An Investigation of Vital Rates of Landbird Populations on Saipan, Northern Mariana Islands

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Introduction

Saipan is one of 14 islands that comprise the Northern Mariana Islands in the tropical western Pacific (Fig. 1). The archipelago is home to 23 native landbird species, including 16 "range-restricted" species, 10 of which are endemic. Birdlife International suggests nine species are globally threatened, yet few data exist on populations status and trends, breeding phenology, or demography. To investigate the vital rates of landbirds on Saipan, we initiated the Tropical Monitoring of Avian Productivity and Survivorship (TMAPS) project in 2008.

Objectives

- Understand timing of life-cycle events, including breeding and molting
- Formulate effective age and sex criteria to estimate avian vital rates
- Provide annual estimates or indices of adult population size, post-fledging productivity, survival rates, proportions of residents, and recruitment
- Identify population trends and proximate and ultimate causes of population change
- Inform management

Here we summarize key findings from the first five years (2008 – 2012) of the Saipan TMAPS project, emphasizing results for four target species ; Micronesian Myzomela (*Myzomela rubratra*), Rufous Fantail (*Rhipidura rufifrons*), Bridled White-eye (*Zosterops conspiculatus*), and Golden White-eye (*Cleptornis marchei*).

Figure 1. Saipan and TMAPS station locations, 2008 - 2012

Age and Sex Based Upon Molt

Accurate assignment of age and sex of captured individuals, both of which may be based upon molt strategies, plumage development, and reproductive status, is essential to estimate vital rates of avian species. Age and sex criteria (based on Radley et al. 2010) of the four target species on Saipan are as follows.

Micronesian Myzomela

Preformative Molt (PF) is either complete or incomplete in this species, and molt can be suspended. Thus, HY/SYs and AHY/ASYs can be aged by whether older retained feathers are juvenile or basic.

A) SY male with retained juvenile s5 and s6.

B) ASY male with suspended molt after tertials and p1-p3 were replaced.

Once PF is complete, females can be separated from males by brown feathering in the body plumage and browner wings.

Bridled White-eye

PF usually complete and cannot be aged by plumage afterwards. Individuals that exhibit incomplete molts can be aged by older retained feathers.

A) HY/SY with retained p6-p9 and s2-s6.

HYs in juvenile plumage (left) average yellower than older birds (right). Sexes not separable by plumage.

Some individuals show an alternating replacement strategy among primaries; we are documenting this and will analyze these patterns relative to molting benefits and constraints.

Golden White-eye

Partial PF allows separation of HY/SYs from AHY/ASYs by limits in wing coverts and shape and condition of primaries and rectrices.

A) SY; five replaced inner greater coverts contrasting with four outer juvenal greater coverts, along with juvenal primary coverts and primaries.

B) Typical ASY; broader and more-uniform wing coverts and primaries.

Sexes are not safely separable by plumage but most can be sexed by bill length.

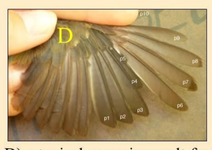
Rufous Fantail

Partial PF allows separation of HY/SYs from AHY/ASYs by limits in wing coverts, and shape and condition of the primaries and rectrices. Adults can exhibit two modes of primary molt.

A) SY; replaced inner greater coverts and juvenal outer greater coverts, primary coverts, and primaries.

B) SY tail showing narrow and pointed rectrices.

C) ASY; broader, more-uniform wing and tail feathers. Sexes not separable by plumage.

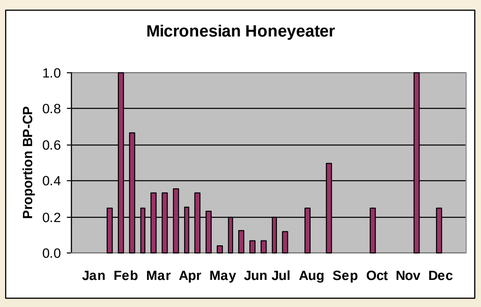


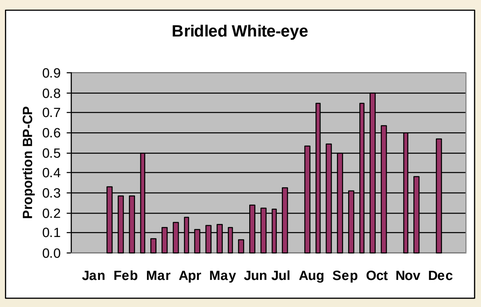
D) a typical passerine molt from p1 outward

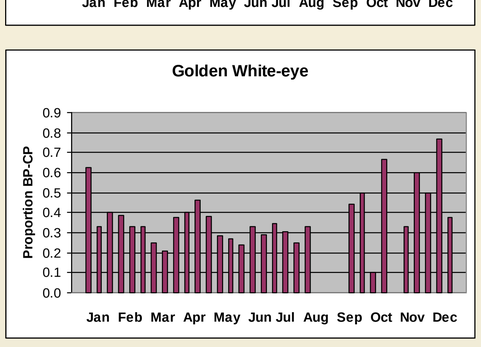
E) molting bi-directionally from among p2-p4 (Junda et al. 2012).

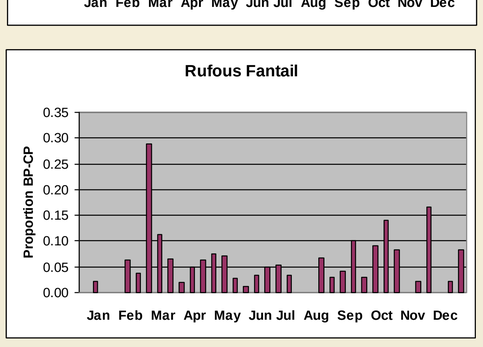
Breeding Seasonality

Seasonality was determined by the proportion of all individuals of the four target species captured per month that exhibited either brood patch (BP) or cloacal protuberance (CP) at the time of capture.



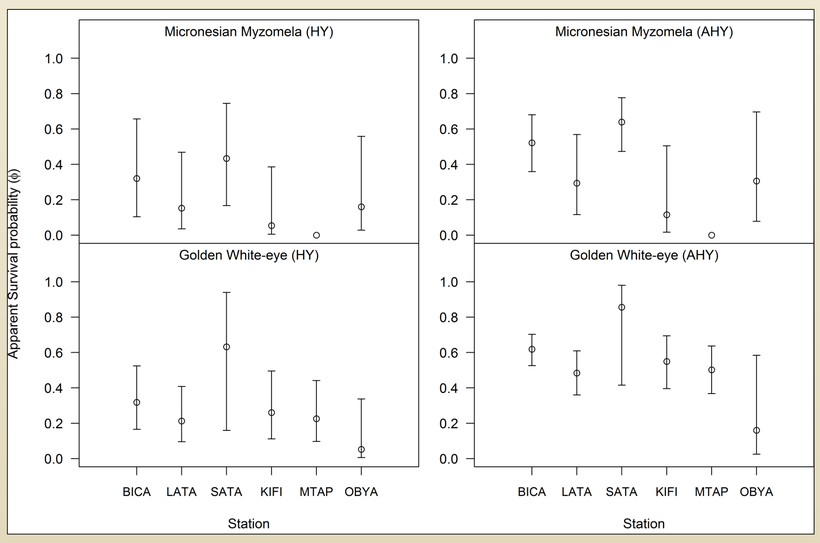


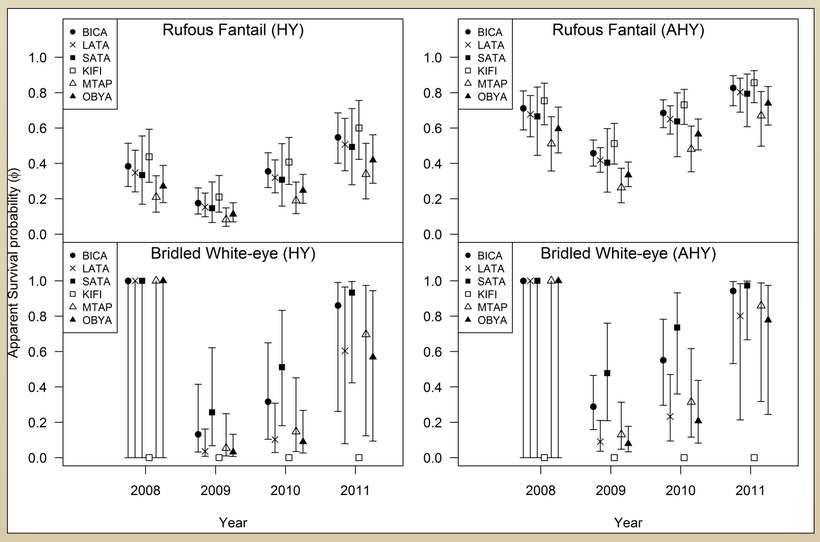




Survival

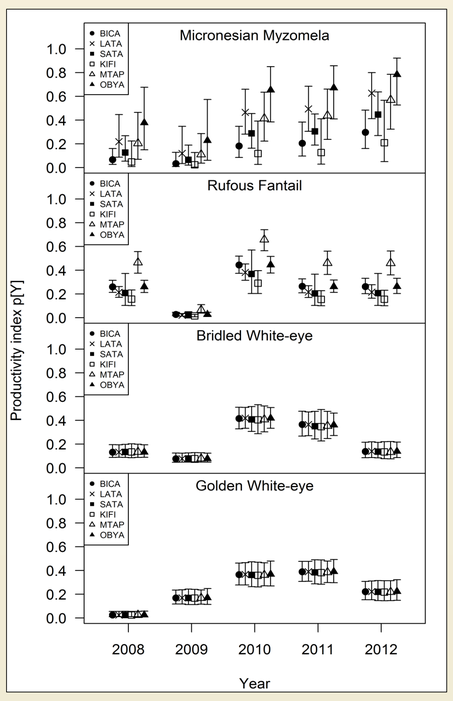
Estimated annual apparent survival probability for two age classes (HY and AHY) of each target species. Estimates and 95% confidence intervals were derived from best (lowest AIC_c) capture-recapture models applied to data collected at six banding stations on Saipan.





Productivity

Estimated productivity index (probability of capturing a HY bird) and 95% confidence intervals were derived from averaging eight logistic regression models assessing spatial and temporal variation in productivity.



Methods

- Six ~20 ha mist-netting stations consisting of eight to 10 12-m × 2.5-m mist nets were established in habitats typically used by landbirds on Saipan (Fig. 1).
- Station were operated one day per every 10-day period over five field seasons of 10 periods each (~11 April–19 July) according to IBP protocol.
- In 2011 and 2012 stations were additionally operated outside of the 10 periods for one pulse of three consecutive days, once per month, facilitating more precise analysis of survivorship.
- Captured birds were identified to species, age (young = "hatching year" [HY]; adult = "after hatching year" [AHY]), and sex, and banded with individually numbered aluminum leg bands if not already so marked.
- Band numbers of all recaptures were carefully recorded.
- Analyses followed Robinson et al. (2007) for productivity and Barker for survival (1997 and 1999).

Results

Capture Summary

We recorded 8,004 captures (excluding same-day recaptures) of 5,381 individual birds of 13 species over 27,848.9 net hours. We determined ages HY or (at least) AHY for 92% (4,938) of all individuals. Ranking of the four most commonly captured species:

- Rufous Fantail (n = 4,083) = 51% of total captured
- Bridled White-eye (n = 1,444) = 18% of total captured
- Golden White-eye (n = 1,242) = 16% of total captured
- Micronesian Myzomela (n = 521) = 7% of total captured

Conclusions

- All four target species could successfully be aged to adult by plumage, but only Micronesian Myzomela can reliably be sexed in this way.
- The target species exhibited continuous or extended breeding seasons, peaking mildly in both the dry and wet season, the latter of which is similar to other tropical systems (e.g., Diniz et al. 2013).
- Productivity of Micronesian Myzomela and Rufous Fantail may be affected more so by local (i.e., station) environmental factors than the two white-eye species.
- All target species show strong spatial variation in survival, but Rufous Fantail and Bridled White-eye may also be affected by temporal environmental factors.

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