p>1989: 1 female captured in a pitfall trap September 25.</p> <p>Description: Cabbage Island is 4.5 ha, although the suitable habitat for the spider is estimated at ~1 ha. (22%). Specimen collected within a wetland complex/marsh in the middle of the island; the habitats on this island are considered some of the most intact wetland and vegetation communities remaining on the Gulf Islands. Since the initial COSEWIC (2012) status report, the species is no longer considered a bog-specialist and occurs in more broadly defined wetland habitats. The habitat throughout the island remains in its natural state, with low historical and present-day threats, and this is the primary reason the subpopulation is considered likely extant. In 2003, Cabbage Island became part of the Gulf Islands National Park Reserve.</p>	Federal; Parks Canada; Gulf Islands National Park Reserve
5. Tumbo Island	Southern Gulf Island located on the east side of Saturna Island, within the southern portion of the Strait of Georgia	<p>Extant.</p> <p>1989: 172 specimens (adult males, females, and juveniles) captured in a pitfall trap set July 12–September 26.</p> <p>Description: Tumbo Island is approximately 120 ha. The island includes a large low-elevation freshwater cattail marsh, which is considered suitable habitat (~15 ha), in the middle portion of the island, and specimens were collected within this marsh. This marsh separates two halves of the island that are Douglas-fir (<i>Pseudotsuga menziesii</i>) forests and considered unsuitable spider habitat. Historically, the island was an old homestead and was once farmed. The COSEWIC (2012) status report lists assessed this subpopulation as non-viable. Since the status report was written, additional specimens have been identified from this area which suggests there is an established subpopulation at the park. The</p>	Federal; Parks Canada Agency; Gulf Islands National Park Reserve

Subpopulation	General location	Status ^a and description	Land tenure
6. Portland Island	Southern Gulf Island within the southern portion of the Strait of Georgia	<p>COSEWIC (2012) status report also defines this species as a bog specialist, although since this initial report the species has been recorded from non-bog wetland habitats, suggesting its habitat preference may not be so specific. The habitat throughout the island remains in its natural state, with low historical and present-day threats, and this is the primary reason the subpopulation is considered likely extant. In 2003, Tumbo Island became part of the Gulf Islands National Park Reserve.</p> <p>Unconfirmed, likely extant.</p> <p>1989: 1 female captured in a pitfall trap June 4.</p> <p>Description: Portland Island is 575 ha. The suitable spider habitat is much smaller; however, the spatial area available is unknown. Specimens collected in a wetland complex/marsh. Portland Island has historical First Nations settlements, and was first farmed by European settlers in the 1880s. The COSEWIC (2012) status report lists assessed this subpopulation as non-viable. Since the status report was written, additional specimens have been identified from this area which suggests there is an established subpopulation at the park. The COSEWIC (2012) status report also defines this species as a bog specialist, although since this initial report the species has been recorded from non-bog wetland habitats, suggesting its habitat preference may not be so specific. The habitat throughout the island remains primarily in its natural state, with low historical and present-day threats, and this is the primary reason the subpopulation is considered likely extant. The island has been a provincial park since 1967 and, in 2003, Portland Island became part of the Gulf Islands National Park Reserve.</p>	Federal; Parks Canada Agency; Gulf Islands National Park Reserve

Subpopulation	General location	Status ^a and description	Land tenure
7. Blaney Lake	Lower mainland within Maple Ridge area; approximately 30 km east of sites on the Fraser River delta	<p>Extant.</p> <p>2010: 1 specimen (male) captured in pitfall trap May 27, labelled as collected from “Haney.” The specific collection site is unconfirmed, although thought to be Blaney Lake (Bennett <i>et al.</i> 2006).</p> <p>1968: 3 specimens (June 20:1 adult female and 1 adult male) and (June 30:1 adult female) from “Haney, Maple Ridge,” a vague collection locality.</p> <p>Description: The Blaney Lake habitat remains in a natural state; floating peatland surrounding a small lake; total area of peatland less than 3 ha. No habitat description information is available for the 1968 collection site.</p>	<p>Private</p> <p>University of British Columbia Malcolm Knapp Research Forest, Maple Ridge</p>
8. Campbell Valley Regional District Park (referred to as “Campbell Valley” throughout document)	Located within the City of Langley in the southwest lower mainland near the international border	<p>Extant.</p> <p>2012: 1 specimen (male) captured in a pitfall trap. Although only one specimen was collected from this site, it is unlikely the specimen ballooned from a nearby extant subpopulation (e.g., subpopulations 3 or 7); therefore, we assume a subpopulation occurs either within this habitat or within the immediate vicinity.</p> <p>Description: This site refers to Campbell Valley Regional District Park. Historically, this area was a forested swamp within a floodplain. The habitat has undergone extensive historical conversion to farmland and agricultural use. Old meadow habitat consisted of six historical farm plots, portions of which were a tree farm.</p>	<p>Private; local government; Metro Vancouver; Campbell Valley Regional Park</p>

^a **Extant:** Recent specimen collection records available within the past 20 years and continued presence of suitable habitat with low or no immediate threats to the habitat. When a record is more than 20 years old and the subpopulation is considered extant, it is because the habitat remains primarily in its natural state with low threats. The species is cryptic and may occur in low abundance as shown by pitfall trap captures (e.g., single specimens) or no specimens caught within areas where the species has previously been recorded (e.g., lack of adequate search effort).

Historical: Habitat is no longer present (e.g., urban or commercial development) and the subpopulation is likely extirpated from the site.

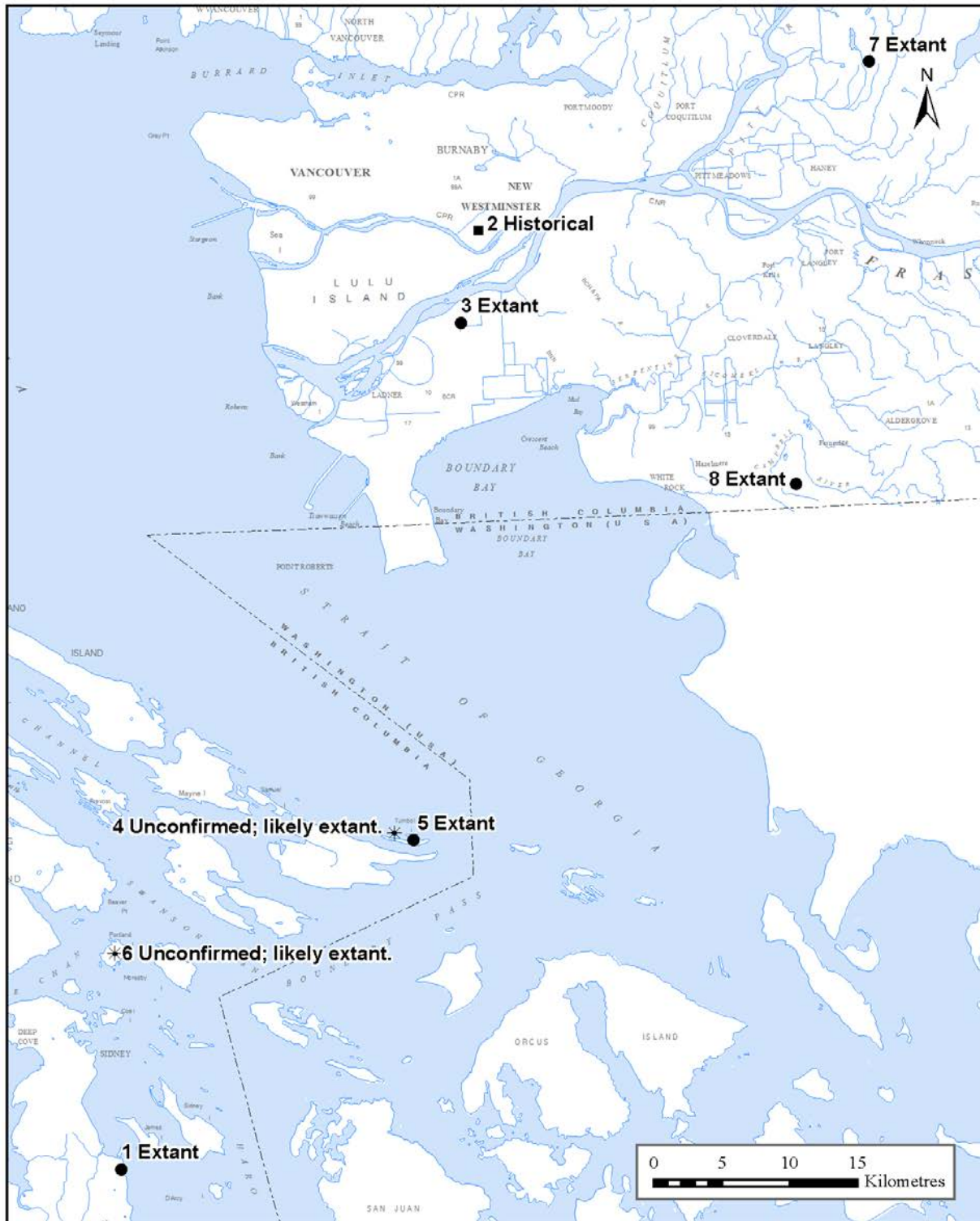


Figure 4. Status, subpopulation number and location of Georgia Basin Bog Spider subpopulations in Canada (see Table 1 for the subpopulation names and descriptions).

Georgia Basin Bog Spider subpopulations listed in this management plan are different than those listed in the COSEWIC (2012) status report. Since the initial COSEWIC status report, there is new information that suggests the subpopulations originally thought non-viable (Cabbage Island [#4], Island View Beach [#5] and Portland Island [#6]) are likely viable subpopulations based on a better understanding of the species habitat (Table 1). This change in subpopulation viability is twofold:

- In 2012, there was one specimen captured at Campbell Valley (#8) within a non-bog wetland complex (see Table 1 for site description). This new information suggests the spider's habitat includes non-bog wetland habitats.
- In 2012, additional specimens were caught within pitfall traps at Island View Beach [#5], also a non-bog wetland habitat.
- These two new records suggest the species habitat is likely not bog-specific.
- The two habitats on Portland and Cabbage Islands (subpopulations 4 and 6, respectively) are also wetland complexes. Based on this new habitat information, the cryptic nature of the spider, the species not readily caught in pitfall traps and the lack of a live specimen collected, it is likely the specimens on Portland and Cabbage Islands represent subpopulations of the spider.

Georgia Basin Bog Spider subpopulations listed in this management plan are defined based on the following:

- 1 The confirmed identification of at least one captured specimen (any life stage) within a habitat patch. As described in Section 3.1, a subpopulation is inferred from a single pitfall trap capture because the species, and more specifically the males, are likely territorial, establishing a home range that may exclude other males from the territory. The home range of the species is unknown; however, the territories of males and females likely overlap and juveniles are more likely to wander farther in search of establishing their own territory, the spiders are cryptic and appear to maintain subpopulations in low numbers.
- 2 The contiguous suitable habitat polygon (see Section 3.3 for habitat information) within which the spider was captured. Multiple capture sites within the same habitat polygon constitute a single subpopulation. If two capture sites are separated by 1km or more of unsuitable habitat (e.g., a shopping mall or housing development, or inappropriate habitat such as salt water), the sites are considered separate subpopulations. For example, at some subpopulations (i.e., Burnaby Marshlands [2] and other unsurveyed potential habitat within the species range), the original habitat polygon has been fragmented by development; if the species is confirmed within any of these habitat patches the occurrences will likely be considered separate subpopulations due to their inability to recolonize such areas.
- 3 The low probability associated with the spider's ability to disperse the large distance from a nearby known extant subpopulation (e.g., ballooning greater than 1km through

non-spider habitat and/or across open ocean²) and the low probability of that specimen then being captured in a pitfall trap.

Subpopulations designated “extant” have specimen collection records within the past 20 years and the continued presence of suitable habitat. If a specimen record is more than 20 years old and the subpopulation is considered extant, it is because the habitat where the specimen was collected remains primarily in its natural state with low historical and present-day threats, which would have otherwise changed the natural habitat (e.g., invasive plants that change the habitat). Because of the cryptic nature of this species and low abundance as shown by pitfall trap captures (e.g., single specimens), it is assumed that a subpopulation has sustained itself within this habitat. Subpopulations designated “historical” have had general habitat loss or degradation of the environment in the area (e.g., related to urban or commercial development) at the specific site and the subpopulation is likely extirpated from that site based on those threats.

Seven of the eight Georgia Basin Bog spider subpopulations are considered extant or likely extant (Figure 4). The Burnaby Marshlands site (#2) is considered historical because agricultural conversion has occurred at the specific collection site since the initial capture date (1998) (Figure 4). However, there are small areas of potential remaining habitat outside of this specific collection site, and because there could be a possibility a subpopulation remains, we are scoring threats potentially applicable to this subpopulation (See Section 4).

The surveys conducted to date for Georgia Basin Bog Spider have focused on recording new subpopulations and, therefore, limited data is available to estimate spider abundance and overall subpopulation size. The species has only been caught by passive trapping methods that are designed to confirm species presence at a site. Natural subpopulation fluctuations in spiders result from factors such as parasites, predators, ambient daily temperatures, fluctuations and changes to water tables, long-term seasonal temperatures, and the previous years’ weather. Insufficient information is available to estimate subpopulation fluctuations or trends for the species in Canada or elsewhere in the species’ range.

3.3 Habitat and Biological Needs of Georgia Basin Bog Spider

The habitat needs of Georgia Basin Bog Spider are described at both the larger, ecosystem (wetland, bog and peat habitats) scale and at the smaller microsite or home range habitat scale. Little information is available on the specific habitat requirements at different life stages, although each life stage appears to have slightly different habitat requirements (Table 2). Based on the presence of adult females in pitfall traps in May (Table 1), Georgia Basin Bog Spider females may hibernate. The spider likely seeks shelter and is less active during the hot and dry summer months of late July and August. Hibernation and aestivation may occur in protected microsites and/or tubular structures. Cover objects include the bark of a fallen tree, leaf litter or elevated grass clumps, or within thick moss mats or low shrub vegetation.

² NatureServe (2002) definition of minimum separation distance for suitable and unsuitable habitats. Minimum values for separation distances have been recommended [by NatureServe] to ensure that element occurrences [subpopulations] are not separated by unreasonably small distances, which would lead to the identification of unnecessarily fragmented populations as potential targets for conservation planning or action. For species Elements, minimum separation distances are generally 1 km or greater for both unsuitable habitat, and for apparently suitable habitat that is not known to be occupied.

Table 2. Summary of essential functions, features, and attributes of Georgia Basin Bog Spider habitat in British Columbia.

Life stage	Function ^a	Feature(s) ^b	Attributes ^c
Eggs	Incubation	Downed woody debris, rocks, leaves, thick peat moss mats	Areas for egg development, refuge from predators and weather, such as provided by crevices and cracks under woody debris, or areas at the base of slightly elevated woody vegetation
All instars of juvenile spiders; adult spiders	Feeding/foraging	Downed woody debris, rocks, leaves, thick peat moss mats	Abundance of downed woody debris and other dense vegetation that would provide habitat for prey species and refuge from predators and weather
Adult spiders	Mating, egg-laying	Downed woody debris, rocks, leaves, thick sphagnum moss mats	Areas for egg development, refuge from predators and weather, such as provided by crevices and cracks under woody debris, or areas at the base of slightly elevated woody vegetation
Adult spiders	Shelter, cover	Silken tubular structure	Woody debris, logs, stones, among plant debris and other similar structures
Early instar juvenile spiders	Dispersal	Shrubs, trees, or other similar structures	Suitable shrubs for ballooning juvenile spiders; ballooning has not been observed in this spider

^a Function: a life-cycle process of the species (e.g., breeding, nursery, feeding/foraging).

^b Feature: the essential structural components of the habitat required by the species. These features are speculative and based on general information from other spiders in the genus *Gnaphosa*.

^c Attribute: the building blocks or *measurable* characteristics of a feature.

3.3.1 Wetland, Peat and Bog Habitat

Broad habitat associations are available based on sites where the spider has been collected. Georgia Basin Bog Spider was initially described as a peatland species (tryphobiontic) based on collection sites in both British Columbia and Washington stated (Bennett *et al.* 2006).

Records at Blaney Lake (#7) and Burns Bog (#3) are within peat and bog habitats. Blaney Lake is a floating mat peatland (site association: Labrador tea – Bog laurel – Peat-moss) dominated by sweet gale (*Myrica gale*), bog rosemary (*Andromeda polifolia*), skunk cabbage (*Lysichiton americanus*), and sedges (*Carex* sp.) (MacKenzie and Moran 2004). The natural areas of Burns Bog (site association: Lodgepole pine – Bog rosemary – Peat-moss) (MacKenzie and Moran 2004) are a raised bog with carpets of peat moss (*Sphagnum* sp.), ericaceous shrubs (bog rosemary, dwarf blueberry [*Vaccinium caespitosum*], and bog cranberry [*Vaccinium oxycoccos*]), and other bog vegetation such as Labrador tea (*Rhododendron groenlandicum*), round-leaved sundew (*Drosera rotundifolia*), rushes (*Juncus* spp.), and grass spp. (Family: Poaceae) (Ward *et al.* 1992; Hebda *et al.* 2000), and scattered short lodgepole pine (*Pinus contorta*) (COSEWIC 2012).

Before its development into a cranberry field in 1999, Burnaby Marshlands (#2) was a peat bog with hummocks of peat and other mosses, round-leaved sundew, rushes, and grasses (Bennett

et al. 2006). At present, a small (~9 ha) nature reserve is adjacent to the northeast corner of the cranberry bog. Habitat within the reserve is dominated by birches (*Betula* spp.), pines (*Pinus* spp.), hardhack (*Spiraea douglasii*), Himalayan blackberry (*Rubus armeniacus*), and fireweed (*Chamerion angustifolium*) (Bennett *et al.* 2006). It is unknown if the spider is resident in this habitat and this site has not been inventoried for the spider. For that reason, we include this habitat in the threats assessment (Section 4.1) although the record itself (at the specific piece of land where it was initially recorded) is considered extirpated.

In 2012, the species was confirmed at Island View Beach (#1) and an additional subpopulation was recorded from Campbell Valley (#8). Both these collection sites were from cattail (*Typha* sp.) marsh, forest swamps, and non-bog wetland complexes, thus broadening our understanding of the species' habitat.

Detailed habitat assessments need to be completed for subpopulations at Cabbage Island (#4), Tumbo Island (#5), Portland Island (#6), and Blaney Lake (#7). In general, the Cabbage Island and Tumbo Island habitats consist of wetland/complex marsh, and the Blaney Lake site consists of floating peatland/marsh. The habitat at the Portland Island site is unknown (COSEWIC 2012).

3.3.2 Microhabitat, Home Range and Hunting Habitat

The microhabitat characteristics needed to sustain individuals, tubular structures, nest sites, and subpopulations of Georgia Basin Bog Spider are unknown. To date, a live specimen has not been caught or observed in the wild in Canada or elsewhere within its global range. All specimens have been caught in pitfall traps or passive traps, and it is inferred that the specimens were hunting or moving when caught. No information is available on the species' resting, mating, egg-laying, hibernating, aestivating, or nesting microhabitat preferences.

Little general information is available on the specific microhabitat needs of the genus *Gnaphosa*. *Gnaphosa* spiders remain under leaf litter, bark, rocks, or within tubular retreats (Platnick and Shadab 1975), and these microhabitat features are necessary components of the spiders' habitats. Based on the wetland, bog, and peat habitat preferences of Georgia Basin Bog Spider, the downed woody debris used as cover within its geographic range is likely from pine or spruce trees (*Picea* spp.). The specific microhabitat features females choose for egg-sac deposition is unknown.

It is unknown whether the Georgia Basin Bog Spider disperses by aerial ballooning as this behaviour has not been observed. It is assumed that this species can disperse by ballooning based on behaviour observed for other similar species. If the species does disperse this way, shrubs or trees are a required habitat feature.

3.4 Ecological Role

Interspecific interactions for Georgia Basin Bog Spider have not been documented, but they are probably similar to those of other ground-dwelling spiders. Ground spiders actively hunt and pursue their prey on the ground and do not construct webs or capture prey within webs. Specific

prey species are unknown but generally include insects and other spiders. Predators of spiders include insects, such as spider wasps, other spider species, frogs, birds, and small mammals such as shrews (Foelix 1996).

3.5 Limiting Factors

Limiting factors are generally not human-induced and include characteristics that make the species less likely to respond to management/conservation efforts. Limiting factors for Georgia Basin Bog Spider include:

- *Habitat requirements.* Areas of wet swamp, marsh, or bog habitat within the lower Fraser Valley have declined from an estimated 27 100 ha before 1 820 to 9 700 ha by 1990, a decline of more than 60% in potential habitat (Boyle *et al.* 1997). It is unknown how much spatial area (habitat) is required to sustain a subpopulation within a habitat patch.
- *Small subpopulation size and genetic isolation.* Georgia Basin Bog Spider subpopulations are within small, isolated, and limited habitat patches. Little or no interbreeding or genetic mixing is likely between subpopulations and thus local extinctions related to inbreeding depression are possible.
- *Poor dispersal ability.* Historically, bog, peat, and wetland ecosystems were connected and more widespread; however, today's ecosystems are isolated and fragmented. Georgia Basin Bog Spider dispersal ability is likely poor because of morphological dispersal limitations (it must crawl on the ground). If the species is capable of aerial ballooning and the surrounding habitat is unsuitable, then the ballooning event is unlikely to result in successful dispersal.

4 THREATS

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

For the most part, threats are related to human activities, but they can also be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., introduction of invasive species). Effects of natural phenomena such as fire or flooding may be especially important when the species is concentrated in one area or has few occurrences, which may be a result of human activity (Master *et al.* 2012). As such, natural phenomena are included in the definition of a threat, though they should be considered cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience. In such cases, the effect on the subpopulation would be disproportionately large compared to the effect experienced historically (Salafsky *et al.* 2008).

4.1 Threat Assessment

The threat classification below is based on the International Union on the Conservation of Nature–Conservation Measures Partnership (IUCN–CMP) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre. For a detailed description of the threat classification system, see the Open Standards website (Open Standards 2014). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2012) and table footnotes for details. Threats for Georgia Basin Bog Spider were assessed for the entire province (Table 3).

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

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

Table 3. Threat classification table for Georgia Basin Bog Spider in British Columbia.

Threat^a		Impact^b	Scope^c	Severity^d	Timing^e	Subpopulation (Subpopulation No.)
1	<i>Residential & commercial development</i>	<i>Low</i>	<i>Small</i>	<i>Extreme</i>	<i>High</i>	
1.1	Housing & urban areas	Low	Small	Extreme	High	Potential habitats surrounding Burnaby Marshlands (2)
1.2	Commercial & industrial areas	Low	Small	Extreme	High	Potential habitats surrounding Burnaby Marshlands (2) Burns Bog (3)
1.3	Tourism & recreation areas	Negligible	Restricted	Negligible	High	Island View Beach (1) Campbell Valley (8)
2	<i>Agriculture & aquaculture</i>	<i>Low</i>	<i>Small</i>	<i>Serious</i>	<i>High</i>	
2.1	Annual & perennial non-timber crops	Low	Small	Serious	High	Potential habitat adjacent to Burnaby Marshlands (2)
6	<i>Human intrusions & disturbance</i>	<i>Low</i>	<i>Small</i>	<i>Slight</i>	<i>High</i>	
6.1	Recreational activities	Low	Small	Slight	High	Island View Beach (1) Campbell Valley (8) Likely negligible within the Gulf Islands National Park Reserve (3, 4, 5)
7	<i>Natural system modifications</i>	<i>Low</i>	<i>Restricted</i>	<i>Slight</i>	<i>High</i>	
7.1	Fire & fire suppression	Low	Small	Moderate	High	Burns Bog (3) – Wildfire potential
7.2	Dams & water management/use	Low	Restricted	Slight	High	Burnaby Marshlands (2), Burns Bog (3). Island View Beach (1) – Historical berm creation
8	<i>Invasive & other problematic species, genes & diseases</i>	<i>Unknown</i>	<i>Large</i>	<i>Unknown</i>	<i>High</i>	
8.1	Invasive non-native/alien species/diseases	Unknown	Large	Unknown	High	All
8.2	Problematic native species/diseases	Unknown	Large	Unknown	High	All

Threat^a		Impact^b	Scope^c	Severity^d	Timing^e	Subpopulation/location
9	<i>Pollution</i>	<i>Low</i>	<i>Small</i>	<i>Slight</i>	<i>High</i>	
9.1	Domestic & urban waste water	Unknown	Large	Unknown	High	Potentially applicable at seven subpopulations (1, 2, 3, 4, 5, 6, 8)
9.3	Agricultural & forestry effluents	Unknown	Large	Unknown	High	Island View Beach (1), Burnaby Marshlands (2), Burns Bog (3), Campbell Valley (8)
9.4	Garbage & solid waste	Low	Small	Slight	High	Burns Bog (3)
10	<i>Geological events</i>	<i>Unknown</i>	<i>Large</i>	<i>Unknown</i>	<i>High</i>	
10.2	Earthquakes/tsunamis	Unknown	Large	Unknown	High	Island View Beach, Cabbage Island, Tumbo Island, Portland Island (1, 4, 5, 6); shoreline habitats within the earthquake zones
11	<i>Climate change & severe weather</i>	<i>Unknown</i>	<i>Pervasive</i>	<i>Unknown</i>	<i>High</i>	
11.2	Droughts	Unknown	Pervasive	Unknown	High	All subpopulations
11.4	Storms & flooding	Unknown	Pervasive	Unknown	High	Island View Beach, Cabbage Island, Tumbo Island, Portland Island (1, 4, 5, 6); shoreline habitats within the earthquake zones

Note: A description of the threats included in this table are in Section 4.2.

^a Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with decimals).

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

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

^d **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation time frame. For this species, a 10-year time frame was used. Severity is usually measured as the degree of reduction of the species’ subpopulation. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

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

4.2 Description of Threats

The overall province-wide Threat Impact for this species is Medium.⁵ The overall threat considers the cumulative impacts of multiple threats. Low-level threats include the following:

- residential and commercial development (Threats 1.1 and 1.2);
- inappropriate water management (Threat 7.2);
- habitat changes that result from the cumulative effects of subsequent native and non-native vegetation succession (Threats 8.1 and 8.2);
- pollution of wetlands from domestic and urban waste water (Threat 9.1);
- agricultural and forestry effluents (Threat 9.3);
- garbage and solid waste (Threat 9.4);
- climate change in the form of droughts (Threat 11.1);and
- storms and flooding (Threat 11.4).

Details on how these threats affect the Georgia Basin Bog Spider are discussed below.

Historical threats to habitat have included extensive wetland habitat conversion, draining, peat mining and inappropriate water management throughout the range of Georgia Basin Bog Spider. Approximately 85% of wetlands in the lower Fraser Valley were destroyed between 1827 and 1996 (Boyle *et al.* 1997; B.C. Ministry of Water, Land and Air Protection 2002). Historical agricultural land conversion of various scope and severity has occurred at Island View Beach (#1; grazing, farming), Burns Bog (#3; cranberry farms and peat extraction), and Cabbage Island, Tumbo Island, Portland Island, and Campbell Valley (subpopulations 4, 5, 6, and 8, respectively; land clearing and farming). Past threats are not scored in the threats assessment; however, the legacy of these activities remains part of the ongoing challenges facing restoration and subpopulation persistence at these sites. Current threats are applicable to the eight extant subpopulations of the spider.

Threat 1. Residential and commercial development (Low threat)

1.1 Housing & urban areas and 1.2 Commercial and industrial areas (Low threat)

Burnaby Marshlands (#2) is part of a large floodplain adjacent to the Fraser River that has undergone extensive historical agricultural development. Some of the areas adjacent to Burnaby Marshlands are within the Agricultural Land Reserve, which limits the type of property development to food production and agricultural land use only⁶; however, some portions have been removed from this land reserve and/or were not initially included within the land reserve, and have been converted to housing developments and commercial shopping malls. The portion where the spider was originally collected has been converted to a cranberry field, however this original habitat polygon was larger than the development footprint. There is no survey data from these other portions of habitat however the spider could remain in this unchecked habitat.

⁵ The overall threat impact was calculated following Master *et al.* (2012) using the number of Level 1 Threats assigned to this species where timing = High or Moderate, which included 5 Low (Table 3). The overall threat impact considers the cumulative impacts of multiple threats.

⁶ See Provincial Agricultural Land Commission website: <<http://www.alc.gov.bc.ca/alc/content/home>>

Although the subpopulation is considered historical (i.e., the actual collection site has been destroyed), we are scoring this threat based on the possibility of a subpopulation remaining in the other areas of adjacent habitat. This threat is ongoing and remnant patches of peat and bog habitat are at risk of further development because housing demand and value of undeveloped land in the lower mainland has substantially increased in the past decade. Due to the overall uncertainty, it is best to use the precautionary principle and assume that there is potential for an unchecked subpopulation within this area.

1.3 Tourism & recreation areas (Negligible threat)

Georgia Basin Bog Spider subpopulations occur in numerous parks and protected areas and further infrastructure development within these areas could affect the aquatic ecosystem as well as destroy habitat. Island View Beach (#1) and Campbell Valley (#8) are popular recreational use parks, and further infrastructure development could affect potential habitats within these areas. Island View Beach has a high potential for further trail development and expansion within the maritime wetland complex adjacent to the popular beach and dog-walking paths through these habitats. The scope and severity of this threat are unknown. Cabbage Island, Tumbo Island, and Portland Island (subpopulations 4, 5, and 6, respectively) are within the Gulf Islands National Park Reserve. These islands require boat access and currently have no public transportation services for recreational users; further infrastructure development is thus considered negligible. Burns Bog (#3) spans two conservation areas—Burns Bog Conservation Area (Metro Vancouver) and Burns Bog Delta Nature Reserve (Corporation of Delta)—both of which have restricted public access and are not likely to have further tourism or recreational development.

Campbell Valley (#8) may require additional recreational infrastructure in response to water management (this threat is scored under Threat 7.2).

Threat 2. Agriculture & aquaculture (Low threat)

2.1 Annual & perennial non-timber crops (Low threat)

Conversion of Burnaby Marshlands (#2) to a commercial cranberry farm after 1999 may have caused the Georgia Basin Bog Spider to become extirpated from this area; however, remnant patches of potential suitable habitat, which may still have subpopulations of the spider, remain within a 1 km radius surrounding this collection site (i.e., the actual collection site was from within the converted habitat). Most of these patches occur on private land, making access for surveys more difficult; therefore, the presence of the spider is unknown. Potential habitat for the spider also exists within other agricultural areas throughout its range. Further habitat mapping needs completion. Due to this uncertainty, and the precautionary principle, we are going to assume there is potential for an unchecked new subpopulation within this area.

Threat 6. Human intrusions and disturbance (Low threat)

6.1 Recreational use (Low threat)

Burns Bog (#3) is a conservation area with restricted public access, although people illegally access the site for walking, off-leash dog use, all-terrain vehicle use, and dirt and mountain biking. Humans will also create bridges from logs and woody debris to facilitate passage over

wetter or flooded portions of old trails and roads; and dig holes or create dirt mounds, and re-route or dam small ditches or waterways to create areas for all-terrain vehicle, dirt bike, or mountain bike use. The cumulative effects from these activities are detrimental to Georgia Basin Bog Spider habitat because the soft bog ground is compacted and vegetation at the site trampled, making it more difficult for spider subpopulations to seek shelter and/or build tubular retreats under objects. Re-routing waterways will also cause drought in some places and/or flood other areas. This threat also applies to unsurveyed potential bog, peat, and wetland habitats throughout the range of Georgia Basin Bog Spider, specifically those habitats on undesignated provincial Crown land and local government land.

Georgia Basin Bog Spider occurs in five publicly accessible parks (i.e., subpopulations #1, 4, 5, 6, and 8). Island View Beach (#1) and Campbell Valley (#8) are popular parks for recreational uses, including dog walking (both on- and off-leash restrictions), walking and hiking, horse-back riding and bike-riding (both on- and off-trail riding). These recreational activities can compact soil and increase the spread of non-native plants through the unintentional spread of seeds; dogs also urinate and defecate, often habitually within the same place, which can affect the growth of plants.

Subpopulations on Cabbage Island (4), Tumbo Island (5), and Portland Island (6) are within the federal Gulf Islands National Park Reserve. Currently, these islands have no regular scheduled boat access and people who would like to visit need to arrange their own transportation. As a result, impacts from recreational use on these subpopulations are likely negligible.

Threat 7. Natural system modifications (Low threat)

7.1 Fire and fire suppression (Low threat)

Wildfires are often ignited by lightning or arson at Burns Bog (#3). Bog and peat fires are difficult to control and will often go undetected and/or smolder for long periods, even within colder and wetter months. These ground fires cause localized destruction of spider microsites, by burning small coarse woody debris that would otherwise be available as nest and refuge sites, and decreasing the soil moisture and micro-humidity at the site through evaporation. After these fires are extinguished, slow-growing bog ecosystems will take decades to regrow, and potentially as long for repopulation by Georgia Basin Bog Spider.

Controlled fires at Tumbo Island (#5) are possible as part of ongoing broader ecosystem restoration work led by Parks Canada Agency within the Gulf Islands National Park Reserve (GINPR Interim Fire Management Plan 2015), although the scope, severity, and timing of these activities are unknown.

Fire suppression is not considered a threat to Georgia Basin Bog Spider subpopulations or habitats.

7.2 Dams & water management/use (Low threat)

Changes to water management regimes (e.g., diversion, infilling) are a potential threat to four Georgia Basin Bog Spider subpopulations (#1, 2, 3, and 8). Some habitat may dry up, whereas other habitat may become too wet; water levels can affect the vegetation growing at a site and

the shelter microhabitats available to the spider (Section 3.3). The scope, severity, and timing of this threat are difficult to predict at any one subpopulation.

Lowered water tables associated with recent and historical drainage programs have altered the hydrology of many of the remaining wetlands, peatlands, and bogs in the Fraser River delta. Since 2002, Burns Bog (#3) water levels have been actively managed (i.e., restricting drainage of existing ditches) to avoid lowering the bog's water table (Howie *et al.* 2006). Island View Beach (#1) was historically a peat wetland; however, subsequent diking has created and maintained farmland at the site. Burnaby Marshlands (#2) and surrounding habitats are managed through extensive ditch and diking systems, thus preventing flooding within these areas during spring runoff and high rainfall months. Other forms of water management include culverts, swales, ditches, dikes and the elimination of wetland complexes, oxbows, and smaller channels. Campbell Valley (#8) was historically a large wetland and forest swamp complex. This area was then drained and converted to agricultural and farmland use before becoming a park. The lowland geography makes it naturally wetter and more susceptible to water accumulation throughout the year, with the need for ongoing wetland management in the future.

Threat 8. Invasive & other problematic species, genes & diseases (Unknown threat)

8.1 Invasive non-native/alien species/diseases (Unknown threat)

The specific impacts of invasive non-native plant species on Georgia Basin Bog Spider habitat is largely unknown. Invasive non-native plants occur in most of the Fraser River delta wetlands, peatlands, bogs, and other similar habitats. Some of the invasive plants threatening bog habitats include highbush blueberry (*Vaccinium corymbosum*), Scotch heather (*Calluna vulgaris*), European birch (*Betula pendula*), tawny cottongrass (*Eriophorum virginicum*), large cranberry (*Oxycoccus macrocarpus*) (Hebda *et al.* 2000), and purple loosestrife (*Lythrum salicaria*). These species can alter the native bog vegetation and contribute to shading of *Sphagnum* (Hebda *et al.* 2000) mosses and shrubs, which are part of the natural bog ecosystem, resulting in less favourable habitat for spider subpopulations. These plants are present at Burnaby Marshlands and Burns Bog (subpopulations 2 and 3, respectively).

Invasive non-native plants present at Island View Beach (#1) include Himalayan blackberry, Scotch broom (*Cytisus scoparius*), and spurge-laurel (*Daphne laureola*). Other plants, such as eastern cattail and purple loosestrife, are abundant in wetland and bog habitats throughout both the lower mainland and greater Victoria. These plants spread quickly, are fast growing, and compete with native vegetation for light, moisture, and nutrients. Some non-native plants such as Scotch broom are known to alter soil chemistry (Slesak *et al.* 2016). How these plants may specifically affect Georgia Basin Bog Spider habitat, including microsites that provide shelter, is unknown.

Campbell Valley (#8) has dense thickets of Himalayan blackberry along trail hedgerows, and reed canarygrass (*Phalaris arundinacea*) occurs within the wetter and flooded areas of the park. Reed canarygrass is a perennial, cool-season, rhizomatous plant that can grow up to 2 m tall and forms a thick sod layer that outcompetes or excludes other plants. Reed canarygrass may change the microsite conditions necessary for Georgia Basin Bog Spider to establish nest and tubular structures, mainly because this grass outcompetes other native vegetation that the spider may use

for this purpose; however, this is speculative, as the overall impacts from reed canarygrass are unknown.

Invasive non-native insects, such as the European Fire Ant (*Myrmica rubra*), and various species of predatory ground beetles (Family: Carabidae) and non-native spiders, have the potential to adversely affect Georgia Basin Bog Spider subpopulations through direct predation and competition for prey. At present, European Fire Ant has not been recorded from any Georgia Basin Bog Spider sites, although records exist close to (within 1 km) potential unsurveyed habitat adjacent to the Burnaby Marshlands (#2) site.

8.2 Problematic native species/diseases (Unknown threat)

Natural succession related to the drainage of peatlands is an ongoing threat to all Georgia Basin Bog Spider subpopulations. As the percent ground cover of native species increases (e.g., lodgepole pine, Douglas-fir, and salal [*Gaultheria shallon*]), peat and other moss cover declines (Hebda *et al.* 2000). Concurrent drainage has accelerated the process and contributed to the degradation of bog habitat (Threat 7.2). Although this threat is present and applicable to all subpopulations, the scope, severity, and timing are variable at each of these habitats.

Threat 9. Pollution (Unknown threat)

9.1 Domestic & urban wastewater (Unknown threat)

The leaching of chemicals from runoff has the potential to accumulate and affect Georgia Basin Bog Spider habitats and subpopulations. Roadway runoff contains pollutants accumulated from car exhaust, industrial sites, septic systems, pesticide applications adjacent to roadways, salt and sand applications during winter months, and other similar activities, and all are examples of chemicals that can enter spider wetland habitats. This threat is applicable to Georgia Basin Bog Spider subpopulations #1, 2, 3, and 8, although the severity and timing are unknown.

9.3 Agriculture & forestry effluents (Unknown threat)

Georgia Basin Bog Spider subpopulations at Island View Beach, Burnaby Marshlands, Burns Bog, and Campbell Valley (subpopulations #1, 2, 3, and 8; respectively) are adjacent to agricultural areas that may be periodically sprayed or treated with pesticides. Leaching and runoff from these agricultural areas has the potential to accumulate and affect the adjacent spider habitats. Extensive research has been conducted on the effect of agricultural pesticides on spiders (Pekár 2013). These effects will depend on the pesticide's chemical composition (e.g., synthetic or naturally occurring compound), application method, and timing, as well as the species it may contact. The extent of this practice within the range of Georgia Basin Bog Spider is unclear. The scope, severity, and timing of this threat are unknown.

9.4 Garbage & solid waste (Low threat)

Burns Bog (#3) has a garbage dump on its western portion. Pieces of garbage get picked up and dropped within other portions of the bog by birds and other wildlife that are attracted to the dump site. Runoff and leaching of compounds from exposed garbage adversely affects the surrounding bog and wetland habitats. The overall effects are unknown but likely detrimental to Georgia Basin Bog Spider subpopulations and habitats.

Threat 10. Geological events (Unknown threat)

10.2 Earthquakes/tsunamis (Unknown threat)

At least seven subpopulations of Georgia Basin Bog Spider (#1, 2, 3, 4, 5, 6, and 8) are close to (less than 3 km) the marine shoreline and could potentially be flooded by an earthquake-generated tsunami. This region has the highest threat of earthquake and tsunami in Canada. The timing of such events is unknown.

Threat 11. Climate change & severe weather (Unknown threat)

11.2 Droughts (Unknown threat)

Within the Pacific Maritime Ecozone, mean annual temperatures increased by 1.71°C from 1960 to 2006 (Coristine and Kerr 2011). Analysis of almost eight decades of global observations (1925–1999) showed that precipitation increased by 6.2 mm per decade in the latitude band of 50–70°N, which includes almost the entire province (Zhang *et al.* 2007). More specifically, a 14% increase in precipitation occurred within the Georgia Basin between 1900 and 2013 (B.C. Ministry of Environment 2016).

Changes to rainfall patterns may cause prolonged drought in wetland, bog, and peatland habitats. Summer droughts are projected to increase within the Georgia Basin (B.C. Ministry of Environment 2007; Rodenhuis 2009). This may affect Georgia Basin Bog Spider habitats by decreasing the available site microhabitat moisture necessary for web and nest construction, burrowing, and cover for individual spiders, as well as affect prey abundance and availability for this spider. Combined with other threats, such as water diversion and infilling, drought within natural habitats may increase over the next 10 years. The impact of this threat is unknown.

11.4 Storms and flooding (Unknown threat)

Subpopulations within 1 km of the marine shoreline (subpopulations #1–6; Table 1, Figure 4) may be flooded by seawater during storm surges, although the adverse effects of temporary flooding may be mitigated depending on the seasonal timing of a storm. Most storm surges occur in winter when Georgia Basin Bog Spiders are likely hibernating, dormant and protected from adverse weather impacts within some form of tunnel or structure, although the actual nature of these structures is unknown.

Much of the species' potential habitat occurs in the projected Fraser River flood zone (B.C. Ministry of Environment 2011). The lower Fraser Valley has experienced major floods, the largest of which occurred in 1894 and the second largest in 1948 (B.C. Ministry of Environment 2011a). A one-in-three chance exists that a flood of similar magnitude will occur in this area within the next 50 years (Fraser Basin Council 2016). The greatest flood threat involves a combination of high tides and storm surges. Sea-level rise is considered a threat to the lower mainland (Thomson 2008; Kangasniemi 2009; Forseth 2012), as well as the lower-elevation areas of greater Victoria and the Gulf Islands. The overall impact to spider subpopulations is unknown; however, if frequency and severity of storms and flooding continue to increase, these impacts may cause additional subpopulation declines.

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Management Goal

The management goal is to maintain subpopulations of Georgia Basin Bog Spider at all extant sites within the province, including any additional subpopulations that may be identified in the future.

5.2 Rationale for the Management Goal

Georgia Basin Bog Spider has a restricted range in British Columbia and is not readily found during surveys even within known habitats. The subpopulation and distribution goal cannot currently be quantified because significant knowledge gaps exist relating to distribution, habitat requirements and spider abundance at each habitat. The difficulty with estimating subpopulations at low densities makes subpopulation estimates labor-intensive and difficult. The above subpopulation and distribution goal sets a minimum subpopulation objective (greater than one spider) for each known subpopulation. This allows the survival/recovery habitat to be aimed at identifying and protecting the habitat needed to ensure the species persists at any given location. The management goal allows for the protection of survival and recovery habitat to ensure the species persists at any given location.

The species status may qualify for down-listing if threats to its habitats are managed with demonstrable effectiveness; and/or a substantial number of new subpopulations are found and their habitats are secured.

5.3 Management Objectives

The management objectives for Georgia Basin Bog Spider are:

1. to secure protection⁷ (with no loss or degradation of habitat) for extant subpopulations of the species;
2. to confirm its distribution within its range in British Columbia;
3. to assess and mitigate threats to extant subpopulations and, more broadly, to potential habitats, including peatland, bog, cattail marsh, and other wetlands within the species range;
4. to address knowledge gaps (e.g., specific wetland habitat requirements; associations and roles within these wetland plant communities; relationships with other organisms; and reproductive, and other life history information) necessary to maintain subpopulations; and

⁷ Protection can be achieved through various mechanisms, including: voluntary stewardship agreements, conservation covenants, sale of private lands by willing vendors, land use designations, and protected areas.

5. to increase public knowledge of the species and its associated bog, peat, and wetland habitats.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

Although the Georgia Basin Bog Spider has not been assessed under the Conservation Framework (B.C. Ministry of Environment 2009), the Planning, Inventory, Ecosystem and Habitat Protection, Restoration, and Private Land Stewardship action groups of this framework apply. The status of each action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2012).

Send to COSEWIC (complete)

- Georgia Basin Bog Spider assessed as of Special Concern (COSEWIC 2012). Re-assessment 2022.

Planning (complete)

- B.C. Management Plan completed (this document, 2017).

Inventory (in progress)

- Georgia Basin Bog Spider was included as a secondary target species during pitfall trap surveys for Audouin's Night-stalking Tiger Beetle (*Omus audouini*) completed as part of the COSEWIC status assessment for this species. One specimen of the spider was captured in a pitfall trap at Campbell Valley Regional Park (Langley) in 2012 (#8); the identification was confirmed (D. Copley, pers. comm., 2016). The specimen was deposited at the Royal British Columbia Museum in Victoria, BC.
- The Royal British Columbia Museum is leading an inventory of the spiders in the province (Bennett, pers. comm., 2016; D. Copley, pers. comm., 2016). The purpose is to document the provincial spider diversity, species' distributions, and natural history information (C. Copley, pers. comm., 2016).

Ecosystem and Habitat Protection, Restoration, and Private Land Stewardship (in progress)

Federal Protection

- Georgia Basin Bog Spider subpopulations within Gulf Islands National Park Reserve (Tumbo Island, Portland Island, and Cabbage Island) are protected through the legal

provisions of the *Canada National Parks Act* (Government of Canada 2000). The species is also protected under the *Species at Risk Act* (Government of Canada 2002).

Provincial Protection

- Burns Bog (#3) is within the Burns Bog Ecological Conservation Area, which is a Conservation Covenant under the *Land Act* (Province of British Columbia 1996) between Metro Vancouver, the Corporation of Delta, and the Province of British Columbia to “guide the protection and management of the hydrologic regime, plant and wildlife communities along with necessary access, habitat enhancement and possible restoration requirements.”
- Georgia Basin Bog Spider habitat is potentially protected under provisions of the *Water Sustainability Act* (Province of British Columbia 2014), which came into force February 29, 2016. This Act replaces the provincial *Water Act*, as well as components of the *Fish Protection Act*, which has now been renamed the *Riparian Areas Protection Act* (Province of British Columbia 1997), with some sections repealed. The *Water Sustainability Act* includes some guidance on the protection of sensitive streams and protection of aquatic ecosystems. For example, under Section 16, the decision maker can require mitigation measures for, and changes in and about, a stream (including the diversion of a stream) when proposed activities are likely to have adverse impact on an aquatic ecosystem. Additional potential protection mechanisms are included in Part 3, Division 4, which refers to “Water Sustainability Plans” (Section 65). Under this section, the Minister may designate an area for the purpose of the development of a water sustainability plan, if the Minister considers it will assist in preventing or addressing risks to aquatic ecosystem health.
- The Riparian Areas Regulation, enacted under the *Riparian Areas Protection Act*, calls on local governments to protect riparian areas during residential, commercial, and industrial development by ensuring that a qualified environmental professional conducts a science-based assessment of proposed activities.

Protection on Local Government Land

- Campbell Valley Regional Park (#8) is managed by Metro Vancouver. The park has a management plan (Greater Vancouver Regional District 1989) that outlines park management objectives, including “to preserve and enhance wildlife habitat and plant communities.” Park managers are aware of the spider and its associated habitat.
- Island View Beach Regional Park (#1) is classified as a Regional Conservation Area by the Capital Regional District through its Board-approved Regional Parks Strategic Plan. The primary purpose of a Regional Conservation Area is “protection of regionally significant natural environments that contain sensitive and threatened ecosystems, including rare or endangered plant and wildlife species and their supporting ecosystems” (Capital Regional District 2016). Subpopulations of Georgia Basin Bog Spider and their associated habitats are protected by the regional district through this mechanism.
- Burns Bog Ecological Conservancy Area (#2) has a management plan (Metro Vancouver 2007) that includes conservation objectives for this land.

Protection on Privately Managed Forest Land

- Blaney Lake (#7) is within the University of British Columbia’s Malcolm Knapp Research Forest, which has a mandate of “research, demonstration, and education in the field of forestry and allied sciences.”⁸ Although university land managers are aware of the presence of Georgia Basin Bog Spider and its habitat needs (COSEWIC 2012), no formal policy is in place for its protection at Blaney Lake.

Table 4 provides a summary of existing mechanisms that afford habitat protection for the Georgia Basin Bog Spider.

Table 4. Existing mechanisms that afford habitat protection for Georgia Basin Bog Spider.

Existing mechanisms that afford habitat protection	Threat^a or concern addressed	Subpopulation
<i>Land Act</i> , Section 16 Reserve; Section 17 Reserve or Notation of Interest	1.1; 1.2; 1.3; 2.1	3
<i>Riparian Areas Protection Act</i>	1.1; 1.2; 1.3	3, 7
<i>Water Sustainability Act</i>	7.2; 9.1	All
<i>Canada National Parks Act</i>	6.1; 8.1; 8.2; 9.1; 10.2	4, 5, 6

^a Threat numbers according to the IUCN–CMP classification (see Table 3 for details).

⁸ See Malcolm Knapp Research Forest website: <http://www.mkrf.forestry.ubc.ca/about/>

6.2 Recommended Management Actions

Management actions for Georgia Basin Bog Spider are concurrent with those for species with similar habitats and threats. Because of the extensive knowledge gaps for this spider, most management actions focus on inventory, habitat information and mapping, and threat clarification (Table 5).

Table 5. Recommended management actions and suggested implementation schedule for Georgia Basin Bog Spider.

Management objective ^a	Actions to meet objectives	Performance measure	Threat ^b or concern addressed	Priority ^b
Conservation Framework Action Group: Inventory				
2, 4	<i>Confirm distribution and address knowledge gaps</i>			
	1. Develop a standard inventory protocol for surveys and threats applicable at extant subpopulations. Protocols should consider habitat attributes such as plant community information, micro-humidity, and wetland classification, and other natural history information.	Inventory protocols developed and tested by 2021	All threats; knowledge gaps	Essential
	2. Using the standard inventory protocol (Action 1), complete fieldwork for each extant subpopulation, including the spatial extent and wetland hydrological processes.	Habitat descriptions for extant subpopulations completed by 2021	All threats; knowledge gaps	Necessary
	3. Using the habitat information obtained (Action 2), develop a habitat suitability model to prioritize survey sites in unchecked potential habitat within this species' range and habitat that may be available in the future, due to climate change.	Habitat model to guide and prioritize future inventory work completed by 2021	All threats; knowledge gaps	Necessary
	4. Develop a 10-year inventory schedule and landowner contact strategy for priority sites, work with landowners to inventory unsurveyed potential habitat, and use knowledge gained to refine habitat model (if necessary).	Identify and continue to inventory additional potential habitat within the species' range and refine habitat model (ongoing)	All threats; knowledge gaps	Essential

Management objective ^a	Actions to meet objectives	Performance measure	Threat ^b or concern addressed	Priority ^b
Conservation Framework Action Group: Monitor Trends				
	5. Monitor (5–10-year intervals) the spatial area of spider habitat erosion at subpopulations that may be flooded by seawater during storm surges (subpopulations 1–6; Table 3). Concurrently monitor for spider presence within these habitats.	Baseline of spatial area of habitat at subpopulations 1–6 quantified by 2021; for comparison in the future should monitoring results show habitat declines	11.4	Necessary
	6. Develop a plan to monitor the extent and quality of habitat once defined from Actions 2 and 3.	Monitoring plan developed for known habitat by 2021	All	Necessary
Conservation Framework Action Group: Ecosystem and Habitat Protection, Restoration and Private Land Stewardship				
1, 3	<i>Protect extant sites</i>			
	7. Confirm land ownership at all extant subpopulations and determine and delineate potential habitat adjacent to extant subpopulations.	List of landowners for each extant subpopulation completed by 2021	All threats	Essential
	8. Complete fieldwork to confirm the scope, severity, and timing of applicable threats to each of the extant subpopulations and habitats.	Protocols that measure and compare threats at extant subpopulations completed by 2021	All threats; knowledge gaps	Essential
	9. Ensure terrestrial and aquatic habitat restoration projects for species within similar habitats (e.g., Oregon Spotted Frog [<i>Rana pretiosa</i>], Western Painted Turtle [<i>Chrysemys picta bellii</i>], Oregon Forestsnail [<i>Allogona townsendiana</i>]) consider habitat needs of the Georgia Basin Bog Spider.	Communication with other recovery teams, stewardship groups and those conducting restoration activities, established and awareness confirmed	7.3	Essential
	10. Work with landowners to determine appropriate stewardship measures to protect habitat at each of the extant subpopulations and develop best management practices for subpopulations on private lands. In the event where subpopulations occur within agricultural areas, develop best	Best management practices specific to the industry or type of landowner, developed by 2021	All threats	Necessary

Management objective ^a	Actions to meet objectives	Performance measure	Threat ^b or concern addressed	Priority ^b
	management practices to reduce subpopulation specific threats.			
	11. On undesignated provincial Crown sites, establish Section 16 Reserve and/or a notation of interest under the <i>Land Act</i> such that future development interest knows species-at-risk habitat occurs in the habitat polygon.	Establish habitat polygon maps for subpopulations that occur on provincial Crown land and apply for a Section 16 Reserve and/or Section 17 notation of interest under the provincial <i>Land Act</i>	All threats	Essential
	12. Map extant habitats (concurrent with Action 1), including the hydrological processes necessary to ensure the habitats remain suitable for this spider.	Spatially mapped polygons of extant subpopulations habitats completed by 2021	All threats	Essential
	13. Determine whether water extraction, diversion, or alterations are planned or ongoing within or adjacent to extant and adjacent habitats.	Protocols that compare and measure subpopulation-specific threats and subpopulation-specific assessments completed by 2021	All threats	Necessary
	14. Apply for a water license for conservation purposes under the provincial <i>Water Sustainability Act</i> at all the extant subpopulations and adjacent wetland habitats.	If deemed applicable, secure water licenses for conservation purposes by 2021	1.1, 1.2, 3.3, 7.2	Necessary
	15. Determine whether water licences have been granted adjacent to extant subpopulations that could affect the habitat (e.g., through drainage, channeling, extraction).	List of granted water licences that may affect subpopulations completed by 2021	1.1, 1.2, 3.3, 7.2	Necessary

Management objective ^a	Actions to meet objectives	Performance measure	Threat ^b or concern addressed	Priority ^b
5	<i>Increase the profile of Georgia Basin Bog Spider</i>			
	16. Increase public awareness of the existence, conservation value, threats, and harm reduction measures for Georgia Basin Bog Spider and associated wetland (e.g., marsh, peatland and bog) habitats.	Sector-specific information sheets that outline the threats and stewardship actions to mitigate those threats developed by 2021	All	Beneficial
	17. Inform and engage regional conservation organizations and integrate the species into ongoing biodiversity conservation actions, including public outreach and education, stewardship agreements and plans. These organizations include many of the partners with the South Coast Conservation Program, such as Ducks Unlimited, BC Nature, The Nature Trust, The Nature Conservancy, and The Land Conservancy.	Outreach strategy for this species and other wetland (e.g., marsh, peatland, and bog) invertebrates developed by 2021	All	Beneficial
	18. Determine what additional species at risk overlap within the habitats of extant subpopulations, as well as potential adjacent habitats, and how recovery action(s) affect these species.	Outreach strategy for this species and other wetland (e.g., marsh, peatland, and bog) invertebrates developed by 2021	Knowledge gap	Beneficial

^a Management objectives are outlined in Section 5.3.

^b Threat numbers according to the IUCN–CMP classification (see Table 3 for details).

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

6.3 Narrative to Support Management Actions Table

Recommended actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2009).

6.3.1 Planning

Planning and zoning aimed towards protecting the loss of low-elevation wetland, bog, and peatland habitats are needed. Actions include identifying where the habitats are located and their ownership, working with municipalities on zoning and habitat protection, and clarifying threats.

The spider should be included as an ecosystem value when considering development permits that affect wetlands, water flow, riparian areas, or other freshwater drainage changes (Section 6.1: Habitat Protection, Habitat Restoration, and Land Stewardship).

Opportunities should be taken to include this spider's habitats in various planning processes, such as new and updated provincial park master plans (if the species is found within a provincial park) and local government development permit areas, private conservation land management plans, and other similar documents. Whenever feasible, including the species in multispecies management and conservation programs is also recommended.

When this management plan was written, Georgia Basin Bog Spider had not been recorded on provincial forest land and, as such, this species is not recommended for listing as "Identified Wildlife" under the province's *Forest and Range Practices Act* and *Oil and Gas Activities Act*. If further inventory confirms the species does occur within the provincial forest land base, listing under these acts will allow for various additional habitat protection mechanisms, such as the establishment of wildlife habitat areas.

6.3.2 Inventory

Much of the suitable habitat across the Canadian range of Georgia Basin Bog Spider remains to be surveyed for this species. Actions in this management plan are intended to apply a systematic approach to inventory. The first step is to conduct geographic information systems (GIS) habitat suitability mapping based on existing vegetation, forest cover, and biophysical mapping. An updated GIS layer showing the distribution of low-elevation bog, peat, non-fish, and ephemeral stream⁹ areas needs further analysis. Developing standard survey protocols will improve the effectiveness of surveys, and a 10-year inventory schedule will enable the systematic tracking of progress. Because of the relatively large area involved, a prioritized sampling regime is required to cover different geographic areas across the species' range. Fieldwork, predictive habitat modeling, and inventory in unsurveyed habitats for Georgia Basin Bog Spider may increase the provincial geographic distribution of the species.

⁹ A stream that only exists for a short period following precipitation or snowmelt. They are not the same as intermittent or seasonal waterbodies, which exist for longer periods, but not year round.

When the attributes of suitable habitat are better understood, surveying areas adjacent to extant Georgia Basin Bog Spider subpopulations at risk of rising sea-levels will be beneficial to determine whether these areas are adequate candidates for natural movement or expansion.

6.3.3 Ecosystem and Habitat Protection, Restoration, and Private Land Stewardship

Much of the suitable habitat for Georgia Basin Bog Spider occurs on private land; therefore, stewardship activities and securement through covenants and memoranda of understanding are an essential component of habitat protection and management. These actions include collaboration with local conservation groups to encourage private landholders to protect habitat through management or formal means such as conservation covenants. Additional actions include raising awareness about Georgia Basin Bog Spider and its habitats among landholders and managers through outreach activities in partnership with governments and local conservation organizations, industry associations, farmer institutes, and/or researchers.

Once we gain a better understanding of the habitat needs and threats to Georgia Basin Bog Spider, drafting best management practices is recommended as part of a best management practices document for terrestrial species co-occurring within similar wetland, bog, and peatland habitats.

6.3.4 Monitor Trends

Monitoring the extent and quality of habitat, rather than patterns of spider abundance throughout its known range, is more appropriate for Georgia Basin Bog Spider. We assume the presence of this spider recorded during site surveys indicates the subpopulation is persisting if the habitat remains intact and threats remain constant or are minimized. Unfortunately, owing to their small size and cryptic habits, the resources required to carry out annual surveys at all spider sites is not logistically feasible and may adversely impact subpopulations (e.g., pitfall trapping kills spiders). Actions address the development and implementation of a program for monitoring habitat trends at prioritized sampling stations in different portions of the species' range. Collaborative opportunities to incorporate monitoring into a multispecies program (e.g., under climate change monitoring) are to be explored.

7 MEASURING PROGRESS

Performance indicators provide a way to define and measure progress toward achieving the management goals and objectives. Performance indicators have been integrated into the Recommended Management Action Table (Section 6.2; Table 5).

8 EFFECTS ON OTHER SPECIES

Management actions to protect subpopulations and habitats for Georgia Basin Bog Spider will be beneficial for other species sharing the same habitat, including other invertebrates, amphibians,

mammals, and birds that depend on similar wetland, peatland, and bog-type environments. Management activities for Georgia Basin Bog Spider will be implemented with consideration for all co-occurring species at risk, such that no negative impacts occur to these species or their habitats.

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Personal Communications

- Bennett, R., Royal British Columbia Museum, Victoria, BC
- Copley, C., Royal British Columbia Museum, Victoria, BC
- Copley, D., Royal British Columbia Museum, Victoria, BC
- Costanzo, B., B.C. Ministry of Environment and Climate Change Strategy, Victoria, BC
- Fairbarns, M., Botanist, Victoria, BC