COSEWIC
Assessment and Status Report

on the

Taylor's Checkerspot
Euphydryas editha taylori

in Canada

ENDANGERED
2011

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC
Assessment Summary

Assessment Summary – May 2011

Common name
Taylor's Checkerspot

Scientific name
Euphydryas editha taylori

Status
Endangered

Reason for designation
The historic range of this small, eye-catching butterfly in Canada was wider and included south-eastern Vancouver Island. Now it only occurs in a very small area on Denman Island, B.C. The habitat it occupies is likely to continue to decline in area and quality. Threats include habitat loss and degradation due to development, natural forest succession and the spraying of bacterial insecticide to control pest insects. Individual ownership issues exacerbate the combination of these and other threats.

Occurrence
British Columbia

Status history
Designated Endangered in November 2000 and in May 2011.

COSEWIC
Executive Summary

Taylor's Checkerspot
Euphydryas editha taylori

Wildlife species description and significance

Taylor's Checkerspot (*Euphydryas editha taylori*) is a small eye-catching butterfly with a wingspan of 26–43 mm. The dorsal wing surfaces of the most common colour form have alternating bands of orange-red, black and white. The ventral wing surfaces are predominantly orange with bands of white. The thorax and abdomen are black with faint orange bands on the posterior half of the abdomen. Taylor's Checkerspot is one of more than 30 subspecies of Edith's Checkerspot in North America.

Taylor's Checkerspot is one of many species used as an interpretive tool by conservation organizations to represent Garry Oak ecosystems. There is no information that suggests that Taylor's Checkerspot has an important cultural or economic role for First Nations people.

Distribution

The global range of Taylor's Checkerspot is restricted to western North America, from southeastern Vancouver Island, British Columbia; south through the Puget Trough, the San Juan Islands through to Tenino in Washington State; south to the Willamette Valley in northern Oregon State. The historical Canadian range of Taylor's Checkerspot was the coastal lowlands of southeastern Vancouver Island and a few adjacent Gulf Islands. Records for Taylor's Checkerspot within British Columbia date from 1887 to 2009. The only known extant location in Canada is on Denman Island and spread over an area of 20 km^2, within which the species actually occupies an area of less than 5km^2.

Habitat

Current habitat descriptions for Taylor's Checkerspot are based on recent larva and adult surveys on central Denman Island, which supports a large population of the butterfly. The population inhabits flat (< 15% slope) disturbed open habitats below 625 m in elevation, with a southeastern exposure, including moist to wet clearings, depressions, meadows, pastures, regenerating clearcuts, logging roads, roadsides, logging landings and areas that have been disturbed by machinery. Historical records for Taylor's Checkerspot are from Garry Oak and associated ecosystems.

Current habitat requirements for Taylor's Checkerspot in Canada are linked to the quality and availability of larval host plants. In British Columbia, documented larval host plants include Ribwort Plantain, Common Plantain, Thyme-leaved Speedwell, Marsh Speedwell (also known as Skullcap Speedwell), American Speedwell and European Centaury. Nectar plant use appears to be opportunistic and generalist, with Woodland Strawberry being most common. Larval basking and sunning sites appear to be important for development. These include bare soil, dry leaves, rocks, bark, sticks and all forms of wood, dead and live plants (including host plants) and the raised root wads of grass and sedge hummocks.

Biology

In British Columbia, Taylor's Checkerspot is in flight from late April through mid-June. Eggs are laid from early May through mid-June and hatch approximately three weeks later. First and second instar larvae remain clustered within a larval web, dispersing after the moult between second and third instars. Larvae are active until mid-July or until high temperatures (presumably) instigate aestivation. The larva overwinters. The life cycle usually takes one year to complete although, for reasons unknown, some larvae diapause a second year.

Population sizes and trends

A small mark-recapture study was completed within occupied habitat on Denman Island in 2009. A total of 1189 butterflies was marked and 44 recaptured over 17 days of the species' flight period. Population size within the habitat surveyed is estimated as approximately 13,000.

Threats and limiting factors

Threats to extant Taylor's Checkerspot in Canada are: 1) habitat loss or degradation; 2) natural forest succession; 3) pesticide application; 4) climate change and natural disasters.

Protection, status, and ranks

Taylor's Checkerspot is protected under the federal *Species at Risk Act* and has been recommended for listing as *Identified Wildlife* under the *British Columbia Forest and Range Practices Act, Wildlife Act* and *Wildlife Amendment Act.* Some Taylor's Checkerspot habitat (historical locations) is protected within parks and protected areas by the *Canada National Parks Act* and British Columbia's *Park Act* and *Ecological Reserves Act*. On Denman Island approximately 475 hectares of private land has been transferred to the British Columbia government for designation as a provincial park or ecological reserve. Not all of this property overlaps with current occupied habitat for Taylor's Checkerspot.

TECHNICAL SUMMARY

Euphydryas editha taylori
Taylor's Checkerspot Damier de Taylor
Range of occurrence in Canada: British Columbia (Denman Island). Historically known from southeastern Vancouver Island and Gulf Islands.

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2008) is being used)	1-2 years. Most individuals reproduce after one year; a small number of individuals requires two years
Is there a continuing decline in number of mature individuals?	Projected, based on natural forest succession in current habitat
Estimated % of continuing decline in total number of mature individuals within 5 years	Unknown
Inferred % increase in total number of mature individuals over the last 10 years.	Population may have increased as logging from 1998-2001 created new habitat. % unknown.
Suspected % reduction in total number of mature individuals over the next 10 years.	Expected to decline due to natural forest succession; % unknown
Inferred % reduction in total number of mature individuals over any 10 years period, over a time period including both the past and the future.	Reduction expected; % unknown
Are the causes of the decline clearly reversible and understood and ceased?	Yes and no: causes of decline reversible at current location but probably not reversible at historical sites where land has been developed Yes, causes understood. No, causes have not ceased.
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence	20 km²
Index of area of occupancy (IAO) *The biological area of occupancy is estimated to be only 4.8 km²*	20 km² using a 2 x 2 km^2 square grid
Is the total population severely fragmented?	No as it does not fit definition
Number of "locations∗"	1 based upon threat of Btk
Is there an observed continuing decline in extent of occurrence?	Yes: based on natural forest succession at current location
Is there a projected continuing decline in index of area of occupancy?	Yes; based on natural forest succession at current location
Is there a projected continuing decline in number of populations?	Yes; in the absence of Btk, based on natural forest succession at current location

∗ See definition of location.

Is there an inferred continuing decline in number of locations?	Yes - if the Btk threat does not materialize natural forest succession is a threat that occurs at more than one location and will occur at different rates due to multiple land ownership
Is there a projected continuing decline in area, extent and quality of habitat?	Yes; based on natural forest succession at current location
Are there extreme fluctuations in number of populations?	Unlikely
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	Unknown

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Denman Island, the number provided is a rough estimate	~13,000
Total	~13,000

Quantitative Analysis

Probability of extinction in the wild is at least 20% within 20 years.	N/A

Threats (actual or imminent, to populations or habitats)

Threats to Taylor's Checkerspot refer only to the current populations and habitat on Denman Island. Threats to Taylor's Checkerspot are:1) habitat loss or degradation due to development; 2) natural forest succession; 3) pesticide application and possibly 4) climate change. Bacterial insecticide spraying is considered to be the threat with the greatest likely impact; it is possible that the entire occupied area might be affected especially if Gypsy Moth became established in the area.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? The species persists in isolated patches in Washington State and further south in the U.S.	
Is immigration known or possible?	Unlikely
Would immigrants be adapted to survive in Canada?	Yes, likely
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	No

Current Status

COSEWIC: Endangered (2011)

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code:** B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)
Reasons for designation: The historic range of this small, eye-catching butterfly in Canada was wider and included southeastern Vancouver Island. Now it only occurs in a very small area on Denman Island, BC. The habitat it occupies is likely to continue to decline in area and quality. Threats include habitat loss and degradation due to development, natural forest succession and the spraying of bacterial insecticide to control pest insects. Individual ownership issues exacerbate the combination of these and other threats.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): No data are available to quantify declines.
Criterion B Meets Endangered under B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v) as the EO and IAO values are below the thresholds; there are fewer than 5 locations (based on the Btk threat and some of the other serious threats); and there is a continuing and projected decline in the EO, IAO, area, extent and quality of habitat (as a result of succession, land ownership changes and Btk application), number of locations and number of mature individuals (based on loss of habitat).
Criterion C Not applicable as the number of mature individuals is above the thresholds.
Criterion D Meets Threatened under D2 as the IAO is very small, the species occurs at only one location and it is susceptible to extirpation over a very short time as a result of succession and potential Btk application.
Criterion E (Quantitative Analysis): Not performed.

PREFACE

Taylor's Checkerspot (*Euphydryas editha taylori*) was assessed by COSEWIC in 2000 as Endangered. Since the first status report was prepared, substantial new information on the distribution, habitat, habitat trends, threats and limiting factors has been gained through inventory and research by numerous private entomologists, academic researchers, government biologists and stewardship groups working within southeastern Vancouver Island and the adjacent Gulf Islands.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2011)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and classification

Scientific Name: *Euphydryas editha taylori* (W.H. Edwards 1888)

Classification:	Order	Lepidoptera,
	Family	Nymphalidae
	Genus	*Euphydryas*
	Species	*Euphydryas editha* (Boisduval 1852)
	Subspecies	*E. editha taylori* (W.H. Edwards 1888)

Synonyms:

Melitaea Taylori W.H. Edwards 1888. *Euphydryas taylori* ab. v*ictoriae* (Gunder 1926). *Euphydryas taylori barnesi* (Gunder 1929)

Type Specimens:

The type specimen of the subspecies is from Beacon Hill, Victoria, British Columbia (Edwards 1888) and is held at the Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario.

The holotype of the synonym *Euphydryas taylori* ab. *victoriae* (Gunder 1926) is held at the Carnegie Museum in Pittsburgh, Pennsylvania. The holotype of a second synonym *Euphydryas taylori barnesi* (Gunder 1929) is held at the American Museum of Natural History, New York. Both taxa were described from Victoria, B.C. and were later synonymized with *E. editha taylori* (Hodges *et al.* 1983).

English Names:

Taylor's Checkerspot, Whulge Checkerspot (NatureServe, 2009), Edith's Checkerspot subspecies *taylori* (Layberry *et al.* 1998).

French Names:

Damier de Taylor.

Taxonomic Background and Similarities:

The taxonomic history of *Euphydryas editha* is complex and many of the over thirty valid (non-synonymous) subspecies are disputed throughout the species' range in North America (Emmel 1998, Hodges *et al.* 1983, Grosball 2005). Within Canada there are three *Euphydryas editha* subspecies: *E. e. beani* (Skinner 1897)*, E. e. taylori* and a third subspecies similar to *E. e. hutchinsi* (Layberry *et al.* 1998). See distribution for further information on ranges.

Euphydryas editha taylori was first described and named by Edwards (1888) as a full species. Gunder named subspecies *victoriae* (1926) and *barnesi* (1929) although his types were later determined to be the same subspecies as *taylori* (Hodges *et al.* 1983). Taxonomic review of *E. e. taylori* has not been completed, although there is substantial evidence to support the entity as a valid subspecies based on phenotype, ecology and distribution (Grosball 2005). For further discussion see Grosball (2005).

Morphological description

Adults

Taylor's Checkerspot (*Euphydryas editha taylori*) is a small (wingspan 26 – 43 mm), eye-catching butterfly. The dorsal wing surfaces of the most common colour form (Figure 1) are alternating bands of orange-red, black and white cells. The ventral wing surfaces (Figure 2) are predominantly orange with bands of white cells forming a similar pattern to the dorsal wing surfaces. The thorax and abdomen are predominantly black with faint orange bands on the rear half of the abdomen (Layberry *et al.* 1998; Guppy and Shepard 2001). When males and females are compared side-by-side, females are (on average) slightly larger than males (Layberry *et al.* 1998; Guppy and Shepard 2001); the male abdomen is more slender with less prominent orange banding than in the female (Grosball 2005).

Figure 1. Taylor's Checkerspot dorsal wing surfaces, specimen from Denman Island, May 2009. Photo Jennifer Heron.

Figure 2. Taylor's Checkerspot ventral wing surfaces, specimen from Denman Island, May 2009. Photo Jennifer Heron.

Taylor's Checkerspot has numerous phenotypic colour morphs (example of one morph in Figure 3) although the frequency of these morphs within the subspecies is unknown. As a group, Checkerspot butterflies respond phenotypically and genetically to local conditions and thus show substantial geographic variation (Ehrlich 1984). Detailed taxonomic descriptions and comparisons with other subspecies have been presented by Ehrlich and Hanski (2004), Grosball (2005), Guppy and Shepard (2001), Layberry *et al.* (1998).

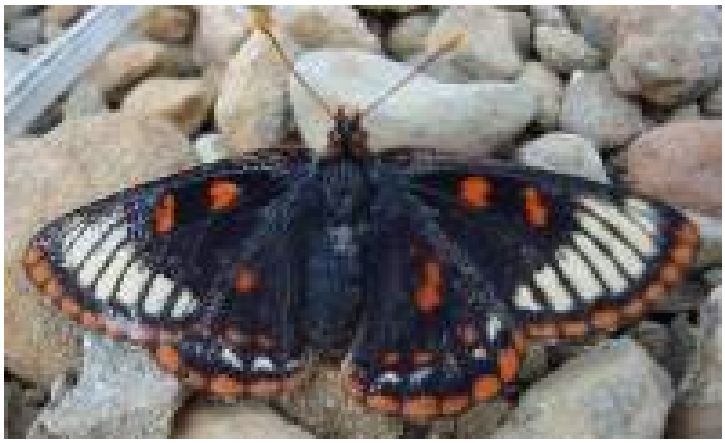

Figure 3. Taylor's Checkerspot alternate colour morph, dorsal wing surfaces, May 28, 2009. Photo Jennifer Heron.

Eggs

Taylor's Checkerspot eggs are bright yellow when first laid (Figure 4) and turn maroon just before hatching (Figure 5). Eggs are slightly oval or oblong and become striated closer to hatching (Figure 5) (Guppy and Shepard 2001).

Figure 4. Taylor's Checkerspot eggs on Lance-leaved Plantain, Denman Island, observed July, 2008. Photo Jennifer Heron.

Figure 5. Taylor's Checkerspot eggs on Thyme-leaved Speedwell, Denman Island, observed June 13, 2007. These eggs are likely darker than those in Figure 4 because of embryonic development. Photo Jennifer Heron.

Larvae

Taylor's Checkerspot first instar larvae are very small (< 2 mm long), tan coloured and have fine dark spines along the lateral and dorsal surfaces (Layberry *et al.* 1998; Guppy and Shepard 2001). First instar larvae weave larval webs (Figure 6), which help protect against parasites and predators (see **Predation and parasitism**). After the second or third instar, larvae gradually turn dark brown to black, develop branched conical spines with orange tufts (Figure 7) and start to live separately (disperse from the communal web and no longer weave a web for protection).

Figure 6. First or second instar Taylor's Checkerspot larva within a larval web, Denman Island June 13, 2007. Photo Jennifer Heron.

Figure 7. Post-diapause Taylor's Checkerspot larvae basking on dry wood, Denman Island, March, 2008. Photo Jennifer Heron.

The average weight of fourth and fifth instar, captive-reared Taylor's Checkerspot larvae entering diapause is 0.037 grams and 0.046 grams respectively (Oregon Zoo 2009). Detailed larval descriptions are in Grosball (2005). The Oregon Zoo (2009) has worked out detailed captive rearing guidelines for Taylor's Checkerspot which include additional information on larval morphology.

Pupae

Taylor's Checkerspot pupae are rarely found in the wild. Pupae have alternating cream and grey bands; the cream bands have irregular shaped orange-black spots (Figure 8) (Oregon Zoo 2009).

Figure 8. Taylor's Checkerspot pupae attached to paper towel, captive reared at Oregon Zoo, 2009. Photo by Mary Jo Anderson (with permission).

Genetic description

There have been no genetic studies to clarify the relationship between Taylor's Checkerspot (*E. e. taylori*) and other Edith's Checkerspot (*E. editha*) subspecies. Further, there is currently no genetic information that would suggest conservation significance of any variation between or within populations of Taylor's Checkerspot in B.C.

Population spatial structure and variability

No studies on population spatial structure and variability have been completed for Taylor's Checkerspot. Extensive research on population spatial structure and variability has been completed on the related Bay Checkerspot (*E. e. bayensis*) subspecies (see Ehrlich and Hanski 2004). Bay Checkerspot has a restricted range in the San Francisco Bay area in central California where it lives in shallow, serpentine-derived grassland soils where its host plants are found (Ehrlich and Hanski 2004). To summarize this research: Bay Checkerspot population fluctuation decreases with increased habitat heterogeneity so long as the habitat is suitable (Hellmann *et al.* 2004). There is limited dispersal between populations, even when they are within potential dispersal distance and habitat connectivity among sites seems important (Hellmann *et al.* 2004).

Designatable units

Taylor's Checkerspot has one designatable unit within Canada. It occurs in one location that is entirely in the Pacific National Ecological Area.

Special significance

Taylor's Checkerspot is an iconic butterfly used as an interpretive tool by numerous conservation organizations to represent the importance of Garry Oak ecosystems. The Garry Oak Ecosystems Recovery Team uses Taylor's Checkerspot as an example to highlight the intricate relationships between plants and insects and the need to conserve and restore these ecosystems (C. Junck, pers. comm. 2009). Conservation organizations such as Salt Spring Conservancy (R. Annschild 2009), Denman Island Conservancy (J. Thornton, pers. comm. 2008) and Conservancy Hornby (T. Law, pers. comm. 2009) use Taylor's Checkerspot as an important example when informing private landowners about stewardship opportunities.

There is no information that suggests that Taylor's Checkerspot has had an important cultural or economic role for First Nations people in the region. However, there is extensive literature on the cultural significance of Garry Oak ecosystems, the plants within these ecosystems, and their importance to First Nations people summarized in Fuchs (2000). Plants ecologically linked to Taylor's Checkerspot and of importance to First Nations peoples in the region (Simonsen *et al.* 1997) include one of the butterfly's nectar sources, Spring Gold (*Lomatium utriculatum* (Nutt. ex T. & G.) Coult. & Rose)) (Guppy and Shepard 2001).

Taylor's Checkerspot is not known to provide an essential ecosystem role, pollination service or vital link to other species. Yet it is one of the most common butterflies observed within the clearings and open wet habitats on central Denman Island (Page *et al.* 2007; Page *et al*. 2008a; J. Heron, unpubl. data 2009). The periodic observations of shredded wing tips (N. Page, pers. comm. 2009; J. Heron, pers. obs. 2009) are evidence the species is likely food for other invertebrates, birds and/or small mammals. There are likely parasitic Hymenoptera that rely on this species to complete their life history, although the obligatory links between them are poorly known (see **Predation and parasitism**).

Euphydryas butterflies are of interest to entomologists and taxonomists because of their rarity and association with rare ecosystems, both at the local and international levels (see Ehrlich and Hanski 2004). In addition to Taylor's Checkerspot, more than 115 provincially listed species at risk inhabit the coastal lowlands of southeastern Vancouver Island, Gulf Islands and Garry Oak ecosystems (B.C. Conservation Data Centre 2009; Garry Oak Ecosystems Recovery Team 2009) with more than 84 of these species having been assessed by COSEWIC (COSEWIC 2009).

DISTRIBUTION

Global range

The global range of Edith's Checkerspot is restricted to western North America. The subspecies *taylori* ranges from southeastern Vancouver Island and Gulf Islands, British Columbia south through the Puget Trough, San Juan Islands to Tenino, Washington State; to the Willamette Valley in northern Oregon State (Figure 9).

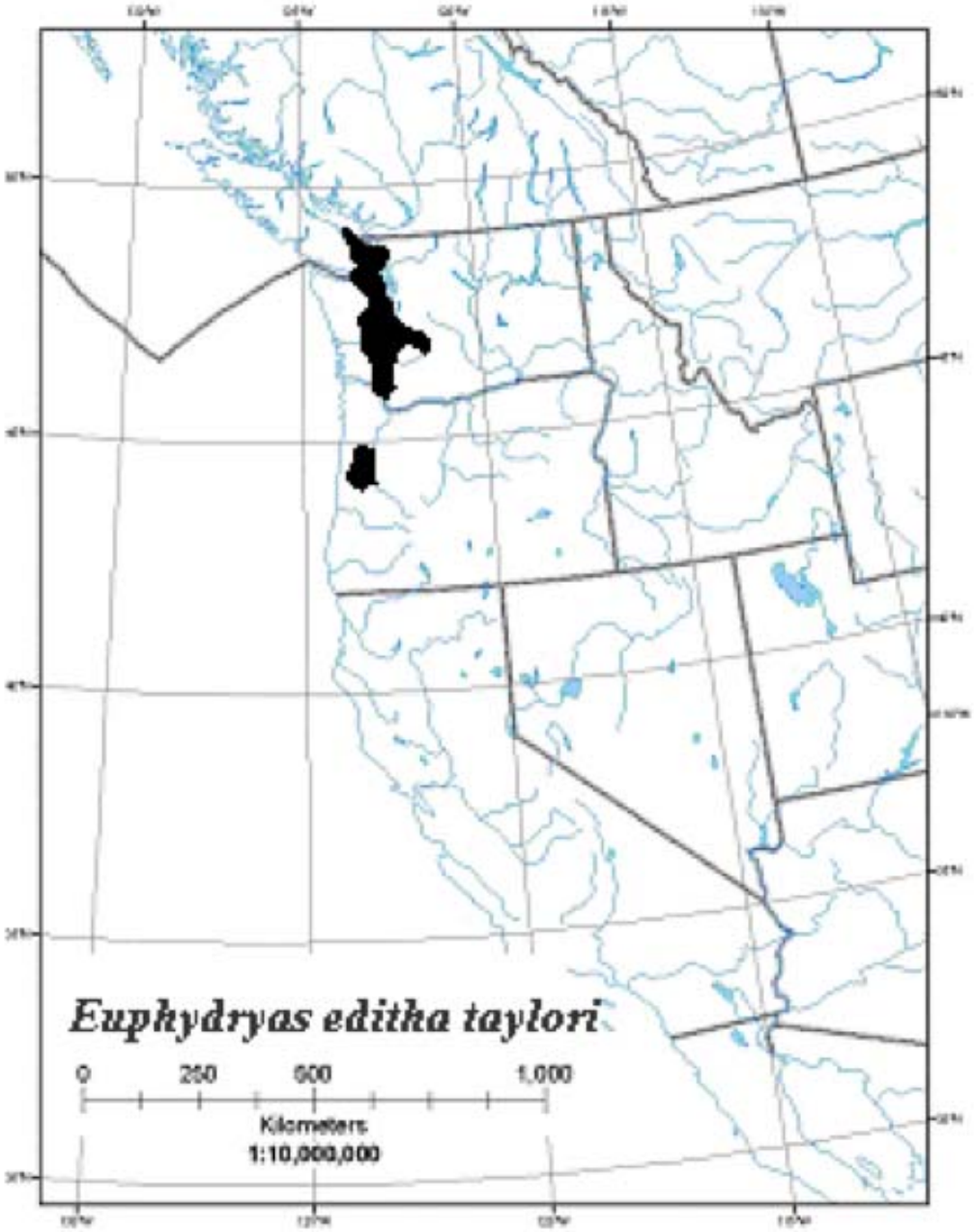

Figure 9. Global range of Taylor's Checkerspot (in black).

Canadian range

The historical and present Canadian ranges of Taylor's Checkerspot are restricted to the coastal lowlands of southeastern Vancouver Island and the adjacent Gulf Islands, B.C. (Figures 10 and 11). The other Edith's Checkerspot subspecies in B.C., *E. e. beani*, has a distinctly separate range through the southern interior from Hope east to the Kootenays and the Rockies on the Alberta border. Additional specimens found from the Cypress Hills at the Alberta-Saskatchewan border are considered similar to *E. e. hutchinsi* (Layberry *et al.* 1998). While work is needed to clarify the taxonomy of these individuals, they do not belong to Taylor's Checkerspot.

Taylor's Checkerspot records in B.C. date from 1887 to 2009 (Appendix 1) and overlap with the range extent of Garry Oak ecosystems (Figure 12) (see **Habitat**). Based on known records, the historical and present (combined) range extent of Taylor's Checkerspot is estimated at 2674 km^2. The current extent of occurrence is approximately 20 km^2. The biological area of occupancy in 2009, based on known occurrence records on Denman Island, combined with potential habitat assessed using recent (2006) orthophotographic information, is estimated at less than 5 km^2. The index of area of occupancy is estimated at 20 km^2 (based upon the minimum number of 2 km X 2 km squares that can cover all outlined sites in Figure 11).

It is difficult to define and thus estimate spatial parameters around historical locations (as defined by COSEWIC) for Taylor's Checkerspot. Most of the historical records are vague and information associated with museum specimens is limited. Recent (within the past twenty years) location information is more specific. To define locations for Taylor's Checkerspot all records were mapped (Figure 10, Table 1). These points were then clustered and numbered; each number representing a potential location for Taylor's Checkerspot (Table 1). A minimum of nineteen historical locations is estimated for Taylor's Checkerspot in B.C., several of which were occupied by the butterfly as recently as the 1990s. Due to the vague locality information associated with some of the collection records (see Appendix 1), the number of historical locations may differ from this.

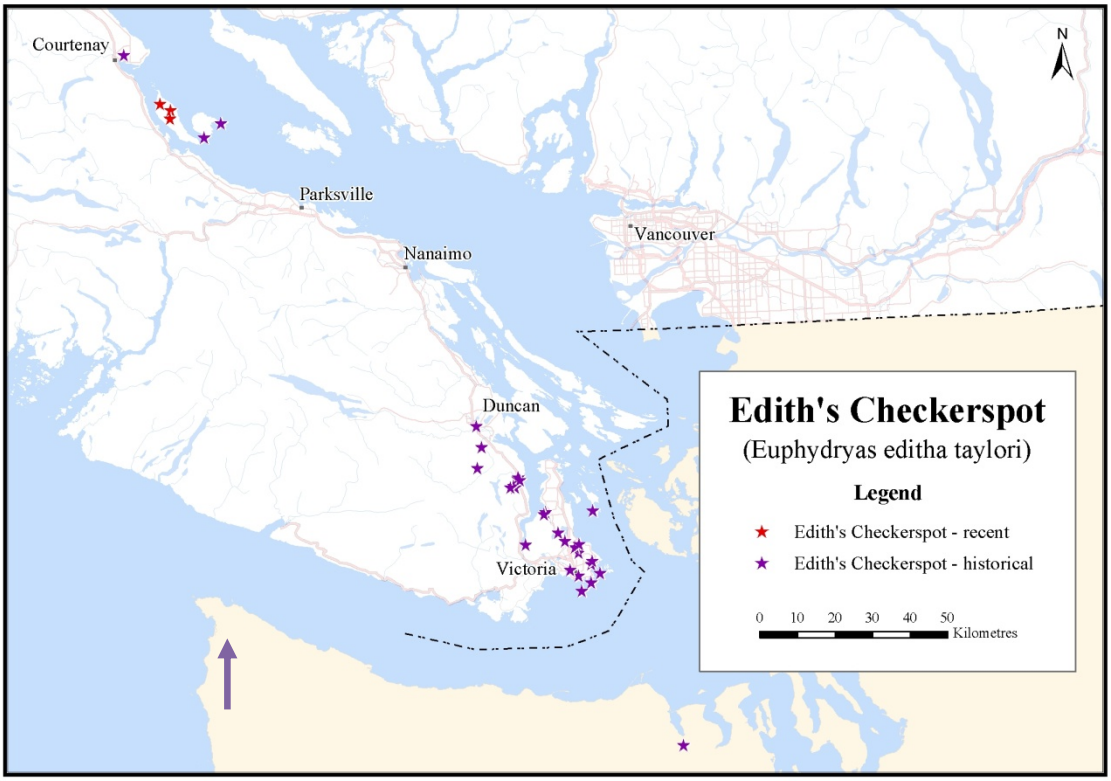

Figure 10. Canadian range of Taylor's Checkerspot. The arrow points north.

Table 1. Taylor's Checkerspot locations (with confidence) in B.C.

Location Number	Location Name	Date Range of Records	Approximate Area Occupied (ha)	Most Recent Year Population Recorded (Appendix 1)	Last Year Surveyed
1	Denman Island	2005 – 2009	> 2000 acres	2009	2009 (J. Heron pers. data, 2009)
2	Helliwell Provincial Park	1977 – 1996 (est.)	~ 4 ha	1996	2009 (J. Heron pers. data, 2009; Page *et al.*, 2007)
3	Mill Bay, 3km southwest under a power line right-of-way	1988 – 1989	~ 5 ha	1989	2008 (Page *et al.*, 2008b)
4	Duncan, just outside Bright Angel Park	1977 – 1978	2 ha	1978	1999 (C. Guppy pers. comm., 2009)
5	Norman Point, Hornby Island	1995	1 ha	1995	2003 (Miskelly, 2004); Page *et al.*, 2007
6	Tribune Bay Provincial Park	1995	2 ha	1995	2007 (Page *et al.,* 2007)
7	Cliffs Road, Duncan, cliff tops above Cowichan River	1960s	~ 1 ha	1960s	2009 (Guppy pers. comm., 2009)

Location Number	Location Name	Date Range of Records	Approximate Area Occupied (ha)	Most Recent Year Population Recorded (Appendix 1)	Last Year Surveyed
Historical locations inferred from museum specimen labels and oral history. Open meadow and Garry Oak habitats within these areas have been searched recently, although the specific location of populations is only inferred. Habitats have changed significantly since the original record.					
8	Beacon Hill	1901	likely within Beacon Hill Park (Victoria Parks); location of population is unknown	1901	2009 (Page and Lilley, (draft), 2009)
9	Mt. Finlayson	1957 – 1958	Goldstream Provincial Park, outside north of Victoria; location of population is unknown	1958	~ 2004
10	Mt. Douglas	1954	Provincial Park (Victoria); location of population is unknown	1954	~ 2009 (Page pers. comm., 2009)
11	Observatory Hill	1957	federal property, near Victoria; location of population is unknown	1957	2007 (Miskelly, 2007)
12	Chain Island	1949 – 1953	likely refers to Great Chain Island, in the Juan de Fuca Strait, less than 2km from Victoria; location of population is unknown	1953	N/A
13	Trial Island	1952 – 1953	B.C. Ecological Reserve and federal coast guard property	1953	2009 (Fairbarns pers. comm., 2009)
14	Courtenay	1931	location of population is unknown	1931	2009 (Page *et al*. (draft), 2009a)
15	Braefoot	1952 – 1954	location of population is unknown	1954	N/A
16	Cattle Point	1932	location of population is unknown	1932	N/A
17	Oak Bay	1951 – 1954	location of population is unknown	1954	N/A
18	Lost Lake	1951 – 1953	location of population is unknown	1953	N/A
19	Royal Oak	1957	location of population is unknown	1957	N/A
20	Todd Inlet	1928	location of population is unknown	1928	N/A
Numerous museum records are labeled ‘Victoria’, which is too vague to assign a specific location within Victoria.					

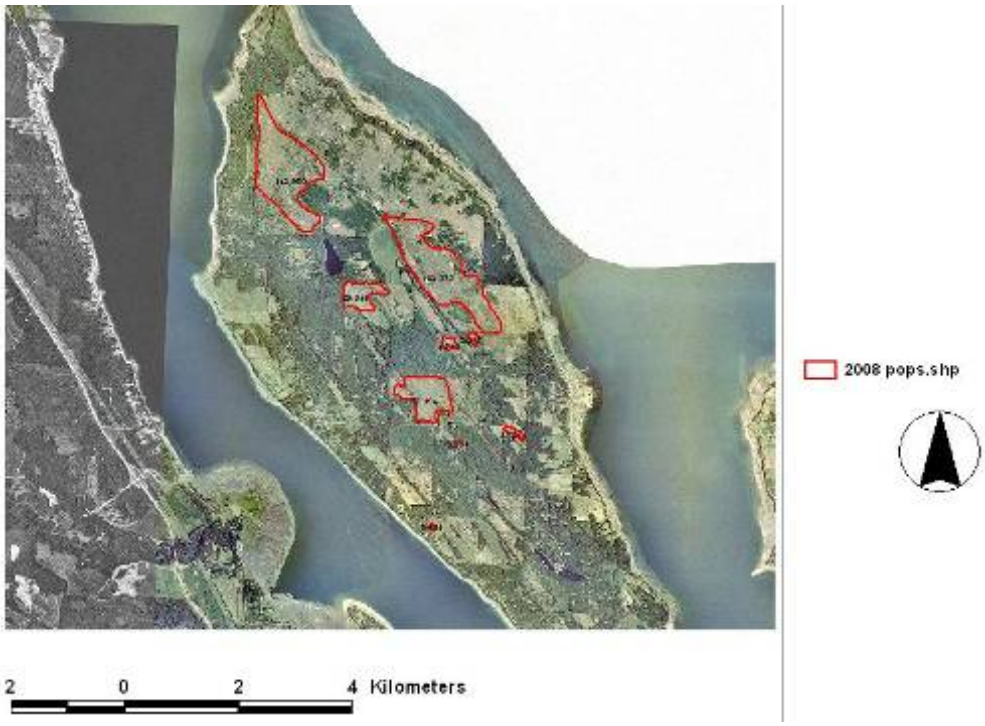

Figure 11. Core areas of occupancy for Taylor's Checkerspot on Denman Island. Note there are records in between these red boundaries and there are likely additional occurrences on unsurveyed private land. Map prepared by Nick Page.

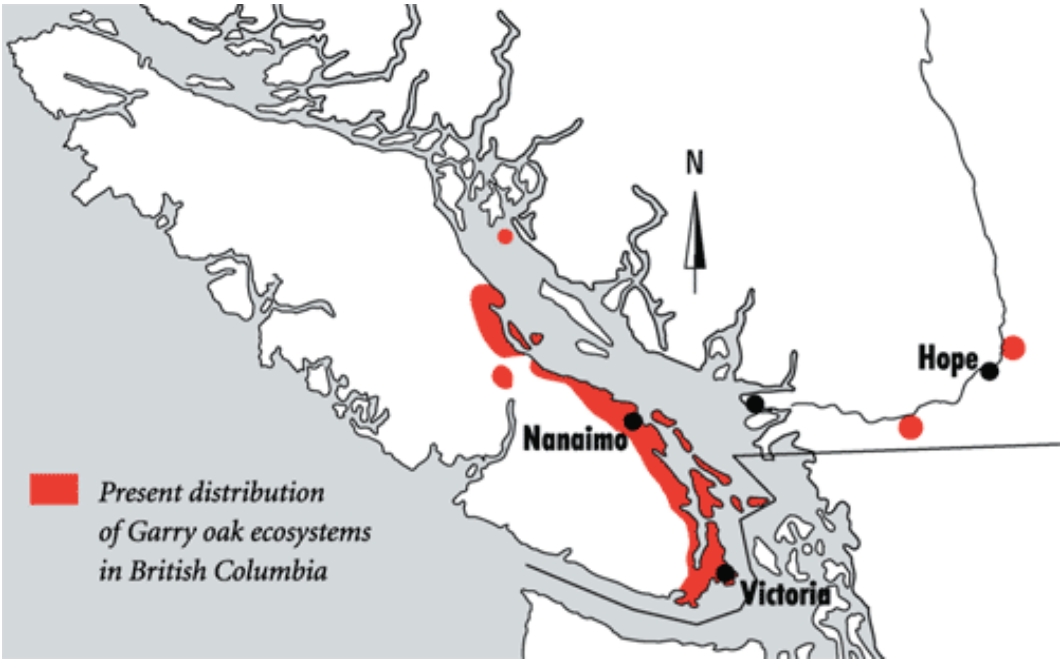

Figure 12. Range of Garry Oak and associated ecosystems in B.C. Map www.goert.ca (with permission).

At present there is one extant location (*sensu* COSEWIC) for Taylor's Checkerspot in B.C. and it appears to be comprised of numerous subpopulations within suitable and connected habitat patches throughout north and central Denman Island. This site is considered to represent one location because a single threatening event, such as spray of Btk to control European Gypsy Moth (*Lymantria dispar*) (see **Threats**), could significantly impact the species throughout the location. In the next ten years, natural forest succession will also impact most of the butterfly's habitat, as larval foodplants and adult nectar plants are outcompeted by other species. Further threats, such as habitat conversion also have the potential to impact much of the population, as more than 95% of the occurrences are on private land. See **Threats** section for further discussion.

Search effort

From 2001 to 2009 there has been substantial search effort for Taylor's Checkerspot within the species' historical range in B.C. (Table 2). In particular, search effort has focused on Denman and Hornby Islands, Salt Spring Island, Galiano Island, Gabriola Island, Gulf Islands National Park Reserve and the Garry Oak ecosystems of southern Vancouver Island and the greater Victoria area. These areas have active conservancies and a community of naturalists that are acutely aware of the butterfly and its endangered status.

Table 2. Recent surveys specifically targeting Taylor's Checkerspot habitat.

General Survey Location and Date	Person-Hours searched during Taylor's Checkerspot Flight Season only	Distance Searched	Historical Locations included in this survey	Report Citation
Gulf Islands National Park Reserve 2007	50.75 hours	18 sites (including islands) with a total area of 1589.11 ha	no historical records known from these survey locations	Fenneman, 2008
Gulf Islands National Park Reserve 2008 (federal)	Not recorded.	18 sites (including islands) with a total area of 1589.11 ha	no historical records known from these survey locations	Guppy, 2009
Denman and Hornby islands April 28 – June 13, 2007 (private and public land)	168.4 hours	288.1 km	Helliwell Provincial Park; remainder of habitat searched was for new records.	Page *et al.,* 2007
Courtenay, Comox, Denman island and Hornby island, May 15 – June 14, 2008 (private and public land)	35.2 km on Vancouver Island; 29.1km on Denman Island; 8.2 km on Hornby Island	72.5 km (58.6km by foot; 13.9km by car)	Helliwell Provincial Park; remainder of habitat searched was for new records.	Page *et al.,* 2008a
Southern Vancouver Island May 4 – May 17, 2008 (private land)	59.3 hours	95.6 km	Mill Bay and Shawnigan Lake power line right-of-way	Page *et al.,* (2008b)

General Survey Location and Date	Person-Hours searched during Taylor's Checkerspot Flight Season only	Distance Searched	Historical Locations included in this survey	Report Citation
Courtenay, Comox and other areas on southern Vancouver Island 2009 (private land)	66.4 hours	data in progress (to be completed by March 2010)	Courtenay and Comox areas (although specific location of historical record is unknown); remainder of habitat searched was for new records.	Page, Lilley and Heron 2010
Denman Island 2009 (private land)	17 days, 2 – 3 surveyors per day	~ 2000 acres	N/A	J. Heron, draft
Lepidoptera surveys in Victoria Parks May 30 – 31, 2009	6.2 hours	20.8 km through 8 parks in the City of Victoria	Beacon Hill Park (although specific location of historical record is unknown); remainder of habitat searched was for new records.	Page and Lilley 2009
Butterfly Surveys on Observatory Hill (federal property)	Not quantified, five days of surveys between 10 am and 4 pm	Not quantified	Observatory Hill (although specific location of historical record is unknown); remainder of habitat searched was for new records.	Miskelly (2007)

Given the recent information on the host plants and habitat in B.C. (see **Habitat**), search effort for Taylor's Checkerspot has broadened to include habitats similar to those on central Denman Island. Suitable habitats adjacent to the existing population on Denman Island have been adequately searched since the species was reported there in 2005. Search effort has been broadened to include areas with historical records on adjacent Vancouver Island, including areas around Courtenay, Comox, Nanaimo and Shawnigan Lake. These surveys are inclusive of search effort completed by local conservancy groups. Much of the habitat adjacent to Denman Island and southern Vancouver Island that is otherwise apparently suitable appears to lack sufficient moisture to support healthy host plant populations.

Taylor's Checkerspot is an easily identified and attractive species that is not likely to be overlooked. Researchers, conservancies, naturalists and biologists have conducted non-quantified surveys for Taylor's Checkerspot in the past ten years. It is not possible to accurately quantify all of the search effort by all individuals, but the effort has clearly been considerable. A summary of recent butterfly research within the range and potential habitat for Taylor's Checkerspot is summarized in Table 3.

Table 3. Academic butterfly research studies within the range and potential habitat of Taylor's Checkerspot. Some of these studies were not specifically targeting Taylor's Checkerspot. However if the species was present the researcher would have noted the occurrence.

General Survey Location	Component of research applicable to Taylor's Checkerspot search effort	Dates	Researcher or Citation
Southern Vancouver Island	Butterfly research in Garry Oak ecosystems at a minimum of nine sites	2004 – 2009	J. Hellmann pers. comm., 2009
Salt Spring Island	Butterfly research in Garry Oak ecosystems	2004 – 2009	D. Clements pers. comm., 2008
Southern Vancouver Island	Pollinator research in Garry Oak ecosystems	2004 – 2009	E. Elle pers. comm., 2009
Southern Vancouver Island	Butterfly research in Garry Oak ecosystems	2003 – 2005	W. Hallstrom pers. comm., 2009
Southern Vancouver Island	Searched many of the historical locations, including Beacon Hill Park, Bright Angel Park, Duncan and Mill Bay areas as part of master's degree research on Taylor's Checkerspot habitat.	2001 – 2004	Miskelly, 2004

Surveys by local conservancy groups have not recorded Taylor's Checkerspot in the past decade on the Gulf Islands other than Denman Island. Surveys conducted over numerous years by conservancies on Salt Spring Island (R. Annschild, pers. comm. 2009), Mayne Island (M. Dunn, pers. comm. 2009) and Galiano Island (T. Crowe, pers. comm. 2009) have not recorded Taylor's Checkerspot. Further surveys coordinated by the Victoria Natural History Society in the greater Victoria area have also not recorded the butterfly in the last twenty years (J. Miskelly pers. comm. 2009; D. Copley pers. comm. 2009).

HABITAT

Until recently Taylor's Checkerspot has been considered a Garry Oak and associated ecosystems species (GOERT 2009): most of the historical localities appear to be from this and associated ecosystems, plant communities and habitats. Detailed habitat information or naturalist's notes are not available for all of these localities and inferences have been drawn based on the species' habitat from some locations elsewhere within Washington and Oregon States. Recent surveys and information around the species' host plants (see Page *et al*. 2008a) have cast doubt on the obligatory association of Taylor's Checkerspot with these ecosystems. As such, two habitat descriptions are provided in this status report, 1) Garry Oak ecosystem habitat, as inferred by historical locations of the subspecies; and 2) open wet meadow and disturbed habitats as occupied by the current populations on Denman Island.

Garry Oak ecosystem habitat

Garry Oak ecosystems range on the eastern side of Vancouver Island, from greater Victoria north to the Comox; throughout the southern Gulf Islands as far north as Savary Island in the Strait of Georgia; and two isolated pockets of habitat at Sumas Mountain and near Yale, in the lower Fraser Valley (Figure 12). Most Garry Oak ecosystems in B.C. are coastal lowland ecosystems below 200 metres elevation (Stein 1990).

Garry Oak ecosystems have been described in detail by Roemer (1972) and Erickson (1995) and are part of the Coastal Douglas-fir biogeoclimatic zone, according to an ecosystem classification (Meidinger and Pojar, 1991) adopted by the B.C. Ministry of Forests (2009). They are further classified into two major ecosystem types: parkland and scrub Garry Oak ecosystems (Pojar 1980a, 1980b) (Figures 13 – 14). Historically, Taylor's Checkerspot likely occurred in both parkland and scrub types.

Figure 13. Garry Oak open meadow habitat at Helliwell Provincial Park, adjacent to Garry Oak habitat, Hornby Island. March 21, 2008. Photo Jennifer Heron.

Figure 14. Private property adjacent to Helliwell Provincial Park, Hornby Island, May 16, 2007. Photo Jennifer Heron.

Parkland Garry Oak ecosystems (Pojar, 1980a, 1980b) are characterized by deep rich soil and support common understory plants including Snowberry (*Symphoricarpos albus* L.), Camas species (*Camassia leichtlinii* Baker and *C. quamash* (Pursh) Greene), Fawn Lily (*Erythronium oregonum*), Bracken Fern (*Pteridium aquilinum* Applegate) and various graminoid species (Pojar 1980a, 1980b). Scrub oak ecosystems are characterized by shallow soils, and shorter, scrubby, shrubby oak trees typically growing on rock outcrops and benches.

Open wet meadow and disturbed habitats

Taylor's Checkerspot populations on Denman Island currently occupy habitat not classified as Garry Oak ecosystems. The following habitat descriptions are based on recent observations of pre- and post-diapause larvae and adults within central Denman Island, which supports a large population of Taylor's Checkerspot (Page *et al.* 2007; Page *et al. 2008a*; J. Heron, unpubl. data 2009). Denman Island habitats consist of open, moist to wet clearings, depressions, meadows, pastures, regenerating clearcuts, logging roads, roadsides, logging landings and areas that have been disturbed by heavy machinery. All these habitats have a slope of less than 15%. Figures 15 – 18 show examples of the open habitats on Denman Island.

Figure 15. Open wet disturbed clearcuts and marshy areas of central Denman Island. April 17, 2008. Photo Jennifer Heron.

Figure 16. Open wet disturbed clearcuts and marshy areas of central Denman Island. June 2, 2009. Photo Jennifer Heron.

Figure 17. Open wet disturbed clearcuts and marshy areas of central Denman Island. May 27, 2009. Photo Jennifer Heron.

Figure 18. Open wet disturbed clearcuts and marshy areas of central Denman Island. June 1, 2009. Photo Jennifer Heron.

Habitat requirements

Larval host plants

Habitat requirements for Taylor's Checkerspot appear to centre on the quality and availability of host plants. In British Columbia, documented native larval host plants include Marsh Speedwell (= Skullcap Speedwell) (*Veronica scutellata* L.) (Page *et al*. 2008a) and American Speedwell (*Veronica beccabunga* L. ssp. *americana* Raf.) (Page *et al*. 2008a). Non-native larval host plants documented in B.C. include Thyme-leaved Speedwell[1] (*Veronica serpyllifolia* L.) (Figure 19) (Page *et al*. 2008a), Ribwort Plantain (*Plantago lanceolata* L.) (Figure 20) (Danby 1890, Shepard 2000, Page *et al*. 2008a), Common Plantain (*Plantago major* L.) (Figure 21) (Page *et al*. 2008a) and European Centaury (*Centaurium erythraea* Raf.) (Page *et al*. 2008a). Taylor's Checkerspot larvae have been observed consuming all these host plants during studies on Denman Island.

Figure 19. Post-diapause larvae feeding on Thyme-leaved Speedwell. Denman Island, April 17, 2008. Photo Jennifer Heron.

[1] Two varieties of *V. serpyllifolia* are known to occur in B.C. *V. serpyllifolia* var. *serpyllifolia* is introduced to B.C., recorded from coastal lowland elevations, and is the variety which Taylor's Checkerspot larvae are consuming on Denman Island. The second variety, *V. serpyllifolia* var. *humifusa*, is native to B.C. and typically found in higher elevation sites (Pojar, 2000) and has not been recorded from Denman Island.

Figure 20. Taylor's Checkerspot eggs on leaves of Ribwort Plantain. May 30, 2009. Photo Jennifer Heron.

Figure 21. Post-diapause larva feeding upon Common Plantain. Photo Jennifer Heron.

Elsewhere within Taylor's Checkerspot range in Washington and Oregon States, larval host plants include Dwarf Owl-clover (*Orthocarpus pusillus* Benth.), Blue-eyed Mary (*Collinsia parviflora* Dougl. ex Lindl.) (Figure 22), Giant Blue eyed Mary (*C. grandiflora* Dougl. ex Lindl.), Sea Blush (*Plectritis congesta* (Lindl.) DC.) (Grosball 2005, Guppy and Shepard 2001), Golden Paintbrush (*Castilleja levisecta* Greenm.) (Grosball, 2005) and Harsh Paintbrush (*Castilleja hispida* Benth.) (A. Potter pers. comm., 2006) (Figure 23). These plants occur in B.C. but Taylor's Checkerspot larvae have not been recorded consuming them in the province.

Figure 22. Blue-eyed Mary. Photo Nick Page (with permission).

Figure 23. Harsh Paintbrush growing on cliffsides at Helliwell Provincial Park, Hornby Island. Photo Nick Page (with permission).

Field studies show Taylor's Checkerspot pre-diapause larvae predominantly use Marsh Speedwell with minor use of Thyme-leaved Speedwell, Common Plantain, American Speedwell and European Centaury (Page *et al*. 2008a). Host plant choice is likely determined by the presence of iridoids, which make the larvae distasteful to predators. A minimum host plant abundance of 1 – 2% total cover is required for larval presence (Page *et al*. 2008a).

Taylor's Checkerspot post-diapause larvae prefer Thyme-leaved Speedwell and Marsh Speedwell, although larvae were observed feeding on the same five host plants listed above for pre-diapause larvae (Page *et al*. 2008a).

Documentation of non-native larval host plants for Taylor's Checkerspot both historically (Danby 1890) and at present (Page *et al*. 2008a) raises questions around the obligatory association this butterfly has with Garry Oak ecosystems. Speedwell plant species are present within Garry Oak ecosystems but are not considered ecosystem obligates. The presence of both pre- and post-diapause larvae within wet marshy habitats dominated with large Common Rush plants may be an indicator of the historical and natural habitat for Taylor's Checkerspot.

It is possible Golden Paintbrush, Harsh Paintbrush or Blue-eyed Mary were historical larval host plants in B.C. Golden Paintbrush has been documented at Trial Island (COSEWIC 2007), a historical location for Taylor's Checkerspot (last recorded in 1953, Appendix 1). Harsh Paintbrush is present within Helliwell Provincial Park (butterfly last recorded ~1995), although the plant is not widespread within the park and may not have been the predominant host at this site (Shepard 2000, Guppy and Shepard 2001, Guppy pers. comm. 2009). Blue-eyed Mary is also well distributed within Helliwell Provincial Park and widely throughout moist to dry habitats in coastal lowland and Garry Oak ecosystems. Blue-eyed Mary is not a dominant plant in the Denman Island habitats.

Nectar plants

In British Columbia the use of nectar plants by Taylor's Checkerspot adults appears to be opportunistic and generalized and reflects the abundance and phenology of available nectar plant species rather than specific preference by the adult butterfly. Taylor's Checkerspot populations on Denman Island nectar on Woodland Strawberry (*Fragaria vesca* L.), Trailing Blackberry (*Rubus ursinus* Cham. & Schltdl.), Cutleaf Blackberry (*Rubus laciniatus* Willd), Creeping Buttercup (*Ranunculus repens* L.), White Clover (*Trifolium repens* L.) and Hairy Cat's Ear (*Hypochaeris radicata* L.) (Page *et al*. 2008a). Woodland Strawberry appears to be the most common nectar source throughout (Page *et al.* 2007, Page *et al*. 2008a, J. Heron pers. data 2009). Elsewhere within Taylor's Checkerspot's extant range, nectar plants include Common Camas, Nine-leaved Desert-parsley (*Lomatium triternatum* (Pursh) Coult. & Rose) (Grosball, 2005), Spring Gold (*L. utriculatum* (Nutt. ex T. & G.) Coult. & Rose) (Guppy and Shepard 2001), Deltoid Balsamroot (*Balsamorhiza deltoidea* Nutt.) (Grosball, 2005), Sea Blush, Coastal Manroot (*Marah oreganos* (T. & G.) Howell) (Grosball, 2005), Wild Strawberry (*Fragaria virginiana* Duchesne), Tolmie's Mariposa Lily (*Calochortus tolmiei* Hook. & Arn.) (Kaye *et al*. 2009) and *Malus* spp. (Ross 2003 as cited by Grosball 2005).

Moisture regime and successional stage

On Denman Island, seasonally wet areas with recent (within the past five years) disturbance contain abundant host plants, partially due to their early successional stage habitat preference. Post-diapause larvae have been observed in disturbed and undisturbed habitats, including wet depressions in roadsides, ditches, swales, logging landings, skidder trails and other areas where host plants are abundant (Figure 24).

Figure 24. Post-diapause Taylor's Checkerspot larvae within swale, Denman Island. Photo Jennifer Heron.

Undisturbed habitats with more apparent natural features, where abundant larvae have been observed, include wet marshy habitats with large Common Rush (*Juncus effusus* L.) plants (Page *et al*. 2008a) (Figure 25). It is unknown if larvae began occupying these habitats only after logging. These natural wet marshy areas were likely shaded by the surrounding forest and may not have contained prolonged moisture due to uptake by the surrounding trees (large trees occupying the site would be using ground water).

Figure 25. Post-diapause Taylor's Checkerspot larvae consuming host plants on dirt road, Denman Island. Photo Jennifer Heron.

Populations in Washington State are found in areas with a high proportion of native grass cover (Grosball 2005). Field observations by Grosball (2005) suggest Taylor's Checkerspot typically avoids vegetation greater than ~ 0.75 m in height. The related Bay Checkerspot subspecies typically avoids habitats heavily invaded by non-native vegetation (Weiss 1999).

Basking and resting sites

Taylor's Checkerspot larvae are predominantly black and likely to absorb thermal energy. Larvae appear to seek substrates that provide thermal value and the opportunity to bask or rest on warm surfaces is likely essential for them to complete their development. Field observations of both pre- and post-diapause Taylor's Checkerspot larvae show resting, basking or sunning as the second most common activity (after feeding) (Page *et al.* 2008a). Bare soil, dry leaves, rocks, bark, sticks and dry wood, dead and live plants (including host plants), and the raised root wads of grass and sedge hummocks have been observed as sites for larvae to rest or bask (Page *et al*. 2008a).

Habitat trends

Habitat trends within Denman Island habitat

At present, the Denman Island Taylor's Checkerspot location is comprised of numerous subpopulations within a mosaic of open and artificially created clearings, pastures, fields, roadsides and rights-of-way (Figure 16 – 18) interspersed with small natural sedge marsh wetlands that likely became larger following logging. General observations over three years of study within these habitats (2007 – 2009) suggest that natural forest succession by early colonizing Red Alder trees (*Alnus rubra* Bong.) and Douglas-fir trees (*Pseudosuga menziesii* (Mirbel) Franco) are quickly out-competing host plant resources. For example, Red Alder has a rapid growth rate, up to 10 metres in five years (Trappe *et al.* 1968). Without management and given the current understanding of natural forest succession within the Coastal Douglas-fir Biogeoclimatic zone, Taylor's Checkerspot populations within this clearcut habitat will decline significantly within the next ten years due to shade and water consumption by the growth of taller trees and shrubs.

The majority of habitat that Taylor's Checkerspot currently occupies on Denman Island was clearcut from 1998 to 2001. Prior to this time, older second growth forests (80 – 100 years old, and originally harvested in the early 1900s) were present on these lands. Following logging, Taylor's Checkerspot populations expanded into the recent clearcuts and disturbed habitats. It is not possible to accurately determine the original source population and habitat location from which the current Taylor's Checkerspot population expanded. Further clearcutting on Denman Island is unlikely as no areas of significant timber value remain.

Garry Oak ecosystems habitat trends

Much historical Garry Oak ecosystem habitat has been destroyed or is degraded due to invasive species and other human activities (see **Threats and Limiting Factors**). Large Garry Oak trees are often preserved during development (both historical and recent) but the natural plant communities under these trees are no longer intact (Lea 2009, GOERT 2009). Lea (2006) mapped historical Garry Oak ecosystems, focusing on the five major geographic areas known to contain them (greater Victoria, Cowichan Valley, Comox Valley and surrounding areas, Nanaimo, Nanoose area as well as Salt Spring Island and Hornby Island).

Garry Oak ecosystems are divided into two ecosystem types, Parkland Garry Oak ecosystems and Scrub Oak ecosystems (see **Habitat**) (Roemer 1972; Erickson 1995). Mapping was completed for both these ecosystem types at a 1:20,000 scale and based on "(1) original land surveys done in the 1850s and 1860s, and (2) recent field observations of forest stand history". The historical ecology of an area was based on information in Egan and Howell (2001).

Less than 10% of the original Garry Oak ecosystem remains on southeastern Vancouver Island (Lea 2006). Table 4 details the area of ecosystem loss (ha) within each of the study units (Lea 2006). Land clearing for urban, rural and agricultural development started in the 1840s, targeted rich and deep soils and has resulted in the loss of 98.5% of the Parkland Garry Oak ecosystem type (Table 4) (Lea 2006). More of the Scrub Oak ecosystem type remains, primarily because it occurs on shallow soils, rocky bluffs and areas that are difficult to develop for agricultural and other purposes (Lea 2006).

Table 4. Area of pre-European settlement Vancouver Island Garry Oak ecosystems separated into deep soil (Parkland) and shallow soil (scrub Oak) ecosystems. Table from Lea (2006).

	Deep Pre-European (ha)	Deep Present Day (ha)	Shallow Pre-European (ha)	Shallow Present Day (ha)	Overall Pre-European (ha)	Overall Present Day (ha)
Greater Victoria	9564	45	890	440	10454	485
Cowichan Valley / Salt Spring Island	1824	83	1301	619	3125	702
Nanaimo / Nanoose	29	29	951	298	980	327
Comox	527	7	0	0	527	7
Hornby / Denman Island	65	11	98	57	163	68
Total	12009	175	3240	1414	15249	1589
% of Original Ecosystem Type		1.5%		44%		10%

Historical Garry Oak ecosystem mapping gives a snapshot comparison of plant communities and is a good tool for comparing ecosystems from one point in time (Lea 2006). Taylor's Checkerspot likely formed one or more metapopulations that colonized new habitat patches based on natural successional changes and disturbance patterns, such as fire.

Historically, low intensity, frequent fire played an important role in the maintenance of Garry Oak ecosystems (Daubenmire 1968, Agee 1993, McPherson 1997 as cited in Fuchs 2000). Before European contact, fires originated with lightning and First Nations cultural burning practices within the region (see Fuchs 2000 for a literature review). Following European contact, cultural burning practices were banned and fire suppression has been in place for over 150 years. Camas, root crops and other plants were used and managed as resources by First Nations peoples within the range of Garry Oak ecosystems (Turner 1999, C. Bryce as read in Carlson 2006). Fire exclusion has resulted in changes to the disturbance regime and gradual changes in plant community composition (McCoy 2006). At one time fire would have been the primary disturbance factor creating ideal host plant densities and habitat for Taylor's Checkerspot. Presently artificially created clearings resulting from logging emulate these same habitat characteristics. Considerable search effort has been expended in

areas of suitable altitude and apparently suitable conditions in order to verify whether the species occurs in areas other than those currently known on Denman Island, but they have all been either too densely forested or impacted by urban development (Page, personal communications 2008-2010).

The introduction and gradual spread of non-native plants has led to further decline in the quality and composition of Garry Oak plant communities (see **Threats and Limiting Factors**). Invasive plants dominate most of the remaining Garry Oak ecosystems. Habitat remnants that contain near-natural Garry Oak ecosystem plant communities as part of the understory vegetation comprise less than 5% of the original ecosystem (Lea 2006, GOERT 2009).

BIOLOGY

Life cycle and reproduction

In British Columbia, the flight period for Taylor's Checkerspot is from late April through mid-June (B.C. Conservation Data Centre 2009, Guppy and Shepard 2001). The earliest record is from 'Victoria' on April 18 and the latest is from Denman Island on June 13 (B.C. Conservation Data Centre 2009). Records from the southern part of the range in B.C. (e.g., Victoria; Appendix 1) suggest an earlier flight period than farther north (e.g., Comox, Hornby Island, Denman Island; Appendix 1) (B.C. Conservation Data Centre 2009; Shepard 2000). The life span is typically one year (Table 5) although some larvae may diapause a second year (see last paragraph this section).

Table 5. Yearly life cycle of Taylor's Checkerspot in B.C. (B.C. Conservation Data Centre, 2009). Dashed line represents larvae that may diapause for a second year.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Eggs					——							
Larvae	——	——	——	·····	·····	·····	——	——	——	——	——	
Pupae (brief)			——	——								
Adults				——	——	——						

Taylor's Checkerspot mating and oviposition coincide with the flight season. Females lay clusters of 25 – 50 eggs (sometimes > 100 eggs) (Figure 5) on the leaves and stems of a host plant (see **Habitat description**) (Page *et al*. 2008a; Oregon Zoo 2009). In laboratory settings, egg clusters hatch simultaneously approximately four days after being laid (Oregon Zoo 2009). Early instar larvae in B.C. have been observed in mid-June, thus eggs likely hatch from late May through late June. When larvae first hatch they tend to climb vertically (up the host plant), cluster and produce silken webs that incorporate host plant leaves within sheltered areas (Oregon Zoo 2009). First to third instar larvae cluster together and form small colonies (Figure 6), which help protect them against parasites and predators (as summarized in Kuussaari *et al.* 2004). In the laboratory, 82% of wild collected eggs hatched and more than 98% of hatched larvae survived to reach diapause (Oregon Zoo 2009). Taylor's Checkerspot larvae tend to disperse and become solitary during and after the third instar. Larvae consume host plant resources and grow rapidly throughout the summer months. During this time, basking is the second most performed activity after feeding (Page *et al*. 2008a). Larvae have been observed basking together, although this is likely because temperatures are favorable at the given basking site.

Taylor's Checkerspot larvae typically reach the fourth or fifth instar before entering diapause (Grosball 2005, Oregon Zoo, 2009). In laboratory settings, larvae diapause from mid-July through to mid-February (Oregon Zoo 2009). In B.C., larvae are active through late July (Page *et al.* 2007, Page *et al*. 2008a) and appear to enter diapause when host plant resources decline due to senescence, likely as a result of hot and dry weather conditions. In captive rearing conditions, where larvae were housed outdoors, larvae lost up to 35% of their weight during diapause (Oregon Zoo 2009). Development from egg to fourth instar larvae and diapause takes place in 4 – 6 weeks (Table 5) (Grosball 2005, Oregon Zoo 2009).

Post-diapause larvae become active between early February and mid-March, when warm weather (Oregon Zoo 2009, Page *et al*. 2008a; Page pers. comm. 2009) and new host plant growth begin. Post-diapause larvae spend much of their time basking to obtain thermal energy (Figure 26 and 27) and consuming host plants (Figure 19 – 23). Post-diapause larvae appear to be less specific about the quality of host plant resources, consuming the previous years' foliage as well as the young emerging shoots (Page *et al*. 2008a).

Figure 26. Post-diapause Taylor's Checkerspot larva basking on warm, dry leaf. Photo Jennifer Heron.

Figure 27. Post-diapause Taylor's Checkerspot larvae basking on warm, dry wood. Photo Jennifer Heron.

Taylor's Checkerspot pupation in B.C. likely takes place from mid-March through mid-April (Grosball 2005, B.C. Conservation Data Centre, 2010, Page *et al*. 2008a). Larvae seek shelter and pupate under dry wood and vegetation (Page pers. comm. 2009; Oregon Zoo 2009), although pupae have rarely been observed in the wild. In captivity, at low temperatures (< 18º C), the pupal stage can last up to three weeks; at high temperatures (> 24º C), it can be as short as eight days (Oregon Zoo 2009). Most adults emerge from the pupa between 7:00 am and 8:00 am (Oregon Zoo 2009). When humidity is low, adults may emerge with deformed or wrinkled wings (Oregon Zoo 2009).

Periodic observations of large larvae on Denman Island in late May (J. Heron pers. obs. 2009; S. Lavallee pers. comm. 2009) and early June (N. Page pers. comm. 2008) suggest some may pupate following a second summer. Captive breeding information on Taylor's Checkerspot estimates 30 – 50% of post-diapause larvae may diapause for a second year (Oregon Zoo 2009). Larvae that overwinter for a second year aid population persistence within a given habitat should adults be impacted by other detrimental factors (e.g., parasites) (Oregon Zoo 2009).

Predation and parasitism

Taylor's Checkerspot has evolved a series of defensive traits to prevent predation and parasitism, including the sequestration of iridoid compounds during larval host plant consumption, the formation of early instar larval colonies within silken webs (see **Life cycle and reproduction**), and adult wing patterns (see Ehrlich and Hanski 2004 for further discussion).

Natural predatory and parasitic enemies most likely attack all Taylor's Checkerspot life stages in British Columbia, although there is little species-specific information. One parasite reared from Taylor's Checkerspot larvae is the fly *Siphosturmia confusa* Reinhard (Tachinidae) (Tothill 1913). Laboratory studies on Taylor's Checkerspot suggest wild-collected larvae may not exhibit signs of parasitic infection until up to a year after collection, when the parasite emerges from the post-diapause larvae (Oregon Zoo 2009). Specialist parasitoids on Edith's Checkerspot (*E. editha*) are predominantly those in the hymenopteran family Braconidae (see van Nouhuys and Hanski 1999).

During host plant consumption, Taylor's Checkerspot sequesters iridoid compounds, which are distasteful to predators. Studies have shown that generalist arthropod predators (insects and spiders) avoid consumption of prey with sequestered iridoid glycosides, both in the field (Camara 1997 as read in Kuussaari *et al.* 2004) and in the laboratory (Dyer and Bowers 1996; Theodoratus and Bowers 1999). Using cage experiments, it has been shown that birds find checkerspot larvae unpalatable (Kuussaari *et al.* 2004).

During survey fieldwork on Denman Island (2007 through 2009), active predation of adult butterflies by various birds was frequently observed (N. Page pers. comm. 2007 – 2009, J. Heron pers. obs. 2009). Predatory attempts on adult butterflies are evident through observations of clipped wings, particularly the hind wings, of adult butterflies (N. Page pers. comm. 2009, J. Heron pers. obs. 2009).

Physiology and adaptability

Taylor's Checkerspot appears to have adapted to feed on introduced plantains: Ribwort Plantain (*P. lanceolata*) in Beacon Hill Park (Danby 1890), Sea Plantain (*P. maritima*) and Ribwort Plantain in Helliwell Provincial Park (Guppy and Shepard 2001).

Dispersal and migration

Taylor's Checkerspot is not migratory. The maximum dispersal distance is unknown, although some general conclusions may be drawn from survey information on Denman Island. In 2008, one adult was observed greater than 5 km from the known population, across a water body and within suitable habitat along a power line right-of-way on Vancouver Island (Figure 28) (Page *et al*. 2008a). There are no previous records of the subspecies along this right-of-way, thus this record may represent an emigration event from Denman Island. There were repeated surveys throughout 2008 and 2009 with no further observations of individuals away from previously known habitat (N. Page pers. comm. 2008; J. Heron pers. data 2009).

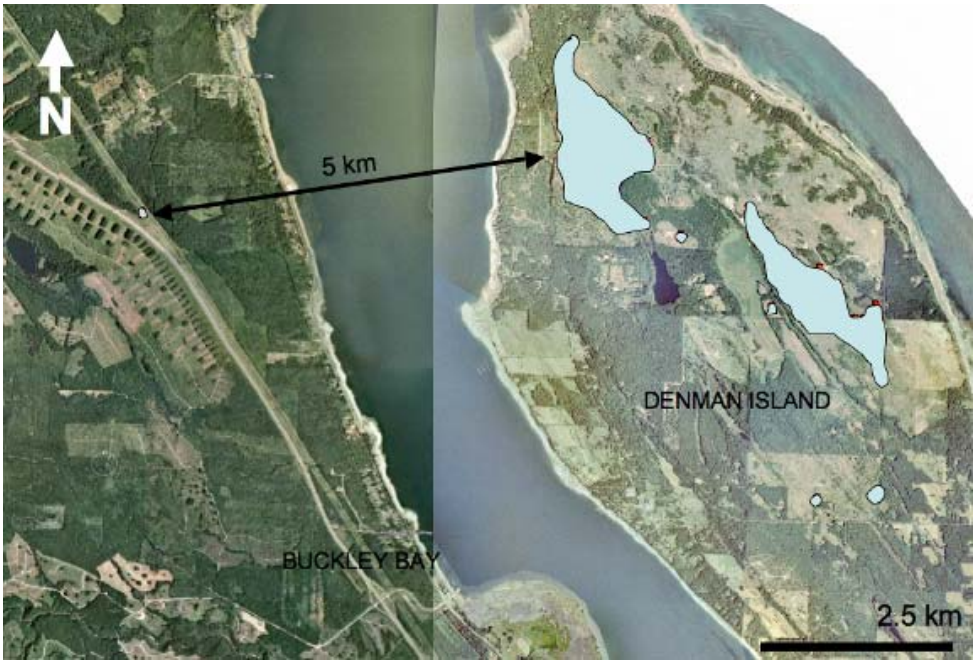

Figure 28. Possible dispersal distance of Taylor's Checkerspot from closest known record on Denman Island (Page *et al*., 2008).

Mark-recapture studies on the related Bay Checkerspot subspecies recorded daily dispersal of more than 500 m and lifetime dispersal and colonization rarely occurred over distances more than 2.3 km (Ehrlich 1965 as cited in Wahlberg *et al.* 2004).

Interspecific interactions

Information on larval host plants, adult nectar sources and predators and parasitoids of the species have been discussed elsewhere in this report.

POPULATION SIZES AND TRENDS

Sampling effort and methods

Taylor's Checkerspot abundance in B.C. has not been fully measured. A small mark-recapture study was completed in 2009 (J. Heron pers. data 2009) over 17 survey days (May 19 to June 6) and covered approximately 4.8 km^2 of suitable habitat on Denman Island. A total of 1220 butterflies was marked, 45 recaptured and an additional 950 observed (but not marked) during the flight period. Three separate observations of an alternate colour form (Figure 3) were recorded during the survey.

Abundance

The mark-recapture data above (J. Heron pers. data 2009) and a modified Schnabel formulation (Krebs 1999) gives a population estimate of about 13,000 adults. This formula assumes the population is closed, and does not account for immigration/emigration and births/deaths within the population (Krebs 1999). Survey effort, transects and area surveyed were not consistent throughout the study. Thus, this estimate is not to be considered an accurate representation of population size.

Fluctuations and trends

Natural population fluctuations for butterflies are a result of numerous factors (e.g., parasites, predators, etc.) including the previous years' weather. Substantial research on Bay Checkerspot and other checkerspot species (see Ehrlich and Hanski 2004) indicates that populations exhibit variability in local distribution and abundance and act as metapopulations among patches of habitat (Ehrlich 1961, Baughman *et al.* 1988; Harrison *et al.* 1988, Baughman 1999, McLaughlin *et al.* 2002a, Singer and Ehrlich 1979 as cited in Grosball 2005).

Historically, Taylor's Checkerspot likely exhibited a more extensive metapopulation structure within suitable habitats throughout southeastern Vancouver Island. Urban and agricultural development, combined with natural succession and fire suppression (see **Threats and Limiting Factors**), led to the isolation of populations and subsequent inability of butterflies to disperse and recolonize habitat patches. Eventually, isolation combined with threats and limiting factors likely led to the extirpation at historical locations in B.C.

Logging on central Denman Island started in the late 1990s and continued until 2001. After clearcuts were created, Taylor's Checkerspot expanded into these new habitats.

Rescue effect

The closest Taylor's Checkerspot populations to Denman Island are in the vicinity of Port Angeles, Washington State, over 250 km south, two orders of magnitude greater than the species is expected to disperse. The closest Canadian historical location to Port Angeles is Beacon Hill (City of Victoria Municipal Park), which is separated by a minimum of 50 km across the Strait of Juan de Fuca. Rescue is unlikely under natural conditions.

THREATS AND LIMITING FACTORS

Threats or reasons for the extirpation of Taylor's Checkerspot from historical locations are speculative (see **Habitat trends**). Extensive land development and habitat conversion, leading to population isolation and demographic collapse, were likely the main threats to historical populations. Fire suppression and natural forest succession, combined with premature host plant senescence, also likely played a role in the extirpation of populations. Many of these historical sites are now dominated by invasive alien plant species such as Scotch Broom *Cytisus scoparius* (L.), agronomic grasses and weedy forbs.

Current threats to Taylor's Checkerspot

Threats to extant Taylor's Checkerspot in Canada are: 1) habitat loss or degradation; 2) natural forest succession; 3) pesticide application; 4) climate change and natural disasters.

Habitat loss or degradation.

Taylor's Checkerspot habitat is threatened by loss, degradation, and fragmentation. Most Taylor's Checkerspot records on Denman Island are on private land from which, according to surveys completed in 2007, 97% of butterflies were seen (Page *et al*. 2007). Private land is subject to development and management by individual landowners.

Following initial logging in 1998, the clearcut habitat had varied ownership and has been used for various purposes. For example, depending on the landowner, the habitat has been converted to agricultural pasture (thus no longer suitable for Taylor's Checkerspot host plants), or lightly grazed by horses (thus appearing to prevent taller grasses from shading host plants), or left to grow through natural succession (resulting in Red Alder trees shading out host plants) (J. Heron pers. obs. 2009). The uncertainty surrounding land use and the frequently changing ownership of the land increases the potential threat of habitat loss.

The province has acquired approximately 5.6 km^2 of habitat on Denman Island, including habitat with populations of Taylor's Checkerspot (see **Habitat protection and ownership**). It is unknown what proportion of the total Taylor's Checkerspot habitat this acquisition represents.

Threats from habitat loss or degradation were considered with respect to the delineation of locations (*sensu* COSEWIC). This leads to a range in location counts from two (one for the land to be purchased by the province and a second one if all other habitat patches were to be treated equally) to a maximum current number of locations of approximately 10 – the number of landowners. Ten was considered the most likely number of locations for this threat. Development of the land was considered to represent a pervasive threat that would have an extreme scope. The calculated impact for this threat was "very high."

Natural forest succession.

All known larval host plants and adult nectar sources require open habitat with abundant light and moisture (Pojar and McKinnon 1994) (see **Habitat requirements** and **Life cycle and reproduction**). Due to the metapopulation structure known for the *E. editha* species group (see Ehrlich and Hanski 2004), ample host plant resources and habitat patches are needed to sustain a population over the long term. Natural forest succession is already progressing rapidly within open habitats on Denman Island. This habitat will continue to decline in quality and quantity of host and nectar plant resources for Taylor's Checkerspot.

Subpopulations of Taylor's Checkerspot are likely at risk from demographic collapse, which may be exacerbated by other threats over time (e.g., natural forest succession). Taylor's Checkerspot appears to be a disturbance-type species and likely forms a metapopulation structure that is dependent on larval host plant resources. Numerous studies on Bay Checkerspot suggest the species forms metapopulations that fluctuate in abundance and local distribution within connected habitat patches (Baughman 1999, Baughman *et al*. 1988, Ehrlich 1961, Harrison *et al*. 1988, McLaughlin *et al*. 2002a, Singer and Ehrlich 1979 as read in Grosball 2005). Taylor's Checkerspot is expected to colonize areas and become locally extirpated at others in response to habitat quality changes over time. Ecological theory suggests the risk of extirpation of a subpopulation from a single habitat patch is reduced with increasing numbers of surrounding subpopulations (Hanski 1982). Like other species confined to patchy habitats, populations of Taylor's Checkerspot are isolated and as natural forest succession continues at variable rates in surrounding habitats, those populations will become more isolated.

The open, wet, marshy clearings and logged areas of central Denman Island have provided ideal habitat for population expansion to other areas throughout the Island. As early seral vegetation and shrub species, such as non-native Scotch Broom, and native tree species establish within these habitats, eventually the connectivity between patches will decrease. The fragmentation of habitats combined with limiting factors (e.g., life history and dispersal limitations) will likely result in the inability of the species' metapopulation dynamics to fully function to repopulate extirpated habitat patches.

With respect to the location count, succession as a threat was considered to result in a minimum number of locations of one, as all areas will succeed if all were left alone, and a maximum number of locations of 8 as not all areas are expected to be left to succeed. The most likely number of locations was considered to fall between these two numbers but likely be towards the lower end, making the impact pervasive. Because succession to shaded and forested habitat is guaranteed to make the habitat unsuitable for the species the threat was considered to have an extreme severity. However, the scope of succession was difficult to assess as it will depend upon the number of ownerships where the property is left to go through succession. Consequently, the scope was suggested to be between small and large to give an overall impact of between low and high.

Pesticide application to control European Gypsy Moth (*Lymantria dispar*).

Denman Island is within the range for potential introduction of European Gypsy Moth (*Lymantria dispar* L.), and traps to detect introductions of this moth are scattered throughout the island (J. Burleigh pers. comm. 2009). Should gypsy moth be found on Denman Island, there is the possibility of ground and aerial spray of Btk (*Bacillus thuringiensis kurstaki*). Btk is a naturally occurring pathogenic bacterium whose spores are a component of commercial pesticide products used to control defoliating caterpillars. Unfortunately, the bacterium also affects most non-target butterfly and moth larvae.

According to October 2009 trap results, no gypsy moth adults have been detected on Denman Island (J. Burleigh pers. comm. 2009) nor has Btk been sprayed near Taylor's Checkerspot populations. Denman Island does occur along prominent points of potential entry for gypsy moth (e.g., Denman Island is a popular tourist destination, as are adjacent Hornby Island and Vancouver Island). Btk for European Gypsy Moth is typically applied in early April to early May, which coincides with the feeding period of Taylor's Checkerspot larvae.

The area of Btk application depends on the extent to which gypsy moth is trapped in surveys and this varies yearly. Since trap results are compiled over at least two years, should gypsy moth be recorded on Denman Island there would likely be time to seek treatment options rather than simply broadcast aerial sprays. Ground treatment from backpack or truck may successfully eradicate the moth while having minimal impact on Taylor's Checkerspot. Under such a scenario it would be unlikely the entire population on Denman Island would be eradicated, although it could be significantly impacted.

On the other hand, one cannot predict with any precision the extent of an area affected by an outbreak in advance of an actual detection. The area that may require treatment could range from ten to hundreds of hectares (J. Burleigh pers. comm. March 2011). While ground-based spraying is likely to be more limited in area covered, past ground-based sprays in British Columbia have exceeded 1 km^2 (Nealis 2009) and so large impacts from this threat are certainly possible. Thus the scope of this potential threat is pervasive and its severity extreme.

Climate change and natural disasters.

Climate change is a potential threat to Taylor's Checkerspot, primarily due to the impacts such change brings to the ecosystem and plant communities within which the subspecies lives. Climate change may increase summer drought on southeastern Vancouver Island, potentially resulting in premature senescence of larval and nectar host plants. It may change rainfall patterns during the larval period, potentially reducing juvenile survival. By 2050, mean annual temperatures are expected to rise approximately 2-3°C (Hebda 1997).

Alternatively, the area within which the climate is suitable for Taylor's Checkerspot could increase as a result of climate change. This could dramatically increase the potential range of the species in British Columbia. The host plants are common and widespread throughout the province. However, current rates of habitat loss and fragmentation within the known range combined with the limited natural dispersal capabilities of Taylor's Checkerspot adults are likely to prevent natural expansion.

Because of uncertainty of its impacts and the very high threat resulting from other causes, climate change was not considered to be the most pressing threat.

Overall threat calculation

Succession and property development were considered to be mutually exclusive threats that would impact all currently occupied sites with the possible exception of the area purchased by the province. Btk would impact even actively conserved sites making the number of locations derived from this threat to be one. The combination of succession and development likely renders all sites except the conserved area very highly threatened. Unfortunately, succession may also make the area more suitable for Gypsy Moth with the result that Btk spraying becomes more likely. In combination with Btk, the threats combine to give a very high impact. It is expected that there is a probability of over 70% of the current population becoming extirpated within the next ten years.

Limiting factors

Factors limiting Taylor's Checkerspot populations have been discussed by the Garry Oak Invertebrates Recovery Implementation Group (2009). The main limiting factor appears to be larval host plant availability (pre- and post-diapause). Host plant senescence may limit populations (Shepard 2000, Miskelly 2004). In early spring, host plants are just beginning to grow and thus host plant phenology likely influences larval occupancy and preference (Page *et al*. 2008a). Host plants grow at variable rates. Thus more than one host plant is likely beneficial to the survival of populations within a given site, and aids in buffering against the effects of environmental stochasticity (e.g., warmer, colder, drier, or moister conditions in early spring) (Page *et al*. 2008a). Nectar sources may also limit egg production (Murphy *et al*. 1983, Boggs 1997) although the population on Denman Island appears to have abundant nectar plant availability at present (see **Habitat requirements**) (Page *et al.* 2007, Page *et al*. 2008a). However, as natural forest succession occurs these resources will diminish (see **Habitat trends and threats)**.

The eggs and larvae of Taylor's Checkerspot may be subject to direct mortality or damage by browsing animals, although this threat is minor. Mule Deer (*Odocoileus hemionus* (Rafinesque)) have been observed browsing on vegetation throughout the open habitats on Denman Island, and may trample larvae or host plants within wet meadow areas or along roadsides.

PROTECTION, STATUS, AND RANKS

Legal protection and status

Taylor's Checkerspot is protected under the federal *Species at Risk Act* (SARA), which provides immediate protection for individuals and their residences and includes provisions for the protection of critical habitat once identified in a recovery strategy. The residence concept under SARA does not apply to all species; as of April 2010, a residence description for Taylor's Checkerspot has not been posted on the SARA Public Registry. Similarly, a finalized recovery strategy has not yet been posted on the Registry, and hence, critical habitat for the species has not yet been defined. Taylor's Checkerspot was included on Schedule 1 of SARA as Endangered in 2003 when the Act was proclaimed. It was last assessed as Endangered in 2011 (COSEWIC 2011).

Taylor's Checkerspot would be protected within national parks and national wildlife areas if there were any populations present within these areas. The B.C. *Park Act* protects invertebrate species at risk in provincial parks and protected areas (B.C. Conservation Data Centre 2009). When species at risk and the habitats they require are known to occur within a protected area, provisions for management are incorporated into the park master plan (e.g., Helliwell Provincial Park). Further, the B.C. *Ecological Reserves Act* provides protection for species occurring within ecological reserves in B.C. Both federal lands managers and staff (K. Fort pers. comm. 2003 – 2009) and provincial parks staff (B. Woodhouse pers. comm. 2003 – 2007, S. Pratt pers. comm. 2008 – 2009) within the range of Taylor's Checkerspot are aware of the habitat requirements of this species, and advise their staff to look out for possible new occurrences. The most recent land acquisition by the provincial government on Denman Island contains 1400 acres of habitat, including some populations of Taylor's Checkerspot. The land will become an ecological reserve or provincial park.

Taylor's Checkerspot is recommended for listing as *Identified Wildlife* under the *B.C. Forest and Range Practices Act*. Once listed under this act, it will be possible to protect known locations and habitat for this subspecies within Wildlife Habitat Areas on provincial Crown land. However, it should be noted that there are currently no Wildlife Habitat Areas on provincial Crown land within the species' range on Denman Island.

Invertebrates assessed by COSEWIC as Threatened, Endangered or Extirpated will be protected through the British Columbia *Wildlife Act* and *Wildlife Amendment Act* once the regulations for listing these species are completed.

Historical locations for the species are inferred to occur within regional or municipal habitats, and these governments are aware of the species and its potential habitat (e.g., Capital Regional District [M. Fuchs pers. com. 2003 – 2009], Comox Regional District [K. Albert pers. comm. 2007 – 2009]).

The recovery strategy goal and objectives for Taylor's Checkerspot are currently being revised by the Garry Oak Invertebrates Recovery Implementation Group (J. Heron pers. obs. 2009). They need revisions because these statements were written prior to the finding of a population on Denman Island and further research since this time has changed our understanding of the subspecies habitat requirements and biology.

Non-legal status and ranks

Taylor's Checkerspot has a conservation status rank of S1 (critically imperiled) in B.C. (B.C. Conservation Data Centre 2009) and nationally listed as N1 (endangered) (NatureServe 2009). The global conservation status rank is G5T1 (NatureServe 2009). In Oregon and Washington States the species has a conservation status rank of S1 (NatureServe 2009).

Taylor's Checkerspot is a priority one species (highest priority) under goal three (maintain the diversity of native species and ecosystems) of the B.C. Conservation Framework (see www.env.gov.bc.ca/conservationframework/).

Draft Best Management Practices Guidelines have been written for Taylor's Checkerspot and other butterfly species at risk on southeastern Vancouver Island.

Non-government conservation organizations, such as Conservancy Hornby (T. Law pers. comm. 2005 – 2009) and Denman Conservancy (J Thornton pers. comm. 2006 – 2009), work with private landowners towards protecting this subspecies within these islands. Numerous conservancies on the Gulf Islands also search for the species and work towards protecting Garry Oak habitat and the low elevation Coastal Douglas-fir ecosystem, including such conservancies as Salt Spring Conservancy (R. Annschild pers. comm. 2005 – 2009), Mayne Island Conservancy (M. Dunn pers. comm. 2008 – 2009) and Galiano Conservancy (T. Crowe pers. comm. 2009).

Within the United States, a petition was submitted to add Taylor's Checkerspot to the Lists of Endangered and Threatened Wildlife and Plants under the *Endangered Species Act* of 1973 (November 9 2009). The decision is pending (U.S. Fish and Wildlife Service 2009).

Habitat protection and ownership

In 2007, landowner contact and surveys for Taylor's Checkerspot on Denman Island recorded 97% of observations on private lands (Page *et al.* 2007). On October 29, 2009 an approved development proposal on Denman Island began the transfer process for approximately 475 hectares of private land to the B.C. government as a provincial park or ecological reserve. The land acquisition negotiations have been completed and B.C. Parks are making plans for how to manage the park.

Conservation covenants on Denman Island that contain small populations of Taylor's Checkerspot include Central Park (59.5 ha), Railway Grade Marsh (31.5 ha) and property owned by the Denman Conservancy (160 ha) (Denman Conservancy Association 2009). Many private properties on Denman Island contain populations of Taylor's Checkerspot and the Denman Conservancy is active and effective at engaging landowners to protect populations on their properties.

Much potential Taylor's Checkerspot habitat on southeastern Vancouver Island is privately owned by individuals (e.g., farms or rural properties) or private forest companies (e.g., for timber production). Historic Taylor's Checkerspot populations may have been present in the following present-day protected areas (according to museum specimen locality records): Beacon Hill Municipal Park (Victoria), Bright Angel Park (Duncan; the population was known from outside the park) (C. Guppy pers. comm. 2009), Helliwell Provincial Park (Hornby Island, confirmed location), Tribune Bay Provincial Park (Hornby Island, confirmed location), Mt. Douglas Municipal Park (Saanich), Mt. Finlayson (Goldstream Provincial Park outside north of Victoria), Observatory Hill (federal property) and Trial Island (B.C. Ecological Reserve and federal lighthouse property). Due to the vague locality information attached to museum specimens, the site(s) of populations within some of these parks is unconfirmed.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Jennifer Heron is the provincial invertebrate specialist with the B.C. Ministry of Environment, Wildlife Science Section, Ecosystems Branch. She directs and manages the provincial approach to invertebrate conservation, including the development and implementation of provincial legislation, policy, procedures, and standards for the conservation, and recovery of invertebrate species at risk, their habitats and ecosystems, and to keep these species from becoming at risk. She works with other invertebrate specialists to develop recovery-planning approaches and assign conservation status ranks to invertebrate groups. She works with local conservation and stewardship groups to achieve common public outreach goals.

COLLECTIONS EXAMINED

See Appendix 1: COSEWIC, 2000. Most recent compilation of records for Taylor's Checkerspot museum records.

Appendix 1: List of Taylor's Checkerspot Museum and Collection Records as summarized in COSEWIC (2000) with sight records from Shepard (2000) and C. Guppy (pers. comm., 2009).

CNC: Canadian National Collection, Agriculture Canada, Ottawa; RBCM: Royal British Columbia Museum, Victoria (specimen numbers in square brackets refer to specimens from RBCM database that have not been checked or sexed); UBC: Beaty Biodiversity Museum Spencer Entomological Collection at the University of British Columbia, Vancouver; AMNH: American Museum of Natural History, New York; JHS: Jon Shepard, Nelson, B.C.; CSG: Cris Guppy, Quesnel, B.C.; NK: Norbert Kondla, Calgary, AB; CAS: California Academy of Sciences, San Francisco; RG: Richard Guppy, sight record*, in litt*.; Lep. Soc.: 1951 Season Summary, Lepidopterists' Society, sight record. YPMN: Peabody Museum of Natural History, Yale University, New Haven, CT.

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
B[eacon].H[ill]. P.	123 21	48 25		1901	5	24	E.M. Anderson	CNC	0	1
Beacon Hill Park	123 21 00	48 25 00			5	5	Wood Coll.	AMNH	1	1
Braefoot	123 20 47	48 28 19		1952	5	7	G.A. Hardy	RBCM	1	0
Braefoot	123 20 47	48 28 19		1952	5	15	G.A. Hardy	RBCM	[1]	0
Braefoot	123 20 47	48 28 19		1953	5	11	G.A. Hardy	RBCM	0	1
Brentwood	123 27 39	48 34 17		1954	5	12	G.A. Hardy	RBCM	[1]	0
Cattle Point	123 17 22	48 26 17		1932	5	7	J. Burbridge	RBCM	[1]	0
Chain Is.	123 16 23	48 25 15		1949	5	10	G.I. Guiget	RBCM	0	1
Chain Is.	123 16 23	48 25 15		1953	5	1	G.A. Hardy	RBCM	1	0
Courtenay	124 59 00	49 41 00		1931	5	2	dos Passos Coll.	AMNH	9	1
Courtenay	124 59 00	49 41 00		1931	5	9	dos Passos Coll.	AMNH	4	2
Duncan	123 42 00	48 47 00					A.W. Hanham	CNC	1	0
Duncan, Bright Angel Park	123 41	48 44		1975			R. Guppy	RG	[many]	0
Duncan, Bright Angel Park	123 41	48 44		1977	5	1	R. Guppy	NK	3	0
Duncan, Bright Angel Park	123 41	48 44		1977	5	11	R. Guppy	NK	3	0
Duncan, Bright Angel Park	123 41	48 44		1978	5	16	R. Guppy	NK	1	0
Duncan, Bright Angel Park	123 41	48 44		1978	5	18	R. Guppy	NK	2	0
Duncan, Cliffs Road clifftop above Cowichan River	123.718358	48.778116		1960s			Dionys de Leeuw spoke to C. Guppy (pers. comm., 2009)		[few]	[few]
Helliwell PP	124 36 10	49 31 29		1977	4	25	J. & S. Shepard	JHS	2	11
Helliwell PP	124 36 10	49 31 29		1995	4	27	J.H. Shepard	RBCM	10	1
Helliwell PP. W	124 36 10	49 31 29		1995	4	27	J.H. Shepard	JHS	6	0

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Hudson Bay Woods [Oak Bay]	123 18 10	48 26 33		1954	5	3	G.A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1951	5	9	G.A. Hardy	RBCM	[1]	0
Lost Lake	123 21 36	48 29 04		1952	4	24	G.A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1952	5	12	G.A. Hardy	RBCM	1	0
Lost Lake	123 21 36	48 29 04		1953	5	9	G.A. Hardy	RBCM	[1]	0
Mill Bay	123 34 22	48 38 12	190m	1988	5	7	C.S. Guppy	RBCM	31	3
Mill Bay	123 33 24	48 39 17	190m	1989	4	15	C.S. Guppy	RBCM	[1]	0
Mill Bay, 3 km SW	123 34	48 38	190m	1988	5	7	C.S. Guppy	CSG	11	1
Mill Bay, 3 km SW	123 34	48 38	190m	1988	5	20	C.S. Guppy	CSG	11	19
Mill Bay, 3 km SW	123 35 00	48 38 00	190m	1988	5	7	C.S. Guppy	JHS	4	1
Mill Bay, 3 km SW	123 35 00	48 38 00	190m	1988	5	20	C.S. Guppy	JHS	10	2
Mt. Douglas	123 20 38	48 29 30		1954	5	24	G.A. Hardy	RBCM	[1]	0
Mt. Finlayson	123 32 14	48 29 44		1957	5	7	G.A. Hardy	RBCM	[1]	0
Mt. Finlayson	123 32 14	48 29 44		1958	5	5	G.A. Hardy	RBCM	0	1
Norman Pt., nr. [Hornby Island]	124 39 55	49 29 32		1995	4	28	J.H. Shepard	JHS	3	0
Norman Pt., nr. [Hornby Island]	124 39 55	49 29 32		1995	4	28	J.H. Shepard	RBCM	1	0
Oak Bay	123 18 00	48 27 00					Richard Guppy	Lep.Soc.	[common]	0
Oak Bay	123 18 00	48 27 00		1951	4	24	Richard Guppy	AMNH	2	0
Oak Bay	123 18 00	48 27 00		1951	4	24	Gibbon Coll.	CNC	4	2
Observatory Hill	123 25 06	48 31 16		1957	5	4	G.A. Hardy	RBCM	[1]	0
Observatory Hill	123 25 06	48 31 16		1957	5	5	G.A. Hardy	RBCM	[1]	0
Royal Oak	123 23 38	48 30 02		1957	5	18	G.A. Hardy	RBCM	[1]	0
Shawnigan Dist.	123 33 14	48 39 23		1931	5	9	J.R.L. Jones	RBCM	[1]	0
Shawnigan Dist.	123 33 00	48 39 00		1952	4	13	J.R.L. Jones	RBCM	1	0
Tod Inlet	123 28 00	48 34 00		1928	5	6	W.H.A. Preece	CNC	0	1
Tod Inlet	123 28 00	48 34 00		1928	5	13	W.H.A. Preece	CNC	0	2
Trial Is.	123 18 19	48 23 57		1952	5	2	G.A. Hardy	RBCM	1	0
Trial Is.	123 18 19	48 23 57		1953	5	25	G.A. Hardy	RBCM	1	0
Tribune Bay Provincial Park				1995			J.H. Shepard	sight (Shepard, 2000)		
Vancouver Isl.							H. Edward	AMNH	0	1
Victoria	123 22 43	48 25 50			4	23	Hulst Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50			4	24	Buchholz Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50			5	1	Buchholz Coll.	AMNH	1	3
Victoria	123 22 43	48 25 50			5	9	Hulst Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50		1887	5	22	J. M[acoun].	CNC	0	2
Victoria	123 22 43	48 25 50		1902	5	9	And[erson]	CAS	1	1

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Victoria	123 22 43	48 25 50		1903	5		E.M. Anderson	CNC	1	1
Victoria	123 22 43	48 25 50		1903	5	3		RBCM	0	2
Victoria	123 22 43	48 25 50		1908	4	20	Gunder Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50		1909	5	6	And[erson]	CAS	1	1
Victoria	123 22 43	48 25 50		1909	5	16	A.J. Croker	CAS	1	0
Victoria	123 22 43	48 25 50		1909	5	23	A.J. Croker	CAS	1	1
Victoria	123 22 43	48 25 50		1909	6	2	G.W. Taylor	JHS	1	0
Victoria	123 22 43	48 25 50		1910	4	30	A.J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1910	4	30		AMNH	0	1
Victoria	123 22 43	48 25 50		1910	5	6	A.J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1910	5	28	A.J. Croker	AMNH	1	0
Victoria	123 22 43	48 25 50		1912	5	4	E.H. Blackmore	RBCM	[2]	0
Victoria	123 22 43	48 25 50		1916	5	9	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1917	5	17		CNC	1	0
Victoria	123 22 43	48 25 50		1917	5	18		CNC	1	0
Victoria	123 22 43	48 25 50		1919	4	21		CNC	0	1
Victoria	123 22 43	48 25 50		1919	5	6	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1921	5	1	W.R. C[arter].	RBCM	[1]	0
Victoria	123 22 43	48 25 50		1922	4	18	E.H. Blackmore	AMNH	0	1
Victoria	123 22 43	48 25 50		1922	5	12	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1924	5	3	W. Downes	CNC	5	0
Victoria	123 22 43	48 25 50		1924	5	26	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1926	4	27	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1927	5	20	W. Downes	CNC	1	0
Victoria	123 22 43	48 25 50		1927	6	22	W. Downes	CNC	0	1
Victoria	123 22 43	48 25 50		1929	5	7	Gunder Coll.	AMNH	9	6
Victoria	123 22 43	48 25 50		1929	5	7	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1929	5	7	Strernitzky Coll.	AMNH	1	0
Victoria	123 22 43	48 25 50		1929	5	10	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1929	5	11	Preece	AMNH	1	4
Victoria	123 22 43	48 25 50		1929	5	13	Preece	AMNH	0	1
Victoria	123 22 43	48 25 50		1952	5	1	ex. N.W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	2	ex. N.W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	3	ex. N.W. Gillman	YPMN	2	0
Victoria	123 22 43	48 25 50		1952	5	5	ex. N.W. Gillman	YPMN	4	0
Victoria	123 22 43	48 25 50		1952	5	6	ex. N.W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	7	ex. N.W. Gillman	YPMN	7	0

Location	Approx. longitude	Approx. latitude	Elevation	Year	Month	Day	Collector	Collection	Male	Female
Victoria	123 22 43	48 25 50		1952	5	8	ex. N.W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1952	5	10	ex. N.W. Gillman	YPMN	1	0
Victoria	123 22 43	48 25 50		1959	5	9	Richard Guppy	AMNH	0	1
Victoria	123 22 43	48 25 50		1959	5	9	Richard Guppy	AMNH	1	0
Victoria Dist.	123 22 43	48 25 50		1933	5	15	J.R.L. Jones	RBCM	[1]	0