5-YEAR REVIEW

Short Form Summary

Species Reviewed: Alala or Hawaiian crow (*Corvus hawaiiensis*)

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):

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 alala (USFWS 2009a). 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 alala (*Corvus hawaiiensis*) published on July 31, 2009 (available at: *http://ecos.fws.gov/docs/five_year_review/doc2526.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 alala.

The alala is a member of the family Corvidae, the family of birds that includes ravens, crows, jays, and magpies, among others. In appearance, the alala is a typical medium-sized crow, from dark brown to black in color (USFWS 2009b).

New status information:
The last observation of alala in the wild was in 2002 (USFWS 2009b). Since then there have been reported sightings of alala, however, none have been confirmed. There are 115 alala in captivity: 74 at the Keauhou Bird Conservation Center, Hawaii; 40 at the Maui Bird Conservation Center, Hawaii; and one bird at the San Diego Safari Park (not on display), California. The size and reproductive output of the captive population can now support a sustained release effort, and reintroduction of alala to Puu Makaala Natural Area Reserve (NAR), Hawaii Island, is planned in fall 2016.

New threats:

- Climate change destruction or degradation of habitat – 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 a nearly 100 percent decrease in the land area where malaria transmission currently is only periodic.
- The lethality of avian malaria for alala in the wild is unknown (Jenkens *et al.* 1989). Juvenile captive-reared alala are able to survive malaria and avian pox virus (*Avipoxvirus*) infection with supportive care. It is unclear at this time what impact climate change and increased prevalence of avian malaria and pox will have on alala reintroduced into the wild.

New management actions:

- Reintroduction / translocation – The Alala Working Group began meeting in 2011 to plan alala reintroduction at Puu Makaala NAR.

Synthesis:
The alala is endemic to the island of Hawaii and was extirpated from the wild by 2003. Captive populations of 115 individuals constitute the entire species (see Table 1). The captive population has increased steadily since its initial inception in 1978, and is now large enough to generate surplus individuals for reintroduction to the wild. Puu Makaala NAR has been selected as a release site and threat reduction, including predator control, will begin before releases. Large tracts of former habitat must be protected from ungulates if the forest vegetation is to recover enough to sustain wild populations of alala. Because the alala is found only in captivity, and most of the remaining habitat on Hawaii Island is threatened by ungulates and other pest species, the general recovery goals for this species have not been met (see Table 2). Therefore the alala meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Surveys / inventories – Conduct searches for alala in areas where there have been credible sightings.
- 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 –
    - We recommend continued habitat management including fencing and ungulate removal to support native forest regeneration in areas suitable for reintroduction (USFWS 2009b).
    - Hawaiian forest birds susceptible to avian disease may become extinct following a drastic reduction in disease-free habitat, but ultimately forest might expand into higher elevations maintaining disease free refugia for some species. Acquisition and management of transmission-free high-elevation habitat is crucial to the preservation and restoration of some native Hawaiian forest birds (Lapointe *et al.* 2009). As a long-term contingency against a warming scenario, we recommend securing deforested and pasture lands on Hawaii at high elevations adjacent to protected refugia and managing these areas for forest growth to provide suitable habitat for alala and other Hawaiian forest birds.
- Predator / herbivore monitoring and control – Implement mammalian predator control efforts in native forest areas suitable for reintroduction to minimize predation and disease risk (particularly Toxoplasmosis (*Toxoplasma gondi*i), which is carried by small mammals and known to kill captive-released alala (Work *et al.* 2000).
- Captive propagation for reintroduction and genetic storage – Continue captive propagation and initiate reintroduction program.

Table 1. Trends in status of alala since listing.

Date	Number wild individuals	Number released	Key Recovery Actions	Actions Accomplished
1967 (listing)	Rare	0	See below	
1978 (Hawaii Forest Bird Survey)	76 $\pm$ 18 (95% CI)	0	See below	
1982 (first recovery plan)	Approximately 75 birds	0	Determine biological and ecological requirements; Improve habitat conditions; Secure wild population; Monitor habitat and populations; Implement public information and education programs;	Determine biological and ecological requirements – Yes; Improve habitat conditions – Yes; Secure wild population – No; Monitor habitat and populations – Yes; Implement public information and education programs – Yes
1992 (first reintroduction)	11 in the wild	27 (between 1993-1998)		
2009 (revised recovery plan)	0 in wild; 56 in captivity	0	Increase numbers in captivity; Identify suitable habitat and manage threats; Establish new populations in managed suitable habitat; Garner public support and funding;	Increase numbers in captivity – Yes; Identify suitable habitat and manage threats – Yes; Establish new populations in managed suitable habitat – No; Garner public support and funding – Yes;
2009 (5-year review)	0 in wild; 68 in captivity	0	Increase numbers in captivity; Identify suitable habitat and manage threats; Establish new populations in managed suitable habitat; Garner public support and funding;	Increase numbers in captivity – Yes; Identify suitable habitat and manage threats – Yes; Establish new populations in managed suitable habitat – No; Garner public support and funding – Yes;

Date	Number wild individuals	Number released	Key Recovery Actions	Actions Accomplished
2015(5-year review)	0 in wild; 115 in captivity	0	Increase numbers in captivity; Identify suitable habitat and manage threats; Establish new populations in managed suitable habitat; Garner public support and funding;	Increase numbers in captivity – Yes; Identify suitable habitat and manage threats – Yes; Establish new populations in managed suitable habitat – No; Garner public support and funding – Yes;

Table 2. Threats to alala 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	Partially, captive propagation
Predation	C	Ongoing	Partially, forest restoration for protection from Hawaiian hawk (*Buteo solitarius*) and rodent and cat control
Climate change	A, E	Increasing	Partially, forest protection at middle elevations and reforestation in some high elevation areas

References:

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

Benning, T. L., D. LaPointe, C. T. Atkinson, and P. M. Vitousek. 2002. Interactions of climate change with biological invasions and land use in the Hawaiian Islands: Modeling the fate of endemic birds using a geographic information system. PNAS 99:14246-14249.

ICAP. 2010. Hawaii's changing climate: Briefing sheet, 2010. Fletcher, C. (ed.). University of Hawaii Sea Grant College Program, Center for Island Climate Adaptation and Policy. Available online at: http://www.soest.hawaii.edu/coasts/publications/ClimateBrief_low.pdf.

IPCC. 2013. Summary for policymakers. *In*: Climate Change 2013: The physical science basis. Contribution of the Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T. F., D. Qin, G. –K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P. M. Bidgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, New York.

Jenkens, C. D., S. A. Temple, C. van Riper, and W. R. Hansen. 1989. Disease-related aspects of conserving the endangered Hawaiian crow. International Council for Bird Preservation (ICBP) Technical Publications 10:77-87.

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[USFWS] U.S. Fish and Wildlife Service. 2009a. Alala or Hawaiian crow (*Corvus hawaiiensis*) 5-year review summary and evaluation. U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 20 pages.

[USFWS] U.S. Fish and Wildlife Service. 2009b. Revised recovery plan for the alala (*Corvus hawaiiensis*). Region 1, Portland, Oregon. xiv + 105 pages.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of
Alala or Hawaiian crow (*Corvus hawaiiensis*)

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
X No Change in listing status

Appropriate Listing/Reclassification Priority Number, if applicable:_____

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

Maria M Buenaman Date 2015-08-18