Recovery Plan for the Western Branded Skipper, *oregonia* subspecies (*Hesperia colorado oregonia*) in British Columbia

Prepared by B.C. Ministry of Environment and Climate Change Strategy

October 2017

About the British Columbia Recovery Strategy Series

This series presents the recovery documents that are prepared as advice to the Province of British Columbia on the general approach required to recover species at risk. The Province prepares recovery documents to ensure coordinated conservation actions and to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a provincial recovery document?

Recovery documents summarize the best available scientific and traditional information of a species or ecosystem to identify goals, objectives, and strategic approaches that provide a coordinated direction for recovery. These documents outline what is and what is not known about a species or ecosystem, identify threats to the species or ecosystem, and explain what should be done to mitigate those threats, as well as provide information on habitat needed for survival and recovery of the species. The provincial approach is to summarize this information along with information to guide implementation within a recovery plan. For federally led recovery planning processes, information is most often summarized in two or more documents that together make up a recovery plan: a strategic recovery strategy followed by one or more action plans used to guide implementation.

Information in provincial recovery documents may be adopted by Environment and Climate Change Canada for inclusion in federal recovery documents that federal agencies prepare to meet their commitments to recover species at risk under the *Species at Risk Act*.

What's next?

The Province of British Columbia accepts the information in these documents as advice to inform implementation of recovery measures, including decisions regarding measures to protect habitat for the species.

Success in the recovery of a species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this document. All British Columbians are encouraged to participate in these efforts.

For more information

To learn more about species at risk recovery 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>

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Jeremy Gatten

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

Disclaimer

This recovery plan has been prepared by the British Columbia Ministry of Environment and Climate Change Strategy, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The British Columbia Ministry of Environment and Climate Change Strategy has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies and actions that are deemed necessary, based on the best available scientific and traditional information, to recover Western Branded Skipper, *oregonia* subspecies populations in British Columbia. Recovery 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 recovery approaches may be modified in the future to accommodate new 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 on the recovery team.

Success in the recovery 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 plan. The British Columbia Ministry of Environment and Climate Change Strategy encourages all British Columbians to participate in the recovery of the Western Branded Skipper, *oregonia* subspecies.

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Western Branded Skipper, *oregonia* subspecies (*Hesperia colorado oregonia*) is a small butterfly (wingspan 25–37 mm) in the skipper family Hesperiidae. It also has the English common name Oregon Branded Skipper, as cited in the status report prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The naming convention used by the British Columbia Conservation Data Centre refers to the species as the "Western Branded Skipper." In this document, this species is referred to as the "*oregonia* subspecies."

The *oregonia* subspecies was assessed as Endangered by COSEWIC in 2013 but is not listed on Schedule 1 of the federal *Species at Risk Act* (SARA).[1] In British Columbia, the *oregonia* subspecies is ranked as S1 (critically imperiled) by the British Columbia Conservation Data Centre and is on the provincial Red list (i.e., any species or ecosystem that is at risk of being lost [extirpated, endangered, or threatened]). The provincial Conservation Framework ranks the *oregonia* subspecies as a priority 2 under goal three (maintain the diversity of native species and ecosystems). Recovery is considered biologically and technically feasible.

The *oregonia* subspecies has tawny-orange wings with distinctive whitish markings and an erratic flight pattern. The adult flight period is late July through mid-September, with one generation per year. The *oregonia* subspecies inhabits two general habitat types: (1) sparsely vegetated, coastal sand ecosystems, including sand and gravel spits; and (2) scrub oak ecosystems, both of which are subgroups of Garry Oak and associated ecosystems.

Ten named subspecies of the Western Branded Skipper occur in North America although the taxonomy of this species is complex. Three known subspecies range within Canada. The *oregonia* subspecies' range in Canada is restricted to the southern portion of Vancouver Island. Within this restricted range are 18 populations: 5 extant and 13 historical. Of the 13 historical populations, 3 are in areas where suitable habitat still exists and the other 10 are from sites that have no remaining suitable habitat or that have vague locality data and, therefore, unknown habitat suitability.

The primary threat to the *oregonia* subspecies is the potential spray of a commercial pesticide containing *Bacillus thuringiensis kurstaki* to control the introduction and spread of non-native Gypsy Moth. Secondary threats include: ecosystem modifications (i.e., the indirect cumulative threats from natural succession related to fire suppression and invasive non-native plant growth within *oregonia* subspecies habitats); recreational activities at some habitats that result in trampling of host and habitat plants from dog walking and hiking; and severe weather events associated with climate change (e.g., storms and flooding).

The recovery (population and distribution) goal is to maintain the abundance and distribution of all extant *oregonia* subspecies populations (as represented by the area of occupancy at extant

[1] The COSEWIC assessment will be reviewed by the Governor in Council who may, on the recommendation of the Minister, amend the List to include this species on Schedule 1 of SARA (Government of Canada 2002).

sites) within British Columbia, including any additional populations that may be identified in the future.

The recovery objectives for the *oregonia* subspecies are:

1. to secure protection[2] for the extant populations with no loss or degradation of occupied habitat;
2. to confirm the distribution of this subspecies within its range in British Columbia;
3. to assess the extent of threats to each of the extant populations and reduce their impacts; and
4. to address knowledge gaps such as habitat requirements, biological attributes, life history, and ecological factors, for the successful maintenance of this subspecies, including habitat restoration if necessary.

RECOVERY FEASIBILITY SUMMARY

The recovery of the *oregonia* subspecies in British Columbia is considered technically and biologically feasible based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility.

1. **Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**

   YES. The *oregonia* subspecies is known from five extant populations within British Columbia. At least three of these extant populations (Cordova Spit, Camas Hill, and Goldstream) have records spanning multiple years that provide evidence of breeding and sustaining a long-term presence within the area. The Mount Manuel Quimper population is recorded from a large natural area that has not had a complete inventory for the *oregonia* subspecies. The Port Renfrew population is newly recorded (as of 2012) on private land; this site has little associated habitat or threat information to ascertain the size of the population or its long-term viability.

2. **Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**

   YES. Sufficient suitable habitat is available to support the five extant populations; however, this habitat will require ongoing management to sustain the abundance and area of occupancy of these extant populations over the longer term. The habitat supporting the *oregonia* subspecies populations is slowly becoming unsuitable because of ecosystem modifications from the cumulative threats of ongoing natural succession of native species (e.g., Douglas-fir ingrowth [*Pseudotsuga menziesii*), encroachment by non-native invasive vegetation (e.g., scotch broom [*Cytisus scoparius*]), and ongoing fire suppression programs. Threats that reduce habitat quality also include recreational activities (e.g., dog walking, defecation and

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

urination, trampling, digging). Examples of habitat management and restoration actions to reduce these threats include the removal of non-native plants and encroaching native vegetation, and restricted access to important habitats through fencing or designated trails for dogs and hikers.

Additional areas of potentially suitable habitat on southeastern Vancouver have been surveyed for the *oregonia* subspecies with null results. Inventory included areas within the vicinity of Courtenay, Comox, Black Creek, Parksville, Nanaimo, Duncan, Shawnigan Lake, greater Victoria, Sooke, Salt Spring Island, Galiano Island, Mayne Island, and other Gulf Islands (COSEWIC 2013).

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

UNKNOWN. The primary threat to the *oregonia* subspecies is the application of an aerial pesticide containing *Bacillus thuringiensis kurstaki* to control the introduction and spread of non-native Gypsy Moth. It is unknown whether this primary threat can be avoided or mitigated since it requires extensive resources and the timing of the threat is difficult to predict. Secondary threats include the ingrowth of plants by natural succession (partially the result of ongoing fire suppression programs throughout the subspecies' range), including invasive species encroachment; and recreational activities at some habitats (e.g., trampling of host and habitat plants from dog walking and hiking).

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

YES. Existing techniques to achieve population and distribution objectives include developing species-specific inventory techniques that record emergence dates, monitor abundance, record oviposition (egg laying) sites and confirm site-specific threats. These data will enable decision makers to implement habitat protection measures at known sites and/or improve habitat management within protected areas. Information will also aid in prioritizing sites for inventory in unchecked habitats. Captive breeding to supplement the wild populations is not considered necessary for the recovery of the *oregonia* subspecies. Captive breeding may take place to gain knowledge regarding this subspecies' life history and reproductive capabilities. Additional recovery techniques to achieve the population and distribution objectives are expected to be developed within a reasonable time frame.

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1 COSEWIC SPECIES ASSESSMENT INFORMATION

Assessment Summary: November 2013

Common Name: Oregon Branded Skipper[a]

Scientific Name: *Hesperia colorado oregonia*

Status: Endangered

Reason for Designation: This species inhabits sparsely vegetated Garry Oak and coastal sand spit ecosystems that have undergone enormous historic losses. The populations of this skipper have likely undergone similar declines and only four of sixteen sites totalling less than 16 km^2 remain extant. This habitat is fragmented and disjunct. The greatest threats this skipper faces at present, however, are the application of Btk (*Bacillus thuringiensis kurstaki)* pesticide, used to control the invasive Gypsy Moth, and vegetation succession in the open habitats.

Occurrence: British Columbia

Status History: Designated Endangered in November 2013

COSEWIC = Committee on the Status of Endangered Wildlife in Canada
[a] This report uses B.C. Conservation Data Centre (2016) nomenclature, "Western Branded Skipper"

2 SPECIES STATUS INFORMATION

Western Branded Skipper, *oregonia* subspecies[a]			
Legal Designation:			
Forest and Range Practices Act:[b] No *Oil and Gas Activities Act*:[b] No	B.C. *Wildlife Act*:[c] No		*Species at Risk Act*:[d] No
Conservation Status[e]			
B.C. List: Red	B.C. Rank: S1 (2013)	National Rank: N1 (May 2013)	Global Rank: G5T3T4 (Feb. 2016)
Other Subnational Ranks:[f] United States: Washington (S2)			
B.C. Conservation Framework[g]			
Goal 1: Contribute to global efforts for species and ecosystem conservation.			Priority:[h] 3 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.			Priority:[h] 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.			Priority:[h] 2 (2009)
Conservation Framework Action Groups:[g]	Review status rank; inventory		

[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). The COSEWIC assessment will be reviewed by the Governor in Council who may, on the recommendation of the Minister, amend the List to include this species on Schedule 1 of SARA.
[e] Red: Includes any indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. S = subnational; N = national; G = global; T = refers to the subspecies level; X = presumed extirpated; H = possibly extirpated; 1 = critically imperilled; 2 = imperilled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable.
[f] Data source: NatureServe (2016).
[g] Data source: B.C. Ministry of Environment (2009).
[h] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

Western Branded Skipper, *oregonia* subspecies (*Hesperia colorado oregonia*) is a small butterfly in the skipper family, Hesperiidae. It also has the common name "Oregon Branded Skipper," as cited in the status report prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2013). The naming convention used by the British Columbia Conservation Data Centre refers to the species as the "Western Branded Skipper" (B.C. Conservation Data Centre 2016). In this recovery plan, the species is referred to as the "*oregonia* subspecies."

The *oregonia* subspecies is one of 10 described subspecies of Western Branded Skipper (*H. colorado*) recognized in North America. The taxonomy surrounding this species is complex and more subspecies remain to be described (Layberry *et al*.1998; Guppy and Shepard 2001; Pyle 2002; Pelham 2008; Guppy, pers. comm., 2016).

At least three subspecies of Western Branded Skipper range in Canada. The *oregonia* subspecies ranges within lower elevations (sea level to 600 m) between the central to the southern tip of Vancouver Island (Pelham 2008; B.C. Conservation Data Centre 2016). A second Western Branded Skipper subspecies in Canada is unnamed and occurs at higher elevations on Vancouver Island (elevation range is unknown). The geographic and elevational boundaries of this undescribed subspecies will remain unknown until further genetic and morphological work is completed (Guppy, pers. comm., 2016). A third subspecies, *H. c. harpalus* (Pelham 2008) occurs in the southwestern interior of British Columbia, with no records in southern Alberta but a few in the Cypress Hills of southwestern Saskatchewan (Layberry *et al*. 1998). A taxonomic revision of *Hesperia* is under way and will likely change the species and/or subspecies names applicable to these populations (Guppy, pers. comm., 2016); however, this revision will not change the known distribution or conservation status of the low-elevation west coast Vancouver Island taxon, which is currently named the *oregonia* subspecies (Guppy, pers. comm., 2016) and the focus of this recovery plan.

The *oregonia* subspecies has four distinct life stages (egg, larva, pupa, and adult) with a generation time of 1 year. The following morphological description of these life stages is summarized from COSEWIC (2013), Layberry *et al*. (1998), Guppy and Shepard (2001), Pyle (2002), and James and Nunnallee (2011).

3.1.1 Adults

The *oregonia* subspecies has a wingspan of 25–37 mm and long, clubbed antenna that are less than one-third of the wing length (Pyle 2002). The dorsal and ventral wing surface coloration differs. The dorsal wing surfaces have orange spots in the centre of a tawny, reddish brown wing, and wing margins outlined by a broad dark brown band. The ventral wing surfaces are an overall rich brown base colour with a post-median line of distinctive and regularly aligned sharp, yellowish, silver-white spots that are small in proportion to the overall wing size (Layberry *et al.* 1998; Guppy and Shepard 2001; Pyle 2002). Ventral wing surfaces appear greenish-grey in flight (refer to cover photo). The males have dart-like stigmata (prominent cells) on the dorsal

forewing (Pyle 2002); the females lack these stigmata. The adult flight season is from mid-July to mid-September.

The *oregonia* subspecies adults differ from other *H. colorado* subspecies by their dorsal wing coloration, which has been described as "warmly reddish above and has an olive disk with light yellowish spots (or white on the females) without a pearly luster" (Pyle 2002).

Figure 1. O*regonia* subspecies adult (dorsal surface). Specimen from the Royal BC Museum (Jennifer Heron photo).

The life cycle of the *oregonia* subspecies was documented by Hardy (1954) who collected eggs and larva, and reared these individuals through to adults. The information below is summarized from Hardy (1954), as well as general information about Western Branded Skipper from James and Nunnallee (2011).

3.1.2 Eggs

The eggs are hemispherical (1 × 0.8 mm) with a smooth, slightly depressed micropylar area and fine microscopic reticulations. When first laid, the egg is a dull chalky white, eventually changing to pink and then pearly grey as it ages. Females ovipost (lay) eggs singly within suitable vegetation throughout the adult flight season, mid-July through mid-September.

3.1.3 Larva

The tiny (2 mm in length) first instar larvae hatch shortly after oviposition (egg laying). The larval body colour is pale beige or putty coloured, with large and jet black heads and a spindle-shaped, stout body. Larvae grow through a series of up to six instars (body exoskeleton molts and a larger, more robust caterpillar emerges), and as they grow and moult their head colour becomes tan to black and the body colour green to tan (Guppy and Shepard 2001). The final (sixth) instar is reddish with black spiracles and grows to approximately 30 mm in length and

6 mm in width. Just before pupation, larvae turn brownish-purple. Larvae are active from July through October, entering diapause (winter hibernation) sometime in the fall. Larvae emerge from diapause sometime in the spring and begin feeding again. The specific larval instar, dates, and/or timing of larval diapause and emergence are unknown for the *oregonia* subspecies.

3.1.4 Pupae

The pupae have dull pink abdominal segments, bluish-black wing cases, and a double row of transverse dark abdominal dashes along the sides of the body. Pupae are approximately 20 mm long and 6 mm wide, and the transverse abdominal markings become much darker in colour just before adult emergence.

Three other skippers occur within the range and habitat of the *oregonia* subspecies: Dun Skipper (*Euphyes vestris*), Woodland Skipper (*Ochlodes sylvanoides*), and European Skipper (*Thymelicus lineola*). These species have concurrent flight periods, as well as similar flight behaviour and morphological characteristics.

Dun Skipper has an overall consistent dark chocolate brown ventral wing coloration with no white markings.

Woodland Skipper has a tawny-orange ventral wing coloration similar to the *oregonia* subspecies; however, the ventral wing margins have a sharply defined and darker brown border. The ventral forewing and hindwing are also different; the hindwing has distinct large yellow spots and the forewing has a sharply defined brown zigzag mark.

European Skipper has thick black wing margins on the ventral surfaces, lacks spots on the dorsal and ventral wing surfaces, and has dorsal wing surfaces with a brownish border.

See Guppy and Shepard (2001) and Pyle (2002) for additional information on these similar species.

3.2 Populations and Distribution

The *oregonia* subspecies is at the northernmost extent of its global range on southern Vancouver Island, B.C. It ranges southward into the Puget Trough of Washington State, through west-central Oregon to northern California (Figure 2). Approximately 10% of the subspecies' global range is in Canada.

Within Canada, the *oregonia* subspecies is restricted to the coastal lowlands of southern Vancouver Island, from the Victoria area north through the Cowichan Valley to Duncan and Maple Bay areas and west to Port Renfrew (Figure 3) (B.C. Conservation Data Centre 2016).

Records for the *oregonia* subspecies in the province date from 1894 to 2015, comprising 18 separate and discrete populations (Table 1; Figure 3). This includes one new subpopulation (E) documented since the preparation of the COSEWIC (2013) status report.

Populations are considered separate if a large distance of unsuitable habitat exists between occurrence records. For the *oregonia* subspecies, the separation distance between two populations is a minimum of 4 km of unsuitable habitat (B.C. Conservation Data Centre 2016). Separate populations are considered discrete and do not intermix with other populations; however, some of these populations have numerous sites (Table 1).

The following five populations are considered extant based on recent records and the presence of natural habitat that is considered suitable for the *oregonia* subspecies (Section 3.3):

A. Camas Hill, Metchosin (2011)
B. Cordova Spit; south Vancouver Island (2015)
C. Goldstream (2009)
D. Mount Manuel Quimper (2012)
E. Port Renfrew (2012)

Thirteen populations are considered historical (possibly extirpated) as no records occurred within the past 40 years. Three of these populations (F, G, and H; see below, respectively) are at sites where suitable habitat remains. Although this habitat could potentially allow the *oregonia* subspecies to persist, recent surveys (Section 6.1) have not confirmed the subspecies from these habitats.

F. Rithet's Bog, Vancouver Island (1951)
G. Mount Douglas Saanich Park, Victoria (1953)
H. Oak Bay, near Uplands Park, Victoria (1953)

The remaining 10 populations (I–R) have vague collection information and it is unlikely that suitable habitat persists in the general geographic area. If aerial photos suggest natural habitat persists, this information is insufficient to evaluate the habitat potential and therefore it is unknown whether this habitat is suitable for the Western Branded Skipper. It is likely these populations will be assessed as "extirpated" by the Conservation Data Centre; however, in the interim they are considered historical.

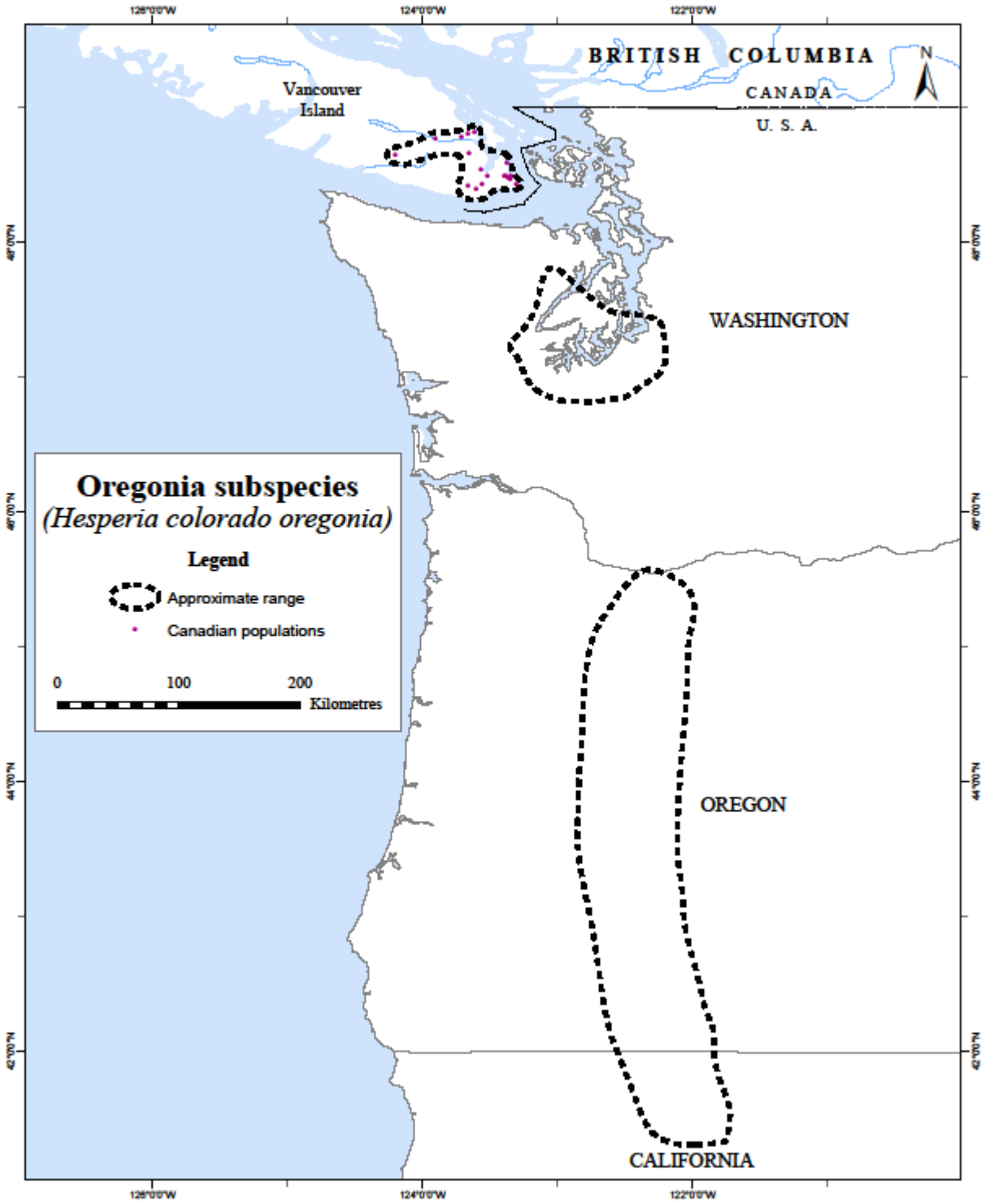

Figure 2. The *oregonia* subspecies (*Hesperia colorado oregonia*) estimated global range (B.C. Conservation Data Centre 2016).

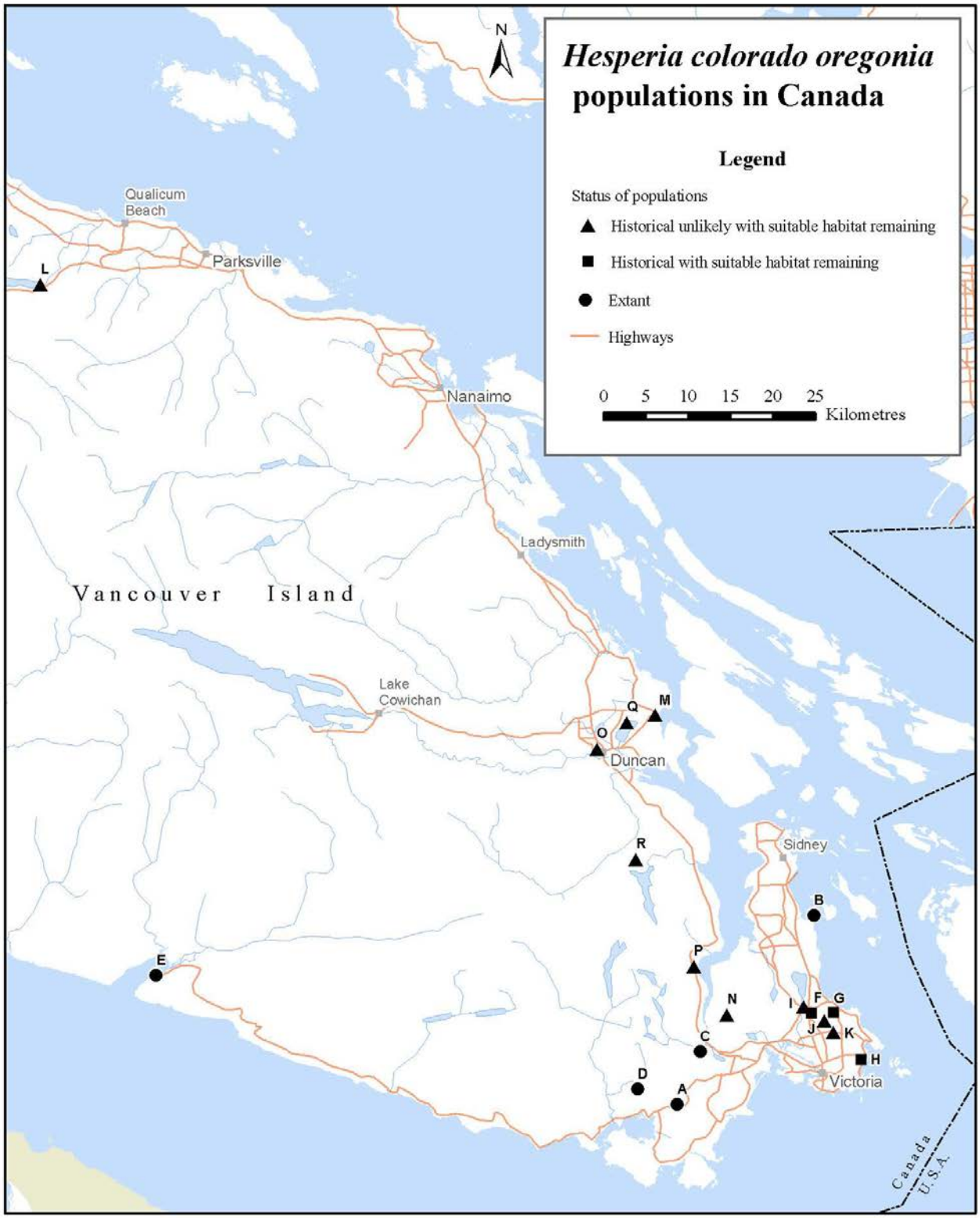

Figure 3. The *oregonia* subspecies (*Hesperia colorado oregonia*) distribution in British Columbia (B.C. Conservation Data Centre 2016). See Table 1 for corresponding population names.

Table 1. Status and description of the *oregonia* subspecies populations in British Columbia.

Population[a]	Population name[b]	Element occurrence no.[c]	COSEWIC site no.[d]	Status[e] (last date of record) habitat description[f]	Land tenure
A	Camas Hill, Metchosin	3	1	Extant (2011) Garry oak and sparsely vegetated habitat remains present at this property.	Private
B	Cordova Spit; south Vancouver Island	5	2a, b, c	Extant (first record 1953, most recent record 2015) Coastal sparsely vegetated sand ecosystem remains present.	Three landowners/managers: 1. First Nation (Tsawout) 2. Capital Regional District 3. Local government (Central Saanich parks)
C	Goldstream	7	3a, b, c	Extant (first record 1902, most recent record 2009) Goldstream Provincial Park; some of the habitat within this park was historically Garry oak and associated ecosystems, but the habitats have changed in the past 50 years and little of this ecosystem remains. Habitat remains in the Capital Regional District park and the private land.	Three (or more) landowners: 1. Crown (provincial park) 2. Capital Regional District 3. Private land (private citizen)
D	Mount Manuel Quimper	14	4	Extant (2012) Garry oak and sparsely vegetated habitat is present throughout this large natural area. Many unchecked habitats exist where the subspecies could occur.	Capital Regional District
E	Port Renfrew	20	na[g]	Extant (2012) Habitat includes roadside and sparsely vegetated areas; little information is available.	Unknown, likely private land, not visibly mapped on the BC Systems and Ecosystem Explorer[h]
F	Rithet's Bog, Vancouver Island	16	6	Historical (1951) Suitable sparsely vegetated habitat remains in area.	Local government (Saanich parks)
G	Mount Douglas Saanich Park, Victoria	22	7	Historical (1953) Suitable Garry oak habitat and sparsely vegetated habitat remains in the area.	Local government (Saanich parks)

Population[a]	Population name[b]	Element occurrence no.[c]	COSEWIC site no.[d]	Status[e] (last date of record) habitat description[f]	Land tenure
H	Oak Bay, near Uplands Park, Victoria	8	9	Historical (1953) Suitable habitat may remain in the area; however, the collection site is unknown. Historically, this area is known to include Garry oak ecosystems.	Local government (Municipality of Oak Bay)
I	Beaver Lake, south of; Vancouver Island	18	12	Historical (1955) Unlikely remaining suitable habitat; likely extirpated (as no individuals were observed during recent inventories and it is unknown how much sparsely vegetated suitable habitat remains). The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
J	Blenkinsop Lake; Victoria	1	5	Historical (1951) Aerial imagery suggests open habitat remains throughout the general geographic area; however, the available information is not sufficient to determine whether the habitat is suitable. Further ground-truthing and inventory is needed. The exact collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
K	Blenkinsop Lake, southeast of Braefoot, Victoria	2	8	Historical (1953) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
L	Cameron Lake, Vancouver Island	4	na[f]	Historical (1952) Aerial imagery suggests open habitat remains throughout the general geographic area; however, the available information is not sufficient to determine whether the habitat is suitable. Further ground-truthing and inventory is needed. The exact collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land

Population[a]	Population name[b]	Element occurrence no.[c]	COSEWIC site no.[d]	Status[e] (last date of record) habitat description[f]	Land tenure
M	Maple Bay, Vancouver Island	9	10	Historical (first record 1916; most recent record 1935) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
N	Millstream, Vancouver Island	11	11	Historical (1955) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
O	Duncan area	Not mapped	13	Historical (1926) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
P	Malahat area	Not mapped	14	Historical (1920) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
Q	Quamichan Lake area	Not mapped	15	Historical (1917) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land
R	Shawnigan Lake area	Not mapped	16	Historical (1894) Unlikely remaining suitable habitat; likely extirpated. The collection site is unknown; however, the area was historically a Garry oak ecosystem.	Unknown, likely private land

[a] See to Figure 3 for population location.
[b] Where identified, population names used in this Recovery Plan correspond to site names associated with the Conservation Data Centre (2016).
[c] B.C. Conservation Data Centre (2016).
[d] COSEWIC (2013).
[e] **Extant:** occurrence has been recently verified as still existing. **Historical:** used when there is a lack of recent field information verifying the continued existence of the occurrence; there is no recent record despite extensive search effort within the general area and it has been more than 20 years since the most recent observation.
[f] Each year listed in this column may correspond to a different site within the element occurrence. Information is summarized from B.C. Conservation Data Centre (2016); more detailed information about collection sites within an element occurrence is available through the BC Species and Ecosystem Explorer <http://a100.gov.bc.ca/pub/eswp/eoMap.do?id=24756>
[g] na = not applicable, applied here when the observation was recorded after publication of the COSEWIC status report (2013).
[h] B.C. Conservation Data Centre (2016).

Determination of a population is based on some evidence of historical or current presence of breeding, which includes oviposition, the presence of active larva, the shed exoskeleton of a larva, the shed pupal casing after adult emergence, and potential breeding habitat (Section 3.3).

Table 1 shows the correspondence between population sites referred to in this Recovery Plan and those referred to in the COSEWIC status report (COSEWIC 2013). Any discrepancies between these population sites occur for the following reasons.

- When the Conservation Data Centre mapped the populations for this subspecies, some of the COSEWIC (2013) sites were combined (i.e., a population can be composed of multiple sites).
- Some of the information on historical populations was considered vague (i.e., COSEWIC sites 13–19; Table 1) as specific geographic collection data were not available (Royal B.C. Museum database; Copley, pers. comm., 2016) and does not have remaining suitable habitat which could have been the potential collection site.
- Although Lea (2015) lists Nanaimo Lakes Road as an occurrence of the *oregonia* subspecies, genetic barcoding has identified these specimens as the nominate subspecies (*H. comma*) and not the *oregonia* subspecies, invalidating this collection site (errata Gelling 2016).

Few data are available to estimate the abundance of extant *oregonia* subspecies populations. Although some populations have been surveyed over multiple years, surveys have focused on recording the presence of the subspecies, as well as the spatial area that the population occupies and the potential habitat within the habitat patch. This infrequent data collection does not allow for population estimates within a habitat patch.

The *oregonia* subspecies likely does not experience extreme fluctuations in abundance; however, insufficient information exists to estimate population fluctuations or trends. The natural population fluctuations in skippers are a result of limiting factors, such as parasites, predators, ambient daily temperatures and long-term seasonal temperatures, and the previous years' weather.

3.3 Habitat and Biological Needs of the *Oregonia* Subspecies

3.3.1 General Habitat

The Canadian range of the *oregonia* subspecies is restricted to lowland and open, sparsely vegetated areas of coastal Douglas-fir biogeoclimatic zone (B.C. Ministry of Forests 2009). Within this zone, the skipper inhabits two general habitat types:

1. sparsely vegetated coastal sand ecosystems, including sand and gravel spits; and
2. scrub oak ecosystems, which are a subgroup of Garry oak and associated ecosystems (Table 1).

In general, both these habitat types contain bunchgrasses and short turf grasses (MacNeill 1964), which are important to the larvae for construction of their tubular shelters. These habitats have significant areas of open, well-drained sandy soil and patches of exposed bare ground

(MacNeill 1964; Thomas 1983; Thomas *et al.* 1986; Dennis 2010). These open areas are important habitat for other related skippers (e.g., *H. comma* in Britain [Thomas *et al.* 1986], *Polites mardon* in south Puget Sound, Washington State [Pyle 2002], and *H. assiniboia* in Alberta [Schmidt, pers. comm., 2012]) and are also thought important to the *oregonia* subspecies. Habitats also require an abundance of larval host plants, which are unknown for the *oregonia* subspecies but suspected to be red fescue (*Festuca rubra*) and Roemer's fescue (*F. roemeri*). Other non-native grass species, such as ryegrasses (*Lolium* spp.) and brome grass (*Bromus* spp.), have been consumed by larvae in captivity (Section 3.3.2).

Sparsely vegetated coastal sand ecosystem habitats, including sand and gravel spits
The most studied *oregonia* subspecies population occurs at Cordova Spit (population B; Figure 3) (Gelling 2015), which is a sparsely vegetated, open coastal sand ecosystem (Ward *et al.* 1998). The shallow soil, gravel, exposed bedrock, and sand inhibit significant tree and shrub growth at these habitats. Patches of low-lying vegetation tend to occur, along with significant moss and herbaceous plant growth. The shifting soil, ocean salt spray, erratic winds, overall shortage of nutrients and fresh water to the vegetation, and intense exposure to summer heat and drought mean the vegetation grows slowly at these habitats (Ward *et al.* 1998).

Results from a study on habitat associations at Cordova Spit showed that most of the *oregonia* subspecies individuals observed (91%) were found within the dune wildrye–beach pea (*Leymus mollis–Lathyrus japonicus*) terrestrial ecosystem, with 9% observed in the black knotweed–yellow sand verbena (*Polygonum paronychia–Abronia latifolia*) terrestrial ecosystem (Gelling 2015).

Garry oak and associated ecosystem habitats
At least 10 of the *oregonia* subspecies populations are recorded from habitats characterized as Garry oak and associated ecosystem (Table 1). Most of these populations are considered historical, and the specific habitat details at the *oregonia* subspecies collection sites are unknown.

Garry oak and associated ecosystems have been described in detail by Roemer (1972) and Erickson (1993, 1995), and further grouped into two major ecosystem types: parkland Garry oak ecosystems and scrub Garry oak ecosystems (Pojar 1980a, 1980b). The *oregonia* subspecies has been recorded from the scrub oak ecosystem type, which is characterized by shallow soils and shorter, scrubby oak trees typically growing on rock outcrops and benches. Detailed vegetative components of scrub oak habitat types are not formally described and may only contain a partial suite of species commonly found in other Garry oak woodlands, such as maritime meadows and vernal pool ecosystems (Lea 2011).

3.3.2 Specific Habitat Functions

The *oregonia* subspecies has four life stages: egg, larva, pupa, and adult, with each requiring specific habitat features. The previous and current year's weather and habitat quality available to one life stage greatly influences the population demographics of the subsequent life stages. Limited information is available to describe the habitat requirements for each life stage.

Table 2 summarizes each essential function of the *oregonia* subspecies' life stage and required habitat features. Further details are provided in the following discussion.

Table 2. Summary of essential functions and features of the *oregonia* subspecies habitat in British Columbia.

Life stage	Function[a]	Feature(s)[b]
Adult (female), Egg	Oviposition and egg development	The base(s) of dry bunchgrass tussocks (e.g., unconfirmed host plant[s] red fescue and Roemer's fescue) mixed within thick herbaceous and dead vegetation, grasses, and forbs. Other structures include sticks and other woody debris, and some anthropogenic structures such as fence posts.
Larva	Feeding, foraging	The larval host plant(s) in the province are unconfirmed, although suspected to be red fescue and Roemer's fescue. Larvae rely on concealment for defence, and develop silken tubular structures at the base of the host plant(s) bunchgrass tussocks, using the blades of the host plant to construct the silken tube. Larvae emerge from these silken tubular structures to feed. Once the host plant resources within the immediate vicinity of the tubular structure are consumed, and/or the tubular structure needs replacing (e.g., larva has outgrown the structure), larvae will move and construct a new tube.
Pupa	Pupation and emergence	Final instar larvae construct a silken cocoon concealed within a tightly woven nest made from grass blades. Larvae pupate within this structure. Emergence habitat is similar to larval habitat (above).
Adult	Perching, roosting, mating, and copulation	At least a 900-m distance adjacent to terrestrial foraging habitat, based on the dispersal distance of Dakota Skipper (300 m within a 3–7 day period and a 21-day maximum life span). The habitat is temporally defined by the adult flight period, mid-July through mid-September. Female: dense, low-lying herbaceous vegetation, thick grassy clumps, leaf litter. Male: similar to female, plus aerial habitat within which to patrol for pheromone-calling females.

[a] **Function:** a life-cycle process of the species (e.g., breeding, feeding/foraging).
[b] **Feature:** the essential structural components of the habitat required by the species. The specific thresholds (measurements and qualifiers, i.e., Attributes) to each of the features listed are unknown.

Oviposition and egg development habitat

Oviposition occurs during the adult skipper flight period, from late July (earliest record July 21) through mid-September (latest record September 22) with one generation per year (Guppy and Shepard 2001; B.C. Conservation Data Centre 2016). Female skippers oviposit eggs singly at the base of host plants (Section 3.3.2) or on other structures (James and Nunnallee 2011). The egg remains at this place until it hatches.

Oviposition and egg development substrate is not good evidence of the subspecies larval host plant, because *Hesperia* will oviposit on other substrates near the host, including fence posts and tree trunks (MacNeill 1964; Pyle 2002). Hardy (1954) observed captive females oviposit on grass, twigs, or the net enclosure.

Oviposition has not been observed in the wild in British Columbia. It is unknown how many eggs are oviposited at one time in the wild; however, when confined to an enclosure, captive females laid up to 40 eggs (one female laid 40 eggs, another group of three females laid 50 eggs total) within a 2-day span (Hardy 1954).

Following oviposition, the egg remains sitting in the dry vegetation, overwinters for approximately 7 months, and hatches into a first instar larvae sometime between March and mid-April. Recent evidence suggests that some eggs may hatch and overwinter as first instar larvae (James and Nunnallee 2011), but this is unconfirmed for the *oregonia* subspecies.

Larval habitat

The *oregonia* subspecies larvae have not been observed in the wild in British Columbia. Larvae grow by incomplete metamorphosis and require sufficient host plant(s) to progress through a series of moults (egg-hatch to pupal stage and adult emergence).

The suspected larval host plant, red fescue, grows within dry, disturbed areas such as roadsides and fields, stream banks, meadows, gravelly sites, and beaches (Douglas *et al.* [editors] 2001). The other suspected host plant, Roemer's fescue, is a mid- to late-succession plant that grows in fine- to medium-textured mineral soil under moderately acid to slightly alkaline conditions (Darris *et al.* 2007). This plant has extensive roots and is drought resistant, yet grows in the range of moderately dry to wet meadows, grassy areas, and open habitats. Neither red fescue (S5) nor Roemer's fescue (S4) is at risk in British Columbia (B.C. Conservation Data Centre 2016).

In the Puget Sound prairies of Washington State, the *oregonia* subspecies females have been documented to oviposit on long-stoloned sedge (*Carex inops*) and California oatgrass (*Danthonia californica*) (Pyle 2002). Both these plants grow throughout southeastern Vancouver Island (and elsewhere in the province) in lowland, moist to dry rock outcrops, meadows, and open woodlands (Douglas *et al.* [editors] 2001). In British Columbia, long-stoloned sedge is ranked vulnerable (S3S4) and California oatgrass secure (S5) (B.C. Conservation Data Centre 2016).

In captivity, the *oregonia* subspecies larvae fed on non-native grasses, such as bromes and ryegrasses (Hardy 1954; MacNeill 1964). Individuals of the nominate subspecies laid eggs on yellow foxtail (*Setaria glauca*) in a captive setting (James and Nunnallee 2011).
Upon hatching in mid-April, larvae feed for 4 months through the spring and summer. They construct small tent like structures for refuge between feeding, leave the structures to eat and, as they grow or host plant resources diminish, will construct new shelters elsewhere (Hardy 1954; James and Nunnallee 2011). Larvae go through six instars before pupation, which occurs sometime from early July to late August.

Pupation and emergence habitat

When larvae are ready to pupate into adult skippers, they require emergence habitat. Pupation from larva to adult skipper occurs from July through August, although pupation has not been observed in the wild in British Columbia. Final instar larvae construct a silken cocoon concealed within a tightly woven nest made from grass blades. The larvae complete metamorphosis (transition from larval form to pupa and emerge as an adult skipper) within these silken cocoons. More research is needed to characterize the emergence habitat, including associated information about: cover objects; slope, aspect, and ambient temperature of emergence site; minimum size of a larva for pupation; host plant vegetation indicators; temperature and weather conditions; and/or other potentially relevant factors.

Foraging habitat

The *oregonia* subspecies drinks the nectar from various native and non-native flowering plants (called "nectaring"), although the complete list of these plants is not fully known. At Cordova Spit (population B; Figure 3), the *oregonia* subspecies has been observed nectaring on American searocket (*Cakile edentula*) and Puget Sound gumweed (*Grindelia stricta integrifolia*) (Costanzo, pers. obs., 2011; Heron, pers. obs., 2011). The skipper likely nectars on other flowering plants throughout their flight season; however, fewer flowering plants remain in the hot, dry, and exposed skipper habitats late in the season. In addition, the corolla (tube) of the flower must be shallow enough to allow the skipper's proboscis (tongue) to reach the nectar, and this physiological trait may limit the flowers the skipper is able to forage upon (Section 3.5).

The spatial extent of skipper foraging patterns is not well studied. In a mark-recapture study on the related Dakota Skipper (*Hesperia dacotae*), which occurs in native tall-grass and upland dry mixed-prairie within Saskatchewan and Manitoba, this species dispersed less than 300 m within a 3–7-day period (Dana 1991). The estimated maximum life span is 3 weeks, with one individual recaptured 19 days after it had been marked during this same mark-recapture study (Dana 1991). The residency of a skipper at a site before emigration and/or death was estimated at 3–10 days (Dana 1991). When defining terrestrial foraging, breeding, and/or oviposition habitat, a 900-m buffer surrounding the known habitat patch may be appropriate for the *oregonia* subspecies (based on a maximum 3-week life span, with up to 300 m dispersal per week).

The adult foraging habitat for the *oregonia* subspecies also includes the aerial areas above the oviposition habitat. Males patrol for females within a defined territory, perching or hill-topping in wait of passing females. The spatial area of habitat needed to sustain a population, aerial height to which the skippers will fly, foraging distance, and horizontal area that adult male skippers patrol is unknown and requires further study.

Perching, roosting, mating, and copulating habitat

The *oregonia* subspecies requires perching and roosting habitat within which to take cover and rest. Like most *Hesperia* species, this subspecies is very active, with short rapid flight, moving and darting around its habitats. As is typical of skippers, the *oregonia* subspecies uses low

shrubs, twigs, grasses, and patches of bare ground. Perching, roosting, mating, and copulating is also most commonly observed within the oviposition habitat.

Skipper mating and copulating habitat is similar to the foraging habitat described above. Females will fly through the habitat patch emitting a pheromone that alerts males. Males have a defined territory they patrol, perching or hill-topping in wait of passing pheromone-calling females. Males are considered opportunistic, and will approach a female when she is perched and nectaring. During copulation, mating pairs need perching or resting sites. The spatial area of this habitat requires further study.

Adult skippers require warm and exposed bare ground for basking (Guppy and Shepard 2001; Pyle 2002). The related Silver-spotted Skipper (*Hesperia comma*) selects oviposition sites with bare ground and shorter, hotter turf (Thomas 1983; Thomas *et al.* 1986; Dennis 2010). The spatial area and distribution of bare ground will change over time within a habitat patch; however, a portion of bare ground is required to sustain a population (Section 3.5).

3.4 Ecological Role

Adult skippers are pollinators and require nectar to sustain themselves. They visit a wide variety of native and non-native flowers and potentially pollinate these flowers. Skippers are also prey items at all life stages, and may be consumed by birds and arthropod predators, such as dragonflies.

3.5 Limiting Factors

Limiting factors are generally not human-induced and include characteristics that make the species less likely to respond to recovery/conservation efforts. For the *oregonia* subspecies, these factors include the following.

- *Vulnerability to weather patterns.* The overall seasonal weather pattern affects the abundance and distribution of skippers at all life stages. For example, the previous year's weather (e.g., average temperature, average rainfall, frost) affects the timing of host plant growth, senescence, and abundance, and directly affects the larval health and abundance of the next generation. Humidity and extreme winter temperatures affect larval survival (McCabe 1979, 1981). Temperature and rainfall affect the species' growth. All these factors contribute to the degree-days and subsequent emergence of the next year's generation.

- *Larval host plant longevity and senescence.* The *oregonia* subspecies larvae require host plant(s) for their development (Section 3.3.2). Although the host plant(s) are not confirmed in the province, the host's phenology, abundance, distribution, and its ability to colonize new areas within a habitat patch will contribute to the maintenance of a population within that patch. Larvae require healthy host plants within which to construct their larval nests. This limiting factor is compounded by increased natural succession (Section 4.2, Threat 7.3) and competition from non-native plants (Section 4.2, Threat 8.1).

- *Adult nectar plant longevity and senescence.* Adult skippers require a constant supply of nectar to produce eggs and sperm, and to sustain themselves and the resident population over the flight season. In the beginning of the flight season (late July), a greater number of flowering plants are available for nectar. The skipper likely nectars on other flowering plants throughout their flight season; however, fewer flowering plants remain in the hot, dry, and exposed skipper habitats late in the season. During surveys in 2011 and 2012, American searocket and hairy gumweed (*Grindelia hirsutula*) were the only two flowering plants used as nectar sources by the subspecies at Cordova Spit (population B, Figure 3); however, these observations were in late August, when other flowering plants had senesced. In addition, the corolla of the flower must be shallow enough to allow the skipper's proboscis to reach the nectar, and this physiological trait may limit the plant species the skipper is able to forage upon.

- *Poor dispersal ability*. The *oregonia* subspecies, like many skippers, is not likely to disperse far from the habitat where it emerged. Adults are small, with a small wing to body ratio and females are heavy with eggs. Larvae are also not highly mobile. The Dakota Skipper[3] does not disperse far, with estimated average adult movements of approximately 300 m over a 3–7-day period, and is unlikely to disperse 1 km across its non-native prairie habitat (Dana 1991; Cochrane and Delphey 2002). These same dispersal limitations may be applicable to the *oregonia* subspecies.

- *Predators.* The *oregonia* subspecies has predators and intraspecific competition; however, these limiting factors are likely similar to those of Dakota Skipper, which are considered low (Dana 1991; Royer and Marrone 1992; COSEWIC 2014).

- *Disease.* Disease in the *oregonia* subspecies is unknown; however, in the related Dakota Skipper, disease is considered infrequent (Dana 1991). Under humid conditions, bacteria are known to cause mortality in *Hesperia* larvae (MacNeill 1964); however, larvae also have natural protection mechanisms against excess moisture (MacNeill 1964).

- *Bare ground*. The spatial area and distribution of bare ground will change within a habitat patch over time; however, this requirement is needed to sustain a population. The spatial area of bare ground is unknown and difficult to measure. This limiting factor is compounded by increased fire suppression (Section 4.2, Threat 7.1) and the succession of both non-native (Section 4.2, Threat 8.1) and native (Section 4.2, Threat 8.2) plants.

[3] Designated "Endangered," *Species at Risk Act*, Schedule 1 (Government of Canada 2002).

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (adapted from Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.[4] Threats were assessed for extant populations and historical populations with remaining suitable habitat.

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 (e.g., fire, flooding) may be especially important when the species is concentrated in one location 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 these 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 population would be disproportionately large compared to the effect experienced historically (Salafsky *et al.* 2008).

The primary threat to the *oregonia* subspecies is the potential for the application of an aerial pesticide containing the bacteria *Bacillus thuringiensis kurstaki* (Btk) to control the introduction and spread of non-native Gypsy Moth. Secondary threats include the encroachment of both non-native and native plants by natural succession (partially the result of ecosystem modifications related to ongoing fire suppression programs throughout the subspecies' range) and recreational activities at some habitats (e.g., trampling of host and habitat plants from dog walking and hiking). The slow progression of habitat loss related to climate change (e.g., storms, flooding, or droughts) is ongoing and particularly evident at Cordova Spit (population B, Figure 3).

[4] 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).

4.1 Threat Assessment

The threat classification below is based on the International Union for 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 the *oregonia* subspecies were assessed for the entire province (Table 3) and the threat impact was High.

Table 3. Threat classification table for the *oregonia* subspecies in British Columbia.

Threat No.[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Population/location[f]
1	***Residential & commercial development***	***Not Calculated***	***Small***	***Moderate***	***Low***	
1.1	Housing & urban areas	Not Calculated	Small	Moderate	Low	Extant population C (private land portions)
1.2	Commercial & industrial areas	Not Calculated	Small	Moderate	Low	Extant population C (private land portions)
1.3	Tourism & recreation areas	Not Calculated	Small	Moderate	Low	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
4	***Transportation & service corridors***	***Not a Threat***	***Unknown***	***Unknown***	***Insignificant/Negligible***	
4.1	Roads & railroads	Not Calculated	Unknown	Unknown	Insignificant/Negligible	Extant populations B and C
5	***Biological resource use***	***Not a Threat***	***Unknown***	***Neutral or potential benefit***	***Insignificant/Negligible***	
5.2	Gathering terrestrial plants	Not a threat	Small	Neutral or potential benefit	Insignificant/Negligible	Extant population B
6	***Human intrusions & disturbance***	***Low***	***Restricted***	***Slight***	***High***	
6.1	Recreational activities	Low	Restricted	Slight	High	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
7	***Natural system modifications***	***Low***	***Pervasive***	***Slight***	***Moderate***	
7.3	Other ecosystem modifications	Low	Pervasive	Slight	Moderate	Extant populations B, C, and D Historical populations with remaining

Threat No.[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]	Population/location[f]
						suitable habitat[g]
8	***Invasive & other problematic species, genes & diseases***	***Low***	***Pervasive***	***Slight***	***Moderate***	
8.1	Invasive non-native/alien species	Low	Pervasive	Slight	Moderate	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
9	***Pollution***	***High***	***Large***	***Serious***	***Moderate***	
9.3	Agricultural & forestry effluents	High	Large	Serious	Moderate	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
10	***Geological events***	***Unknown***	***Small***	***Extreme***	***Unknown***	
10.2	Earthquakes/tsunamis	Unknown	Small	Extreme	Unknown	Extant population B
11	***Climate change & severe weather***	***Low***	***Small***	***Moderate***	***Moderate***	
11.1	Habitat shifting and alteration	Not Calculated	Pervasive	Unknown	Low	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
11.2	Droughts	Not Calculated	Pervasive	Unknown	Low	Extant populations B, C, and D Historical populations with remaining suitable habitat[g]
11.4	Storms & flooding	Low	Small	Moderate	Moderate	Extant population B

Note: A description of the threats included in this table are found 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 population. The median rate of population 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' population 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. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[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.

[f] Refer to Table 2 for a description of the populations; Figure 3 shows the distribution of these populations.

[g] Historical populations with remaining suitable habitat refers to populations F, G, and H.

4.2 Description of Threats

Threats to the *oregonia* subspecies populations are well documented at some habitats, although at other habitats the threats remain unclear. The land ownership and activities at that land greatly influence the type of threat to the skipper and its associated habitat.

The overall province-wide threat impact for this subspecies is High.[5] The threats assessment in this recovery plan is slightly different from the first assessment prepared for the COSEWIC (2013) status report, although the overall threats impact remains unchanged. It considers threats at the one new population documented since the COSEWIC (2013) status assessment; additional local knowledge of each population; the linkages between causal versus proximal threats that are known for each population; the unknown severity, and threats to historical populations if potentially suitable habitat remains at the property.

The overall threat impact considers the cumulative impact of multiple threats (Table 3). The primary threat to the *oregonia* subspecies populations is the potential spraying of pesticide containing *Bacillus thuringiensis kurstaki* (Btk) to control Gypsy Moth (Threat 9.1). Other lower impact threats include recreational activities (Threat 6.1), and succession of non-native (Threat 8.1) and native (Threat 8.2) plants in the open habitats in which the skipper lives. Details are discussed below under the Threat Level 1 headings. Threats with negligible impacts or impacts not calculated are also described because of the uncertain applicability to the *oregonia* subspecies and its habitat.

Threat 1. Residential & commercial development (Not Calculated)

1.1 Housing and urban areas and 1.2 Commercial and industrial areas (Not Calculated)
Much of the Canadian range of the *oregonia* subspecies overlaps with some of the most desirable real estate in the province. Multiple landowners and private properties are adjacent to the *oregonia* subspecies populations within urban areas and most of these areas are subject to future land development. Land development involves clearing land, which subsequently removes larval host plants, adult nectar sources, and pupation sites, and will result in unsuitable habitats for the *oregonia* subspecies.

Unsurveyed and unoccupied *oregonia* subspecies' habitats, and natural areas that contain extant and historical populations for the species, are within the local government jurisdictions of Greater Victoria (13 municipalities), Nanaimo, and Duncan. Most of the large, intact natural habitats within the range of the *oregonia* subspecies are owned by local governments, private landowners or timber companies and future (within the next 25 years) urban planning projections designate many of these areas as future housing, commercial and recreational development. The uncertainty surrounding land use and frequently changing land ownership increases the potential threat of habitat conversion. This threat applies to areas surrounding Camas Hill (population A;

[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 0 Very High, 1 High, 0 Medium, and 4 Low (Table 3). The overall threat impact considers the cumulative impacts of multiple threats.

see Figure 3 for the location of all historical and extant populations) and private land portions of Goldstream (population C). Camas Hill has a conservation covenant protecting the *oregonia* subspecies as well as other Garry oak and associated ecosystems values; however, habitats surrounding this property may also have populations of the *oregonia* subspecies and are potentially at risk of urban development.

1.3 Tourism and recreational areas (Not Calculated)

The demand for tourism and recreational development on southern Vancouver Island is projected to increase within the next decade. For example, camping facilities have expanded at Island View Beach Regional Park near Cordova Spit (population B), and expansion is planned at Goldstream (population C) Provincial Park. Expansion of campgrounds and recreational areas, as well as trail building, destroys habitat and compounds other threats, such as road building to access these areas (Threat 4.1) and the spread of non-native plants (Threat 8.1). Both roads and trails are corridors that can facilitate the spread of introduced species into natural habitats; plant seeds attach to car tires and become dislodged at new sites (Trombulak and Frissell 2000), or plant seeds attached to hiking boots can drop and spread throughout a natural area.

Threat 4. Transportation & service corridors (Not a Threat)

4.1 Roads & railroads (Not a Threat)

Skippers, like many butterflies, may be susceptible to road mortality, especially along roadways with higher speeds (Mckenna *et al*. 2001). They will often sit in sunny spots on roadways, or they will use mud puddles for water and salt uptake.

The development, widening, or expansion of roadways is not likely to affect the five extant *oregonia* subspecies populations. A gated access road runs through a portion of Cordova Spit (population B), but there are no plans for expansion. Portions of habitat at Goldstream (population C) are within a railroad right-of-way, although the population likely spans other areas of unsurveyed surrounding habitat. No future expansion is currently planned; however, maintenance of the right-of-way is likely ongoing. Road expansion may occur during campsite expansion at Goldstream (population C) (Threat 1.3), although the scope and timing are unknown.

Threat 5. Biological resource use (Not in timeframe)

5.2 Gathering terrestrial plants (Not in time frame)

The sparsely vegetated ecosystems at Cordova Spit (B) are of significance to First Nations, and culturally significant plants grow throughout the habitat. Impacts from gathering (e.g., picking plants, walking on plants, or digging plants) are negligible because the plants gathered would not likely be the same ones consumed by the *oregonia* subspecies larvae and, if these same plants were gathered, the severity is likely negligible.

Threat 6. Human intrusions & disturbance (Low impact)

6.1 Recreational activities (Low impact)

Adult emergence of the *oregonia* subspecies coincides with the high season of recreational activity at Cordova Spit (population B), Goldstream (population C), and Mount Manuel Quimper (population D). Although populations of the *oregonia* subspecies have persisted at these habitats for many generations, recreational activities have increased over the past decade. At Cordova Spit, off-leash dog walking within the *oregonia* subspecies habitat affects host-plant health, larval nests, perching, and resting sites, as off-leash dogs may dig, defecate, and urinate within these areas. At other recreational sites, campfires and other day-use activities, such as hiking, mountain biking within some areas, and off-leash dog walking, are detrimental to habitats. Recreational hiking/walking also facilitates the spread of non-native plant seeds (Threat 8.1). It is unknown what recreational impacts threatened the historical populations from Rithet's Bog (population F), Beaver Lake (population G), and Mount Douglas (population H).

Threat 7. Natural system modifications (Low impact)

7.3 Other ecosystem modifications (Low impact)

Historically, low-intensity, frequent fires played an important role in the maintenance of Garry oak ecosystems (Daubenmire 1968; Agee 1993; McPherson 1997 as read in Fuchs 2000). Before European contact, fires originated from lightning and First Nations cultural burning practices (see Fuchs [2000] for a literature review). Garry oak and associated ecosystem habitats are extremely dry during the summer months, and fire was previously one of the primary disturbance factors that maintained the open habitat and host plants needed for the *oregonia* subspecies. Today, accidental fires may occur at some of these sites where high recreational use takes place.

Natural succession of native trees, shrubs, and herbaceous vegetation is ongoing at the habitats of all extant *oregonia* subspecies populations (A, B, C, D, and E), as well as historical populations with suitable habitat remaining (F, G, and H). Ongoing fire suppression programs increase the rate of natural succession within suitable habitats (McCoy 2006) and make these areas less suitable for the skipper. The rate of habitat creation is likely not as fast as habitat loss related to natural succession. Potential larval host plants, adult nectar sources, and adult activity require open habitat with abundant light and moisture (see Pojar and McKinnon 1994 for associated habitat information on potential host plants). Natural plant succession results in competition for resources (light, nutrients), and ultimately displace the larval and nectar hosts needed to sustain an *oregonia* subspecies population.

Threat 8. Invasive & other problematic species & genes (Low impact)

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

Non-native plants are present at all extant population habitats. Invasive plant species are known to change soil structure, enabling other plants to grow, leading to vegetation stabilization and the subsequent decline in number and connectivity between habitats available to the *oregonia* subspecies. They also occupy greater ground cover, reducing the area of bare patches available to adult skippers. Overall, sparsely vegetated plant communities are susceptible to the colonization of invasive plants.

English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), and Himalayan blackberry (*Rubus discolor*) are widespread invasive plants within native ecosystems on southern Vancouver Island, and are known to displace native vegetation. Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), and laurel-leaved daphne (*Daphne laureola*) are also likely to invade disturbed areas. Scotch broom is associated with suppressed native species richness (Rook 2011), grows quickly, and can fix nitrogen in low fertility, sandy soils (Parker 2002; Haubensak and Parker 2004; Huenneke *et al*. 1990). Three of the *oregonia* subspecies population habitats contain large patches of Scotch Broom (B, C, and D).

Numerous introduced grasses such as European beachgrass (*Ammophila arenaria*), sweet vernalgrass (*Anthoxanthum odoratum*), soft brome (*Bromus hordeaceus*), cheatgrass (*B. tectorum*), orchard grass (*Dactylis glomerata*), common velvet-grass (*Holcus lanatus*), and rattail fescue (*Vulpia myuros*) are also present within the sparsely vegetated and Garry oak ecosystems. These invasive plants are known from the *oregonia* subspecies sites, although the scope and severity of their impacts have not been studied.

Herbivory by introduced mammals such as European Rabbits (*Oryctolagus cuniculus*) is present at Cordova Spit (population B) (Gelling, pers. comm., 2016), although it is likely a minor threat. Parasitism by tachinid flies may be a potential threat; these flies were introduced to control Gypsy Moth (Tothill 1913).

Threat 9. Pollution (High impact)

9.3 Agricultural & forestry effluents (High impact)

Southern Vancouver Island and the Canadian range of the *oregonia* subspecies is within the range of potential introduction of European Gypsy Moth (*Lymantria dispar dispar*) and Asian Gypsy Moth (*Lymantria dispar asiatica*). These moths are brought to British Columbia through numerous vectors, including transport on recreational vehicles, shipping containers, and commercial trucks. The arrival and detection of this invasive pest varies yearly and is a challenge to predict. Pheromone traps to detect Gypsy Moths are set up in systematic grids throughout the area.

Should Gypsy Moths be detected in high numbers, ground and aerial spraying of a pesticide that contains Btk may occur. This naturally occurring pathogenic bacterium is a component of a commercial pesticide used to control defoliating caterpillars. The bacterium also affects most non-target butterfly and moth larvae. The use of Btk for Gypsy Moth control occurs in early April to early May, which coincides with the *oregonia* subspecies larval activity.

Aerial spray for Gypsy Moth has occurred close to *oregonia* subspecies sites in the last 5 years; all extant sites and historical sites with suitable habitat remaining are within potential future spray zones. Non-aerial treatment options are a possibility, including ground spray from truck tanks or backpack sprayers operated by individual personnel. These options may successfully eradicate the pest while having minimal impact on the *oregonia* subspecies. It is unlikely that Gypsy Moth control would be required simultaneously throughout all populations of the *oregonia* subspecies.

The site at Cordova Spit (population B) is along a prominent point of entry for Gypsy Moth, particularly because adjacent to the site is a private campground, which receives visitors from across North America. Recreational vehicles such as camper vans, as well as firewood, canoes, or equipment that has sat idle since the previous fall, are favourable places for adult Gypsy Moths to oviposit eggs. These items are also vectors known to transport egg masses, especially from areas of high Gypsy Moth populations within eastern Canada. This may result in an accidental introduction of Gypsy Moth to the region.

The threat of neonicotinoid insecticides on nectar-feeding butterflies and moths needs further research. Neonicotinoids can accumulate in the pollen and nectar of treated plants, and when consumed affects the central nervous system of an insect and can be lethal. Neonicotinoids can accumulate in the environment. The insecticide remains within plant tissue roots and stems and does not rot or break down with the senescence of the plant. For example, in the agricultural sector, the continued use of neonicotinoid-treated seeds in field crops can accumulate within the plant matter and environment over time. Neonicotinoid use in the agricultural sector is not currently applicable to the *oregonia* subspecies; however, the use of neonicotinoids within the ornamental tree and shrub nursery sector is ongoing. This threat is applicable at private land habitats or habitats where restoration actions involve planting vegetation. No central registration system is in place for neonicotinoid-treated ornamental tree and shrub plants or any indication of where these plants are ultimately planted. Information on this threat, and to what extent it is applicable to the *oregonia* subspecies, needs further research.

Threat 10. Geological events (Low impact)

10.2 Earthquakes/tsunamis (Low impact)

The habitat at Cordova Spit (population B) is less than 2 m above sea level. In the event of a tsunami, this property would be submerged. The timing of this event is unknown.

Threat 11. Climate change & severe weather (Low impact)

11.1 Habitat shifting and alteration (Not Calculated)

Within the Pacific Maritime Ecozone, mean annual temperatures increased by 1.7°C from 1960 to 2006 (Coristine and Kerr 2011). By 2050, mean annual temperatures are expected to increase by approximately 2–3°C (Hebda 1997). Climate change affects the flowering time, bloom period, and senescence of host and nectar plants at all of the *oregonia* subspecies populations. Premature host and nectar plant senescence affects larval survival by changing the synchrony between plant longevity and fall larval diapause. The severity is unknown, and the timing is likely outside of the 10-year assessment period.

11.2 Droughts (Not Calculated)

The threat of drought applies to populations A–H. Increased summer droughts (Mote and Salathe 2010) have the potential to affect the open, sparsely vegetated habitats of southern Vancouver Island, which experience hot and dry summers. Changes to rainfall patterns over the past decade, as well as a decline in snowpack and subsequent freshet, has led to a greater demand on the water resources within these areas. Conversely, an anticipated increase in winter precipitation is

projected for coastal areas such as east Vancouver Island. A recent analysis of global observations from 1925 to1999 showed that precipitation increased by 6.2 mm per decade in the latitude band of 50–70° N, which includes almost all of British Columbia (Zhang *et al*. 2007). More specifically on southeastern Vancouver Island, the projected change in precipitation by the middle of the 21st century (2041–2071), relative to historical records (1961–1990), models a 10–25% increase for average winter conditions (December–February) and a 0–10% decrease for average summer conditions (June–August) (Rodenhuis 2009).

11.4 Storms & flooding (Low impact)

The greater frequency and severity of winter storms (Page 2010) affects the shoreline habitat at Cordova Spit (population B). The cumulative effects of wave wash, scouring, water runoff from terrestrial habitats and impacts from woody debris washing ashore, all contribute to a potential decline in the *oregonia* subspecies habitat. The effects of an increase in the severity, frequency, and seasonality of storms and flooding to the *oregonia* subspecies habitat needs further study and long-term monitoring. All other populations are not close to shoreline habitats.

5 RECOVERY GOAL AND OBJECTIVES

5.1 Recovery (Population and Distribution) Goal

The recovery (population and distribution) goal is to maintain the abundance (as represented by area of occupancy) and distribution of all extant *oregonia* subspecies populations within British Columbia, including any additional populations that may be identified in the future.

5.2 Rationale for the Recovery (Population and Distribution) Goal

The *oregonia* subspecies is endemic to the west coast of North America. Within Canada, 18 populations occur on southern Vancouver Island: 5 extant populations (A, B, C, D, and E); and 13 historical populations, with 3 of these having potentially suitable habitat remaining (F, G, and H).

Suitable habitat for the *oregonia* subspecies comprises sparsely vegetated coastal sand ecosystems, including sand and gravel spits and scrub oak ecosystems, both of which are highly threatened ecosystems in Canada. The low number of extant populations, limited geographic range, high threats, and decline in habitat quality also led to its assessment as Endangered[6] in Canada (COSEWIC 2013). The threshold criteria that led to this assessment include estimated extent of occurrence of less than 5000 km^2 and an estimated index of area of occupancy less than 500 km^2, the species being present at fewer or equal to five locations,[7] and a continued decline in the area, extent, and/or quality of habitat.

[6] COSEWIC (2013): assessed as Endangered; criterion**:** B1ab(iii)+2ab(iii)

[7] The term "location" as defined by COSEWIC: a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most

The *oregonia* subspecies has likely always been naturally rare because its habitat, coastal sand and Garry oak ecosystems, is also historically rare in Canada. Currently, the *oregonia* subspecies has a small estimated extent of occurrence (66 km^2 for extant sites; 250 km^2, including populations F, G, and H) and a small index of area occupancy (20 km^2; less than 32 km^2, including populations F, G, and H). Even if the historical condition (distribution and abundance) could be achieved, this subspecies would likely continue to be assessed as Endangered in Canada.

The recovery goal is proposed to ensure the persistence of the *oregonia* subspecies in British Columbia, and includes maintaining any additional populations that may be recorded. Population information for the *oregonia* subspecies is incomplete at all habitats and specific population targets cannot currently be quantified. Consequently, no information is available to measure abundance trends or to complete a minimum population viability analysis. Lifespan, dispersal, and recolonization capabilities are unknown, and detailed habitat requirements are unclear. A lack of natural history information, including the larval host plant(s) for the *oregonia* subspecies, precludes a recovery goal to increase the number of populations through translocation or other techniques at historical population locations, and is not currently recommended. If additional naturally occurring populations are recorded, these will be included in recovery planning. Fulfilling knowledge gaps will provide important information to help maintain the present number of extant populations and allow future quantification of the recovery goal. In the interim, conserving the existing habitat quantity and quality will serve as a surrogate for maintaining population abundance.

5.3 Recovery Objectives

The recovery objectives for the *oregonia* subspecies are:

1. to secure protection[8] for the extant populations so that there is no loss or degradation of occupied habitat;
2. to confirm the distribution of this subspecies within its range in British Columbia;
3. to assess the extent of threats to each of the extant populations and reduce their impacts; and
4. to address knowledge gaps, such as habitat requirements, biological attributes, life history, and ecological factors.

serious plausible threat. Where the most serious plausible threat does not affect all of the taxon's distribution, other threats can be used to define and count locations in those areas not affected by the most serious plausible threat (Source: IUCN 2010, 2011). In the absence of any plausible threat for the taxon, the term "location" cannot be used and the sub-criteria that refer to the number of locations will not be met (Source: IUCN 2010, 2011).

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

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2009). Status of the action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2013).

Send to COSEWIC (complete)

- The *oregonia* subspecies assessed as Endangered (COSEWIC 2013).

Planning (complete)

- British Columbia Recovery Plan completed (this document, 2017).

Inventory (in progress)

- Inventory to 2012 is summarized in the COSEWIC (2013) status report. Areas targeted for searches in 2012 include: Sooke Hills Wilderness Regional Park Reserve (including Mount Manuel Quimper); Cordova Spit (including Island View Beach Regional Park); Central Saanich Park and Tsawout First Nations properties); Nanaimo River Road (outside of Nanaimo), private property owned by TimberWest; Mount Baldy (near Shawnigan Lake); Spectacle Lake and surrounding areas; Camas Hill (population A), private property and Mill Hill Capital Regional District Park (Heron, pers. data).
- Inventory by Gelling (2013 to 2014) occurred at Cordova Spit, Sooke Hills Wilderness Regional Park Reserve, Uplands Park (population H), and in the Nanaimo Rivers Road area (same areas as above).
- Non-targeted and opportunistic searches have occurred simultaneously during surveys for other butterflies in the greater Victoria area. The Victoria Natural History Society has completed butterfly counts monthly throughout this area for at least 20 years. During this time, the *oregonia* subspecies has only been recorded along a railway right-of-way near Goldstream (population C) and confirmed at Cordova Spit (population B). The count is conducted by volunteers, with each person covering a spatial area of habitat in the greater Victoria area.
- Surveys in greater Victoria area parks, including Beacon Hill, Moss Rock, Bamfield, Summit, and Topaz (Page *et al.* 2010).
- Inventories during academic research projects that have submitted their butterfly records to the Conservation Data Centre have not recorded the *oregonia* subspecies (B.C. Conservation Data Centre 2016).

Habitat Protection and Private Land Stewardship (in progress)

- Existing mechanisms that could potentially protect the *oregonia* subspecies habitat are listed in Table 4.

- Portions of the habitat at Goldstream (population C) are protected under the provincial *Parks Act* and *Protected Areas of British Columbia Act* (Province of British Columbia 2000).
- Camas Hill (population A) is on private land owned by an active steward of the property, and with an environmental covenant registered on title.
- Cordova Spit (population B) spans properties owned and managed by three separate landowners: Tsawout First Nation, Central Saanich municipal government, and Capital Regional District (Island View Beach Regional Park). The *Cordova Shore Conservation Strategy* (Page 2010) is a collaborative document developed in partnership with these three landowners, and outlines actions to restore, recover, and protect ecosystem values within this area, including those important for the *oregonia* subspecies.
- For portions of the habitat at Cordova Spit (population B), the Tsawout First Nation has developed the *Land Code* (Tsawout First Nation 2006), which identifies important natural features and conservation values within the Tsawout Indian Reserve 2, including the spit where the *oregonia* subspecies occurs. Details on the protection policies and community plans for the reserve are outlined in the *Comprehensive Community Plan* (Tsawout First Nation 2010), as well as summarized in the Cordova Shore Conservation Strategy (Page 2010). These conservation plans assist in mitigating impacts from threats, such as land development, recreational development, and invasive species.
- Mount Manuel Quimper (population D) is within Sooke Hills Capital Regional District Park Reserve, and owned by Capital Regional District. The park is managed for natural ecological values.
- Much of the low-elevation, natural habitat on southeastern Vancouver Island and Gulf Islands that is suitable for the *oregonia* subspecies is privately owned by individual landowners (e.g., farms or rural properties), private forest companies (e.g., for timber production), and development companies (e.g., with future plans for urban housing or industrial real estate use), or is within local government ownership (e.g., watersheds and natural areas, or future urban/commercial real estate development).
- Local government bylaws that protect environmental values on private lands differ between local governments. Currently, no bylaws specifically protect the *oregonia* subspecies or butterflies; however, numerous local governments recognize the importance of rare ecosystems and use Sensitive Ecosystem Inventory information (Ward *et al*. 1998) to guide and limit the type of development within certain areas. Depending on the jurisdiction, development permit applications may require environmental assessments that include wildlife values and consider impacts to natural habitats as part of the approval process. For example, the District of Central Saanich Official Community Plan includes provisions to protect sensitive environmental areas within several development permit areas, including coastal sand spits and inland bluff habitats (Page 2010). Cordova Spit (population B), including Island View Beach Regional Park, are considered regionally significant by the District of Central Saanich.

Table 4. Existing mechanisms that afford habitat protection for the *oregonia* subspecies.

Existing mechanisms that afford habitat protection	Threat[a] or concern addressed	Site/population
Tsawout First Nation (2006) *Land Code*	All	Portion of Cordova Spit (B)
British Columbia *Parks Act* and *Protected Areas of British Columbia Act*	1.1; 1.2; 1.3	Portion of Goldstream (C)
Saanich Parks	All	Portion of Cordova Spit (B)
Capital Regional District	All	Portion of Cordova Spit (B) and (Mount Manuel Quimper Regional Park (D)
British Columbia *Land Act*, Section 16 Reserve; Section 17 Reserve or Notation of Interest (Province of British Columbia 1996)	1.1; 1.2; 1.3; 2.3; 4.1	All

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

6.2 Recovery Action Table

Recovery planning for the *oregonia* subspecies is concurrent with recovery planning approaches for similar species under the Garry Oak Ecosystems Recovery Team (2017) and the South Coast Conservation Program (2016). Because of the extensive knowledge gaps for the *oregonia* subspecies, most of the recovery planning activities listed in Table 5 centre on inventory, habitat information gathering, habitat mapping, and threat clarification. These activities will help prioritize areas for future surveys and inform habitat protection efforts. A combined approach to recovery also includes engaging the academic, naturalist, and stewardship community in recovery projects for the species, including inventory, natural history, and habitat information gathering.

Table 5. Recovery actions for the *oregonia* subspecies.

Objective	Conservation Framework action group	Objectives/recovery actions	Performance measures	Threat[a] or concern addressed	Priority[b]
		Protect extant populations			
1, 2	Habitat Protection, Restoration and Private Land Stewardship	Using geographic information system applications, complete habitat mapping and spatial delineation of suitable habitat at each of the extant (A–E) and historical (F–H) populations. For those populations where collection information is vague and suitable habitat unlikely remains (H–R), confirm through this mapping for the presence of suitable habitat and field confirm as necessary.	Mapping of habitat and spatial delineation of suitable habitat for extant and historical populations completed by 2021.	All threats	Essential
		Confirm the spatial extent and land ownership of extant *oregonia* subspecies populations and potential habitat delineated above.	List of landowners with the subspecies extant and potential habitat completed by 2021.	All threats	Essential
		On undesignated provincial Crown sites, establish Section 17 Reserve and/or a notation of interest under the provincial *Land Act* such that future development interests know species at risk habitat occurs on the site. Applicable to provincially owned land in the Duncan, Goldstream, Port Renfrew, and Cowichan Lake areas.	Habitat polygon maps completed for sites on provincial Crown land and draft applications for a Section 16 Reserve and/or notation of interest under the provincial *Land Act* at these sites by 2021.	All threats	Essential
		Work with BC Parks to update the park Master Plan for Goldstream Provincial Park (population C) to include management actions for the *oregonia* subspecies. If no master plans are available, draft a separate management recommendation for the skipper within this park.	If inventory within BC Parks confirms new populations, work to update park Master Plans (if written) with appropriate management information; if no Master Plan is available, work to draft a separate management recommendation specific to the park by 2021.	1.3, 6.1	Necessary

Objective	Conservation Framework action group	Objectives/recovery actions	Performance measures	Threat[a] or concern addressed	Priority[b]
		Work with private landowners to determine appropriate stewardship measures to protect *oregonia* subspecies habitat at extant sites and historical sites with suitable habitat.	Work towards stewardship agreements and/or covenants for known (and any new) populations on private conservation lands, and regional district and municipal lands by 2021.	All threats	Necessary
		Work with the timber companies that own the property the *oregonia* subspecies has been recorded from (population E), to develop and implement best management practices to reduce site-specific threats.	Work towards stewardship agreements and/or covenants for known (and any new) populations on private conservation lands, and regional district and municipal lands by 2021.	1.1, 1.2, 1.3, 8.1	Necessary
		Recommend the *oregonia* subspecies be a priority for listing in the category "Species at Risk" under the provincial *Forest and Range Practices Act* and the *Oil and Gas Activities Act*.	Recommend the *oregonia* subspecies for listing as Species at Risk under these acts and draft an *Identified Wildlife Species Account* for this species under these acts by 2021.	All	Necessary
		Work with pest management programs (e.g., Provincial Gypsy Moth Committee, sectors that use neonicotinoid insecticides) on monitoring and mitigation options for non-target butterflies and moths within the potential areas of introduction and/or future pesticide spray.	General mitigation options drafted for management programs by 2021.	9.3	Essential
		Confirm distribution and address knowledge gaps, such as habitat requirements for each life stage			
2, 4	Inventory, Monitor Trends	Develop standardized inventory methods for the *oregonia* subspecies, including habitat attributes, plant community information, life stage surveys (e.g., months to survey for specific life stages), immediate threats, and other natural history information.	Inventory methods drafted and tested by 2021.	Knowledge gaps; all threats	Essential

Objective	Conservation Framework action group	Objectives/recovery actions	Performance measures	Threat[a] or concern addressed	Priority[b]
		Using standard inventory protocol developed above, complete fieldwork at extant sites (A–E), historical sites with potential habitat (F–G), and additional habitats.	Completed habitat descriptions for extant sites with *oregonia* subspecies populations by 2021.	Knowledge gaps; all threats	Necessary
		Using the habitat information obtained (above), develop inputs to a habitat suitability model that can be mapped using geographic information systems.	Habitat model to guide and prioritize future inventory work drafted by 2021.	Knowledge gaps; all threats	Necessary
		Use the outputs from this habitat suitability model to prioritize survey sites in unchecked potential habitat.	List of priority habitats to survey completed by 2021.	Knowledge gaps; all threats	Necessary
		Develop a 10-year inventory and monitoring schedule and landowner contact strategy for priority sites.	Landowner contact, inventory, and monitoring schedule drafted by 2021.	Knowledge gaps; all threats	Necessary
		Work with landowners and lands managers to identify and inventory priority sites (from habitat model) and refine habitat model as fieldwork is completed.	Potential habitat within the subspecies' range inventoried and results used to refine habitat model (ongoing).	Knowledge gaps; all threats	Necessary
		Explore the feasibility of monitoring these sites to obtain information on the life history, movements, habitat use, and population biology of the species. This will enable a better understanding of habitat requirements for each life stage, and the potential dispersal to adjacent habitats.	Potential habitat within the subspecies' range inventoried and results used to refine habitat model (ongoing).	Knowledge gaps; all threats	Necessary
		Develop threats assessment and monitor sites			
3	Monitor Trends	Develop threats assessment methods (e.g., determine scope, severity, and timing of threat) and habitat monitoring protocols (e.g., photographic) for the *oregonia* subspecies extant populations (A–E) and historical populations with remaining suitable habitat (F–G). This information is to be gathered concurrently with standard inventory protocols developed above.	Protocols that compare and measure site-specific threats completed by 2021. Site-specific threat assessments at extant populations completed by 2021.	All threats	Essential

Objective	Conservation Framework action group	Objectives/recovery actions	Performance measures	Threat[a] or concern addressed	Priority[b]
		Within parks, record and assess the impact of physical changes to the habitat by humans (e.g., disturbances from off-leash dog walking, hiking, picnicking, and other recreational activities, trampling, etc.) at each of the extant populations.	Protocols that compare and measure site-specific threats completed by 2021. Site-specific threat assessments at extant populations completed by 2021.	6.1	Essential
		Increase the profile of the* oregonia *subspecies			
5	Private Land Stewardship and Habitat Protection	Increase public awareness of the existence, conservation value, threats, and habitats for the *oregonia* subspecies and other species within sparsely vegetated and Garry oak ecosystems habitats.	Information sheets for landowners, land stewards, managers, and lease-holders that is specific to the sector, outlines the threats applicable to that sector, and outlines stewardship actions to mitigate those threats completed by 2021.	All	Beneficial
		Inform regional forest industry companies of the *oregonia* subspecies to reduce potential threat impacts.	Information sheets for landowners, land stewards, managers, and lease-holders that is specific to the sector, outlines the threats applicable to that sector and outlines stewardship actions to mitigate those threats completed by 2021.	All	Beneficial
		Inform regional conservation organizations about the *oregonia* subspecies and integrate the species into the biodiversity planning and engagement actions currently led by these conservation organizations. These organizations include many of the partners with the Garry Oak and Associated Ecosystems Recovery Team, BC Nature, The Nature Trust, The Nature Conservancy, South Coast Conservation Program, and additional local organizations.	Outreach strategy for the *oregonia* subspecies developed by 2021.	All	Beneficial

Objective	Conservation Framework action group	Objectives/recovery actions	Performance measures	Threat[a] or concern addressed	Priority[b]
		Engage local stewardship and conservation groups, such as those listed in the action above, through the development and delivery of public education and outreach workshop specific to the *oregonia* subspecies and other butterfly and moth species at risk.	Public education materials and workshops for landowners, stewardship groups, and those interested in habitat conservation developed and given by 2021.	All	Beneficial
		Determine the co-occurring species at risk within the same habitats as the *oregonia* subspecies and what similar recovery actions can be completed for all species.	Inventory and list of co-occurring species at risk within the same habitats as the *oregonia* subspecies completed by 2021. Integrate actions specifically for the *oregonia* subspecies into other ecosystem-based recovery documents, approaches, and action planning (ongoing).	All	Beneficial

[a] Threat numbers according to the IUCN–CMP classification (see Table 3 for details).
[b] Essential: urgent and important, needs to start immediately; Necessary: important but not urgent, action can start in 2–5 years; or Beneficial (action is beneficial and could start at any time that was feasible).

7 SPECIES SURVIVAL AND RECOVERY HABITAT

Survival and recovery habitat is defined as the habitat that is necessary for the survival or recovery of the species. This is the area where the species naturally occurs or depends on directly or indirectly to carry out its life-cycle processes, or where it formerly occurred and has the potential to be reintroduced.

7.1 Biophysical Description of the Species' Survival/Recovery Habitat

Section 3.3 and Table 2 provide a description of the known biophysical features and attributes of the species' habitat required to support these life-cycle processes (functions). Additional work is required to fulfill habitat knowledge gaps. These knowledge gaps are provided in Table 5.

7.2 Spatial Description of the Species' Survival/Recovery Habitat

The area of survival/recovery habitat required for a species is guided by the amount of habitat needed to meet the recovery goal. Although no survival/recovery maps are included with this document, it is recommended that the location of survival/recovery habitat be spatially described to mitigate habitat threats and to facilitate the actions outlined to meet the recovery (population and distribution) goals.

8 MEASURING PROGRESS

Performance measures toward meeting each of the four recovery objectives have been integrated into the Recovery Action Table in Section 6.2 (Table 5). The recovery plan will be reviewed in 10 years to assess progress and to identify additional approaches or changes that may be required to achieve recovery.

The performance indicator presented below provides a way to define and measure progress toward achieving the recovery (population and distribution) goal.

- The abundance of each known extant population of the *oregonia* subspecies in British Columbia is maintained. The abundance at a site is measured by completing surveys/counts on specific date(s) at that site throughout the flight season, and comparing these results over time.

9 EFFECTS ON OTHER SPECIES

In addition to the *oregonia* subspecies, numerous additional federally and provincially listed species at risk co-occur within similar habitats, depending on the locality (B.C. Conservation Data Centre 2016). Conservation actions for the skipper will benefit plants and other invertebrates most. For example, at Cordova Spit (population B), a summary of co-occurring

species was assembled as part of the Cordova Shore Conservation Strategy (see Page 2010 for additional species). Table 6 describes the plants and arthropods that occur within the same habitat at Cordova Spit.

Table 6. Plant and arthropod species that occur within the same habitat as the *oregonia* subspecies at Cordova Spit.

Common name	Scientific name	Provincial list[a]/rank[b]	Federal status[c]
Plants			
yellow sand-verbena	*Abronia latifolia*	Blue/S3	*Not assessed*
Contorted pod evening primrose	*Camissonia contorta*	Red/S1	Endangered
beach morning glory	*Calystegia soldanella*	Red/S2	*Not assessed*
American glehnia	*Glehnia littoralis ssp. leiocarpa*	Blue/S3	*Not assessed*
fleshy jaumea	*Jaumea carnosa*	Blue/S2S3	*Not assessed*
silky beach pea	*Lathyrus littoralis*	Red/S2	*Endangered*
black knotweed	*Polygonum paronychia*	Blue/S3	*Not assessed*
Howell's triteleia	*Triteleia howellii*	Red/S1	Endangered
Arthropods			
Edward's Beach Moth	*Anarta edwardsii*	Red/S1	Endangered
Sand-verbena Moth	*Copablepharon fuscum*	Red/S1	Endangered
Vancouver Island Ringlet	*Coenonympha california insulana*	Red/S1	*Not assessed*
Georgia Basin Bog Spider	*Gnaphosa snohomish*	*Not assessed*	Special Concern

[a] Source: B.C. Conservation Data Centre (2016); Red – Includes any indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia; Blue – Any species or ecosystem that is of special concern.
[b] Source: B.C. Conservation Data Centre (2016); S – subnational (provincial) ranks assigned and maintained by the Conservation Data Centre; 1=critically imperiled; 2= imperiled; 3 = special concern, vulnerable to extirpation or extinction.
[c] Source: Government of Canada (2017)

At least 10 bird species at risk also occur at Cordova Spit (Page 2010). Completion of similar species lists need to be completed for the other sites inhabited by the *oregonia* subspecies.

Protection for *oregonia* subspecies habitat will benefit some of these species, although not all species at risk have been specifically identified within the extant population habitats (this is a knowledge gap). Recovery planning activities for the *oregonia* subspecies 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. Conservation strategies are consistent with Garry Oak Ecosystems Recovery Team and South Coast Conservation Program.

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