

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R1-ES-2011-0110]

[4500030114]

Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to List the ‘I’iwi as Endangered or Threatened

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 90-day petition finding and initiation of status review.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 90-day finding on a petition to list the ‘i’iwi (*Vestiaria coccinea*) as endangered or threatened under the Endangered Species Act of 1973, as amended (Act), and designate critical habitat. Based on our review, we find that the petition presents substantial information indicating that listing the ‘i’iwi may be warranted. Therefore, with the publication of this notice, we are initiating a review of the status of the species to determine if listing the

‘i’iwi as endangered or threatened is warranted. To ensure that this status review is comprehensive, we are requesting scientific and commercial data and other information regarding this species. Based on the status review, we will issue a 12-month finding on the petition, which will address whether the petitioned action is warranted, as provided in section 4(b)(3)(B) of the Act.

DATES: To allow us adequate time to conduct this review, we request that we receive information on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Please note that if you are using the Federal eRulemaking Portal (see **ADDRESSES** section, below), the deadline for submitting an electronic comment is 11:59 p.m. Eastern Time on this date. After [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER], you must submit information directly to the Pacific Islands Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT** section below). Please note that we might not be able to fully address or incorporate information that we receive after the above requested date.

ADDRESSES: You may submit information by one of the following methods:

- *Federal eRulemaking Portal:* <http://www.regulations.gov>. Search for FWS-R1-ES-2011-0110, which is the docket number for this finding.
- *U.S. mail or hand-delivery:* Public Comments Processing, Attn: FWS-R1-ES-2011-0110; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042-PDM; Arlington, VA 22203.

We will post all information we receive on <http://www.regulations.gov>. This generally means that we will post any personal information you provide us (see the **Request for Information** section below for more details).

FOR FURTHER INFORMATION CONTACT: Loyal Mehrhoff, Field Supervisor, Pacific Islands Fish and Wildlife Office, 300 Ala Moana Boulevard, Room 3-122, Honolulu, HI 96850; by telephone (808-792-9400); or by facsimile (808-792-9581). If you use a telecommunications device for the deaf (TTD), please call the Federal Information Relay Service (FIRS) at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Request for Information

When we make a finding that a petition presents substantial information indicating that listing a species may be warranted, we are required to promptly review the status of the species (status review). For the status review to be complete and based on the best available scientific and commercial information, we request information on the ‘i’iwi from governmental agencies, the cultural community, the scientific community, industry, and any other interested parties. We seek information on:

- (1) The species’ biology, range, and population trends, including:
 - (a) Habitat requirements for feeding, breeding, and sheltering;
 - (b) Genetics and taxonomy;

- (c) Historical and current range, including distribution patterns;
 - (d) Historical and current population levels, and current and projected trends; and
 - (e) Past and ongoing conservation measures for the species, its habitat, or both.
- (2) The factors that are the basis for making a listing determination for a species under section 4(a) of the Act (16 U.S.C. 1531 *et seq.*), which are:
- (a) The present or threatened destruction, modification, or curtailment of its habitat or range;
 - (b) Overutilization for commercial, recreational, scientific, or educational purposes;
 - (c) Disease or predation;
 - (d) The inadequacy of existing regulatory mechanisms; or
 - (e) Other natural or manmade factors affecting its continued existence.
- (3) The potential cumulative effects of these factors that may endanger or threaten the ‘i’iwi.
- (4) Management programs for the conservation of the ‘i’iwi.
- (5) The potential effects of climate change on the ‘i’iwi and its habitat.

If, after the status review, we determine that listing the ‘i’iwi is warranted, we will propose critical habitat (see definition in section 3(5)(A) of the Act) under section 4 of the Act, to the maximum extent prudent and determinable, at the time we propose to list

the species. Therefore, within the geographical range currently occupied by the ‘i’iwi, we also request data and information on:

- (1) What may constitute “physical or biological features essential to the conservation of the species,”
- (2) Where these features are currently found, and
- (3) Whether any of these features may require special management considerations or protection.

In addition, we request data and information on “specific areas outside the geographical area occupied by the species” that are “essential to the conservation of the species.” Please provide specific comments and information as to what, if any, critical habitat you think we should propose for designation if the species is proposed for listing, and why such habitat meets the requirements of section 4 of the Act.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination. Section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or threatened species must be made “solely on the basis of the best scientific and commercial data available.”

You may submit your information concerning this status review by one of the methods listed in the **ADDRESSES** section. If you submit information via <http://www.regulations.gov>, your entire submission—including any personal identifying information—will be posted on the website. If you submit a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this personal identifying information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on <http://www.regulations.gov>.

Information and supporting documentation that we received and used in preparing this finding is available for you to review at <http://www.regulations.gov>, or you may make an appointment during normal business hours at the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**).

Background

Section 4(b)(3)(A) of the Act (16 U.S.C. 1533(b)(3)(A)) requires that we make a finding on whether a petition to list, delist, or reclassify a species presents substantial scientific or commercial information indicating that the petitioned action may be warranted. We are to base this finding on information provided in the petition, supporting information submitted with the petition, and information otherwise available

in our files. To the maximum extent practicable, we are to make this finding within 90 days of our receipt of the petition and publish our notice of the finding promptly in the **Federal Register**.

Our standard for substantial scientific or commercial information within the Code of Federal Regulations (CFR) with regard to a 90-day petition finding is “that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted” (50 CFR 424.14(b)). If we find that substantial scientific or commercial information was presented, we are required to promptly conduct a species status review, which we subsequently summarize in our 12-month finding.

Petition History

On August 25, 2010, we received a petition dated August 24, 2010, from Noah Greenwald, Center for Biological Diversity, and Dr. Tony Povilitis, Life Net, requesting that the ‘i’iwi be listed as endangered or threatened and that critical habitat be designated under the Act. The petition clearly identified itself as such and included the requisite identification information for the petitioners as required by 50 CFR 424.14(a). In a September 10, 2010, letter to the petitioners, we responded that we had reviewed the information presented in the petition and determined that issuing an emergency regulation temporarily listing the species under section 4(b)(7) of the Act was not warranted. We also stated that we were required to complete a significant number of listing and critical habitat actions in Fiscal Year 2010, including complying with court orders and court-approved settlement agreements with specific deadlines, listing actions

with absolute statutory deadlines, and high priority listing actions. Our listing and critical habitat funding for Fiscal Year 2010 was committed to complying with these court orders, settlement agreements, and statutory deadlines. Therefore, we were unable to further address the petition to list the ‘i’iwi at that time. This finding addresses the petition.

Previous Federal Action(s)

To date, no Federal actions have been taken with regard to the ‘i’iwi.

Species Information

The ‘i’iwi is a member of the family Fringillidae, and the endemic subfamily Drepanidinae (Hawaiian honeycreepers) (Pratt *et al.* 2009, pp. 114, 122). The ‘i’iwi is placed in the monotypic genus (a genus of only one species) *Vestiaria*, and is classified as a discrete species by the American Ornithologists’ Union (AOU 1998, p. 677). The ‘i’iwi is a medium-sized forest bird (total body length is approximately 5.5 inches (in) (14 centimeters (cm))), with bright scarlet feathers, black wings and tail, and a small white patch on its inner secondaries (shorter flight feathers along the inner wing). The bill is long, curved, and salmon in color. Juveniles are a buff color with black spots, and have shorter bills that change in color from dusky yellow to salmon as they mature (Hawaii Audubon Society 2011, p. 97).

‘I‘iwi songs are complex with variable creaks, often described as a rusty hinge, whistles, or gurgling sounds, and they sometimes mimic other birds (Hawaii Audubon Society 2011, p. 97). The diet consists primarily of nectar from the flowers of *Metrosideros polymorpha* (ohia), *Sophora chrysophylla* (mamane), plants in the bellflower (Campanulaceae) family (Pratt *et al.* 2009, p. 193), insects, and spiders (Hawaii Audubon Society 2011, p. 97; Pratt *et al.* 2009, p. 193). The breeding season starts as early as October and continues through August (Hawaii Audubon Society 2011, p. 97). Peak breeding is from February through June and coincides with peak flowering of *Metrosideros polymorpha* (Fancy and Ralph 1997, p. 2). ‘I‘iwi nest sites are typically found in the upper canopy of *Metrosideros polymorpha* (Hawaii Audubon Society 2011, p. 97), and are cup-shaped nests made of twigs and lined with lichens and moss (Hawaii Audubon Society 2011, p. 97). Breeding pairs remain together during the season, and defend a small area around the nest and disperse after breeding (Fancy and Ralph 1997, p. 2). Clutch size typically consists of two eggs, with an ‘i‘iwi pair incubating one to two broods per year (Hawaii Audubon Society 2011, p. 97).

Habitat, Distribution, and Status

The ‘i‘iwi occurs on the five largest Hawaiian islands (Hawaii, Maui, Molokai, Oahu, and Kauai), and is most abundant in montane wet, closed-canopied, high-stature *Metrosideros polymorpha* and *Acacia koa* (koa)-*Metrosideros polymorpha* forests above approximately 4,900 feet (ft) (1,500 meters (m)) in elevation (Pratt *et al.* 2009, p. 122). The largest population (more than 340,000 birds) and range (approximately 770 square

miles (sq mi) (2,000 square kilometers (sq km)) occur on Hawaii Island (Scott et al. 1986 in Pratt *et al.* 2009, p. 122). On the windward (eastern) side of Hawaii Island, ‘i’iwi populations are generally declining other than in high-elevation forest areas. ‘I’iwi populations appear to be stable in the main unit of Hakalau Forest National Wildlife Refuge, Kulani-Keahou, and possibly in the Kau district, in the southeast portion of Hawaii Island (Pratt *et al.* 2009, p. 123). On the leeward (western) side of Hawaii Island, the number of ‘i’iwi appears to have declined between 1986 and 2009 (Pratt *et al.* 2009, p. 123).

The ‘i’iwi occurs in two disjunct populations on Maui. The east Maui population on the windward slopes of Haleakala was estimated to number approximately 19,000 birds in 1980, although subsequent surveys indicated higher densities and probable higher numbers (Pratt *et al.* 2009, p. 123). The west Maui population was estimated to number approximately 180 birds in 1980, and they were restricted to a 6.2-sq-mi (16-sq-km) area, approximately 19 mi (30 km) from the eastern population. Subsequent surveys indicated the population persists at very low densities (Pratt *et al.* 2009, p. 123). Twelve ‘i’iwi were detected during 1979 surveys on Molokai, and surveys in 1988, 1995, and 2004 detected only 2, 1, and 3 birds respectively, which indicate the Molokai population is at high risk of extirpation (Pratt *et al.* 2009, p. 123).

The species’ precipitous decline on Oahu was evident by the early 1900s (Fancy and Ralph, 1998 in Pratt *et al.* 2009, p. 123). On Oahu, surveys from the mid-1990s recorded only 8 individuals located in three areas isolated from each other in the Waianae

and Koolau mountain ranges. The Oahu population was estimated to number fewer than 50 birds in 1991 (Ellis *et al.* 1992 in Pratt *et al.* 2009, p. 123), indicating it also faces likely extirpation (Pratt *et al.* 2009, p. 123).

On Kauai, the ‘i’iwi population also appears to be in decline. In the early 1970s, the ‘i’iwi occurred down to approximately 2,900 ft (900 m) in elevation, with the population estimated at approximately 26,000 birds across 54 sq mi (140 sq km). By 2000, the population had decreased to approximately 10,000 birds, and the species’ range was reduced to approximately 39 sq mi (100 sq km), with occurrences mostly restricted to elevations above 3,600 ft (1,100 m). Based on the 1968–1973 surveys, the core population in the interior Alakai Plateau (above 3,900 ft (1,200 m)) was estimated to be approximately 7,800 birds. Subsequent surveys in this area yielded highly variable densities, but indicated this portion of the population is presently stable (Pratt *et al.* 2009, p. 123).

Evaluation of Information for this Finding

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR 424 ,set forth procedures for adding species to, or removing a species from, the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act:

(A) The present or threatened destruction, modification, or curtailment of its

habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

In considering what factors might constitute threats, we must look beyond the mere exposure of the species to the factor to determine whether the species responds to the factor in a way that causes actual impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine how significant a threat it is. If the threat is significant, it may drive or contribute to the risk of extinction of the species such that the species may warrant listing as endangered or threatened as those terms are defined by the Act. This does not necessarily require empirical proof of a threat. The combination of exposure and some corroborating evidence of how the species is likely impacted could suffice. The mere identification of factors that could impact a species negatively may not be sufficient to compel a finding that listing may be warranted. The information shall contain evidence sufficient to suggest that these factors may be operative threats that act on the species to the point that the species may meet the definition of endangered or threatened under the Act.

In making this 90-day finding, we evaluated whether information regarding threats to the ‘i’iwi, as presented in the petition and other information available in our files, is substantial, thereby indicating that the petitioned action may be warranted. Our evaluation of this information is presented below.

*A. The Present or Threatened Destruction, Modification, or Curtailment of the Species’
Habitat or Range*

Information Provided in the Petition

The petitioners claim that 52 percent of the ‘i’iwi’s forest habitat on the island of Hawaii and 85 percent on the island of Oahu has been cleared for crops, livestock grazing, tree plantations, and urban development (Petition, p. 7). The petition also states that ‘i’iwi habitat is being lost and degraded by nonnative feral ungulates, including pigs (*Sus scrofa*), goats (*Capra hircus*), domestic sheep (*Ovis aries*), mouflon sheep (*Ovis gmelini musimon*), axis deer (*Axis axis*), black-tailed deer (*Odocoileus hemionus*), and cattle (*Bos taurus*) (Pratt *et al.* 2009, p. 556). According to the petitioners, feral ungulates destroy forest understory vegetation, eliminate food plants for birds, create mosquito breeding sites, open the forest floor to weed invasion, transport weeds into native forests, cause soil erosion, disrupt seedling regeneration of native plants, and girdle young trees (Petition, pp. 7–8). The petitioners claim that the ‘i’iwi’s native forests that provide food and nesting sites are being displaced by nonnative plants, a displacement which increases the risk of fire (Petition, p. 8). According to the

petitioners, rats (*Rattus* spp.) consume native plants and impact their regeneration, reducing their availability as food resources and habitat for the ‘i’iwi (see Factor E). The petition also claims nonnative insects may reduce or eliminate native insects that pollinate plants important to the ‘i’iwi (Petition, p. 8).

Evaluation of Information Provided in the Petition and Available in Service Files

Habitat Conversion

Information provided by the petitioners and readily available in our files indicates the ‘i’iwi may be declining due to loss, degradation, and modification of its native forest habitat. The consequences of past land use practices, such as agricultural conversion for food crops, ranching, and tree plantations, or for urban development, have resulted in little or no native vegetation remaining below 2,000 ft (600 m) throughout the Hawaiian Islands (The Nature Conservancy (TNC) 2007). Agriculture has been declining as a priority land use, and large tracts of former agricultural lands are being converted into residential areas or being allowed to remain fallow (TNC 2007). Hawaii’s population has also increased approximately 10 percent in 10 years, increasing demands on limited land and water resources (Hawaii Department of Business, Economic Development and Tourism (DBEDT) 2010). The ‘i’iwi is most abundant above 4,900 ft (1,500 m) (Pratt *et al.* 2009, p. 122), but likely no longer occurs in low- and mid-elevation native forests below that elevation because of a number of factors, including habitat loss and degradation (Pratt *et al.* 2009, p. 238) (also see Factor C).

Nonnative Ungulates

Introduced mammals have greatly impacted the native vegetation and native fauna of the Hawaiian Islands, with impacts accelerating following the arrival of Captain James Cook in 1778. The Cook expedition and subsequent explorers introduced a European race of pigs and other livestock, such as goats, to serve as food sources for seagoing explorers (Tomich 1986, pp. 120–121; U.S. Geological Survey 1998, p. 752). The mild climate of the islands, combined with the lack of competitors or predators, led to the successful establishment of large populations of these introduced mammals, to the detriment of native Hawaiian species and ecosystems. The presence of introduced nonnative mammals is considered to be one of the primary factors underlying the alteration and degradation of native plant communities and habitats on Kauai, Oahu, Maui, Molokai, and Hawaii islands, where the ‘i’iwi occurs (Pratt *et al.* 2009, pp. 150–152).

Pigs are widely recognized as one of the greatest threats to forest ecosystems in Hawaii (Aplet *et al.* 1991, p. 56; Anderson and Stone 1993, p. 195; Pratt *et al.* 2009, p. 54), and occur on each of the five islands where the ‘i’iwi occurs. Pigs are extremely destructive, and directly and indirectly impact native forest communities. While rooting in the earth in search of invertebrates and plant material, pigs disturb and destroy native vegetation, and trample plants and seedlings. They may also reduce or eliminate plant regeneration by consuming seeds and seedlings (Diong 1982, pp. 161–164). In forest

habitats, pigs consume many native plants including lobelioids (plants in the bellflower family), which are an important nectar source for nectarivorous birds such as the ‘i’iwi (Pratt *et al.* 2009, p. 150). Pigs also tear open tree fern trunks when feeding, leaving troughs that fill with rain water and develop into mosquito breeding sites (Pratt *et al.* 2009, p. 150); mosquitoes may carry avian malaria (see Factor C). Their continued rooting on the forest floor promotes the establishment of nonnative plants, particularly grasses, ferns, and aggressive shrubs. Pigs are also responsible for dispersing some of the most invasive rainforest weeds (Pratt *et al.* 2009, p. 150). Their rooting contributes to erosion by clearing vegetation and creating large areas of disturbed soil, particularly on slopes (Aplet *et al.* 1991, p. 56; Smith 1985, pp. 190, 192, 196, 200, 204, 230–231; Stone 1985, pp. 254–255, 262–264; Medeiros *et al.* 1986, pp. 27–28; Scott *et al.* 1986, pp. 360–361; Tomich 1986, pp. 120–126; Cuddihy and Stone 1990, pp. 64–65; Loope *et al.* 1991, pp. 1–21; Wagner *et al.* 1999, p. 51–52).

Goats occupy a wide variety of habitats on each of the five islands where the ‘i’iwi occurs. Goats are able to access and forage in extremely rugged terrain, have a high reproductive capacity (Clarke and Cuddihy 1980, pp. C–19, C–20; Culliney 1988, p. 336; Cuddihy and Stone 1990, p. 64), and are believed to have completely eliminated some plant species from the islands (Atkinson and Atkinson 2000, p. 21). Goats can be highly destructive to natural vegetation and contribute to erosion by trampling roots and seedlings, eating young trees and young shoots of plants before they can become established, creating trails that can damage native vegetation, destabilizing substrate, creating gullies that exacerbate erosion, promoting the invasion of nonnative plants, and

dislodging stones from ledges that can damage vegetation below (van Riper and van Riper 1982, pp. 35–35; Cuddihy and Stone 1990, p. 64). Feral goats have been reported to impact the reproduction of native tree species such as *Acacia koa* and *Sophora chrysophylla* (mamane), which provide forest habitat and a source of nectar for the ‘i’iwi (Pratt *et al.* 2009, p. 152).

Domestic sheep were introduced to five Hawaiian Islands (Niihau, Kauai, Lanai, Kahoolawe, and Hawaii), but are currently known only on Hawaii Island (Pratt *et al.* 2009, p. 151). Their browsing behavior and stripping of bark from native *Sophora chrysophylla* trees on Mauna Kea has been documented as a threat to endangered palila (*Loxioides bailleui*), a Hawaiian forest bird that is completely dependent on that species for food and habitat. However, we do not have any information in our files that would indicate this activity may be also a direct threat to the ‘i’iwi.

Mouflon sheep were introduced to Lanai and Hawaii islands in the 1950s for sport hunting purposes, and have become widely established (Tomich 1986, pp. 163–168; Cuddihy and Stone 1990, p. 66; Hess 2008, p. 1). Mouflon sheep are grazers and browsers, and have decimated vast areas of native forest and shrubland as a result of this behavior (Stone 1985, p. 271; Cuddihy and Stone 1990, pp. 63, 66; Hess 2008, p. 3). Studies on the island of Hawaii found that two of the plant species most affected are *Acacia koa* and *Sophora chrysophylla*, both of which provide food and habitat for the ‘i’iwi (Giffin 1981, pp. 22–23; Scowcroft and Conrad 1992, pp. 628–662; Hess 2008, p. 3). Mouflon sheep also create trails and pathways through thick vegetation, which leads

to increased runoff and erosion because of soil compaction. According to Pratt *et al.* (2009, p. 151), mouflon sheep represent a threat to forest bird habitat wherever they occur.

Axis deer were introduced to Molokai and Maui, where the ‘i’iwi occurs (Tomich 1986, p. 126), and in April 2011, it was confirmed that they had been introduced illegally to the island of Hawaii (Cravalho 2011, in litt.). On Molokai, axis deer are thought to occur throughout the island, from the coast to the summit (approximately 5,000 ft (1,500 m)) (Kessler 2011, pers. comm.). They prefer to browse and graze in lower more open vegetated areas, but can move into urban and forested areas to search for food during drought conditions, as was observed on Maui between 1998 and 2001 (Medeiros 2010, pers. comm.; Waring 1996, in litt., p. 5; Nishibayashi 2001, in litt.). Axis deer can be highly destructive to native vegetation, and contribute to erosion by creating trails that convey water. They eat young trees and plants before they can become established, damage native vegetation, and destabilize substrate. They can also dislodge stones from ledges, causing rockfalls and landslides, which damage the vegetation below (Cuddihy and Stone 1990, pp. 63–64). Their reproductive potential, extreme habitat flexibility and ability to use diverse types of forage make them a serious threat to forest bird habitat, including the forest habitat used by the ‘i’iwi (Pratt *et al.* 2009, p. 152).

Black-tailed deer (also known as mule deer) were introduced on Kauai in 1961, for sport hunting. They are currently limited to the western side of Kauai, up to 4,000 ft (1,200 m) in elevation, where they feed on a variety of native (e.g., *Acacia koa* and

Metrosideros polymorpha) and nonnative plants (Pratt *et al.* 2009, p. 152; 75 FR 18959, April 13, 2010). During dry periods, black-tailed deer have been reported in native forest bird habitat, including ‘i’iwi habitat, in the Alakai Swamp on Kauai (Pratt *et al.* 2009, p. 152). In addition to directly impacting native plants through browsing, they likely serve as a primary source for spreading nonnative plants by distributing seeds through their feces as they travel (Center for Invasive Plant Management 2009, p. 2).

Cattle were introduced to the Hawaiian Islands in 1793. Large feral herds (as many as 12,000 on the island of Hawaii) developed as a result of restrictions on the killing of cattle, decreed by King Kamehameha I over 200 years ago (Cuddihy and Stone 1990, p. 40). Although relatively small cattle ranches were developed on Kauai, Oahu, Molokai, west Maui, and Kahoolawe, much larger ranches encompassing tens of thousands of acres were established on east Maui and Hawaii Island (Stone 1985, pp. 256, 260; Broadbent in litt., 2010). Establishing cattle ranches required the logging of native *Acacia koa* trees, which converted native forest habitat to agricultural grassland (Tomich 1986, p. 140; Cuddihy and Stone 1990, p. 47). According to Pratt *et al.* (2009, p. 149), cattle are present on Kauai, Molokai, Maui, and Hawaii, where the ‘i’iwi occurs. They eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. Forests in areas grazed by cattle are converted to grassland pasture, and plant cover is reduced for many years following their removal. During this time, this degraded habitat is unsuitable as forest bird habitat (Tomich 1986, pp. 140–150; Cuddihy and Stone 1990, p. 29).

Nonnative Plants

Native vegetation on all the main Hawaiian Islands has undergone extreme alteration because of past and present land management practices such as ranching, nonnative species introductions, and agricultural development (Cuddihy and Stone 1990, pp. 27, 58). The original native flora of Hawaii consisted of about 1,000 taxa, 89 percent of which were endemic (species that occur only in the Hawaiian Islands). Since humans arrived, over 800 nonnative plant taxa have been introduced, approximately 100 of which have become injurious in Hawaii (Smith 1985, p. 180; Cuddihy and Stone 1990, p. 73; Gagne and Cuddihy 1999, p. 45). When plantation owners (and the then-territorial government of Hawaii) became alarmed at the reduction of water resources for their crops as a result of native forest destruction, they introduced nonnative trees for reforestation. Ranchers also introduced pasture grasses and other nonnative plants for agricultural purposes, which introduced other weed species. Other nonnative plants were imported to Hawaii for potential horticultural value (Scott *et al.* 1986, pp. 361–363; Cuddihy and Stone 1990, p. 73), or for food and cultural reasons by various groups, including Polynesians. Nonnative plants adversely impact native habitat in Hawaii, including forest habitat used by the ‘i’iwi, by modifying or altering light availability, soil-water regimes, and nutrient cycling processes. They also alter fire characteristics by opening areas where successive fires can burn farther into native habitats, destroying native vegetation and creating conditions that favor the establishment of nonnative

species (Cuddihy and Stone, 1990, p. 74; D'Antonio and Vitousek 1992, p. 73; Smith 1985, pp. 180–181; Vitousek *et al.* 1997, p. 6).

Rats

According to the petitioners, the nonnative black rat impacts forest bird habitat by feeding on native plant fruits and flowers (Petition, p. 8), which impacts native plant regeneration. Snetsinger *et al.* (1994, p. 47) stated that few studies have documented the food habits of several introduced mammals in Hawaii, particularly in upland forests. However, Pratt *et al.* (2009, pp. 152–153) reported that rats feed on seeds and flowers, and strip bark from plants, changing the composition of native forest plant communities, including habitat that supports the 'i'iwi.

Insects

The petition (Petition, p. 8) claims introduced predatory insects may reduce or eliminate specialized native insects that pollinate plants important to the 'i'iwi. According to Pratt *et al.* (2009, p. 153), *Metrosideros polymorpha*, the native tree that provides habitat and food for the 'i'iwi, may be particularly susceptible to damage by the nonnative two-spotted leaf-hopper (*Sophonia rufofascia*). This insect was first reported on Oahu in 1987, and now occurs on each of the main Hawaiian islands. However, we have no substantive information indicating this species, or any other predatory insects, may present a threat to the 'i'iwi.

Summary of Factor A

In summary, we find that information provided in the petition, and other information in our files, presents substantial scientific or commercial information to indicate that the petitioned action may be warranted due to habitat destruction, modification, or curtailment caused by nonnative animals (feral pigs, goats, mouflon sheep, axis deer, black-tailed deer, cattle, and rats) and nonnative plants. Land use practices, such as agriculture (e.g., food crop production, ranching, tree plantations) and urban development, have significantly reduced native vegetation below 2,000 ft (600 m) (TNC 2007) throughout the Hawaiian Islands. The resulting conversion of native to nonnative habitat likely reduced the availability of lowland forest habitat for native birds, including the ‘i’iwi (Pratt *et al.* 2009, pp. 146–148). The ‘i’iwi appears to be restricted to forest habitat above 2,000 ft (600 m) in elevation, and usually above 3,600 ft (1,100 m), because of habitat loss and degradation. The prevalence of mosquito-borne avian diseases at lower elevations may also be a factor in this apparent habitat constriction (see Factor C).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The petitioners did not present information suggesting overutilization may be a current threat to the ‘i’iwi, and we have no information in our files in this regard. We

will further investigate whether overutilization for commercial, recreational, scientific, or educational purposes may be a threat to the ‘i’iwi during the status review.

C. Disease or Predation

Information Provided in the Petition

Disease

The petitioners claim avian disease is a primary reason for the decline of the ‘i’iwi and other Hawaiian honeycreepers (Petition, p. 8). They state experimental evidence demonstrates the high susceptibility of the ‘i’iwi to avian malaria, with mortality significantly higher in birds exposed to malaria-infected mosquitoes than in uninfected controls (Petition, p. 8). According to Atkinson *et al.* (2001), Freed *et al.* (2005), and Valkiunas (2005), as cited in the petition (Petition, p. 9), some individual birds are capable of an immunological response to some strains of malaria (i.e., birds are infected but able to survive), but it is likely these birds retain chronic infection for life. In addition, there is likely a reduced survivorship of these birds in the wild due to a host of other factors, including challenges to the immune system by stress, excessive energy expenditure, weight loss, predation, unfavorable weather, and other diseases like avian pox (Petition, p. 9). The petition states that avian pox is also a threat to the ‘i’iwi, and its lethal effects have been experimentally demonstrated in Hawaiian honeycreepers (Petition, p. 9). The petition (Petition, p. 9) cites Atkinson *et al.* (2005), who found that a

significant proportion of Hawaiian forest birds with avian pox also had avian malaria, which suggested an interaction between the two diseases.

The petitioners claim 'i'iwi populations are on a downward trajectory, similar to the decline of federally endangered Hawaiian forest birds that are vulnerable to disease, such as the akikiki (*Oreomystis bairdi*), the akekee (*Loxops caeruleirostris*), and the Hawaii akepa (*Loxops coccineus coccineus*) (Pratt *et al.* 2009, pp. 126 and 127). The petitioners also claim the effects of climate change are expected to increase the 'i'iwi's exposure to avian disease (Petition, pp. 9–11).

The petition claims ectoparasites, such as chewing lice (order Phthiraptera), may increase 'i'iwi morbidity, reduce the ability of birds to survive environmental challenges, and affect the ability of parasitized birds to successfully overcome diseases such as avian malaria and pox (Petition, p. 11). According to the petitioners, additional disease risks to the 'i'iwi include potential introductions of the West Nile virus, new avian malaria vectors, and biting midges (Culicoides) that transmit avian diseases (Petition, p. 11).

Predation

According to the petition (Petition, p. 11), predation by introduced rats (*Rattus* spp.), which are abundant at high elevations, is a serious threat to adult Hawaiian forest birds and their nests, including the 'i'iwi. The petitioners also claim that predation by feral cats (*Felis domesticus*), the native short-eared owl or pueo (*Asio flammeus*

sandwichensis), the introduced barn owl (*Tyto alba*), and the introduced small Indian mongoose (*Herpestes auropunctatus*) may also threaten the ‘i’iwi (Petition, p. 11).

Evaluation of Information Provided in the Petition and Available in Service Files

Disease

Several studies cited in Pratt *et al.* (2009, pp. 234–252, 405–425) identified substantial threats from avian malaria and pox to Hawaii’s native forest birds, including the ‘i’iwi. Other studies indicate avian diseases transmitted by the introduced southern house mosquito (*Culex quinquefasciatus*), including avian pox and malaria, play a major role in limiting the distribution of many Hawaiian forest bird species (Benning *et al.* 2002, p. 14,246; Pratt *et al.* 2009, p. 234). Like many other native Hawaiian forest birds, ‘i’iwi are no longer observed at lower elevations, and are restricted to higher elevation montane forest habitat, where mosquitoes and the diseases they carry are less prevalent (Scott *et al.* 1986, pp. 367–368; Pratt *et al.* 2009, pp. 237–238).

Native Hawaiian forest birds are more susceptible to malaria than are nonnative bird species (van Riper *et al.* 1986, pp. 327–328; Pratt *et al.* 2009, p. 238). They evolved in the absence of mosquito-borne avian diseases, and became exposed to avian pox and malaria when mosquitoes were accidentally introduced to the islands in 1827 with imported cage birds and domestic fowl (Yorinks and Atkinson 2000, p. 731; Pratt *et al.* 2009, pp. 235–236, 406). Avian malaria appears to be highly pathogenic for the

Hawaiian honeycreepers, including the 'i'iwi (Yorinks and Atkinson 2000, p. 737; Pratt *et al.* 2009, pp. 238–240). Atkinson *et al.* (1995, p. 1) described extraordinarily high mortality of birds infected with malaria in a pathogenicity study of avian malaria in experimentally infected 'i'iwi. Another study demonstrated that the native forest bird apapane (*Himatione sanguinea*), when experimentally infected with malaria, demonstrated altered behaviors that increase their vulnerability to predation (Yorinks and Atkinson 2000, pp. 731–738). Infected birds devoted less time to locomotory activities involving flight, walking, or hopping, as well as stationary activities such as singing, preening, feeding, and probing. This susceptibility to avian malaria, in combination with observations that other Hawaiian honeycreepers have become restricted to high-elevation forests, led Atkinson *et al.* (1995, p. 1) and Pratt *et al.* (2009, p. 251) to predict that a shift in the current mosquito distribution to higher elevations could be disastrous for species with already reduced populations. In addition, climate change may exacerbate this threat by increasing the elevation at which regular transmission of avian malaria occurs (Benning *et al.* 2002, pp. 14,246–14,247). See Factor D for a more complete discussion of the potential relationship between avian malaria and climate change.

The limited information about the potential effects of avian pox virus on Hawaiian forest birds is based on observations of pox-like lesions on captured wild birds (Pratt *et al.* 2009, p. 242). VanderWerf (2001, cited in Pratt *et al.* 2009, p. 242) found a correlation between pox epizootics and decreases in the size of breeding cohorts in the Hawaii elepaio (*Chasiempis sandwichensis*), a native forest bird. Little is known about the interaction of avian pox and avian malaria. Some studies indicate infections of pox

and malaria are independent of each other, although other studies found concurrent malaria infections were more frequent than expected in birds with pox like lesions (Pratt *et al.* 2009, p. 244). Accordingly, more research is needed to fully understand the possible effects of pox virus on the 'i'iwi.

Although the petition asserts the potential introduction of the West Nile virus to Hawaii may have severe impacts on Hawaii's native birds, this virus has not been recorded in Hawaii, and there is no experimental or other data available with which to assess the susceptibility of the 'i'iwi to this potential disease. The petitioners did not provide any information or studies substantiating the claim that biting midges or other avian malaria vectors may be a threat to the 'i'iwi, and we have no information in our files in this regard. There is some evidence that chewing lice (Phthiraptera) increase food requirements of host bird species, which reduces their individual immune defenses against disease. However, there is no indication chewing lice represent a threat to the 'i'iwi, which have shortened upper bills that may be effective in removing lice (Freed *et al.* 2008, pp. 1,017, 1,019).

Predation

At least three rat species have been introduced to the Hawaiian Islands. The Polynesian rat (*Rattus exulans*) and the black rat (*Rattus rattus*) occur primarily in dry to wet habitats, while the Norway rat (*Rattus norvegicus*) is typically observed in manmade habitats, such as urban areas or agricultural fields (Tomich 1986, p. 41). The Polynesian

rat is an agile climber but is seldom observed in trees, which may be due to competitive exclusion by the larger black rat (Pratt *et al.* 2009, p. 276). The black rat is considered to be the most significant avian predator among the three rat species (Pratt *et al.* 2009, p. 275). It is known to prey on incubating forest birds, their eggs, and nestlings in mesic and wet forest habitats (Snetsinger *et al.* 2005, p. 83; Tweed *et al.* 2006, p. 753). The Norway rat is not believed to be a threat to forest birds because of its limited distribution in forest habitats (Pratt *et al.* 2009, p. 277).

Forest bird predation by feral cats has been documented since the late 1800s (Pratt *et al.* 2009, p. 277). Feral cats are believed to prey on roosting or incubating native forest bird adults, on eggs, and on young (Scott *et al.* 1986, pp. 363–364; VanderWerf and Smith 2002, p. 73). Although most common at lower elevations, they have been observed in high-elevation rain forests on Kauai, Maui, and Hawaii (Scott *et al.* 1986, p. 363; Tweed *et al.* 2006, p. 753). In montane wet forests on Hawaii Island, native forest birds are a regular component in the diet of feral cats (Smucker *et al.* 2000, p. 233). An examination of the stomach contents of 118 feral cats at Hakalau forest determined that native and introduced birds were the most common prey item (Banko *et al.* 2004, p. 16.2).

Although the petition describes potential adverse impacts of the small Indian mongoose on native forest birds, they are weak climbers and there is no indication they represent a threat to canopy-dwelling birds (Pratt *et al.* 2009, p. 278), such as the ‘i’iwi.

Two species of owls, the native pueo and the introduced barn owl, are known to prey on forest birds. Between 1996 and 1998, 10 percent of nest failures of a rare forest bird on Kauai, the puaiohi (*Mayadestes palmeri*), were attributed to owls (Snetsinger *et al.* 1994, p. 47; Snetsinger *et al.* 2005, pp. 72, 79). The ‘i’iwi occurs in the same habitat as the puaiohi, and may be exposed to similar threats.

Summary of Factor C

In summary, we find that the information provided in the petition, as well as other information in our files, presents substantial scientific or commercial information to indicate that the petitioned action may be warranted because of disease threats such as avian malaria and avian pox, and predation by nonnative rats, cats, and potentially by native and nonnative owls. We did not find substantial scientific or commercial information in the petition or in our files that would indicate the West Nile virus, chewing lice infestation, or predation by the small Indian mongoose represent potential threats to the ‘i’iwi.

D. The Inadequacy of Existing Regulatory Mechanisms

Information Provided in the Petition

Climate Change

The petitioners claim existing U.S. and international regulatory mechanisms, including the United Nations Framework Convention on Climate Change and the Kyoto Protocol, are inadequate to safeguard the ‘i’iwi against the effects of climate change, and inadequate to conserve high-elevation forests needed to serve as refugia for native forest birds, including the ‘i’iwi, from the climate-induced advance of mosquito-transmitted avian diseases (Petition, pp. 12–13). The petitioners also claim existing laws such as the Clean Air Act (42 U.S.C. 7401 *et seq.*), Energy Policy and Conservation Act (42 U.S.C. 6201 *et seq.*), Clean Water Act (33 U.S.C. 1251 *et seq.*), and the Endangered Species Act (16 U.S.C. 1531 *et seq.*) provide authority to executive branch agencies to require virtually all major U.S. sources to reduce greenhouse gas emissions, but U.S. agencies fail to implement or only partially implement those laws (Petition, p. 12).

Habitat Conservation

The petition claims most of the lands identified for forest bird recovery are not being managed for conservation, and most management actions identified in forest bird recovery plans to restore and conserve habitat have either not been implemented or are inadequately implemented (Petition, p. 13). According to the petitioners (Petition, p. 13), conflicting management goals and policies involving State forest lands, the lack of funding, conflicts between management of game animals and conservation of rare native species, and agency decisions regarding land uses contribute to the inadequate protection of native forest birds. They also stated the ‘i’iwi, like all other Hawaiian honeycreepers,

is not included on the list of species protected under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 *et seq.*), and thus receives no protection under Federal law.

Evaluation of Information Provided in the Petition and Available in Service Files

Climate Change

Environmental conditions that may result from climate change and their potential impacts on the ‘i’iwi are unpredictable at this time (see Factor E, below). Although there are some existing regulatory mechanisms to address anthropogenic causes of climate change, there are no known regulatory mechanisms in place at the national or international level that directly and effectively reduce or reverse this overall trend.

Habitat Conservation

There are no existing regulatory mechanisms that were written to specifically conserve or protect high-elevation forest habitat needed by the ‘i’iwi, or mitigate habitat-related threats described under Factors A, C, and E. Some State regulations might have an indirect impact on protecting this habitat. For example, although nonnative ungulates destroy and degrade ‘i’iwi habitat, the State of Hawaii supports and manages game mammal hunting (H.A.R. 13-123; DLNR 2009, pp. 20–21) in areas inhabited by this species. Many public hunting areas are not fenced, which allows game mammals unrestricted access to most areas across the landscape. While fences have been installed

to protect certain areas from game mammals, these efforts have not been adequate to prevent native forest bird habitat degradation and destruction on a larger scale. The Hawaii Department of Agriculture (HDOA) regulates the import of plants into the State from domestic origins under Hawaii Revised Statute 150A, and while all plants require inspection upon entry into the State and must be “apparently free” of insects and diseases, not all plants require import permits. Nonnative plants have been shown to outcompete native plants and convert native-dominated plant communities to nonnative plant communities, throughout the ‘i’iwi’s range. Accordingly, developing management strategies or other measures to mitigate the impacts of nonnative plants to ‘i’iwi habitat may be an important habitat conservation need.

Nonnative Species

The capacity of Federal and State agencies and their nongovernmental partners to mitigate the effects of introduced pests in Hawaii is limited because of the large number of taxa causing damage (Coordinating Group on Alien Pest Species (CGAPS) 2009, pp. 1–14). The CGAPS partnership was formed in 1995, and is comprised primarily of managers from major Federal, State, county, and private agencies and organizations that work with invasive species in Hawaii. The CGAPS goal was to influence policy and funding decisions, improve communication, increase collaboration, and promote public awareness of invasive species (CGAPS 2009). The CGAPS facilitated the formation of the Hawaii Invasive Species Council (HISC), which was created by gubernatorial executive order in 2002. The HISC is responsible for coordinating local initiatives for

the prevention and control of invasive species, by providing policy level direction and planning for the State departments responsible for invasive species issues. In 2003, the Governor signed Act 85 into law, conveying statutory authority to the HISC to continue to coordinate approaches among the various State and Federal agencies, and international and local initiatives for the prevention and control of invasive species (DLNR 2003, p. 3–15; HISC 2009; H.R.S. Chapters 194–2(a)).

Many established invasive plants have currently limited but expanding ranges. Resources available to reduce their spread are limited, and largely focused on those that cause significant economic or environmental damage to public and private lands. The State noxious weed list (H.A.R. Chapter 4-68) and U.S. Department of Agriculture-Animal Plant Health Inspection Service-Plant Protection Quarantine (USDA-APHIS-PPQ) Restricted Plants List prohibit the importation of a limited number of noxious weeds. The State allows the importation of plant taxa shipped from domestic ports (HLRB 2002; USDA-APHIS-PPQ), and USDA-APHIS-PPQ risk assessments for plant pests are based on species considered threats to the continental United States. These assessments may not address the many species that could be pests in Hawaii (HLRB 2002; USDA-APHIS-PPQ; CGAPS 2009, pp. 1–14). In addition, unless specifically prohibited or restricted, Federal regulations allow plants to be imported to Hawaii from international ports.

State of Hawaii law prohibits the importation of animals unless specifically authorized (Hawaii Legislative Reference Bureau (HLRB) 2002). Generally, the HDOA

has sole responsibility to regulate species entering Hawaii from other parts of the United States. Its authority extends only to interstate movement, that is, materials coming from the continental United States, and it relies on referrals from U.S. Customs, USDA-APHIS-PPQ, and the Service's Office of Law Enforcement to intercept foreign and trust territory items imported into the United States that are prohibited by the State of Hawaii. The Hawaii Board of Agriculture is responsible for enforcing the list of species prohibited by statute and determining which plant and animal species are prohibited or permitted into the State. The board maintains three lists for animals: conditionally approved (permit required for importation), restricted (permit required for both importation and possession), and prohibited. If an animal is not included on either of the first two lists, importation into the State is prohibited.

The importation or transportation of invasive vertebrate species is regulated under the injurious wildlife provisions of the Lacey Act (18 U.S.C. 42; 16 U.S.C. 3371 *et seq.*) by the U.S. Fish and Wildlife Service (Fowler *et al.* 2007, pp. 353–359). Fowler *et al.* 2007 (p. 353) evaluated the efficacy of the Lacey Act at disrupting the injurious wildlife invasion processes, and concluded that, while the Lacey Act may have been somewhat effective at preventing transport into the country of the few taxa listed prior to their introduction, over half of the listed taxa were already present when listed, and most taxa that were already established in the wild continued to spread after listing. The authors suggest that if the goals of the Lacey Act are to be achieved in the face of increasing international trade in live organisms, revision or replacement of the provision would be necessary (Fowler *et al.* 2007, p. 353).

The introduction of most nonnative invertebrate pests to the State of Hawaii likely has been and continues to be accidental or incidental to other activities. Although Hawaii State government and Federal agencies have regulations and some controls in effect, as identified above, the introduction and movement of nonnative invertebrate pest species between islands and from one watershed to the next continues. For example, an average of 20 new alien invertebrate species have been introduced to Hawaii per year since 1970, an increase of 25 percent over the previous totals between 1930 to 1970 (TNC 1992, p. 8).

The lack of adequate staffing, facilities, and equipment for Federal and State pest inspectors and identifiers in Hawaii devoted to invasive species interdiction has been identified as a critical biosecurity gap (USDA-APHIS-PPQ 2007; HLRB 2002; CGAPS 2009). State laws have recently been passed that allow the HDOA to collect fees for quarantine inspection of freight entering Hawaii (e.g., Act 36 (2011) H.R.S. 150A – 5.3), and legislation was signed into law in 2011 (H.B. 1568) requiring commercial harbors and airports in Hawaii to provide biosecurity and inspection facilities to facilitate the movement of cargo through the ports.

Nonnative species may prey upon, modify, or destroy habitat, or directly compete with the ‘i’iwi for food, space, and other necessary resources. On the basis of the above information, existing regulatory mechanisms do not appear to adequately protect the

‘i’iwi’s habitat from the threat of new introductions of nonnative species, or the expansion of nonnative species on and between islands and watersheds.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703–712) is the domestic law that implements the United States’ commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of shared migratory bird resources, and each of the conventions protects selected species of birds. Under the MBTA, it is illegal to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg, unless authorized under a permit issued by the Secretary of the Interior. The petitioners claim the ‘i’iwi is not a protected species under the MBTA. However, contrary to the petitioner’s claim, the ‘i’iwi is protected under the MBTA (75 FR 9282; March 1, 2010). As the petitioners did not present information suggesting that overcollection is a threat to the ‘i’iwi, and we have no information in our files in this regard (see Factor B), we did not find substantial scientific or commercial information that the MBTA is an inadequate regulatory mechanism.

Summary of Factor D

The petition and suggests that international and national-level regulatory mechanisms may not be adequate to address the environmental effects of climate change to the ‘i’iwi, which will be further evaluated during our 12-month status review. The

capacity of Federal and State agencies and their nongovernmental partners in Hawaii to mitigate the effects of introduced pests, such as ungulates and weeds, appears to be limited by resources and the large number of taxa currently causing damage (CGAPS 2009, pp. 1–14). Because the control of established pests is largely focused on a few invasive species that cause significant economic or environmental damage to public or private lands, the impacts of those and other established pests (e.g., nonnative ungulates, weeds, and invertebrates) are expected to continue. Environmental changes that may affect the ‘i’iwi could include habitat loss or alteration, changes in disturbance regimes (e.g. storms and hurricanes), and the movement of mosquitoes and bird diseases to higher elevations (see Factor C). In addition, the State’s current management of nonnative game mammals may be inadequate to prevent the degradation and destruction of native forest bird habitat used by the ‘i’iwi (see Factor A). Existing State and Federal regulatory mechanisms do not appear to be effectively preventing the introduction and spread of nonnative plant and animal species from outside and between islands and watersheds within the State of Hawaii. There is, however, no substantial scientific or commercial information in the petition or in our files indicating that the ‘i’iwi may be threatened by overutilization, or that the MBTA is inadequate to protect this species from that potential threat.

E. Other Natural or Manmade Factors Affecting the Species’ Continued Existence

Information Provided in the Petition

Climate Change and Avian Diseases

The petitioners state that climate change will facilitate the spread of avian diseases and severely curtail the 'i'iwi's range (Petition, p. 7). Please refer to Factor C above, which identifies the specific concerns raised by the petitioners and discusses the potential interrelationship between climate change and avian disease.

Hurricanes

The petitioners state that hurricanes have devastating effects on island birds (Foster *et al.* 2004, cited in the Petition, p. 14), and can reduce habitat by blowing down trees and creating forest openings that facilitate the spread of nonnative plants. According to the petitioners, the 'i'iwi decline on Kauai may have been associated with Hurricane Iniki in 1992, and attributed to birds having to find alternative nectar resources at lower elevations after the storm, where the risk of malaria transmission is higher (Petition, p. 14). The petitioners claim hurricane intensity is likely to increase with increasing global temperatures, although their frequency may decrease (Petition, p. 14). They allege strong winds can carry disease-transmitting mosquitoes to higher elevations, potentially resulting in avian disease outbreaks. They identified the avian malaria outbreak above 6,200 ft (1,900 m) elevation on the island of Hawaii as evidence of this potential disease pathway (Petition, p. 14, citing Freed *et al.*, 2005).

Volcanism

According to the petition, volcanic eruption and inundation of habitat by lava is a potential threat to the 'i'iwi and other native forest birds on the island of Hawaii (Petition, p. 14). They identified the inundation of prime habitat for the native honeycreeper ou (*Psittirostra psittacea*) in the Upper Waiakea Forest Reserve in 1984, which destroyed thousands of acres of forest and created a treeless corridor over 0.6 mi (1 km) wide, as evidence of this potential threat.

Competition

The petition states nonnative birds and insects may compete with native Hawaiian forest birds for food and other resources, including the malaria-resistant nonnative Japanese white-eye (*Zosterops japonicus*). They cite a study by Fancy and Ralph (1998) that found negative correlations between Japanese white-eye and 'i'iwi densities as supporting evidence (Petition, pp. 14–15).

Population Fragmentation and Isolation

The petitioners state that 'i'iwi populations are fragmented and reduced in size and range (Petition, p. 15). According to Primack (2006, cited in Petition, p. 15), there is an extinction risk from random demographic fluctuations, localized catastrophes (e.g., severe storms, wildfire, disease, volcanism, etc.), inbreeding depression, and genetic drift for small population units.

Evaluation of Information Provided in the Petition and Available in Service Files

Climate Change and Avian Diseases

We find that the information provided in the petition, as well as other information in our files, presents substantial scientific or commercial information to indicate that climate change and avian diseases may present a threat to the 'i'iwi.

The average worldwide ambient air temperature (at sea level) is projected to increase by about 4.1 degrees Fahrenheit (°F) (2.3 degrees Centigrade (°C)), with a range of 2.7–6.7 °F (1.5–3.7 °C) by 2100 (Intergovernmental Panel on Climate Change (IPCC) 2007). According to citations in Pratt *et al.* (2009, p. 564), overall temperature increases in the tropics are predicted to increase about 3.6–5.4 °F (2–3 °C), and mean temperature increases are already occurring in the Hawaiian Islands. Overall, the daily temperature range in Hawaii is decreasing, resulting in a warmer environment, especially at higher elevations and at night (Pratt *et al.* 2009, p. 564). In the main Hawaiian Islands, predicted changes associated with increases in temperature include shifts in vegetation zones to higher elevations, shifts in animal species' ranges, changes in mean precipitation with unpredictable effects on local environments, increased occurrence of drought cycles, and increases in the intensity and number of hurricanes (Loope and Giambelluca 1998, pp. 514–515; U.S. Global Change Research Program (US-GCRP) 2009).

The synergistic implications of climate change and habitat fragmentation are the most threatening facet of climate change for biodiversity, according to Hannah *et al.* (2005, p. 4). The magnitude and intensity of the impacts of global climate change and increasing temperatures on native Hawaiian ecosystems are uncertain, and there are no climate change studies that specifically address impacts to the ‘i’iwi. Changes to weather patterns such as droughts and floods will likely occur because of increased annual average temperatures related to more frequent El Niño episodes in Hawaii (Giambelluca *et al.* 1991, p. v). However, there is high uncertainty in predicting changes to future weather patterns, because they partly depend on how the El Niño-La Niña weather cycle (a disruption of the ocean atmospheric system in the tropical Pacific having important global consequences for weather and climate) might change (DBEDT 1998, pp. 2–10). Environmental changes that may affect the ‘i’iwi could include habitat loss or alteration, changes in disturbance regimes (e.g., storms and hurricanes), and the establishment of mosquitoes and bird diseases at higher elevations (Pratt *et al.* 2009, p. 564). Despite considerable progress in understanding the impacts of climate change on many of the processes that contribute to El Niño variability, it is not possible to predict whether weather patterns will be enhanced or damped, or if the frequency of events will change (Collins *et al.* 2010, p. 391).

Environmental changes triggered by global warming that may affect the ‘i’iwi could include habitat loss or alteration, changes in disturbance regimes (e.g., storms and hurricanes), and the movement of mosquitoes and bird diseases to higher elevations (Pratt *et al.* 2009, p. 564). If this occurs, ‘i’iwi populations in mid- and high-elevation forests

could potentially decline, similar to observations made in lower elevation forests (Pratt *et al.* 2009, pp. 123, 238). We will more fully evaluate this potential threat in our status review.

Hurricanes

Climate modeling has projected changes in tropical cyclone frequency and intensity due to global warming over the next 100 to 200 years (Vecchi and Soden 2007, pp. 1,068–1,069; Emanuel *et al.* 2008, p. 360, Figure 8; Yu *et al.* 2010, p. 1,371). The frequency of hurricanes generated by tropical cyclones is projected to decrease in the central Pacific (i.e., the Northwestern and main Hawaiian Islands, including those that provide ‘i’iwi habitat), although storm intensity (strength) is projected to increase (Vecchi and Soden 2007, pp. 1,068–1,069; Emanuel *et al.* 2008, p. 360, Figure 8; Yu *et al.* 2010, p. 1,371). Although climate models include projections for the frequency and intensity of Pacific tropical cyclones, there are no projections for changes in their duration (which currently runs from May through November). In general, hurricanes have been a rare occurrence in the Hawaiian Islands. From the 1800s until 1949, hurricanes were only rarely reported from ships in the area. Between 1950 and 1997, 22 hurricanes passed near or over the Hawaiian Islands, 5 of which caused serious damage (Businger 1998, in litt., pp. 1–2). Hurricanes can destroy native vegetation and open the native canopy, allowing an invasion of nonnative plant species (Kitayama and Mueller-Dombois 1995, p. 671). Following Hurricane Iniki in 1992, the ‘i’iwi population declined significantly on Kauai, which may have been due to several factors, including

direct mortality, long-term impacts on food resources, and the need to seek food resources in areas where birds may have been exposed to disease-transmitting mosquitoes (Conant *et al.* 1998 cited in Foster *et al.* 2004, p. 724). Similar effects to ‘i’iwi populations could occur on other Hawaiian Islands, if they are exposed to hurricanes of comparable magnitude and intensity.

Volcanism

The petition claims that substantial ‘i’iwi habitat loss could occur as a result of volcanic eruptions on Hawaii Island, comparable to the Upper Waiakea forest habitat destroyed by lava flows in 1984. Although the largest population of the ‘i’iwi occurs on Hawaii, which is the youngest and only volcanically active island in the Hawaiian chain, there is no information demonstrating volcanic activity may represent a threat to this species or to its habitat. However, we will further investigate the petitioners’ concern during our status review for this species.

Competition

There was little information presented in the petition, and we have no information in our files, regarding competition between the ‘i’iwi and nonnative birds for habitat and food resources. In addition, the diets of nonnative birds in Hawaii are poorly described, and comparison studies of the diets of native and nonnative birds have not been published (Pratt *et al.* 2009, p. 325). Although some studies suggest that the Japanese white-eye

may compete with the 'i'iwi and other native forest birds, additional research is needed to confirm whether this is occurring (Mountainspring and Scott 1985; Ralph and Noon 1988; Freed *et al.* 2008 cited in Pratt *et al.* 2009, p. 325).

Population Fragmentation and Isolation

On Oahu, the most recent comprehensive 'i'iwi surveys were conducted from 1994 to 1996, during which only eight birds were recorded in three isolated populations (Pratt *et al.* 2009, p. 123). On west Maui, a 1980 survey estimated the population to number fewer than 200 birds, and subsequent surveys found lower numbers (Pratt *et al.* 2009, p. 123). The west Maui population is separated from the east Maui population (estimated at approximately 19,000 birds in 1980) by over 30 km (17 mi). More recent surveys indicate the east Maui population may now be higher (Pratt *et al.* 2009, p. 123). On Molokai, a 2004 survey recorded only three birds (Pratt *et al.* 2009, p. 123).

Small, isolated populations often exhibit reduced levels of genetic variability, diminishing the species' capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (Barrett and Kohn 1991, p. 4; Newman and Pilson 1997, p. 361). These populations are also more susceptible to reduced reproductive vigor due to inbreeding depression and genetic drift. Challenges associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes can also be further magnified by synergistic interactions with other threats, such as those discussed above (see Factors A and C).

Summary of Factor E

In summary, we find that the information provided in the petition, as well as other information in our files, presents substantial scientific or commercial information to indicate that the ‘i’iwi may be threatened by environmental changes triggered by global warming, changes in disturbance regimes (e.g., storms and hurricanes), and the movement of mosquitoes and bird diseases to higher elevations. Certain ‘i’iwi populations may also be threatened because of their small size and isolation from other populations, making them susceptible to inbreeding depression, genetic drift, and random demographic fluctuations, or natural catastrophes. We did not find substantial scientific or commercial information in the petition or in our files to indicate that volcanism may be a threat to the continued existence of the ‘i’iwi. Although there is no substantial scientific or commercial information indicating that competition with nonnative birds represents a threat to the ‘i’iwi, we will further investigate this claim during our status review.

Finding

On the basis of our review under section 4(b)(3)(A) of the Act, we determine that the petition presents substantial scientific or commercial information indicating that listing the ‘i’iwi throughout its entire range may be warranted. The petition presents substantial information indicating the ‘i’iwi may be threatened by the destruction,

modification, or curtailment of habitat from nonnative animals (feral pigs, goats, mouflon, deer, and cattle; rats; and insects) and nonnative plants (Factor A); disease (avian malaria and pox) and predation by nonnative animals (rats, cats, and possibly barn owls), and possibly the native pueo (Factor C); inadequate regulatory mechanisms to prevent degradation and destruction of native forest bird habitat by nonnative game mammals, and the introduction and spread of nonnative plant and animal species (Factor D); and environmental changes triggered by climate change (storm and hurricane intensity, upslope movement of disease-transmitting mosquitoes), and the species' occurrence in small and isolated populations (Factor E). The petition does not present substantial information that the 'i'iwi may be threatened by overutilization for commercial, recreational, scientific, or educational purposes (Factor B). Because we have found that the petition presents substantial information indicating that listing the 'i'iwi may be warranted, we are initiating a status review to determine whether listing this species under the Act is warranted.

The "substantial information" standard for a 90-day finding differs from the Act's "best scientific and commercial data" standard that applies to a status review to determine whether a petitioned action is warranted. A 90-day finding does not constitute a status review under the Act. In a 12-month finding, we will determine whether a petitioned action is warranted after we have completed a thorough status review of the species, which is conducted following a substantial 90-day finding. Because the Act's standards for 90-day and 12-month findings are different, as described above, a substantial 90-day finding does not necessarily mean that the 12-month finding will result in a warranted

finding.

References Cited

A complete list of all references cited is available on the Internet at <http://www.regulations.gov> and upon request from the Pacific Islands Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this notice are the staff members of the Pacific Islands Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**).

Authority

The authority for this action is the Endangered Species Act of 1973, as amended
(16 U.S.C. 1531 *et seq.*).

Date: January 6, 2012

Rowan W. Gould

Acting Director, U.S. Fish and Wildlife Service.

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