

HAWAII DEPARTMENT OF LAND & NATURAL RESOURCES  
DIVISION OF FORESTRY & WILDLIFE

**Statewide Endangered Wildlife Program Annual Performance Report**

**FINAL REPORT**

- 1. State:** Hawai‘i  
**Grant Number:** E-2, Segment 13  
**Grant Name:** Statewide Endangered Wildlife Program  
**Project Number and Name:** Puaiohi Population Research and Management (EWP-4-13)  
**Expected Project Duration:** July 1, 2010 to June 30, 2011  
**DOFAW Activity Code:** 339
- 2. Report Period:** July 1, 2010 to June 30, 2011  
**Report Due Date:** September 28, 2011  
**Report Received Date:**

- 3. Location of Work:** Congressional District 2

**4. Costs:**

Source	Budgeted	Estimated
Federal	\$308,164	\$310,000
State	\$102,721	\$100,000
Other	0	
Total	\$410,885	\$410,000

**5. Objectives:**

- a) Conduct intensive surveys for wild and captive-released birds, using methods developed in coordination with our partners at USGS-BRD, to estimate the population size.
- b) Document the distribution, demographics, ecology, life-history, limiting factors, habitat and management needs for the Puaiohi (*Myadestes palmeri*), ‘Akikiki (*Oreomystis bairdi*), and ‘Akeke‘e (*Loxops caeruleirostris*). Mist net and color band adults and nestlings to determine survival. Determine the prevalence of avian malaria (*Plasmodium relictum*) and avian pox (*Avipoxvirus* sp.). Determine nest success and the cause of nest failure and determine appropriate management strategies based on the causes of nest failure. Quantify food availability and determine foraging preferences.
- c) Collaborate and assist ZSSD with the release of captive reared Puaiohi including maintaining predator control grids near the release site, providing supplemental food, and monitoring and tracking the survival of released birds.

- d) Use survival and reproductive data to develop population viability models.
- e) Support and contribute to management activities of other agencies (i.e., Natural Areas Reserve System, The Nature Conservancy, Kaua'i Watershed Alliance) for Kaua'i's forests.
- f) Assist other agencies in managing and protecting Kaua'i's forests by documenting invasive weeds, feral ungulate activity, infrastructure needs in study areas, and when possible supporting and/or participating in weed removal and fence repair projects.

## **6. Grant Relationship to Other Projects:**

The work funded by this grant directly supports the objectives of the State's Comprehensive Wildlife Conservation Strategy and is carried out by a team of biologists located on Kaua'i, the Kaua'i Forest Bird Recovery Project (KFBRP). Support for the captive propagation of Puaiohi is provided by another project within the Section 6 Grant Program (see EWP-1). In FY2010-11, funds to initiate a long-term demographic study of the 'Akikiki and 'Akeke'e were provided to KFBRP by the USFWS, Pacific Islands Fish and Wildlife Office.

## **7. Performance:**

### **a) Conduct intensive surveys for wild and released captive-bred birds.**

In 2011, we implemented a pilot Occupancy Survey (OS) protocol for Puaiohi. The goal of the OS is to model occupancy, abundance and detection probability of Puaiohi along randomly selected streams in their range with respect to a suite of predictor variables including topography, stream sinuosity, Puaiohi density, and canopy tree species, and use these data to estimate the species' population size. In 2011, 20 stations along 2,850 m sections of five streams (Halepā'ākai, Halehaha, Mōhihi, N. Kawaikōi and E. Kawaikōi) were surveyed six times (Fig.1). Each survey consisted of an eight-minute point count followed by an 8.5-minute playback bout during which all Puaiohi detections and the distances to detection were recorded. During these surveys we attempted to resight color-banded wild and captive bred Puaiohi. These surveys took 80 person hours to set up and 260 person hours to complete. Data is currently being entered into a database for analysis by USGS-BRD.

For 'Akikiki and 'Akeke'e, we determined that the best method to census density and investigate habitat relations was to map territories (Bibby et al. 2002). Within five ~100 m<sup>2</sup> plots (two near N. Kawaikōi, one near Mōhihi, and two near Halepā'ākai/Halehaha), we conducted systematic searches for these species between February and June 2011. We recorded the location of each detection with GPS, and noted the species, sex, age, and behavior of detected individuals. Each plot was completely searched 4-6 times during the breeding season which required approximately 860 person hours. Analysis of these data is ongoing. Within the two plots in the Halepā'ākai/Halehaha study area we recorded 12-16 'Akikiki territories and 12-18 'Akeke'e territories. Within the single Mōhihi study plot we recorded 4-6 'Akikiki territories and 5-7 'Akeke'e territories. At the lowest density study area near N. Kawaikōi, only one 'Akikiki territory and 3-5 'Akeke'e territories were located. The size, number, and habitat characteristics of territories will be compared within and among plots during the fall of 2011 and territory search methodology will be refined for the 2012 breeding season.

**b) Document the distribution, demographics, ecology, life-history, limiting factors, habitat and management needs for the Puaiohi, ‘Akikiki and ‘Akeke’e.**

During the 2011 breeding season, KFBRP staff used observations from the above OS surveys as the basis of territory maps and nest searching/monitoring for Puaiohi, and supplemented these data with intensive territory mapping and nest searching off-stream and in side streams as time allowed, with emphasis on Halepā‘akai / Halehaha and Kawaikoi streams.

Territory mapping off-stream and in side streams, and intensive searching for nests and monitoring reproduction was conducted as time allowed with emphasis on Halepā‘akai/Halehaha and Kawakoi. In these areas, KFBRP staff used standard protocols described in Bibby et al. (2002) to map territories of banded and unbanded Puaiohi. Territory size and location will be overlaid stream features such as cliff walls to look for patterns of use relevant to Puaiohi conservation.

Territory and stream data will be compared across all streams surveyed as well as to data collected by USGS researchers in the 1990s along the Mōhihi Stream; which is approximately five km northwest of the current study site. During the 2011 season, 141 person hours were spent mapping 20 territories along the Halepā‘akai and Halehaha streams, three territories on E. Kawaikōī, and two territories along N. Kawaikōī (Fig. 1).

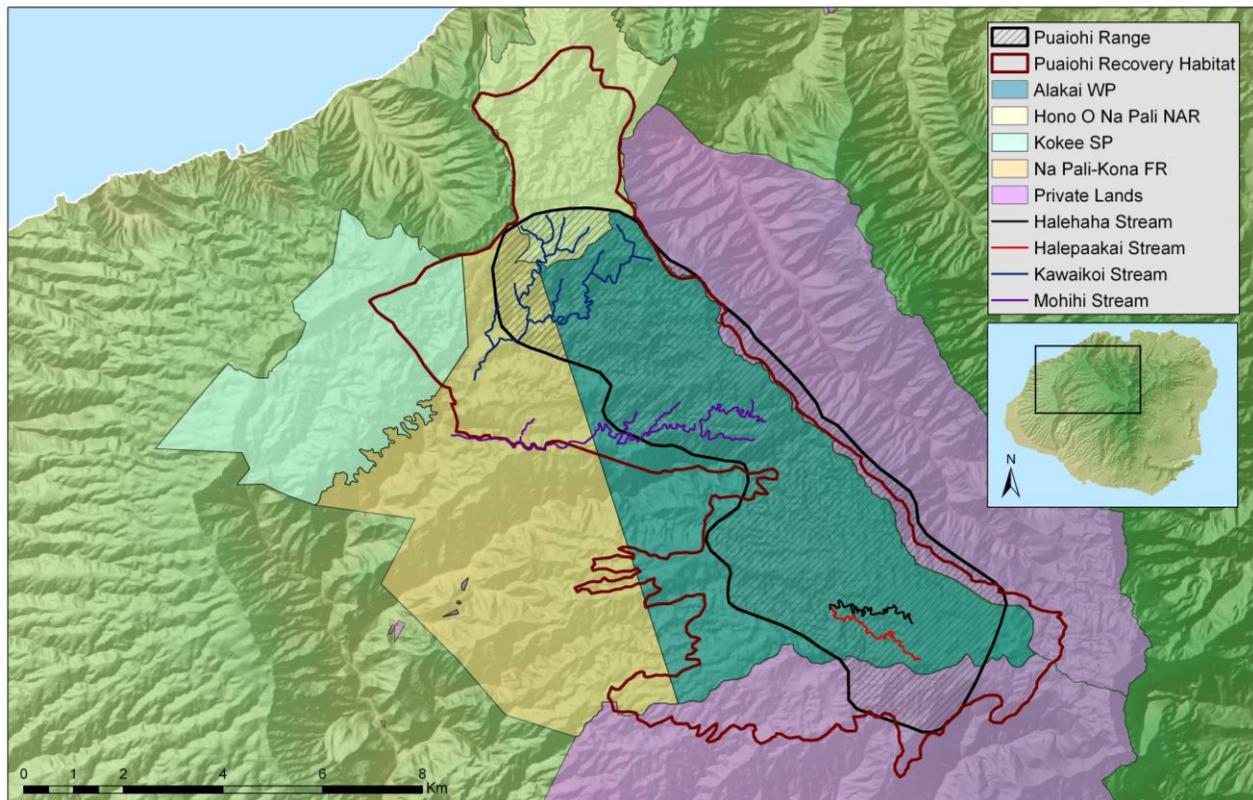


Figure 1. Geographic range of the Puaiohi and the major drainages where the Kaua'i Endangered Forest Bird Project works.

Vegetation composition and structure of potential Puaiohi habitat was surveyed along the Halepā‘ākai and Halehaha streams using 100 m<sup>2</sup> plots at 25 locations, an effort requiring 18 person hours. To compare vegetation in areas used as territories to those not incorporated in territories, 14 plots were located in Puaiohi territories and 11 were located outside territories. At each plot the identity, DBH, and number of canopy trees were quantified; we also recorded the presence of fruits and flowers. Ground, shrub and canopy cover were recorded, as well as a list of ground and shrub species. In addition, pig and goat damage, and the presence of invasive species, mosquito larvae, and endangered birds were noted. Finally, representative photographs were taken of each plot. A preliminary analysis of these data was presented at the 2011 Hawaii Conservation Conference. Analyses to date have found that moss cover and abundance of pūkiawe (*Styphelia tameiameia*), a fruiting shrub, was higher inside territories than outside.

The same protocol was used to survey vegetation structure and composition in and out of territories in the five ‘Akikiki/’Akeke’e study sites. Collecting data in 55 plots in the two Kawaikōi study sites, 25 plots at the Mōhihi study site, and 27 plots at the Halepā‘ākai study sites required 260 person hours. These data will be entered into a database in fall 2011 and be used to compare vegetation characteristics of used and unused areas within and among study sites to elucidate ‘Akikiki habitat requirements.

During OS and territory mapping efforts, 14 Puaiohi nests were located, three in Halepā‘ākai, four in Halehaha, four in Mōhihi, two in N. Kawaikōi, and one in E. Kawaikōi (Table 1.) Six nests fledged, two nests failed, and the fate of six nests was unknown. For the first time since the State began overseeing research on Puaiohi in 2003, we documented Puaiohi nesting in nestboxes. One pair (captive bred male, wild female) nested in a wooden box nailed to a tree in N. Kawaikōi and fledged one chick. The other pair (wild female, uncertain paternity) nested in a flower-pot-on-a-stick nest box, however this nested failed when the chicks were ~14 days old.

Table 1. Number and fate of Puaiohi nests located in different study plots in 2011.

<b>Study plot</b>	<b># nests located</b>	<b># fledged</b>	<b># failed</b>	<b># unknown</b>
Halepā‘ākai	3	2	0	1
Halehaha	4	2	1	1
Mōhihi	4	1	0	3
N. Kawaikōi	2	1	1	0
E. Kawaikōi	1	1	0	0

Nest searching for ‘Akikiki and ‘Akeke’e also was conducted during territory mapping. One active ‘Akikiki and no active ‘Akeke’e nests were found in the Mōhihi plot. At the Mōhihi study plot, at least two additional ‘Akikiki pairs were observed with young. Five active ‘Akikiki nests and one inactive ‘Akeke’e nest were found in the two Halepā‘ākai plots. Of the five ‘Akikiki nests located, at least three fledged young, and two additional territories were observed with fledglings. No ‘Akikiki nests were found in the Kawaikōi plots, and one ‘Akeke’e nest was found. The ‘Akeke’e nest fledged at least one young.

In 2011, KFBRP staff caught and banded 11 Puaiohi (2 male, 3 female, 6 young) and two adult ‘Akikiki (160 person hours; Table 2). We also caught three Kaua‘i ‘Amakihi (*Hemignathus kauaiensis*), one ‘Apapane (*Hematione sanguinea*), five Kaua‘i ‘Elepaio (*Chasiempis sclateri*), three ‘Anianiau (*Hemignathus parvus*), and three Japanese White-eyes (*Zosterops japonicas*). All birds were captured using standard methods by appropriately experienced and permitted staff. All birds were individually marked with a combination of metal and plastic color bands. A blood sample was taken from each bird for disease screening. Blood samples were preserved in the field and sent to Dr. Carter Atkinson at the *Pacific Island Ecosystem Research Center, Biological Research Division, Hawai‘i Volcanoes National Park* for analysis. Results will be compared to infection rates detected from sampling efforts in the 1990s to track changes in disease prevalence. Given that mosquitoes are thermally limited and that the highest elevation on Kaua‘i is only 4,000 feet, global climate change is likely to have profound effects on the island’s native birds because of increases in mosquitoes.

Table 2. Number of birds caught in the Alaka‘i Wilderness Area and Koke‘e State Park in 2011, by species, age and sex.

Species	Total	Sex			Age				
		M	F	U	HY	SY	ASY	AHY	U
PUAI	11	2	3	6	6	2	-	3	-
KACR	2	2	-	-	-	-	1	1	-
ANIA	3	2	-	1	-	-	1	2	-
APAP	1	-	-	1	-	-	-	1	-
KAAM	3	2	-	1	-	-	-	1	2
KAEL	5	1	-	4	-	-	3	1	1
JAWE	4	1	-	3	-	-	-	4	-

Radiotransmitters were attached to three adult female and one hatch-year Puaiohi to track post-breeding seasonal movements and survival. Puaiohi were tracked on foot and with one helicopter flight (130 person hours). The hatch-year moved ~900 m over three weeks before the radio signal was lost. The signal of one female (in N. Kawaikōi) was lost immediately after attachment; which we believe was the result of a failed transmitter. The other two females (one in Mōhihi and one in Halepā‘ākai) stayed close to their last nest of the season for several weeks. The Mōhihi bird’s signal could not be detected by mid-August, 2011, but the Halepā‘ākai female moved several hundreds of meters away, then back to the vicinity of her nest as of September 1, 2011.

**c) Collaborate with ZSSD to release captive reared Puaiohi.**

In collaboration with ZSSD, 12 Puaiohi were released on October 18, 2010. All birds were soft-released from two hack towers along the Kawaikōi Stream in the northern portion of the Alaka‘i Wilderness Preserve, in an area supporting a low density of wild Puaiohi (Fig. 1). Approximately 40 person hours were required to coordinate helicopter sling loads, pick up ZSSD staff and transport them to the field site, and set up the weatherport, lua, and aviaries or hack towers. Birds were hiked to the release site carried in specially designed backpacks. Birds were acclimated to the site for two weeks. During this time, there was a 24 hour presence at the release site. Food was provided daily until October 26, 2010, and every other day until November 16, 2010. Five feeding

stations were set up around the release site and food (i.e., scrambled eggs, papaya, and monkey chow) was prepared daily. Food trays were cleaned and new food added twice per day. This effort required 40 person hours by KFBPR staff. By the end of the first week, no birds were resighted at feeders. KFBPR staff spent 96 hours over the next few weeks attempting to resight released bred birds in the Kawaikōi without success, although a banded wild Puaiohi and at least one (and probably two) unbanded hatch-year Puaiohi was located.

**d) Use survival and reproductive data to develop population viability models.**

Data necessary for a population viability model has been collected and models are currently being developed in conjunction with a graduate student under the direction of Dr. Sheila Conant at University of Hawaii Manoa. During 2007-2010, survival and reproductive data were collected along the Halepā‘ākai and Halehaha streams, although effort to collect these data was minimal in 2010 (Table 3). Demographic data was collected along the Mōhihi Stream between 1996 and 1998. In latter study, nest success and fledgling production varied considerable from year to year (Snetsinger *et al.* 2005), most likely because of annual variation in rat (*Rattus* sp) abundance. Similar variation was not found at the Halepā‘ākai and Halehaha streams and this may explain the differences in overall nest success between this study and the Mōhihi. Based on a small number of banded birds, adult survival was estimated at 74% (8 of 11 individuals) and juvenile survival at 25% (9 of 36 individuals) in the Mōhihi Stream (Snetsinger *et al.* 2005). At the Halepā‘ākai and Halehaha site adult survival was estimated using the program MARK at 69% and juvenile survival was 19%. These estimates are based on re-sightings of 48 birds banded as nestlings or fledglings and 24 birds banded as adults.

Table 3. Summary reproductive data for the Puaiohi collected at two sites in the Alaka‘i Wilderness Preserve.

Parameter	Halepā‘ākai / Halehaha	Mōhihi
Number of nests	114	43
Nest success	75%	41%
Fledglings per successful nest	1.7 ± 0.5	1.6 ± 0.4

**e) Support and contribute to the management activities of other agencies**

In summer 2011, construction of the first major ungulate fence on the Alaka‘i plateau was completed by The Nature Conservancy and the Kaua‘i Watershed Alliance; ungulate removal from the area has been initiated. As part of the Hawai‘i Forest Bird Survey, 107 VCP points were established in the eastern Alaka‘i. These points were first surveyed in 1981 and were re-surveyed in 1989, 1994, 2000, 2005, 2007, and 2008. These surveys provide important baseline information that can be used to document changes in bird populations associated with habitat recovery after ungulates are removed. To increase the precision of survey data and the ability to detect changes in bird abundance, an additional 67 stations were installed on either side of the fence in FY10; all 174 stations were surveyed in 2010. In fall 2010, vegetation data was collected, using the above protocol, at half of the 174 stations. In spring 2011, 120 person hours were spent resurveying birds at the 174 stations. In fall 2011 KFBPR plans to sample vegetation at the remaining stations. Henceforth, surveys will be repeated every five years to track changes in bird populations. KFBPR presented a preliminary analysis of the 2010 data at

the Hawaii Conservation Conference. Although all extant native forest birds were detected on both sides of the fence line, greater numbers were detected at stations outside of the area to be fenced. More native birds were detected than non-native species. There were no differences in vegetation structure on either side of the fence line and bird abundance was positively correlated with shrub cover.

**f) Collaborate with the Kaua'i Watershed Alliance to control invasive weeds and protect and manage native Puaiohi habitat.**

KFBRP staff report incipient weeds to the appropriate management agency or entity. Halepā'ākai field camp was used by Koke'e Resource Conservation Program for their weed removal program in fall 2010, assisted by KFBRP staff (16 hours). KFBRP staff also provided data on locations of endangered birds and nests to NARS and FWS personnel to inform planning of the proposed fence around Hono 'O' Na Pali NAR and spent 10 hours surveying the proposed fence line with NARS personnel.

**8. Discuss differences between expected and actual expenditures:**

All work associated with this segment was completed in FY11. The difference between expected and actual expenditures is within 10% of the total grant award.

**9. Publications/Reports:**

Crampton, LH, PK Roberts, LA Behnke. Starting small: population size and distribution of an endangered Kauai endemic, the Puaiohi. Hawaii Conservation Conference, Honolulu HI, Aug 2010.

Crampton, LH, PK Roberts, LA Behnke. Starting small: population size and distribution of an endangered Kauai endemic, the Puaiohi. The Wildlife Society Conference, Snowbird UT, Oct 2010.

**10. Report Prepared by:**

Lisa Crampton, Project Leader, KFBRP, PCSU phone: (808) 335-5078, email: [crampton@hawaii.edu](mailto:crampton@hawaii.edu)

David Leonard, Wildlife Biologist, DOFAW/PCSU phone: (808) 783-2163, email: [david.l.leonard@hawaii.gov](mailto:david.l.leonard@hawaii.gov).

**11. Additional Information:** None

