

Recovery Strategy for the Edwards' Beach Moth (*Anarta edwardsii*) in Canada

Edwards' Beach Moth



2017



Government
of Canada

Gouvernement
du Canada

Canada

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

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¹ <http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1>

RECOVERY STRATEGY FOR THE EDWARDS' BEACH MOTH (*Anarta edwardsii*) IN CANADA

2017

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

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the *Recovery Plan for Edwards' Beach Moth (Anarta edwardsii) in British Columbia (Part 2)* under Section 44 of the *Species at Risk Act (SARA)*. Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Edwards' Beach Moth in Canada consists of two parts:

Part 1 – Federal Addition to the *Recovery Plan for Edwards' Beach Moth (Anarta edwardsii) in British Columbia*, prepared by Environment and Climate Change Canada.

Part 2 – *Recovery Plan for Edwards' Beach Moth (Anarta edwardsii) in British Columbia*, prepared by the British Columbia Ministry of Environment.

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Part 1 – Federal Addition to the *Recovery Plan for Edwards' Beach Moth (Anarta edwardsii) in British Columbia*, prepared by Environment and Climate Change Canada

Preface

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

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Edwards' Beach Moth and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the province of British Columbia (B.C.) as per section 39(1) of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Province of British Columbia provided the attached recovery plan for the Edwards' Beach Moth (Part 2) as science advice to the jurisdictions responsible for managing the species in British Columbia. It was prepared in cooperation with Environment and Climate Change Canada, and the Parks Canada Agency.

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

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and/or the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

² <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area³ be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

³ These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgements

Many people are to be acknowledged for their involvement in the preparation of this federal recovery strategy addition. The development of this recovery strategy was coordinated by Kella Sadler (Environment and Climate Change Canada, Canadian Wildlife Service - Pacific and Yukon Region (ECCC CWS-PYR)). Nick Page (Raincoast Applied Ecology) developed the initial draft of this document under contract with Environment and Climate Change Canada. Substantial input and/or collaborative support was provided by Conan Webb and Nicole Kroeker (Parks Canada Agency), Matt Huntley, Holly Middleton, Lucy Reiss, and Dan Shervill (ECCC CWS-PYR), Véronique Lalande (ECCC CWS – National Capital Region), and Connie Miller Retzer (B.C. Ministry of Forests, Lands and Natural Resource Operations). Danielle Yu (ECCC CWS-PYR) provided additional assistance with mapping and figure preparation.

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the *Recovery Plan for the Edwards' Beach Moth (Anarta edwardsii) in British Columbia* (Part 2 of this document, referred to henceforth as "the provincial recovery plan") and/or to provide updated or additional information.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the provincial recovery plan referring to protection of survival/recovery habitat may not directly correspond to federal requirements. Recovery measures dealing with the protection of habitat are adopted; however, whether these measures will result in protection of critical habitat under SARA will be assessed following publication of the federal recovery strategy.

1. Species Status Information

The provincial recovery plan does not include a statement on proportion (%) of the species' range inside and outside Canada.

Although detailed population and distribution information is not available to determine a reliable estimate proportion of the species' global range in Canada, COSEWIC (2009) indicates that the estimated extent of occurrence for Edwards' Beach Moth in Canada is <1% (i.e., 2 050 km² in Canada, versus 350 000 km² globally).

2. Critical Habitat

This section replaces the "Information on Habitat Needed to Meet Recovery Goal" (Section 7) in the provincial recovery plan.

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. The provincial recovery plan for Edwards' Beach Moth includes a description of the biophysical attributes of survival/recovery habitat, and activities likely to result in the damage of survival/recovery habitat. This science advice was used to inform the following critical habitat sections in this federal recovery strategy.

2.1 Identification of the Species' Critical Habitat

Geospatial location of areas containing critical habitat

Critical habitat for Edwards' Beach Moth is identified at six sites on the southeast coast of Vancouver Island, and at one site near Tofino (west coast Vancouver Island), British Columbia (Figures 1 - 3):

Southeast coast Vancouver Island

- 1) Sidney Island (2 sites): Sidney Spit, Hook Spit (Figure 1)
- 2) James Island (3 sites): Powder Jetty, North Spit, Melanie Spit (Figure 2)
- 3) Vancouver Island (1 site): Cordova Spit and Island View Beach (Figure 2)

Tofino (west coast Vancouver Island)

- 4) Wickanninish Beach (Figure 3)

The areas containing critical habitat for Edwards' Beach Moth are identified based on a combination of (1) documented occurrences⁴ that met all of the following criteria: (i) must be relatively recent (<20 years old); (ii) identification of the specimen must have been undertaken or verified by a professional taxonomist; and (iii) specimens must be available in collections for verification, (2) an estimate of the seasonal dispersal capabilities of adult Edwards' Beach Moth, applied as a 750 m distance around each documented occurrence, and (3) refinement to select only the distinct ecological features⁵ (i.e., habitat types) that are known to support Edwards' Beach Moth, occurring within the dispersal distance area.

The dispersal ability of Edwards' Beach Moth is not known; however, the 750 m dispersal estimate comprises the best available information based on biologically similar species. Noctuid moths⁶ are generally strong fliers and good dispersers. A mark-recapture study of moths in Finland found dispersal distances as high as 30 km, although the average was around 100 m (Nieminen, 1996). Dispersal studies of two diurnal moths in Sweden found mean transfer distance was 1.1 km (Franzen and Nilsson, 2007). NatureServe (2002) cites a default upper limit of 1 km inferred extent buffer for Noctuid moths, suggesting the upper limit would be associated with species that typically occupy large habitats, e.g., forest and woodland species. Considering the smaller and more localized nature of the habitats occupied by Edwards' Beach Moth, a 750 m dispersal distance was considered to be a realistic estimate on which to base critical habitat identification.

The 750 m dispersal distances around each documented occurrence of Edwards' Beach Moth were refined to include only habitat types that are known to support the species (as described in the section below). This geospatial refinement was completed using recent air photograph and/or moderate resolution orthoimagery (30 m), sensitive ecosystems inventory mapping information (Ward et al. 1998), topographic data (1:20,000 TRIM), and expert site knowledge. Detailed methods and decision-making

⁴ An occurrence is defined as the point location at which an individual was observed.

⁵ Distinct ecological features are those that are distinguishable at a scale relevant to the critical habitat identification (through use of detailed ecosystem mapping and/or aerial photos), which, at that scale, appear as ecologically contiguous features with relatively distinct boundaries (e.g., distinct vegetation assemblages and/or habitat types). Edwards' Beach Moth habitat has been identified at a "site" level scale (1:15,000 scale of reference).

⁶ Edwards' Beach Moth belongs to the Lepidoptera family Noctuidae.

processes relating to critical habitat identification are archived in a supporting document.

Biophysical attributes of Critical Habitat

Within the areas identified as containing critical habitat, critical habitat is identified wherever the following habitat types occur:

- coastal sand habitat such as sand spits, dunes, and beaches
- coastal salt marsh habitat
- sparsely-vegetated upper beach communities, beachgrass meadow communities, and patchy shrub communities

Edwards' Beach Moth likely uses sand substrates for overwintering, and may also use sand for resting or hiding during its flight period, when adult moths are susceptible to predation. Within the habitat types mentioned, Edwards' Beach Moth uses host plants for larval feeding, adult nectaring, and as structural elements for resting and hiding from predators. Information about the identity, composition and density of host plant species required by Edwards' Beach Moth uses during different life history stages is unknown. Common plants in sandy beach habitats where Edwards' Beach Moth has been captured are Dune Wildrye (*Leymus mollis* ssp. *mollis*), Silver Burweed (*Ambrosia chamissonis*), Large-headed Sedge (*Carex macrocephala*), Beach Pea (*Lathyrus japonicus* var. *maritimus*), and American Searocket (*Cakile edentula*). Common salt marsh plants where the species has been observed include Seashore Saltgrass (*Distichlis spicata* var. *spicata*), American Glasswort (*Sarcocornia pacifica*), and the exotic Common Orache (*Atriplex patula*). Edwards' Beach Moth may use and/or require some of these plant species during its life cycle.

Biophysical attributes of critical habitat include the vegetation (composition and abundance of plant species) and substrates (sand, soil) that comprise the habitat types listed above. The areas containing critical habitat for Edwards' Beach Moth (totaling 116.6 ha) are presented in Figures 1-3. Critical habitat for Edwards' Beach Moth in Canada occurs within the shaded yellow polygons shown on each map where the biophysical attributes described in this section occur. The identified habitat types (as represented by vegetation and substrate) comprise the biophysical attributes of critical habitat for this species, and therefore the shaded yellow polygons (units) shown on the map represent a close approximation of actual critical habitat.

Within these polygons, clearly unsuitable habitats such as: (i) beach areas below the high water mark, and salt marsh areas below vegetated terrestrial habitat margins (e.g., semi-aquatic plants that occur in the intertidal zone), and (ii) forested and dense-shrub communities are not required by Edwards' Beach Moth, and they are not identified as critical habitat. Similarly, anthropogenic features including: existing active trails and/or other existing highly-disturbed areas that are specifically designated for foot traffic, roads, and existing infrastructure such as anchored picnic tables and buildings do not possess biophysical attributes required by Edwards' Beach Moth, and they are not identified as critical habitat. The 1 km x 1 km UTM grid overlay shown on these

figures is a standardized national grid system that highlights the general geographic area containing critical habitat, for land use planning and/or environmental assessment purposes.

The critical habitat identified is sufficient to meet the population and distribution objectives and therefore a schedule of studies is not required. Critical habitat for Edwards' Beach Moth is identified in this document to the extent possible; as responsible jurisdictions and/or other interested parties conduct research (including surveys to clarify species' range, identify host plants, and substrate requirements), the critical habitat methodology and identification may be modified and/or refined to reflect new knowledge.

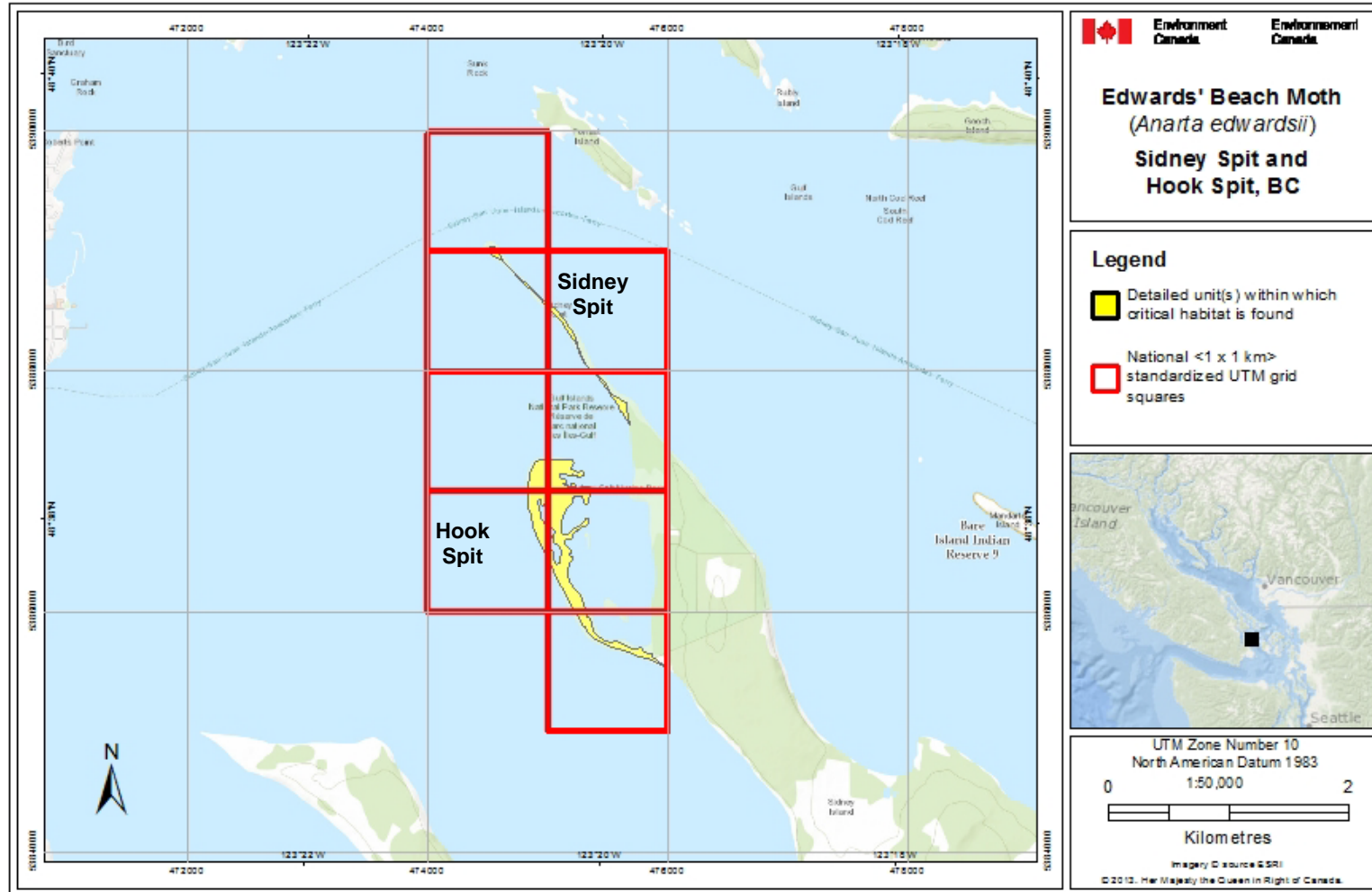


Figure 1. Critical habitat for Edwards' Beach Moth on Sidney Island, B.C. is represented by the yellow shaded polygons where the criteria and methodology set out in Section 2.1 are met. The detailed polygons show a total of 35.4 ha containing critical habitat at Sidney Spit (3.7 ha) and Hook Spit (31.7 ha). The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area within which critical habitat is found in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

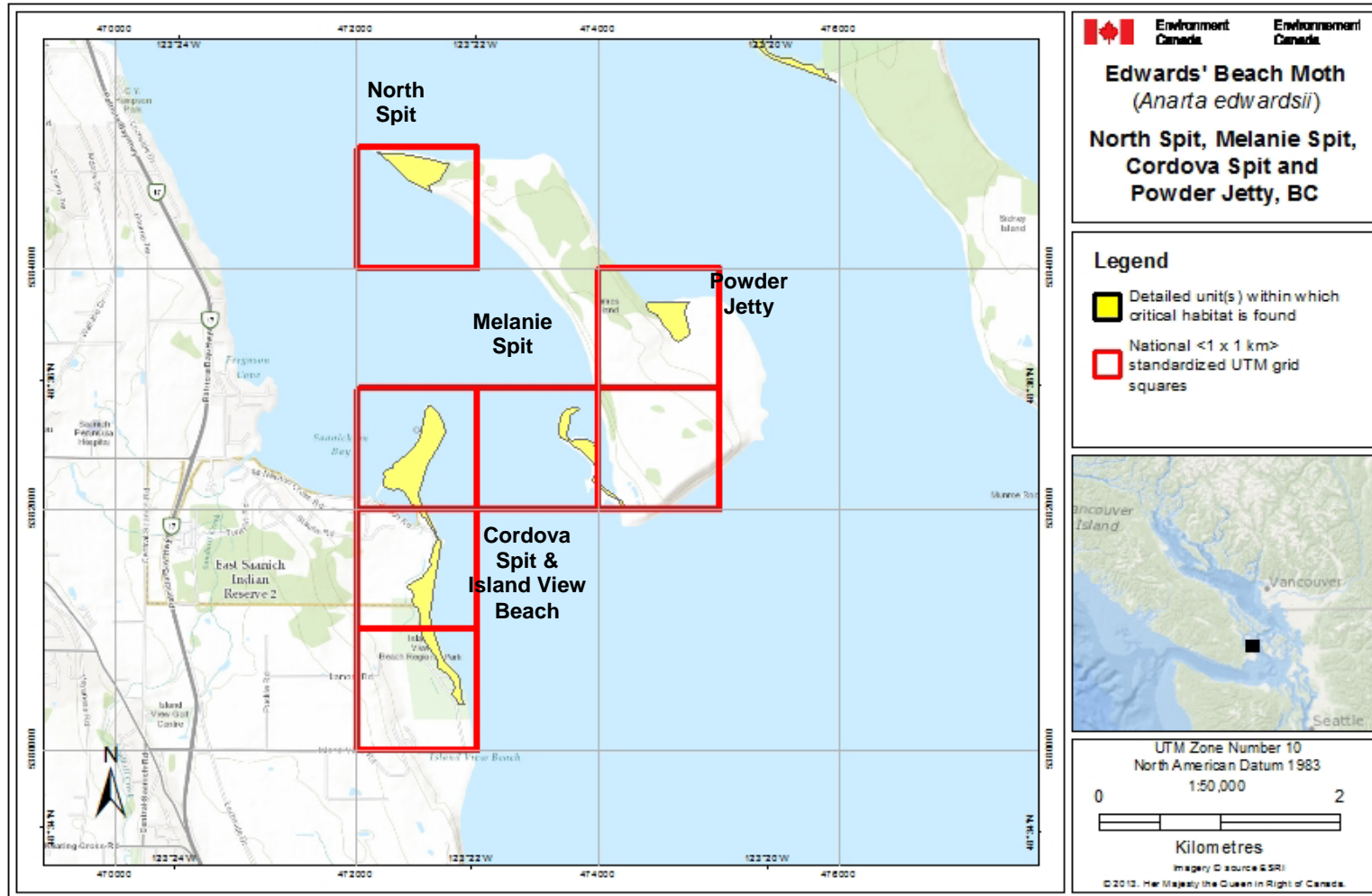


Figure 2. Critical habitat for Edwards' Beach Moth on James Island and on southeast Vancouver Island, B.C. is represented by the yellow shaded polygons where the criteria and methodology set out in Section 2.1 are met. The detailed polygons show a total of 21.2 ha containing critical habitat on James Island at Powder Jetty (7.0 ha), North Spit (8.7 ha), and Melanie Spit (5.5 ha), and 30.0 ha on southeast Vancouver Island, at Cordova Spit & Island View Beach. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area within which critical habitat is found in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

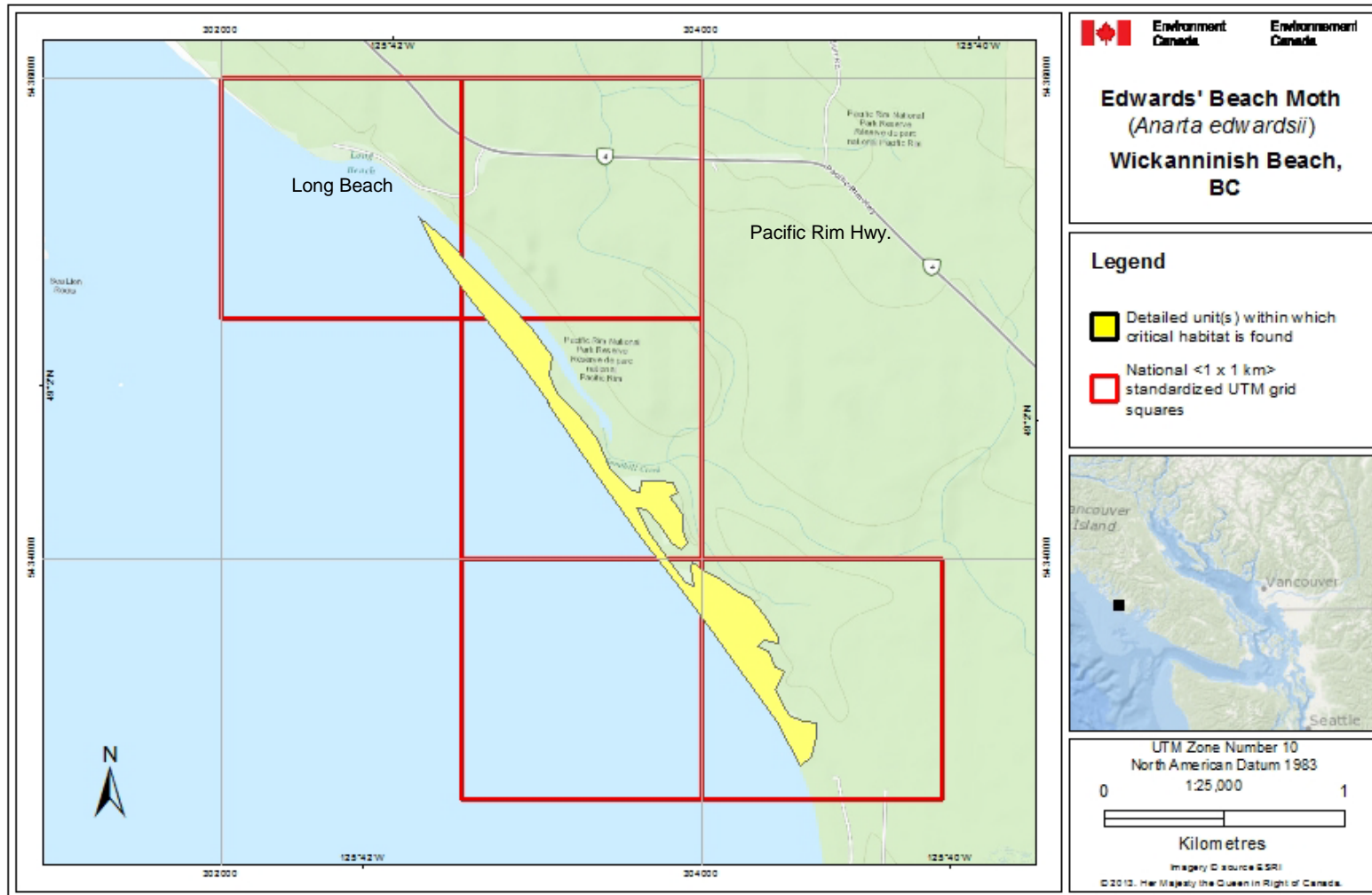


Figure 3. Critical habitat for Edwards' Beach Moth at Wickanninish Beach near Tofino, B.C. is represented by the yellow shaded polygons where the criteria and methodology set out in Section 2.1 are met. The detailed polygon shows a total of 30.0 ha containing critical habitat at this site. The 1 km x 1 km UTM grid overlay shown on this figure is a standardized national grid system that indicates the general geographic area within which critical habitat is found in Canada. Areas outside of the shaded yellow polygons do not contain critical habitat.

2.2 Activities Likely to Result in Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. Activities described in Table 1 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

The provincial recovery plan contains a section describing specific human activities likely to damage survival/recovery habitat. This science advice was used to inform the description of activities likely to result in the destruction of critical habitat in this federal recovery strategy.

Table 1. Activities likely to result in the destruction of critical habitat for Edwards' Beach Moth. IUCN⁷ threat numbers are in accordance with the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system ([CMP 2010](#)).

Description of activity	Description of effect in relation to habitat function loss	Details and relationship threats
<p>Conversion of natural landscape areas for residential and commercial development, or related infrastructure (e.g., roads, buildings, facilities).</p>	<p>Results in the direct loss of critical habitat through vegetation removal and replacement, debris deposition, substrate disturbance and compaction, and/or related indirect effects which cause damage or destruction to biophysical attributes required by Edwards' Beach Moth.</p>	<p>Related IUCN-CMP threat #1.3</p> <p>Most sites are unsuitable for residential development because of soil conditions or flood risk, however there is possibility that James Island could be developed for housing.</p> <p>All sites in which Edwards' Beach Moth are found have important values for public tourism and recreation. Development for recreational purposes has resulted in loss of habitat. This threat is ongoing.</p>
<p>Human use of landscape that results in significant adverse effects:</p> <p>Use of motorized vehicles (e.g., ATVs, cars, trucks, or other)</p> <ul style="list-style-type: none"> - During the dormant period (August – May inclusive): any amount or type occurring outside of existing roads or trails - During the non-dormant period (June – July inclusive): any amount or type occurring outside of existing roads or trails, <u>except</u> for where used specifically towards the improvement of Edwards' Beach Moth survival and recovery (i.e., habitat restoration and/or monitoring), <u>and</u> where it does not reduce the ability of the habitat to support the species' needs.⁷ <p>Non-motorized traffic (e.g., foot traffic, mountain biking)</p> <ul style="list-style-type: none"> - At all times of year, type and/or amount of use that results in the damage or destruction of natural vegetation (potential host 	<p>Results in disturbance of local biophysical conditions, including direct physical damage to or loss of biophysical attributes required by Edwards' Beach Moth. Activities may cause vegetation removal (i.e., impacting the availability of potential egg, larval and nectar host plants) and/or cause compaction or removal of substrate and/or litter required by Edwards' Beach Moth eggs and larvae.</p>	<p>Related IUCN-CMP threats:</p> <p>#4.1. Motorized vehicle use has historically been a source of major habitat disturbance at several sites (Island View Beach and Cordova Spit). Direct loss of habitat through the incremental increase in areas used for parking, storage, and other uses adjacent to existing roads may occur in the future. Also linked to Threat #8.1 - heavy machinery (e.g., backhoes) sometimes used for invasive plant removal.</p> <p>#6.1. Recreation is common in most of the sites where Edwards' Beach Moth is</p>

⁷ International Union for Conservation of Nature

Description of activity	Description of effect in relation to habitat function loss	Details and relationship threats
and/or nectar plants), and/or substrates, to the extent that the habitat does not support the recovery of the species ⁸		found except for James Island where access is currently controlled (2015).
Anthropogenic modification of natural habitats such as slope stabilization or the construction of groynes or breakwaters, that result in vegetation succession .	Loss of biophysical attributes of critical habitat through reduction or disruption of coastal sand movement, which contributes to stabilization and vegetation establishment in sparsely vegetated communities.	Related IUCN-CMP threat # 7.3.
Deliberate introduction of alien invasive species, for example by not following provincial best management practices for clean equipment use ⁹ .	Alien invasive species may cause destruction of habitat available to Edwards' Beach Moth by making required biophysical attributes of critical habitat (e.g., potential larval host plants and/or nectar host plants, or substrates) functionally unavailable, as a consequence of their physical occupation of space and resources, and by stabilizing and colonizing sparsely vegetated habitats, and potential changing soil chemistry.	Related IUCN-CMP threat # 8.1. Scotch Broom, European Beachgrass, Common Gorse, and various non-native grasses have rapidly changed many coastal sand habitats in coastal B.C.
Activities related to the control of invertebrate pests and/or invasive plant species (mechanical or chemical) that are not in accordance with provincial best management practices (where available); this may include on-site activities, an pesticide or herbicide drift from adjacent areas.	Efforts to control invertebrate pests or invasive plants through chemical means (pesticides or herbicides) or by physical means can result in destruction of critical habitat by degrading or removing plant and/or substrate biophysical attributes (as a consequence of weed-pulling), or microhabitat toxicity resulting from the application of pesticides and/or	Related IUCN-CMP threat # 8.1, 9.3. A provincial program to detect and eradicate introductions of European Gypsy Moth has been ongoing since 1979 and spray has been applied in numerous areas within the range of Edwards' Beach Moth since this time. This activity may occur in the future, depending on the extent to which Gypsy Moths are trapped during annual

⁸ The success of the species' survival and recovery will be assessed by the adopted population and distribution objective, and the associated performance measure set out in this document, that: the persistence and distribution of Edwards' Beach Moth at all known extant sites (including any newly identified sites) have been maintained, i.e., population size and extent of occurrence or area of occupancy at each site is stable and/or naturally increasing.

⁹ See: [Best Management Practices for Invasive Plants in Parks and Protected Areas of British Columbia](#)

Description of activity	Description of effect in relation to habitat function loss	Details and relationship threats
	herbicides.	surveys. Methods to mechanically remove invasive plants may also cause destruction; refer to "use of motorized vehicles" activity, described above.

3. Measuring Progress

The performance indicator presented below provides a way to define and measure progress toward achieving the population and distribution objective. Every five years, success of recovery strategy implementation will be measured against the following performance indicator:

- The persistence and distribution of Edwards' Beach Moth at all known extant sites (including any newly identified sites) have been maintained, i.e., population size and extent of occurrence or area of occupancy at each site is stable and/or naturally increasing.

4. Statement on Action Plans

One or more action plans will be posted on the Species at Risk Public Registry by 2021.

5. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)¹⁰. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s¹¹ (FSDS) goals and targets.

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

The provincial recovery plan for Edwards' Beach Moth contains a section describing the effects of recovery activities on other species (i.e., Section 9). Environment and Climate Change Canada adopts this section of the provincial recovery plan as the statement on effects of recovery activities on the environment and other species. The distribution of Edwards' Beach Moth overlaps with that of several other species at risk including the federally endangered Sand-verbena Moth (*Copablepharon fuscum*), and the

¹⁰ www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1

¹¹ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

Contorted-pod Evening Primrose (*Camissonia contorta*). Recovery planning activities for the Edwards' Beach Moth will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats.

6. References

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**Part 2 – *Recovery Plan for Edwards' Beach Moth (Anarta edwardsii) in British Columbia*, prepared by the
British Columbia Ministry of Environment**

Recovery Plan for Edwards' Beach Moth (*Anarta edwardsii*) in British Columbia



Prepared by B.C. Ministry of Environment



December 2013

About the British Columbia Recovery Strategy Series

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

What is recovery?

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

What is a provincial recovery document?

Recovery documents summarize the best available scientific and traditional information of a species or ecosystem to identify goals, objectives, and strategic approaches that provide a coordinated direction for recovery. These documents outline what is and what is not known about a species or ecosystem, identify threats to the species or ecosystem, and explain what should be done to mitigate those threats, as well as provide information on habitat needed for survival and recovery of the species. This information may be summarized in a recovery strategy followed by one or more action plans. The purpose of an action plan is to offer more detailed information to guide implementation of the recovery of a species or ecosystem. When sufficient information to guide implementation can be included from the onset, all of the information is presented together in a recovery plan.

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

What's next?

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

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

For more information

To learn more about species at risk recovery in British Columbia, please visit the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>>

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Prepared by the B.C. Ministry of Environment

December 2013

Recommended citation

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Cover illustration/photograph

Merrill A. Peterson, Pacific Northwest Moths

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

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Disclaimer

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

This document identifies the recovery strategies and actions that are deemed necessary, based on the best available scientific and traditional information, to recover Edwards' Beach Moth populations in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new findings.

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

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the recovery of Edwards' Beach Moth.

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Edwards' Beach Moth (*Anarta edwardsii*) is a small, powdery-grey moth with a forewing length of 32–38 mm. The hindwings are bright white, crossed by a distinctive wide dark grey or dull black marginal band. The forewing fringes are brown-grey and hindwing fringes white. Larvae are pale green with faint white-green patterning. Eggs and pupae are undescribed.

Edwards' Beach Moth was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) because of the small number of known population localities and habitat decline. It is listed as Endangered in Canada on Schedule 1 of the *Species at Risk Act* (SARA). In British Columbia, Edwards' Beach Moth is ranked S1 (Endangered) by the Conservation Data Centre and is on the provincial Red list. The B.C. Conservation Framework ranks Edwards' Beach Moth as a Priority 1 under goal 3 (maintain the diversity of native species and ecosystems).

Recovery is considered to be biologically and technically feasible.

Surveys from 1995 to 2007 confirmed Edwards' Beach Moth is extant at 6 sites¹ in B.C.: 5 within the southern Georgia Strait on southern Vancouver Island and 1 near Tofino, on western Vancouver Island. Since 2008, additional sampling in suitable habitats has not recorded additional occupied sites.

Specific habitat requirements for Edwards' Beach Moth are poorly understood and the host plant(s) used for larval feeding is unknown. Sampling records indicate the moth is associated with 2 habitat types in B.C.: (1) sand beaches, spits, or dunes with coarse sand substrates and sparse vegetation communities, and (2) areas adjacent to coastal salt marshes.

Important threats to Edwards' Beach Moth include invasive plants (native and non-native), disturbance from recreation, natural system modification, and climate change. Invasive plants contribute to the development of more densely vegetated herbaceous or shrub-dominated plant communities that do not provide the same plant composition, plant abundance, or soil characteristics for Edwards' Beach Moth as native habitats. Recreation threats include the construction of recreation facilities, walking, camping, and beach activities. Impacts from these threats result in damage or mortality to host plants; trampling of adults or larvae seeking refuge under host plants; or compaction or disturbance of the sand substrates, which the moth or its host plant(s) requires. The construction of features that disrupt sediment transport, such as breakwaters or groynes, are an additional threat, as the natural movement of sand sustains habitat for Edwards' Beach Moth. Sea-level rise associated with climate change is considered a threat

¹ Sites are considered spatially defined population units that individually or as a group make up a location. Locations are based on the biological parameters of the moth (e.g., dispersal distance and habitat connectivity between known occurrences, and whether the individuals mix between locations). Individuals are expected to mix between sites depending on distance between suitable habitat and other factors, but not between locations. Five sites near Sidney, B.C., constitute a location, while a single site on the west coast of Vancouver Island near Tofino is defined as the second location in B.C.

because it is expected to contribute to increased frequency of flooding in low-level sites occupied by the species.

The recovery (population and distribution) goal is to ensure the persistence of Edwards' Beach Moth at all extant sites (and any new sites) and maintain its current distribution within its range in British Columbia.

The recovery objectives are:

1. To secure protection for the known sites (and new sites) and habitats of Edwards' Beach Moth.
2. To assess and mitigate the extent of current threats to Edwards' Beach Moth at all sites in B.C.
3. To address knowledge gaps (e.g., habitat requirements, host plant use, range in B.C., dispersal abilities) for Edwards' Beach Moth.

RECOVERY FEASIBILITY SUMMARY

The recovery of Edwards' Beach Moth in B.C. is considered technically and biologically feasible based on the criteria outlined by the Government of Canada (2009):

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

Yes. Recent (< 20 year old) sampling captured adult individuals in extant populations in B.C. that are capable of reproducing, and sustaining the existing populations. Populations have likely persisted in relict habitats for thousands of years.

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

Yes. Edwards' Beach Moth occurs within 6 extant sites in B.C. and other sites are likely to exist. At present, there is sufficient habitat to support populations of Edwards' Beach Moth in B.C.

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

Yes. The primary threats to Edwards' Beach Moth and its habitat can be avoided or mitigated through habitat restoration and management. All known extant populations of Edwards' Beach Moth are afforded some measure of protection by way of current land designations.

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

Yes. Recovery techniques focusing on the restoration and management of coastal sand and salt marsh habitats are currently available to achieve the population and distribution goal and recovery objectives. Invasive species control and recreation management are the most important threat mitigation approaches for Edwards' Beach Moth recovery, and there are established techniques for this purpose.

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1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2009

Common name: Edwards' Beach Moth

Scientific name: *Anarta edwardsii*

COSEWIC Status: Endangered

Reason for Designation: In Canada, this species of noctuid moth has only been found in sparsely vegetated sandy beach and dune habitats on the coast of Vancouver Island and two small adjacent Gulf Islands. Together, these constitute only two locations. The habitats are at risk from succession, invasive species, recreational activities and changing patterns of sand deposition resulting from increasing frequency and intensity of winter storms. It is currently known from James and Sydney Islands and Pacific Rim National Park. The chance of genetic exchange is minimal between Pacific Rim and other areas and low between the Gulf Islands. One population has not been detected in recent times, and the species could not be found at 38 other locations where there appeared to be suitable habitat.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in April 2009. Assessment based on a new status report.

* Committee on the Status of Endangered Wildlife in Canada.

2 SPECIES STATUS INFORMATION

Edwards' Beach Moth^a		
Legal Designation:		
FRPA: ^b No	B.C. <i>Wildlife Act</i> : ^c No	SARA Schedule: 1 – Endangered (2011)
OGAA: ^b No		
Conservation Status^d		
B.C. List: Red B.C. Rank: S1 (2009) National Rank: N1 (2011) Global Rank: GNR		
B.C. Conservation Framework (CF)^e		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority: ^f 3 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 6 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 1 (2009)
CF Action Groups:	Compile Status Report, Planning, List under <i>Wildlife Act</i> , Send to COSEWIC, Habitat Protection, Habitat Restoration, Private Land Stewardship	

^a Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.

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

^c No = not designated as wildlife under the B.C. *Wildlife Act* (Province of British Columbia 1982). Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).

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

^e Data source: B.C. Ministry of Environment (2010).

^f Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

Edwards' Beach Moth (*Anarta edwardsii*) is a small (32–38 mm), powdery light grey moth with a line of black dots along the edge of the forewing (COSEWIC 2009) (Figure 1). The hindwings are bright white, crossed by a distinctive wide dark grey or dull black marginal band. Fringes of the wings are brown-grey on the forewings and white on the hindwings. Larvae are pale green with faint white green patterning although they have not been observed in B.C. Further morphological description can be found in the COSEWIC (2009) status report.



Figure 1. Illustration of Edwards' Beach Moth. Source: M.A. Peterson (Peterson 2013).

3.2 Populations and Distribution

Edwards' Beach Moth has been recorded from coastal areas of southwestern B.C. to southern California (Figure 2).

Current B.C. records are situated in 2 geographically separate regions and population mixing between these regions is not likely. Five sites on southeastern Vancouver Island and the adjacent Gulf Islands together comprise one geographic population within the Georgia Strait. The second (Tofino) encompasses a single site on Vancouver Island's west coast (Table 1; Figure 3). These records of Edwards' Beach Moth were collected on sandy beaches with some sites associated with coastal salt marshes.



Figure 2. Edwards' Beach Moth distribution in North America (from COSEWIC 2009). Canadian (B.C.) range indicated within rectangle outlined in red.

There are also 2 historical records from Thetis Island (1966 and 1971), and 1 record from Mill Bay in Saanich Inlet (1935). The presence of this species at either of these sites has not been

confirmed due to vague site collection information. The COSEWIC (2009) status report suggests the Mill Bay locality is believed no longer extant as surveys conducted from 2001 to 2007 did not find the moth. However, there is remaining habitat within the area, and since the moth has low detectability, it cannot be certain the species is no longer extant. Suitable habitat in the Mill Bay area and on Thetis Island will need to be mapped and priority sites inventoried to determine the status of these historical records. There is a third historical record labeled "Shawnigan District" (1931) but this record has no associated collection or habitat information, location is too vague² and thus not considered an extant site.

There is no quantitative information on population sizes; however, recent sampling indicates it can be locally abundant in suitable habitat (COSEWIC 2009). Anthropogenic and natural habitat loss has resulted in declines in the extent of occurrence and area of occupancy since 1994 and has likely resulted in minor population declines as well (e.g., Edwards' Beach Moth has not been found at Cordova Spit and Island View Beach since 1994/1995 despite more recent searches) (COSEWIC 2009).

Over the past 100 years, sand-dominated coastal sites in B.C. have been rapidly and extensively changed throughout the range of Sand-verbena Moth (*Copablepharon fuscum*), a related noctuid moth with similar sand habitat requirements (COSEWIC 2009). The loss of open dune habitat over the last 40 years and more was 50% at the 2 sites near Comox and 21% at the Island View Beach/Cordova Spit site (COSEWIC 2003).

Table 1. Status and description of extant^a and historical Edwards' Beach Moth sites in B.C.

Site number	Site name	Most recent record	Land ownership
1	Thetis Island ^b (Georgia Strait)	1966 and 1971	Unknown
2	Mill Bay ^c (Georgia Strait)	1935	Unknown, likely private
3	James Island (Georgia Strait)	2007: 3 sites on James Island (Page 2007; COSEWIC 2009; University of Alberta 2013)	Private conservation land (The Nature Conservancy)
4	Cordova Spit (Georgia Strait)	1994 and 1995 (Troubridge and Crabo 1995)	Portions of Cordova Spit are owned/managed by 3 landowners/managers: Municipality of Central Saanich (local government, private land), Tsawout First Nation (federal), and Capital Regional District (local government, private land)
5	Sidney Spit, Sidney Island (Georgia Strait)	2001, 2002, 2004, 2006 (COSEWIC 2009)	Federal (Parks Canada). Gulf Islands National Park Reserve
6	Wickaninnish Beach, Tofino	2001: 1 specimen captured	Federal, Parks Canada, Pacific Rim National Park Reserve

^a The B.C. Conservation Data Centre and NatureServe databases define "extant" as all observations made within the last 20 years, provided the habitat has not been substantially altered or degraded. Sites 3, 4, 5, and 6 are considered extant sites.

^b Collection sites unknown. Site collection information associated with the 2 records labeled "Thetis Island" is not well documented. Habitat on Thetis Island likely has not changed since the collection. This is considered to be a historical site.

² At the time of collection this area was not well mapped and the area was more accessible. As such, "Shawnigan District" likely represents a much broader area than is currently defined by the Shawnigan Lake municipality.

° Collection sites unknown. Site collection information associated with record is vague. This is considered to be a historical site.

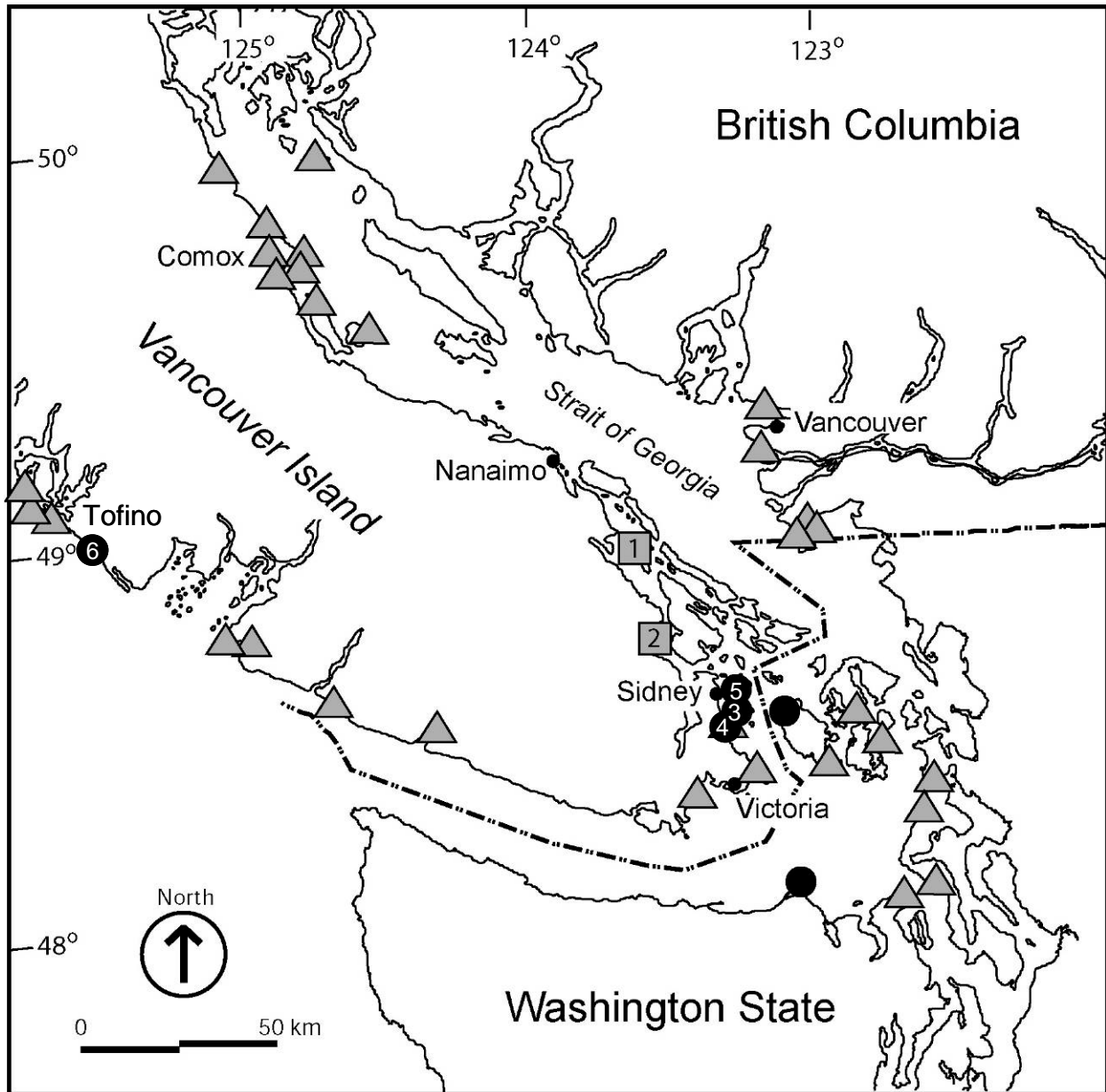


Figure 3. Edwards' Beach Moth distribution in British Columbia and portions of Washington State (adapted from COSEWIC 2009). Numbers correspond to site numbers found in Table 1. Large black dots denote recent sampling records (3-James Island, 4-Cordova Spit, 5-Sidney Island, and 6-Wickaninnish Beach) in B.C. and Washington (Dungeness Spit and Henry Island). Grey squares show historical records (1-Thetis Island 1971 capture; and 2-Shawnigan District 1931 capture). Grey triangles show coastal sites that were sampled from 2001 to 2007 without capturing Edwards' Beach Moth. Note that not all sites sampled are considered suitable habitat.

3.3 Habitat and Biological Needs of Edwards' Beach Moth

Sampling records indicate that Edwards' Beach Moth is associated with 2 habitat types in B.C. and adjacent areas of Washington State (COSEWIC 2009; L. Crabo, pers. comm., 2013).

1. Sand ecosystems adjacent to salt marsh. Most often, the species has been captured in sand beaches, spits, or dunes with coarse sand substrates and sparse vegetation communities. Some of these sites are adjacent to coastal salt marshes and Edwards' Beach Moth may also use salt marsh vegetation. Coastal spits and salt marshes often occur as paired habitats: spits create shallow, low-energy coastal environments that accumulate sediment and organic matter over time leading to salt marsh development.
2. Sand ecosystems with no adjacent salt marsh. Conversely, 2 sites in which Edwards' Beach Moth has been captured (Sidney Spit and Wickaninnish Beach) have no salt marsh present. As well, there is no indication, or evidence from other moth species, that Edwards' Beach Moth (adults, eggs, larvae, or pupae) is able to tolerate regular inundation from tidal waters. If salt marsh vegetation is used by this species, it is likely at the larval stage, when larvae feed on plants near the margin of salt marshes. Similarly, it would not occur in the intertidal zone associated with coastal sand habitats.

Within these environments, Edwards' Beach Moth likely uses sand substrates for overwintering,³ and may also use sand for resting or hiding during the day when adult moths are susceptible to predation. Soil at adult capture sites is coarse to medium sand that is well-drained and generally free of organic matter (N. Page, pers. comm., 2013). Soil chemistry is generally neutral to slightly acidic, and very low in organic matter and nutrient matter (N. Page, pers. comm., 2013).

Edwards' Beach Moth has not been captured in stabilized dunes (N. Page, pers. comm., 2013), which suggest it may need open sand for egg laying; this is similar to other sand ecosystem moth species. Sampling records indicate that forested or dense shrub areas are not suitable for Edwards' Beach Moth (N. Page, pers. comm., 2013).

Edwards' Beach Moth uses host plants for larval feeding (possibly leaves), adult nectaring, and possibly for egg laying and to provide resting or hiding places for adult moths. Specific host plants used for these different life history stages are unknown. Larvae of Edwards' Beach Moth were recorded on a species of orache (*Atriplex* spp.) in California (Comstock and Henne 1941) but sampling records from B.C. indicate that orache is not always present in sites where Edwards' Beach Moth was captured and habitats where orache is most abundant do not appear to support the moth (N. Page, pers. comm., 2013). Common plants in sandy beach habitats where Edwards' Beach Moth has been captured are dune wildrye (*Leymus mollis* ssp. *mollis*), silver burweed (*Ambrosia chamissonis*), large-headed sedge (*Carex macrocephala*), beach pea (*Lathyrus japonicus* var. *maritimus*), and American searocket (*Cakile edentula*). Common salt marsh plants include seashore saltgrass (*Distichlis spicata* var. *spicata*), American glasswort (*Sarcocornia pacifica*), and the exotic common orache (*Atriplex patula*).

Figure 4 shows photographs of habitat conditions in sites where Edwards' Beach Moth adults were captured.

³ Overwintering life stage is unknown, either larva or pupa.



Figure 4 (a-f). Habitat characteristics at sites where Edwards' Beach Moth adults were captured between 2001 and 2007 in B.C.: (a) sand spit (Sidney Spit, Sidney Island); (b) spit and adjacent salt marsh (Powder Dock, James Island); (c) sparsely vegetated dune (North Spit, James Island); (d) sparsely vegetated spit (Melanie Spit, James Island); (e) dense patch of yellow sand-verbena (Sidney Spit, Sidney Island); and (f) dune margin (Wickaninnish Beach, Pacific Rim National Park Reserve). All photos by N.A. Page.

3.4 Limiting Factors

Habitat rarity is the predominant limiting factor for Edwards' Beach Moth. Suitable conditions for the development of sand beaches, spits, and dunes, as well as salt marshes are naturally rare in coastal B.C. because of the limited area of glacial sand deposits (Clague 1977). In addition, a supply of sand sediment must be paired with a shallow coastal environment to create conditions suitable for spit and dune development (Page *et al.* 2011). Salt marsh development requires similar conditions and must also receive little freshwater drainage to maintain high salinity levels.

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community or ecosystem) in the area of interest (global, national, or subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.⁴ Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems, which are considered limiting factors.⁵

For the most part, threats are related to human activities, but they can be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species or ecosystem is concentrated in one location or has few occurrences, which may be a result of human activity (Master *et al.* 2009). As such, natural phenomena are included in the definition of a threat, though should be applied cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky *et al.* 2008) so that this type of event would have a disproportionately large effect on the population/ecosystem compared to the effect they would have had historically.

⁴ Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are taken into consideration when determining long-term and/or short-term trend factors (Master *et al.* 2009).

⁵ It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts.

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the CMP website (CMP 2010). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2009) and table footnotes for details. Threats for Edwards' Beach Moth were assessed for the entire province (Table 2).

Table 2. Threat classification table for Edwards' Beach Moth.

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d	Site(s)
1	Residential & commercial development	Low	Small	Moderate	Moderate	
1.1	Housing & urban areas	Not calculated	Negligible	Negligible	Low	Unchecked habitat on James Is
1.2	Commercial & industrial areas	Not calculated	Negligible	Negligible	Low	Unchecked habitat on James Is
1.3	Tourism & recreation areas	Low	Small	Moderate	Moderate	Cordova Spit
4	Transportation & service corridors	Not calculated	Small	Negligible	Low	
4.1	Roads & railroads	Not calculated	Small	Negligible	Low	James Island
5	Biological resource use	Negligible	Negligible	Negligible	High	
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible	Negligible	High	All sites
6	Human intrusions & disturbance	Low	Restricted	Slight	High	
6.1	Recreational activities	Low	Restricted	Slight	High	Cordova Spit, Sidney Spit, Wickaninnish Beach, James Island
7	Natural system modifications	Low	Small	Slight	High	
7.1	Fire & fire suppression	Not calculated	Small	Slight	Low	Sidney Spit, James Island, Cordova Spit
7.3	Other ecosystem modifications	Low	Small	Slight	High	Sidney Spit, James Island, Cordova

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d	Site(s)
						Spit
8	Invasive & other problematic species & genes	Low	Restricted	Moderate	High	
8.1	Invasive non-native/alien species	Low	Restricted	Moderate	High	All sites
9	Pollution	Not calculated	Restricted	Moderate	Low	
9.3	Agricultural & forestry effluents	Not calculated	Restricted	Moderate	Low	Sidney Spit, James Island, Cordova Spit
9.5	Air-borne pollutants	Not calculated	Large	Negligible	Low	Sidney Spit, James Island, Cordova Spit
10	Geological events	Not calculated	Small	Serious	Low	
10.2	Earthquakes/tsunamis	Not calculated	Small	Serious	Low	Wickaninnish Beach, all other sites (although less likely)
11	Climate change & severe weather	Low	Small	Slight	High	
11.1	Habitat shifting & alteration	Not calculated	Pervasive	Unknown	Low	All sites
11.2	Droughts	Not calculated	Pervasive	Unknown	Low	All sites (although less likely at Wickaninnish Beach)
11.4	Storms & flooding	Low	Small	Slight	High	Cordova Spit, Sidney Spit

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

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

^c **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

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

4.2 Description of Threats

The overall province-wide threat impact for this species is medium.⁶ This overall threat considers the cumulative impacts of multiple threats. The greatest threat is considered to be from invasive non-native/alien species. Details are discussed below under the Threat Level 1 headings.

4.2.1 Threats with Low Impact

IUCN-CMP Threat 1. Residential & commercial development

1.1 Housing & urban areas; 1.2 Commercial & industrial areas

Residential and commercial development is rare in sites where Edwards' Beach Moth is found. Most sites are unsuitable for development because of soil conditions or flood risk. Edwards' Beach Moth habitats are not typically within areas targeted for housing development. There is the possibility James Island could be developed for housing, although development proposals to date have focused on large scale lots. The three sand ecosystems on the island have covenants held by the Nature Trust, none of which allow for housing or commercial development. There are other areas on James Island which have potential habitat, although have not been surveyed. This threat is acknowledged, but not likely a factor.

1.3 Tourism & recreation areas

All sites in which Edwards' Beach Moth are found have important values for public recreation, which restricts development. The largest loss of habitat in which Edwards' Beach Moth may have occurred was in the 1990s when a golf course was developed along the eastern shore of James Island in an area that was historically sand dunes. One of the sites, Cordova Spit, spans three separate landowners/land managers. Development for recreational purposes has recently occurred within a portion of the area owned by the Capital Regional District (local government). Although the area is a park, there is pressure to further develop the area for camping/picnic day use area. The threat is acknowledged and potentially applicable to small portions within the next 10 years, based on development within the past 5 years.

IUCN-CMP Threat 6. Human intrusions & disturbance

6.1 Recreational activities

Recreation including walking, camping, and beach activities can damage or kill plants or compact or disturb sand substrates which Edwards' Beach Moth adults or its host plant(s) requires (e.g., egg laying, resting or seeking refuge, larval shelter). Recreational activities such as walking (including dogs) and beach activities are common at Sidney Spit and Wickaninnish Beach and Cordova Spit. Camping is prohibited at these sites, although illegal camping does occur. Recreational activities are less common at James Island (all three sites) because access is strictly controlled. Tsawout First Nation limits recreation use of Cordova Spit through a

⁶ The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 0 Very High, High, Medium, and 4 Low (Table 2). The overall threat considers the cumulative impacts of multiple threats.

stewardship program that prevents all-terrain vehicles or other gas-operated vehicles from access to the spit. Overall recreational activities are considered a low impact threat to Edwards' Beach Moth.

IUCN-CMP Threat 7. Natural system modifications

7.1 Fire & fire suppression

Fire is an infrequent activity in natural coastal sand ecosystems because of low fuel loads. However, more densely vegetated coastal meadows or shrub thickets of Scotch broom (*Cytisus scoparius*) or common gorse (*Ulex europaeus*) increase the risk of wildfire. Fire is considered a threat to Edwards' Beach Moth because it kills or damages plants that may be used for larval feeding, or may cause direct mortality to adults, eggs, or larvae. However, there is no evidence of recent fire in known sites and is not likely to be an issue in the next 10 years.

7.3 Other ecosystem modifications

Habitat for Edwards' Beach Moth is created and sustained by coastal sediment transport processes including bluff erosion, longshore sediment movement, and wind movement of sand. Modifications to these processes such as the slope stabilization or the construction of groynes or breakwaters are considered threats to Edwards' Beach Moth because they reduce or disrupt coastal sand movement, which contributes to stabilization and vegetation establishment in sparsely vegetated communities.

Direct loss of habitat during road maintenance activities, such as mowing of road margins within or near known habitat, was also considered here, but is thought to be negligible.

IUCN-CMP Threat 8. Invasive & other problematic species & genes

8.1 Invasive non-native/alien species/diseases

Invasive plants are a well-known cause of habitat loss or change in sparsely vegetated coastal sand ecosystems (Page *et al.* 2011) and are considered a threat to Edwards' Beach Moth over the next 10 years. Specific non-native species that affect habitat for Edwards' Beach Moth include Scotch broom on James Island, Sidney Spit, and Cordova Spit; common gorse on James Island and Cordova Spit; European beachgrass (*Ammophila arenaria*) at James Island, Sidney Spit, and Wickaninnish Beach; and a suite of non-native grasses including brome species cheatgrass (*Bromus tectorum*), soft brome (*Bromus hordeaceus*), rip-gut brome (*Bromus rigidus*), and sweet vernalgrass (*Anthoxanthum odoratum*) at James Island, Sidney Spit, and Cordova Spit. The impact of invasive species is variable, but most cause or contribute to the development of most densely vegetated herbaceous or shrub-dominated plant communities that do not provide the same plant composition, plant abundance, or soil characteristics as native plant communities. Scotch broom and other native shrubs and trees (e.g., oceanspray [*Holodiscus discolor*], snowberry [*Symphoricarpos albus*], Douglas-fir [*Pseudotsuga menziesii*], and shore pine [*Pinus contorta*]) may also exclude native plants through shading. European beachgrass is well known for its ability to disrupt sand movement in dune systems and accelerate stabilization.

Fallow Deer (*Dama dama*) are also present on James Island and Sidney Spit and may occasionally browse plants used by Edwards' Beach Moth. Eastern Cottontail (*Sylvilagus floridanus*) may also browse plants at Cordova Spit. Both are non-native species.

IUCN-CMP 11. Climate change & severe weather

11.1 Habitat shifting & alteration; 11.2 Droughts; 11.4 Storms & flooding

Three components of climate change—habitat shifting and alteration, droughts, and storms and flooding—are expected to impact Edwards' Beach Moth over the next century, although the first two are not likely to cause population-level effects in the next 10 years. Climate change is predicted to cause sea-level rise and the inundation of low-lying coastal areas (which would likely cause some flooding at all sites), and increase summer drought (Littel *et al.* 2009), although the overall affect is unknown. An increase in frequency and size of storms causing habitat loss has been seen at Cordova Spit and Sidney Spit and is ongoing. Edwards' Beach Moth is at high risk from these changes because it is confined to low-lying coastal areas.

4.2.2 Other Threats Considered

IUCN-CMP Threat 4. Transportation & service corridors

4.1 Roads & railroads

Several sites that support Edwards' Beach Moth are known to have roads or utility corridors. Roads are present in 2 of the 3 sites on James Island within or near known habitat (Powder Jetty and Southwest Spit). A utility corridor is also present at Cordova Spit. Currently there are no plans to expand these corridors; however, direct loss of habitat through the incremental increase in areas used for parking, storage, and other uses adjacent to existing roads may occur in the future. This is not considered a present threat.

IUCN-CMP Threat 5. Biological resource use

Biological collecting (purposeful or accidental mortality from targeted or incidental collecting) is considered a negligible threat to Edwards' Beach Moth. Collecting happens rarely in these habitats. As well, sampling records indicate Edwards' Beach Moth may be abundant at some sites where it occurs (COSEWIC 2009).

IUCN-CMP Threat 9. Pollution

9.3 Agricultural & forestry effluents

Edwards' Beach Moth is within the introduction range of European Gypsy Moth (*Lymantria dispar*), and traps to detect introductions of this moth are scattered throughout southern B.C. (B.C. Ministry of Forests, Range and Natural Resource Operations 2013). A provincial program to detect and eradicate introductions of this moth has been ongoing since 1979 and spray has been applied in numerous areas within the range of Edwards' Beach Moth since this time (Figure 5).

If the moth is recorded in abundance (criteria are determined by the provincial Gypsy Moth Committee) ground and aerial spray of *Bacillus thuringiensis kurstaki* (Btk) are applied to control the moth. Btk is a component of commercial pesticides that use spores of a naturally occurring pathogenic bacterium to control defoliating caterpillars, although the bacterium also affects most non-target butterfly and moth larvae. Btk for European Gypsy Moth is typically applied in early April to early May, which coincides with Edwards' Beach Moth larval activity.

The area of Btk application varies yearly and depends on the extent to which Gypsy Moths are trapped during previous years' surveys. Since trap results are compiled over at least 2 years, should European Gypsy Moth be recorded there would likely be time to seek treatment options rather than simply broadcast aerial sprays. It is unlikely the entire Edwards' Beach Moth range would be treated for European Gypsy Moth according to October 2012 trap results; no Btk treatment is planned for 2013 (J. Burleigh, pers. comm., 2012).

The area most likely to have introduced Gypsy Moth is near Sidney, B.C. (e.g., Cordova Spit, Sidney Spit, James Island, and Thetis Island). Btk spray is not considered a high threat at the Wickaninnish Beach site on western Vancouver Island as Gypsy Moth has yet to be found there. Although the possibility of Gypsy Moth introduction still exists, Tofino is not a major port and does not have much shipping traffic or containers that increase the potential for spread of Gypsy Moth egg masses. The spread of egg masses by tourists is still possible, as camper vans, canoes, and recreational equipment are known to have egg masses attached and are often moved around during the summer.

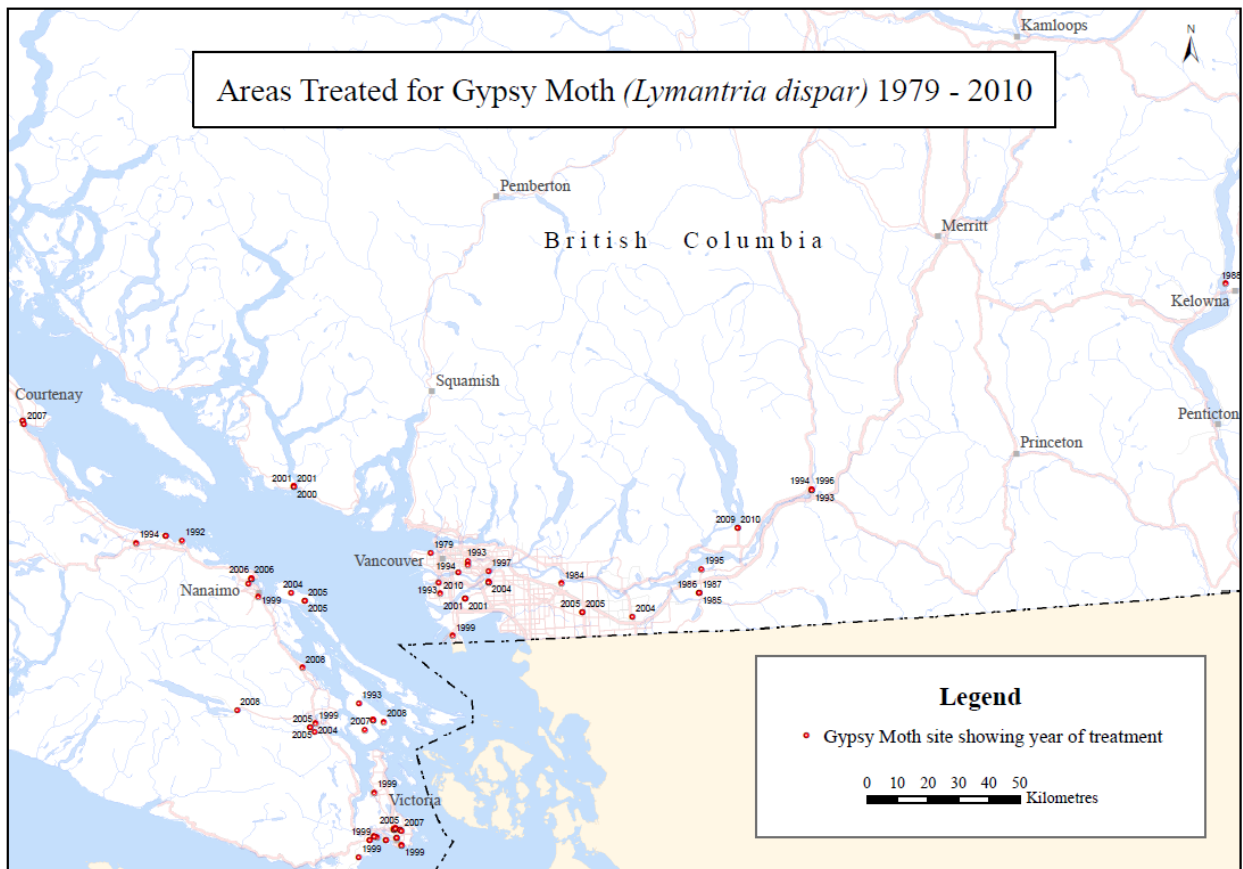


Figure 5. The use of aerial spraying of *Bacillus thuringiensis kurstaki* (Btk) or other microbiological pesticides to combat the introduced insect Gypsy Moth from 1979 to 2010.

9.5 Air-borne pollutants

Atmospheric nitrogen deposition is considered a threat to Edwards' Beach Moth because it contributes to the loss of sparsely vegetated native plant communities through increased fertility.

In western European dune systems, there is sufficient evidence of substantial habitat change to consider it a threat (Gerlach 1993). In B.C., preliminary analysis indicates nitrogen levels in rainwater are low. Should this become a substantiated threat in B.C., it is most likely to affect the Sidney sites because of proximity to industrial sources.

IUCN-CMP 10. Geological events

10.2 Earthquakes, tsunamis

Tsunamis caused by large earthquakes could threaten Edwards' Beach Moth in low-lying sites, particularly the Wickaninnish Beach (see background information in Clague *et al.* 2000). The James Island, Sidney Spit, and Cordova Spit sites can also be affected as tsunamis may also occur in the Strait of Georgia from earthquakes or landslides but are likely less frequent and smaller (Clague and Orwin 2005). It is expected that large tsunamis will move large amounts of sediment, bury or damage vegetation, and inundate coastal areas with saline waters. Mortality or injury to Edwards' Beach Moth adults, eggs, larvae, or pupae would likely be severe.

5 RECOVERY GOAL AND OBJECTIVES

5.1 Recovery (Population and Distribution) Goal

The population and distribution goal is to ensure the persistence of Edwards' Beach Moth at all extant sites (and any new sites) and maintain its current distribution within its range in British Columbia

5.2 Rationale for the Recovery (Population and Distribution) Goal

Edwards' Beach Moth is known from 2 isolated populations (6 sites) throughout its range in B.C.; it is unlikely these 2 populations mix. Suitable habitat is related to geologic conditions and coastal processes, which create coastal sand and salt marsh habitats. Coastal sand habitats were likely more prevalent following the retreat of the last glaciers and present populations of Edwards' Beach Moth are likely smaller and more isolated than in the past. The persistence of Edwards' Beach Moth in these relict habitats suggests the species has persisted in isolated habitats over millennia, attesting to its apparent resilience to long-term stochastic threats. If additional naturally occurring populations are recorded, these will be included in recovery planning.

There is currently no information from historical sampling to suggest Edwards' Beach Moth was more widespread. The historical records labeled "Shawnigan District" are vague, with little site collection information. At the time of collection (1931), this area was not well mapped and was more accessible. As such, this likely represents a much broader area than is currently defined by the Shawnigan Lake municipality. The site collection information associated with the 2 records labeled "Thetis Island" is also not well documented. Habitat on Thetis Island likely has not changed since the collection. There is need to spatially map (e.g., with aerial photography and ground fieldwork) and prioritize these areas for further inventory to determine if the moth is still present at these sites. Other than these three sites, we do not have evidence there were/are

additional Edwards' Beach Moth sites. Thus a goal to actively increase the number of sites through translocation or other techniques is not recommended at this time.

Population targets cannot be quantified at this time. There are no population estimates for Edwards' Beach Moth and there is no easy method for filling this knowledge gap. Consequently, there is no information with which to measure abundance trends or to complete a minimum population viability analysis. Dispersal and re-colonization capabilities are unknown, and detailed habitat requirements are unclear. If future population and distribution data indicate either or both of abundance and/or species' range (i.e., measured as extent of occurrence or area of occupancy) shows a documented decline than deliberate attempts to increase abundance may be warranted at one or more sites. The feasibility of restoring habitat or the feasibility of re-introducing Edwards' Beach Moth to increase abundance would need to be determined.

5.3 Recovery Objectives

1. To secure protection for the known sites (and new sites) and habitats of Edwards' Beach Moth.
2. To assess and mitigate the extent of current threats to Edwards' Beach Moth at all sites in B.C.
3. To address knowledge gaps (e.g., habitat requirements, host plant use, range in B.C., dispersal abilities) for Edwards' Beach Moth.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2010). Status of the action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2009). Update due 2019.

Send to COSEWIC (complete)

- Edwards' Beach Moth assessed as Endangered (COSEWIC 2009).

Recovery Planning (in progress)

- B.C. Recovery Plan completed (this document, 2013).

Habitat Protection and Private Land Stewardship (in progress)

Table 3. Existing mechanisms that afford habitat protection for Edwards' Beach Moth.

Existing mechanisms that afford habitat protection	Threat ^a or concern addressed	Site
Gulf Islands National Park Reserve (includes what was Sidney Spit Provincial Park) provides protection through the <i>Canada National Parks Act</i>	1.3, 6.1, 8.1	Sidney Spit
Conservation covenant on coastal sand ecosystem and salt marsh sites (see Page and Harcombe 2010) held by Nature Conservancy of Canada	1.3, 6.1, 8.1	James Island (3 sites)
Conservation zoning (Tsawout First Nation)	6.1	Cordova Spit
Municipal park in District of Central Saanich (e.g., local by-laws; park management plans)	6.1	Cordova Spit
Pacific Rim National Park Reserve provides protection through the <i>Canada National Parks Act</i>	1.3, 6.1, 8.1	Wickaninnish Beach

^a Threat numbers according to the IUCN-CMP classification (see Table 2 for details).

Habitat Restoration and Private Land Stewardship (in progress)

- A management plan for the covenant areas on James Island was developed by the Nature Conservancy in 2010 (Page and Harcombe 2010). Invasive species management and other stewardship activities have occurred since 2010.
- A large-scale habitat restoration project is currently being undertaken by Parks Canada in the Wickaninnish Dunes, Pacific Rim National Park Reserve, to remove non-native invasive species, specifically European beachgrass.
- Tsawout First Nation has managed access to Cordova Spit to reduce recreation-related disturbance, particularly from off-road vehicle use.
- CRD Parks, Tsawout First Nation, and District of Central Saanich developed a management plan for the Cordova Shore, which includes Island View Beach, Cordova Spit, and the Tsawout Wetland (Page 2010).
- Parks Canada has implemented measures to manage recreation and control non-native invasive species at Sidney Spit, Gulf Islands National Park Reserve.

6.2 Recovery Planning Table

Table 4. Recovery planning table for Edwards' Beach Moth.

Actions to meet objectives	Threat ^a or concern addressed	Priority ^b
Objective 1. To secure protection for the known sites (and new sites) and habitats of Edwards' Beach Moth.		
1. Establish protection measures. e.g., memorandums of understanding with landowners and lands managers for four private landowners at Cordova Spit (three landowners) and James Island (one landowner).	1.3, 6.1, 7.1, 8.1	Essential
2. Work with municipalities where Edwards' Beach Moth occurs, to use environmental protection tools as afforded under current legislation (e.g., Development Permit Areas).	All	Essential
3. Determine the area of occupancy of known sites and spatially define the	Knowledge	Essential

Actions to meet objectives	Threat ^a or concern addressed	Priority ^b
habitat polygon where Edwards' Beach Moth occurs at each site. This identifies the spatial areas needed for protection and informs specific management protection actions (e.g., fencing, invasive species management).	Gap	
Objective 2. To access and mitigate the extent of current threats to Edwards' Beach Moth at all sites in B.C.		
1. For all extant sites, develop and implement site management plans that assess and prioritize threats, and develop action-oriented management prescriptions. Doing this as part of multi-species management plans for the coastal sand ecosystems is recommended.	6.1, 8.1	Essential
2. Identify and prioritize possible techniques for invasive plant control with emphasis on Scotch broom and European beachgrass.	8.1	Essential
3. Test and implement invasive plant control methods.	8.1	Necessary
4. Review the success of Nature Conservancy invasive species removal at North Spit on James Island.	6.1	Necessary
5. Review habitat recovery at Cordova Spit following access management by the Tsawout First Nation.	6.1	Necessary
6. Develop recreation management plans for all known locations and adjacent sites with recovery potential.	6.1	Essential
7. Consult with the Province of B.C. regarding potential aerial application of microbial pest control agents such as Btk near known localities.	9.3	Essential
8. Prepare a fact sheet or at risk brochure on all rare moths within sand ecosystems.	All	Beneficial
Objective 3. To address knowledge gaps (e.g., habitat requirements, host plant use, range in B.C., dispersal abilities) for Edwards' Beach Moth.		
1. Sample potential sites including Island View Beach, Hook Spit (Sidney Island), historical sites such as Thetis Island and Shawnigan areas, and beaches in the Long Beach Unit of Pacific Rim National Park Reserve to clarify species range.	Knowledge Gap	Necessary
2. Undertake larval surveys at known locations to identify host plant(s) use.	Knowledge Gap	Essential
3. Sample salt marsh sites and coastal sand habitats to assess possible habitat use.	Knowledge Gap	Necessary
4. Review recent records from the Puget Sound region of WA to provide further information on habitat requirements including host plant use.	Knowledge Gap	Beneficial
5. Assess soil fertility and atmospheric nitrogen levels to determine the potential effects of soil eutrophication.	Knowledge Gap; 9.5	Beneficial
6. Estimate dispersal ability based on published literature for noctuid moth species to better understand population isolation.	Knowledge Gap	Beneficial

^a Threat numbers according to the IUCN-CMP classification (see Table 2 for details).

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

6.3 Narrative to Support Recovery Planning Table

It is recommended that a collaborative ecosystem-based approach to recovery planning that will support the suite of rare plant and invertebrate species found in coastal sand ecosystems in B.C.

is used. Recovery teams such as the B.C. Invertebrates Recovery Team are in a good position to offer advice as to how to manage habitat for Edwards' Beach Moth in combination with other species. This will allow possible conflicts and synergies with habitat recovery actions for Edwards' Beach Moth and other species at risk to be assessed.

7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL

To assist in meeting the recovery (population and distribution) goal, this description of the habitat needed for the survival and recovery of Edwards' Beach Moth was developed. It is based on the available information on the habitat requirements and biology of the species. The description of survival/recovery habitat will be clarified as knowledge gaps are filled.

7.1 Description of Survival/Recovery Habitat

The known biophysical attributes of survival/recovery habitat for this species in B.C. are:

- coastal marine sites less than 0.5 km from the shore at elevations less than 5 m above sea level;
- sparsely vegetated coastal sand habitats such as sand spits, dunes, and beaches, as well as coastal salt marshes; and
- soil at capture sites is coarse to medium sand that is well-drained and generally free of organic matter. Soil chemistry is generally neutral to slightly acidic, and very low in organic matter and nutrients.

Host plants needed by Edwards' Beach Moth during the different life history stages is unknown; however, common plants in habitats where the moth has been captured are dune wildrye, silver burweed, large-headed sedge, beach pea, and American searocket. Common salt marsh plants include seashore saltgrass, American glasswort, and the exotic common orache.

7.2 Specific Human Activities Likely to Damage Survival/Recovery Habitat

Activities likely to damage survival/recovery habitat are listed in Table 5. It includes any activity that disturbs, damages, is detrimental to the survival/growth, or kills the host plant and associated vegetation and changes soil structure and chemistry such as excavation, compaction, filling, scraping, mowing, or planting.

Table 5. Activities likely to result in the damage of survival/recovery habitat for Edwards' Beach Moth.

Description of activity	Description of effect (biophysical attribute or other) in relation to habitat function loss	Details and relationship to identified threats ^a
Development or conversion of natural landscape for buildings, roads, infrastructure, recreation facilities, or other uses that disturb soil and damage or remove vegetation or shade or otherwise alter ecology of host plant	Results in the direct loss of survival/recovery habitat through removal or damage to native vegetation (host or nectar plants), soil disturbance and compaction, and/or related indirect effects, which cause damage or destruction to biophysical attributes required by Edwards' Beach Moth	The threat of direct habitat loss is limited by the formal protection for most of the sites in which Edwards' Beach Moth is found (IUCN-CMP 1.1, 1.3)
Recreation activities including walking, camping, and other non-motorized activities	Results in the direct loss of survival/recovery habitat through removal or damage to native vegetation (host or nectar plants) soil disturbance and compaction, and/or related indirect effects which cause damage or destruction to biophysical attributes required by Edwards' Beach Moth	Recreation is common in most of the sites where Edwards' Beach Moth is found except for James Island where access is controlled. Recreation disturbance is considered a relatively minor threat at most sites (IUCN-CMP 6.1)
Operation of motorized vehicles, such as ATVs, trucks, heavy equipment	Results in the direct loss of survival/recovery habitat through removal or damage to native vegetation (host or nectar plants), soil disturbance and compaction, and/or related indirect effects, which cause damage or destruction to biophysical attributes required by Edwards' Beach Moth	Motorized vehicle use is a minor threat at most sites but has historically been a source of major habitat disturbance at several sites (Island View Beach and Cordova Spit) (IUCN-CMP 4.1)
Introduction of alien invasive species	Alien invasive plants deprive Edwards' Beach Moth of suitable habitat by competing with native plants for resources, stabilizing and colonizing sparsely vegetated habitats, and potential changing soil chemistry	Scotch broom, European beachgrass, common gorse, and various non-native grasses have rapidly changed many coastal sand habitats in coastal B.C. (IUCN-CMP 8.1).
Anthropogenic shoreline modification that may cause erosion	Loss of survival/recovery habitat from conversion from terrestrial to marine or intertidal habitat	Erosion is a natural process that can be initiated or accelerated by anthropogenic changes to coastal processes (IUCN-CMP 7.3)
Application of insecticides	Treatment of host and food plants with insecticide may cause these habitat components to become lethal to Edwards' Beach Moth when ingested	While this is an unlikely threat, insecticides used to control invasive species may coat food sources with lethal substances (IUCN-CMP 9.3)

^aThreat numbers according to the IUCN-CMP classification (see Table 2 for details).

8 MEASURING PROGRESS

The following performance indicators provide a way to define and measure progress toward achieving the recovery (population and distribution) goal and objectives. As determining population estimates for Edwards' Beach Moth is not feasible, monitoring programs and measurement of recovery success will need to be based on persistence of habitat attributes and

recovery implementation. Performance measures are listed below for each objective.

Measurables for Objective 1:

- Establish stewardship agreements and/or covenants for known (and any new) Edwards' Beach Moth sites on regional district and municipal lands by 2016.

Measurables for Objective 2:

- Develop site management plans for all known localities by 2015 and implement by 2017.
- Design, test, implement, and monitor initial invasive plant control projects of a minimum size of 1000 square metres at all Sidney sites by 2015.
- Design and implement recreation management at known locations and adjacent recovery habitat (e.g., Island View Beach Regional Park) by 2015.

Measurables for Objective 3:

- Undertake new sampling at 12–15 potential locations including salt marsh sites by 2014.
- Undertake larval surveys and assess host plant use by 2016.

9 EFFECTS ON OTHER SPECIES

A suite of other species at risk is found in coastal sand ecosystems where Edwards' Beach Moth is known or may occur. They include Streaked Horned Lark (*Eremophila alpestris strigata*) (endangered/extirpated), Sand-verbena Moth (endangered), pink sand-verbena (*Abronia umbellata* var. *breviflora*) (endangered), grey beach peavine (*Lathyrus littoralis*) (under assessment), and contorted-pod evening-primrose (*Camissonia contorta*) (endangered). Other species such as yellow sand-verbena (*Abronia latifolia*), American glehnia (*Glehnia littoralis* ssp. *leiocarpa*), and black knotweed (*Polygonum paronychia*) are listed as species at risk provincially.

All the species of conservation significance in coastal sand ecosystem depend on sparsely vegetated habitats with intact disturbance processes for continued persistence. Recovery activities to benefit Edwards' Beach Moth are generally expected to benefit other species at risk as well. Removal of invasive plants using burning, mechanical excavation, or herbicides can cause local, short-term impacts including soil compaction and vegetation loss; however, these activities are expected to have long-term benefits for Edwards' Beach Moth and other species at risk on coastal sand ecosystems.

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