

Tracking Hawai'i 'Amakihi (*Chlorodrepanis virens wilsoni*) in Nakula Natural Area Reserve on East Maui: home range estimation and evaluation of techniques for upcoming Kiwikiu (*Pseudonestor xanthophrys*) conservation translocation

Authors: Fukunaga, K.M, L.K. Berthold, C.C. Warren, H.L. Mounce



Nakula Natural Area Reserve (NAR). Photo of one of our banding stations and location of 4 home ranges

Intro

Nakula Natural Area Reserve (NAR) was created in 2011 to protect and restore the natural resources that had been heavily impacted by non-native ungulates. Nakula NAR was subsequently chosen as the first release site in an effort to reintroduce Kiwikiu (Maui Parrotbill, *Pseudonestor xanthophrys*); a critically endangered Hawaiian honeycreeper. As part of the Kiwikiu translocation in fall 2019, released Kiwikiu will be fitted with radio transmitters to track their movements.



Kiwikiu (Maui Parrotbill, *Pseudonestor xanthophrys*) (PC: R. Kohley)

However, every location has its inherent challenges and radio telemetry has never been done in Nakula or with this species. In order to streamline the process for the Kiwikiu release and to gain insight into bird movements within Nakula, we monitored another honeycreeper; Hawai'i 'Amakihi (*Chlorodrepanis virens wilsoni*). We chose to monitor 'Amakihi because they are a common native honeycreeper found in Nakula and are most similar to Kiwikiu of the species remaining in Nakula. Here we give an overview of the findings from tracking 'Amakihi and any adjustments needed for tracking Kiwikiu in Nakula in the future.



Hawai'i 'Amakihi (*Chlorodrepanis virens wilsoni*) (PC: Z. Pezillo)

We also analyzed 'Amakihi movements and home ranges. The most recent study of 'Amakihi movement was conducted over 30 years ago on Hawai'i Island in the māmane-naio forests of Mauna Kea (van Riper III, 1987). Nakula is on the leeward, southern slope of Haleakalā, Maui and is a mixed 'ōhi'a-koa mesic forest. We hypothesized that home range sizes in Nakula may differ from previously published estimates, likely reflecting variation in resource availability. Investigating 'Amakihi movements in Nakula may also shed light on the distribution of important habitat attributes in the fragmented forest.

Methods

- Location: Wailaulau Unit of Nakula NAR: A 422 ac site on the south slope of Haleakalā, Maui. Hawai'i 'Amakihi were caught at two banding sites <1 km apart.
- Fitted 9 birds with Lotek PicoPip Ag379 radio transmitters using leg-loop harnesses and color-banded each bird.
- Cut antennas short, 2-2.5 cm beyond end of tail, as trial of possible modification for Kiwikiu.
- Three trips into Nakula from April to May 2019; 1st trip: 5 transmitters deployed and tracked, 2nd trip: 4 transmitters deployed and 8 tracked, 3rd trip: 8 birds tracked. Daily goal was to get 5 points on each bird, <5 points were taken if the birds did not leave a small area. Behavioral observations were taken as well.

- Estimated home range by using minimum convex polygons and kernel density estimator (95% isopleths) using Geospatial Modeling Environment (Version 0.7.2.0) and ArcMap 10.

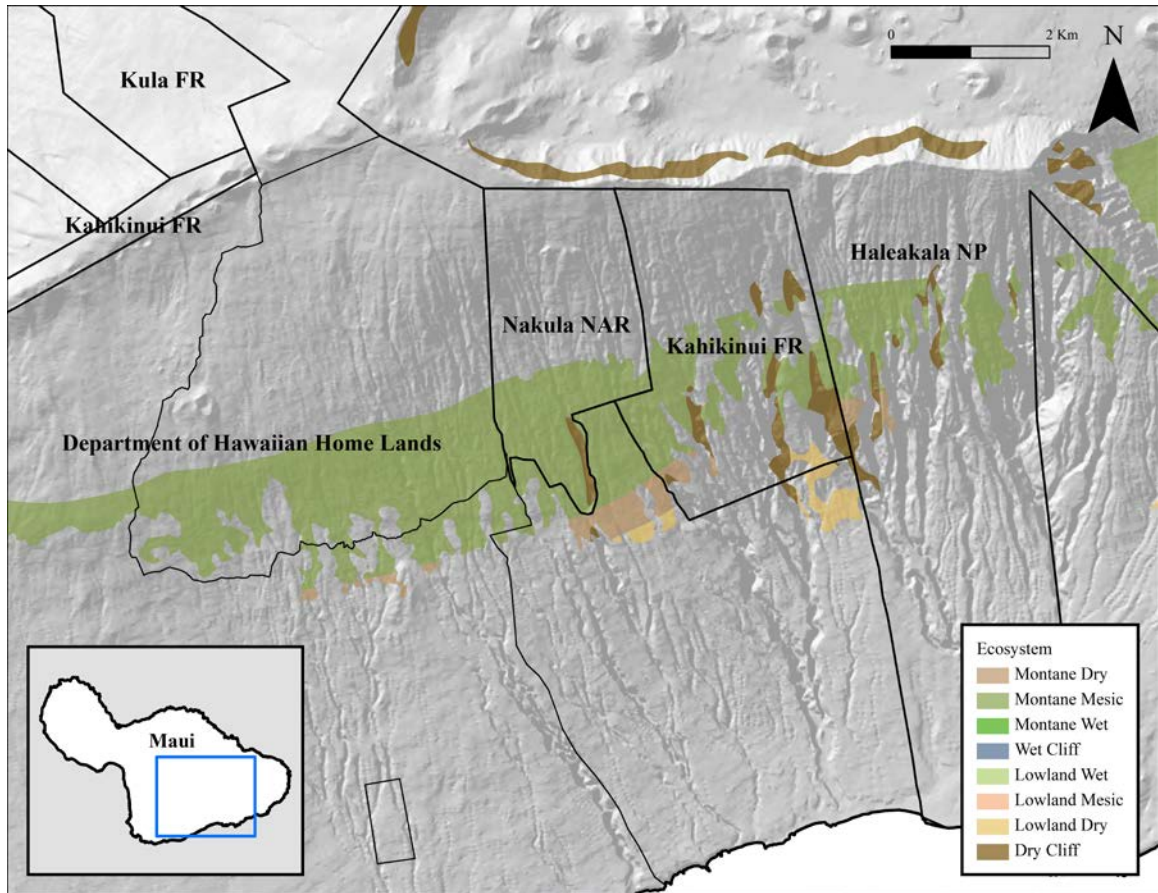


Figure 1. Location of Nakula NAR



An 'Amakihi being fitted with a transmitter at our banding station (PC: Z. Pezillo)



Chris Warren using our telemetry gear to locate a tagged 'Amakihi (PC: B. Berkowitz)

Results

Deployed 9 transmitters; Tracked 8 birds, 1 malfunction

Hawai'i 'Amakihi statistics: 8 males, 1 female, known ages between 1 and 7+ years old (1 HY, 2 SY, 6 ASY). Two tagged birds had known banded mates, both in nest building stage.

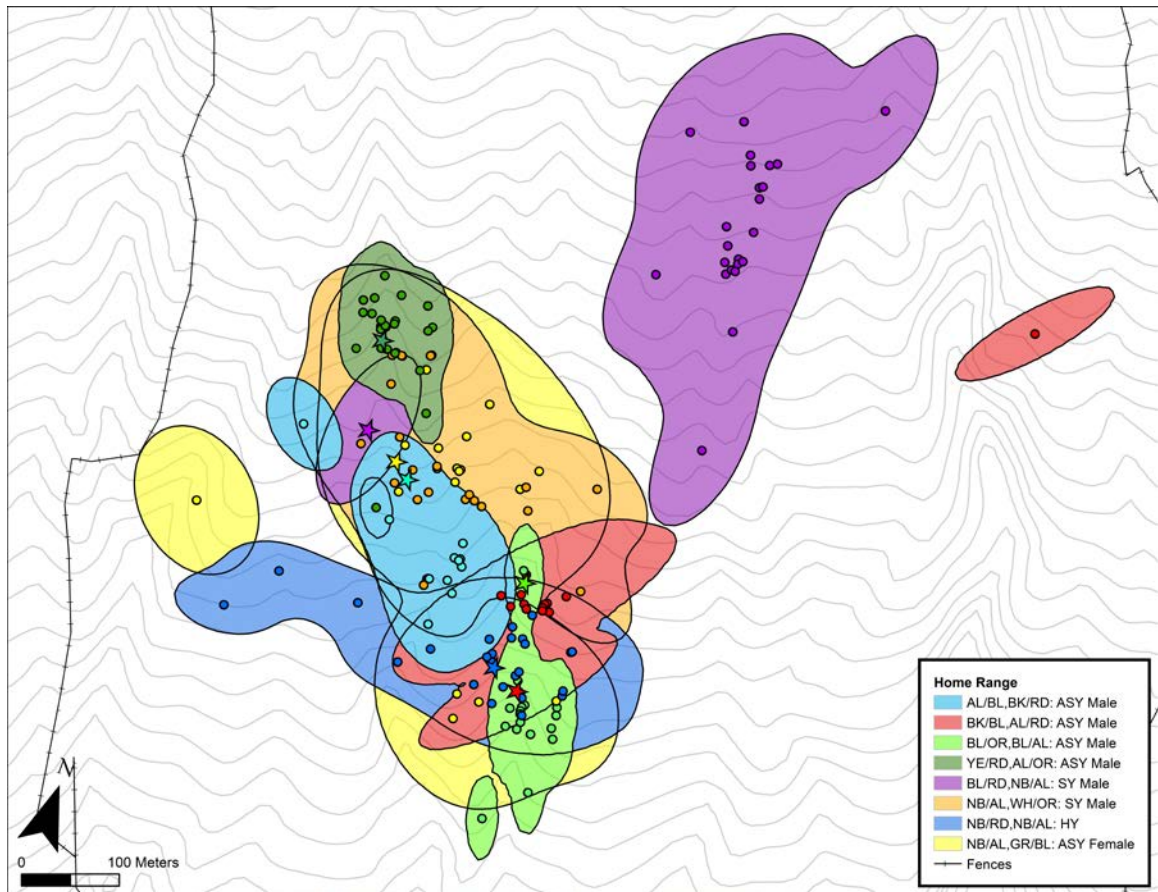


Figure 2. Hawai'i 'Amakihi home ranges created using kernel density estimator analysis (95% isopleths). Points are resights and stars are capture location.

Bird	Number of resights	Home range area (ha) (KDE)	Home range area (ha) (MCP)	Furthest points in home range (m)
BK/BL,AL/RD	15	4.37	3.18	646
BL/OR,BL/AL	19	1.84	0.92	259
NB/AL,GR/BL	21	13.46	8.09	409
NB/RD,NB/AL	26	5.50	2.51	363
AL/BL,BK/RD	14	3.27	1.14	243
BL/RD,NB/AL	23	9.80	8.85	393
NB/AL,WH/OR	23	8.66	3.89	308
YE/RD,AL/OR	24	1.79	1.20	238
Average	21	6.09	3.72	357.38

Table 1. Sizes of home ranges for each bird as well as the average of all 'Amakihi tracked.

Discussion

Hawai'i 'Amakihi home ranges:

- Average Hawai'i 'Amakihi home range size had been previously reported as 0.45 ha (van Riper III 1987). We estimated home ranges in Nakula to be 8 to 13× larger (depending on methodology), averaging 3.72 ± 1.1 ha (MCP) and 6.09 ± 1.48 ha (KDE).
- The difference in home range size between our study and van Riper III (1987) can likely be attributed in part to methodology. However, these differences may also reflect variation in behavior between sites. The larger home ranges in Nakula may be the result of fragmentation of the forest requiring birds to seek out more diffuse food resources. This may be supported by several instances of individual birds taking long flights outside their “core” area seemingly to feed on a particular blooming 'ōhi'a.

What we found for future Kiwikiu release:

- This experiment was a successful trial of tracking honeycreepers in Nakula NAR as the future Kiwikiu reintroduction site.
- Shorter antennas did make it harder to track; our total antenna lengths were 7-7.5 cm. Our maximum detection range was <1 km.
- In gulches, we would lose signal easily or the signal would bounce around. Tracking from above and looking down toward the birds was advantageous.
- The hatch-year we tracked may not have had a home range and may best represent how an “unanchored” bird may behave (something we may see in future released Kiwikiu).

Acknowledgments



Lit Cited

Beyer, HL. 2012. Geospatial Modeling Environment (Version 0.7.2.0). (software). URL: <http://www.spatial ecology.com/gme>.

Pratt, TK, JC Simon, BP Farm, KE Berlin, and JR Kowalsky. 2001. Home range and territoriality of two Hawaiian honeycreepers, the 'Ākohekohe and Maui Parrotbill. *The Condor* 103:746-755.

van Riper III, C. 1987. Breeding ecology of the Hawaii Common Amakihi. *The Condor*, 89(1): 85-102.

Warren, CC, PJ Motyka, HL Mounce. 2015. Home range sizes of two Hawaiian honeycreepers: implications for proposed translocation efforts. *Journal of Field Ornithology* 86(4):305-316