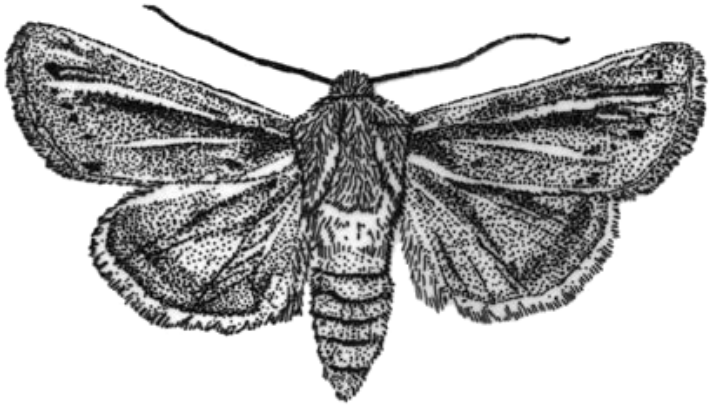
COSEWIC
Assessment and Status Report

on the

Sand-verbena Moth
Copablepharon fuscum

in Canada



ENDANGERED
2003

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
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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 – November 2003

Common name
Sand-verbena moth

Scientific name
Copablepharon fuscum

Status
Endangered

Reason for designation
The global population of this moth is very small and occurs in a very restricted range. The Canadian population, occurring at only three small sites, is even smaller and more restricted. The moth and its host plant are habitat specialists dependent on coastal dunes, a rare habitat along the West Coast. This habitat has undergone extensive losses due to stabilization of open dunes (including the introduction of invasive plant species), development, and recreational use. The host plant and therefore the moth are facing the threat of continuing declines due to the loss and degradation of coastal dunes.

Occurrence
British Columbia

Status history
Designated Endangered in November 2003. Assessment based on a new status report.

COSEWIC
Executive Summary

Sand-verbena Moth
Copablepharon fuscum

Species information

The Sand-verbena Moth (*Copablepharon fuscum*) is a noctuid moth. It was described in 1996 from specimens collected near Sidney, B.C. and Whidbey Island, Washington. Although the species was recently described, its specific habitat requirements and apparently poor dispersal abilities indicate that it was not recently introduced to Canada. Adults are dark to golden brown with distinctive black and pale yellow forewing lines. There are no superficially similar moth species in British Columbia, and the Sand-verbena Moth is the only species of *Copablepharon* found west of the Cascade Mountains. Most species in the genus are found in arid, sandy or dune environments.

Distribution

The Sand-verbena Moth has been recorded from eight sites globally. Three occurrences are in Canada in the Strait of Georgia region of southwestern British Columbia. Five occurrences are in the Puget Sound region of Washington. Each location is believed to encompass one population. The most northern occurrence is in the Comox area in B.C. and the most southern is near Port Townsend, Washington. Populations are spatially isolated.

Habitat

The Sand-verbena Moth occurs in association with its host-plant, yellow sand-verbena, in spits, dunes and other sand-dominated coastal sites. It has consistently been found in close spatial association with large, dense patches of yellow sand-verbena. The Sand-verbena Moth and the yellow sand-verbena appear to have a parasite/host relationship. The yellow sand-verbena is dependent on open sand habitats and declines in vigour where competition from other vascular plants and bryophytes occurs.

Biology

The Sand-verbena Moth is dependent on the yellow sand-verbena for all phases of its lifecycle. Adult moths fly once per year between mid-May and early July during dusk

and early evening. They feed on the nectar of yellow sand-verbena flowers. Mating peaks in mid-June. Eggs are laid singly or in groups on yellow sand-verbena leaves and flowers. Larvae feed nocturnally on yellow sand-verbena during July and August before a period of fall and winter dormancy. Pupation occurs in late April and May.

Population sizes and trends

There is no quantitative information on population sizes and trends for the Sand-verbena Moth. Changes in the distribution and abundance of yellow sand-verbena may be useful in inferring Sand-verbena Moth population trends. This extrapolation relies on the assumption that Sand-verbena Moth population size is related to the quantity and quality of yellow sand-verbena. Occurrences of yellow sand-verbena in British Columbia are generally stable. However, the size of yellow sand-verbena populations in many sites has likely declined substantially in the past 50 years because of vegetation changes.

Limiting factors and threats

The primary threat to the Sand-verbena Moth is the reduction in the quantity and quality of host-plant resources as a result of loss or change to open sand habitats. This is primarily caused by vegetation stabilization. Stabilization occurs as a result of natural succession in sand-dominated coastal sites. However, anthropogenic impacts, particularly exotic species invasion, have increased the rate of successional change. Direct disturbance from human development and recreational use are considered secondary threats. Other potential threats include the use of Btk, a pest control product that was developed to control moth and butterfly pests, and climate change, which could eliminate habitat through rising sea-level.

Special significance of the species

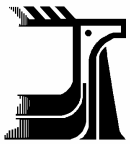
The Sand-verbena Moth is endemic to coastal sites in the Strait of Georgia region of British Columbia and adjacent areas in the Puget Sound region of Washington. It is a monophagous species that relies exclusively on yellow sand-verbena, a regionally rare plant species of coastal dunes and beaches, for food and reproduction. While this type of parasite/host relationship is not unique in moths, the habitat specialization of both species increases its conservation significance. It may also mean that the Sand-verbena Moth is not resilient to anthropogenic or stochastic change.

Existing protection or other status designations

No national, provincial, or state jurisdictions have designated the protection status of the Sand-verbena Moth. It is not listed in the BC Conservation Data Centre's database or in the international conservation database maintained by NatureServe.

The host-plant, yellow sand-verbena, is designated by the BC Conservation Data Centre as *vulnerable*, which indicates it is sensitive to human activities or natural

events. It is not listed by the Washington Natural Heritage Program. Dune plant communities were recently designated by the BC Conservation Data Centre as *endangered/threatened*, which indicates they are critically imperiled or imperiled. They are included under the plant association "*Carex macrocephala* Herbaceous Vegetation".



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. 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 and include 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 organizations (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership, chaired by the Canadian Museum of Nature), three nonjurisdictional members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The committee meets to consider status reports on candidate species.

DEFINITIONS
(**After May 2003**)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* 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.

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

COSEWIC Status Report

on the

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2003

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SPECIES INFORMATION

Name and classification

Scientific Name: *Copablepharon fuscum* Troubr. & Crabo, [1996]

Classification:

Order: Lepidoptera
Superfamily: Noctuoidea
Family: Noctuidae
Subfamily: Noctuinae
Tribe: Agrotini
Genus: *Copablepharon*
Species: *fuscum*

Synonyms: None

Moths of North America (MONA) Number: 10692.2

Bibliographic Citation: Troubridge, J.T. and L.G. Crabo. 1996. A new species of *Copablepharon* (Lepidoptera: Noctuidae) from British Columbia and Washington. Journal of the Entomological Society of British Columbia 92: 87–90.

Type Specimens: Holotype male: USA, Washington, Island County, Deception Pass State Park, 26 May,1995, Troubridge and Crabo in the Canadian National Collection (CNC). Paratypes (16 males, 18 females): 15 males, 15 females, same data as holotype; 1 female, 1 July, 1994, Saanichton, B.C., Troubridge; 1 male, 2 females, 1 July, 1995, Saanichton, B.C., Troubridge.

English Names: Sand-verbena Moth

French Name: Noctuelle de l'abronie des dunes

Taxonomic Background and Similarities: Fifteen species in the genus *Copablepharon* have been described in North America north of Mexico. Seven of these have been recorded in Canada and three in British Columbia. *C. fuscum* is the only species known from west of the Cascade Mountains. The genus is currently being revised by D. Lafontaine (Canadian National Collection of Insects, Arachnids and Nematodes) and the number of described species is anticipated to increase. The taxonomy of *C. fuscum* will not be affected by this revision (J.T. Troubridge pers. comm., 2002). Most *Copablepharon* species are found in arid, sandy or dune environments and have narrow distribution ranges (J.T. Troubridge, pers. comm., 2002). The closest *Copablepharon* species geographically to *C. fuscum* is *Copablepharon absidum* (Harv.), which occurs at one site near Osoyoos, B.C. and in dunes in Washington, northern Oregon and central Idaho (Troubridge and Crabo, 1995). Another species, *Copablepharon hopfingeri* Francl., has also been recorded in arid, sandy soils in northeastern Washington and one

site in southeastern British Columbia. It has been extirpated from British Columbia (Lafontaine and Troubridge, 1998).

Description

Adults

Copablepharon fuscum is a dark to golden brown noctuid moth with distinctive black and pale yellow forewing lines (Figures 1a and 1b). The forewing is 17-19 mm long and slightly darker than the thorax. The trailing margin is gray-brown and the costa and anal margin is white. The medial vein is edged with a pale yellow or white line anteriorly and a diffuse black line posteriorly. A shorter and more diffuse black line is located nearer the apex of the forewing. A second pale yellow line borders the cubital vein. There is a series of irregular black dots located along the subterminal line. The hindwing is dark gray-brown, fading to very light gray or white basally. Overall pigmentation is variable among individuals and southern populations appear to be darker than northern populations (Figure 2). Males and females are similar in colouration, wing patterning and size (total wingspan varying from 35-40 mm).

There are no superficially similar moth species in British Columbia, and field determination based on external features (e.g., forewing colour patterns) is reliable. Troubridge and Crabo (1995) provided a detailed technical summary of adult morphology in their initial species description, including information on male and female genitalia. It is provided in Appendix 1.

Eggs

Eggs are deposited singly or in groups on the exterior of *Abronia latifolia* (yellow sand-verbena) leaves or flowers. Their structure has not been described.

Larvae

Larvae are green in early instars and brown in later instars with longitudinal pale stripes and a light brown head capsule (Figure 1c).

Pupae

Pupae are dark brown and are about 20 mm in length (Figure 1d). They have a distinctive external compartment (exarate haustellum) for the development of the proboscis. A fragile layer of sand particles protects the pupa.

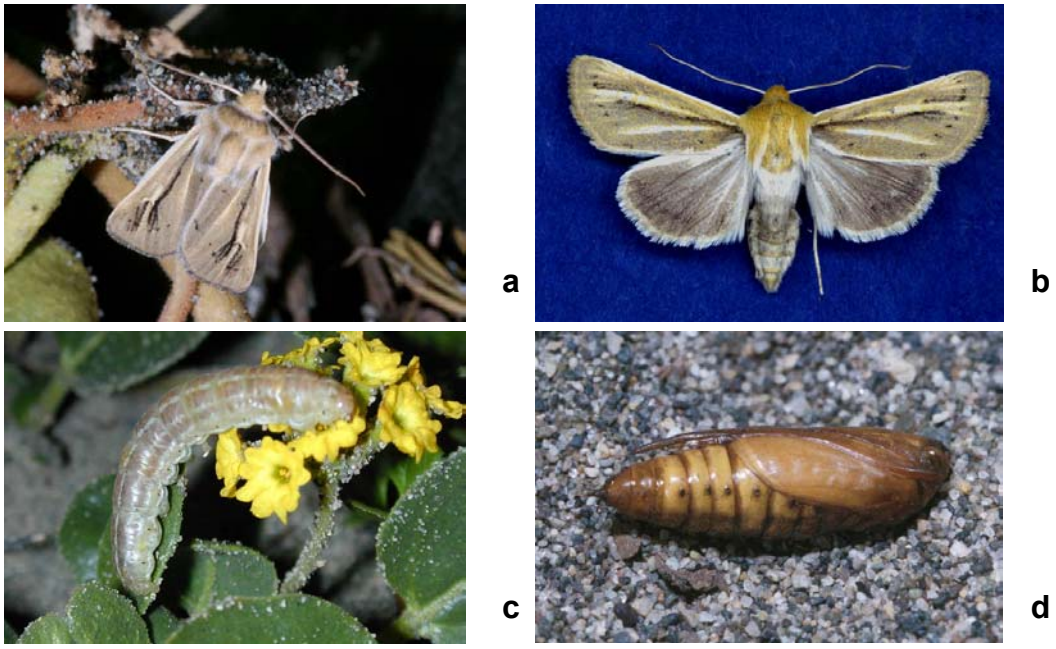

Figure 1. Adult, larval and pupal stages of *C. fuscum*: a) live adult moth on *A. latifolia* stem; b) adult moth from J.T. Troubridge collection; c) late instar larva feeding on *A. latifolia* flower; d) pupa (note external proboscis). Photos (a) and (d) provided by J. Tatum. Photos (b) and (c) by N.A. Page.

Figure 2. Example of colour range in adult *C. fuscum*. Photo provided by J.T. Troubridge.

DISTRIBUTION

Global range

Copablepharon fuscum has been recorded in eight sand-dominated coastal sites such as spits and dunes surrounding the Strait of Georgia of British Columbia and Puget Sound of Washington State (Figures 3 and 4). All population records are based on light-trap or hand-net captures from three sources: Troubridge and Crabo (1996)

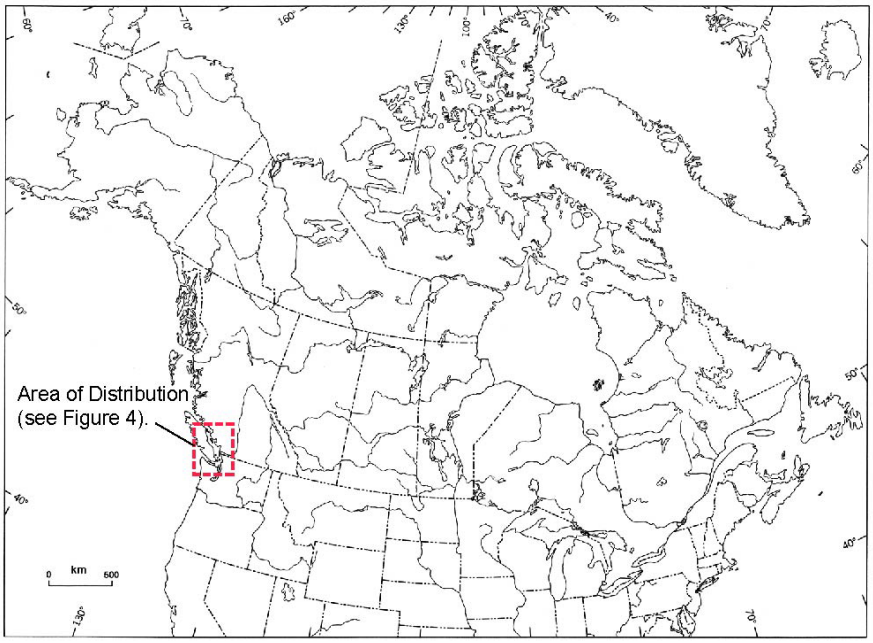

Figure 3. North American range of *C. fuscum* based on confirmed specimens.

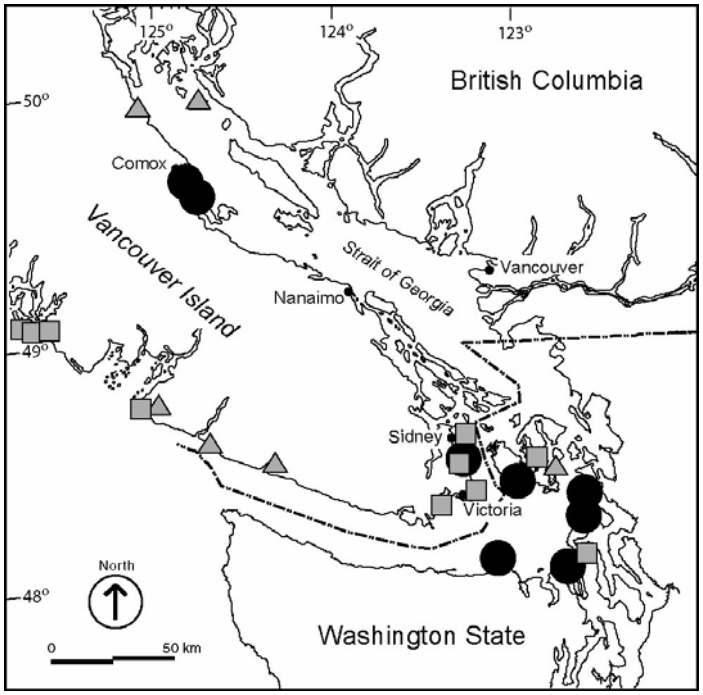

Figure 4. *Copablepharon fuscum* populations and sampling sites in the Strait of Georgia – Puget Sound and west coast of Vancouver Island. Sites with confirmed populations of *C. fuscum* are shown with black dots. Sites with *A. latifolia* that were sampled in 2001/2002 without capturing *C. fuscum* are shown with squares. Sites without *A. latifolia* that were sampled in 2001/2002 without capturing *C. fuscum* are shown with triangles.

from the type localities; Troubridge and Woodward (2000) for one site in the northern Strait of Georgia; and records collected by N. Page in 2001 and 2002 from one new site in the northern Strait of Georgia and four new sites in Puget Sound. Collections by N. Page were made using a modified Robinson light-trap or by hand-netting in proximity to a light-trap between the middle of May and early July. In most cases, a single light-trap was placed adjacent to patches of *A. latifolia* prior to dusk and was operated for the full dusk to dawn period. Two traps were used occasionally. This sampling method and intensity has been used successfully to capture *Copablepharon* species (J.T. Troubridge, pers. comm., 2002). Additional coastal sites that did not support *C. fuscum* were also sampled but provide contextual information on habitat preferences (see Figure 4). Detailed sampling records from 2001 and 2002 are provided in Appendix 2 (note: sites with known *C. fuscum* populations are not identified by name or geographic coordinates). All known specimens of *C fuscum* have been identified by J.T. Troubridge.

Each location is believed to encompass one population. The extent of occurrence of all known sites with *C. fuscum* is 4850 km^2, which is a maximum of 220 km long and 45 km wide. The extent of the three Canadian populations is approximately 3700 km^2. The maximum distance between known populations is 220 km.Canadian range.

Canadian range

C. fuscum has been recorded at three sites in Canada in the past eight years (Figure 4). Two populations are located in the northern Strait of Georgia in the Comox area, B.C. A single population is located in the southern Strait of Georgia near Sidney, B.C. The southern Canadian population is proximate to populations in Washington described below.

Based on the presence of its host-plant, *Abronia latifolia*, *C. fuscum* may occur in up to four additional sites in the Canadian portion of the southern Strait of Georgia. One potential site was sampled in June 2002 without success and more intensive sampling is needed in that locality. A privately owned island near Sidney, B.C. has recent records of *A. latifolia* from one to three sand spits or dunes (Clement, 1998). It has not been sampled for moths. Three sites with small patches of *A. latifolia* (< 25 m^2) in the southern Strait of Georgia were also sampled in 2002 without success. In addition, *C. fuscum* was not captured in three other sites that do not support *A. latifolia*. No additional sites with suitable habitat (e.g., open dunes with *A. latifolia*) for *C. fuscum* were found in the northern Strait of Georgia. Dunes on the west coast of Savary Island were visited on June 2002. No *A. latifolia* plants were observed, and light-trapping in dune meadow areas did not result in capture of *C. fuscum*. Five dune sites on the west coast of Vancouver Island with *A. latifolia* populations were sampled between May 15 and July 10, 2001. No *C. fuscum* were captured or observed at these sites.

It is unknown if *C. fuscum* has been extirpated from any sites in Canada.

United States range

C. fuscum has been recorded from five sites in the Puget Sound region of Washington: two on Whidbey Island (including the type locality at Deception Pass State Park), one on San Juan Island, and two on the eastern side of the Strait of Juan de Fuca (Figure 4).

C. fuscum may occur in up to 6 additional sites in the Puget Sound area. These potential sites have not been visited, and the presence of *C. fuscum* was inferred from inspecting oblique air photos for suitable open dune habitat. Other than the visually confirmed presence of *A. latifolia* on one spit on Lopez Island, it is unknown if these additional sites support large patches of *A. latifolia*. Two other sites with small patches of *A. latifolia* in the Puget Sound area were sampled in June 2002 using light-traps. No *C. fuscum* were captured or observed at either site.

There is no indication that *C. fuscum* populations in the Strait of Georgia - Puget Sound region are peripheral to a larger population on the Oregon and California coasts. A review of collections from the western U.S. by J.T. Troubridge did not reveal any additional collection records of *C. fuscum* (J.T. Troubridge pers. comm., 2002). One site in Oregon with *A. latifolia* was visited in June 2002. No light-trapping was possible, and *C. fuscum* was not found during hand searches of patches of flowering *A. latifolia*. *A. latifolia* has declined throughout its range on the Oregon and California coasts because of exotic species invasion, intensive recreational use and urban development (A. Wiedemann, pers. comm., 2002). However, additional sampling is needed to determine the presence or absence of *C. fuscum* in coastal sites in Oregon and California.

Population structure

The distribution of *C. fuscum* appears to be structured at two spatial scales. The geographic isolation of sand-dominated coastal sites with large *A. latifolia* patches creates a fragmented regional distribution pattern of *C. fuscum* populations. It is unclear if *C. fuscum* exhibits a metapopulation[1] structure in which infrequent dispersal increases population persistence, or if the populations are better described as isolated populations without dispersal. The northern Strait of Georgia populations are approximately 6.7 km apart and may have infrequent immigration (e.g., < 1 migrant per year). The southern populations are more geographically isolated (mean, minimum and maximum distance between the six southern populations: 32.6, 3.9, 59.9 km respectively). The population near Sidney, B.C. is the most isolated Canadian population and the closest known population is 33.2 km away on San Juan Island.

Within sites, *A. latifolia* plants are also patchily distributed. Dense patches may be separated by open sand or grass areas without *A. latifolia*, or by sparse nonflowering *A. latifolia* plants. In some sites, *C. fuscum* was captured among relatively small patches

[1]A metapopulation is a complex of connected populations whose persistence as a whole depends on limited migration between the isolated populations (Hanski, 1997). An important assumption for metapopulations is that habitat patches are not too isolated to prevent immigration.

of *A. latifolia* (+/-50 m^2) that are up to 200 m from large, contiguous patches. Each *C. fuscum* population may be composed of a series of subpopulations with regular migration between subpopulations.

HABITAT

Habitat requirements

Because of the relationship of *Copablepharon fuscum* with its host-plant, *Abronia latifolia*, habitat requirement information is provided for both species in this section.

Copablepharon fuscum habitat requirements

C. fuscum occurs in association with *A. latifolia* in spits, dunes and other sand-dominated coastal sites. These sites occur where coastal erosion and transport of glacially derived sand deposits has created and sustained large depositional coastal features (e.g., dunes, spits, etc.) over the long term. Sand-dominated coastal sites are generally rare in B.C. and are typically clustered spatially because of shared physiographic conditions and coastal processes.

The specific habitat requirements of *C. fuscum* are poorly understood. Available information on its habitat requirements is based on Troubridge and Crabo's (1996) species description, personal observations made by N. Page and published information on coastal dune ecosystems. Three points are noteworthy:

1. *C. fuscum* has consistently been found in close spatial association with *A. latifolia*. The moth and the plant appear to have a parasite/host relationship. *C. fuscum* has not been captured in a variety of coastal sites lacking *A. latifolia*. Similarly, *C. fuscum* has not been captured more than 25 m from *A. latifolia* plants.
2. Anecdotal observations indicate that *A. latifolia* is used for all phases of *C. fuscum*'s lifecycle: adult nectaring, egg-laying and larval development. While other polyphagous moths and insects use *A. latifolia* flowers for nectaring or feed on the leaves as larvae, *C. fuscum* is considered a monophagous species with high fidelity to its host-plant. Few other plant species found in coastal beaches have the combined resources (i.e., large, nectar-rich flowers and succulent leaves) found in *A. latifolia*.
3. Only large, flowering patches of *A. latifolia* appear to support *C. fuscum*. Estimates of *A. latifolia* patch size (visual estimates of total foliar cover in m^2) and the presence/absence of *C. fuscum* in these patches suggests that *C. fuscum* is only found above a threshold of resource availability. *C. fuscum* was only present in sites where the total foliar cover of *A. latifolia* was greater than 400 m^2. The total *A. latifolia* cover in the three Canadian sites with *C. fuscum* was estimated 450 m^2, 620 m^2 and 680 m^2 respectively based on field visits and air photo assessment. Host-plant quality and density also appears to be important for sustaining populations. *C. fuscum* was not captured or observed in sites or portions of sites with diffuse or non-flowering *A. latifolia*

patches. For example, light-trapping in a grass-dominated meadow with remnant *A. latifolia* plants on San Juan Island did not result in capture of *C. fuscum* despite its presence in nearby open dune areas. Thresholds of resource availability for population persistence have been demonstrated for other insects (Forare and Solbreck, 1997; Grez and Gonzalez, 1995).

Abronia latifolia habitat requirements

Abronia latifolia is a long-lived perennial plant with distinctive prostrate growth form, bright yellow umbellate flowers and succulent leaves, stems and roots (Tillet, 1967; Wilson, 1972) (Figure 6a). It is found in coastal, sand-dominated habitats that lack dense herbaceous or bryophyte plant cover (Figure 6b and c). *A. latifolia* is endemic to the Pacific Coast of North America and is distributed from Santa Barbara County, California to the Queen Charlotte Islands, British Columbia (Tillett, 1967; Barbour and Breckon, 1974). In Canada, *A. latifolia* is restricted to dunes and sandy spits, islands and beaches in the Strait of Georgia, the west coast of Vancouver Island and the Queen Charlotte Islands. A review of herbarium records in British Columbia and intensive fieldwork by N. Page in 2001 and 2002 indicated that *A. latifolia* has been recorded or observed at approximately 25 sites in British Columbia (Page, 2003) (see Figure 5). It is currently designated by the BC Conservation Data Centre with a global rank of G5 ("demonstrably widespread, abundant and secure") and a provincial rank of S3 ("vulnerable to extirpation or extinction") (BC Conservation Data Centre, 2002).

Two spatial patterns have been observed in local-scale *A. latifolia* distribution: 1) small patches or isolated plants often occur near the margin of the upper beach where water-dispersed seeds are deposited; and 2) contiguous or isolated patches occur on beach ridges and open dunes (Figures 6b, c and e) (Wiedemann, 1984). These patches can be either sparse (2-25% cover (Figure 6e)) or dense (>25% cover (Figure 6b)). *C. fuscum* was only captured in dense patches by N. Page in 2000–2001.

A. latifolia can be considered either a beach or dune obligate-species and is found near sea-level (Tillet, 1967; Wiedemann et al., 1999). Only two of more than twenty-five sites with *A. latifolia* observed in the 2000-2001 study were located more than 5 m above the high tide line: one had extensive populations above 50 m asl on a sand-dominated coastal prairie, while the other had a small population approximately 15 m asl on a coastal bluff. In only one site was *A. latifolia* found more than 100 m from the shore.

A. latifolia populations are maintained by the unique natural disturbance regime of coastal sites that sustains open sand areas through wave, tide and wind disturbance. Observations by N. Page suggest that vigour and flowering decline when the sand stabilization promotes development of bryophyte or herbaceous communities. *A. latifolia* is sometimes found in grass-dominated areas; however, flowering and growth is only vigorous in patches where *A. latifolia* is the dominant species on open sand. It is not known if the lower growth rate and flowering is caused by reduced light, competition for soil resources (e.g., nutrients, water), or other factors. Succession in dunes is generally initiated by surface stabilization by bryophytes followed by development of grass- and shrub-dominated communities (Kumler, 1969; Page, 2003).

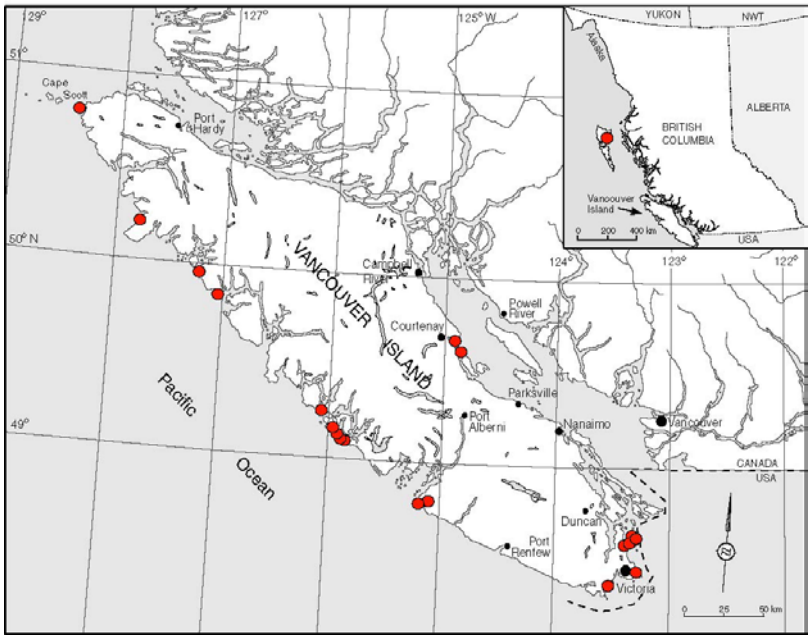

Figure 5. Distribution of *Abronia latifolia* in southern British Columbia based on herbarium records and field sampling. One site in the Queen Charlotte Islands is shown in the smaller map to the top right. Populations in Washington are not shown.

Based on the 2000-2001 study, *A. latifolia* occurs in sites with sand soils (dominant particle size is 0.25 – 0.15 mm) that are weakly acidic (pH 5.5 to 6.3) and nutrient poor (total nitrogen <0.01%) (Page, 2003). This is characteristic of sandy dune soils that experience precipitation-induced leaching and soil development (Ranwell, 1972). *A. latifolia* has unique adaptations to this environment, including deep tap roots with high water storage capacity, prostrate growth and succulent leaves with thick epidermis.

The leaves and flowers of *A. latifolia* are a rich resource for a variety of moths and other insects. *A. latifolia* flowers from early May to early October and peaks in June and July. Numerous browsing scars (Figure 6g) were observed in all *A. latifolia* populations regardless of whether *C. fuscum* was present. A total of 18 moth species were captured in light-traps with *C. fuscum* by N. Page in 2000–2001.

Based on the lack of seeds in *A. latifolia* seed husks in a variety of sites, seed predation appears to be high. Alternately, poor pollination or other factors may reduce seed set. *C. fuscum* may be an important pollinator of *A. latifolia* in some sites, particularly given its long proboscis; however, successful pollination of *A. latifolia* in many sites lacking *C. fuscum* indicates that their relationship is not an example of exclusive mutualism as occurs in yucca moths (*Parategeticula* spp., *Tegeticula* spp.).

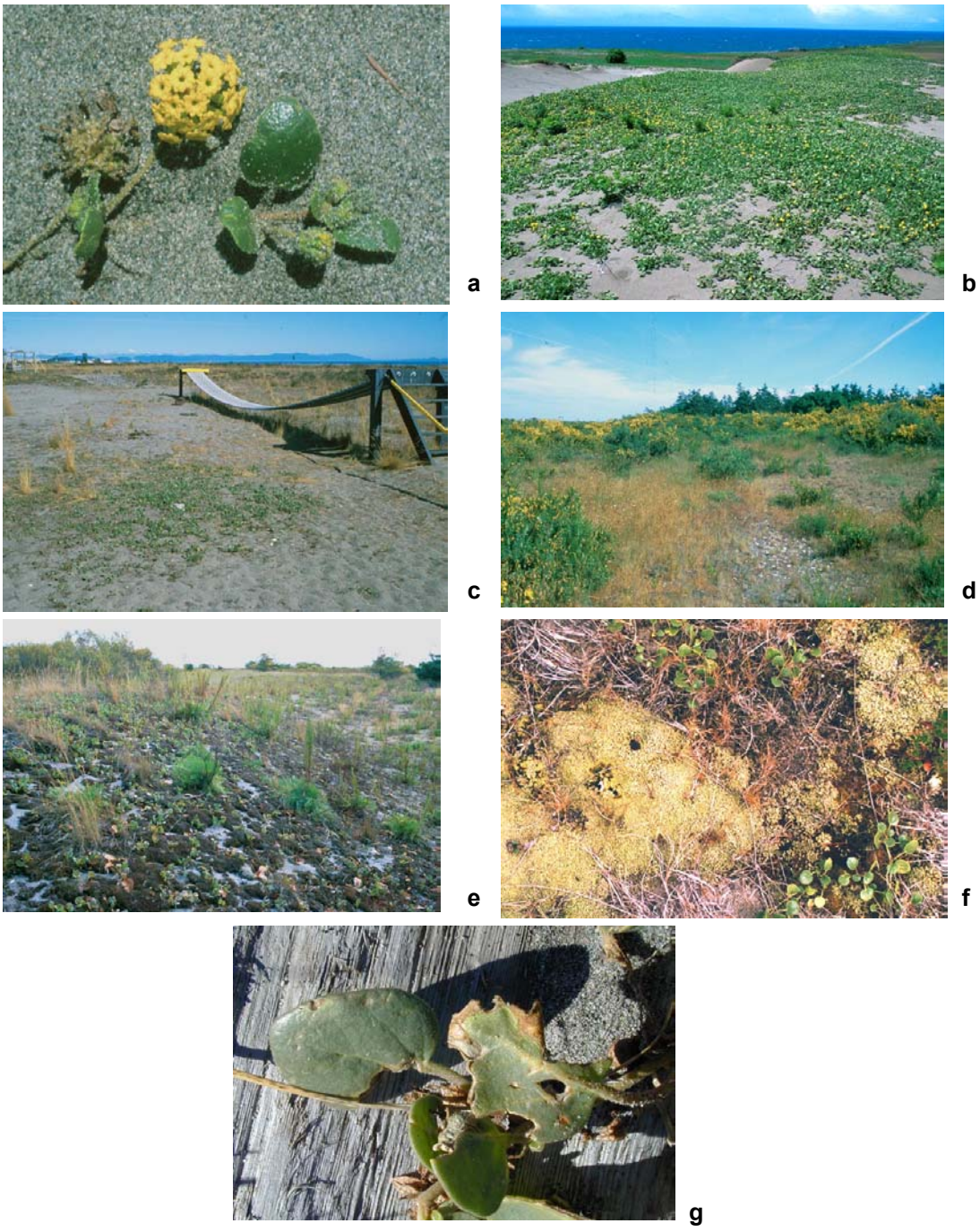

Figure 6. Photographs of *A. latifolia* plants and habitat: a) flower and leaves; b) dense patch on sand ridge; c) small patch in disturbed open sand; d) broom and grass stabilization on former open dune; e) sparse *A. latifolia* on stabilized dune ridge; f) non-flowering *A. latifolia* amongst bryophyte matt; g) browsing damage from herbivorous insects. All photos by N.A. Page.

Habitat trends

Sand-dominated coastal sites in British Columbia have been rapidly and extensively modified throughout the known range of *C. fuscum* over the past 100 years. Detrimental effects vary in intensity and range from recreational disturbance, construction of roads and buildings, modification of disturbance regimes (e.g., shoreline armouring) and vegetation stabilization. Dunes, spits and other sparsely vegetated communities were the most poorly represented of seven sensitive ecosystem types that were inventoried on southeastern Vancouver Island between 1993 and 1997; only 39.5 ha of dune and 111.3 ha of spit were identified by air photo analysis and field assessment (Ward *et al.*, 1998).

Progressive loss of open sand habitats from vegetation stabilization is the primary cause of habitat decline for *C. fuscum* in Canada. Sand-dominated coastal sites develop from sand accretion which is controlled by sediment transport processes (Thomson, 1981). Vegetation stabilization rates show similar temporal variability, and the recent stabilization trend in many dunes and spits in the Strait of Georgia may reflect a period of reduced sediment transport. It is more likely, however, that much of the recent vegetation stabilization is caused by anthropogenic impacts. In particular, the introduction of invasive exotic plant species, such as *Cytisus scoparius* (Scotch broom) and a variety of exotic grasses (e.g., *Bromus tectorum, Ammophila arenaria, Dactylis glomerata, Holcus lanatus, Bromus hordeaceus, Vulpia myuros, Anthoxanthum odoratum*), have accelerated stabilization. Native mosses (*Tortula ruralis, Racomitrium canescens, Ceratodon purpureus* and *Bryum capillare*) function in concert with vascular plants rapidly colonizing the sand surface. *C. scoparius* is the most important of the exotic species in sand-dominated coastal sites because of its rapid growth and ability to fix nitrogen in low fertility sand soils (Parker, 2002). *A. arenaria*, a widespread invasive grass species of outer west coast beaches from B.C. to California (Wiedemann and Pickart, 1996), is also present in some dune sites in the southern Strait of Georgia. Increased log debris in some coastal sites may also contribute to stabilization.

Direct habitat loss from land development (e.g., roads, buildings, etc.) or recreational use has also caused habitat decline. Recreational uses may have contributed to localized damage to *A. latifolia*, although in other areas limited disturbance has maintained open sand areas.

Finally, it is difficult to evaluate if changes to coastal sediment transport have affected sites with *C. fuscum* populations. Shoreline modifications, including erosion protection, may reduce sand supply and change transport and deposition patterns. This may contribute to stabilization of dunes.

Historic air photos were used to evaluate land cover change in the three Canadian sites in which *C. fuscum* occurs. Photos were scanned, adjusted to a common scale, and land cover types (urban, tree and shrub, grass and bryophyte, and open dune) were measured. For the two northern sites, photos from 1957 were compared to 1995 or 1997 photos. For the southern site, photos from 1932 were compared to 1995.

Table 1. Changes in total area and land cover in *C. fuscum* population sites.

Site	Date	Total Area	Urban	Forest/Shrub	Grass/Bryophyte	Open Dune
Site 1 (Comox area, B.C.)	1957	27.5	2.6	3.5	17.0	4.4
	1997	28.2	9.2	8.2	8.8	2.2
Change (ha.)		+0.7	+6.6	+4.7	-8.8	-2.2
Site 2 (Comox area, B.C.)	1957	5.4	0.0	1.3	3.3	0.8
	1996	5.4	0.0	1.9	3.1	0.4
Change (ha.)		0.0	0.0	+0.6	-0.2	-0.4
Site 3 (near Sidney, B.C.)	1932	6.8	0.0	0.5	4.0	2.3
	1995	6.9	0.0	1.6	3.5	1.8
Change (ha.)		+0.1	0.0	+1.1	-0.5	-0.5

In general, all three sites show relatively little overall change in total area and similar, but variable, loss of open dune habitat (Table 1). Two sites enlarged slightly (0.7 ha and 0.1 ha increases) because of sand accretion, while the other remained stable. Open dune areas declined in all sites; two sites lost 50% of their open dune area (loss of 2.2 and 0.4 ha), while the other lost 21% (loss of 0.5 ha). Grass and bryophyte areas also declined in all sites; one site lost over 52%, while the others lost 6% and 13%. Forest and shrub cover increased substantially in all sites: 134% in one site, 46% in another and 220% in the third (gain of 4.7, 0.6 and 1.1 ha). Only one site has urban land use and increased from 2.6 ha to 9.2 ha (254% increase) since 1957.

Protection/ownership

Ownership and protection status of Canadian sites with *C. fuscum* populations is variable, but all have some form of public ownership (Table 2). None are privately owned. Relative to many species of conservation concern, a high proportion of *C. fuscum* habitat is located within parks or other publicly owned lands. One site recently transferred to Parks Canada has a relatively large population of *A. latifolia*, but sampling for *C. fuscum* did not result in the capture of any specimens.

US sites with *C. fuscum* populations also have a high level of public ownership: one site is in a national park, one is in a wildlife refuge, two are in state parks and one is in a military reserve.

Table 2. Ownership of sites with *C. fuscum* populations in Canada.

Site	Park	Indian Reserve	Other Federal Land (DND)	Private Land	Total Area[1]
Site 1 (Comox area, B.C.)	1.5 ha (park)	5.6 ha	21.1 ha	0.0 ha	28.2 ha
Site 2 (Comox area, B.C.)	5.4 ha (park)	0.0 ha	0.0 ha	0.0 ha	5.4 ha
Site 3 (near Sidney, B.C.)	0.9 ha (reg park) 1.8 ha (mun. park)	4.2 ha	0.0 ha	0.0 ha	6.9 ha

[1]Total Area includes the entire site rather than just the portion in which *C. fuscum* has been captured or *A. latifolia* has been observed.

BIOLOGY

General

The biology of *Copablepharon fuscum* is poorly understood. No detailed studies have been undertaken since the species was described in 1995. This summary is based on published sources (Troubridge and Crabo, 1996; Tatum, 2002), observations made during sampling and inferences from general moth biology.

Adults have been observed or captured during dusk and early night between May 19 and July 1 on or near flowering *A. latifolia* plants. The flight season is estimated to be approximately 45 to 55 days and appears to peak around June 10, based on the midpoint between the earliest and latest recorded capture date. Adults may live between 5 to 14 days (J.T. Troubridge pers. comm., 2002). The moth has one flight season per year.

Adults have been observed intently nectaring on *A. latifolia* flowers. *C. fuscum* has a long proboscis that allows it to access nectar within the trumpet-shaped flower of *A. latifolia*. Mating has not been observed. Observations indicate that eggs are laid singly or in groups on the composite inflorescence of *A. latifolia* or on adjacent leaves (Troubridge and Crabo, 1996). Larvae hatch after approximately 2 weeks and feed on the leaves of *A. latifolia*. Feeding initially focuses on leaf-mining within the leaf epidermis and subsequently on the exterior of the leaves as the larvae mature. Feeding was not observed during the day and is believed to be exclusively nocturnal (Troubridge and Crabo, 1996). Larval feeding and growth slows with declining ambient temperature, and larvae remain dormant during the winter in the sand below *A. latifolia* patches. Larvae that were captured and raised artificially emerged to feed on new flower buds in late April and early May (J. Tatum, pers. comm., 2002). Pupation appears to occur in late April to the end of May and lasts approximately 10 days.

Reproduction

Very little is known about the reproduction of this species including mating behaviour (e.g., pheromones, mate selection, etc.). Reproduction occurs once per year. Mating commences as early as May 15, peaks around June 10 and finishes by late June. Eggs are deposited singly or in small groups on the inflorescence or leaves of *A. latifolia* (J.T. Troubridge pers. comm., 2002). Sex ratios in collections are generally evenly split (J.T. Troubridge pers. comm., 2002).

Survival

Annual and longer-term survival rates are unknown. There is no information on predation, intra- or inter-specific competition, stochastic effects such as climate or disturbance, disease or other factors that may reduce survival of *C. fuscum*.

Physiology

C. fuscum flies during the onset of warmer weather in late spring and maximizes its larval growth during July and August. The larvae overwinter in the sand, although conditions of dormancy (e.g., depth of burial) or other overwintering strategies are unknown. Larvae may use warmer periods during the fall and spring to feed briefly on *A. latifolia* leaves (J. Tatum pers. comm., 2002). It is unknown how seasonal temperature changes affect adult flight periods, mating or larvae survival. In June 2002, adults were captured during unseasonably cool, windy weather at two sites in Puget Sound.

Climate may be an important limiting factor for *C. fuscum* distribution. No occurrences have been recorded on the west coast of Vancouver Island despite the presence of *A. latifolia* in dunes and beaches. The west coast of Vancouver Island has a hypermaritime climate with slightly cooler summer and substantially higher winter precipitation compared to the southeast side (Phillips, 1990). It is not known how these differences affect the distribution of *C. fuscum*. Other *Copablepharon* species are restricted to arid regions.

Movements/dispersal

Dispersal abilities of *C. fuscum* have not been assessed and are difficult to infer from other species. Three points are important when assessing the potential dispersal abilities of *C. fuscum*:

1. Observations and trap records by N. Page made in 2002 indicate that *C. fuscum* is rarely found away from dense patches of flowering *A. latifolia* plants. Traps sited more than 25 m away from patches have not captured individuals.
2. In contrast, *C. fuscum* appears to be a strong flier. Moths disturbed during nectaring were often able to evade capture by hand net through rapid flight. Moths also flew strongly in winds between 5 and 15 km/hour. Noctuid moths are generally good dispersers, and a mark-recapture study in Finland found dispersal distance as high as 30 km, although average distances were around 100 m (Nieminen, 1996).
3. Satellite patches of *A. latifolia* located away from the central patch also supported *C. fuscum* at some sites. Based on observations of isolated, small *A. latifolia* patches, these satellite patches are unlikely to support *C. fuscum* over the long term. Population persistence is therefore likely maintained by colonists from the central patch.

In summary, recolonization of Canadian populations from known US populations is unlikely. The closest known population to the southern Canadian sites is 33 km away over water. However, many noctuids are good dispersers, and more detailed information is required to assess recolonization ability.

Nutrition and interspecific interactions

C. fuscum relies on *A. latifolia* for adult and larval nutrition. The relationship is considered a parasite/host association.

A. latifolia has dense, sticky, glandular trichomes on the leaves and stems that may serve to reduce herbivory by insects. The chemical defenses of *A. latifolia* and specific adaptations of *C. fuscum* to avoid their effects are unknown.

There is no indication that *C. fuscum* is able to use alternate host-plants. Most dunes support a small group of distinctive plant species (e.g., *Glehnia littoralis* spp. *leiocarpa, Carex macrocephala, Convolvulus soldanella, Poa macrantha, Polygonum paronychia*) that are not similar to *A. latifolia* in terms of flower or leaf structure. Captive raised larvae rejected other plant material, and fresh *A. latifolia* leaves and stems were required for successful rearing (J. Tatum pers. comm., 2002).

Behaviour/adaptability

Behaviour, other than the lifecycle observations described previously, is unknown.

Some monophagous insects are able to change host-plants, often to related species (Young, 1997). However, there is no indication that *C. fuscum* has diversified to use other host-plants for adult nectaring or larval feeding. As well, there are no plant species closely related to *A. latifolia* in the Georgia Basin / Puget Sound region.

C. fuscum appears to be tolerant of direct human activities. Adult moths were captured near low-use roads at several sites.

C. fuscum was raised successfully from young larvae to adults (J. Tatum pers. comm., 2002). Rearing required frequent addition of new *A. latifolia* leaves for feeding. No *C. fuscum* population transplants have been attempted but would likely be successful if adequate host-plant resources were provided.

POPULATION SIZES AND TRENDS

There is no quantitative information on population sizes and trends for *Copablepharon fuscum*. Its relatively recent description and the inherent difficulty in assessing population sizes, variability and trends in rare, nocturnal insects has greatly reduced the potential for detailed population information. Light-trap captures provide a biased estimate of relative population size and are inappropriate for characterizing population density within or between sample sites. In general, moth population densities vary widely between species and it is difficult to extrapolate total population sizes from published values: 0.1 adults per m^2 is noted as an average density in habitat patches (Hanski *et al*., 1994); however, densities vary between 0.0001 and 10.0 adults per m^2 (Nieminen, 1996). Based on hand-searching for mature larvae in sand beneath dense

Abronia latifolia patches at two sites, population density of *C. fuscum* varied from about 0.2 moths per m^2 to 6 moths per m^2 (J. Troubridge, pers. comm., 2002). Total population size based on these density estimates is 350–10,500 adult moths in Canada.

Changes in the distribution and abundance of *A. latifolia* may be useful in inferring *C. fuscum* population trends. This relies on the assumption that *C. fuscum* population size is related to the quantity (m^2) and quality (foliar or flower density) of *A. latifolia*. This assumption is supported by population sampling on moth species in other areas (Forare and Solbreck, 1997; Nieminen, 1996).

Based on a review of herbarium records and field assessment, the number of *A. latifolia* occurrences in Canada is stable. One population has been extirpated recently: *A. latifolia* was recorded in the Cheewhat dunes south of Nitinat Lake on the west coast of Vancouver Island in 1979 (Turner *et al*., 1983) but was not observed in 2001. Several additional sites in the Victoria area have also been extirpated; however, they were considered small transitory occurrences that do not provide habitat for *C. fuscum* populations.

In contrast, the size and health of *A. latifolia* populations in many Canadian sites has likely declined substantially in the past 50 years because of the vegetation stabilization trends described previously. *A. latifolia* appears to decline in vigour and flower density where competition from other vascular plants and bryophytes occurs. While vegetation stabilization occurs as a result of natural successional change in sand-dominated coastal sites, anthropogenic impacts have likely increased the rate of successional change.

In summary, both *A. latifolia* and *C. fuscum* populations in Canada appear to be declining because of habitat loss and change. The rate of decline is likely accelerating as open dunes are affected by vegetation stabilization, land development and recreation.

LIMITING FACTORS AND THREATS

The following factors are important for contextualizing the limiting factors and threats to *Copablepharon fuscum* in Canada:

Habitat loss

The primary threat to *C. fuscum* is the reduction in the quantity and quality of host-plant resources as a result of loss of, or change to, open sand habitats. As noted previously, this is primarily caused by vegetation stabilization. Direct disturbance from human development and recreational use are considered secondary threats but may have substantial local impacts. Long-term maintenance of *C. fuscum* populations will require chronic natural disturbance to maintain *Abronia latifolia* populations in open sand areas or new sand deposition in which seedling colonization can occur.

Host-plant specificity

Host-plant specificity may be an important measure of extinction risk in moths (Nieminen, 1996). Indeed, Nieminen (1996), noted: “the pattern of population extinction in moths is affected by host-plant characteristics rather than by the characteristics of the moths themselves”. He found that monophagous moths were more likely to suffer extirpation or extinction than polyphagous species.

Collecting

The collecting of specimens has likely had a very minor effect on total population size in *C. fuscum*. However, research collections should avoid unnecessary or concentrated collecting. Recreational collecting is inappropriate.

Population structure

C. fuscum populations are spatially isolated. Ecological theory predicts that population extinction risk is reduced with increasing numbers of subpopulations (Hanski, 1982). This outcome is generally related to the “rescue effect” that allows multiple populations to avoid stochastic or deterministic extinctions through immigration. It relies on the dispersal ability of species to allow recolonization following population extirpation. As noted previously, it is unclear if between-site dispersal is important for *C. fuscum* population persistence. It is unlikely that recolonization from known US populations could occur naturally if Canadian populations were extirpated.

Btk

Btk is a commercial pest-control product used to control North American gypsy moth (*Lymantria dispar*). It uses spores of a naturally occurring pathogenic bacteria (*Bacillus thuringiensis* var. *kurstaki*) applied aerially to kill target and nontarget butterflies and moths as larvae. It has been used in the Victoria and Vancouver area on a localized basis. It has not been used near *C. fuscum* populations to date, but it could pose a serious risk.

Climate change

The potential effects of climate change on *C. fuscum* are complex. Climate change may be associated with sea-level rise which could threaten coastal dune habitats directly. However, accelerated coastal disturbance and sediment transport associated with increased storm frequency may result in increased development of open sand habitats, which would have a positive effect.

Conservation concerns in similar species

It is noteworthy that a closely related species, *Copablepharon hopfingeri* Francl., is the only moth species known to have been extirpated from western Canada (Lafontaine

and Troubridge, 1998). It historically occurred in a small site with sandy soils at Brilliant, B.C. (near Castelgar). This loss may indicate that other *Copablepharon* species are similarly sensitive to habitat change.

Copablepharon longipenne Grote occurs on unstable dune systems on the northern Great Plains. As a result of extensive agriculture and control of prairie fires, this habitat has been drastically reduced in the last century (J. Troubridge, pers. comm., 2002). The moth is still common on the Great Sand Hills of southwestern Saskatchewan, where grazing by cattle has helped to retard stabilization of these dunes (J. Troubridge, pers. comm., 2002). All known *Copablepharon* species are associated with sandy, dune habitats. Three species occur (or did so) in Alberta and Saskatchewan: *Copablepharon grande* (Strecker), *C. longipenne* and *Copablepharon viridisparum* (Dod).

The Canadian distributions of several other species of noctuid moths (*Apamea maxima* (Dyar), *Oligia tusa* (Grote), *Trichoclea edwardsii* Smith, *Lasionycta wyatti* (Barnes & Benjamin), *Lasionycta arietis* (Grote), *Agrotis gravis* Grote and *Euxoa wilsoni* (Grote)) are restricted to coastal beaches in British Columbia (Troubridge and Crabo, 1996). Although restricted to coastal beaches, the global distribution of these species is much greater than that of *C. fuscum*: *A. maxima*, *O. tusa*, *L. wyatti*, *L. arietis*, *E. wilsoni* and *A. gravis* occur commonly on beaches from central California to British Columbia and persist despite stabilization of the dunes on the outer coast. *T. edwardsii* occurs on coastal and interior dunes in southern California, is apparently absent from the outer coast of northern California, Oregon, Washington and British Columbia, but occurs with *C. fuscum* on sandy beaches within the Strait of Georgia and Puget Sound.

SPECIAL SIGNIFICANCE OF THE SPECIES

Copablepharon fuscum is endemic to coastal sites in the Strait of Georgia region of British Columbia and adjacent areas in the Puget Sound region of Washington. It is a monophagous species that relies on *Abronia latifolia*, a regionally rare plant species of coastal dunes and beaches, for food and reproduction. While this type of host/parasite relationship is not unique, the habitat specialization of both species increases its conservation significance. It may also reduce the resilience of *C. fuscum* to anthropogenic or stochastic change.

No traditional knowledge, including use for crafts or for medicine, has been discovered for *C. fuscum*. The roots of *A. latifolia* were used by the Clallam and Makah First Nations for food (Gunther, 1973).

EXISTING PROTECTION OR OTHER STATUS

The protection status of *Copablepharon fuscum*, *Abronia latifolia* and dune plant communities is presented in this section.

Copablepharon fuscum

No national, provincial or state jurisdictions have designated the protection status of *C. fuscum* (NatureServe, 2002). It is not listed in the BC Conservation Data Centre's database or in the international database maintained by NatureServe (NatureServe, 2002). Staff from BC Parks and Capital Regional District Parks is aware of the presence of *C. fuscum* in parks in the respective jurisdictions, but there are no formal protection measures in place. One site with a relatively large population of *A. latifolia* but without a confirmed population of *C. fuscum* has recently been added to the Gulf Islands National Park Reserve and will be managed by Parks Canada.

Abronia latifolia

A. latifolia is listed by the BC Conservation Data Centre as G5 S3 which indicates it is vulnerable to extirpation or extinction provincially but is considered secure globally (BC Conservation Data Centre, 2002a). It is not listed by the Washington Natural Heritage Program (Washington Department of Natural Resources, 2002).

Dune plant communities

Dune plant communities were recently designated by the BC Conservation Data Centre as part of the *Provincial Rare Natural Plant Community Red and Blue List* (BC Conservation Data Centre, 2002b). They are included under the plant association "*Carex macrocephala* Herbaceous Vegetation" which is currently listed as S1S2 (Red List). The *Sensitive Ecosystems Inventory of Southeastern Vancouver Island and Gulf Islands* grouped dune and spit vegetation under the "Sparely Vegetated Sensitive Ecosystem Type" (Ward *et al.*, 1998). The Washington Natural Heritage Program lists several coastal plant communities under "High-Quality Plant Communities and Wetland Ecosystems". They include "Coastal Spit with Native Vegetation" (Washington Department of Natural Resources, 2002).

Portions of all sites in Canada where *C. fuscum* occurs are protected as provincial or regional parks. One population is fully encompassed within a provincial park. Four of five populations in Washington State occur in sites with some degree of park protection: two are located in state parks, one in a US Fish and Wildlife National Wildlife Refuge, and the last is situated within a National Historic site. The remaining population is located in a military reserve.

The *Park Act* of British Columbia prevents the collection of plants or animals from provincial parks without a park use permit. This provides limited protection of *C. fuscum* and *A. latifolia* in one Canadian site.

SUMMARY OF STATUS REPORT

Copablepharon fuscum has been recorded in three sites in Canada. It is confined to sparsely vegetated, sand-dominated coastal sites with large patches of its host-plant, *Abronia latifolia*. Habitat for both species is regionally rare and has declined because of vegetation stabilization, human development and other factors. *A. latifolia*, and by association, *C. fuscum*, appears to be declining because of habitat-related impacts. The rate of decline is likely accelerating.

TECHNICAL SUMMARY

Copablepharon fuscum
Sand Verbena Moth Noctuelle de l'abronie des dunes
Range of Occurrence in Canada: Georgia Basin region, southwestern British Columbia

Extent and Area Information	
• *Extent of occurrence (EO)(km²)*	3700 km^2 in Canada, 4850 km^2 globally
• *Specify trend in EO*	Unknown; likely stable
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)*	+/- 5 km^2 in Canada <25 km^2 globally
• *Specify trend in AO*	Unknown; likely declining
• *Are there extreme fluctuations in AO?*	No
• *Number of known or inferred current locations*	3 in Canada; 8 globally
• *Specify trend in #*	Unknown; stable in short-term; declining in long-term?
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Declining
Population Information	
• *Generation time (average age of parents in the population)*	1 year.
• *Number of mature individuals*	Unknown (range of 350 to 10,500 based on a range of 0.2 to 6.0 moths/m^2 of *A. latifolia*)
• *Total population trend:*	Unknown but likely declining.
• *% decline over the last/next 10 years or 3 generations.*	Unknown.
• *Are there extreme fluctuations in number of mature individuals?*	Unknown but likely yes (based on other insects)
• *Is the total population severely fragmented?*	Yes.
• *Specify trend in number of populations*	Unknown; stable in short-term; declining in long-term
• *Are there extreme fluctuations in number of populations?*	No
List populations with number of mature individuals in each:	Near Comox, B.C. Pop 1 Near Comox, B.C. Pop 2 Near Sidney, B.C. Pop 3 Number of mature individuals unknown.
Threats (actual or imminent threats to populations or habitats)	
- reduction in quantity and quality of host-plant resources from stabilization or degradation of open sand habitat. This includes exotic plant species colonization, recreation disturbance, development of roads, buildings, etc., and changes to sand supply or transport. The risk of disease, predation, or other biotic threats to either *C. fuscum* or *A. latifolia* is unknown. - potential threats include pesticide use in or adjacent to population sites and loss of habitat from sea-level increases associated with climate change. - collecting or other forms of direct human-caused mortality are considered low.	

Rescue Effect (immigration from an outside source)	Low
• *Status of outside population(s)?* USA: Unknown; likely declining	
• *Is immigration known or possible?*	Possible, but very unlikely
• *Would immigrants be adapted to survive in Canada?*	Yes
• *Is there sufficient habitat for immigrants in Canada?*	Unknown
• ***Is rescue from outside populations likely?***	Highly unlikely
Quantitative Analysis	Not undertaken because of lack of data

Author: N.A. Page, May 2003
Sources of information: status report

Current Status

COSEWIC: No previous COSEWIC designation

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code:** B1ab(ii,iii,iv,v) +2ab(ii,iii,iv,v)

Reasons for Designation: The global population of this moth is very small and occurs in a very restricted range. The Canadian population, occurring at only three small sites, is even smaller and more restricted. The moth and its host-plant are habitat specialists dependent on coastal dunes, a rare habitat along the West Coast. This habitat has undergone extensive losses due to stabilization of open dunes (including the introduction of invasive plant species), development and recreational use. The host-plant and therefore the moth are facing the threat of continuing declines due to the loss and degradation of coastal dunes.

Applicability of Criteria

Criterion A (Declining Total Population):
- cannot be applied as there have not been any previous population estimates and so it is not possible to quantify declines.

Criterion B (Small Distribution, and Decline or Fluctuation):
- the EO is <5,000 km^2 (B1);
- the AO is << 500 km^2 (B2);
- the population is severely fragmented and is known to exist at 3 sites between which there is believed to be no, or very little, genetic exchange (a);
- there is evidence for continuing declines in area and quality of habitat, number of locations and number of mature individuals – all related to loss/degradation of the larval hostplant and its habitat (b)(ii - v);
- the population likely undergoes extreme fluctuations in numbers of mature individuals (c)(iv), but there is no hard evidence for this.

Criterion C (Small Total Population Size and Decline):
- the number of mature individuals is <10,000;
- there is no quantitative information enabling a calculation of decline rate;
- a continuing decline in the number of mature individuals is inferred because of continuing habitat degradation (C2);
- population fragmentation exists and no population consists of >1,000 mature individuals (a)(i);
- and extreme fluctuations in the number of mature individuals are suspected (b).

Criterion D (Very Small Population or Restricted Distribution):
- the total number of mature individuals in likely >1,000
- the AO is <20 km^2 and the species occurs at <5 locations (D2).

Criterion E (Quantitative Analysis):
- the available information is insufficient to do a quantitative analysis of the probability of extinction.

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Nick Page is an ecologist who has worked on the assessment and management of streams, wetlands and plant communities in south coastal British Columbia for 10 years. He recently completed a Master of Science degree in the Institute for Resources, Environment, and Sustainability at the University of British Columbia. His thesis focused on regional- and local-scale effects of exotic plant invasion in beach vegetation of Vancouver Island, B.C. This is his first COSEWIC status report.

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COLLECTIONS EXAMINED

Specimens of *C. fuscum* are deposited in the following collections. All specimens have been identified by J.T. Troubridge.

Canadian National Collection of Insects and Arachnids, Ottawa, Ontario, Canada.
United States National Collection, Smithsonian Institution, Washington, D.C., USA.
Oregon State University, Corvallis, Oregon, USA.
J.T. Troubridge personal collection, Ottawa, Ontario, Canada.
L.G. Crabo personal collection, Bellingham, Washington, USA.

Appendix 1. Initial Description of the *Copablepharon fuscum* (Lepidoptera: Noctuidae) (reprinted from Troubridge and Crabo, 1996 [1995])

Description

Adult

Males and females similar. Eyes round. Frons smooth. Antennae ciliate, dorsal surface with white scales; scape white with small patch of golden brown scales dorsally. Palpi white, second segment with a small patch of gray scales dorsally. All tibiae with stout setae. Head and thorax golden brown, base of thoracic collar and edges of tegulae paler. Forewing length 17-19 min. Forewing ground colour golden brown, slightly darker than thorax; trailing margin darker gray-brown; costa and anal margin white; medial vein and MI edged posteriorly with a pale yellow line, this line edged posteriorly within discal cell with a black line which follows vein M2 to within 2 mm of margin; a diffuse black line follows vein R5 to within 2 mm of margin; a second pale yellow line borders the cubital vein and vein CuA2; postmedian line a series of black dots on veins; fringe concolourous with forewing basally, white to pale gray-brown distally. Hindwing dark gray-brown, fading to very light gray or white basally; fringe white in distal half, dark gray-brown basally. Undersurface of wings predominantly dark gray, light gray on hindwing base and along forewing costa, vein M2 distal to cell and anal margin.

Male genitalia

Uncus curved, thin, tapered distally. Tegumen broad with penicillus lobes. Juxta broad, flat. Clavi long, cylindrical, slightly expanded distally. Valve 4X as long as wide, rounded distally, widest distal to sacculus due to triangular process of ventral margin; corona present; sacculus 2/5X length of valve; clasper as long as valve width, parallel to dorsal valve, broadest at base, tip curved slightly dorsad, basal sclerite strong, joined to clasper proper at 90°angle; digitus very short. Aedoeagus 3X as long as wide with a long, thin extension onto inner curve of coiled vesica; inflated vesica spirals 360° ventrad and leftward to project distal to tip of aedoeagus, distal vesica bulbous, median diverticulum finger-like with a single spike-like cornutus at apex.

Female genitalia

Ovipositor lobes elongate, cone-shaped, covered with long and short setae; ductus bursae very rightly sclerotized, joined to posterior corpus bursae; bursa copulatrix bisaccate, without signa; corpus bursae straight, 4X as long as narrow, swollen anteriorly; appendix bursae joined to right side of posterior corpus bursae, curved 360' ventrad, its distal end swollen and fiddlehead-shaped; ductus seminalis joined to right side of distal appendix bursae.

Type specimens

Holotype male

USA, Washington, Island County, Deception Pass State Park, 26 May, 1995, Troubridge and Crabo in the Canadian National Collection (CNC). Paratypes (16 males, 18 females): 15 males, 15 females, same data as holotype; 1 female, 1 July, 1994, Saanichton, B.C., Troubridge; 1 male, 2 females, 1 July, 1995, Saanichton, B.C., Troubridge. Paratypes to be deposited in the CNC, American Museum of Natural History and United States National Museum.

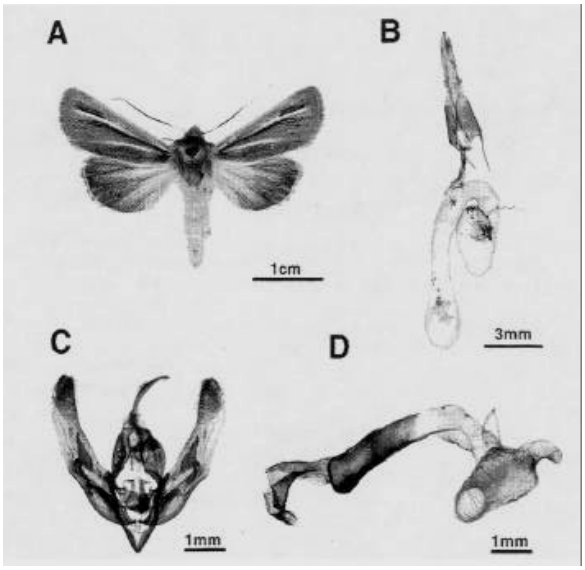

Figure 1. *Copablepharon fuscum*: A. holotype male; B. female genitalia; C. male genital capsule; D. aedoeagus and everted vesica.

Derivation of the name

The specific epithet is derived from the Latin word fuscus, which means dark or swarthy. This refers to the wing colour, which is unusually dark for the genus.

Diagnosis

Adults of *C. fuscum* are easily separated from all other species in the genus by their dark colour and the presence of the contrasting yellow and black forewing lines. It is the only species with a predominantly gray underside to both forewing and hindwing - the ventral forewing of other species may be dark, but their ventral hindwing is white or off-white. Structurally, *C. fuscum* is most closely related to *C. absidum* (Harv.). The male and female genitalia are nearly identical to those of *C. absidum*, but the clasper of *C. fuscum* is wider (ca. 0.16 mm near tip vs. 0.12mm in *C. absidum*) and is rounded distally, while that of *C. absidum* is slightly pointed.

Appendix 2. 2001 and 2002 moth sampling records from beaches, spits, and dunes in the Strait of Georgia, western Vancouver Island, Queen Charlotte Islands, and Puget Sound. Note: the names and coordinates for all sites with confirmed *Copablepharon fuscum* populations are not included for conservation reasons.

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
2001 Samples								
Goose Spit (west)	northern Strait of Georgia	49 39 40, 124 55 00	May 20, 2001	3	Noctuidae	*Apamea cinefacta*	(Grote, 1881)	1 Lighttrap
	(near Comox, B.C.)			1	Noctuidae	*Leucania insueta*	Guenée, 1852	
				1	Noctuidae	*Plusia nichollae*	(Hampson, 1913)	
				1	Noctuidae	*Egira perlubens*	(Grote, 1881)	
				1	Noctuidae	*Egira rubrica*	(Harvey, 1878)	
				1	Arctiidae	*Spilosoma virginica*	(Fabricius, 1798)	
Keeha Bay	Vancouver Island	48 47 04.1, 125 10 02.4	May 21, 2001	1	Noctuidae	*Scoliopteryx libatrix*	(Linnaeus, 1758)	1 Lighttrap
	(near Bamfield, B.C. within PRNPR)			1	Noctuidae	*Sideridis maryx*	(Guenée, 1852)	
				23	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Egira simplex*	(Walker, 1865)	
				7	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Pseudaletia unipuncta*	(Haworth, 1809)	
Wickaninnish Beach	Vancouver Island	49 01 15.8, 125 40 33.6	June 2, 2001	2	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	1 Lighttrap
	(near Tofino, B.C.)							
Not available	northern Strait of Georgia	Not available	June 11, 2001	2	Noctuidae	*Apamea cuculliformis*	(Grote, 1875)	
	(Comox area, B.C.)			7	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	
				3	Noctuidae	*Leucania insueta*	Guenée, 1852	
				1	Noctuidae	*Parabagrotis sulinaris*	Lafontaine, 1998	
Wickaninnish Beach	Vancouver Island	49 01 15, 125 40 33	June 12, 2001	4	Noctuidae	*Apamea maxima*	(Dyar, 1904)	1 Lighttrap
	(near Tofino, B.C.)			1	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				3	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Arctiidae	*Spilosoma virginica*	(Fabricius, 1798)	
				2	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Schooner Cove	Vancouver Island	49 03 58.3, 125 47 39.8	June 13, 2001	1	Sphingidae	*Smerinthus cerisyi*	Kirby	1 Lighttrap
	(near Tofino, B.C.)			1	Noctuidae	*Acronicta fragilis*	(Guenée, 1852)	
				1	Noctuidae	*Scoliopteryx libatrix*	(Linnaeus, 1758)	
				1	Noctuidae	*Sideridis maryx*	(Guenée, 1852)	
				3	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				10	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Pachena Bay	Vancouver Island	48 47 31.3, 125 06 55.9	June 14, 2001	11	Noctuidae	*Apamea maxima*	(Dyar, 1904)	1 Lighttrap
	(near Bamfield, BC)							
Not available	northern Strait of Georgia	Not available	June 18, 2001	1	Noctuidae	*Apamea cuculliformis*	(Grote, 1875)	1 Lighttrap
	(Comox area, B.C.)			3	Arctiidae	*Hyphantria cunea*	(Drury, 1773)	
				2	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	
				6	Noctuidae	*Leucania insueta*	Guenée, 1852	
				7	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				8	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				1	Noctuidae	*Diarsia rosaria*	(Grote, 1878)	
				1	Noctuidae	*Apamea scoparia*	Mikkola, Mustelin & Lafontaine, 2000	
				1	Noctuidae	*Discestra trifolii*	(Hufnagel, 1766)	
Cheewhat Beach dunes	west Vancouver Island	48 39 27.1, 124 48 34.4	June 21, 2001	1	Noctuidae	*Lasionycta arietis*	(Grote, 1879)	1 Lighttrap
	(near Nitinat Lake, B.C.)			6	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Notodontidae	*Oligocentria pallida*	(Strecker, 1899)	
				13	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Pantheidae	*Panthea virginaria*	(Grote, 1880)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Port Renfrew	west Vancouver Island	48 34 05.6, 124 24 11.0	June 26, 2001	1	Noctuidae	*Euplexia benesimilis*	McDunnough, 1922	1 Lighttrap
	(Port Renfrew, B.C.)			3	Noctuidae	*Mniotype ducta*	(Grote, 1878)	
				1	Noctuidae	*Leucania farcta*	(Grote, 1881)	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Port Renfrew	west Vancouver Island	“”	June 26, 2001 continued	1	Noctuidae	*Ochropleura implecta*	Lafontaine, 1998	
				3	Arctiidae	*Lophocampa maculata*	Harris, 1841	
				7	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				4	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				4	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Apamea plutonia*	(Grote, 1883)	
				1	Notodontidae	*Furcula scolopendrina*	(Boisduval, 1869)	
				2	Arctiidae	*Spilosoma virginica*	(Fabricius, 1798)	
Witty's Lagoon	southern Strait of Georgia (near Metchosin, B.C.)	48 23 10, 123 30 55	June 28, 2001	2	Notodontidae	*Clostera brucei*	(Hy. Edwards, 1885)	1 Lighttrap
				1	Noctuidae	*Lacinipolia cuneata*	(Grote, 1873)	
				1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				4	Noctuidae	*Leucania multilinea*	Walker, 1856	
				1	Noctuidae	*Lacanobia nr. atlantica*	undescribed	
Vargas North Dunes	Vancouver Island (Vargas Island)	49 11 24.4, 126 01 51.3	July 4, 2001	1	Noctuidae	*Trichordestra liquida*	(Grote, 1881)	1 Lighttrap
				1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				4	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Ahous Bay North	Vancouver Island (Vargas Island)	49 11 06.1, 126 00 44.0	July 5, 2001	1	Noctuidae	*Leucania farcta*	(Grote, 1881)	1 Lighttrap
				1	Noctuidae	*Trichordestra liquida*	(Grote, 1881)	
				13	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
Wickaninnish Beach	Vancouver Island (near Tofino, B.C.)	49 01 15.8, 125 40 33.6	July 18, 2001	1	Noctuidae	*Diarsia esurialis*	(Grote, 1881)	1 Lighttrap
				1	Noctuidae	*Ochropleura implecta*	Lafontaine, 1998	
				1	Noctuidae	*Spiramater lutra*	(Guenée, 1852)	
				31	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				2	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Notodontidae	*Furcula scolopendrina*	(Boisduval, 1869)	
				1	Pantheidae	*Panthea virginaria*	(Grote, 1880)	
				8	Noctuidae	*Euxoa wilsoni*	(Grote, 1873)	
				6	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Stubbs Island	Vancouver Island	49 09 44.3, 125 55 26.3	July 19, 2001	2	Noctuidae	*Leucania farcta*	(Grote, 1881)	1 Lighttrap
	(near Tofino, B.C.)			1	Noctuidae	*Oligia indirecta*	(Grote, 1875)	
				14	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Noctuidae	*Peridroma saucia*	(Hübner, 1803-08)	
				1	Arctiidae	*Spilosoma virginica*	(Fabricius, 1798)	
				5	Noctuidae	*Euxoa wilsoni*	(Grote, 1873)	
				24	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Sidney Spit	southern Strait of Georgia	48 38 38.9, 123 20 00.4	July 23, 2001	1	Noctuidae	*Leucania anteoclara*	Smith, 1902	1 Lighttrap
	(near Sidney, B.C.)			1	Noctuidae	*Noctua comes*	(Hübner, [1813])	
				23	Noctuidae	*Trichoclea edwardsii*	Smith, 1888	
				5	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				8	Noctuidae	*Leucania multilinea*	Walker, 1856	
				1	Noctuidae	*Euxoa tristicula*	(Morrison, 1876)	
				1	Noctuidae	*Oligia tusa*	(Grote, 1878)	
				1	Noctuidae	*Agrotis vancouverensis*	Grote, 1873	
				3	Noctuidae	*Euxoa wilsoni*	(Grote, 1873)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Whitesand Cove 1	Vancouver Island	49 15 41, 126 03 35	August 3, 2001	1	Noctuidae	*Syngrapha celsa*	(Hy. Edwards, 1881)	1 Lighttrap
	(Flores Island)			1	Noctuidae	*Diarsia esurialis*	(Grote, 1881)	
				1	Noctuidae	*Leucania farcta*	(Grote, 1881)	
				2	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Noctuidae	*Phlogophora periculosa*	Guenée, 1852	
				5	Noctuidae	*Euxoa wilsoni*	(Grote, 1873)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
Whitesand Cove 2	Flores Island	49 15 40, 126 03 35	August 4, 2001	1	Noctuidae	*Pseudohermonassa*	(Smith, 1892)	1 Lighttrap
				1	Notodontidae	*Oligocentria pallida*	(Strecker, 1899)	
Ahous Bay Middle	Vargas Island	49 11 20, 126 01 22	August 14, 2001	1	Noctuidae	*Apamea amputatrix*	(Fitch, 1857)	1 Lighttrap
				1	Noctuidae	*Protolampra brunneicollis*	(Grote, 1865)	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Ahous Bay Middle	Vargas Island	“”	August 14, 2001 continued	1	Noctuidae	*Xestia c-nigrum*	(Linnaeus, 1758)	
				1	Noctuidae	*Apamea cogitata*	(Smith, 1891)	
				8	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Noctuidae	*Eurois occulta*	(Linnaeus, 1758)	
				2	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				1	Notodontidae	*Oligocentria pallida*	(Strecker, 1899)	
				2	Noctuidae	*Phlogophora periculosa*	Guenée, 1852	
				5	Noctuidae	*Anaplectoides prasina*	(Denis & Schiffermüller, 1775)	
				1	Noctuidae	*Adelphagrotis stellaris*	(Grote, 1880)	
				1	Noctuidae	*Parabagrotis sulinaris*	Lafontaine, 1998	
				1	Noctuidae	*Oligia tusa*	(Grote, 1878)	
				1	Noctuidae	*Euxoa wilsoni*	(Grote, 1873)	
				12	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
2002 Samples								
Not available	northern Strait of Georgia (Comox area, B.C.)	Not available	1-Jun-02	1	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	Net
Spencer Spit (state park)	Puget Sound	122 52 00, 48 33 00	June 6, 2002	1	Noctuidae	*Leucania insueta*	Guenée, 1853	1 Lighttrap
	(Lopez Is., Washington)			1	Noctuidae	*Agrotis vancouverensis*	Grote, 1874	
Odlin County Park	Puget Sound	122 54 00, 43 30 00	June 6, 2002	1	Noctuidae	*Agrotis vancouverensis*	Grote, 1875	1 Lighttrap
	(Lopez Is., Washington)							
Not available	Puget Sound	Not available	June 7, 2002	1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	1 Lighttrap
				2	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	
	(San Juan Is., Washington)			5	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				1	Noctuidae	*Dargida procincta*	Grote, 1873	
				7	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
				21	Noctuidae	*Agrotis vancouverensis*	Grote, 1876	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Not available	Puget Sound (San Juan Is., Washington)	Not available	June 7, 2002	Records unavailable (No *C. fuscum* captured)				1 Lighttrap
Not available	Puget Sound (San Juan Is., Washington)	Not available	June 7, 2002	3	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	Net
				1	Noctuidae	*Autographa californica*	Speyer, 1875	
Not available	Puget Sound (Whidbey Is., Washington)	Not available	June 8, 2002	1	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	Net
Perego's Lagoon	Puget Sound (Whidbey Is, Washington)	48 11 00, 122 44 00	June 8, 2002	1	Noctuidae	*Apamea cuculliformis*	(Grote, 1875)	1 Lighttrap
				1	Noctuidae	*Euxoa quebecensis*	Smith, 1900	
				1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Noctuidae	*Parabagrotis sulinaris*	Lafontaine, 1999	
				1	Noctuidae	*Noctua comes*	(Hübner, [1813])	
				1	Noctuidae	*Zosteropoda hirtipes*	Grote, 1974	
				6	Noctuidae	*Leucania insueta*	Guenée, 1854	
Sidney Spit	southern Strait of Georgia (Sidney Is., B.C.)	48 38 53.7, 123 20 10.7	June 11, 2002	1	Noctuidae	*Apamea alia*	Guenee, 1852	1 Lighttrap
				8	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				11	Noctuidae	*Trichoclea edwardsii*	Smith, 1889	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
				1	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				1	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
Not available	Juan de Fuca Strait (Sequim, Washington)	Not available	June 12, 2002	3	Noctuidae	*Trichoclea edwardsii*	Smith, 1890	1 Lighttrap
				1	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	
				2	Noctuidae	*Leucania insueta*	Guenée, 1855	
				6	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
Not available	Port Townsend, Washington	Not available	June 12, 2002	1	Noctuidae	*Aletia oxygala*	(Grote, 1881)	1 lightrap

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Not available	Port Townsend, Washington	Not available	June 12, 2002 Continued	4	Noctuidae	*Aletia oxygala*	(Grote, 1881)	
				1	Noctuidae	*Apamea cogitata*	(Smith, 1891)	
				1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	
				29	Noctuidae	*Copablepharon fuscum*	Troubridge & Crabo, [1996]	
				18	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Lasionycta wyatti*	(Barnes & Benjamin, 1926)	
				2	Noctuidae	*Leucania farcta*	(Grote, 1881)	
				10	Noctuidae	*Leucania insueta*	Guenée, 1856	
				3	Noctuidae	*Oligia tusa*	(Grote, 1878)	
				1	Noctuidae	*Parabagrotis sulinaris*	Lafontaine, 2000	
				1	Noctuidae	*Zosteropoda hirtipes*	Grote, 1974	
Savary Island dunes	northern Strait of Georgia (Savary Island)	49 56 10, 124 48 00	June 15, 2002	1	Noctuidae	*Apamea maxima*	(Dyar, 1904)	1 Lighttrap
				1	Arctiidae	*Grammia complicata*	(Walker, 1865)	
				1	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Sideridis maryx*	(Guenée, 1852)	
				6	Noctuidae	*Homorthodes hanhami*	Barnes and McDunnough, 1911	
				1	Noctuidae	*Leucania insueta*	Guenée, 1858	
Witty's Lagoon (west)	southern Strait of Georgia (Metchosin, B.C.)	48 23 10, 123 30 55	May 30, 2002	2	Noctuidae	*Euxoa vetusta*	Walker, 1865	1 Lighttrap
				1	Noctuidae	*Behrensia conchiformis*	Grote, 1875	
				1	Noctuidae	*Apamea cinefacta*	(Grote, 1881)	
				4	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Parabagrotis exertistigma*	(Morr.)	
				1	Noctuidae	*Trichordestra liquida*	(Grote, 1881)	
				6	Noctuidae	*Lacanobia nr. atlantica*	undescribed	
Island View Beach	southern Strait of Georgia (Sidney, B.C.)	48 35 50, 123 23 50	May 31, 2002	6	Noctuidae	*Leucania insueta*	Guenée, 1859	1 Lighttrap
				7	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				7	Noctuidae	*Agrotis vancouverensis*	Grote, 1878	

Location	Region	Coordinates (NAD83)	Date	No.	Family	Genus	Author	Method
Witty's Lagoon (east)	southern Strait of Georgia (Metchosin, B.C.)	48 23 15, 123 30 45	May 30, 2002	5	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	1 Lighttrap
				2	Noctuidae	*Leucania insueta*	Guenée, 1860	
Witty's Lagoon (east)	Southern Strait of Georgia	""	May 30, 2002 continued	4	Noctuidae	*Lacanobia nr. atlantica*	undescribed	
				1	Noctuidae	*Lacinipolia cuneata*	(Grote, 1873)	
				1	Noctuidae	*Agrotis vancouverensis*	Grote, 1879	
Shoreline Park	northern Strait of Georgia (Campbell River, B.C.)	49 53 50, 125 08 50	June 1, 2002	1	Arctiidae	*Hyphantria cunea*	(Drury, 1773)	1 Lighttrap
				1	Arctiidae	*Spilosoma virginica*	(Fabricius, 1798)	
				1	Noctuidae	*Lacinipolia patalis*	(Grote, 1873)	
				1	Noctuidae	*Leucania insueta*	Guenée, 1861	
				1	Noctuidae	*Trichordestra liquida*	(Grote, 1881)	
				1	Noctuidae	*Apamea amputatrix*	(Fitch, 1857)	