

## Density of Maui Parrotbill in Waikamoi Preserve West of Ko`olau Gap

Research Report for The Nature Conservancy (with modified map for website)

Maui Forest Bird Recovery Project ([www.mauiforestbirds.org](http://www.mauiforestbirds.org))

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**MFBRP Rare Bird Search team 2009**

**Abstract.** In September 2009, the Maui Forest Bird Recovery Project (MFBRP) surveyed The Nature Conservancy's (TNC) Waikamoi Preserve between Waikamoi stream and Ko`olau gap on Haleakala Volcano, east Maui, to determine relative abundance of Maui parrotbill (*Pseudonestor xanothphrys*). We estimated the density of Maui parrotbill (MAPA) in the Waikamoi survey area using mapped detections and variable circular plot (VCP) point counts. Our estimates were around 20 MAPA per km<sup>2</sup>, half the density found in the core area at Hanawi Natural Area Reserve. To reduce extinction probability, endangered native forest birds require additional mesic forest at elevations above 1500 m. TNC could increase this important habitat by replacing conifers with native forest and by adding more easements to the Waikamoi Preserve. More public-private partnerships in reforestation are badly needed on Maui to prevent the extinction of the Maui parrotbill and declines of forest birds as avian malaria moves upslope.

### Introduction

The Nature Conservancy's (TNC) Waikamoi Preserve on east Maui represents nearly 40% of the 50 km<sup>2</sup> range of Maui parrotbill (*Pseudonestor xanothphrys*; MAPA) and Crested Honeycreeper (*Palmeria dolei*; CRHO; `Akohekohe), two endangered Hawaiian honeycreepers (USFWS 2006). The habitat protected by the preserve is important for sustaining the two endangered forest bird populations, but distribution and abundance of

MAPA and CRHO is not well known within particular units of Waikamoi Preserve (Waikamoi). In this report we present results of a two-week survey effort to determine relative abundance and density of MAPA between Waikamoi stream and Ko`olau gap, in an area of approximately 200 hectares.

Over recent decades, TNC has worked to recover native forest features at Waikamoi by removing alien plants and ungulates, especially pigs. Pig wallows make breeding areas for mosquitoes and destroy important understory structure supportive of habitat and food resources used by native birds (USFWS 2006). TNC's management activities have probably improved habitat suitability for MAPA, but Hawaiian Forest Bird Surveys have not shown any population increases on Maui since 1980 (Camp 2007).

Since 1997, the Maui Forest Bird Recovery Project (MFBRP) has pioneered conservation techniques for endangered bird species as well as contributing to the determination of the distribution and abundance of MAPA. MFRBP has baseline data on MAPA ecology at the Hanawi Natural Area Reserve (Hanawi) where densities have been relatively constant at 40 birds per km<sup>2</sup> for at least three decades. In spring 2009 we collected data on detection rates of MAPA and CRHO by effort (hours and linear trail distance) and we completed 200 Variable Circular Plot counts (Scott *et al.* 1986) to serve as baseline for the Hanawi study area. During September 2009 we repeated a similar sampling approach at Waikamoi, and extrapolated density estimates using the published Hanawi value of 40 birds per km<sup>2</sup>. We also surveyed for `Akohekohe and Maui Alauahio or Creeper (*Paroreomyza montana*) at Waikamoi, and provide subjective comparisons for these two bird species pending further analyses.

## **Methods**

During September 7-18, 2009, MFBRP biologists and trained volunteers searched for MAPA, CRHO, and Maui Alauahio (MACR) along established trails in the Waikamoi Preserve (Figure 1) between Ko`olau gap and Waikamoi stream. Search effort was concentrated on trails to the east of Waikamoi stream between 5400 and 6300 ft. Sightings and vocalizations were used to detect birds along trails, 500 m transects, and at VCP count stations. High power binoculars (10 X), male song, three-note contact whistles, and hatch-year begging vocalizations were used to detect MAPA and to confirm breeding. CRHO and MACR were also detected visually and by song and other vocalizations.

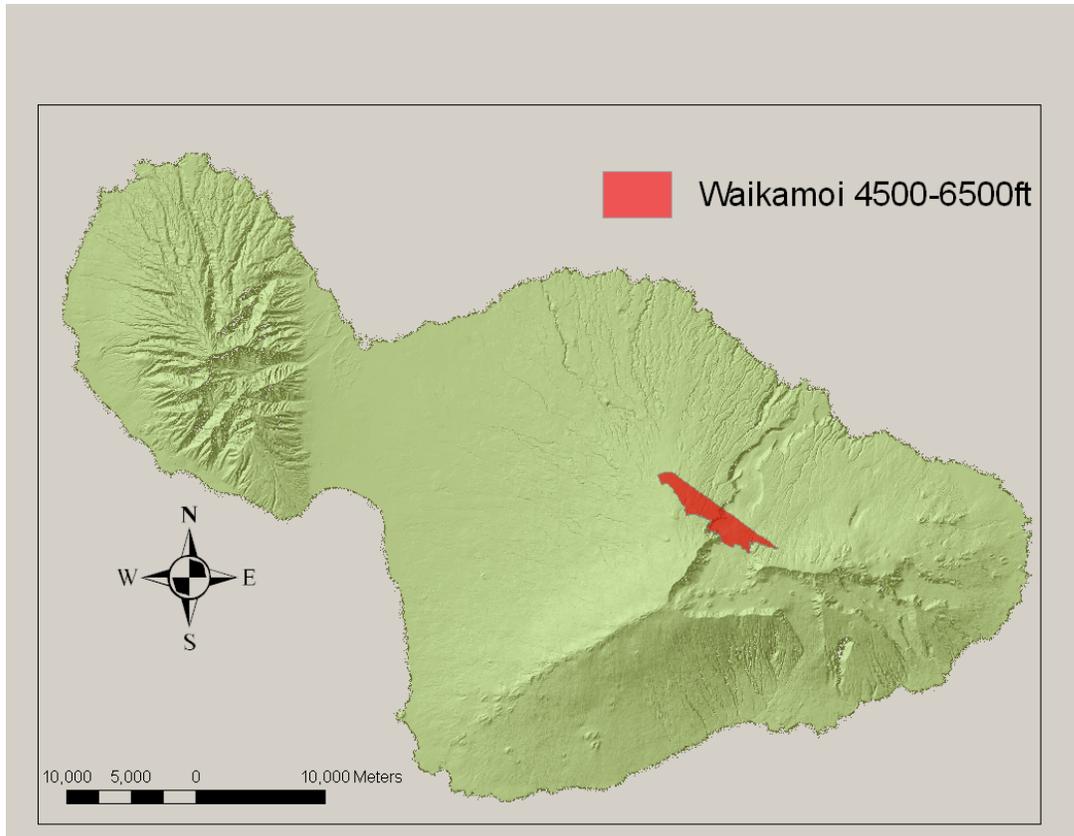


Figure 1. TNC Waikamoi Preserve on Maui.

Teams of two (one staff, one volunteer) spent 6-8 hours walking attentively along trails and 500 m transects, stopping at pre-assigned locations to complete 8-minute variable circular plot (VCP) counts. All VCP count stops were least 200 m apart and distances to each bird detected were estimated. When MAPA or CRHO were detected during counts or along trails and transects, a GPS location was recorded along with the distance and direction to the detection. Observers were instructed on making additional field notes regarding evidence of feral cats, pigs, ungulates, rats. Data were entered into an Excel and Access database and subsets of data were used for statistical analysis using JMP8 software (SAS, 2008).

## Results

We logged 560 person hours in the field, with 186 hours in MAPA 8 field survey days. Given that trails surveyed covered a linear distance of about 9600 m and at any point on a trail or transect a singing male MAPA could be heard within 100 m of the trail we estimate our survey area as 960,000 m<sup>2</sup>, 96 ha, or approximately 1 km<sup>2</sup>. Evaluation of mapped detections along trails and transects suggested that at least 15 distinct male MAPA were

present in the survey area. Five males were verified to be paired and three pairs had an offspring, bringing the total minimum estimate in the survey area to 23 individual parrotbill.

Next we evaluated point count results. We treated all VCP counts as statistically independent and performed a T-test to compare mean counts at Waikamoi (N= 70) with those from Hanawi (N = 200). MAPA per station at Waikamoi averaged 0.08 about half the mean at Hanawi (0.15) and the difference was significant at a 93% confidence level ( $p = 0.07$ ). Extrapolation suggests that the density of MAPA at Waikamoi is 53% of density at Hanawi or 18-20 birds/km<sup>2</sup>.

The highest single day encounter rate for MAPA at Waikamoi was 10 individuals found by the whole team covering the approximately 100 ha search area. We also found evidence of three begging juvenile MAPA during the search.

Although we have yet to analyze transect or VCP count data for CRHO or MACR, the four observers with experience in Hanawi all felt that CRHO were surprisingly abundant at Waikamoi in September compared with the 2009 breeding season in Hanawi. On one day, a team of two observers detected 29 CRHO along 2.5 km of trail and several `Akohekohe were seen everyday by most observers during the two-week survey period. Given the extensive foraging of the birds, some of these were probably repeat counts. Adults and young were found in most CRHO foraging parties. MACR seemed to have a similar abundance to Hanawi, mainly pairs and small family groups of 3-5 birds. Many family parties still had vocal begging young during the survey and a few territorial encounters led to counts of 10 MACR in one location. MACR surveys at Hanawi were prior to the peak in fledged young giving an impression of smaller parties.

## **Discussion**

The recovery of critically endangered bird species is focused on three facets: 1) restoring populations to numbers that persist despite demographic and environmental stochasticity, 2) protecting enough habitat to support self-sustaining populations, and 3) identifying and removing threats responsible for current declines (USFWS 2006). Assessing success of recovery efforts requires a reasonable understanding of distribution and abundance of each endangered bird species. For MAPA a knowledge gap is variation in density and productivity (fledlings/pair) in different forest types. Our survey at Waikamoi Preserve provides some new insight about MAPA populations in mesic koa-ohia forest.

Based on a rather crude evaluation of mapped detections of unmarked individual males widely separated by time and/or distance, and on results of VCP counts, we estimate that the density of MAPA at Waikamoi is 20 birds per km<sup>2</sup>. Although we have not assessed

transect results, confidence is boosted because two substantially different methods derived fairly similar density values ranging from 18-23 birds per km<sup>2</sup>. Conclusions may change if evaluation by GIS and results on 500 m transects yield extremely different density estimates.

At Hanawi, color-banding has allowed MFBRP to determine that at least 46 breeding adults and 15 young used the Hanawi study area in 2009, indicating that counts may underestimate density of these rare birds.

Based on one HFBS transect (Transect 3) previous estimates at Waikamoi were significantly lower (6-9 birds/km<sup>2</sup>) than our estimates. This estimate may have been due to poorer forest condition prior to ungulate removal. Managers of Waikamoi should be cautious with this interpretation because the lower estimate may also be an artifact of limited sampling, and inclusion of VCP stations located in conifer forest and at elevations where MAPA are absent.

Why are MAPA numbers lower in the survey area of Waikamoi when forest condition appears good and seems similar to Hanawi? The forest west of Ko`olau gap is a forest peninsula jutting into inhospitable habitat. More edge and closer proximity to human populations and associated feral cats may reduce MAPA numbers. Dispersal across the Ko`olau gap from the core area may be low, as the gap's lower elevations could bring dispersing MAPA into contact with avian malaria. While understory damage by pigs was not recorded during our surveys, the understory appeared more open than at Hanawi and may lack some structural features that are present in the Hanawi core area. A comparative study of the density of understory woody shrubs and plants used by MAPA at the two sites would be informative.

No matter what methods are used, density estimates of bird species are compromised by biases. Like many other bird species, MAPA detections, are heavily biased towards adult males. Fortunately, males have a very loud and detectable song, but females and young are under-detected. Also detection rates vary depending on the time of the year they are done (Bibby *et al.* 2000).

Hawaiian honeycreepers have experienced severe habitat loss and population declines, especially since the introduction of malaria to Maui in the early 1800's. Massive extirpation now limits MAPA and CRHO and most other native honeycreepers to high elevations too cold for development of deadly *Plasmodium* that cause avian malaria. Suitable habitat for MAPA above 1500 m actually covers only about 40 km<sup>2</sup> and is expected to decline further over the next century as climate change favors upslope movement of avian malaria (Hammond *et al.* 2009).

To reduce extinction probability, endangered native forest birds require more native mesic forest at elevations above 1500 m. TNC could increase important habitat by replacing the approximately 800 acres (324 ha) of conifers at Waikamoi with native forest. If they purchased another similar sized easement from Haleakala Ranch and restored koa forest on it, the combined area of 648 ha could accommodate 250 MAPA and other native birds. In order to recover MAPA and CRHO, more public and private partnerships are needed to reforest east Maui above the “malaria line” estimated at around 1500 m (4650 ft).

### **Acknowledgements**

We thank Pat Bily and Mark White for their support and help with setting up the rare bird search project at Waikamoi Preserve. We thank volunteers for working long days navigating steep slopes in cold mist and rains: Patricia Fitzgerald, Andrew Keaveney, Brooks Rownd, and Thomas Juhasz. We thank USFWS, DOFAW, Tri-Isle RC & DC, PCSU, and the University of Hawaii for project support.

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