# Easy or facilis yellow-faced bee
# (*Hylaeus facilis*)

## 5-Year Review
## Summary and Evaluation

**U.S. Fish and Wildlife Service**
**Pacific Islands Fish and Wildlife Office**
**Honolulu, Hawai‘i**

# 5-YEAR REVIEW

**Species reviewed: easy or facilis yellow-faced bee (*Hylaeus facilis*)**

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# 5-YEAR REVIEW
# easy or facilis yellow-faced bee (*Hylaeus facilis*)

## 1.0 GENERAL INFORMATION

### 1.1 Reviewers:

Diane Sether, Ph.D., Invertebrate and Wildlife Biologist, Pacific Islands Fish and Wildlife Office (PIFWO)
John Vetter, Animal Recovery Coordinator, PIFWO
Megan Laut, Conservation and Restoration Team Manager, PIFWO

**Lead Regional Office:**
Interior Region 12, Portland Regional Office, Portland Oregon

**Lead Field Office:**
Interior Region 12, PIFWO, Honolulu, Hawai‘i

**Cooperating Field Office(s):**
N/A

**Cooperating Regional Office(s):**
N/A

### 1.2 Methodology used to complete the review:

This review was conducted by staff of the U.S. Fish and Wildlife Service (Service) at the Pacific Islands Fish and Wildlife Office beginning in November 2020. The review was based on the final rule listing this species; peer reviewed scientific publications; unpublished field observations by the Service, State of Hawai‘i, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information. The evaluation completed by Diane Sether, Ph.D., Invertebrate and Wildlife Biologist, was reviewed by John Vetter, Animal Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

### 1.3 Background:

#### 1.3.1 FR Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2019. Endangered and threatened wildlife and plants; Initiation of 5-year status reviews for 91 species in Oregon, Washington, Hawaii, and American Samoa. Federal Register 84:27152–27154.

### 1.3.2 Listing history:

Original Listing
**FR notice:** [USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; Determination of endangered status for 49 species from the Hawaiian Islands. Federal Register 81:67786–67860.
.
**Date listed:** September 30, 2016
**Entity listed:** *Hylaeus facilis* (easy or facilis yellow-faced bee)
**Classification:** Endangered

Revised Listing, if applicable
**FR notice:** N/A
**Date listed:** N/A
**Entity listed:** N/A
**Classification:** N/A

### 1.3.3 Associated rulemakings:
**FR notice:** N/A

### 1.3.4 Review History:
This is the first 5-year review for *Hylaeus facilis*.

### 1.3.5 Species' Recovery Priority Number at start of this 5-year review:
5

### 1.3.6 Current Recovery Plan or Outline:
**Name of plan or outline:** Recovery Outline for the Multi-Island Species (USFWS 2020).
**Date issued:** July 30, 2020
**Dates of previous revisions, if applicable:** N/A

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

#### 2.1.1 Is the species under review a vertebrate?
____**Yes**
__X_**No**

#### 2.1.2 Is the species under review listed as a DPS?
____**Yes**
____**No**

#### 2.1.3 Was the DPS listed prior to 1996?
____**Yes**

**____No**

**2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?**

**____Yes**
**____No**

**2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?**

**____Yes**
**____No**

**2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?**

**____Yes**
**____No**

## 2.2 Recovery Criteria

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?**

**____Yes**
**__X_No**

**2.2.2 Adequacy of recovery criteria.**

**2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?**

**____Yes**
**____No**

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery?**

**____Yes**
**____No**

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**
The Draft Recovery Plan for the Multi-Island Species will include easy yellow-faced bee (*Hylaeus facilis*). The draft plan is scheduled to be completed in 2021.

## 2.3 Updated Information and Current Species Status

### 2.3.1 Biology and Habitat

#### 2.3.1.1 New information on the species' biology and life history:

In general, *Hylaeus* species are small to medium sized bees with forewing lengths of about 0.12 to 0.31 inches (in) (3 to 8 millimeters [mm]), slender bodies that are usually black, short-bilobed tongues, and two submarginal cells in the forewing (Daly and Magnacca 2003, p. 12). Males of most of the *Hylaeus* species and females of several species have yellow marks on their face, hence the common name "yellow-faced bees." Yellow-faced bees, in general, lack the elongated hairs on the hind legs that other bee genera use to carry pollen externally. The lack of these hairs gives them a wasp-like appearance. But, yellow-faced bees can be distinguished from wasps by the presence of branched hairs on the body that are longest on the sides of the thorax (Michener 2000, entire).

Easy yellow-faced bee is a medium sized bee relative to other coastal *Hylaeus* species in the family Colletidae and subfamily Hylaeinae. The species has smoky colored wings. The male has an oval yellow mark on its face that covers the entire clypeus (lower face region), and a narrow stripe beside the eyes, but is otherwise unmarked. The large, externally visible gonoforceps (paired lateral outer parts of the male genitalia) distinguish the easy yellow-faced bee from the closely related *Hylaeus simplex* (Daly and Magnacca 2003, p. 83). The female is entirely black and indistinguishable from females of *Hylaeus difficilis* and *Hylaeus simplex* (Daly and Magnacca 2003, pp. 81–82). A more detailed description of the species can be found in Daly and Magnacca (2003, pp. 81–83).

Easy yellow-faced bees, like most *Hylaeus*, have abundant curved hairs on the foreleg that function in gathering pollen for nest provisioning. A female grooms the pollen off her head and the curved hairs on her forelegs and transfers the pollen to her internal crop for transport to her nest. The rest of the pollen is discarded (Michner 2000, p. 84). Transport of the pollen in the internal crop, rather than on external, elongated hairs on the hindleg, is unique to bees in the subfamily Hylaeinae (Michner 2000, p. 15). The bees concentrate nectar by holding a drop between their mandibles to evaporate the water. Because yellow-faced bees carry pollen internally in the crop instead of on body hairs, the nectar is often cloudy with pollen grains.

Hawaiian *Hylaeus* species group within two categories: ground-nesting species that require relatively dry conditions and stem-nesting species found within wetter areas (Daly and Magnacca 2003, p. 11). Easy yellow-faced bees have been observed nesting in a dead twig of *Broussaisia arguta* (akiahala or kanawao), a hollow twig of *Clermontia grandiflora* (ʻōhā wai), and in beetle burrows in dead stems of *Smilax melastomifolia* (akaʻawe) on Molokaʻi in the watersheds of east Kawela, Kamiloloa,

Kainalu, and Waikolu (Daly and Magnacca 2003, p. 83; Swezey and Bryan 1929, pp. 297, 310–312; Swezey 1954, p. 203). Other dryland species such as *Hylaeus chlorostictus*, *Hylaeus simplex*, *Hylaeus difficilis*, *Hylaeus laetus* may construct their nests in the ground within existing burrows or small natural cavities under bark or rocks, but it is unknown if the easy yellow-faced bee, which is known from dry grassland and shrubland, also nests in the ground (Daly and Magnacca 2003, entire; p. 106; Magnacca 2007, p. 187).

Bees in the family Colletidae are also referred to as plasterer bees because they line their nests with a cellophane-like membrane secreted from their salivary and Dufour's gland (Espelie et al. 1992, entire; Daly and Magnacca 2003, p. 9). The female lines and provisions her own nest, even if nesting in aggregations, hence the name solitary bees (Daly and Magnacca 2003, p. 9). After lining the nest, the female lays her eggs and provides her brood (young) with a mass of semiliquid nectar and pollen left alongside her eggs (Daly and Magnacca 2003, p. 9). Once provisioned, the female secretes a membrane sealing the nest.

Within the nest, the general life cycle for yellow-faced bees is as follows. The eggs hatch and develop into grub-like larvae. As larvae grow, they molt through three successive instars. During this time, the larvae consume the nectar and pollen provisions left for them by their mother (Daly and Magnacca 2003, p. 9; Michener 2000, p. 24). After the third instar, the larvae change into pupae (a resting form). It is in this stage that they metamorphose (i.e. undergo change) and emerge as adults. The brood cycle from egg to adult takes about 30 to 60 days (Graham 2015 in litt., entire), during which time, the solitary females do not provide parental care or defend their brood.

Our knowledge of breeding and longevity behaviors of easy yellow-faced bee individuals is very limited. Females mate as young adults and store the sperm for the rest of their lives (Daly and Magnacca 2003, pp. 7–8). Based on Daly and Magnacca (2003, p. 7–8), *Hylaeus* females, in general, appear to live longer than males. An adult male of the wood nesting species *Hylaeus pubescens*, survived 74 days (Daly and Coville 1982, p. 76), but little else is known about average longevity of grassland and shrubland nesting species.

Adult yellow-faced bees consume pollen and nectar, but their exact nutritional needs are unknown. According to Magnacca (2007, entire), coastal nesting bees are almost exclusively found in areas dominated by a variety of native shrub and herb species rather than a single species. *Scaevola* spp. (naupaka kahakai), for example, is common and widespread in the coastal strand habitat, yet yellow-faced bees are apparently not capable of surviving solely on this plant species (Magnacca 2007 p. 187).

Analyses of pollen loads show that coastal *Hylaeus* species, in particular, use many different plants as food sources, not only seasonally but also at any given time (Magnacca 2007). The presence of diverse, simultaneously available native pollen sources that support the adults and are used for provisioning the nest are likely a necessary part of suitable habitat for facilis yellow-faced bees' survival and reproduction.

With the exception of nonnative *Heliotropium foertherianum* (tree heliotrope), yellow-faced bees very rarely visit non-native plants for nectar and pollen; consequently, the bees are almost completely absent from habitats dominated by exotic plant species (Daly and Magnacca 2003, p. 11; Magnacca 2007, pp. 186, 188). Also, Hawaiian *Hylaeus* species are dependent on relatively few species of native Hawaiian plants for their nutritional needs (Daly and Magnacca 2003, entire; Magnacca 2007, p. 185). Visitation records of Hawaiian *Hylaeus* bees to native flowers (Daly and Magnacca 2003, p. 11) and pollination studies of native plants (Sakai et al. 1995, pp. 2524–2528; Cox and Elmqvist 2000, p. 1,238; Sahli et al. 2008, p. 1; Shay 2014, entire) have demonstrated Hawaiian *Hylaeus* species pollinate the plants they visit.

The native host plants of adult easy yellow-faced bees are unknown, but it is likely this species visits several plants other *Hylaeus* species are known to frequent, including *Acacia koa* (koa), *Euphorbia spp*. (ʻakoko), *Leptecophylla tameiameiae* (pūkiawe), *Metrosideros polymorpha* (ʻōhiʻa), and naupaka kahakai (Daly and Magnacca 2003, p. 11). Easy yellow-faced bee has also been observed visiting nonnative tree heliotrope for nectar and pollen (Magnacca 2007, p. 181). This plant species is naturalized on all of the main Hawaiian islands except Kahoʻolawe (Wagner et al. 1999, p. 398).

**2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

In the early 1900's, yellow-faced bee species were ubiquitous throughout the islands (Perkins 1912, p. 688). On Oʻahu, Perkin's collected easy yellow-faced bees from the following six locations: Honolulu coast and 2,000 feet (ft) (610 meters [m]); "Honolulu Mountains" (1,500 ft [457 m]); Makaha, Waianae (3,000 ft [914 m]); Mt. Kaala (2,000 ft [610 m]); Tantalus; Waianae Mountains (2,000 ft [610 m]) and "Oahu" (Daly and Magnacca 2003, p. 83). On Maui, the species was collected from Haleakala (5,000 ft [1,524 m]); "Iao" Valley; "west Maui mountains" (2,000 ft [610 m]); Wailuku, on sandy isthmus (Wailuku Sand Hills/Waiehu Dunes); and "Maui" (Daly and Magnacca 2003, p. 83). On Lānaʻi, the species was collected from the "center of the island, forest above Koele" (2,000 ft [610 m]); Halelepaakai (3,000 ft [914 m]); "Koele

Mountains" (2,000 ft [610 m]); and "Lanai" (Daly and Magnacca 2003, p. 83). On Molokaʻi, the species was collected from the east mountains (2,000 ft [610 m]); "Molokai mountains" (3,000 ft [914 m]); "Molokai Mountains" ( >3,000 ft [> 914 m]); and "Molokai Mountains" (3,500 ft [1,067 m]) (Daly and Magnacca 2003, p. 83).

After the 1930s, collection of *Hylaeus* species lapsed for about 70-100 years. When surveys resumed, the easy yellow-faced bee had almost entirely disappeared from most of its historical range (Daly and Magnacca 2003, p. 7; Magnacca 2007, p. 183). Three specimens of easy yellow-faced bee have been collected in the last 30 years. One from Oʻahu in 1975, one from Maui in 1993, and one from Molokaʻi in 2005 (Daly and Magnacca 2003, p. 83; Magnacca 2005, entire; Magnacca 2007, entire).

Between 1998 and 2006, 39 sites on Oʻahu, Molokaʻi, Lānaʻi, and Maui, were intensively surveyed, including 13 historical sites where easy yellow-faced bee had once been abundant. The species was absent from all 13 historical localities and the 26 other sites with potentially suitable habitat (Magnacca 2007, p. 183). Other native *Hylaeus* species were observed at these sites, including many sites from which other native yellow-faced bee species have been recently collected (Daly and Magnacca 2003, pp. 7, 80–83; Magnacca 2007, p. 183).

***Oʻahu***

In 2011 and 2012, 40 locations on Oʻahu, including difficult to access sites in the Waiʻanae and Kooʻlau Mountains, were intensively surveyed for *Hylaeus* species (Magnacca and King 2013, entire). Sites were selected based primarily on habitat suitability including the presence of plants with favored flowers, as determined by previous collection records and observations. Easy yellow-faced bee was not found during these surveys and dry shrubland habitat for this species has largely disappeared (Magnacca and King 2013, pp. 8–9). All of the native yellow-faced bees were much rarer than they were during previous surveys in 1999–2002, including many previously considered common.

***Molokaʻi***

Perkins collected easy yellow-faced bees in three locations within montane mesic forest habitat in the east Molokai Mountains (Daly and Magnacca 2003, p. 83). These locations were probably between Makakupaʻia and the rim of Pelekunu Valley, where Perkins did most of his collecting (Liebherr and Polhemus 1997, p. 347). Makakupaʻia is located within Kamakou Preserve, owned by The Nature Conservancy. Extensive surveys in similar, high-elevation habitat near Perkins collecting area, including Kamakou Road (3,200 ft [975 m] elevation), Puʻu Kolekole (3,400 ft [1,040 m] elevation), and Kawela Gulch (3,600 ft

[2,000 m] elevation), found other *Hylaeus* species but the easy yellow-faced bee was not found (Daly and Magnacca 2003, pp. 217–229).

In 2005, the easy yellow-faced bee was collected in coastal habitat within Kalaupapa National Historical Park on the southeast coast of the Kalaupapa peninsula (Magnacca 2007, pp. 44–45). This area, located on the east side of the peninsula, contains scattered patches of native coastal vegetation including *Euphorbia degeneri* (ʻakoko), *Heliotropium* spp. (hinahina), *Jacquemontia ovalifolia* (pa'uohi'iaka), and *Sida fallax* (ʻilima), as well as nonnative tree heliotrope.

***Lānaʻi***

The species has not been documented since Perkins collected it in 1899. Because of this, the easy yellow-faced bee is considered extirpated from Lānaʻi.

***Maui***

In 1993, a single individual was collected on Maui in a residential area near Makawao at 1,500 ft (457 m) in elevation (Magnacca 2007, entire). This site is an urbanized area devoid of native plants. All dry and mesic forest *Hylaeus* species are now rare on Maui Nui. Native dry and mesic habitats on Maui are in small patches (Javar-Salas et al. 2020, entire; Lowe et al 2020, entire; Magnacca 2007, entire; Mueller-Dombois 1973, entire, Medeiros et al. 1986, entire) that may be incapable of supporting a population of yellow-faced bees. If easy yellow-faced bee still survives on Maui, it is in small remnant patches of mesic or dry forest that have yet to be searched for bees (Daly and Magnacca 2003, pp 217–229; Magnacca 2007, entire).

***Summary***

All dry and mesic forest-inhabiting Hawaiian *Hylaeus* are now rare on Maui and Oʻahu (Magnacca 2007, p. 184). In spite of extensive surveys in the historical areas and in other sites with potentially suitable habitat on the islands of Oʻahu and Maui, the last documentation of easy yellow-faced bee is limited to one location on each island, Oʻahu in 1975, Maui in 1993, and Molokaʻi in 2005. Already believed to be extirpated on Lānaʻi and possibly on Maui, easy yellow-faced bee may also be extirpated from Oʻahu, or at best, extremely limited in abundance.

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

The diversity of habitat and the breadth of genetic diversity is strongly influenced by the current and historic biogeographical range of easy yellow-faced bee. While there are no historic population estimates or genetic information, qualitative accounts of this yellow-faced bee indicate that they were abundant in their habitat. In recent decades, the species has

have been absent at sites previously occupied. We have no historical genetic information, and thus cannot determine how much genetic variation has been lost since humans arrived in Hawai‘i. The mobility of yellow-faced bees provides a means of short-range connectivity between populations, which in turn, can support genetic exchange and representation. However, genetic exchange is severely limited by having only one known extant population.

**2.3.1.4 Taxonomic classification or changes in nomenclature:**
*Hylaeus facilis* is the most recent taxonomic treatment for this species (Daly and Magnacca 2003, pp. 81–83).

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**
See section 2.3.1.2 above for historic and current spatial distribution of the species. According to R.C.L. Perkins (1899, p. 77–78), easy yellow-faced bee was among the most common and widespread species throughout its multi-island range, which is substantiated by the dozens of specimens in collections at the Bernice Pauahi Bishop Museum and the British Museum of Natural History (Daly and Magnacca 2003, p. 83; Magnacca 2007, p. 183). Historically, easy yellow-faced bee was known from dry shrubland to wet forest habitats from coastal to montane elevations up to 5,000 ft (1524 m) on O‘ahu, Moloka‘i, Lāna‘i, and Maui. (Daly and Magnacca 2003, p. 81–83, 221; Perkins 1912, p. 688). Currently, the species is absent in areas where other rare Hawaiian *Hylaeus* species are present. Easy yellow-faced bees are considered extirpated from Lāna‘i where the species was last recorded in 1899. The species was last known from O‘ahu almost 50 years ago, and was last known from Maui almost 30 years ago. On Moloka‘i, easy yellow-faced bee is known from a small area on the Kalaupapa peninsula. Abundance of individuals in the populations is unknown, but is likely very low, given the size of the habitat area.

Habitat loss and degradation have contributed significantly to population declines of easy yellow-faced bees. Much of the dry coastal shrubland and dry and mesic forest ecosystems have been modified, degraded, fragmented, and lost by land use conversion (e.g. development, agriculture, road building), invasion by nonnative species, and environmental changes (Cuddihy and Stone 1990, pp. 94–95; Kim et al. 2020, entire; Javar-Salas 2020, entire; Lowe et al., 2020, entire; P‘ea et al. 2020, entire; Wagner et al. 1999, entire). The quality of the degraded areas no longer sustain easy yellow-faced bees. Nesting and native foraging resources are becoming increasingly rare in dry coastal shrublands and dry forest habitats (Cuddihy and Stone 1990, entire; Magnacca 2005, entire;

Magnacca 2007, entire). As a result, easy yellow-faced bees have disappeared from most of their historical range.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**
The majority of the dry coastal shrublands and dry and mesic forest habitats below 5,000 ft (1,524 m) once occupied by easy yellow-faced bees are now dominated by invasive plant species that are replacing native flora (Cuddihy and Stone 1990, pp. 73–74; Wagner et al. 1999, p. 52; Mascaro et al. 2008, entire; Kim et al. 2020, entire; Javar-Salas et al 2020, entire; Lowe et al., 2020, entire; Peʻa et al., 2020, entire). Most of the coastal habitats of the main Hawaiian islands lack significant amounts of native foraging plants besides naupaka kahakai, which cannot support native yellow-faced bee populations on its own (Magnacca 2007, p. 187).

In the coastal and lowland dry shrublands used by easy yellow-faced bees, rainfall is mostly restricted to winter months, while summers are hot and dry (Gagne and Cuddihy 1999, entire). Annual rainfall ranges between 4 and 69 in (10 and 175 centimeters [cm]) (Gagne and Cuddihy 1999, entire; Peʻa et al. 2020, entire). Dry shrublands likely once extended to the coast in many locations but now only remain in areas that were not altered by intensive agriculture or grazing (Peʻa et al. 2020, entire). Dry shrublands with intact native plant communities are dominated by *Dodonaea viscosa* (ʻaʻaliʻi), *Wikstroemia* species (ʻākia), *Chenopodium oahuense* (ʻaweoweo), *Bidens menziesii* (koʻokoʻolau), *Styphelia tameiameiae* (pūkiawe), *Psydrax odoratum* (alaheʻe), and low-growing *Metrosideros polymorpha* (ʻōhiʻa) (Peʻa et al. 2020, entire). Dry shrubland is usually characterized by mixed stands with one or two of the aforementioned species as dominant. Invasive grasses are abundant in dry shrublands. Most islands have few, if any, high quality, coastal and lowland dry sites with diverse native vegetation that are protected.

Mesic forests in Hawaiʻi generally receive about 8 to 100 in (20 to 250 cm) of rainfall annually and are found on leeward and windward sides of the islands in lowland or in montane-subalpine zones (Cuddihy and Stone, 1990). Elevation ranges from 100 to 5,200 ft (30 to 1600 m) and elevation and climate primarily dictate the species assemblage (Gagne and Cuddihy, 1999, entire). Dominant species that may be used by easy yellow-faced bees include ʻōhiʻa and koa. Historically, mesic forests in Hawaiʻi were located on all of the main Hawaiian Islands. These forests were distributed across the islands of Oʻahu, Maui, Kauaʻi, and Hawaiʻi, and to a lesser extent, on Molokaʻi and Lānaʻi. Currently, mesic forests are still found on all of the main Hawaiian islands. However, the quality of these forests are largely composed of a mixture of native/nonnative vegetation (Lowe et al., 2020, entire). For a more comprehensive description of the mesic forests in Hawaiʻi see Lowe et al. 2020 (entire).

Dry forests have relatively low rainfall between 12 and 79 in (30 and 200 cm) and are found on the leeward sides of the islands in lowland or in montane-subalpine zones. Ranging in elevations from 1000 to 2900 ft (30 to 120 m), dry forests are located on all of the main Hawaiian islands (Gagne and Cuddihy 1999, entire; Javar-Salas et al. 2020, entire). Characteristic plants in the dry forest include koa, ʻakoko, pūkiawe, *Melicope hawaiensis* (alani), ʻōhiʻa, *Myoporum sandwicense* (naio), *Myrsine lanaiensis* (kōlea), *Nestegis sandwicensis* (olopua), *Nothocestrum breviflorum* (ʻaiea), and *Sophora chrysophylla* (māmane), some of which may be used by easy yellow-faced bee. Presently, the quality of these forests is largely composed of a mix of native/nonnative vegetation.

### 2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

#### 2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range (Factor A):

*Ungulates and degradation of habitat*—Nonnative animals, such as feral pigs (*Sus scrofa*), goats (*Capra hircus*), horses (*Equus ferus caballus*), mouflon sheep (*Ovis gmelini musimon*), axis deer (*Axis axis*), and cattle (*Bos taurus*), are considered one of the primary factors underlying degradation of native vegetation in Hawaiʻi. These habitat changes remove food sources and nesting sites for easy yellow-faced bees (Stone 1985, pp. 262–263; Cuddihy and Stone 1990, pp. 60–66, 73). Browsing, grazing, and trampling by these mammals degrade native plant communities and facilitate invasion of exotic plants by spreading seeds and creating disturbed areas where seeds can germinate (Hobdy 1993, entire). Specific threats to the yellow-faced bee habitat posed by introduced ungulates are: (1) crushing or trampling of nests; (2) trampling and grazing effects on the plants used for pollen and nectar; (3) ungulate paths leading to mechanical damage of host plant roots and substrate erosion; and (4) creation of open, disturbed areas facilitating weedy plant invasion and the establishment of nonnative plants from dispersed fruits and seeds, which results in the conversion of a native community to one dominated by nonnative vegetation.

*Invasive, nonnative plants*—Habitat destruction and modification by nonnative plants such as *Asystasia gangetica* (Chinese violet), *Atriplex semibaccata* (saltbush), *Cenchrus ciliaris* (buffelgrass), *Chloris barbata* (swollen fingergrass), *Digitaria insularis* (sourgrass), *Leucaena leucocephala* (koa haole), *Melinis minutiflora* (molasses grass), *Pluchea indica* (Indian fleabane), *Pluchea carolinensis* (sourbush), *Prosopis pallida* (kiawe), *Psidium cattleianum* (strawberry guava), *Rubus* spp. (blackberry), *Schinus terebinthifolius* (Brazilian peppertree), *Urochloa mutica* (buffalo grass), and *Verbesina encelioides* (golden crown-beard)

negatively affect the habitat of easy yellow-faced bee (Cuddihy and Stone 1990, p. 105). Such nonnative plants adversely affect microhabitat by modifying the availability of light, shifting soil-water regimes, changing nutrient cycling processes, altering fire characteristics of native plant habitat, outcompeting natives, and inhibiting the growth of native plant species (Vitousek 1987, p. 224). Each of these effects can convert native-dominated plant communities to nonnative plant communities (Cuddihy and Stone 1990, p. 74). This conversion has negative effects on the host plants that yellow-faced bees feed likely feed upon and use for provisioning their nests. Endemic yellow-faced bees are dependent on having a variety of native plants for pollen and nectar. The conversion of native plant communities to nonnative communities can also alter or remove ground, twig, or stem nesting sites. The loss of native plant species from coastal and dry lowland habitats is one of the main causes of decline of *Hylaeus* species, in general (Sakai et al. 2002, pp. 276, 291; Liebherr 2005, p. 186).

*Drought*—Drought can modify and destroy habitat of easy yellow-faced bees (Magnacca 2007, pp. 181, 183). The dry coastal shrubland and dry and mesic forest habitats already incur cyclical droughts, which in turn, effect vegetation flushes and food availability. Though rare, easy yellow-faced bees may survive in small numbers and increase once conditions improve (Magnacca 2007, p. 181), but increase can be exacerbated by already low numbers. Drought also creates disturbed areas conducive to invasion by nonnative plants and eliminates food and nesting resources (Kitayama and Mueller-Dombois 1995, p. 671; Businger 1998, pp. 1–2; Magnacca 2015 in litt., entire). Droughts lead to an increase in the number of forest and wildfires (Giambelluca et al. 1991, p. v), causing a reduction of native plant cover and habitat (D'Antonio and Vitousek 1992, pp. 77–79). Such environmental events can be particularly devastating to easy yellow-faced bees because they have restricted geographic ranges.

*Fire*—Fire is a threat to easy yellow-faced bees because it destroys the dry and mesic habitats on which this species depends and opens habitat for increased invasion by nonnative plants. Human alteration of landscapes and the introduction of nonnative plants, especially grasses, has led to greater frequency, intensity, and duration of fires (Brown and Smith 2000, p. 172). Grass-fueled fire often kills most native trees and shrubs (D'Antonio and Vitousek 1992, p. 70, 73–74). The dry coastal and forest ecosystems of easy yellow-faced bees are highly vulnerable to wildfire, which destroys food and nesting resources. The number and size of wildfires are increasing in the main Hawaiian islands; however, their occurrences and locations are unpredictable, and could affect the remaining habitat of this yellow-faced bee at any time (USFWS 2016, p. 67814). Fire poses a risk to the species because their habitat is located in or near areas that have burned previously or is in areas considered at risk

due to the cumulative and compounding effects of drought and the presence of highly flammable nonnative grasses (USFWS 2016, p. 67814).

**2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes (Factor B):**
Not known to be a threat.

**2.3.2.3 Disease or predation (Factor C):**
*Disease*—Introduced disease is suggested as a threat because pathogens carried by nonnative bees, wasps, and ants may be transmitted to yellow-faced bees through shared food sources (Graham 2015 in litt., entire). However, we have no confirmed reports of this type of disease transmission in easy yellow-faced bees.

*Western yellow-jacket wasp*—Predation by nonnative western yellow jacket wasps (*Vespula pensylvanica*) is a threat to easy yellow-faced bees. This wasp species is an aggressive generalist predator that will opportunistically predate *Hylaeus* species, although *Hylaeus* is not its primary prey source (Gambino et al. 1987, entire). In temperate climates, *V. pensylvanica* has an annual life cycle; but, in Hawai‘i, colonies often persist through a second year. This allows them to have larger numbers of individuals per colony (Gambino et al. 1987, entire) and thus, a greater impact on prey populations. Most colonies are found between elevations of 1,969 to 3,445 ft (600 to 1,050 m), but they can occur down to sea level where easy yellow-faced bees occurs (Gambino et al. 1987, p. 169; Graham 2015 in litt., entire). Although easy yellow-faced bee is a rare solitary bee, the presence of *V. pensylvanica* colonies near a yellow-faced bee nest may extirpate a local population.

*Ants*—Several nonnative ant species have a deleterious effect on the native Hawaiian invertebrate fauna including yellow-faced bees (Perkins 1913, entire; Gagne 1979, entire; Cole et al. 1992, entire; Reimer 1993, entire; Daly and Magnacca 2003, p. 10; Krushelnycky et al. 2005, entire; Krushelnycky et al. 2017, entire). Yellow-faced bee populations are drastically reduced in ant infested areas (Medeiros et al. 1986, pp. 45–46; Stone and Loope 1987, entire; Cole et al. 1992, entire; Reimer 1993, p. 17).

Big-headed ants (*Pheidole megacephala*), yellow crazy ants (*Anoplolepis gracilipes*), Papuan thief ants (*Solenopsis papuana*), and tropical fire ants (*Solenopsis geminata*) are aggressive, generalist predators (preying on a variety of species) that occur in the coastal and shrubland habitat. Yelow-faced bee species that nest in the ground or near the ground, like easy yellow-faced bees, are particularly vulnerable to predation by nonnative ants (Medeiros et al. 1986, entire; Cole et al. 1992, entire). Ants are primarily a threat to the brood (i.e. egg, larvae, and pupal stages) because

broods are immobile, nests are easily accessible in or near the ground, and are undefended.

In general, big-headed ants and yellow crazy ants are ubiquitous in the habitat of easy yellow-faced bees. Both of these ant species are abundant and colonize native and nonnative plant communities (Holway et al. 2002, entire; Reimer 1993, entire). Big-headed ants are the most common ants found from coastal to mesic habitat up to 4,000 ft (1,219 m) in elevation, including within the habitat areas of easy yellow-faced bees. With few exceptions, native insects have been eliminated in habitats where big-headed ants are present (Perkins 1913, p. xxxix; Gagne 1979, p. 81; Gillespie and Reimer 1993, p. 22). Consequently, this species represents a threat to the Molokaʻi population of easy yellow-faced bees in coastal habitat (Reimer 1993, p. 14, 17; Daly and Magnacca 2003, pp. 9–10). Tropical fire ants are found in drier areas where the species has displaced big-headed ants as the dominant ant in some localities (Wong and Wong 1988, p. 175).

Papuan thief ant are the only abundant, aggressive ant species that has invaded intact mesic to wet forest, as well as coastal and lowland dry habitats. This thief ant species occurs from sea level to over 2,000 ft (600 m) on all of the main Hawaiian islands, and is still expanding its range (Reimer 1993, p. 14). Because of the expanding range of this species and its widespread occurrence in coastal habitats, it is a threat to the coastal easy yellow-faced bees population on Molokaʻi or individuals in the dry or mesic forest (Reimer 1993, p. 14).

The threat of ant predation is intensified by the fact that most ant species have winged reproductive adults and can quickly establish new colonies (Staples and Cowie 2001, p. 55). This attribute allows ants to access and potentially destroy otherwise geographically isolated populations of native arthropods (Nafus 1993, pp. 19, 22–23). With few exceptions, native insects have been eliminated in habitats where big-headed ant is present (Perkins 1913, p. xxxix; Gagne 1979, p. 81; Gillespie and Reimer 1993, p. 22). Consequently, nonnative ant species represent a significant threat to the remaining easy yellow-faced bees (Reimer 1993, p. 14, 17; Daly and Magnacca 2003, pp. 9–10).

**2.3.2.4 Inadequacy of existing regulatory mechanisms:**
Existing State and Federal regulatory mechanisms are not effectively preventing introduction and spread of nonnative species from outside the State of Hawaiʻi, or within the State, between islands and watersheds. Predation by nonnative invertebrate species such as introduced ants, and habitat-altering, nonnative plant species and ungulates pose major ongoing threats to the yellow-faced bees. The State's current management of nonnative game mammals is inadequate to prevent the degradation and

destruction of the native plants and habitat used by yellow-faced bees.

Nonnative feral ungulates pose a threat to easy yellow-faced bees through destruction and degradation of the species' habitat and herbivory of its pollen and nectar hosts. Regulatory mechanisms are inadequate to address this threat (USFWS 2013, p. 64679). The State of Hawai‘i provides game mammal (feral pigs and goats, axis deer, and mouflon sheep) hunting opportunities on State-designated public hunting areas on the island of Hawai‘i (State of Hawai‘i Department of Land and Natural Resources [HDLNR] 2015, pp. 19–21 and 66–77). The State's management objectives for game animals range from maximizing public hunting opportunities to support sustained yield in some areas to completely removing game animals by State staff, or their designees, in other areas (HDLNR 2015, entire).The State's current management of nonnative game mammals is inadequate to prevent the degradation and destruction of habitat of the yellow-faced bees.

Currently, four agencies are responsible for inspection of goods arriving in Hawai‘i (USFWS 2013, p. 64679). The Hawai‘i Department of Agriculture inspects domestic cargo and vessels and focuses on pests of concern to Hawai‘i, especially insects or plant diseases not yet known to be present in the State. The U.S. Department of Homeland Security‘s Customs and Border Protection is responsible for inspecting commercial, private, and military vessels and aircraft and related cargo and passengers arriving from foreign locations (USFWS 2013, p. 64679). The U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Plant Protection and Quarantine inspects propagative plant material, provides identification services for arriving plants and pests, and conducts pest risk assessments among other activities (USFWS 2013, pp. 64679–64680). The Service inspects arriving wildlife products, enforces the injurious wildlife provisions of the Lacey Act (18 U.S.C. 42; 16 U.S.C. 3371 *et seq*.), and prosecutes CITES (Convention on International Trade in Wild Fauna and Flora) violations (USFWS 2013, p. 64680). The State of Hawai‘i allows the importation of most plant taxa, with limited exceptions (USFWS 2013, p. 64680). It is likely that the introduction of most nonnative invertebrate pests to the State has been and continues to be accidental and incidental to other intentional and permitted activities. Many invasive weeds established on Hawai‘i have currently limited but expanding ranges. Resources available to reduce the spread of these species and counter their negative ecological effects are limited. Control of established pests is largely focused on a few invasive species that cause significant economic or environmental damage to public and private lands, and comprehensive control of an array of invasive pests remains limited in scope (USFWS 2013, pp. 64680–64681).

**2.3.2.5 Other natural or manmade factors affecting its continued**

**existence (Factor E):**
*Competition*—In addition to predation, nonnative ants also compete with yellow-faced bees for nectar resources (Howarth 1985, p. 155; Hopper et al. 1996, p. 9; Holway et al. 2002, pp. 188, 209; Daly and Magnacca 2003, p. 9; Lach 2008, p. 155; Magnacca 2015 in litt., entire). Native yellow-faced bees are less likely to land on flowers occupied by big-headed ant (Krushelnycky et al. 2005, p. 9; Magnacca 2015 in litt., entire).

Nonnative bees competing for food resources is a potential threat to easy yellow-faced bees (Magnacca 2007, p. 188; Graham 2015 in litt., entire; Magnacca 2015 in litt., entire). Most non-native bees inhabit areas dominated by invasive vegetation and thus, are not competing with *Hylaeus* species (Daly and Magnacca 2003, pp. 10–13). European honeybee (*Apis mellifera*) is one of the exceptions; this social species is often very abundant in areas with native vegetation and aggressively competes with native yellow-faced bees for nectar and pollen (Snelling 2003, p. 345; Magnacca 2007, p. 188).

Other nonnative bee species also use the same native vegetation as easy yellow-faced bees. These include carpenter bees (*Ceratina* spp.), sweat bees (*Lasioglossum* spp.), and the nonnative *Hylaeus albonitens* and *Hylaeus strenuous* (Snelling 2003, entire; Magnacca 2007, entire; Magnacca et al., 2011, entire; Magnacca et al. 2013, entire). *Hylaeus strenuus* has been found on O‘ahu. The impact of competition for nectar and pollen from nonnative bee species may have a significant impact on easy yellow-faced bees through competition for pollen, because they are similar in size and probably visit similar flowers (Magnacca 2007, p. 189; Magnacca et al. 2013, entire).

*Limited populations and individuals*—Like most native island biota, the yellow-faced bees are particularly sensitive to disturbances due to low number of individuals, low population numbers, and small geographic ranges. Easy yellow-faced bees is extremely vulnerable to extinction due to threats associated with low number of individuals and only one known population. As a result of having extremely low numbers, the species may experience the following: reduced reproductive vigor due to inbreeding depression; reduced levels of genetic variability leading to diminished capacity to respond and adapt to environmental changes; and increased vulnerability to localized catastrophes such as hurricanes, tsunami, and drought (Daly and Magnacca 2003, p. 3; Magnacca 2007, p. 173; Magnacca 2015 in litt., entire). Together these may result in population extirpation and extinction of this species.

Because of limited numbers of individuals and a single known population, a catastrophic event (e.g., hurricane, drought) may result in extirpation of the extant population and extinction of this species. Species with few

known locations, such as easy yellow-faced bees, are less resilient to threats that might otherwise have a relatively minor impact on widely distributed species. For example, the reduced availability of nesting substrate or an increase in predation of yellow-faced bees that might be absorbed in a widely distributed species could result in a significant decrease in survivorship or reproduction of a species with limited distribution and populations. The limited distribution of this species thus magnifies the severity of the impact of the other threats.

The persistence of easy yellow-faced bees is hampered by having only one known population on Moloka‘i and possibly populations on Oahu and Maui, though not observed in more than 25 years (Daly and Magnacca 2003, pp. 80-83, 221; Magnacca 2007). This limited number leaves the species vulnerable to extinction from natural and anthropogenic caused factors. The demographic structure needed to support easy yellow-faced bees is unknown. Though yellow-faced bee females can store sperm for life, small isolated populations are particularly vulnerable to reduced mating encounter and decreased reproductive vigor caused by inbreeding depression. They may suffer a loss of genetic variability over time due to random genetic drift, resulting in decreased evolutionary potential and lessened ability to cope with environmental change (Lande 1988, entire).

*Stochastic events*—Stochastic events such as hurricanes, earthquakes, and tsunamis can result in the direct loss of easy yellow-faced bee individuals and brood, nests, and foraging resources due to wind, rain, flooding, and tidal surge. The dry coastal habitat inhabited by easy yellow-faced bees is extremely vulnerable to storm surge and flooding associated with severe storms; the dry and mesic forests are vulnerable to wind storms. Indirect effects include creating disturbed areas conducive to invasion by nonnative plants, which outcompete the native plants (Harrington et al. 1997, pp. 539–540; Mitchell et al. 2005, p. 4–3). This would further decrease the remaining native-plant-dominated habitat that supports this bee species (Bellingham et al. 2005, p. 681). Stochastic events may also alter microclimatic conditions (e.g. soil erosion, and decreasing soil moisture) so that the habitat no longer supports the native host plants necessary for nectar and pollen or provides nesting substrates or existing burrows. In addition, stochastic events can exacerbate the impacts of other threats such as habitat destruction and modification by ungulates, erosion, invasion of nonnative predators, and increased competition for foraging resources. Small populations are demographically vulnerable to extinction caused by random fluctuations in population size and sex ratio. Thus, random and stochastic events may extirpate a species from an island with a single population (Lande 1988, p. 1455).

*Changes in environmental conditions*—Climate change has the potential to adversely affect easy yellow-faced bees. The species reproduces in the

dry coastal and dry and mesic forest habitat. Sea level rise will further reduce the already small amount of remaining coastal habitat. This will force the species to nest at higher densities in the remaining suitable habitat, which may lead to further isolation from other populations. Habitats of easy yellow-faced bees are likely to be affected by changes in temperature, humidity, precipitation, and the frequency and severity of storms. These stressors may change the habitats on the islands occupied by the species and exacerbate the threats (Javar-Salas et al. 2020, entire; Lowe et al., 2020, entire; Pe‘a et al., 2020, entire) rendering the habitats unsuitable for easy yellow-faced bees.

**Conservation Actions**

*Endangered Species Act*—In 2016, the Service determined endangered status under the Endangered Species Act of 1973 (Act), as amended, for 49 species from the Hawaiian Islands including easy yellow-faced bees (USFWS 2016, entire). The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The long-term goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Conservation measures provided to species listed as endangered or threatened under the Act include recognition of threatened or endangered status, recovery planning, requirements for Federal protection, and prohibitions against certain activities. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The Act and its implementing regulations in addition set forth a series of general prohibitions and exceptions that apply to all endangered wildlife and plants. For plants listed as endangered, the Act prohibits the malicious damage or destruction on areas under Federal jurisdiction and the removal, cutting, digging up, or damaging or destroying of such plants in knowing violation of any State law or regulation, including State criminal trespass law. Certain exceptions to the prohibitions apply to agents of the Service and State conservation agencies. The Service may issue permits to carry out otherwise prohibited activities involving endangered or threatened wildlife and plant species under certain circumstances. With regard to endangered plants, a permit must be issued for scientific purposes or for the enhancement of propagation or survival. For federally listed species unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting, including import or export across State lines and international boundaries, except for properly documented antique specimens of these taxa at least 100 years old, as defined by section 10(h)(1) of the Act, is prohibited. In addition, damaging or destroying any of the listed species is violation of the Hawai‘i State law prohibiting the take of listed species. The State of Hawai’i’s endangered species law (HRS, Section 195-D) is automatically invoked when a species is Federally listed, and provides supplemental protection, including

prohibiting take of listed species and encouraging conservation by State government agencies. Easy yellow-faced bees occurs on State and private lands.

*Land Protection and Conservation*— The only site known to be occupied by easy yellow-faced bees is on the southeast coast of the Kalaupapa peninsula of Molokaʻi in coastal habitat within the Kalaupapa National Historical Park, (Magnacca 2007, p. 181). The park is cooperatively managed by the National Park Service and the State of Hawaiʻi. This area is actively managed to restore native habitat and to reduce or eliminate many of the common threats to the native plant communities found there, including feral ungulates and wildfire.

**Table 1.** Number of populations and individuals of easy yellow-faced bees from listing to this 5-year review.

| Date | Number of Populations | Number of Individuals |
|---|---|---|
| 2016 listing | ≥2 | unknown |
| 2020 species report | ≥1 | unknown |
| 2021 5-year review | ≥1 | unknown |

**Table 2 –** Status of threats to easy yellow-faced bees from listing through the current 5-year review.

| Threat | Listing Factor | Current Status | Conservation/Management Efforts |
|---|---|---|---|
| Agriculture and urban development | A | Ongoing | Partial—some coastal habitat within the Kalaupapa National Historical Park, on the Kalaupapa peninsula of Molokaʻi, where the species was most recently observed is cooperatively managed by the National Park Service and the State of Hawaiʻi. This area is actively managed to restore native habitat and to reduce or eliminate many of the common threats to the native plant communities found there, including feral ungulates and wildfire. |
| Ungulates | A | Ongoing | Partial—ungulate control occurs at the Kalaupapa National Historical Park on Molokaʻi. |
| Invasive nonnative plants | A | Ongoing | Partial—control and removal of nonnative invasive plants is ongoing at Kalaupapa National Historical Park on Molokaʻi. |

| Threat | Listing Factor | Current Status | Conservation/Management Efforts |
|---|---|---|---|
| Fire | A | Ongoing | Partial—habitat within the Kalaupapa National Historical Park on Molokaʻi is managed for wildfire |
| Stochastic events (drought, hurricane, tsunami) | A | Ongoing | None |
| Disease (potential) | B | Ongoing | None |
| Predation by nonative wasps | C | Ongoing | None |
| Predation by ants | C | Ongoing | None |
| Inadequate existing regulatory mechanisms | D | Ongoing | Partial—restrictions on transport of invasive species to the islands are insufficient to prevent introduction of invasive species and diseases; regulatory mechanisms are inadequate to address the threat of ungulate destruction of easy yellow-faced bee. |
| Competition from nonnative bees | E | Ongoing | None |
| Lack of sufficient food resources | E | Ongoing | None |
| Lack of nesting resources | E | Ongoing | None |
| Limited numbers | E | Ongoing | None |
| Not in captive rearing | E | Ongoing | None |
| Climate change | E | Ongoing | None |

## 2.4 Synthesis

Easy yellow-faced bees is an endangered Hawaiian archipelago endemic species that nests opportunistically in hollow stems or twigs, or in existing burrows made by other invertebrates. Known from dry shrubland to wet forest habitats from coastal to montane elevations up to 5,000 ft (1,524 m) on Oʻahu, Molokaʻi, Lānaʻi, and Maui. Currently, the species is considered extirpated from Lānaʻi where it was last recorded in 1899, was last known from Oʻahu almost 50 years ago, and was last known from Maui almost 30 years ago. On Molokaʻi, easy yellow-faced bees is most recently known (2005) from a small area on the Kalaupapa peninsula. The exact cause of the disappearance of this once abundant and widespread species is unknown, though habitat degradation and loss, predation by ants and wasps, competition of food resources, and loss of native

pollen and nectar resources threaten the existence of this once widely distributed bee.

Habitat loss and predation have largely reduced the suitable habitat for this species. The species requires foraging habitats nearby that provide a variety of suitable native plant pollen and nectar. The native host plants of adult easy yellow-faced bees are unknown, but it is likely this species visits several plants other *Hylaeus* species are known to frequent, including ʻakoko, koa, naupaka kahakai, ʻōhiʻa, and pūkiawe. Easy yellow-faced bee has also been observed visiting tree heliotrope for nectar and pollen,  For an individual bee, the nutritional resources need to come from a diverse group of native plant species that are simultaneously available; individuals appear to need nutritional variety to survive. Additionally, the bee may be present at any time during the year; thus, the plant species the bee visits may change with the time of year and resource availability. The size of the occupied habitat limits the abundance of individuals because of suitable nesting materials and native pollen and nectar food resources, especially during drought.

There is little information about demographics or rate of mating encounter, other than to confirm the species is rare. Upon successfully mating, a mated female needs to find an acceptable burrow for nest preparation. If the species is still extant on Oʻahu and Maui, the population would be limited in size because of fragmentation of the coastal dry shrublands and dry and mesic forests habitats in the islands due to degradation and loss. Unprotected areas not occupied by the bees are shrinking in size due to development, drought, and encroachment by nonnative plants and predators, such as ants and yellow-jacket wasps. The known population is vulnerable to a catastrophic event such as flooding or tsunami in their coastal habitat. The stability and growth rate of the remaining population is not known.

While there are no historic population estimates or genetic information, qualitative accounts of this yellow faced bee indicate that they were once common and widely distributed. In recent decades, the species has been absent at most sites previously occupied on each island. We have no historical genetic information, and thus cannot determine how much genetic variation has been lost since humans arrived in Hawaiʻi. The diversity of habitat and the breadth of genetic diversity is strongly influenced by the current and historic biogeographical range of easy yellow-faced bees. We have no historical genetic information, and thus cannot determine how much genetic variation has been lost since humans arrived in Hawaiʻi. The mobility of yellow-faced bees provides a means of short-range connectivity between populations, which in turn, can support genetic exchange and representation. However, genetic exchange is likely limited by the isolation of the one known population. Exchange between possible undocumented populations on Oʻahu and Maui Nui is probably extremely rare. It is possible that traits have been lost over time given the reduction in habitat range.

In summary, the primary factors that pose serious and ongoing threats to the species, its plant hosts, and its habitat range include the following: habitat degradation and destruction, nonnative ungulates and plants, drought, fire, predation, inadequate regulatory mechanisms to address nonnative species, natural disasters, limited numbers of populations and individuals, competition, potential environmental changes, and the interaction of these threats. Initial management actions benefitting the species have been extremely limited. A recovery plan is expected to be completed in 2022.

## 3.0 RESULTS

### 3.1 Recommended Classification:

**____Downlist to Threatened**
**____Uplist to Endangered**
**____Delist**
____*Extinction*
____*Recovery*
____*Original data for classification in error*
__X__**No change is needed**

### 3.2 New Recovery Priority Number:

**Brief Rationale:**

### 3.3 Listing and Reclassification Priority Number:

**Reclassification (from Threatened to Endangered) Priority Number:____**
**Reclassification (from Endangered to Threatened) Priority Number:____**
**Delisting (regardless of current classification) Priority Number:____**

**Brief Rationale:**

## 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Develop measurable downlisting and delisting criteria for the recovery of easy yellow-faced bees.
- Identify habitats that may support easy yellow-faced bees and survey for extant individuals and populations.
- Conduct studies on the range, demography, and dispersal of easy yellow-faced bees.
- Develop microclimate models and identify suitable habitat based on historical and existing species distribution and potential future climate conditions.
- Identify and prioritize management units that are necessary for easy yellow-faced bees recovery.
- Ensure long-term protection of management units.

- Identify threats specific to management units.
- Construct and maintain ungulate fences around management units where needed.
- Remove ungulates from fenced areas.
- Control or eradicate habitat-modifying invasive plants from management units.
- Provide wildfire protection as necessary.
    - Develop management-unit specific fire management plans and infrastructure, and initiate management actions to reduce the likelihood of fire, especially in coastal, dry, and mesic habitats.
    - Assess the need for fire management plans in habitats affected by climate change.
- Protect management units from human disturbance as necessary.
- Conduct surveys, focused on likely source areas (e.g., airports, docks), and control newly discovered pest or invasive species prior to their dispersal to management units.
- Control other threats to management units as appropriate.
- Monitor management and use results to adapt management actions.
- Develop and implement control programs for nonnative ants (e.g. big-headed ant, yellow crazy ant, Papuan thief ant, and tropical fire ant).
- Develop and implement control programs for nonnative western yellow jacket wasps.
- Monitor populations to detect disease, assess impacts, and control outbreaks as soon as possible, if needed.
- Control other threats to easy yellow-faced bees as appropriate.
- Determine if translocation is appropriate for easy yellow-faced bee.
- Establish a captive rearing program for easy yellow-faced bees and establish populations from appropriate genetic sources.
- Identify areas within management units appropriate for translocating individuals.
- If translocation is appropriate, develop and implement translocation plans according to IUCN Reintroduction Guidelines (2013).
- Select populations for translocation.
- Prepare reintroduction sites.
- Translocate genetically appropriate individuals into managed sites.
- Develop tools to enhance habitat and species survival and reproduction.
- Develop tools to inform actions that will improve easy yellow-faced bees viability.
- Conduct research on threats to species' viability.
- Develop tools for monitoring population growth and status.
- Conduct population viability analyses for each population.
- Conduct studies on the optimization of conservation translocation survival and success.
- Implement the Hawai‘i interagency biosecurity plan to prevent the influx of new pests and invasive species into Hawai‘i and habitats of easy yellow-faced bees.
- Implement public outreach and education and enforce policies that prohibit species collection and harassment.

- Identify, develop, and support alliances and partnerships to plan and implement easy yellow-faced bee habitat restoration and management to benefit and recover the species.

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**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW for easy of facilis yellow-faced bee**
**(*Hylaeus facilis*)**

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**

____Downlist to Threatened
____Uplist to Endangered
____Delist
_X__No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable**: _____

**Review Conducted By:**
Diane Sether, Ph.D., Invertebrate and Wildlife Biologist, PIFWO
John Vetter, Animal Recovery Coordinator, PIFWO
Megan Laut, Conservation and Restoration Team Manager, PIFWO

**FIELD OFFICE APPROVAL:**

MEGAN LAUT Digitally signed by MEGAN LAUT
Date: 2021.05.12 10:44:43 -10'00'

for _____
**Field Supervisor, Pacific Islands Fish and Wildlife Office**