

5-YEAR REVIEW

Short Form Summary

Species Reviewed: Kakawahie or Molokai creeper (*Paroreomyza flammea*)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; 5-year status reviews of 46 species in Idaho, Oregon, Washington, Nevada, Montana, Hawaii, Guam, and the Northern Mariana Islands. Federal Register 77(44):13248-13251.

Lead Region/Field Office:

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

Name of Reviewer(s):

Jay Nelson, Fish and Wildlife Biologist, PIFWO

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

Marie Bruegmann, 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 May 5, 2015. The review was based on a review of current, available information since the last 5-year review for kakawahie (USFWS 2009). The evaluation by Jay Nelson, 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 at: http://ecos.fws.gov/tess_public.

Review Analysis:

Please refer to the previous 5-year review for kakawahie (*Paroreomyza flammea*) published on July 31, 2009 (available at: http://ecos.fws.gov/docs/five_year_review/doc2530.pdf) for a complete review of the species' status, threats, and management efforts. No significant new information regarding the species' biological status has come to light since listing to warrant a change in the Federal listing status of kakawahie.

The kakawahie is a small, short billed, sexually dichromatic Hawaiian honeycreeper endemic to the Island of Molokai. Adult males are mostly scarlet in various shades, while females are brown with scarlet washes and markings (USFWS 2006).

New status information:

- Surveys for Hawaiian forest birds using the variable circular-plot method as previously conducted by Scott *et al.* (1986) were conducted in forest areas on Molokai in 2010 in areas with historical occurrence of kakawahie (R. Camp, U.S. Geological Survey, pers. comm. 2015). Kakawahie were not detected during these surveys.
- Elphick *et al.* (2010) estimated the extinction of the kakawahie to have occurred in 1969 using a method by which the predicted probability of extinction increases as a function of the time since a species was last observed. Using 1963 as the last reliable observation record for kakawahie, the authors determined the year 1985 as the upper 95% confidence bound for species extinction. This approach for establishing extinction probability however is problematic when applied to extremely rare species such as kakawahie that are potentially distributed over a large area because the absence of observation records may be the result of inadequate survey effort and the few if any visits by qualified observers to remote areas where rare and potentially extinct species may still exist.
- Scott *et al.* (2008), a reference not included in the previous 5-year review, estimated the number of 8-minute variable circular-plot surveys needed to be 215,427 to determine with 95% confidence the absence of kakawahi on Molokai. In 2008, only 131 variable circular-plot surveys had been conducted on Molokai in areas where kakawahie might still exist. A 1,644-fold increase in survey effort using the variable circular-plot survey methodology therefore would be required to determine with 95% confidence the absence of kakawahie in areas of suitable habitat for the species.

New threats:

Climate change destruction or 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). Benning *et al.* (2002) used GIS simulation to show that an increase in temperature of 2 degrees Celsius (3.6 degrees Fahrenheit), which is within the range predicted by some climate models (*e.g.*, IPCC 2013; ICAP 2010), would result in 100 years in the virtual complete disappearance from Kauai of habitat where malaria transmission currently is only periodic. Kauai is a taller island than Molokai and it is expected effects of climate change will be similar on Molokai. Lia *et al.* (2015) assessed how global climate change will affect future malaria risk for native Hawaiian bird populations and expect even 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 kakawahie as predicted, it would likely contribute to the extinction of this species over time.

New management actions:

- Surveys / inventories – Forest bird surveys were conducted on Molokai in 2010, but no birds were detected.

Synthesis:

We applied a standard of demonstrated species absence at the 95% confidence level to recommend species status change from unknown to “delisting” due to extinction. This standard means we assumed a species is potentially extant until survey or other information shows the species is absent with 95% confidence from suitable habitat and areas it was known to have occupied historically during the roughly last half century. The last confirmed detections of kakawahie were in 1961-1963 (Pekelo 1963). Forest bird surveys in the remote Olokui Plateau in 1980 and 1988 failed to detect this species; however a far greater number of variable circular-plot survey counts are needed to determine species absence from this area with statistical confidence. We believe the status of the kakawahie is “unknown,” based on conclusions regarding extinction probability for the Hawaii Rare Bird Search 1994-1996 and the low survey effort for kakawahie subsequent to this intensive search (see Table 1). There are instances where rare Hawaiian birds have been rediscovered after they were presumed extinct or have been found in larger populations than expected (Reynolds and Snetsinger 2001). The large area on East Molokai with suitable habitat (approximately 2,300 hectares [5,700 acres]) (USFWS 2012), and the many remote areas within this that are only rarely visited by qualified observers, increase the potential that a small population of kakawahie could still exist on Molokai. The extremely rough terrain on Molokai and frequent wet weather make surveys difficult, and numerous steep valleys create many small pockets of habitat where the species could still exist (see Table 2).

Recommendations for Future Actions:

- Surveys / inventories
 - One of the most important recovery actions for the kakawahie is to intensively and systematically search areas of forest habitat where the species occurred historically (USFWS 2006). Statewide surveys of Hawaiian forest bird populations are conducted along widely spaced transects (Scott *et al.* 1986) and do not cover all areas where extremely rare Hawaiian forest birds are most likely to be. Additionally, these surveys do not spend the lengths of time needed to maximize the probability that extremely rare Hawaiian forest birds will be detected or rediscovered. Therefore, we recommend that an intensive search for kakawahie be conducted on Molokai using similar methodologies as those employed during the Hawaii Rare Bird Search 1994-1996 (Reynolds and Snetsinger 2001).
 - In addition, we recommend that autonomous recording units, or ARUs (Fitzpatrick 2002; Wallace 2010), be deployed in suitable habitats for this species. These field recording units record vocalizations of forest birds. The

tapes are then analyzed using computer programs to determine if the target species is present in the area. Use of this technology would greatly increase the amount of search time for this species.

- 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.
- Habitat and natural process management and restoration – Kakawahie would benefit in the long-term from habitat restoration to assist other native Hawaiian forest birds on Molokai.
- Captive propagation for reintroduction and genetic storage – Should kakawahie be rediscovered we recommend the Rare Bird Discovery Protocol in the revised recovery plan for Hawaiian forest birds (USFWS 2006) be followed with regard to decisions for whether to attempt to establish a captive population for propagation and reintroduction or to manage rediscovered population(s) *in situ*.

Table 1. Trends in status of kakawahie since listing.

Date	Number wild individuals	Number released	Key Recovery Actions	Actions Accomplished
1963	3 known	0	See below	
1970 (listing)	Very rare	0	See below	
1984 (first recovery plan)	Unknown	0	Improve habitat conditions; decrease threat of avian disease; systematically search area of suitable forest habitat;	Improve habitat conditions – Yes Decrease threat of avian disease – No Systematically search area of suitable forest habitat – Yes

Date	Number wild individuals	Number released	Key Recovery Actions	Actions Accomplished
2006 (revised recovery plan)	Unknown	0	Improve habitat conditions; decrease threat of avian disease; systematically search area of suitable forest habitat;	Improve habitat conditions – Yes Decrease threat of avian disease – No Systematically search area of suitable forest habitat – No
2009 (5-year review)	Unknown	0	Improve habitat conditions; decrease threat of avian disease; systematically search area of suitable forest habitat;	Improve habitat conditions – Yes Decrease threat of avian disease – No Systematically search area of suitable forest habitat – No
2015 (5-year review)	Unknown	0	Improve habitat conditions; decrease threat of avian disease; systematically search area of suitable forest habitat;	Improve habitat conditions – Yes Decrease threat of avian disease – No Systematically search area of suitable forest habitat – No

Table 2. Threats to kakawahie and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – degradation of habitat and herbivory	A, C, E	Ongoing	Partially, some habitat areas fenced
Invasive introduced plants	A, E	Ongoing	Partially, some habitat areas managed
Low numbers	E	Ongoing	None
Climate change	A, E	Increasing	None

References:

See previous 5-year review for a full list of references (USFWS 2010).

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**U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of
Kakawahie or Molokai creeper (*Paroreomyza flammea*)**

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: _____

for Programmatic Deputy Field Supervisor, Pacific Islands Fish and Wildlife Office

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