

**PETITION TO LIST THE
Sand Verbena Moth (*Copablepharon fuscum*)
UNDER THE U.S. ENDANGERED SPECIES ACT**



Photo © Nick Page

**Petition Submitted to the U.S. Secretary of Interior
Acting through the U.S. Fish and Wildlife Service**

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Executive Summary

The Sand Verbena Moth (*Copablepharon fuscum*) (Moth) is a critically imperiled moth known to exist in only ten populations within a narrow range in the Strait of Georgia of British Columbia in Canada and the Puget Sound of Washington in the United States. Within its range, this moth depends on dune coastal habitat containing relatively large stands of its host plant, the yellow sand verbena (*Abronia latifolia*). Yellow sand verbena only grows near sea level, in sandy coastal areas that lack dense plant cover. The Moth depends on the yellow sand verbena in all life stages except pupation. Adult moths feed on the nectar of the sand verbena's trumpet-shaped flower; adults lay eggs in its flowers; and larvae feed on its leaves and flowers.

Of its ten populations, four are in British Columbia and six are in Washington. The populations within Canada are likely isolated from each other, and they are isolated from the U.S. populations. The total occupied area of the Canadian populations is approximately 61 hectares (151 acres). The occupied area within the U.S. is unknown, but limited. The entire range of this species measures 220 km by 45 km (137 mi by 28 mi).

The Moth is in a precarious situation, as it is a habitat specialist tied to another habitat specialist in a highly threatened habitat type. This specialization on one food plant (monophagy) alone makes the Moth vulnerable to extinction. Primary anthropogenic threats include: inundation of its coastal habitat as a result of rising sea levels and increased storm surges due to climate change; habitat loss from stabilization of its shifting dune habitat; displacement of yellow sand verbena due to non-native vegetation; recreation, development, and military activities within its habitat; use of pesticides that kill all Lepidoptera, including the Moth; and other threats.

Recognizing the Moth's imperilment, Canada listed this species as Endangered under its Species At Risk Act in 2005 and released its Recovery Strategy in 2008. In contrast, the Sand Verbena Moth has no status under the U.S. Endangered Species Act (ESA). This petition therefore requests that the U.S. list this critically imperiled insect as Endangered or Threatened under the ESA. The Sand Verbena Moth requires protection on both sides of the border.

Such protection will not only benefit the Sand Verbena Moth, but also the dune coastal ecosystem it requires, an ecosystem that is likewise becoming imperiled. The Moth is but a bellwether of ecosystem decline. Other dwindling species that would benefit from habitat protection measures for the Moth include the Streaked Horned Lark (*Eremophila alpestris strigata*), which is currently a candidate for ESA protection, and the Island Marble Butterfly (*Euchloe ausonides insulanus*), a highly imperiled butterfly that occurs in the same range and on at least one of the same sites (San Juan Island, Washington).

Introduction

This petition requests that the U.S. Fish and Wildlife Service (FWS) list the Sand Verbena Moth (*Copablepharon fuscum*) (Moth) as Endangered or Threatened throughout its entire range under the U.S. Endangered Species Act (ESA). This moth has a narrow range, is narrowly distributed within that range, and has life history traits and habitat associations that make it vulnerable to anthropogenic and natural threats. While it enjoys protection under the Canadian Species At Risk Act (SARA), it enjoys no ESA protections in the U.S.

The Moth is classified by scientists as critically imperiled and is thought to be facing increasing threats and an accelerating decline. A wide range of threats may usher in its extinction unless the U.S. affords this species federal protection and collaborates with Canadian authorities on a binational recovery strategy. A recovery effort should seek to preserve and restore the moth, its coastal dune habitat, and its host plant, the yellow sand verbena (*Abronia latifolia*). These recovery actions would result in collateral benefits to other plants and animals that rely on this vanishing habitat.

WildEarth Guardians and The Xerces Society for Invertebrate Conservation seek listing of the Sand Verbena Moth under the ESA in order to give this rare, fragile creature its best chance of survival. Over 99% of the species listed under the ESA still exist.¹ The ESA is the Sand Verbena Moth's best hedge against extinction.

Endangered Species Act Implementing Regulations

Section 424 of the regulations implementing the Endangered Species Act (50 C.F.R. § 424) is applicable to this petition. Subsections that concern the formal listing of the Sand Verbena Moth as an Endangered or Threatened species are:

424.02(e) "*Endangered species* means a species that is in danger of extinction throughout all or a significant portion of its range."... (k) "species" includes any species or subspecies that interbreeds when mature. *See also* 16 U.S.C § 1532(6).

(m) "*Threatened species* means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." *See also* 16 U.S.C § 1532(20).

ESA Section 4 (16 U.S.C. § 1533(a)(1)) sets forth listing factors under which a species can qualify for ESA protection (see also 50 C.F.R. § 424.11(c)):

- 1. The present or threatened destruction, modification, or curtailment of habitat or range;**
2. Overutilization for commercial, recreational, scientific, or educational purposes;

¹Compare the number of species currently listed under the ESA (1321) with the species that have been delisted due to extinction (9). *See* <http://www.fws.gov/endangered/wildlife.html> [Accessed November 2009].

3. **Disease or predation;**
4. **The inadequacy of existing regulatory mechanisms; and**
5. **Other natural or manmade factors affecting its continued existence.”**

At least four of the five factors (bolded above) set forth in 424.11(c) and in ESA Section 4 (16 U.S.C. § 1533(a)(1)) have resulted in the imperilment of the Sand Verbena Moth and are causing the species to face extinction or endangerment in the foreseeable future across its range in the U.S. and Canada. A taxon needs to meet only one of the listing factors outlined in the ESA to qualify for federal listing.

Classification and Nomenclature

Common Name. The common name for *Copablepharon fuscum* Troubridge and Crabo, 1995 is the “Sand Verbena Moth” or “Sand-verbena Moth.” We refer to this species as the “Sand Verbena Moth” or “Moth” throughout this petition.

Taxonomy. The Sand Verbena Moth was first described by J.T. Troubridge and L.G. Crabo in 1995, based on specimens collected near Sidney, British Columbia (BC), and on Whidbey Island, Washington (WA) (Troubridge and Crabo 1995). The taxonomic classification for *Copablepharon fuscum* is shown in Table 1.

Table 1. Taxonomy of *Copablepharon fuscum*.

Order	Lepidoptera
Superfamily	Noctuoidea
Family	Noctuidae
Subfamily	Noctuinae
Tribe	Agrotini
Genus	<i>Copablepharon</i>
Species	<i>Copablepharon fuscum</i>

The species name originates from the Latin “fuscus,” meaning dark or swarthy, and is a reference to its unusually dark wing color (Troubridge and Crabo 1995). Most species in this genus are found in arid sandy environments and have narrow ranges (J.T. Troubridge, pers. comm., 2002, cited in COSEWIC 2003).

Description

The Sand Verbena Moth has a 35-40 mm (1.4-1.6 in) wingspan, is golden to dark brown, and has distinctive black and yellow lines parallel to the wing margins. Its wings have a predominantly gray underside. Overall coloring varies among individuals and southern populations may be darker than northern populations. Males and females have similar coloring, wing patterns, and size (Troubridge and Crabo 1995; COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008).

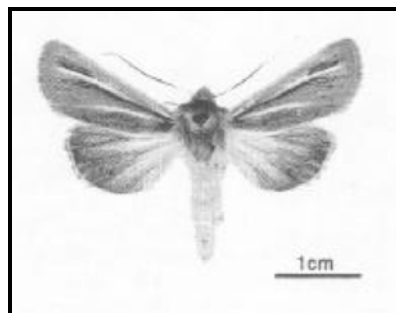


Figure 1. *Copablepharon fuscum*: holotype male. Source: Troubridge & Crabo (1995).

The Moth has exhibited a range of colors (Figure 2).



Figure 2. Color Range in Adult Sand Verbena Moth.
Source: J.T. Troubridge, in COSEWIC 2003.

Distinctive traits

There are no species in the Moth's range with a similar appearance to the Moth (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008).

Range distinction

This Moth is the only species within the *Copablepharon* genus that occurs west of the Cascade Mountains. While three other species in this genus occur in BC (*C. absidum*, *C. hopfingeri*, and *C. spiritum*), none occur within coastal sand dune habitats (British Columbia Invertebrates Recovery Team 2008). The closest species to the Sand Verbena Moth geographically is *C. absidum*, which is found near Osoyoos in BC and in Washington, northern Oregon, and central Idaho. Additionally, *C. hopfingeri* has been found in northeastern Washington and southeastern BC, but was extirpated from BC (COSEWIC 2003).

Geographic Distribution: Historic and Current

The Moth is limited to the Salish Sea (the Georgia Basin-Puget Sound watershed) of BC and WA (British Columbia Invertebrates Recovery Team 2008). Additional surveys have been conducted in suitable habitats on the Long Beach peninsula in Washington and have not uncovered new populations of this species (pers. comm. with Lars Crabo, 2 February 2010). The global range of this species is less than 220 km long and 45 km wide (137 mi by 28 mi) (British Columbia Invertebrates Recovery Team 2008).

Habitat & Natural History

The Sand Verbena Moth is dependent on yellow sand verbena, its only host plant. There is no evidence that it can use alternate host plants. Yellow sand verbena grows exclusively in sandy dune habitats near sea level along the Pacific Coast. Only large coastal sand features, such as dunes, beaches, and spits support this plant. The verbena is known from only 28 locations in BC, and it is rare in the Georgia Basin/Puget Sound region. Sand-dominated coastal sites are likewise considered rare in BC. This plant is considered to be vulnerable in Oregon and BC, but its conservation status has not been assessed in Washington or California (NatureServe 2010). A viable Moth population requires stands of large, flowering patches of yellow sand verbena greater than 500 square meters (547 square yards). The Moth requires the yellow sand verbena in all life stages except pupation. Adult moths feed on the nectar of the sand verbena, using their long proboscis to access the trumpet-shaped flowers. Adults lay eggs in the verbena's flowers, which hatch within approximately 2 weeks. Larvae feed on the verbena's leaves and flowers (COSEWIC 2003; Page 2005a; British Columbia Invertebrates Recovery Team 2008).



Figure 3. Dense Patch of Flowering Sand Verbena on Sandy Ridge.
Photo by Nick Page in COSEWIC 2003.



Figure 4. Yellow Sand Verbena Flowers and Leaves.
Photo by Sarina Jepsen/Xerces Society.

Adult Moths take flight from mid-May to early July, with a lifespan of 7-21 days. The adults fly once per year, at dusk or early evening. The flight season and mating peaks in mid-June, which corresponds to the peak flowering period of the yellow sand verbena. Adults deposit small groups of eggs or single eggs in the flowers of the yellow sand verbena. Larvae feed nocturnally on the verbena's flowers and leaves during the summer and subsequently enter dormancy (diapause) and overwinter from early fall to early spring. Diapause ends in early spring, at which time larvae continue feeding until they enter pupation in late April and May. Pupation takes place below ground in the sand, underneath verbena patches (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008). After a pupation period of approximately 10 days, adults emerge (SARA Registry 2009).

Historic and Current Population Status & Trends

There are 10 known populations, four of which are in BC, and six of which are in WA. All

populations are isolated from each other (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008). Population numbers are unknown, but NatureServe (2009) roughly estimates the total population in Canada as less than 10,000 individuals, and the total in the U.S. as likely just a few thousand, but possibly more than 10,000 individuals. The global population has been described as “very small,” “likely declining,” and “low for an insect” (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008; NatureServe 2009). NatureServe (2009) describes the species as “obviously not secure,” and describes global long-term declines of 75-90%.

Each location is considered a metapopulation, consisting of subpopulations distributed according to availability of yellow sand verbena. While the British Columbia Invertebrates Recovery Team (2008) describes the four BC populations as apparently stable, it points out that “it is premature to suggest the populations will remain stable” given variability in insect populations annually, as well as the threats this species faces. *Id.* at p. 2. In addition, COSEWIC (2003: v) writes: “the size of yellow sand-verbena populations in many sites has likely declined substantially in the past 50 years because of vegetation changes.” Given the dependence of the Moth on the verbena, these verbena declines may have resulted in Moth declines. Because this species was only recently described, information on historical population abundance that would inform whether or not this species has declined over time is unavailable.

Table 2. Table of Sand Verbena Moth Occurrences.

Source: British Columbia Invertebrates Recovery Team 2008; Troubridge and Crabo 1995.

Location	Country	Total habitat hectares (acres)
Goose Spit	Canada	9.8 (24.2)
Sandy Island Marine Provincial Park	Canada	17.8 (44)
Island View Beach and Cordova Spit, Capital Regional Park	Canada	20.2 (49.9)
James Island	Canada	13.3 (32.9)
San Juan Island (Puget Sound)	U.S.	Not available
Whidbey Island in Deception Pass State Park (Puget Sound) *Type locality	U.S.	Not available
Whidbey Island Site 2 (Puget Sound)	U.S.	Not available
Sequim, WA Site 1 (eastern side of Juan de Fuca Strait)	U.S.	Not available
Sequim, WA Site 2 (eastern side of Juan de Fuca Strait)	U.S.	Not available
Port Townsend, WA	U.S.	Not available

Other locations have been surveyed for Moths without success (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008; NatureServe 2009), including the Long Beach peninsula in Washington (pers. comm. with Lars Crabo, 2 February 2010). NatureServe

(2009) indicates that some of the 10 known sites, and particularly the 6 known sites in Washington, may not be separate occurrences. Washington Department of Fish and Wildlife Service (2008) considers the following counties as within the Moth's range: Clallam, Jefferson, and San Juan Island.

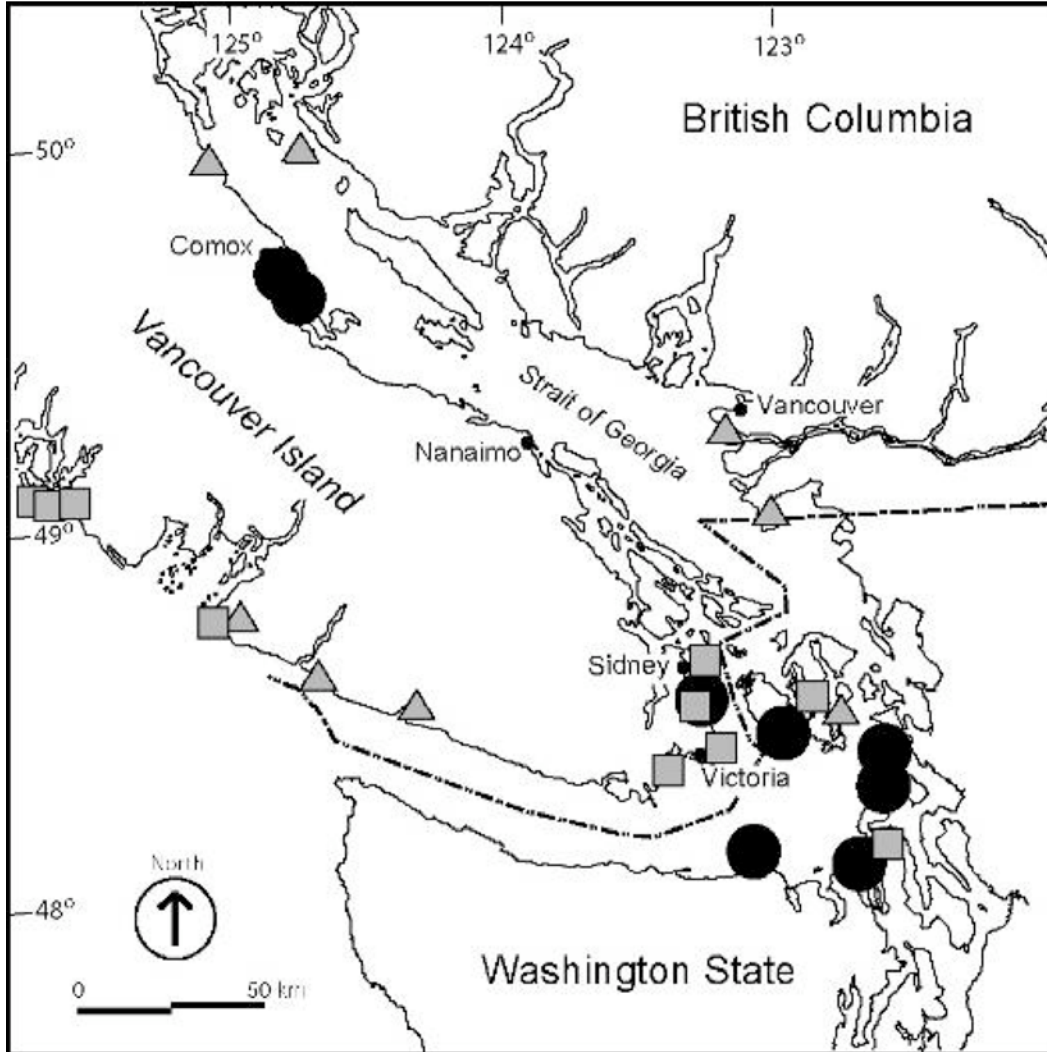


Figure 5. Sand Verbena Moth locations and recent sampling sites in the U.S. and Canada. Source: British Columbia Invertebrates Recovery Team 2008. Sand Verbena Moth locations are indicated by black dots. Sites with yellow sand-verbena that were sampled but failed to capture the Moth are indicated by squares. Dune sites without yellow sand-verbena that were sampled and failed to capture the Moth are indicated by triangles. Note that additional sites have been surveyed in Washington and have not found the Sand Verbena Moth, but they are not included in this map (pers. comm. with Lars Crabo, 2 February 2010).

Land ownership

United States. COSEWIC (2003) describes the U.S. sites as primarily on public lands: 1 location is within a national park; 1 within a wildlife refuge; 2 in state parks (including the type locality from Deception Pass State Park on Whidbey Island); and 1 on military land.

Canada. Of the 4 BC locations, 1 is entirely on private land (James Island); and the majority of another (Island View/Cordova Spit) is on indigenous land. The entire Sandy Island site occurs on national park land. A small portion of the Goose Spit site occurs on national park land. *See* British Columbia Invertebrates Recovery Team 2008 at Table 1. The British Columbia Invertebrates Recovery Team (2008: 15) notes that: “While much Sand-verbena Moth habitat is within protected areas, ongoing threats to this habitat...continue within some protected areas.”

Identified Threats to the Petitioned Species: Criteria for Listing

The Sand Verbena Moth meets several of the criteria for listing under the ESA (factors met are bolded):

- 1. Present and threatened destruction, modification, and curtailment of habitat and range;**
2. Overutilization for commercial and recreational purposes;
- 3. Disease or predation;**
- 4. The inadequacy of existing regulatory mechanisms; and**
- 5. Other natural or manmade factors affecting its continued existence.**

I. Present and Threatened Destruction, Modification, or Curtailment of Habitat or Range.

Several factors reduce and degrade Moth habitat. These include any activities altering the sand dune vegetation or other conditions at Moth locations. Examples are: vegetation stabilization, habitat conversion, military and recreational activities, coastal erosion, and stochastic events, such as extreme weather (British Columbia Invertebrates Recovery Team 2008). COSEWIC (2003) described the Moth as already having undergone extensive habitat loss, and this habitat decline is continuing at an increased pace. The British Columbia Invertebrates Recovery Team (2008) describes habitat threats to the species as increasing.

For example, on Goose Spit, Page (2005b) found that dune areas had decreased nearly 80% in the past 70 years, from 10.54 ha (26 ac) in 1931 to 2.22 ha (5.5 ac) in 2002. The primary cause of this decrease was invasion of scotch broom, which appears to be accelerating. *Id.* In Washington, this species primarily occurs in state and national parks, which are popular locations for beach recreation, which is on the rise. The foot traffic within these parks presents a significant threat to the yellow sand verbena and the Moth that depends on it.

Vegetation stabilization. The yellow sand verbena requires dynamic sand dune ecosystems. Write COSEWIC (2004: 19): “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.” Stabilization of dunes by native and introduced (e.g., European beachgrass, scotch broom, cheatgrass) species degrades habitat for the verbena and therefore the moth. Stabilization results in a loss of suitable verbena patches and declined flowering. This threat is considered severe at all Moth locations in BC (COSEWIC 2003; British Columbia Invertebrates Recovery Team 2008), and most locations in Washington. Troubridge and Crabo (1995: 99) note that: “The introduced European beach grass, *Ammophila arenaria* (L.) (Gramineae), has stabilized most of the dune habitat on the Pacific Coast, supplanting the native beach vegetation.” The State of Washington describes non-native beachgrass as currently dominating most Washington dunes.² This displaces yellow sand verbena. L. Crabo noted (pers. comm. 2 February 2010) that the dunes at the type locality in Deception Pass State Park have been less affected by European beachgrass and Scotch broom than some of the other sites, but the Moth population at this site is threatened by habitat conversion and high levels of human recreation.

Habitat conversion. At least four locations (Cordova Spit, Sandy Island, and Goose Spit in BC; Deception Pass State Park on Whidbey Island in WA) have experienced reduced habitat because of park infrastructure, such as campgrounds and parking areas. Military buildings and other infrastructure has also reduced Moth habitat. Marine developments and beach area expansions at Island View and Goose Spit, past and proposed, have and will destroy Moth habitat (British Columbia Invertebrates Recovery Team 2008). A parking lot has already converted sand dune habitat in Deception Pass State Park site, and a housing development occurs nearby; only about 300 yards of beach dune habitat remain at the type locality for the Sand Verbena Moth, making this species vulnerable to extirpation at this location (pers. comm. with L. Crabo, 2 February 2010).

Recreation activities. Recreational foot traffic on beach dunes presents a substantial threat to the Sand Verbena Moth, in part because the Moth’s habitat overlaps significantly with popular recreational sites on public land in Washington and BC. For example, one park within the range of the Moth received 421,630 visitors in 2005. Nearly all Moth populations in Washington occur on public lands that experience high recreational use. High levels of foot traffic will trample and disturb the yellow sand verbena and compact the sand dunes. Moths at all life stages can be killed or otherwise harmed. Because the Sand Verbena Moth pupates within the sand, at this life stage it is especially vulnerable to being killed by trampling. The burgeoning human population in the U.S. portion of the Moth’s range (Mote et al. 2005) means that threats from recreation will likely increase.

Coastal erosion. Because all Moth habitat occurs within 25-100 m (82-328 ft) of the shore, the species is particularly vulnerable to coastal erosion from severe winter storms, wildfire, and heavy winds during the Moth’s flight season. The Moth population on San Juan Island in particular is threatened by erosion, as it is located on an eroded dune and the roots of yellow sand verbena plants are visible in many places. Severe winter storms typically occur when larvae are overwintering, buried in the sand. This occurred, for instance, in 2005/2006, when

²See <http://www.ecy.wa.gov/programs/sea/coast/plants/dunegrass.html> [Accessed January 2010].

storms eroded 2-10 m (7-33 ft) of dunes along Goose Spit for 200 m, which reduced sand verbena plants used by the Moth. Alternatively, erosion barriers at Comox Bluffs may lead to vegetation stabilization at Goose Spit (British Columbia Invertebrates Recovery Team 2008). The threat of coastal erosion in the U.S. is discussed in Mote et al. (2005).

The Moth is also adversely affected by artificial barriers constructed to reduce coastal erosion (British Columbia Invertebrates Recovery Team 2008). In a report on Washington State, Canning (1991) describes:

The common response to shoreline erosion – real or apparent – has been a proliferation of bulkheading and other ‘hard protection’ techniques....Extensive shore protection will minimize shoreline erosion and retreat, but will also eliminate the source of materials which would otherwise be available to maintain beaches and accreting shorelines. (Cited in Mote et al. 2005: 14).

Given the threat of habitat loss to this species, the Canadian recovery effort is focused on habitat protection of known Moth locations, with an emphasis on processes that influence the sand dune ecosystems and yellow sand verbena populations (British Columbia Invertebrates Recovery Team 2008).

II. Overutilization for commercial, recreational, scientific, or educational purposes

Collection is not known to constitute a threat to the Sand Verbena Moth. However, the rarity of the species may make it more attractive to lepidoptera collectors. Lepidoptera populations that are small and easily accessible are especially vulnerable to over-collection. However, much information may be gained about the life history and conservation status of this species through collecting. FWS should investigate the extent of collection and the potential consequences to the species during the course of a status review.

III. Disease

FWS should further investigate disease as a threat in a status review for the species. Many, if not most, insect populations normally experience large fluctuations in size (Ehrlich 1992; British Columbia Invertebrates Recovery Team 2008). Predation and disease may cause annual changes in Lepidoptera numbers of an order of magnitude or more. The limited extent of Moth populations increases their vulnerability to extirpation due to natural fluctuations that may occur as a result of disease or predation pressures. Adult and larval moths are likely subject to predation by bats, birds, and small mammals (British Columbia Invertebrates Recovery Team 2008). In addition, alien parasitic tachinid flies, introduced to control gypsy moths, can harm the Moth. These flies are known to parasitize and kill moths. If they become established in the Moth’s range, they will threaten this imperiled species. Herbivory of yellow sand verbena by deer and introduced rabbits is considered a minor threat at all Moth locations. *Id.*

IV. The inadequacy of existing regulatory mechanisms

The Sand Verbena Moth is not adequately protected by federal or state laws or policies to prevent its endangerment or extinction.

Canadian Legal Status: The Sand Verbena Moth is listed as Endangered under the Species At Risk Act. Species protective actions are well underway in Canada (British Columbia Invertebrates Recovery Team 2008, *see especially* pp. 8-9). However, this status provides no regulatory protection for the Moth in the U.S. portion of its range, and the Moth requires active recovery efforts in both countries in order to recover.

NatureServe Global Status: The Sand Verbena Moth is ranked “G1G2,” which NatureServe rounds to G1. A rank of G1G2 means that NatureServe is undecided on whether the taxon should be ranked as G1 (critically imperiled) or G2 (imperiled). The detailed definitions of these NatureServe ranks are:

G1 Critically Imperiled: At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.³

G2 Imperiled: At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.⁴

NatureServe National Status: The Sand Verbena Moth is ranked “N1N2” in both Canada and the U.S. The detailed definitions of these NatureServe ranks are:

N1 Critically Imperiled: Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.⁵

N2 Imperiled: Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.⁶

While indicating biological imperilment, these rankings do not provide any regulatory or policy mechanisms to protect the Moth.

State/Provincial Status: The Sand Verbena Moth occurs in British Columbia within Canada; and Washington within the U.S. In British Columbia, it is ranked by NatureServe as “S1,” which signifies it is critically imperiled, with the same definition as N1. In Washington state, it is ranked “S1?,” which signifies the species is likely critically imperiled but the ranking is

³See <http://www.natureserve.org/explorer/ranking.htm#globalstatus> [Accessed November 2009].

⁴*Id.*

⁵*Id.*

⁶*Id.*

inexact.⁷ While indicating biological imperilment, these rankings do not provide any regulatory or policy mechanisms to protect the Sand Verbena Moth.

In Washington State, the Moth is ranked as a Species of Concern. This designation includes “those species listed as State Endangered, State Threatened, State Sensitive, or State Candidate, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.”⁸ However, the Moth is only a candidate for state-listing and is not yet listed as endangered or threatened.⁹ It therefore does not enjoy the protections provided to state-listed or sensitive species, such as prohibiting take, a recovery plan, or management plans.¹⁰

The Moth is also considered a priority species in the State of Washington. Its status as a candidate species automatically makes it a Priority Habitats and Species (PHS) Criteria #1 species. The state considers “any occurrence” of this species to be a priority area (Washington Department of Fish and Wildlife 2008). This status does not confer any protections to the Moth, but is used to guide mapping and management recommendations. *Id.* at p. 2. The Moth was not included in Washington’s 1995 management recommendations for invertebrates (Larsen et al. 1995).

USFWS: The Sand Verbena Moth is not currently a FWS Species of Concern.

V. Other natural or manmade factors affecting its continued existence

Climate change. The British Columbia Invertebrates Recovery Team (2008) cite climate change as a threat to the Sand Verbena Moth due to sea level rise and increases in summer drought. All Moth locations in BC are less than 5 m (16.4 ft) above sea level and most Moth habitat occurs within 25 m (82 ft) of the shoreline. *Id.* Inundation from rising sea level and increasingly severe coastal storms present a real threat, as indicated in recent national and international reports on climate change (IPCC 2007; Karl et al. 2008, 2009). *See also* SARA Registry (2009). Regionally, Mote et al. (2005) have documented a significant temperature rise in the Puget Sound region by 1.5°C (2.3°F) over the course of the 20th Century. This is greater than that recorded for the Pacific Northwest or the planet. *Id.* Mote et al. (2008) estimate sea level rises of 22 in (55 cm) by 2050 and of 50 in (128 cm) by 2100 for Puget Sound. Shipman (2009: unnumbered p. 6) notes how even small increases in sea level rise lead to pronounced increases in effects of storms:

Global warming is expected to bring a gradual increase in mean sea level, but the impact on shorelines will be largely driven by major storms and high water events. The frequency and severity of these will increase even with small increases in sea level.

⁷*Id.*

⁸See <http://wdfw.wa.gov/wlm/diversty/soc/definitn.htm> [Accessed November 2009].

⁹See Washington State Candidate List at: <http://wdfw.wa.gov/wildlife/management/endangered.html> [Accessed November 2009].

¹⁰See WAC 232-12-297, online at: <http://wdfw.wa.gov/wlm/diversty/soc/wac-297.htm> [Accessed November 2009].

Climate change-induced increases in summer drought can result in early senescence of yellow sand verbena. This will detrimentally affect the Moth, larvae of which feed on leaves and shoots throughout the summer in preparation for winter diapause. During drought, the plant will lose leaves and enter dormancy early, thus reducing forage for the Moth during a critical period (British Columbia Invertebrates Recovery Team 2008). Mote et al. (2005), however, describe difficulties in predicting climate change-induced alterations in precipitation patterns in the Puget Sound region.

Insecticides. The use of insecticides, such as *Bacillus thuringiensis kurstaki* (Btk), to control gypsy moths near Sand Verbena Moth locations, can harm the Moth (British Columbia Invertebrates Recovery Team 2008). Btk can harm all Lepidoptera, including the Moth. Btk application is considered a potential threat to all Moth populations. It is typically applied from early April to early May, which overlaps with the Moth's larval feeding period. Applications at this time would therefore result in high mortality for the species. *Id.* Gypsy Moths have been captured in all 3 counties where the Sand Verbena Moth may occur in WA (Washington Department of Agriculture 2008).

Herbicides. Scientists are searching for ways to control European beachgrass. Pickart (1997) discusses manual, mechanical, and chemical means. Chemical control (using glyphosate) is the most cost-effective method and may therefore be the most commonly used approach. Pickart notes the problem of impacts to non-target vegetation when glyphosate is applied. *Id.* Hyland and Holloran (undated) describe manual and mechanical approaches as costly and recommend a prescribed burn/glyphosate integrated approach. In the course of a status review FWS should consider whether any of the means being employed to control European beachgrass are adversely affecting the Moth.

Biological Vulnerability. The Moth's complete dependence on yellow sand verbena is a biologically limiting factor (British Columbia Invertebrates Recovery Team 2008) that compounds the anthropogenic threats this species faces. *See also* COSEWIC (2004) and SARA Registry (2009).

In addition, FWS has routinely recognized that small population size and restricted range increase the likelihood of extinction.¹¹ The Sand Verbena Moth has a small global population and a narrow range that is literally on the edge: all Canadian locations are less than 5 m (16 ft) above sea level (British Columbia Invertebrates Recovery Team 2008). For the Langford's tree snail (*Partula langfordi*), the Service states:

Even if the threats responsible for the decline of this species were controlled, the persistence of existing populations is hampered by the limited number of known individuals of this species. This circumstance makes the species more vulnerable to extinction due to a variety of natural processes. Small populations are

¹¹See, e.g., Service candidate assessment forms for *Doryopteris takeuchii*, *Huperzia stemmermanniae*, *Megalagrion nesiotis*, *Melicope degeneri*, *Melicope hiiakae*, *Myrsine mezii*, *Ostodes strigatus*, *Partula langfordi*, *Peperomia subpetiolata*, *Phyllostegia bracteata*, and *Tryonia circumstriata*. Accessible via FWS website at <http://www.fws.gov/endangered/wildlife.html> [Accessed November 2009].

particularly vulnerable to reduced reproductive vigor caused by inbreeding depression, and they may suffer a loss of genetic variability over time due to random genetic drift, resulting in decreased evolutionary potential and ability to cope with environmental change (Lande 1988; Pimm et al. 1988; Center for Conservation Update 1994; Mangel and Tier 1994).¹²

Here, the Service relies on citations not specific to *Partula langfordi* that indicate the threat to survival presented by limited population numbers even without other known threats. The Service similarly notes for a snail called Sisi (*Ostodes strigatus*), “Even if the threats responsible for the decline of this species were controlled, the persistence of existing populations is hampered by the small number of extant populations and the small geographic range of the known populations.”¹³ Because the Moth’s range is limited and is vulnerable to weather events such as drought and storms, FWS should consider this moth’s narrow range as itself a threat to the taxon.

Human population growth. Human population growth in the Puget Sound region has been more than twice that of the U.S. national average every year for the past 50 years (Mote et al. 2005). This growth has driven environmental degradation in the area, including conversion of natural habitat to urban and agricultural uses; artificial fortification of the shoreline with riprap and concrete; and proliferation of non-native plants. *Id.* An increase in human population in this area has also led to an increase in recreational use of coastal dune habitats.

Cumulative Threats. FWS should consider whether the array of aforementioned threats intersect and act synergistically, therefore increasing the likelihood of extinction or endangerment of the Sand Verbena Moth in the foreseeable future. For example, the natural biological constraints of the Moth are compounded by human infrastructure – from buildings to riprap – that further hem this Moth in; and habitat loss is exacerbated by the threats of inundation or severe winter storms, caused by climate change. These are just examples of intersecting threats the Moth faces.

Summary

The Sand Verbena Moth merits listing as an Endangered or Threatened species under the Endangered Species Act. The species is suffering from multiple threats, including habitat loss and degradation from exotic weed proliferation, which displaces its principal host plant and stabilizes dunes; development of its coastal habitat; recreational and military activities; climate change effects, including inundation of its coastal habitat from rising sea levels, storms, and drought; potential use of Lepidoptera-harming pesticides; and increased vulnerability of extinction due to monophagy, small number of populations, and restricted range.

¹²See 2009 Listing Form for *Partula langfordi* at: http://ecos.fws.gov/docs/candforms_pdf/r1/G0AI_I01.pdf [Accessed November 2009] at p. 5.

¹³See 2009 Listing Form for *Ostodes strigatus* at: http://ecos.fws.gov/docs/candforms_pdf/r1/G0A5_I01.pdf [Accessed November 2009] at p. 4.

The Sand Verbena Moth occurs on both sides of the U.S./Canada border, in the Strait of Georgia/Puget Sound region of British Columbia and Washington. Canada has already taken steps to recover the species, but international cooperation between the U.S. and Canada is necessary to bring the Sand Verbena Moth back from the brink. This petition is submitted with the hope that federal protection will be granted in the U.S. and will prevent this species' extinction. We believe ESA listing is vital to preserving and recovering this species.

Requested Designation

WildEarth Guardians and The Xerces Society for Invertebrate Conservation hereby petition the U.S. Fish and Wildlife Service under the Department of Interior to list the Sand Verbena Moth (*Copablepharon fuscum*) as an Endangered or Threatened species pursuant to the Endangered Species Act. This listing action is warranted, given the onslaught of threats it faces, including any threats to its fragile but dynamic sand dune/yellow sand verbena habitat. The Sand Verbena Moth is threatened by at least four of the five listing factors: present and threatened destruction, modification and curtailment of habitat and range; disease or predation; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence.

Critical habitat

Given that habitat loss and degradation is a significant cause of imperilment for the Sand Verbena Moth, as recognized in its Canadian recovery plan, WildEarth Guardians and The Xerces Society requests that critical habitat be designated for this species concurrent with final ESA listing. Indeed, protection for the moth can also provide safeguards for other species, including its host plant, the Yellow Sand Verbena; the Streaked Horned Lark and the Island Marble butterfly (both of which sometimes co-occur with the Moth); as well as protections for the increasingly rare dune coastal habitat that the Moth requires. Scientists have warned that state and federal recognition of at least 60 imperiled species in the Georgia Basin/Puget Sound region "is a wake-up call to reverse ecosystem decay" (Gaydos & Gilardi 2003 at p. 6; Gaydo & Brown 2009). Critical habitat designation for the Moth can help address the ecosystem imperilment for which it is a bellwether.

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