

The Presence of an Ecological Trap in the Juvenile Dispersal of the Akohekohe (*Palmeria dolei*), a Population Limiting Life-Stage?

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Introduction

The Akohekohe is a critically endangered Hawaiian Honeycreeper, with a population of ~3,800 individuals (Camp et al. 2009). Found only in high-elevation wet forest free of mosquitoes, the Akohekohe is restricted to about 5% of its former range on Maui. Over the past 30 years Akohekohe habitat has been protected and even restored through the use of fencing and invasive species removal. Furthermore, Akohekohe have a relatively high nest success (Simon et al. 2001), but their population has not been observed to increase since conservation efforts have taken place. To investigate what may be limiting the population growth of this species, radio-telemetry was employed to examine if juvenile birds were dispersing to low elevations where they may fatally encounter avian malaria.



Females (left) are slightly smaller than males (right) and receive a correspondingly smaller transmitter

The Akohekohe is a nectarivorous bird relying primarily on the blossoms of the dominant canopy tree, the ohia lehua (*Metrosideros polymorpha*). It has been hypothesized that Akohekohe migrate altitudinally following ohia phenology that peaks at different elevations seasonally (Berlin et al. 1999). I hypothesize that these movements expose Akohekohe to an ecological trap on a landscape scale whereby lower elevation forest is attractive due to the abundance of ohia bloom, but is actually poor quality habitat because of a high rate of disease mortality. And that this primarily affects juvenile birds.

Methods

Akohekohe were captured through mist-netting and were given unique combinations of color-bands to identify individuals on their legs. Radio-transmitters were attached by harness with a biodegradable link and weighed about 3% of a birds weight. Radio-telemetry in Waikamoi Forest Transmitters had a battery life of approximately one to two months. Researchers used a handheld antenna and receiver to track birds up to a kilometer away in The Nature Conservancy's 158 ha Waikamoi Preserve, ranging between 1600 and 1900 meters.

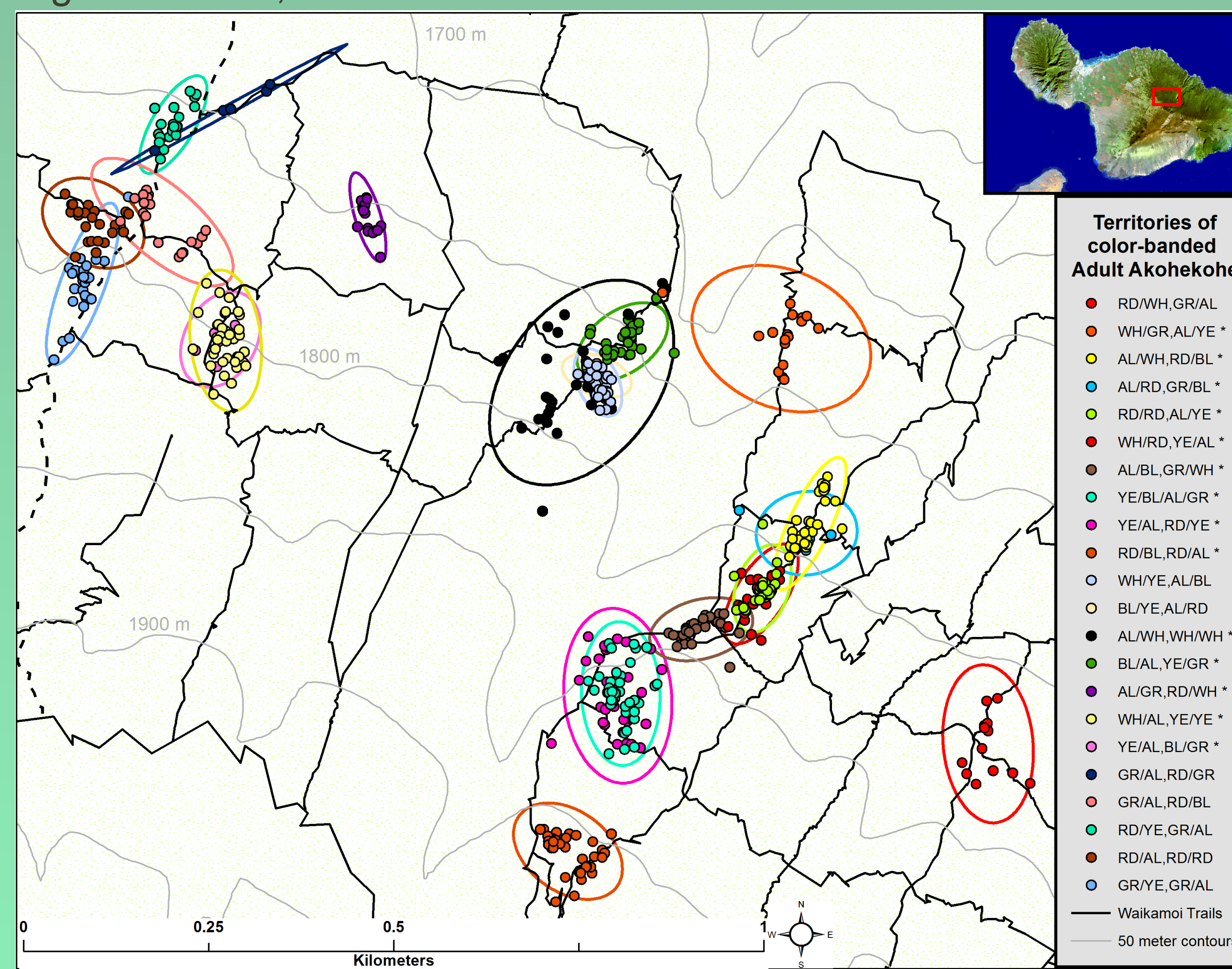


Transmitter Backpack

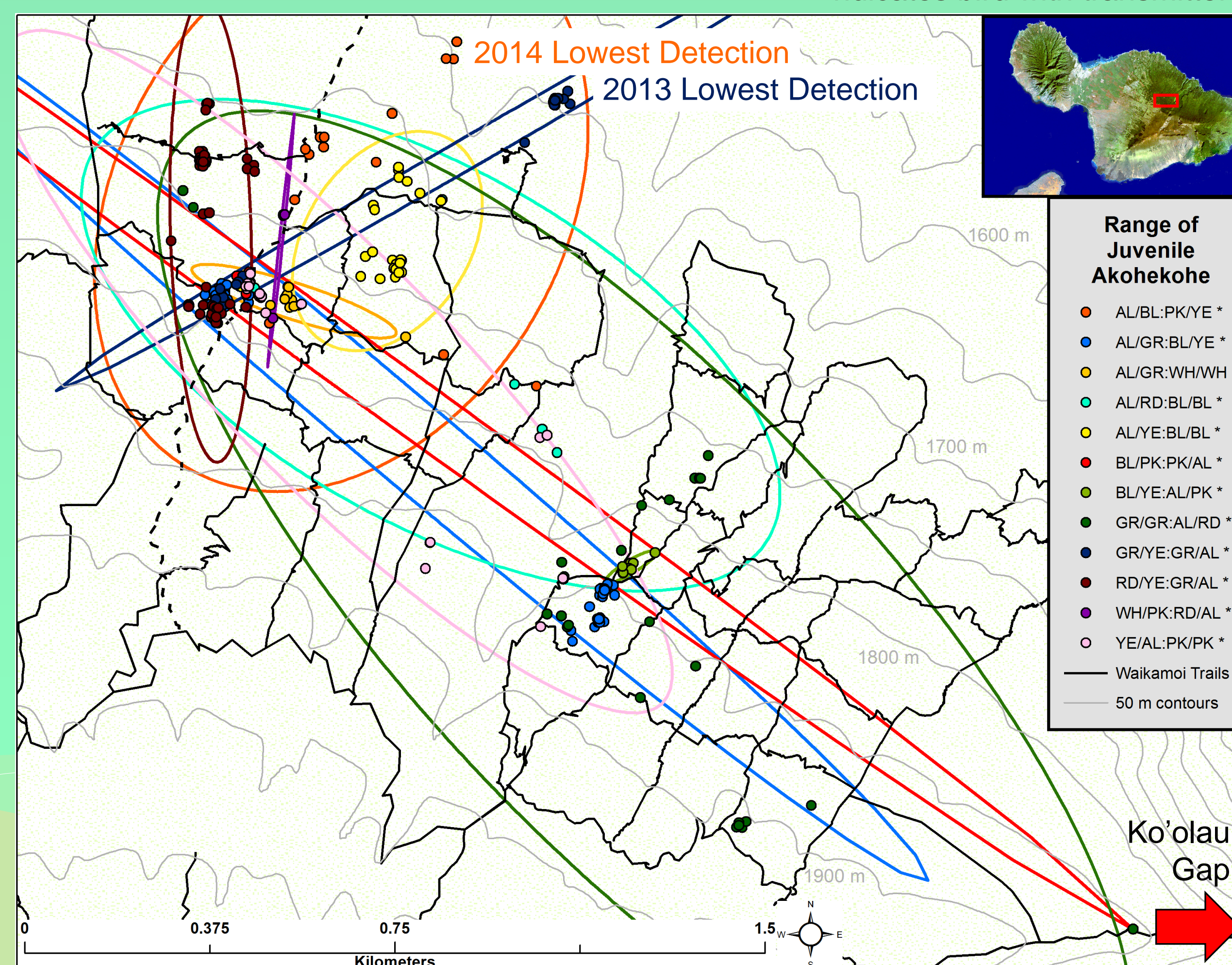
Ohia bloom was also recorded at 50 meter elevation increments along two transects using repeatable photo stations and time-lapse cameras.

Results

In the summer of 2013, 7 Akohekohe were color-banded and 4 were deployed with transmitters and tracked. During the spring/summer 2014 field season, 34 Akohekohe were banded and 25 transmitters were deployed. Two transmitters failed, but still 27 birds were tracked by telemetry over both seasons. In addition to the transmitted birds, another 8 color-banded adult birds were monitored. With two previously tracked birds observed again in 2014, a total of 33 birds were monitored in total.



* Indicates bird with transmitter



Discussion

A strong contrast was seen between the range of movements of adult and juvenile Akohekohe. Adult territories averaged $14,000 \pm 11,000$ m² over seven months and rarely ranged farther than 250 m in any one direction. They could be tracked even without the aid of telemetry. On the other hand, juveniles could range nearly 2km in a single day! And once their transmitters expired, juveniles were rarely seen again.



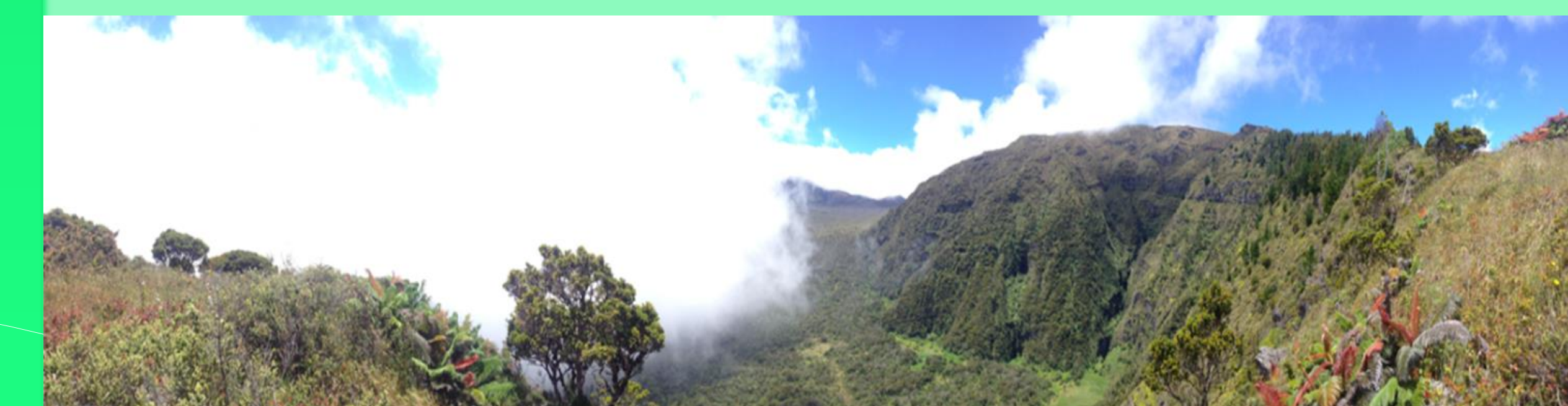
Adult Akohekohe



Juvenile Akohekohe

The lowest elevation (~1600m) at which Akohekohe were seen were juvenile birds tracked by radio-telemetry during both seasons. These birds were above the predicted elevation for mosquitoes to persist (1475m), but below the elevation mosquitoes are thought to sometimes extend during summer (1715m) (Ahumada et al. 2004). In both seasons, birds were also known to be at lower elevations based on telemetry signal, but proved to be inaccessible to researchers. An example of this was three juvenile birds in the 2014 season that all descended into or even across the Ko'olau Gap to the east of Waikamoi Preserve. The bottom of the gap is around 1500m in elevation and it is possible these birds may have encountered avian malaria.

Because juveniles exhibited a dispersal behavior that brought them within or close to the suspected malaria zone and overall moved so much farther than the relatively sedentary and territory holding adults, it seems likely that juvenile dispersal is a population-limiting life-stage for the Akohekohe. This find is in support of my original hypothesis.



View of the Ko'olau Gap seen from Waikamoi Preserve

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