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Limiting Factors

LIMITING FACTORS—INTRODUCTION

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Speculation for reasons for the decline in numbers and extinction of Hawaii's endemic birds date back to at least the end of the 19th century. Scott Wilson and A. H. Evans in their classic *Aves Hawaienses: The Birds of the Sandwich Islands* (1890–1899:ix), stated:

“The regrettable extinction of certain of the rarer woodland birds is due to the absence of the trees which supply a large part of their diet: for other causes have undoubtedly contributed to their loss, and it has been well remarked that, for all we know to the contrary, the destruction of some particular insect might result in the simultaneous disappearance of one or more of members of the avifauna.”

Repeated observations of continuing loss of endemic species and mounting threats have been made by generations of observers of Hawaiian bird life (see Loope et al. *this volume* and van Riper and Scott *this volume* for details). In the papers that follow, the role that limiting factors play in the ongoing loss of species and their habitats is well documented.

In the introductory chapter to this section, “Limiting Factors Affecting Native Birds of Hawaii,” Charles van Riper, III, and J. Michael Scott provide a comprehensive overview of six limiting factors: (1) habitat changes, (2) human predation, (3) nonhuman predation, (4) avian competition, (5) avian parasites and diseases, and (6) abiotic factors. The influence of each of these is discussed along a time line of cultural influences, i.e., prehuman contact prior to 500 BC, post-Polynesian contact from 500 to 1778 AD, and post-European contact from 1778 to 1998 AD. Their chapter provides the background for the other eight papers in this section.

Darcy Hu and her colleagues characterize Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) nest sites in southeast Mauna Loa at two spatial scales and use population viability assessment to suggest that, with current demographic characteristics, the population may not persist.

Paul Krushelnycky, Cathleen Hodges, Arthur Medeiros, and Lloyd Loope's study of interactions between the Dark-rumped Petrel and the Argentine ant (*Linepithema humile*) indicate that the alien ant species is not significantly influencing the nesting success rate of Dark-rumped Petrels under current ecological conditions.

Eric VanderWerf's correlation of avian pox-like lesions with demography of 'Elepaio (*Chasiempis sandwichensis*) populations on Mauna Kea is one of the first to relate the demographics of an endemic Hawaiian bird to avian diseases.

Susan Jarvi, Carter Atkinson, and Robert Fleischer provide an excellent overview of the role of avian malaria in the decline of Hawai'i's endemic avifauna. Cherie Shehata, Leonard Freed, and Becky Cann's study of changes in native and introduced bird populations on O'ahu suggest that genetic resistance and/or tolerance factors to avian malaria are evolving on O'ahu. This paper has major implications for the siting of new nature reserves. Similar studies on the low elevation populations of Hawai'i 'Amakihi (*Hemignathus virens virens*) found on Moloka'i and Hawai'i (Scott et al. 1986) might be instructive regarding putative disease resistant populations found there.

Steven Fancy and Thomas Snetsinger's speculation on what caused the population decline of the Bridled-white Eye (*Zosterops conspicillatus rotensis*) on Rota, in the Mariana Islands, has implications for future management of Hawaiian birds. Bertram Murray discusses in detail the evolution of passerine life histories on ocean islands and implications for the dynamics of population decline and recovery in bird populations in Hawai'i and other islands.

The chapter on newly emergent and future threats of alien species to Pacific birds and ecosystems (Loope et al. *this volume*) is a comprehensive survey of potential threats to Hawaiian endemic flora and fauna. However, their findings have implications for endemic flora and faunas worldwide.