

5-YEAR REVIEW

Short Form Summary

Species Reviewed: Palila (*Loxioides bailleui*)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2013. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 44 species in Oregon, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 78(24):8185-8187.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaii

Name of Reviewer(s):

Rachel Rounds, Fish and Wildlife Biologist, PIFWO

Michelle Bogardus, Maui Nui and Hawaii Island Team Manager, PIFWO

Marie Brueggemann, Plant Recovery Coordinator, PIFWO

Kristi Young, Programmatic Deputy Field Supervisor, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on March 6, 2013. The review was based on a review of current, available information since the last 5-year review for the palila (USFWS 2009) as well as information from the Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006) and updates obtained from researchers currently working on this species. The evaluation by Rachel Rounds, Fish and Wildlife Biologist, was reviewed by the Island Team Manager, followed by the Plant Recovery Coordinator. It was subsequently reviewed and approved by the Programmatic Deputy Field Supervisor.

Background:

For information regarding the species listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (http://ecos.fws.gov/tess_public).

Review Analysis:

Please refer to the Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006) and the previous 5-year review for the palila, published on July 31, 2009 (available at http://ecos.fws.gov/docs/five_year_review/doc2542.pdf) for a complete review of the species' status, threats, and management efforts. No new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of the palila as endangered.

The palila currently occurs only on Hawaii Island, in one population in subalpine, dry forest habitat on the southwestern slope of Mauna Kea (Banko and Farmer 2014). The palila population has been surveyed annually from 1998 to 2015 to determine abundance,

population trend, and spatial distribution. The most recent population estimation for 2014 was 1,697 to 2,508 (point estimate: 2,070) individuals (Camp *et al.* 2014). No palila were detected outside the western slope of Mauna Kea in 2013 or 2014 (Camp *et al.* 2014), and the range of the species appears to have remained stable since 2003. However, the palila population has declined steadily since a peak in 2003, and over the 16-year monitoring period, the population is estimated to have declined by 68 percent (Camp *et al.* 2014).

The current status for the palila, as known, is provided in Table 1 below. Threats to the species continue, including predation from introduced mammals, habitat degradation from ungulate browsing, habitat modification from alien weeds, avian disease, fire, and drought.

New status information:

- Counts of palila have declined steadily since a peak in 2003 (Camp *et al.* 2014), with a 2014 estimate of 1,697 to 2,508 individuals. The 2015 official population estimate has not been calculated to date, but the preliminary estimate of raw palila detections was roughly 50 percent below the 2014 number of detections (C. Farmer, American Bird Conservancy, pers. comm. 2015).
- As of September 30, 2014, there were 35 palila in captivity at the Maui Bird Conservation Center and the Keauhou Bird Conservation Center (Hawaii Endangered Bird Conservation Program [HEBCP] 2014).

New threats:

- The Mauna Kea Forest Restoration Project (MKFRP) conducts predator control on the west slope of Mauna Kea. In the spring of 2015, the MKFRP updated their predator trapping methods and have since caught a record number of cats (MKFRP 2015). From June 1, 2015, to August 17, 2015, the improved trapping system caught 25 cats, 16 mongoose, and 2 rats; in addition Division of Forestry and Wildlife (DOFAW) staff caught 18 cats and 18 mongoose at game bird water units (MKFRP 2015). Previous trapping efforts typically caught zero to five cats per quarter. It is not clear yet whether there is a new influx of cats to the south slope of Mauna Kea or if cat numbers have been higher than previously thought.
- Drought conditions on Mauna Kea occurred during 74 percent of the months from 2000 to 2010, with drought recorded in all but two months from 2006 to 2010 (Banko *et al.* 2013).
- *Myoporum sandwicense* (naio) is an important tree species in Mauna Kea dry forests, and is especially prevalent in lower elevations of palila core habitat. Naio thrips, *Klambothrips myopori*, is a recently established insect pest which infests *M. sandwicense* in Hawaii, and was first found on Hawaii Island in December, 2008. High infestation by the thrips causes branch die-back, and can eventually result in tree death. Damage from naio thrips has been observed on Mauna Kea, and has the potential to substantially reduce the number of *M. sandwicense* in palila critical habitat and leave large stands of dead trees that are prone to fire.
- Climate change degradation of habitat – Hawaiian honeycreepers are known to be highly susceptible to introduced avian disease, particularly avian malaria

(*Plasmodium relictum*) (Atkinson *et al.* 1995; Atkinson *et al.* 2000; Yorinks and Atkinson 2000; Banko and Banko 2009). According to some climate change projections, temperature increases could present an additional threat specific to Hawaiian forest birds by causing an increase in the elevation below which regular transmission of avian malaria occurs, potentially reducing the remaining suitable habitat for these species. In Hawaii, the threshold temperature for transmission of avian malaria has been estimated to be 13 degrees Celsius (55 degrees Fahrenheit), whereas peak *P. relictum* prevalence in wild mosquitoes occurs in mid-elevation forest where the mean ambient summer temperature is 17 degrees Celsius (64 degrees Fahrenheit) (Benning *et al.* 2002). Lia *et al.* (2015) assessed how global climate change will affect future malaria risk for native Hawaiian bird populations and expect high elevation areas to remain mosquito free only to mid-century due to combined factors of increased rainfall and increasing temperatures. If climate change were to reduce the remaining suitable habitat for palila, it would likely contribute to the extinction of this species over time.

New and on-going management actions:

- MKFRP – The MKFRP conducts weed control, forest restoration, forest monitoring, fence monitoring and maintenance, community outreach, volunteer trips, and ungulate control at Kaohe and Puu Mali Restoration Areas and in palila core habitat. From 2010 to 2013, 70,000 seedlings and 4,688 trees were planted (with assistance from volunteers and other partners).
- Predator control – The MKFRP and DOFAW conduct predator trapping on the southwestern slopes of Mauna Kea within palila core habitat.
- Ungulate control – Beginning in April, 2013, DOFAW ramped up removal efforts of ungulates in palila critical habitat. To date, approximately 3,200 goats and sheep have been removed from critical habitat (J. Vetter, DOFAW, pers. comm. 2015). Removal efforts continue, with an average of 40-50 animals removed per month in 2014-2015 (J. Vetter, pers. comm., 2015).
- Fencing – To date, there are 100 kilometers (62.5 miles) of fencing around palila critical habitat and around the Kaohe and Puu Mali restoration areas. Twenty-four kilometers (15 miles) of fencing still needs to be completed on the north slope of Mauna Kea.
- Two helicopter water dip tanks were installed in 2015 on the west slope of Mauna Kea, within occupied palila habitat, to improve fire response capacity.
- Surveys – Annual palila surveys are conducted in January or February each year to monitor the range and abundance of palila.
- The current goals of the HEBCP are to increase the captive palila population to a sufficient size and level of productivity to provide cohorts of young birds for release, to resume releases of captive-reared birds onto Mauna Kea or other suitable sites, and to maintain a second flock of palila at the Maui facility (HEBCP 2014).

Synthesis:

Downlisting and delisting objectives are provided in the Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006). The palila may be downlisted from endangered to threatened when all of the following four criteria have been met, (1) palila occur in two or more viable populations, and viable populations exist on the southwestern slope of Mauna Kea, either the northern, eastern or the southern slope of Mauna Kea, and at least one other location on Hualalai or Mauna Loa, over a 15-year period; (2) either (a) quantitative surveys show that the number of individuals in each isolated population or in the metapopulation has been stable or increasing for 15 consecutive years, or (b) demographic monitoring shows that each population or the metapopulation exhibits an average growth rate (λ or lambda) not less than 1.0 over a period of at least 15 consecutive years; and total population size is not expected to decline by more than 20 percent within the next 15 consecutive years for any reason; (3) sufficient recovery area is protected and managed to achieve criteria 1 and 2 above; and (4) the threats that were responsible for the decline of the species have been identified and controlled. The palila may be delisted when all four of the criteria above have been met for a 30-year period.

The downlisting goals for this species have not been met (Table 1), as there is only one declining population on the southwestern slope of Mauna Kea, the population continues to decline, palila habitat is not adequately managed, and while threats to the palila have been identified, they are not adequately controlled (Table 2). Therefore, the palila meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Population surveys and monitoring – Continued monitoring of palila is important to determine species response to management actions and effects of climate change.
- Habitat protection and restoration – Increase frequency and improve efficacy of aerial hunting to remove all mouflon sheep from palila critical habitat. Continue funding for the MKFRP for forest restoration, fence maintenance, and all other aspects of the MKFRP program. When ungulates are removed from critical habitat, increased habitat management should occur in palila core habitat, including grass control and forest restoration. Continue enhancement of habitat outside the currently occupied range of palila, including Puu Mali and Lupea. Complete the last kilometers (15 miles) of the palila critical habitat fence.
- Research – Threats - invasive plant control research / Habitat and natural process management and restoration – Investigate methods to reduce or control invasive grass cover on Mauna Kea. Examine experimental approaches to restore *Sophora chrysophylla* (mamane) in heavily degraded areas and improve mamane tree vigour and density by applying fertilizers, giving water, and/or removing competing weeds in the less affected mamane forest habitats.
- Threats – disease control research – Of particular concern to the continued survival of many Hawaiian forest birds (particularly Hawaiian honeycreepers) is avian disease. Existing tools and approaches have proved largely ineffective in addressing this problem given mosquito dispersal distance and the abundance of mosquito breeding sites in most wet native forest habitats (LaPointe *et al.* 2009). Opportunities are emerging however based on new genetic tools as part of the fields of synthetic

biology and genomic technology that have the potential to assist Hawaiian forest birds in developing genetic resistance to avian disease (LaPointe *et al.* 2009). In addition, recent progress has been made with the development of genetically modified mosquitoes for disease control. Several of these techniques have achieved proof-of-principle in laboratory studies, while other transgenic insect techniques, including self-sustaining technologies to achieve long-term transmission control are anticipated to advance to field testing in the near future. We encourage continued research in the fields of genomic technologies and genetically modified mosquitoes for disease control and their field application as a conservation strategy for Hawaiian forest birds.

- Predator monitoring and control – Continue and expand predator control (particularly for cats) in all areas where palila breed.
- Captive propagation for reintroduction and genetic storage / Reintroduction / translocation – Continue and enhance the captive propagation and release program for palila.
- Fire monitoring and control – Implement fire risk reduction measures by establishing green fuel breaks and improving existing roadway fire breaks; improve fire detection and response by stationing fire response resources (such as water trucks and fire spotters) on the west slope of Mauna Kea in key habitat; and conduct other improvements where necessary to allow a rapid and effective ground and aerial response to fire.
- Weed monitoring and control – Continued funding for the MKFRP for weed control, including *Delairea odorata* (cape ivy), *Ulex europaeus* (gorse), and *Cenchrus setaceum* (fountain grass) and any newly identified invasive plants.

Table 1. Status and trends of palila from listing through current 5-year review.

Date	No. wild individuals	Downlisting Criteria identified in Recovery Plan	Downlisting Criteria Completed?
1967 (listing)	Unknown	No recovery plan developed yet.	N/A
1977 (critical habitat designation)	Unknown	No recovery plan developed yet.	N/A
1978 (recovery plan, USFWS 1978)	1,400 individuals	1. Protect existing habitat from further degradation	Partially
		2. Improve palila habitat	Partially
		3. Monitor palila population	Yes
		4. Identify factors limiting palila population growth other than loss of habitat	Yes
		5. Develop and implement a public relations program	Partially
1986 (recovery plan, USFWS 1986)	2,269 individuals (USFWS 1986); ~2,000 individuals (Leonard et al. 2008)	1. Maintain existing palila habitat	Partially
		2. Improve palila habitat	Partially
		3. Monitor palila population	Yes

		4. Identify factors, other than deterioration of habitat, limiting palila population growth, and take corrective action as needed	Yes
		5. Develop and implement a public information program to acquaint government leaders and the public with the palila and the recovery program.	Partially
2006 (revised recovery plan, USFWS 2006)	3,958 individuals (Camp et al. 2014)	1. Palila occur in two or more viable populations or a viable metapopulation that represent the ecological, morphological, behavioral, and genetic diversity of the species, and viable populations exist on the southwestern slope of Mauna Kea, either the northern, eastern or the southern slope of Mauna Kea, and at least one other location on Hualālai or Mauna Loa, over a 15-year period.	No
		2. Either (a) quantitative surveys show that the number of individuals in each isolated population or in the metapopulation has been stable or increasing for 15 consecutive years, or (b) demographic monitoring shows that each population or the metapopulation exhibits an average growth rate (λ or lambda) not less than 1.0 over a period of at least 15 consecutive years; and total population size is not expected to decline by more than 20 percent within the next 15 consecutive years for any reason.	No
		3. Sufficient recovery area is protected and managed to achieve criteria 1 and 2 above.	No
		4. The threats that were responsible for the decline of the species have been identified and controlled.	Partially (threats identified)
2009 (5-yr review)	2,518 individuals (Camp et al. 2014); 2,640 individuals (USFWS 2009)	1. Palila occur in two or more viable populations or a viable metapopulation that represent the ecological, morphological, behavioral, and genetic diversity of the species, and viable populations exist on the southwestern slope of Mauna Kea, either the northern, eastern or the southern slope of Mauna Kea, and at least one other location on Hualālai or Mauna Loa, over a 15-year period.	No
		2. Either (a) quantitative surveys show that the number of individuals in each isolated population or in the metapopulation has been stable or increasing for 15 consecutive years, or	No

		(b) demographic monitoring shows that each population or the metapopulation exhibits an average growth rate (λ or lambda) not less than 1.0 over a period of at least 15 consecutive years; and total population size is not expected to decline by more than 20 percent within the next 15 consecutive years for any reason.	
		3. Sufficient recovery area is protected and managed to achieve criteria 1 and 2 above.	No
		4. The threats that were responsible for the decline of the species have been identified and controlled.	Partially (threats identified)
2015 (5-yr review)	2,070 individuals	1. Palila occur in two or more viable populations or a viable metapopulation that represent the ecological, morphological, behavioral, and genetic diversity of the species, and viable populations exist on the southwestern slope of Mauna Kea, either the northern, eastern or the southern slope of Mauna Kea, and at least one other location on Hualālai or Mauna Loa, over a 15-year period.	No
		2. Either (a) quantitative surveys show that the number of individuals in each isolated population or in the metapopulation has been stable or increasing for 15 consecutive years, or (b) demographic monitoring shows that each population or the metapopulation exhibits an average growth rate (λ or lambda) not less than 1.0 over a period of at least 15 consecutive years; and total population size is not expected to decline by more than 20 percent within the next 15 consecutive years for any reason.	No
		3. Sufficient recovery area is protected and managed to achieve criteria 1 and 2 above.	No
		4. The threats that were responsible for the decline of the species have been identified and controlled.	Partially (threats identified; limited control)

Table 2. Threats to the palila and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, E	Ongoing	Partial: ungulate removal from critical habitat is on-going
Invasive introduced plants	A, E	Ongoing	Partial: MKFRP conducts weed control on Mauna Kea

Fire	A	Ongoing	Partial: New dip tanks near Pu'u La'au; maintenance of fire breaks in core habitat
Predation	C	Ongoing	Partial: MKFRP and DOFAW conduct cat and mongoose trapping in core habitat
Avian Disease	C	Ongoing	No
Stochastic events - drought	E	Ongoing	No
Stochastic events – low numbers	E	Ongoing	Partial: captive population maintained by HEBCP
Climate change	A, E	Increasing	No

References:

See previous 5-year review for a full list of references (USFWS 2009). Only references not listed in that document are provided below.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of palila (*Loxioides bailleui*)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

- Delisting
- Reclassify from Endangered to Threatened status
- Reclassify from Threatened to Endangered status
- No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable: _____

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Mai M. Bugman

Date 2015 08-25