

NATIONA PARK SERVICE

Introduction

The island of Moloka'i has been beset with the rapid decline and extinction of many endemic forest birds. In the late 1800s, naturalists collected records of the Bishop's 'O'o (Moho bishopi), Black Mamo (Drepanis funerea), 'Ō'ū (Psittirostra psittacea), and Ākohekohe (Palmeria dolei)¹. In less than 40 years, each species had gone extinct because of habitat loss, predators, and disease. More recently, the Kakawahie (Paroreomyza flammea) was officially declared extinct, and the Oloma'o, or Moloka'i thrush (Myadestes lanaiensis), has not been seen in decades^{2,3}.

Since 1979, only the 'l'iwi (Drepanis coccinea), Hawai'i 'Amakihi (Chlorodrepanis virens), and 'Apapane (*Himatione sanguinea*) have persisted on the island⁴. Non-native species such as the Warbling White-eye (Zosterops japonicus), Japanese Bush-Warbler (Horornis diphone), and Red-billed Leiothrix (Leiothrix lutea) became ubiquitous in native forest. To track populations of native and non-native forest birds, point-transect distance sampling is repeated approximately every six years. In 2021, the Maui Forest Bird Recovery Project, Hawai'i Division of Forestry and Wildlife, National Park Service, and The Nature Conservancy partnered to repeat surveys on monitoring transects. We present a summary of species composition, population densities, and trends over a 42-year period.

History of Decline and Extinction on Moloka'i



Oloma'o (Myadestes Ianaiensis, bottom)

Methods

Bird surveys were conducted on Moloka'i using point-transect distance sampling, which estimates abundance for undetected individuals as a function of the distance between the observer and birds⁵. Detection type and horizontal distance from the station center to individual birds detected was recorded during the 8-minute count. Indices of relative occurrence and relative abundance were calculated for each species by survey year. Speciesspecific density estimates were calculated for species that had sufficient detections (>75) to adequately characterize the detection probability using the R package DISTANCE. We limited the candidate detection function models to half normal and hazard-rate detection functions with expansion series of order two. We paired the half normal with cosine and Hermite polynomial adjustments, and the hazard-rate was paired with cosine and simple polynomial adjustments. Species-specific densities for each survey year were estimated from the global detection function using the post-stratification procedure, and variances and confidence intervals were derived by bootstrap methods. A core inference area was identifed by the frequency of surveys to estimate abundance. We assessed long-term population trends (1979-2021) from the bootstrap sample estimates with a log-linear regression model. The evidence of a trend was derived from the bootstrap distribution of slopes.

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The Status and Trends of Forest Birds on Moloka'i

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Study Area



In 2021, surveys were conducted on transects located within The Nature Conservancy's (TNC) Kamakou and Pelekunu Preserves, the Hawai'i Department of Land and Natural Resource's Pu'u Ali'i Natural Area Reserve and Moloka'i Forest Reserve, Kalaupapa National Park, and various small privately-owned lands. The elevation of transects ranged from 200 m to 1,500 m, encompassing low-elevation valleys and the highest peaks on the island. Forest canopy was dominated by native 'ohi'a (Metrosideros polymorpha), 'olapa (Cheirodendron trigynum), and kopiko (*Psychotria mariniana*). Weedy species such as strawberry guava (*Psidium cattleianum*) and Christmas berry (Schinus terebinthiolia) predominated low areas. Since many parts of the island were surveyed irregularly with variable effort, we identified transects that had the most consistent survey effort to confidently estimate abundance. We defined a core inference area of 3,527 ha. The area included 11 transects that were surveyed in 1979, 1988, 1995, 2004, 2010, and 2021. The area excluded most of Kalaupapa National Park and eastern portions of Moloka'i Forest Reserve.



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Results and Conclusions: Population Trends

Since 1979, 17 non-native species and 3 native species of forest birds have been detected within the core inference area. 'Apapane were widespread with relatively high densities every survey year-trends were inconclusive because of high variance but encouraging with a robust 2021 abundance estimate of 81,896 ± 10,836 birds. In contrast, there were only 11 detections of Hawai'i 'Amakihi in 2021, with an abundance of 1,085 ± 510 birds, which is an 80% decrease since its highest estimate in 1995. The last confirmed sighting of 'l'iwi was near the boundary of TNC's Pelekunu and Kamakou Preserve in 2010, and the Oloma'o was last seen outside the inference area within the Olukui Natural Area Reserve in 1979. In 2021, non-native species accounted for more than two-thirds of the 1,791 total detections. The Warbling White-eye had the highest density of any species, with an estimated abundance of 90,388 ± 9,324 birds. Populations of the Red-billed Leiothrix increased significantly since 1979 to an abundance of 9,813 ± 1,051 birds. The occurrence and distribution of the Japanese Bush-Warbler increased sharply. In 1979, 13 birds were detected, whereas in 2021, 639 birds were detected with an associated abundance estimate of 21,403 ± 1,787 birds. The White-rumped Shama (Copsychus malabaricus), Eurasian Skylark (Alauda arvensis), and Hwamei (Garrulax canorus) were recent additions to the avifauna, each being detected only within the last 20 years. Non-native birds can contribute to habitat degradation by dispersing weedy species and affect disease transmission because they host avian malaria and pox.

'l'iwi are particularly vulnerable to disease and additional surveys are needed to confirm its status on the island. It's unlikely Oloma'o have persisted undetected for over 40 years, but the deployment of audio recording units in steep and remote areas may confirm its presence or absence. Without continuous habitat management, predator control, and mosquito suppression, the remaining native forest bird populations may follow the path to extinction as so may others on Moloka'i^{7,8}.





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