



# Leeward East Maui Forest Bird Community: Surveys in Nakula Natural Area Reserve

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## Introduction

Nakula Natural Area Reserve (NAR) on southeast Maui has been highly degraded by introduced ungulates and plants. It is currently being restored in part for the reintroduction of endangered Hawaiian honeycreepers like the Kiwikiu (*Pseudonestor xanthophrys*).

Monitoring wildlife responses to forest restoration can be used as an indicator of the effectiveness of such programs. Birds, being sensitive to habitat changes, typically respond to restoration (Gelarden and McLaughlin 2013, MacGregor-Fors et al. 2010). Baseline data on the avian community can help evaluate restoration progress and inform management decisions (Gelarden and McLaughlin 2013).

To quantify the current bird community composition and monitor temporal changes throughout restoration, we implemented a bird census program in Nakula NAR.

## Methods

Surveys were conducted April-June 2015, in a 170-ha fenced portion of Nakula NAR (6200' - 3800'; Fig.1). This area contains remnant forest patches of ohia (*Metrosideros polymorpha*) and koa (*Acacia koa*). Understory species survive mainly in gulches. Otherwise, nonnative grasses dominate.

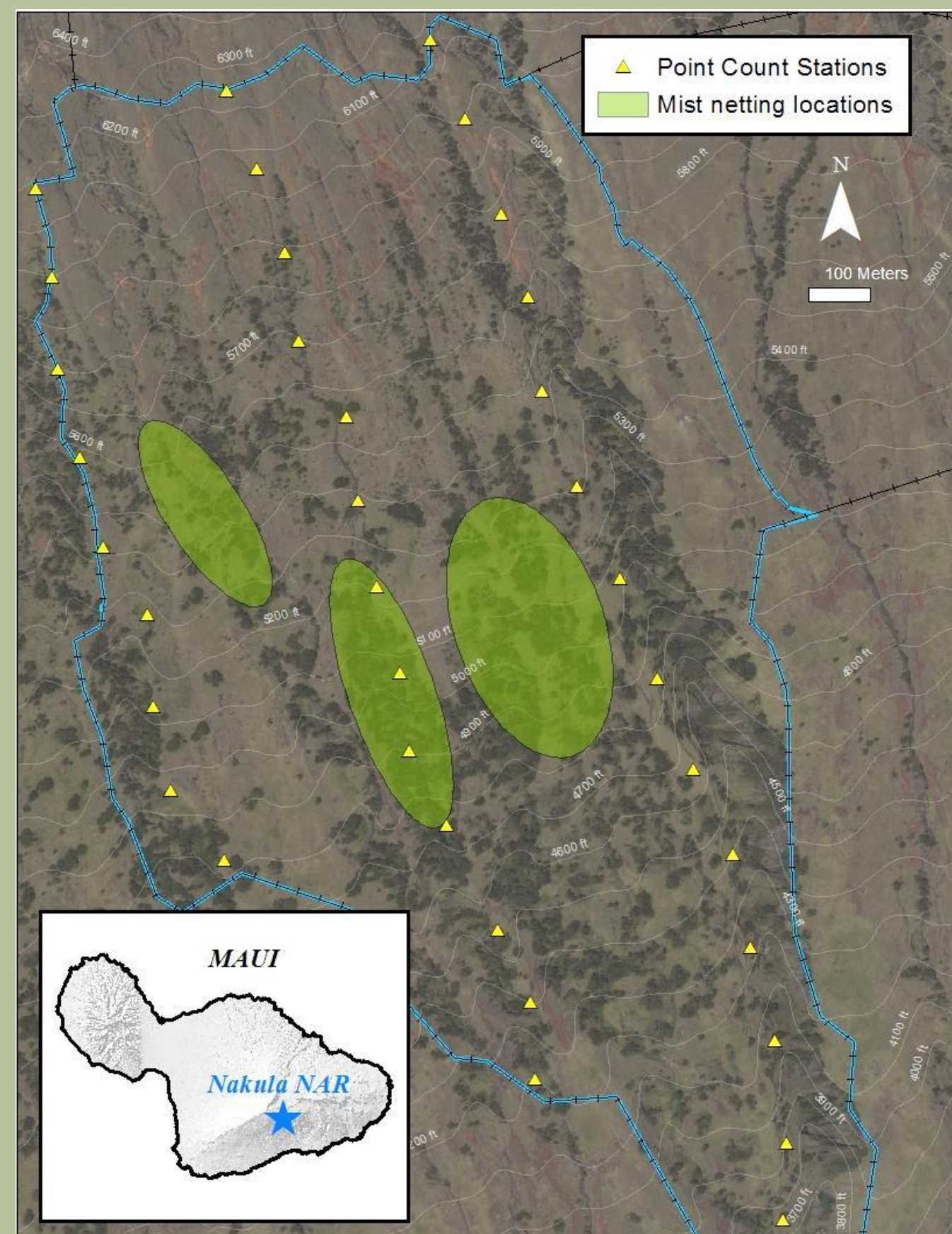


Figure 1. Nakula NAR point count transects and 2015 banding locations.

Three Variable Circular Plot (VCP) point count transects were installed 300m apart with stations spaced 150m (36 stations total). Transects were surveyed six times. For methodology, see Scott et al. (1986) and Brinck et al. (2012).

Mist nets (20-30) were open all day, weather permitting, for a total of 12 days/1700 net hours. Birds were fitted with USFWS bands, and native species color-band combinations. Morphometric data, fecal and blood samples were collected for diet and disease analyses.

## Results

Nineteen species were detected during VCP counts (Fig.2). Data will be analyzed using *Distance* in the future.

We grouped birds into primary feeding guilds and habitat preference (Fig.3).

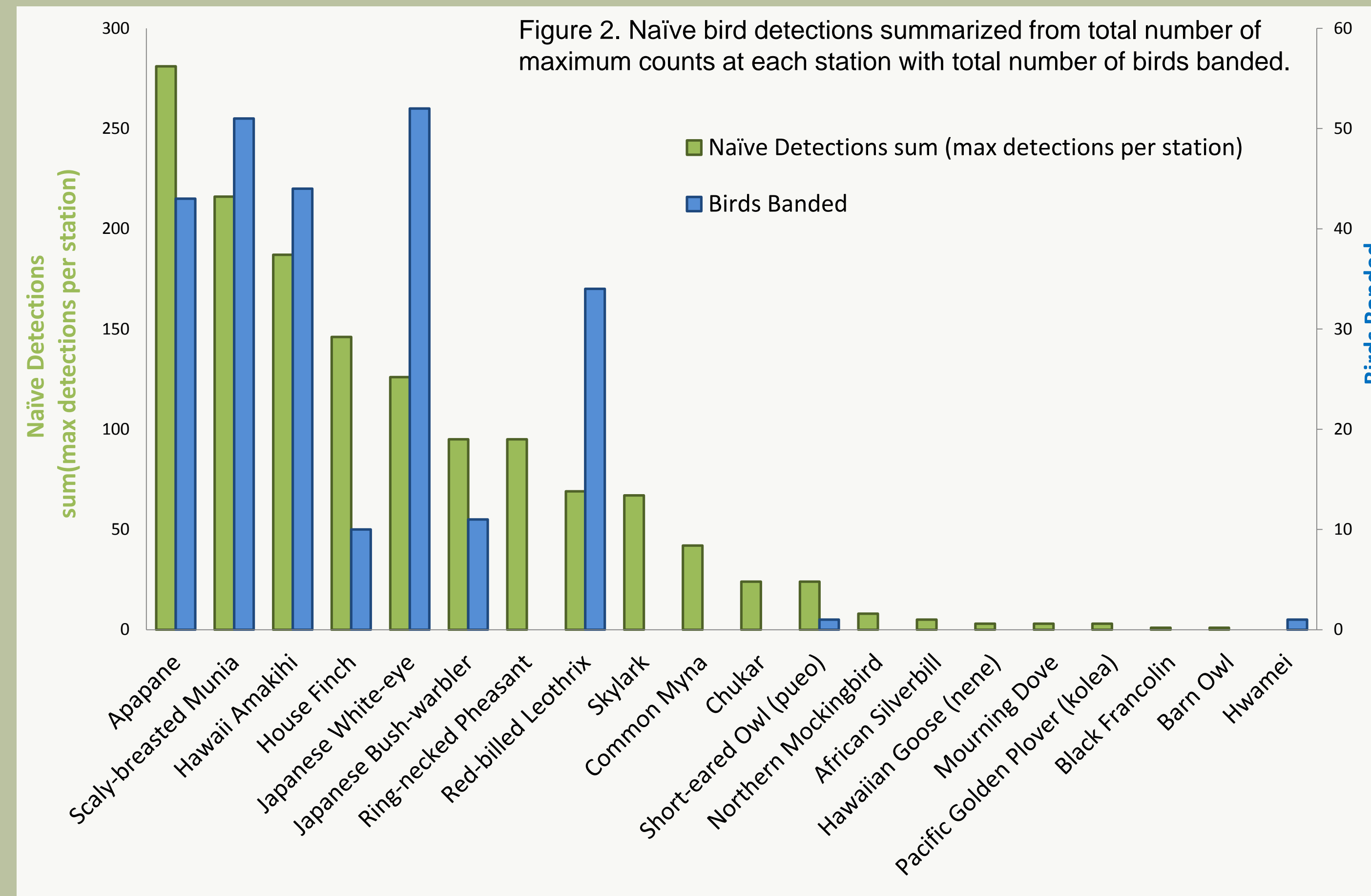


Figure 2. Naive bird detections summarized from total number of maximum counts at each station with total number of birds banded.

Nine species were caught during mist netting, representing 247 individuals (Fig.2). Of the native honeycreepers, Apapane (*Himatione sanguinea*) and Hawaii Amakihi (*Chlorodepanis virens*), many (63% and 41%) were juveniles. Adults showed signs of breeding: 26% of ♂s CP>2 and 41% of ♀s BP>1.

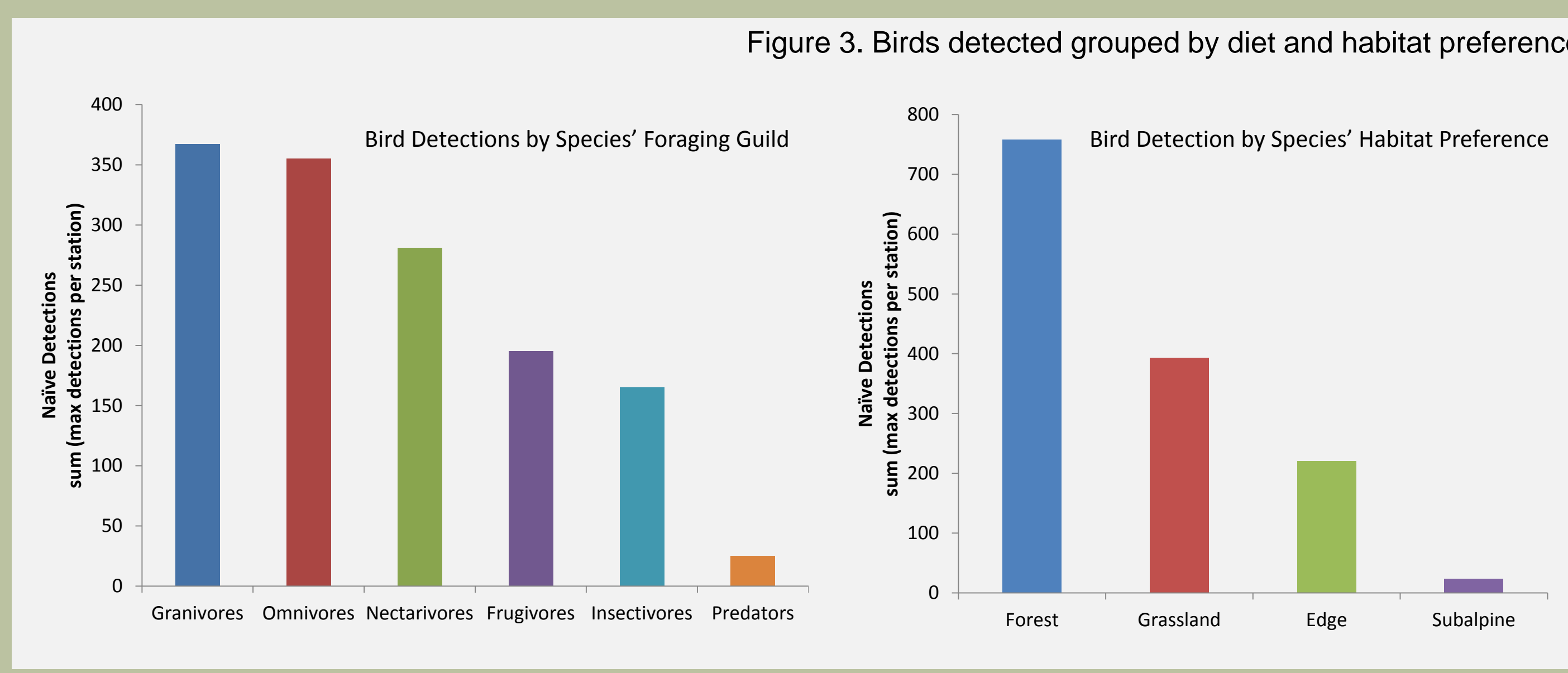


Figure 3. Birds detected grouped by diet and habitat preference.

## Literature Cited

Brinck KW, Camp RJ, Gorresen PM, Leonard DL, Mounce HL, Iknayan KJ, Paxton EH. 2012. 2011 Kiwikiu (Maui Parrotbill) and Maui Alauahio abundance estimates and the effect of sampling effort on power to detect a trend. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo. Technical Report HCSU-035.  
Edwards DP, Ansell FA, Ahmad AH, Nilus R, Hamer KC. 2009. The value of rehabilitating logged rainforest for birds. *Conservation Biology* 23.6: 1628-1633.  
Flaspohler DJ, Giardina CP, Asner GP, Hart P, Price J, Lyons CK, Castaneda X. 2010. Long-term effects of fragmentation and fragment properties on bird species richness in Hawaiian forests. *Bio. Con.* 143: 280-288.  
Foster JT, Robinson SK. 2007. Introduced birds and the fate of Hawaiian rainforests. *Cons. Biology* 21.5: 1248-1257.  
Gelarden CJ, McLaughlin JF. 2013. Forecasting avian responses to Elwha River restoration. *Ecol. Restoration* 31.1: 31-45.  
MacGregor-Fors I, Blanco-García A, Lindig-Cisneros R. 2010. Bird community shifts related to different forest restoration efforts: a case study from a managed habitat matrix in Mexico. *Ecological Engineering* 36: 1492-1496.  
Peck RW, Banko PC, Cappadonna J, Steele C, Leonard DL, Mounce HL, Becker CD, Swinerton K. 2015. An assessment of arthropod prey resources at Nakula Natural Area Reserve, a potential site of reintroduction for Kiwikiu (*Pseudonestor xanthophrys*) and Maui Alauahio (*Paroreomyza montana*). Hawaii Cooperative Studies Unit, University of Hawaii at Hilo. Technical Report HCSU-059.  
Scott JM, Mountainspring S, Ramsey FL, Kepler CB. 1986. Forest bird communities of the Hawaiian Islands: their dynamics, ecology, and conservation. *Studies in Avian Biology* No. 9. Cooper Ornithological Society. Allen Press, Lawrence, KS, U.S.A.

## Discussion

These surveys provide a baseline for this avian community. Currently, Nakula is mostly nonnative; only 5 out of the 20 species found were native (Fig.2 and 4).

Although all frugivores in Nakula are nonnative, they can be effective native seed dispersers, facilitating some native forest recovery (Foster and Robinson 2007). However, they also disperse nonnative fruits.

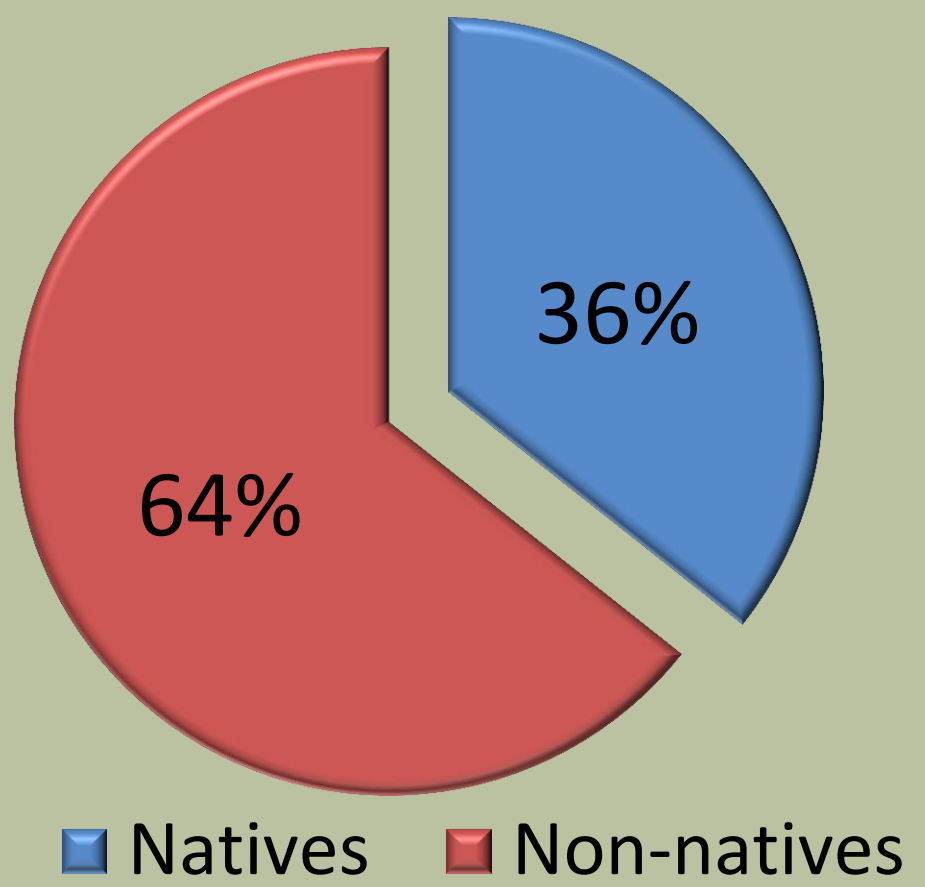


Figure 4. Native and non-native bird detections and captures for VCP counts/banding, n=1643.

Kiwikiu are insectivorous. Three insectivorous and three omnivorous species were found. Current data suggest prey is available for insectivorous birds but should increase in availability as plant stem density and total cover increase (Peck et al. 2015). Insectivorous birds typically increase as restoration continues since many prefer understory and undisturbed canopy (Edwards et al. 2009).

We expect that as the forest recovers there will be more forest bird species and fewer grassland species. This shifting bird community will reflect the changing habitats and food resources available. Forest patch density, structure, and percent forest are important drivers for bird species composition (Flaspohler et al. 2010).

Future research includes analyses of blood/fecal samples and demographic research such as survival and reproduction, which can also be used to indicate bird population health (Flaspohler et al. 2010). Breeding and juvenile birds were caught, suggesting that at least native birds are reproducing. Color-banded individuals will allow for future survival analyses.

Continued surveys will monitor changes in the composition and densities of the bird community and provide measures for managers to evaluate the effectiveness of various restoration efforts.



## Acknowledgements

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