Longiceps or long head yellow-faced bee (*Hylaeus longiceps*)

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: longiceps or long head yellow-faced bee (*Hylaeus longiceps*)

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1.0 GENERAL INFORMATION

1.1 Reviewers:

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Lead Regional Office:
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Lead Field Office:
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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 of, 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 The review was based on the final rule listing this species; peer reviewed scientific publications; unpublished field observations by the Service, State of Hawai‘i, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information.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 longiceps* (longiceps or long head 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 longiceps*.

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 longiceps yellow-faced bee (*Hylaeus longiceps*). The draft plan is scheduled to be completed in 2021 and the plan finalized in 2022.

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." *Hylaeus* 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).

Longiceps, which means long head, yellow-faced bee has smoky to clear wings and is a medium sized bee, relative to other *Hylaeus* species, in the family Colletidae and subfamily Hylaeinae. Distinguishing characteristics are its long head and the facial marks of the male. The male's lower face is entirely yellow below the antennae; the yellow area is extended at the sides in a broad stripe above the antennal sockets. The upper margin of the face is very long and narrow, and the scape (i.e., basal segment of the antennae) is twice as long as it is wide. The female is entirely black and unmarked with distinct punctation on the front of her head (Daly and Magnacca 2003, p. 134; Magnacca 2005, entire). A more detailed description of the species is provided by Daly and Magnacca (2003, pp. 133–135).

Longiceps yellow-faced bees, are believed to be ground-nesting, though nests have not been described. Ground-nesting yellow-faced bees usually construct their nests opportunistically within existing burrows or small natural cavities under bark or rocks. Longiceps yellow-faced bee appears to nest at sandy or ashy sites (Kaʻena Point, Oʻahu; Waiehu dune, Maui; Kahue area, Lānaʻi; and Moʻomomi Preserve, Molokaʻi). Longiceps yellow-faced bees and anthracinan yellow-faced bees (*Hylaeus anthracinus*) are often found together; however, longiceps yellow-faced bees have not been found at strictly rocky sites (e.g. Manawainui, Maui or Kalaupapa, Molokaʻi) where anthracinan yellow-faced bees, which also nest in twigs, are found (Magnacca 2010 in litt., entire). This may be due to specific nest requirements of these two sympatric (i.e. overlapping in distribution) species. Ground-nesting species need relatively dry conditions for nesting (Daly and Magnacca 2003, p. 11). *Hylaeus* species that nest in the ground lack the physical characteristics necessary for digging a nest, such as strong mandibles and terminal abdominal plate (pygidial plate) that would allow them to excavate hard-packed soil (Daly and Magnacca 2003, entire; Magnacca 2007, p. 187). As a result, ground

nesting species do not usually initiate their own nest holes; rather they utilize vacant burrows made by other insects such as beetles or wasps or natural crevices in or on the ground (Magnacca 2007, p. 188). 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 longiceps yellow-faced bee 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. Prior to sealing the nest, the female provides her brood (young) with a mass of semiliquid nectar and pollen left alongside her eggs (Daly and Magnacca 2003, p. 9).

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 stages. During this time, the larvae consume the nectar and pollen provisions left for them by the female (Daly and Magnacca 2003, p. 9; Michener 2000, p. 24). After the third molt, 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 longiceps 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, pp. 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 the coastal and dry forest nesting species.

Adult yellow-faced bees consume pollen and nectar, but their exact nutritional needs are unknown. 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). 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 taccada* (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). In coastal sites, "favored" pollen sources visited by other *Hylaeus* species include *Dodonaea viscosa* (ʻaʻaliʻi) and *Jacquemontia ovalifolia* ssp. *sandwicensis* (pāʻū o Hiʻiaka,

oval-leaf clustervine). All of the most common pollen types collected by yellow-faced bees are the dominant or codominant plants in the native coastal shrubland. Flower visitation records of Hawaiian *Hylaeus* bees (Daly and Magnacca 2003, p. 11) and pollination studies of native plants (Sakai et al. 1995, pp. 2524-2528; Cox and Elmqvist 2000, p. 1238; Sahli et al. 2008, p. 1; Shay 2014, entire) have demonstrated Hawaiian yellow-faced bees pollinate the plants they use as their food sources. 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, entire). 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 longiceps yellow-faced bee survival and reproduction.

Longiceps yellow-faced bee have been observed visiting *Euphorbia* spp. (pōpolo, ʻakoko), *Myoporum sandwicense* (naio), *Santalum ellipticum* (ʻiliahi, sandalwood), naupaka kahakai, *Sesbania tomentosa* (ʻōhai), *Sida fallax* (ʻilima), *Vitex rotundifolia* (pōhinahina) and nonnative *Heliotropium foertherianum* (tree heliotrope), though it is possible other species are also visited (Daly and Magnacca 2003, p. 135; Magnacca 2007, p. 186). The use of the nonnative tree heliotrope is possibly due to the decline in abundance of native *Heliotropium* species (Daly and Magnacca 2003, p. 11).

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). R.C.L. Perkins noted longiceps yellow-faced bee was locally abundant (Perkins 1899, p. 98), and probably occurred throughout much of the leeward and lowland areas of Oʻahu, Molokaʻi, Lānaʻi, and Maui, because its host plants, pōpolo, ʻakoko, pāʻū o Hiʻiaka, andʻilima, occurred throughout these areas (Magnacca 2005, p. 2). On Oʻahu, the species was collected from the coastal area of southwest Waianae (Perkins 1899, entire). On Molokaʻi, the longiceps yellow-faced bee was collected at Kaunakakai, and at unknown locations labeled "Molokai coast and plains," "west end of the island," and the "Molokai Mountains." On Lānaʻi, the species was collected at Mānele Bay, and other unspecified localities, labeled "Lanai" (Perkins 1899, entire). On Maui, he collected the species at the Wailukū sand hills (Waiehu dunes) and from several unknown localities labeled only "Maui" (Daly and Magnacca 2003, p. 135). He also collected the species in dry forest habitat at an elevation of 2,000 feet (ft) (610 meters [m]) on Haleakalā, probably near the town of Pukalani or Makawao (Daly and Magnacca 2003, p. 135; Perkins 1899, entire).

Native dry forests that supported populations of longiceps yellow-faced bees were common in lowland areas at the time Perkins collected. The coastal and lowland dry grassland and shrubland habitat of each island were among the first habitats effected by anthropomorphic actions. This habitat has since been greatly reduced and fragmented throughout the historical range of the bee. Development, agriculture, and other human activities have modified and degraded the former *Hylaeus* habitat (Liebherr and Polhemus 1997, pp. 346-347; Magnacca 2007, pp. 186–188).

Longiceps yellow-faced bees are now restricted to small populations in patches of coastal and lowland dry habitat on the Oʻahu, Molokaʻi, Lānaʻi, and Maui (Magnacca 2005, p. 2; Magnacca 2007, entire; Magnacca and King 2013, pp. 13, 16). Twenty-five sites, either that were historical collecting localities or that contained potentially suitable habitat for this species, were surveyed between 1997 and 2008 (Magnacca and King 2013, p. 16). The species was observed at only seven of the surveyed sites: two sites on Oʻahu (in the coastal ecosystem), three sites on Lānaʻi (in the coastal and lowland dry ecosystems), and one site on each of the islands of Molokaʻi (in the coastal ecosystem) and Maui (in the coastal ecosystem) (Daly and Magnacca 2003, p. 135; Magnacca 2007, entire; Magnacca and King 2013, pp. 11–12). Only one known historical location, Waiehu dunes on Maui, still supports a population of longiceps yellow-faced bees (Daly and Magnacca 2003, p. 135).

Oʻahu – In 1999, 2000, and 2002, a significant population of longiceps yellow-faced bees was present in coastal habitat at Kaʻena Point Natural Area Reserve (Daly and Magnacca 2003, p. 224). The species was not found at other coastal sites with potentially suitable habitat, including Makapuʻu in 1999 and Kalaeloa in 2002. Although both areas have vegetation similar to the vegetation in the Kaʻena Point Natural Area Reserves, no species of *Hylaeus* were observed in either area (Daly and Magnacca 2003, pp. 217–229; Magnacca 2015 in litt., entire). In 2012, only two male individuals of longiceps yellow-faced bees were collected during multiple visits to the Kaʻena Point population site, despite good weather and a healthy abundance of host plants. The species population at Kaʻena Point was previously considered stable (Magnacca and King 2013, p. 14). This had been the only known population on Oʻahu until a second one was discovered at Kahuku Point in 2012 (Magnacca and King 2013, p. 16). This low-density population extends for nearly 0.62 mile (1 kilometer) in native coastal plant habitat segments along the coast, extending eastward from the shoreline beginning near the Turtle Bay Resort golf course (Magnacca and King 2013, p. 13–14). A relatively high density of longiceps yellow-faced bees was observed on ʻōhaʻi and nonnative tree heliotrope. In 2019–2020, longiceps yellow-faced bees

were observed again at Kaʻena Point and the population appears to be slowly coming back (Magnacca 2019 in litt., entire).

Molokaʻi – Multiple (>6) sites on Molokaʻi have been surveyed for longiceps yellow-faced bees over the last 20 years. A population of longiceps yellow-faced bee is known from northwestern coast at the Moʻomomi Preserve, which is owned by The Nature Conservancy (Daly and Magnacca 2003, p. 224; Magnacca 2007, p. 181). With the exception of the protected lands at Moʻomomi Preserve, most of the coastal habitat on the west end of Molokaʻi has been degraded and converted to nonnative, invasive plants (Magnacca 2007, p. 181). Longiceps yellow-faced bees were notably absent from the Kalaupapa peninsula (Daly and Magnacca 2003, pp. 217–229). The peninsula is part of the Kalaupapa National Historical Park and has native coastal vegetation on the east side that includes the native species ʻakoko, pāʻū o Hiʻiaka, and ʻilima, as well as the nonnative nonnative tree heliotrope in places (Magnacca 2007, entire). Other species that often are found in areas with longiceps yellow-faced bees, namely anthracinan yellow-faced bees and easy yellow-faced bees (*Hylaeus facilis*), are present and it is postulated that longiceps yellow-faced bees are probably also present during the flowering season, though absent when surveyed during the dry period (Magnacca 2007, p. 182). Longiceps yellow-faced bees were also absent in sand dune habitat near the Kaluakoi Resort on the northwest coastline. Although historically longiceps yellow-faced bees have been collected in the Kaunakakai area, the species was absent in more recent surveys (Magnacca 2010 in litt., entire). Kaunakakai is the primary urban area on Molokaʻi and any former yellow-faced bee habitat has been altered by urban development and nonnative, invasive plants (Magnacca 2010 in litt., entire).

Lānaʻi – Between 1999 and 2001, seven sites were surveyed for *Hylaeus* species. Longiceps yellow-faced bees were not found at Mānele Bay, a historical site of the species, although other rare *Hylaeus* species were observed there (Daly and Magnacca 2003, pp. 217–229). In addition, the species was not found at three other sites with suitable lowland dry habitat. These include the Kahue unit of the Kanepuʻu Preserve, Garden of the Gods, and the Munro Trail/Kaiholena area (Daly and Magnacca 2003, pp. 217–229). Longiceps yellow-faced bees are now known only from very small pockets of native vegetation in three locations. In 1999, Magnacca collected longiceps yellow-faced bee in lowland dry forest at Kahue and Polihua Road (south of Kanepuʻu Preserve) at an elevation of 1,400 ft (427 m) (Daly and Magnacca 2003, p. 135). The species was not found at Kanepuʻu. In 1999, the longiceps yellow-faced bee was collected in lowland dry forest at 1,000 ft (300 m) in elevation, along Polihua Road in central Lānaʻi (Daly and Magnacca 2003, p. 135). In 2001, the species was collected in native, coastal habitat at Shipwreck Beach (Daly and Magnacca 2003, p. 135). Most recently, the species was observed in the

lowland dry forest and shrubland (Bustamente 2020 in litt., entire; Magnacca 2019 in litt., entire).

Maui – Longiceps yellow-faced bees are currently known from only one Maui location, at the Waiehu dunes in a very small (< 12.5 acres [<5 hectares]) patch of native dune vegetation adjacent to a golf course (Magnacca 2007, p. 182). Between 1999 and 2001, seven specimens were collected in native habitat of the northern dunes (Daly and Magnacca 2003, p. 224). To the northwest of Waiehu dunes lies the Waihee Coastal Dunes and Wetlands Refuge, purchased by the Hawaiian Islands Land Trust in 2004. The dunes are undergoing active restoration and management, but surveys have not yet been conducted. Longiceps yellow-faced bees were not found in the southern Waiehu dunes (towards Kahului) (Daly and Magnacca 2003, p. 224).

The species was not found at five other sites on Maui surveyed between 1999 and 2001 (Daly and Magnacca 2003, pp. 217–229). One of those sites is in dry forest habitat on the slopes of Haleakalā from which longiceps yellow-faced bee is historically known. The site is now developed and overgrown with nonnative, invasive plants (Magnacca 2010 in litt., entire). The other four sites, Kanaio Natural Area Reserve, Lahainaluna, Manawainui Gulch, and Waikapū near Kaohonua, have potentially suitable habitat. Other *Hylaeus* species with similar habitat requirements to longiceps yellow-faced bee were present; yet, longiceps yellow-faced bee was notably absent (Daly and Magnacca 2003, pp. 217–229). A few additional specimens have been collected from unspecified locations on West Maui. Much of that area is now largely dominated by exotic plants, but it has not been adequately searched for patches of native vegetation (Magnacca 2007, p. 182).

Summary—The current population size or demographics of longiceps yellow-faced bees is unknown; however, the species is believed to be extant in low numbers in seven populations located on four islands in Hawai‘i. Though the species is present on four islands, there are a limited number of populations on each island and all are vulnerable to catastrophic events.

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 longiceps yellow-faced bees. 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. However, genetic exchange is likely limited by the isolation of the seven known populations. Populations within Maui Nui may have a low level of exchange because of the mobility of the bees. But, exchange between populations on O‘ahu and Maui Nui is probably extremely rare. It is possible that traits have been lost over time given the reduction in habitat range.

2.3.1.4 Taxonomic classification or changes in nomenclature:
Hylaeus longiceps is the most recent taxonomic treatment for this species (Daly and Magnacca 2003, pp. 133–135).

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. Historically, the species was likely abundant throughout the leeward and lowland areas coastal and lowland dry shrubland habitats up to 2000 feet (ft) (610 meters [m]) in elevation on O‘ahu, Lāna‘i, Moloka‘i, and Maui (Daly and Magnacca 2003, p. 135; Perkins 1899, entire). The species coastal habitat occurs in a relatively narrow belt around each island from sea level to 980 ft (300 m) in elevation.

Habitat loss and degradation have contributed significantly to population declines of the longiceps yellow-faced bee. Native coastal strand habitat is one of the rarest habitats on each island (Cuddihy and Stone 1990, pp. 94-95; Wagner et al. 1999, pp. 45, 54; Magnacca 2007, p. 180). Much of the coastal strand and dunes and the lowland dry shrubland ecosystems have been modified, degraded, fragmented, and lost by land use conversion (e.g. development, agriculture, road building), invasion by nonnative species, fire, and environmental changes (Cuddihy and Stone 1990, pp. 94-95; Wagner et al. 1999, entire; Kim et al. 2020, entire; Pe‘a et al. 2020, entire). The quality of the habitat in these areas no longer sustains longiceps yellow-faced bees. Less than 1 percent of native lowland dry shrubland remains on O‘ahu, Moloka‘i, and Lāna‘i and less than 2 percent remains on Maui (Pe‘a et al. 2020; entire). Nesting and foraging resources are becoming increasingly rare (Cuddihy and Stone 1990, entire; Magnacca 2005, entire; Magnacca 2007, entire). As a result, longiceps yellow-faced bees have disappeared from much of the historical range they once occupied on O‘ahu, Moloka‘i, Lāna‘i, and Maui.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):
Historically, coastal strand vegetation was dominated by *Achyranthes splendens* var. *rotundata* (ʻewa hinahina), pōpolo, ʻakoko, *Gossypium tomentosum* (maʻo, Hawaiian cotton), *Hibiscus* spp. (hibiscus), pāʻū o Hiʻiaka, naio, *Nama sandwicensis* (nama), ʻiliahi, naupaka kahakai, ʻōhai, *Sesuvium portulacastrum* (ʻākulikuli), ʻilima, *Sophora chrysophylla* (māmane), *Vigna* spp., pōhinahina, and *Wikstroemia uva-ursi* (ʻakiʻa) (Kim et al. 2020, entire), some of which are known food resources for longiceps yellow-faced bee (Daly and Magnacca 2003, p. 217; Magnacca 2007, entire). Coastal habitats are highly valued for development, popular for recreation, typically dry and therefore vulnerable to fire, susceptible to invasion by exotic plants, and cover a relatively small area (Magnacca 2007, entire). As a result, intact coastal habitats have become extremely limited in Hawaiʻi; most islands have few, if any, coastal sites with diverse native vegetation that are protected.

Native coastal strand habitat is one of the rarest habitats on each island (Cuddihy and Stone 1990, pp. 94-95; Wagner et al. 1999, pp. 45, 54; Magnacca 2007, p. 180). Much of the coastal strand and dunes and the lowland dry shrubland ecosystems have been modified, degraded, fragmented, and lost by land use conversion (e.g. development, agriculture, road building), invasion by nonnative species, fire, and environmental changes (Cuddihy and Stone 1990, pp. 94-95; Wagner et al. 1999, entire; Kim et al. 2020, entire; Peʻa et al. 2020, entire). The quality of the habitat in these areas no longer sustains longiceps yellow-faced bee. Less than 1 percent of native lowland dry shrubland remains on Oʻahu, Molokaʻi, and Lānaʻi and less than 2 percent remains on Maui (Peʻa et al. 2020; entire). Nesting and foraging resources are becoming increasingly rare (Cuddihy and Stone 1990, entire; Magnacca 2005, entire; Magnacca 2007, entire). As a result, longiceps yellow-faced bees have disappeared from much of the historical range they once occupied on Oʻahu, Molokaʻi, Lānaʻi, and Maui.

In the lowland dry shrublands used by longiceps yellow-faced bee, 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 inches (10 and 175 centimeters) (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 ʻaʻaliʻi, 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.

The majority of the coastal and lowland dry shrubland habitats below 2000 ft (610 m) once occupied by longiceps yellow-faced bee 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; Kim et al. 2020, entire; Pe‘a 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 the yellow-faced bee populations on its own (Magnacca 2007, p. 187).

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 Hawai‘i. These habitat changes remove food sources and nesting sites for longiceps yellow-faced bees (Stone 1985, pp. 262–263; Cuddihy and Stone 1990, pp. 60–66, 73). Browsing, grazing, and trampling by these mammals degrades native plant communities and facilitates invasion of exotic plants by spreading seeds and creating disturbed areas where seeds can germinate (Hobdy 1993, entire). Specific threats to yellow-faced bee habitat posed by introduced ungulates are: (1) crushing or trampling of ground 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 carolinensis* (sourbush), *Pluchea indica* (Indian fleabane), *Prosopis pallida* (kiawe), *Schinus terebinthifolius* (Brazilian peppertree), and *Verbesina encelioides* (golden crown-beard), represents a serious and ongoing threat to longiceps yellow-faced bee (USFWS 2016, entire). 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 et al. 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 upon and use for provisioning their nests. While some yellow-faced bees have been observed on the nonnative tree heliotrope, yellow-faced bee species 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 nesting sites. The loss of native plant species from coastal and dry lowland habitats is one of the main causes of decline of yellow-faced bees (Sakai et al. 2002, pp. 276, 291; Liebherr 2005, p. 186).

Drought—Drought can modify and destroy habitat of longiceps yellow-faced bee (Magnacca 2007, pp. 181, 183). The dry coastal and shrubland habitats already incur cyclical droughts, which in turn, effect vegetation flushes and food availability. Though rare, longiceps yellow-faced bee may survive in small numbers and increase once conditions improve (Magnacca 2007, p. 181). 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 brushfires (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 longiceps yellow-faced bees because they have restricted geographic ranges.

Fire— Fire is a threat to longiceps yellow-faced bees because it destroys native coastal and dry shrubland 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, pp. 70, 73-74). The dry coastal and shrubland ecosystems of longiceps 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, entire; USFWS 2019, entire). 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, entire).

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 longiceps yellow-faced bee through shared food sources (Graham 2015 in litt., entire). However, we have no reports of this type of disease transmission in longiceps yellow-faced bee.

Western yellow-jacket wasp—Predation by nonnative western yellow jacket wasps (*Vespula pensylvanica*) is a threat to longiceps yellow-faced bee. This wasp species is an aggressive generalist predator that will opportunistically predate *Hylaeus* species, although yellow-faced bees are 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 longiceps yellow-faced bee occur (Gambino et al. 1987, p. 169; Graham 2015 in litt., entire). Although longiceps 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 ant (*Pheidole megacephala*), yellow crazy ant (*Anoplolepis gracilipes*), Papuan thief ant (*Solenopsis papuana*), and tropical fire ant (*Solenopsis geminata*) are aggressive, generalist predators (preying on a variety of species) that occur in the coastal and shrubland habitat. Ground-nesting species like longiceps yellow-faced bee are particularly vulnerable to predation by nonnative ants (Cole et al. 1992, entire; Medeiros et al. 1986, entire). Ants are primarily a threat to the brood (i.e. egg, larvae, and

pupal stages) of the bee because the brood 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 coastal and shrubland habitat of longiceps yellow-faced bee. Both of these ant species are abundant and colonize native and nonnative plant communities (Holway et al. 2002, pp. 188, 209; Reimer 1993, entire). 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 the 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 populations of longiceps yellow-faced bees (Reimer 1993, pp. 14, 17; Daly and Magnacca 2003, pp. 9-10).

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).

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 Hawai‘i, 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 longiceps 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—Nonnative bees competing for food resources is a potential threat to longiceps yellow-faced bee (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 *Hylaeus* species for nectar and pollen (Snelling 2003, p. 345; Magnacca 2007, p. 188).

Other nonnative bee species also use the same native vegetation as longiceps yellow-faced bee. These include carpenter bees (*Ceratina* spp.), sweat bee (*Lasioglossum* spp.), and the nonnative *Hylaeus albonitens* and

Hylaeus strenuous (Magnacca 2007, entire; Magnacca et al. 2013, entire; Snelling 2003, entire). *Hylaeus strenuus* has been found on O‘ahu visiting both naupaka kahakai and nonnative tree heliotrope, pollen and nectar hosts used by longiceps yellow-faced bees (Magnacca et al. 2013, pp. 61-62). The impact of competition for nectar and pollen from nonnative bee species may have a significant impact on longiceps yellow-faced bee 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. Longiceps yellow-faced bees are vulnerable to extinction due to threats associated with low number of individuals and low number of populations. 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 populations, a single catastrophic event (e.g., hurricane, drought) may result in extirpation of the extant populations and extinction of this species. Species with few known locations, such as longiceps 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. The limited distribution of this species thus magnifies the severity of the impact of the other threats.

The persistence of longiceps yellow-faced bee is hampered by having only seven known populations; three sites on Lanai, two on O‘ahu, one population on Moloka‘i and one on Maui (Daly and Magnacca 2003, pp. 133-135, 224; Magnacca 2007, p. 181). This limited number leaves the species vulnerable to extinction from natural and anthropogenic caused factors. The demographic structure needed to support longiceps 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 longiceps yellow-faced bee individuals and brood, nests, and foraging resources due to wind, rain, flooding and tidal surge. The coastal habitat inhabited by the species is extremely vulnerable to storm surge and flooding associated with severe 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 longiceps yellow-faced bee. The species reproduces in the coastal habitat. Sea level rise may further reduce the already small amount of remaining coastal habitat. Coastal and shrubland habitats of longiceps 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 described above (Kim et al. 2020, entire) making the habitats unsuitable for longiceps 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 longiceps yellow-faced bee (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. Longiceps yellow-faced bees occur on State and private lands.

Land Protection and Conservation—A population of longiceps yellow-faced bees occurs on the northwestern coast of Moloka‘i at Mo‘omomi Preserve on lands protected by The Nature Conservancy of Hawai‘i. The bee fauna of the coast and dunes at the preserve also includes anthracinan yellow-faced bee and the cleptoparasitic native, hilaris yellow-faced bee, which parasitizes the nests of longiceps and anthracinan yellow-faced bees (Daly and Magnacca 2003, p. 106; Magnacca 2007, entire). The coastal lands consist of native beach flora bordered by mostly exotic trees. The habitat is protected from development but is susceptible to fire and invasion by nonnative plants and invertebrate species.

In October 2015, the State of Hawai‘i, City and County of Honolulu, U.S. Army, and The Trust for Public Land completed a transaction to place 628 acres of undeveloped coastal acres into conservation for perpetuity. Included in those conservation lands is Kahuku Point or Kalaeokauna‘oa, an area of undeveloped coastline on the North Shore of O‘ahu. A volunteer-based community stewardship and coastline restoration effort stemming from a partnership between North Shore Community Land

Trust, Turtle Bay Resort, Hawai'i Marine Animal Response, and U.S. Fish and Wildlife Pacific Islands Coastal Program are restoring approximately 39 acres of the Kahuku Point coastal dune ecosystem; approximately five acres of this coastal sand dune ecosystem are restored. Actions include removing invasive plants and marine debris and outplanting of over 14,000 native coastal plants. Yellow-faced bees and native host plants including ʻōhiʻa, akoko, naupaka, and others are present at the site.

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

Date	Number of Populations	Number of Individuals
2016 listing	≥7 (based on surveys from 1997 to 2013)	unknown
2020 species report	≥7 (based on surveys from 1997 to 2020)	unknown
2021 5-year review	≥7 (based on surveys from 1997 to 2020)	unknown

Table 2 – Status of threats to longiceps 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 at Keana Point and Kahuku Point on Oʻahu are undergoing restoration to provide suitable habitat. Coast habitat on Oʻahu (Kahuku Point) and on Moloakʻi (Moʻomomi Preserve) are protected from development into perpetuity through land trusts.
Ungulates	A	Ongoing	Partial—some strategic fencing is in place at the Moʻomomi Preserve on Molokaʻi.
Invasive nonnative plants	A	Ongoing	Partial—control and removal of nonnative invasive plants is ongoing at Kahuku Point on Oʻahu.
Fire	A	Ongoing	none
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

Threat	Listing Factor	Current Status	Conservation/Management Efforts
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 longiceps yellow-faced bee habitat;
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

Longiceps yellow-faced bee is an endangered Hawaiian archipelago endemic species that nests opportunistically in existing burrows or natural crevices under bark or rocks. The species is historically known from coastal and shrubland dry forest habitat up to 2,000 ft (610 m) in elevation on Oʻahu, Molokaʻi, Lānaʻi, and Maui. Longiceps yellow-faced bees are currently known from seven sites: two coastal sites on Oʻahu, three sites (coastal and shrubland) on Lānaʻi, one coastal site on Molokaʻi, and one coastal site on Maui. Habitat loss and predation have largely reduced the suitable habitat for this species.

Ground-nesters need relatively dry conditions and existing burrows for nesting. They require foraging habitats nearby that provide a variety of suitable native plant pollen and nectar. Longiceps yellow-faced bee have been observed visiting pōpolo, ʻakoko, naio ʻiliahi, naupaka kahakai, ʻōhai, ʻilima, pōhinahina, and nonnative tree heliotrope, though it is possible other species are also visited. 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 bees visit may change with the time of year and resource availability. In general, the remaining longiceps yellow-faced bee inhabited areas are highly fragmented and surrounded by degraded habitats.

The unprotected areas 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 size of the occupied habitat also 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. All known populations are vulnerable to catastrophic events such as flooding or fire in their coastal habitat. The stability and growth rate of each remaining population are not known.

While there are no historic population estimates or genetic information, qualitative accounts of this yellow faced bee indicate that they were locally abundant, and probably occurred throughout much of the leeward and lowland areas of Oʻahu, Molokaʻi, Lānaʻi, and Maui, because its host plants occurred throughout these areas. 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 longiceps yellow-faced bees. In recent decades, longiceps yellow-faced bees have been absent at sites previously occupied.

The mobility of yellow-faced bees provides a means of short-range connectivity between populations in close proximity, which in turn, can support genetic exchange and representation. However, genetic exchange is likely limited by the isolation of the seven known populations. Populations within Maui Nui may have a low level of exchange because of the mobility of the bees. But, exchange between 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 remaining seven known populations have been extremely limited. A draft recovery plan is expected to be completed in 2021 and the final plan published 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 longiceps yellow-faced bee.
- Identify habitats that may support longiceps yellow-faced bee and survey for extant individuals and populations.
- Conduct studies on the range, demography, and dispersal of longiceps yellow-faced bee.
- 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 longiceps yellow-faced bee 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 longiceps yellow-faced bee as appropriate.
- Establish a captive rearing program for longiceps yellow-faced bee and establish populations from appropriate genetic sources.
- Determine if translocation is appropriate for longiceps yellow-faced bee.
- 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 longiceps yellow-faced bee 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 longiceps yellow-faced bee.
- 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 longiceps 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 of longiceps yellow-faced bee
(*Hylaeus longiceps*)

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:

for MEGAN LAUT Digitally signed by MEGAN LAUT Date: 2021.05.12 10:56:26 -10'00'
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Field Supervisor, Pacific Islands Fish and Wildlife Office